RSPA-1997-12604-1

PSL "Protecting the Environment"

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P-1347

July 28, 1997

Mr. Alan I. Roberts
DHM-1
Associate Administrator for Hazardous Materials Safety
**U. S. Department of Transportation**
400 Seventh Street, SW
Washington, DC 20590-0001

Dear Mr. Roberts:

Pursuant to Section 106.31 of the 49 CFR (revised as of October 1, 1996), we would ask that the following regulations be amended as outlined below to benefit the public interest by providing an alternate form of leak detection test which allows a greater level of safety at lower cost:

1. A. **§ 173.32(b) - Periodic testing and inspection of Specification IM portable tanks.** **Existing Rule** - *"Periodic testing -- (1) Hydrostatic test. Each Specification IM portable tank (§§178.270, 178.271 and 178.272 of this subchapter) and all piping, valves and accessories, except pressure-relief devices, shall be hydrostatically tested with water, or other liquid of similar density and viscosity to a pressure not less than 150 percent of its maximum allowable working pressure."*

   **Proposed Rule Change** - Amend the regulations to allow the use of a leakproofness test at pressures of less than 2 psi, if such test can detect leaks of 180 mls per hour or less, with a probability of detection of 95% or greater.

   B. **§ 178.270-13** *"Testing. (a) Hydrostatic test. Each portable tank and all piping, valves, and other attachments which are subject to the pressure of the contents of the tank, except pressure relief devices, must be hydrostatically tested by completely filling the tank (including domes, if any) with water or other liquid having a similar density and viscosity and applying a pressure of at least 150 percent of the maximum allowable working pressure."*

   **Proposed Rule Change** - Amend the regulations to allow the use of a leakproofness test at pressures of less than 2 psi, if such test can detect leaks of 180 mls per hour or less, with a probability of detection of 95% or greater.

   C. **§178.345-13(a) - Pressure and leakage tests.** **Existing Rule** - *"Each cargo tank must be pressure and leakage tested in accordance with this section and §§178.346-13(a), 178.347-13(a) or 178.348-13(a), as applicable."* . . . and (c) **Leakage test.** *"The cargo tank with all its accessories in place and operable must be leak tested at not less than 80 percent of tank's MAWP with the pressure maintained for at least 5 minutes.*

**Proposed Rule Change** - Amend the regulations to allow the use of a leakproofness test at pressures of less than 2 psi, if such test can detect leaks of 180 mls per hour or less, with a probability of detection of 95% or greater.

D. **§178.346-5(a) Pressure and leakage test.**
**Existing Rule** - *"Each cargo tank must be tested in accordance with §178.345-13 and this section."* and **§178.346-5(c) Leakage test.** *"Cargo tanks equipped with vapor collection equipment may be leakage tested in accordance with the Environmental Protection Agency's "Method 27 -- Determination of Vapor Tightness of Gasoline Delivery Tank Using Pressure-Vacuum Test," as set forth in 40 CFR Part 60, Appendix A."*

**Proposed Rule Change** - Change 178.345-13 as outlined above in paragraph C to amend the regulations to allow the use of a leakproofness test at pressures of less than 2 psi, if such test can detect leaks of 180 mls per hour or less, with a probability of detection of 95% or greater.

E. **§178.347-5(a) - Pressure and leakage test.**
**Existing Rule** - *"Each cargo tank must be tested in accordance with §178.345-13 and this section."*

**Proposed Rule Change** - Change 178.345-13 as outlined above in paragraph C to amend the regulations to allow the use of a leakproofness test at pressures of less than 2 psi, if such test can detect leaks of 180 mls per hour or less, with a probability of detection of 95% or greater.

F. **§178.348-5(a) - Pressure and leakage test.**
**Existing Rule** - *"Each cargo tank must be tested in accordance with §178.345-13 and this section."*

**Proposed Rule Change** - Change 178.345-13 as outlined above in paragraph C to amend the regulations to allow the use of a leakproofness test at pressures of less than 2 psi, if such test can detect leaks of 180 mls per hour or less, with a probability of detection of 95% or greater.

G. **§178.604 - Leakproofness test.**
**Existing Rule - (d) Test method.** *". . . Other methods, at least equally effective, may be used in accordance with appendix B of this Part."*

**Proposed Rule Change** - Either obtain approval from the Associate Administrator for Hazardous Materials Safety for the PSL Test System (or any similar system that can perform to the same level of accuracy with equal or greater probability of detection), as described herein, or amend the regulations to allow the use of a leakproofness test at pressures of less than 2 psi, if such test can detect leaks of 180 mls per hour or less, with a probability of detection of 95% or greater.

H. **§ 178.813(c) - Leakproofness Test**
**Existing Rule** - For Intermediate Bulk Containers, the existing rule states that *"The Leakproofness test must be carried out for a suitable length of time using air at a gauge pressure of not less than 20 kPa (2.9 psig)."* The paragraph further states that *"Other methods, if at least equally effective, may be used in accordance with appendix B of this part, or if approved by the Associate Administrator for Hazardous Materials Safety, as provided in § 178.801(i)."* Furthermore, in Appendix B to part 178 - Alternative Leakproofness Test Methods, a pressure differential test is allowed if the packaging is pressurized to the pressure required by § 178.604(e), which states that *"An internal air pressure (gauge) must be applied to the packaging as indicated for the following packing groups: (1) Packing Group I: Not less than 30 kPa (4 psi). (2) Packing Group II: Not less than 20 kPa (3 psi). (3) Packing Group III: Not less than 20 kPa (3 psi)."*

**Proposed Rule Change** - Either obtain approval from the Associate Administrator for Hazardous Materials Safety for the PSL Test System (or any similar system that can perform to the same level of accuracy with equal or greater probability of detection), as described herein, or amend the regulations to allow the use of a leakproofness test at pressures of less than 2 psi, if such test can detect leaks of 180 mls per hour or less, with a probability of detection of 95% or greater.

I. **§180.407(h) - Leakage Test**
**Existing Rule** - *"...Leakage Test pressure must not be less than 80 percent of the tank design pressure or MAWP, whichever is marked on the certification or specification plate, except as follows: (i) A cargo tank with a MAWP of 690 kPa (100 psig) or more may be leakage tested at its maximum normal operating pressure provided it is in dedicated service or services; or (ii) An MC 330 or MC 331 cargo tank in dedicated liquified petroleum gas service may be leakage tested at not less than 414 kPa (60 psig)."*

**Proposed Rule Change** - Amend the regulations to allow the use of a leakproofness test at pressures of less than 2 psi, if such test can detect leaks of 180 mls per hour or less, with a probability of detection of 95% or greater.

2. **Overview of the PSL Test Kit System ("PSL Test System") and its operation**

The PSL Test System is certified to 100% accuracy and can detect leaks as small as 100 mls per hour. Its applications include leak detection tests for cargo tanks, rail cars, underground storage tanks and above-ground storage tanks. The PSL Test Kit (the "Test Kit") fits in a briefcase sized container and can be carried to the site of the test. The Test Kit conforms to U. S. EPA standards and is intrinsically safe.

With the PSL Test System, leak tests can be completed in approximately two (2) hours. Moreover, no water is needed to complete the test. The test does not introduce outside elements into the tank which eliminates the chance for damage to the tank or its contents.

The PSL Test System is designed to create a pressure or vacuum in the ullage (air space) of a storage tank, which is monitored on an integral high-resolution digital pressure gauge (which is accurate to approximately 1/700th of a psi). Under test conditions, the tank is first sealed, following which a known low pressure is applied to the ullage via the tester and is stabilized. If the tank is sound, then the pressure remains constant. In the presence of a leak, however, the volume of ullage increases and the consequent decrease in pressure is registered on the pressure gauge. By then applying a vacuum to the ullage, it can be determined whether air or product is leaking from the tank, and the stabilized negative pressure level is used to calculate the precise depth of the leak, assisting in its location, inspection and repair.

The PSL Test System includes a "sound detector" which is portable and can be used to pinpoint the exact location of the leak on a weld, fitting, valve, etc. This sound detector is extremely accurate, and is quicker and easier to use than the soap bubble system. Using the Sound Detector, a leak can typically be located in a matter of minutes.

In addition to its precision and convenience, the Test Kit can be set up in minutes and the test process itself may be completed in a maximum of two hours in the case of a leak-free tank. It is equipped to test the tank systems and associated pipework simultaneously. On completion of testing, highly accurate, visible and indisputable results are immediately produced. The very nature of the test process, coupled with the sensitivity of the Test Kit to minimal pressure changes, means that it is able to detect extremely low leakage rates. Accordingly, a problem may be detected perhaps years sooner than by conventional means, with the result that the consequent contamination is minimized.

Of all the leaks detected in tanks, 80% of the total are found in the pipework emanating from the tested tank and the PSL Test System takes this into account. The tank and ALL pipework is tested as one by the PSL Test System. Only when a leak is detected are joints broken for isolation and each item is checked independently. Where a tank is found to be leaking, the PSL Test System has the capability to draw a vacuum on the tank and stop the leak until whatever work necessary can be accomplished to remedy the leak.

## 3. Petitioner's Interest in the Proposed Action

PSL is the manufacturer of a Precision Leak Detection Test Kit ("PSL Test Kit") which can perform the leak detection work outlined in the proposed regulation change. It is the intention of the petitioner to manufacture and sell the PSL Test Kit to parties who may wish to perform the leak detection work in the United States. The PSL Test Kit has been in use commercially since 1992, for testing underground storage tanks, above ground storage tanks and cargo tanks, primarily in the United Kingdom, Spain, and the Middle East for companies such as British Petroleum, Texaco, Shell and Mobil.

4. **Support for the Proposed Regulation Change**

- **Third party Certification** Attached are reports regarding the capabilities of the PSL Precision Leak Detection Test System as prepared by Ken Wilcox Associates, Inc., of Independence, Missouri (who is a third party EPA Certifier); the University of Leeds (England) and the University of Valencia in Spain. These reports indicate that the PSL Test Kit provides 100% accuracy in detecting leaks of 180 mls per hour, or less using test pressures of 200 Mb (which is less than 3 psi).

  The enclosed letters from fire authorities in England further prove the system's capabilities.

- **Time and cost savings** The PSL Test Kit allows completion of the leak detection test within two to four hours and includes a test of the pipes, fittings, etc., of the tank while they remain in place. The hydrostatic test typically requires filling the tank to be tested with water, which can take 8 - 12 hours. If a leak is detected, then the leak must be fixed and the process must be repeated. Obviously this also entails a substantial waste and/or contamination of fresh water. By using the PSL Test System, industry will save substantial amounts of time in completing the required leak detection tests and will have more accurate results.

  In England, insurance companies are likely to decrease the premiums payable by companies using the PSL Test Kit because its accuracy allows leaks to be detected earlier than other systems which decreases potential damage and liability.

- **Safety** By using low pressure, the proposed test method does not affect the integrity of the tank to be tested or endanger the personnel performing the test or others in the area of the test.

- **Purity** The test does not inject test matter into tank (preventing foul smells and/or contamination). No water is needed for the test.

- **Flexibility** Can test tanks with various liquids (not just oil or gas). The test can be performed with the tank empty, filled or partially filled.

- **Precision** Can detect leaks in pipework, valves, connections and manifold assemblies (where a majority of leaks occur) while they remain in place on the tank.

- **Emergency Response** The Test Kit can be utilized to create a vacuum within the vessel being tested to stop a leak for an extended period (greater than 12 hours) until the damage can be repaired or the product can be removed from the leaking tank.

- **Other Uses** The Association of Container Re-conditioners and the Steel Shipping Container Institute requested that plastic drums used in dedicated services be leakproofed, citing a 2% failure rate in a sample of existing tanks (see attached report). The proposed rule changes would allow the use of systems that could quickly and accurately detect leaks in these drums.

- **Other Regulations** In early 1997, the British [Freight Transport Association ("FTA")] requested that PSL adapt its Test Kit for use in detecting leaks in cargo tankers, after a cargo tank that recently passed another form of leak detection test failed, releasing approximately 30,000 liters of gasoline into the London sewer system. The FTA has approved the PSL system for use in the U.K., and is purchasing five Test Kits for their own regulatory use.

5. **Potential Impact of the Proposed Regulation Change**

The petitioner does not believe that the proposed regulation change creates a significant impact, because it merely provides industry with an additional option to perform required leak detection tests. The petitioner does, however, believe that the PSL Test System will be attractive to industry because it provides greater accuracy and convenience while using less time and resources. Moreover, the petitioner does not believe that the proposed change will increase the regulatory burden on small businesses, or meaningfully change the existing recordkeeping and recording requirements.

To better understand the existing regulations, the petitioner completed a demonstration of the PSL Test System on a cargo tank for Ron Kirkpatrick and Phil Olsen of the DOT RSPA and provided materials explaining the PSL Test System to Cheryl West Freeman and Mark Toughiry, also of DOT RSPA. The petitioner also completed a demonstration of the PSL Test System for James Rader of the Federal Railroad Administration.

We appreciate, in advance, the consideration of the proposed regulation changes, and would be pleased to provide additional information, or answer any clarifying questions. My telephone number is (303) 295-3000.

Sincerely,

**PSL Limited**

Walter J. Coughlin
Director

WJC:st

# EXHIBIT A

1. Evaluation of the Piper Services, Limited, PSL Precision Tester by Ken Wilcox Associates, Inc.
2. Evaluation Report on the PSL Precision Tank Testing Equipment by University of Leeds Innovations Ltd.
3. University of Valencia Report
4. Letters from English Fire Authorities
5. Letter from Association of Container Reconditioners and the Steel Shipping Container Institute

# Evaluation of the Piper Services, Limited PSL Precision Tester

## Volume 1. Final Report

PREPARED FOR

Piper Services, Limited

May 2, 1995

KWA

KEN WILCOX ASSOCIATES, INC. - 19401 E. 40 HIGHWAY

INDEPENDENCE, MISSOURI 64055 - (816) 795-7997

Rev. 1.1

# Evaluation of the Piper Services, Limited PSL Precision Tester

Volume 1. Final Report

PREPARED FOR
Piper Services, Limited
Ahed House Estate
Dewsbury Road
Ossett
West Yorkshire, WF5 9ND

May 2, 1995

## Preface

This report describes the testing that was conducted on the Piper Services, Limited, PSL Precision Tester. The forms contained in this report are based on data collected using the EPA protocol "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods", EPA/530/UST-90/005, March, 1990. The leak simulations, data collection, data analysis, and report were conducted by Ken Wilcox Associates, Inc. The evaluation generally meets the requirements of the U.S. Environmental Protection Agency for nonvolumetric leak detection systems except for the number of fuel transfers that were conducted during the evaluation.

Technical questions should be directed to Mr. Carl Denby, Piper Services, Ltd, at 01924 283200.

H. Kendall Wilcox, President
KEN WILCOX ASSOCIATES, INC.

H. Kendall Wilcox

May 2, 1995

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## Introduction

This report presents an evaluation of the Piper Services, Ltd., PSL Precision Tester. The results of the evaluation have been applied to tanks up 68,000 litres capacity when the ullage is 4,000 litres or less. This report covers both the pressure and the vacuum testing methods that are used by the PSL system.

The evaluation of the PSL Precision Tester was based on an adaptation of the U.S. EPA protocol "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods", EPA/530/UST-90/005, March 1990. This protocol requires that nonvolumetric methods such as the PSL Precision Tester meet the same general performance requirements as volumetric methods.

The testing conducted during this evaluation deviates from the normal procedures used for a U.S. EPA evaluation in the following way. The U.S. Protocol specifies that the product level be altered between each pair of tests. To meet this specification, a total of 21 product transfers (seven at each of three temperatures) must be conducted. Because of the shortness of the tests and the relatively long stabilisation times required by the PSL system, this procedure was altered. The test forms have accordingly been modified to indicate that alternate test methods were used in the evaluation. The remainder of the testing follows the U.S. EPA procedures. A complete description of the testing procedures is included in this report.

## Description of the PSL Precision Tester

The PSL Precision Tester is a relatively simple test system consisting of valving and piping necessary to create positive or negative pressure (vacuum) in the ullage of an underground storage tank, and a high resolution pressure gauge (0.1 Mb). The tester is sealed into a riser using an expansion plug that is an integral part of the test probe. Different size plugs can be attached to adapt the probe to any size riser. The control box has valving so that two tanks can be tested simultaneously. A Venturi is also included in the unit so that the ullage can be evacuated to produce a negative pressure reading. A barometer is provided so that the atmospheric conditions can be monitored during the test.

The test is based on the systems ability to detect small changes in the volume of the ullage when product leaks from the tank. Under pressure test conditions, as product leaks from the tank, the ullage volume increases and the pressure decreases. The pressurization process amplifies any leaks that might be present so that they are more easily detected. For example, a 380 ml/hr leak at the midpoint of a 96 in diameter tank that is 95% full will leak at a rate of approximately 1500 ml/hr when the ullage pressure is increased to 180 Mb. A 380 ml/hr leak at the bottom of the tank under the same conditions will increase to 760 ml/hr.

A calibration check is conducted by rapidly removing one litre of product from the tank. This process typically takes about 1.5 minutes. The pressure is noted at the beginning and end of the removal process. The calibration data is used to estimate the approximate magnitude of any leaks that might be present. For example, if removal of 1 litre of product results in a pressure loss of 2 Mb, and a one hour test results in a pressure loss of 1 Mb, the rate of loss would be estimated at 500 ml/hr under the test conditions.

Piper Services, Ltd normally tests for leaks by applying a positive pressure to the ullage. However a negatively pressurized ullage is preferable under certain circumstances or as further verification that the tank is leaking. Under vacuum ullage conditions, leaks are detected in a manner similar to the pressure ullage conditions. Decreases in the vacuum would indicate that a leak is present. Additionally, by performing a negative pressure test after a positive pressure test and comparing their respective pressure losses, the method can determine if the leak is an air/ullage leak or a product leak. If the pressure loss from a positive pressure test is equal to the pressure loss from a negative pressure test, the leak will be reported as an air/ullage leak. If the negative pressure test records a greater pressure loss than the positive pressure test, the leak will be reported as a product leak.

## Description of the PSL Test Procedure

Under pressure ullage conditions, nitrogen is metered into the tank until a pressure of approximately 180 Mb is reached. The nitrogen flow is then stopped and the pressure is monitored. The introduction of nitrogen produces a small amount of heating that causes the pressure to rise for a short time after the flow of nitrogen has ended. This is followed by a relatively rapid decrease in pressure as the ullage balances out between fill pipe and tank plus thermal equilibrium. A small rise in pressure occurs for tight tanks as vaporization of the fuel takes place. After a stabilization period of approximately 90 minutes and the data readings are at ±0.1 Mb, the test is initiated. Test readings throughout the complete procedure are taken at 5 minute intervals throughout the test.

After the tank is stable, one liter of product is removed from the tank for calibration purposes. The temperature of this removed product is measured using a digital thermometer with a resolution of 0.01 deg C.

If the pressure drops in regular increments during the test, a visual inspection is conducted to see if the source of the leak can be determined. If the leak is located, it is repaired and the test is repeated. If the leak cannot be located, the tank is retested independently of all pipework. If the same pressure drop trend is recorded, a leaking tank is declared. If the pressure decrease is due to temperature decreases in either the ullage or the product, the rate of pressure change will decrease as the tank comes into thermal equilibrium. However, the rate of pressure change will remain steady if a true leak is present.

If the tank is tight, the pressure trend will remain steady as long as the barometric pressure and product temperature remain stable. Any barometric or thermal changes that should occur during testing, may result in slight irregular changes in the pressure trend. However, the changes in pressure resulting from barometric or thermal changes will be small in comparison to pressure changes that are brought about by a leak in a tank.

Under negative pressure (vacuum) ullage conditions, air is removed from the tank until a vacuum of approximately 180 Mb is reached. The testing is conducted in the same manner as it is for the pressure. The vacuum test is preferable to the pressure test under certain conditions and is also sometimes used to compliment pressure testing. If the pressure test indicates that a leak is present, the vacuum test conditions are sometimes used as further verification that a leak is present. Under other conditions, such as high groundwater levels, the vacuum conditions may be preferable to the pressure conditions.

### Description of the KWA Test Site

The testing was conducted using a 45,600 litre (12,000 gallon) steel tank located in Denver, Colorado. The tank is equipped with several 10 cm (four inch) diameter risers which are used to install test equipment. Each riser not used during the testing was capped securely and tested for leaks. The product contained in the test tank was diesel fuel.

After installing the test equipment to the tank, all exposed fittings and caps were checked for leaks using a soap solution. For the pressure ullage conditions, pressure was produced in the tank by introducing nitrogen from a compressed gas cylinder equipped with a pressure regulator. For the vacuum ullage conditions, air was removed from the tank by a vacuum pump. The pressure or vacuum was monitored by the PSL Precision Tester during the introduction of nitrogen or the removal of air.

### Overview of Evaluation Procedure

The testing procedures used for this evaluation were designed to verify that the PSL Precision Tester has the sensitivity and resolution necessary to detect the volume changes typical of a 380 ml/hr leak at the bottom of a 95% full tank. The evaluation of the PSL Precision Tester was based on an adaptation of the EPA protocol "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods", EPA/530/UST-90/005, March 1990.

All unused openings on the 45,600 litre tank used in the evaluation were sealed prior to initiating the testing. For the pressure ullage conditions, the ullage of the tank was pressurized to a nominal pressure of 180 Mb (2.0 psi). For the vacuum ullage conditions, the ullage of the tank was adjusted to a nominal vacuum of 180 Mb (-2.0 psi). The pressure within the ullage was monitored by the PSL Precision Tester. Additionally, the temperature of the product and the barometric

Table 1. Test Results for the Piper PSL Precision Tank Test System for Pressure Ullage Conditions

## Reporting Form for Leak Test Results
# Nonvolumetric Tank Tightness Testing Method

Method Name and Version: Piper PSL (Pressure Version)________ Leak Detection Mode: Precision Test____________

Evaluation Period: from:__11/13/94__ to _11/19/94_ (Dates)

| Test No. | If applicable Date at Completion of last fill (m/d/y) | If applicable Time at Completion of last fill (military) | Date Test Began (m/d/y) | Time Test Began (military) | Time Test Ended (military) | If applicable Product Temperature Differential (deg F) | Nominal Leak Rate (gal/h) | Induced Leak Rate* (gal/h) | Tank Tight? (Yes, No, or Test Invalid) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 11/13/1994 | 1300 | 11/14/1994 | 1005 | 1100 | 5.1 | 0 | 0 | y |
| 2 | 11/13/1994 | 1300 | 11/14/1994 | 1110 | 1210 | 5.1 | 0.1 | 0.195 | n |
| 3 | 11/14/1994 | 1500 | 11/15/1994 | 915 | 1015 | -0.9 | 0 | 0 | y |
| 4 | 11/14/1994 | 1500 | 11/15/1994 | 1035 | 1135 | -0.9 | 0 | 0 | y |
| 5 | 11/14/1994 | 1500 | 11/15/1994 | 1200 | 1300 | -0.9 | 0.1 | 0.25 | n |
| 6 | 11/14/1994 | 1500 | 11/15/1994 | 1330 | 1430 | -0.9 | 0.1 | 0.31 | n |
| 7 | 11/14/1994 | 1500 | 11/15/1994 | 1440 | 1540 | -0.9 | 0.1 | 0.27 | n |
| 8 | 11/15/1994 | 1827 | 11/16/1994 | 925 | 1025 | 5.3 | 0 | 0 | y |
| 9 | 11/15/1994 | 1827 | 11/16/1994 | 1045 | 1145 | 5.3 | 0.1 | 0.21 | n |
| 10 | 11/15/1994 | 1827 | 11/16/1994 | 1155 | 1255 | 5.3 | 0.1 | 0.26 | n |
| 11 | 11/15/1994 | 1827 | 11/16/1994 | 1350 | 1450 | 5.3 | 0 | 0 | y |
| 12 | 11/15/1994 | 1827 | 11/16/1994 | 1500 | 1600 | 5.3 | 0 | 0 | y |
| 13 | 11/16/1994 | 1903 | 11/17/1994 | 623 | 740 | 0.4 | 0 | 0 | y |
| 14 | 11/16/1994 | 1903 | 11/17/1994 | 750 | 850 | 0.4 | 0 | 0 | y |
| 15 | 11/16/1994 | 1903 | 11/17/1994 | 850 | 950 | 0.4 | 0 | 0 | y |
| 16 | 11/16/1994 | 1903 | 11/17/1994 | 1000 | 1100 | 0.4 | 0.1 | 0.2 | n |
| 17 | 11/16/1994 | 1903 | 11/17/1994 | 1130 | 1230 | 0.4 | 0.1 | 0.25 | n |
| 18 | 11/16/1994 | 1903 | 11/17/1994 | 1235 | 1335 | 0.4 | 0 | 0 | y |
| 19 | 11/16/1994 | 1903 | 11/17/1994 | 1340 | 1440 | 0.4 | 0.1 | 0.23 | n |
| 20 | 11/16/1994 | 1903 | 11/17/1994 | 1445 | 1545 | 0.4 | 0.1 | 0.22 | n |

* The induced leak rates were adjusted for the additional pressure due to pressurization of the ullage.

Table 1. (continued)

## Reporting Form for Leak Test Results
# Nonvolumetric Tank Tightness Testing Method

Method Name and Version: Piper PSL (Pressure Version) Leak Detection Mode: Precision Test

Evaluation Period: from: 11/13/94 to 11/19/94 (Dates)

| Test No. | If applicable Date at Completion of last fill (m/d/y) | If applicable Time at Completion of last fill (military) | Date Test Began (m/d/y) | Time Test Began (military) | Time Test Ended (military) | If applicable Product Temperature Differential (deg F) | Nominal Leak Rate (gal/h) | Induced Leak Rate* (gal/h) | Tank Tight? (Yes, No, or Test Invalid) |
|---|---|---|---|---|---|---|---|---|---|
| 21 | 11/16/1994 | 1903 | 11/17/1994 | 1550 | 1650 | 0.4 | 0.1 | 0.22 | n |
| 22 | 11/16/1994 | 1903 | 11/17/1994 | 1655 | 1755 | 0.4 | 0 | 0 | y |
| 23 | 11/17/1994 | 2103 | 11/18/1994 | 600 | 700 | -3.9 | 0 | 0 | y |
| 24 | 11/17/1994 | 2103 | 11/18/1994 | 705 | 805 | -3.9 | 0 | 0 | y |
| 25 | 11/17/1994 | 2103 | 11/18/1994 | 816 | 916 | -3.9 | 0.1 | 0.17 | n |
| 26 | 11/17/1994 | 2103 | 11/18/1994 | 920 | 1020 | -3.9 | 0.1 | 0.27 | n |
| 27 | 11/17/1994 | 2103 | 11/18/1994 | 1030 | 1130 | -3.9 | 0 | 0 | y |
| 28 | 11/17/1994 | 2103 | 11/18/1994 | 1135 | 1235 | -3.9 | 0.1 | 0.24 | n |
| 29 | 11/17/1994 | 2103 | 11/18/1994 | 1240 | 1340 | -3.9 | 0 | 0 | y |
| 30 | 11/17/1994 | 2103 | 11/18/1994 | 1345 | 1445 | -3.9 | 0.1 | 0.23 | n |
| 31 | 11/17/1994 | 2103 | 11/18/1994 | 1450 | 1550 | -3.9 | 0.1 | 0.2 | n |
| 32 | 11/17/1994 | 2103 | 11/18/1994 | 1555 | 1655 | -3.9 | 0 | 0 | y |
| 33 | 11/18/1994 | 2000 | 11/19/1994 | 600 | 700 | -1.3 | 0 | 0 | y |
| 34 | 11/18/1994 | 2000 | 11/19/1994 | 705 | 805 | -1.3 | 0 | 0 | y |
| 35 | 11/18/1994 | 2000 | 11/19/1994 | 810 | 910 | -1.3 | 0 | 0 | y |
| 36 | 11/18/1994 | 2000 | 11/19/1994 | 915 | 1015 | -1.3 | 0.1 | 0.27 | n |
| 37 | 11/18/1994 | 2000 | 11/19/1994 | 1025 | 1125 | -1.3 | 0.1 | 0.26 | n |
| 38 | 11/18/1994 | 2000 | 11/19/1994 | 1130 | 1230 | -1.3 | 0 | 0 | y |
| 39 | 11/18/1994 | 2000 | 11/19/1994 | 1235 | 1335 | -1.3 | 0.1 | 0.2 | n |
| 40 | 11/18/1994 | 2000 | 11/19/1994 | 1340 | 1440 | -1.3 | 0.1 | 0.2 | n |
| 41 | 11/18/1994 | 2000 | 11/19/1994 | 1445 | 1545 | -1.3 | 0 | 0 | y |
| 42 | 11/18/1994 | 2000 | 11/19/1994 | 1550 | 1650 | -1.3 | 0.1 | 0.17 | n |

* The induced leak rates were adjusted for the additional pressure due to pressurization of the ullage.

Table 2. Test Results for the Piper PSL Precision Tank Test System for Vaccuum Ullage Conditions

Reporting Form for Leak Test Results

## Nonvolumetric Tank Tightness Testing Method

Method Name and Version: Piper PSL (Vacuum Version) Leak Detection Mode: Precision Test

Evaluation Period: from: 12/4/94 to 12/20/94 (Dates)

| Test No. | If applicable Date at Completion of last fill (m/d/y) | If applicable Time at Completion of last fill (military) | Date Test Began (m/d/y) | Time Test Began (military) | Time Test Ended (military) | If applicable Product Temperature Differential (deg F) | Location of Leak | Nominal Leak Rate (gal/h) | Induced Leak Rate* (gal/h) | Tank Tight? (Yes, No, or Test Invalid) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12/4/94 | N/A | 12/18/94 | 1245 | 1325 | 0 | Tight | 0 | 0 | Y |
| 2 | 12/4/94 | N/A | 12/18/94 | 1335 | 1350 | 0 | Ullage | 0.1 | 0.1 | N |
| 3 | 12/4/94 | N/A | 12/18/94 | 1400 | 1415 | 0 | Liquid | 0.1 | 0.1 | N |
| 4 | 12/4/94 | N/A | 12/18/94 | 1425 | 1440 | 0 | Tight | 0 | 0 | Y |
| 5 | 12/4/94 | N/A | 12/18/94 | 1540 | 1555 | 0 | Liquid | 0.1 | 0.1 | N |
| 6 | 12/4/94 | N/A | 12/18/94 | 1600 | 1615 | 0 | Ullage | 0.1 | 0.1 | N |
| 7 | 12/18/94 | 1626 | 12/19/94 | 930 | 945 | 0 | Tight | 0 | 0 | Y |
| 8 | 12/18/94 | 1626 | 12/19/94 | 950 | 1005 | 0 | Liquid | 0.1 | 0.1 | N |
| 9 | 12/18/94 | 1626 | 12/19/94 | 1010 | 1025 | 0 | Tight | 0 | 0 | Y |
| 10 | 12/18/94 | 1626 | 12/19/94 | 1040 | 1055 | 0 | Tight | 0 | 0 | Y |
| 11 | 12/18/94 | 1626 | 12/19/94 | 1120 | 1135 | 0 | Ullage | 0.1 | 0.1 | N |
| 12 | 12/18/94 | 1626 | 12/19/94 | 1140 | 1155 | 0 | Liquid | 0.1 | 0.1 | N |
| 13 | 12/18/94 | 1626 | 12/19/94 | 1200 | 1215 | 0 | Tight | 0 | 0 | Y |
| 14 | 12/18/94 | 1626 | 12/19/94 | 1500 | 1520 | 0 | Tight | 0 | 0 | Y |
| 15 | 12/18/94 | 1626 | 12/19/94 | 1525 | 1540 | 0 | Ullage | 0.1 | 0.1 | N |
| 16 | 12/18/94 | 1626 | 12/19/94 | 1545 | 1600 | 0 | Liquid | 0.1 | 0.1 | N |
| 17 | 12/18/94 | 1626 | 12/19/94 | 1605 | 1620 | 0 | Tight | 0 | 0 | Y |
| 18 | 12/18/94 | 1626 | 12/19/94 | 1625 | 1640 | 0 | Liquid | 0.1 | 0.1 | N |
| 19 | 2/19/94 | 1925 | 12/20/94 | 840 | 855 | 1.67 | Tight | 0 | 0 | Y |
| 20 | 2/19/94 | 1925 | 12/20/94 | 915 | 930 | 1.67 | Liquid | 0.1 | 0.1 | N |

Table 2. (continued)

Reporting Form for Leak Test Results

## Nonvolumetric Tank Tightness Testing Method

Method Name and Version: Piper PSL (Vacuum Version) Leak Detection Mode: Precision Test

Evaluation Period: from: 12/4/94 to 12/20/94 (Dates)

| Test No | If applicable<br>Date at Completion of last fill (m/d/y) | If applicable<br>Time at Completion of last fill (military) | Date Test Began (m/d/y) | Time Test Began (military) | Time Test Ended (military) | If applicable<br>Product Temperature Differential (deg F) | Location of Leak | Nominal Leak Rate (gal/h) | Induced Leak Rate* (gal/h) | Tank Tight? (Yes, No, or Test Invalid) |
|---|---|---|---|---|---|---|---|---|---|---|
| 21 | 2/19/94 | 1925 | 12/20/94 | 935 | 950 | 1.67 | Ullage | 0.1 | 0.1 | N |
| 22 | 2/19/94 | 1925 | 12/20/94 | 955 | 1010 | 1.67 | Ullage | 0.1 | 0.1 | N |
| 23 | 2/19/94 | 1925 | 12/20/94 | 1015 | 1030 | 1.67 | Tight | 0 | 0 | Y |
| 24 | 2/19/94 | 1925 | 12/20/94 | 1035 | 1050 | 1.67 | Liquid | 0.1 | 0.1 | N |
| 25 | 2/19/94 | 1925 | 12/20/94 | 1055 | 1110 | 1.67 | Liquid | 0.1 | 0.1 | N |
| 26 | 2/19/94 | 1925 | 12/20/94 | 1115 | 1130 | 1.67 | Tight | 0.1 | 0.1 | N |
| 27 | 2/19/94 | 1925 | 12/20/94 | 1135 | 1150 | 1.67 | Tight | 0 | 0 | Y |
| 28 | 2/19/94 | 1925 | 12/20/94 | 1155 | 1210 | 1.67 | Tight | 0 | 0 | Y |
| 29 | 2/19/94 | 1925 | 12/20/94 | 1225 | 1240 | 1.67 | Liquid | 0.1 | 0.1 | N |
| 30 | 2/19/94 | 1925 | 12/20/94 | 1245 | 1300 | 1.67 | Ullage | 0.1 | 0.1 | N |
| 31 | 2/19/94 | 1925 | 12/20/94 | 1305 | 1320 | 1.67 | Ullage | 0.1 | 0.1 | N |
| 32 | 2/19/94 | 1925 | 12/20/94 | 1325 | 1340 | 1.67 | Tight | 0 | 0 | Y |
| 33 | 2/19/94 | 1925 | 12/20/94 | 1345 | 1400 | 1.67 | Tight | 0 | 0 | Y |
| 34 | 2/19/94 | 1925 | 12/20/94 | 1405 | 1420 | 1.67 | Liquid | 0.1 | 0.1 | N |
| 35 | 2/19/94 | 1925 | 12/20/94 | 1425 | 1440 | 1.67 | Ullage | 0.1 | 0.1 | N |
| 36 | 2/19/94 | 1925 | 12/20/94 | 1445 | 1500 | 1.67 | Liquid | 0.1 | 0.1 | N |
| 37 | 2/19/94 | 1925 | 12/20/94 | 1505 | 1520 | 1.67 | Liquid | 0.1 | 0.1 | N |
| 38 | 2/19/94 | 1925 | 12/20/94 | 1525 | 1540 | 1.67 | Ullage | 0.1 | 0.1 | N |
| 39 | 2/19/94 | 1925 | 12/20/94 | 1545 | 1600 | 1.67 | Liquid | 0.1 | 0.1 | N |
| 40 | 2/19/94 | 1925 | 12/20/94 | 1605 | 1620 | 1.67 | Tight | 0 | 0 | Y |
| 41 | 2/19/94 | 1925 | 12/20/94 | 1625 | 1640 | 1.67 | Ullage | 0.1 | 0.1 | N |
| 42 | 2/19/94 | 1925 | 12/20/94 | 1645 | 1700 | 1.67 | Tight | 0 | 0 | Y |

pressure were recorded during the testing using equipment that was external to the PSL Precision Tester.

For the pressure ullage tests, leaks were created using a peristaltic pump which was connected to a tube extending into the product. The leak rate was adjusted to account for the additional flow that would result from pressurization of the ullage to 180 Mb. A leak of 380 ml/hr with a diesel fuel head pressure of 2.44 meters will increase to 760 ml/hr when the ullage is pressurized to 180 Mb. The actual leak rates were verified after each test by measuring the volume of liquid removed during the test.

For the vacuum ullage tests, leaks were simulated using two orifices that had been calibrated to allow a flow of 380 ml/hr of diesel fuel under a 122 cm (4ft) head pressure. One orifice was connected to a tube that extended to the bottom of the tank. Air leaks through this orifice bubbled up through the liquid in the same manner as would occur if the leak were below the liquid level. The other orifice was installed to allow air leaks to occur directly into the ullage. The testing sequence involved randomly selecting on of the two orifices for each test. Fourteen ullage leaks, fourteen leaks below the liquid and 14 tight tests were conducted for a total of 42 tests under vacuum conditions.
Since calibrated orifices were used, changes in the test conditions automatically produced changes in the leak rates.

## Test Results and Discussion

The results of the testing have been presented in Tables 1 and 2. The pressure test results are presented in Table 1 and the vacuum test results are presented in Table 2. A total of 84 tests were conducted for this evaluation. Forty-two tests were conducted under pressurized ullage conditions and forty-two tests were conducted under vacuumized ullage conditions. Of the forty-two tests conducted under both types of conditions (pressure and vacuum), twenty-one leak conditions and twenty-one tight conditions were induced.

### Probability of Detection and Probability of a False Alarm

Of the 84 tests conducted, there were no missed detections and no false alarms at either positive or negative pressure. The probability of detection ($P_D$) was accordingly determined to be 100%. The probability of a false alarm ($P_{FA}$) was determined to be 0%.

### Size of Tank

Although the ullage testing was conducted on a 45,600 litre tank, the tank size is probably not the limiting parameter. A more appropriate parameter is the ullage volume. For this evaluation, testing was conducted on an ullage volume of 4,000 litres. It is therefore suggested that testing be limited to tanks with a maximum ullage volume of 4,000 litres.

Average Data Collection Time Per Test

The data collection time for a typical test is usually less than one hour. For the pressure tests, the average time for the series of tests was 60 minutes with a range of 55 to 77 minutes. For the vacuum tests, the average time for the series of tests was 16 minutes with a range of 15 to 40 minutes.

Product Level

The product level for the testing was adjusted to give an ullage volume of 4,000 litres. For this particular tank, the product level was adjusted to approximately 2133 mm (84 in). The diameter of the tank was 2,438 mm (96 in).

Minimum Total Testing Time

The minimum total test time for this system is estimated to be 2 hours. This includes 1 hour to set up the tank for testing, 0.5 hours to conduct the test, and 0.5 hours to return the tank to service. The tank setup time could be a major variable. Longer test times are permissible.

Maximum Allowable Temperature Difference

The temperature of the product which was transferred to the tank during the testing ranged from -3.9 degrees F to +5.3 degrees F for the positive pressure tests and from 0 degrees F to +5.0 degrees F for the negative pressure tests. The standard deviation of the temperature differences was 3.7 degrees F for the positive pressure tests which gives a maximum allowable temperature difference of ±5.5 degrees F between product delivered and product in the tank before a positive pressure test can be conducted. The standard deviation of the temperature differences was 2.5 degrees F for the negative pressure tests which gives a maximum allowable temperature difference of ±3.8 degrees F between product delivered and product in the tank before a negative pressure test can be conducted.

The practical implications of the maximum allowable temperature difference are not obvious. While it is clear that testing should not be conducted immediately following a product delivery, it is also clear that after some minimum stabilization time, testing may be reliably conducted even if the temperature differences were greater than those allowed by the protocol. The test results reported for this evaluation were obtained under the temperature conditions stated above. Larger differences could require correspondingly longer stabilisation times.

## Sources of Variation in the Test Results

There are sources of variation in all leak detection methods. Because the use of pressure decay is a relatively new procedure for the precision testing of underground storage tanks, it seems advisable to provide some discussion of the potential error sources of this method. This will allow regulators, owners, and other cognizant parties to evaluate the applicability of the method to a specific set of site conditions. The methodology used by PSL to compensate for potential interferences has also been briefly discussed.

### Product Type

The type of product contained in the tank can effect the testing times. Since water and diesel fuel have low vapour pressures at the temperature of a typical tank test, volatilization of the product is much less of a problem. The time required to reach equilibrium for gasoline or other volatile products may be considerably longer. In addition, the coefficient of expansion for gasoline is approximately 50% greater than that for diesel. Extended test times may be required when there is a large gasoline ullage.

### Test Pressure

Higher pressures will amplify the leak more than lower pressures and will offset the effects of a water table. The test pressures used in this evaluation (180 Mb) will change a leak rate of 380 ml/hr to 760 ml/hr.

### Water Table

The presence of a water table above the leak will reduce the differential pressure and reduce the leak rate. To assure that the water table does not mask a leak, the pressure can be increased to a high enough level that the water table will be overcome and the leak will be re-established. If the position of the water table is known, the necessary increase can be readily calculated. Under vacuum conditions, the presence of a water table above the leak will produce a water ingress into the tank thereby reducing the vacuum conditions.

### Temperature Changes in the Product

Temperature changes in the product will cause the product to expand or contract, producing changes in the ullage volume and pressure. Temperature changes in the product can potentially mask or produce a false alarm (report a leak when the tank is actually tight). This is caused because thermal contraction or expansion can reach rates higher than 380 ml/hr, particularly for large tanks. An adequate stabilisation time is therefore required. This is particularly true when the product is gasoline. Because the coefficient of expansion is larger for gasoline than for diesel, particular caution should be taken when testing large gasoline tanks. The results of this evaluation indicate that testing should not be conducted sooner than 8 to 10 hours after the tank is filled.

Two additional steps may be taken to reduce the potential problem caused by temperature variations in the product. First, the owner is encouraged to fill the tank well in advance of the test and keep the product level high so that the last delivery prior to testing is basically a topping-off process. This will reduce the effects of product deliveries of a different temperature. Second, the test data is monitored carefully to verify that pressure changes are uniform in behavior. Unstable temperatures will produce curvature in the data as the product approaches equilibrium. If curvature is observed, additional stabilisation times are required.

Temperature Changes in the Ullage

Temperature changes in the ullage will effect the ullage pressure. In most cases, a stabilisation time of 1.5 hrs after pressurization should be adequate to establish thermal equilibrium.

Barometric Pressure Changes

The PSL system is sensitive to barometric pressure changes. The tester must monitor the barometric pressure during the change to assure that the ullage pressure changes are not due to atmospheric changes. Caution should be observed when testing during storms or other times when atmospheric changes are likely to occur. Testing should be discontinued during times of rapid barometric pressure changes.

**Conclusions**

Specific conclusions for the PSL Precision Tester are discussed below.

1. The PSL Precision Tester will meet the performance requirements for the U.S. EPA for nonvolumetric test methods when testing is conducted under stable conditions.

2. Since there were no missed detections or false alarms, the Probability of Detection ($P_D$) is 100% and the Probability of False Alarm is ($P_{FA}$) is 0%.

3. The volume of the ullage that may be used during a test should not exceed 4,000 litres.

4. It is recommended that the tank be allowed to stabilise overnight after a delivery has occurred. A minimum of 8-10 hours should be provided. If a leak is detected, a second test should be conducted to identify potential temperature influences.

5. A minimum of 1.5 hours must be allowed for stabilisation after the tank is pressurized. Longer times may be required for volatile fuels.

6. Testing should be avoided during times of rapid barometric pressure changes.

7. The maximum allowable temperature difference after a delivery is ±5.5 degrees F for a positive pressure test and ±3.8 degrees F for a negative pressure test. Although these temperature differentials are specified by the USEPA, it is often difficult to to determine that they have been met. If larger temperature differentials are encountered, longer stabilisation times may be required.

# Attachment A

## EPA Forms for the Piper Services, Ltd., PSL Precision Tester

# Results of U.S. EPA Alternative Evaluation
# Nonvolumetric Tank Tightness Testing Method

This form tells whether the tank tightness testing method described below complies with the performance requirements of the federal underground storage tank regulation. The evaluation was conducted by the equipment manufacturer or a consultant to the manufacturer using a modification of the U.S. EPA'S "Standard Test Procedure for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods." The full evaluation report also includes a form describing the method and a form summarizing the test data.

Tank owners using this leak detection system should keep this form on file to prove compliance with the federal regulations. Tank owners should check with State and local agencies to make sure this form satisfies their requirements.

## Method Description

Name PSL Precision Tester

Version Positive Pressure

Vendor Piper Services (Yorks) Ltd.

Ahed House Estate, Dewsbury Road
(street address)

Ossett, West Yorkshire. WF5 9ND, United Kingdom 0924 283200
(city) (county) (country) (phone)

## Evaluation Results

This method, which declares a tank to be leaking when pressure decay exceeds the calibration value over a period of 15 minutes
has an estimated probability of false alarms [P(FA)] of 0.0 % based on the test results of 0 false alarms out of 21 tests. A 95% confidence interval for P(FA) is from 0 to 13 %.

The corresponding probability of detection [P(D)] of a 0.10 gallon per hour leak is 100.0 % based on the test results of 21 detections out of 21 simulated leak tests. A 95% confidence interval for P(D) is from 86 to 100 %.

Does this method use additional modes of leak detection? ( ) Yes (X) No. If Yes, complete additional evaluation results on page 3 of this form.

Based on the results above, and on page 3 if applicable, this method (X) does ( ) does not meet the federal performance standards established by the U.S. Environmental Protection Agency (0.10 gallon per hour at P(D) of 95% and P(FA) of 5%).

## Test Conditions During Evaluation

The evaluation testing was conducted in a 12,000 gallon (X) steel ( ) fiberglass tank that was 96 inches in diameter and 389 inches long, installed in gravel backfill.

The ground-water level was 0 inches above the bottom of the tank.

**Test Conditions During Evaluation (continued)**

The tests were conducted with the tank _96%_ percent full.

The temperature difference between product added to fill the tank and product already in the tank ranged from _-3.9_ degrees F to _+5.1_ degrees F, with a standard deviation of _3.7_ degrees F.

The product used in the evaluation was _diesel fuel_.

This method may be affected by other sources of interference. List these interferences below and give the ranges of conditions under which the evaluation was done. (Check None if not applicable.)

( ) None

| Interferences | Range of Test Conditions |
|---|---|
| Product temperature change | Ullage volume must be less than 4,000 L |
| Ullage volume too large | |
| Stabilization time must be 8-10 hrs | |

**Limitations on the Results**

The performance estimates above are only valid when:

- The method has not been substantially changed.
- The vendor's instructions for using the method are followed.
- The tank contains a product identified on the method description form.
- The tank capacity is 18,000 gallons or smaller. (The ullage volume must not exceed 4,000 L)
- The difference between added and in-tank product temperatures is no greater than ± _5.5_ degrees Fahrenheit.

( ) Check if applicable:
Temperature is not a factor because ______

- The waiting time between the end of filling the test tank and the start of the test data collection is at least _8_ hours. (Longer for large tanks)
- The waiting time between the end of "topping off" to final testing level and the start of the test data collection is at least _N/A_ hours. (Underfill test)
- The total data collection time for the test is at least _0.25_ hours.
- The ullage volume in the tank during testing is _less than 4,000 L_.
- This method (X) can ( ) cannot be used if the ground-water level is above the bottom of the tank. (If the product head pressure must be greater than the external water pressure at the bottom of the tank.)

Other limitations specified by the vendor or determined during testing:

Nonvolumetric TTT Method PSL Precision Tester
Version Positive Pressure

> **Safety disclaimer: This test procedure only addresses the issue of the method's ability to detect leaks. It does not test the equipment for safety hazards.**

---

**Additional Evaluation Results (if applicable)** NOT APPLICABLE TO THIS EVALUATION

This method, which declares a tank to be leaking when ______________________
has an estimated probability of false alarms [P(FA)] of ______% based on the test results of ____ false alarms out of ____ tests. Note: A perfect score during testing does not mean that the method is perfect. Based on the observed results, a 95% confidence interval for P(FA) is from 0 to _____%.

The corresponding probability of detection [P(D)] of a _______ gallon per hour leak is ______% based on the test results of ______ detections out of _____ simulated leak tests. Note: A perfect score during testing does not mean that the method is perfect. Based on the observed results, a 95% confidence interval for P(D) is from ______ to ______%.

> **Water detection mode (If applicable)** NOT APPLICABLE TO THIS EVALUATION

Using a false alarm rate of 5%, the minimum water level that the water sensor can detect with a 95% probability of detection is _____ inches.

Using a false alarm rate of 5%, the minimum change in water level that the water sensor can detect with a 95% probability of detection is ______ inches.

Based on the minimum water level and change in water level that the water sensor can detect with a false alarm rate of 5% and a 95% probability of detection, the minimum time for the system to detect an increase in water level at an incursion rate of 0.10 gallon per hour is ______ minutes in a ________-gallon tank.

---

**Certification of Results**

I certify that the nonvolumetric tank tightness testing method was installed and operated according to the vendor's instructions. I also certify that the evaluation was performed according to the standard EPA test procedure for nonvolumetric tank tightness testing methods and that the results presented above are those obtained during the evaluation.

| | |
|---|---|
| H. Kendall Wilcox, President | Ken Wilcox Associates, Inc. |
| (printed name) | (organization performing evaluation) |
| H. Kendall Wilcox | Independence, MO 64055 |
| (signature) | (city, state. zip) |
| January 31, 1995 | (816) 795-7997 |
| (date) | (phone number) |

Reporting Form for Leak Test Results

# Nonvolumetric Tank Tightness Testing Method

Method Name and Version: Piper PSL (Pressure Version) Leak Detection Mode: Precision Test

Evaluation Period: from: 11/13/94 to 11/19/94 (Dates)

| Test No. | If applicable Date at Completion of last fill (m/d/y) | If applicable Time at Completion of last fill (military) | Date Test Began (m/d/y) | Time Test Began (military) | Time Test Ended (military) | If applicable Product Temperature Differential (deg F) | Nominal Leak Rate (gal/h) | Induced Leak Rate* (gal/h) | Tank Tight? (Yes, No, or Test Invalid) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 11/13/1994 | 1300 | 11/14/1994 | 1005 | 1100 | 5.1 | 0 | 0 | y |
| 2 | 11/13/1994 | 1300 | 11/14/1994 | 1110 | 1210 | 5.1 | 0.1 | 0.195 | n |
| 3 | 11/14/1994 | 1500 | 11/15/1994 | 915 | 1015 | -0.9 | 0 | 0 | y |
| 4 | 11/14/1994 | 1500 | 11/15/1994 | 1035 | 1135 | -0.9 | 0 | 0 | y |
| 5 | 11/14/1994 | 1500 | 11/15/1994 | 1200 | 1300 | -0.9 | 0.1 | 0.25 | n |
| 6 | 11/14/1994 | 1500 | 11/15/1994 | 1330 | 1430 | -0.9 | 0.1 | 0.31 | n |
| 7 | 11/14/1994 | 1500 | 11/15/1994 | 1440 | 1540 | -0.9 | 0.1 | 0.27 | n |
| 8 | 11/15/1994 | 1827 | 11/16/1994 | 925 | 1025 | 5.3 | 0 | 0 | y |
| 9 | 11/15/1994 | 1827 | 11/16/1994 | 1045 | 1145 | 5.3 | 0.1 | 0.21 | n |
| 10 | 11/15/1994 | 1827 | 11/16/1994 | 1155 | 1255 | 5.3 | 0.1 | 0.26 | n |
| 11 | 11/15/1994 | 1827 | 11/16/1994 | 1350 | 1450 | 5.3 | 0 | 0 | y |
| 12 | 11/15/1994 | 1827 | 11/16/1994 | 1500 | 1600 | 5.3 | 0 | 0 | y |
| 13 | 11/16/1994 | 1903 | 11/17/1994 | 623 | 740 | 0.4 | 0 | 0 | y |
| 14 | 11/16/1994 | 1903 | 11/17/1994 | 750 | 850 | 0.4 | 0 | 0 | y |
| 15 | 11/16/1994 | 1903 | 11/17/1994 | 850 | 950 | 0.4 | 0 | 0 | y |
| 16 | 11/16/1994 | 1903 | 11/17/1994 | 1000 | 1100 | 0.4 | 0.1 | 0.2 | n |
| 17 | 11/16/1994 | 1903 | 11/17/1994 | 1130 | 1230 | 0.4 | 0.1 | 0.25 | n |
| 18 | 11/16/1994 | 1903 | 11/17/1994 | 1235 | 1335 | 0.4 | 0 | 0 | y |
| 19 | 11/16/1994 | 1903 | 11/17/1994 | 1340 | 1440 | 0.4 | 0.1 | 0.23 | n |
| 20 | 11/16/1994 | 1903 | 11/17/1994 | 1445 | 1545 | 0.4 | 0.1 | 0.22 | n |

* The induced leak rates were adjusted for the additional pressure due to pressurization of the ullage.

Reporting Form for Leak Test Results

# Nonvolumetric Tank Tightness Testing Method

Method Name and Version: Piper PSL (Pressure Version) Leak Detection Mode: Precision Test

Evaluation Period: from: 11/13/94 to 11/19/94 (Dates)

| Test No. | If applicable Date at Completion of last fill (m/d/y) | If applicable Time at Completion of last fill (military) | Date Test Began (m/d/y) | Time Test Began (military) | Time Test Ended (military) | If applicable Product Temperature Differential (deg F) | Nominal Leak Rate (gal/h) | Induced Leak Rate* (gal/h) | Tank Tight? (Yes, No, or Test Invalid) |
|---|---|---|---|---|---|---|---|---|---|
| 21 | 11/16/1994 | 1903 | 11/17/1994 | 1550 | 1650 | 0.4 | 0.1 | 0.22 | n |
| 22 | 11/16/1994 | 1903 | 11/17/1994 | 1655 | 1755 | 0.4 | 0 | 0 | y |
| 23 | 11/17/1994 | 2103 | 11/18/1994 | 600 | 700 | -3.9 | 0 | 0 | y |
| 24 | 11/17/1994 | 2103 | 11/18/1994 | 705 | 805 | -3.9 | 0 | 0 | y |
| 25 | 11/17/1994 | 2103 | 11/18/1994 | 816 | 916 | -3.9 | 0.1 | 0.17 | n |
| 26 | 11/17/1994 | 2103 | 11/18/1994 | 920 | 1020 | -3.9 | 0.1 | 0.27 | n |
| 27 | 11/17/1994 | 2103 | 11/18/1994 | 1030 | 1130 | -3.9 | 0 | 0 | y |
| 28 | 11/17/1994 | 2103 | 11/18/1994 | 1135 | 1235 | -3.9 | 0.1 | 0.24 | n |
| 29 | 11/17/1994 | 2103 | 11/18/1994 | 1240 | 1340 | -3.9 | 0 | 0 | y |
| 30 | 11/17/1994 | 2103 | 11/18/1994 | 1345 | 1445 | -3.9 | 0.1 | 0.23 | n |
| 31 | 11/17/1994 | 2103 | 11/18/1994 | 1450 | 1550 | -3.9 | 0.1 | 0.2 | n |
| 32 | 11/17/1994 | 2103 | 11/18/1994 | 1555 | 1655 | -3.9 | 0 | 0 | y |
| 33 | 11/18/1994 | 2000 | 11/19/1994 | 600 | 700 | -1.3 | 0 | 0 | y |
| 34 | 11/18/1994 | 2000 | 11/19/1994 | 705 | 805 | -1.3 | 0 | 0 | y |
| 35 | 11/18/1994 | 2000 | 11/19/1994 | 810 | 910 | -1.3 | 0 | 0 | y |
| 36 | 11/18/1994 | 2000 | 11/19/1994 | 915 | 1015 | -1.3 | 0.1 | 0.27 | n |
| 37 | 11/18/1994 | 2000 | 11/19/1994 | 1025 | 1125 | -1.3 | 0.1 | 0.26 | n |
| 38 | 11/18/1994 | 2000 | 11/19/1994 | 1130 | 1230 | -1.3 | 0 | 0 | y |
| 39 | 11/18/1994 | 2000 | 11/19/1994 | 1235 | 1335 | -1.3 | 0.1 | 0.2 | n |
| 40 | 11/18/1994 | 2000 | 11/19/1994 | 1340 | 1440 | -1.3 | 0.1 | 0.2 | n |
| 41 | 11/18/1994 | 2000 | 11/19/1994 | 1445 | 1545 | -1.3 | 0 | 0 | y |
| 42 | 11/18/1994 | 2000 | 11/19/1994 | 1550 | 1650 | -1.3 | 0.1 | 0.17 | n |

* The induced leak rates were adjusted for the additional pressure due to pressurization of the ullage.

# Results of U.S. EPA Alternative Evaluation
# Nonvolumetric Tank Tightness Testing Method

This form tells whether the tank tightness testing method described below complies with the performance requirements of the federal underground storage tank regulation. The evaluation was conducted by the equipment manufacturer or a consultant to the manufacturer using a modification of the U.S. EPA'S "Standard Test Procedure for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods." The full evaluation report also includes a form describing the method and a form summarizing the test data.

Tank owners using this leak detection system should keep this form on file to prove compliance with the federal regulations. Tank owners should check with State and local agencies to make sure this form satisfies their requirements.

## Method Description

Name PSL Precision Tester

Version Negative Pressure (Vacuum)

Vendor Piper Services (Yorks) Ltd.

Ahed House Estate, Dewsbury Road
(street address)

Ossett, West Yorkshire, WF5 9ND, United Kingdom 0924 283200
(city) (county) (country) (phone)

## Evaluation Results

This method, which declares a tank to be leaking when vacuum decay exceeds the calibration value over a period of 15 minutes has an estimated probability of false alarms [P(FA)] of 0.0 % based on the test results of 0 false alarms out of 21 tests. A 95% confidence interval for P(FA) is from 0 to 13 %.

The corresponding probability of detection [P(D)] of a 0.10 gallon per hour leak is 100.0 % based on the test results of 21 detections out of 21 simulated leak tests. A 95% confidence interval for P(D) is from 86 to 100 %.

Does this method use additional modes of leak detection? ( ) Yes (X) No. If Yes, complete additional evaluation results on page 3 of this form.

Based on the results above, and on page 3 if applicable, this method (X) does ( ) does not meet the federal performance standards established by the U.S. Environmental Protection Agency (0.10 gallon per hour at P(D) of 95% and P(FA) of 5%).

## Test Conditions During Evaluation

The evaluation testing was conducted in a 12,000 gallon (X) steel ( ) fiberglass tank that was 96 inches in diameter and 389 inches long, installed in gravel backfill.

The ground-water level was 0 inches above the bottom of the tank.

**Test Conditions During Evaluation (continued)**

The tests were conducted with the tank 96% percent full.

The temperature difference between product added to fill the tank and product already in the tank ranged from 0 degrees F to +5.0 degrees F, (only two transfers were conducted) with a standard deviation of 2.5 degrees F.

The product used in the evaluation was diesel fuel.

This method may be affected by other sources of interference. List these interferences below and give the ranges of conditions under which the evaluation was done. (Check None if not applicable.)

( ) None

| Interferences | Range of Test Conditions |
|---|---|
| Product temperature change | Ullage volume must be less than 4,000 L |
| Ullage volume too large | |
| Stabilization time must be 8-10 hrs | |

**Limitations on the Results**

The performance estimates above are only valid when:

- The method has not been substantially changed.
- The vendor's instructions for using the method are followed.
- The tank contains a product identified on the method description form.
- The tank capacity is 18,000 gallons or smaller. (The ullage volume must not exceed 4,000 L)
- The difference between added and in-tank product temperatures is no greater than ± 3.8 degrees Fahrenheit.

( ) Check if applicable:
Temperature is not a factor because ______

- The waiting time between the end of filling the test tank and the start of the test data collection is at least 8 hours. (Longer for large tanks)
- The waiting time between the end of "topping off" to final testing level and the start of the test data collection is at least N/A hours. (Underfill test)
- The total data collection time for the test is at least 0.25 hours.
- The ullage volume in the tank during testing is less than 4,000 L .
- This method (X) can ( ) cannot be used if the ground-water level is above the bottom of the tank. (If the product head pressure must be greater than the external water pressure at the bottom of the tank.)

Other limitations specified by the vendor or determined during testing:

______

Nonvolumetric TTT Method ____PSL Precision Tester____
Version __Negative Pressure (Vacuum)__

> **Safety disclaimer: This test procedure only addresses the issue of the method's ability to detect leaks. It does not test the equipment for safety hazards.**

---

**Additional Evaluation Results (if applicable)** NOT APPLICABLE TO THIS EVALUATION

This method, which declares a tank to be leaking when ______________ has an estimated probability of false alarms [P(FA)] of ______% based on the test results of ____ false alarms out of ____ tests. Note: A perfect score during testing does not mean that the method is perfect. Based on the observed results, a 95% confidence interval for P(FA) is from 0 to ____%.

The corresponding probability of detection [P(D)] of a _______ gallon per hour leak is ______% based on the test results of ______ detections out of ______ simulated leak tests. Note: A perfect score during testing does not mean that the method is perfect. Based on the observed results, a 95% confidence interval for P(D) is from ______ to ______%.

> **Water detection mode (If applicable)** NOT APPLICABLE TO THIS EVALUATION

Using a false alarm rate of 5%, the minimum water level that the water sensor can detect with a 95% probability of detection is _____ inches.

Using a false alarm rate of 5%, the minimum change in water level that the water sensor can detect with a 95% probability of detection is ______ inches.

Based on the minimum water level and change in water level that the water sensor can detect with a false alarm rate of 5% and a 95% probability of detection, the minimum time for the system to detect an increase in water level at an incursion rate of 0.10 gallon per hour is _______ minutes in a ________-gallon tank.

---

**Certification of Results**

I certify that the nonvolumetric tank tightness testing method was installed and operated according to the vendor's instructions. I also certify that the evaluation was performed according to the standard EPA test procedure for nonvolumetric tank tightness testing methods and that the results presented above are those obtained during the evaluation.

| | |
|---|---|
| H. Kendall Wilcox, President<br>(printed name) | Ken Wilcox Associates, Inc.<br>(organization performing evaluation) |
| H. Kendall Wilcox<br>(signature) | Independence, MO 64055<br>(city, state, zip) |
| January 31, 1995<br>(date) | (816) 795-7997<br>(phone number) |

## Reporting Form for Leak Test Results

# Nonvolumetric Tank Tightness Testing Method

Method Name and Version: Piper PSL (Vacuum Version) Leak Detection Mode: Precision Test

Evaluation Period: from: 12/4/94 to 12/20/94 (Dates)

| Test No. | If applicable Date at Completion of last fill (m/d/y) | If applicable Time at Completion of last fill (military) | Date Test Began (m/d/y) | Time Test Began (military) | Time Test Ended (military) | If applicable Product Temperature Differential (deg F) | Nominal Leak Rate (gal/h) | Induced Leak Rate* (gal/h) | Tank Tight? (Yes, No, or Test Invalid) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 12/4/94 | N/A | 12/18/94 | 1245 | 1325 | 0 | 0 | 0 | Y |
| 2 | 12/4/94 | N/A | 12/18/94 | 1335 | 1350 | 0 | 0.1 | 0.1 | N |
| 3 | 12/4/94 | N/A | 12/18/94 | 1400 | 1415 | 0 | 0.1 | 0.1 | N |
| 4 | 12/4/94 | N/A | 12/18/94 | 1425 | 1440 | 0 | 0 | 0 | Y |
| 5 | 12/4/94 | N/A | 12/18/94 | 1540 | 1555 | 0 | 0.1 | 0.1 | N |
| 6 | 12/4/94 | N/A | 12/18/94 | 1600 | 1615 | 0 | 0.1 | 0.1 | N |
| 7 | 12/18/94 | 1626 | 12/19/94 | 930 | 945 | 0 | 0 | 0 | Y |
| 8 | 12/18/94 | 1626 | 12/19/94 | 950 | 1005 | 0 | 0.1 | 0.1 | N |
| 9 | 12/18/94 | 1626 | 12/19/94 | 1010 | 1025 | 0 | 0 | 0 | Y |
| 10 | 12/18/94 | 1626 | 12/19/94 | 1040 | 1055 | 0 | 0 | 0 | Y |
| 11 | 12/18/94 | 1626 | 12/19/94 | 1120 | 1135 | 0 | 0.1 | 0.1 | N |
| 12 | 12/18/94 | 1626 | 12/19/94 | 1140 | 1155 | 0 | 0.1 | 0.1 | N |
| 13 | 12/18/94 | 1626 | 12/19/94 | 1200 | 1215 | 0 | 0 | 0 | Y |
| 14 | 12/18/94 | 1626 | 12/19/94 | 1500 | 1520 | 0 | 0 | 0 | Y |
| 15 | 12/18/94 | 1626 | 12/19/94 | 1525 | 1540 | 0 | 0.1 | 0.1 | N |
| 16 | 12/18/94 | 1626 | 12/19/94 | 1545 | 1600 | 0 | 0.1 | 0.1 | N |
| 17 | 12/18/94 | 1626 | 12/19/94 | 1605 | 1620 | 0 | 0 | 0 | Y |
| 18 | 12/18/94 | 1626 | 12/19/94 | 1625 | 1640 | 0 | 0.1 | 0.1 | N |
| 19 | 2/19/94 | 1925 | 12/20/94 | 840 | 855 | 1.67 | 0 | 0 | Y |
| 20 | 2/19/94 | 1925 | 12/20/94 | 915 | 930 | 1.67 | 0.1 | 0.1 | N |

Reporting Form for Leak Test Results

# Nonvolumetric Tank Tightness Testing Method

Method Name and Version: Piper PSL (Vacuum Version) Leak Detection Mode: Precision Test

Evaluation Period: from: 12/4/94 to 12/20/94 (Dates)

| Test No. | If applicable Date at Completion of last fill (m/d/y) | If applicable Time at Completion of last fill (military) | Date Test Began (m/d/y) | Time Test Began (military) | Time Test Ended (military) | If applicable Product Temperature Differential (deg F) | Nominal Leak Rate (gal/h) | Induced Leak Rate* (gal/h) | Tank Tight? (Yes, No, or Test Invalid) |
|---|---|---|---|---|---|---|---|---|---|
| 21 | 2/19/94 | 1925 | 12/20/94 | 935 | 950 | 1.67 | 0.1 | 0.1 | N |
| 22 | 2/19/94 | 1925 | 12/20/94 | 955 | 1010 | 1.67 | 0.1 | 0.1 | N |
| 23 | 2/19/94 | 1925 | 12/20/94 | 1015 | 1030 | 1.67 | 0 | 0 | Y |
| 24 | 2/19/94 | 1925 | 12/20/94 | 1035 | 1050 | 1.67 | 0.1 | 0.1 | N |
| 25 | 2/19/94 | 1925 | 12/20/94 | 1055 | 1110 | 1.67 | 0.1 | 0.1 | N |
| 26 | 2/19/94 | 1925 | 12/20/94 | 1115 | 1130 | 1.67 | 0.1 | 0.1 | N |
| 27 | 2/19/94 | 1925 | 12/20/94 | 1135 | 1150 | 1.67 | 0 | 0 | Y |
| 28 | 2/19/94 | 1925 | 12/20/94 | 1155 | 1210 | 1.67 | 0 | 0 | Y |
| 29 | 2/19/94 | 1925 | 12/20/94 | 1225 | 1240 | 1.67 | 0.1 | 0.1 | N |
| 30 | 2/19/94 | 1925 | 12/20/94 | 1245 | 1300 | 1.67 | 0.1 | 0.1 | N |
| 31 | 2/19/94 | 1925 | 12/20/94 | 1305 | 1320 | 1.67 | 0.1 | 0.1 | N |
| 32 | 2/19/94 | 1925 | 12/20/94 | 1325 | 1340 | 1.67 | 0 | 0 | Y |
| 33 | 2/19/94 | 1925 | 12/20/94 | 1345 | 1400 | 1.67 | 0 | 0 | Y |
| 34 | 2/19/94 | 1925 | 12/20/94 | 1405 | 1420 | 1.67 | 0.1 | 0.1 | N |
| 35 | 2/19/94 | 1925 | 12/20/94 | 1425 | 1440 | 1.67 | 0.1 | 0.1 | N |
| 36 | 2/19/94 | 1925 | 12/20/94 | 1445 | 1500 | 1.67 | 0.1 | 0.1 | N |
| 37 | 2/19/94 | 1925 | 12/20/94 | 1505 | 1520 | 1.67 | 0.1 | 0.1 | N |
| 38 | 2/19/94 | 1925 | 12/20/94 | 1525 | 1540 | 1.67 | 0.1 | 0.1 | N |
| 39 | 2/19/94 | 1925 | 12/20/94 | 1545 | 1600 | 1.67 | 0.1 | 0.1 | N |
| 40 | 2/19/94 | 1925 | 12/20/94 | 1605 | 1620 | 1.67 | 0 | 0 | Y |
| 41 | 2/19/94 | 1925 | 12/20/94 | 1625 | 1640 | 1.67 | 0.1 | 0.1 | N |
| 42 | 2/19/94 | 1925 | 12/20/94 | 1645 | 1700 | 1.67 | 0 | 0 | Y |

# Nonvolumetric Tank Tightness Testing Method

This section describes briefly the important aspects of the nonvolumetric tank tightness testing method. It is not intended to provide a thorough description of the principles behind the method or how the equipment works.

**Method Name and Version**

PSL Precision Tester - Pressure or Vacuum

**Product**

**> Product type**

For what products can this method be used? (check all applicable)

(X) gasoline

(X) diesel

(X) aviation fuel

(X) fuel oil #4

( ) fuel oil #6

(X) solvents

(X) waste oil

(X) other (list) Water

**> Product level**

What product level is required to conduct a test?

( ) above grade

( ) within the fill pipe

( ) greater than 90% full

( ) greater than 50% full

( ) empty

(X) other (specify) Ullage volume less than 4,000 L or 1000 gal

## Principle of Operation

What principle or principles are used to identify a leak?

( ) acoustical signal characteristic of a leak

( ) identification of a tracer chemical outside the tank system

( ) changes in product level or volume

( ) detection of water inflow

( ) other (describe briefly) Pressure or vacuum decay over time.

## Temperature Measurement

If product temperature is measured during a test, how many temperature sensors are used?

( ) single sensor, without circulation

( ) single sensor, with circulation

( ) 2-4 sensors

( ) 5 or more sensors

( ) temperature-averaging probe

If product temperature is measured during a test, what type of temperature sensor is used?

( ) resistance temperature detector (RTD)

( ) bimetallic strip

( ) quartz crystal

( ) thermistor

( ) other (describe briefly) ____________

If product temperature is not measured during a test, why not?

( ) the factor measured for change in level or volume is independent of temperature (e.g., mass)

( ) the factor measured for change in level or volume self-compensates for changes in temperature

(X) other (explain briefly) Adequate stabilization time is allowed to minimize temperature effects. A second test after additional stabilization may also be conducted

## Data Acquisition

How are the test data acquired and recorded

(X) manually

( ) by strip chart

( ) by computer

## Procedure Information

> **Waiting times**

What is the minimum waiting period between adding a large volume of product to bring the level to test requirements and the beginning of the test (e.g., from 50% to 95% capacity)?

( ) not applicable

( ) no waiting period

( ) less than 3 hours

( ) 3-6 hours

(X) 7-12 hours

( ) more than 12 hours

( ) variable, depending on tank size, amount added, operator discretion, etc.

> **Test duration**

What is the minimum time for collecting data?

(X) less than 1 hour

( ) 1 hour

( ) 2 hours

( ) 3 hours

( ) 4 hours

( ) 5-10 hours

( ) more than 10 hours

( ) variable

> **Total time**

What is the total time needed to test with this method?

*(setup time plus waiting time plus testing time plus time to return tank to service)*

__10__ hours _____ minutes

> **Other important elements of the procedure or method**

List here any other elements that could affect the performance of the procedure or method (e.g., positive or negative ullage pressure, tracer concentration, distance between tank and sampling ports, etc.)

Product temperature must be stable prior to testing.

Product head pressure must be greater than external water table pressure for pressure test

> **Identifying and correcting for interfering factors**

How does the method determine the presence and level of the ground water above the bottom of the tank?

(X) observation well near tank

( ) information from USGS, etc.

(X) information from personnel on-site

( ) presence of water in the tank

( ) other (describe briefly) ______________________

(X) Level of ground water above bottom of the tank not determined (NOT NEEDED IF PRESSURE AND VACUUM TESTS ARE PERFORMED)

How does the method correct for the interference due to the presence of ground water above the bottom of the tank?

(X) head pressure increased by raising the level of the product

( ) different head pressures tested and leak rates compared

(X) tests for changes in water level in tank

( ) other (describe briefly) ______________________

( ) no action

Does the method measure inflow of water as well as loss of product (gallon per hour)?

( ) yes

(X) no

Does the method detect the presence of water in the bottom of the tank?

( ) yes

(X) no

How does the method identify the presence of vapor pockets?

( ) erratic temperature, level, or temperature-compensated volume readings

( ) sudden large changes in readings

( ) statistical analysis of variability of readings

( ) other (describe briefly) ____________

( ) not identified

(X) not applicable; underfilled test method used

How does the method correct for the presence of vapor pockets?

( ) bleed off vapor and start test over

( ) identify periods of pocket movement and discount data from analysis

( ) other (describe briefly) ________________

( ) not corrected

(X) not applicable; underfilled test method used

How does the test method determine when tank deformation has stopped following delivery of product?

( ) wait a specified period of time before beginning test

( ) watch the data trends and begin test when decrease in product level has stopped

( ) other (describe briefly) ________________

( ) no procedure

(X) not applicable, does not affect principle of operation

Are the method's sensors calibrated before each test?

( ) yes

(X) no

If not, how often are the sensors calibrated?

( ) weekly

( ) monthly

(X) yearly or less frequently

( ) never

> **Interpreting test results**

What effect is used to declare the tank to be leaking? (List all modes used by the method.)

Loss of pressure or vacuum during the test..

If a change in volume is used to detect leaks, what threshold value for product volume change (gallon per hour) is used to declare that a tank is leaking?

( ) 0.05 gallon per hour

( ) 0.10 gallon per hour

( ) 0.20 gallon per hour

(X) other The threshold is determined by measuring the pressure loss when one liter of product is removed from the tank.

Under what conditions are test results considered inconclusive?

( ) ground-water level above bottom of tank
( ) presence of vapor pockets
( ) too much variability in the data (standard deviation beyond a given value)
( ) unexplained product volume increase
( ) other (describe briefly) ____________________

---

**Exceptions**

Are there any conditions under which a test should not be conducted?

( ) ground-water level above bottom of tank

( ) presence of vapor pockets

(X) large difference between ground temperature and delivered product temperature

( ) extremely high or low ambient temperature

( ) invalid for some products (specify) ____________

( ) soil not sufficiently porous

( ) other (describe briefly) ____________________

What are acceptable deviations from the standard testing protocol?

( ) none

(X) lengthen the duration of test

( ) other (describe briefly) ____________________

What elements of the test procedure are left to the discretion of the testing personnel on-site?

(X) waiting period between filling tank and beginning test

(X) length of test

( ) determination of presence of vapor pockets

( ) determination that tank deformation has subsided

( ) determination of "outlier" data that may be discarded

( ) other (describe briefly) ____________________

( ) none

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Leeds LS2 3AR

Fax 0532 343811
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# CERTIFICATE OF CONFORMITY

PSL Precision Tank Testing Equipment

This summary indicates the findings of an evaluation carried out by us to satisfy the requirements made by the Health and Safety Executive in their guidelines No HS (G) 41. As required by these guidelines the evaluation tests were performed according to procedure set out in the US. EPA "Standard Test Procedures for Evaluating Leak Detection Methods".

**Equipment Used** - PSL Precision Tank Testing Equipment

MK III Serial No 005. Designed and Manufactured in the UK by Piper Services Ltd

**Test Tank** - 4'-6" Diam. 12'-0" Long of steel construction with two equally sized compartments. Total nominal capacity 1,000 gall. The tank is sited at PSL's own test house facility.

**Product** - Diesel Fuel having a Density of 830kg/m$^3$ @ 15°C and a Kinematic Viscosity of 1.5 to 5.5 CStokes.

**Evaluation Results** - The variables introduced were -

| | | |
|---|---|---|
| Product volume | - | 500 to 2,300 litres |
| Ullage volume | - | 500 to 4,500 litres |
| Leak rates | - | 150, 250 and 500 mL/hr |

The ability of the test equipment to detect water leaks was evaluated using an adjoining water tank and a flexible hose containing the test orifice. The relative water height and orifice position were varied to simulate both inflow and outflow.

A total of 40 tests were performed when leaks were created using a calibrated test orifice set at different positions both **above** and **below** the product level.

In Every test that we set the equipment user was able to establish correctly whether the system was **Leaktight** or **Leaking**.

**Limitations on the Results** - Although a 100% score was achieved the PSL system is not perfect or infallible.

Tests will only be valid when:

- The equipment and method have not been substantially changed.
- The test personnel have been adequately trained and evaluated.
- The test tank contains the product identified for this evaluation.
- The Ullage is not greater than that tested.
- The product and gas conditions are stable after the prescribed waiting time.

**Safety Disclaimer** - This test procedure only addresses the issue of the PSL equipment's ability to detect leaks. It does not test the equipment for safety hazards.

**Certification of Results** - We certify that a thorough evaluation has been carried out by the undersigned according to standards set by the UK. HSE and the US. EPA and that the PSL equipment meets the performance requirements set by the British Health and Safety Executive. The results summarised here are presented more comprehensively, with tabulated and graphical results, in the full report commissioned by PSL.

Signed J. S Mulligan Date 11th May 1994

J S Mulligan
Chief Experimental Officer
Department of Mechanical Engineering

Enclosure - Description of the PSL Precision Tank Tightness Method

CONS0042

**Piper SERVICES (YORKS) LTD**

## DESCRIPTION OF THE P.S.L. PRECISION TANK TIGHTNESS METHOD BASED ON THE US EPA FORMAT

MODEL - MK III.Serial No 005

### PRODUCT

Product type

Petrol Diesel Aviation Fuel Solvents Waste Oil and most liquids

### PRODUCT LEVEL

What product level is required to conduct a test ?

The product level is less important than the ullage volume for this equipment and therefore the level may vary from empty to the statutory "full" level dependant upon tank size

The maximum ullage space is at present 4000 litres dependant upon product type and gas stability

### PRINCIPLES OF OPERATION

What principle or principles are used to identify a leak ?

Positive pressure is applied to the ullage space using inert Nitrogen gas of upto 200 mb Any loss of product or gas will be accompanied by a drop in the applied pressure

## TEMPERATURE MEASUREMENT

If product temperature is measured during a test. How may temperature sensors be used ?

Product temperature is not measured.

If product temperature is not measured during a test. Why not ?

The product temperature is allowed to become stable, ensuring that only very small changes occur during the actual test period.

Ambient temperature is measured to ensure that the ullage temperature does not change significantly.

## DATA ACQUISITION

How are the test data acquired and recorded ?

The data is acquired manually and recorded in tabular and graphical form.

## WAITING TIMES

What is the minimum waiting period between adding a large volume of product to bring the level to test requirements and the start of test ?

The normal requirement is that any additional product required for testing should be delivered the day before testing.

## TEST DURATION

What is the minimum time for collecting data?

For majority of tests - 1 hour

For a small ullage - less than 1 hour

For a large ullage - up to 2 hours

These times are at the discretion of the tester

TOTAL TIME:

What is the total time needed to test with this method ?

(set up time plus waiting time plus testing time plus time to return tank to service).

Normally 2 - 3 hours but note above comments.

OTHER IMPORTANT ELEMENTS OF THE PROCEDURE OR METHOD.

List here any other elements that could affect the performance of the procedure or method (e.g. positive or negative ullage pressure, tracer concentration, distance between tank and sampling ports, etc.)

The sensitivity of the equipment depends upon the ullage rather than the product volume Therefore there is a limit to the maximum ullage and consequently the testers ability to confidently predict a tight or leaking tank. This limit of testing confidence is reached when small instabilities become large in comparison to the pressure drop recorded

IDENTIFYING AND CORRECTING FOR INTERFERING FACTORS.

How does the method determine the presence and level of the ground water above the bottom of the tank ?

It is not necessary to determine the exact level for this equipment, but information sought from appropriate sources.

How does the method correct for the interference due to the presence of ground water above the bottom of the tank?

Equivalent head pressure of up to 200 mb is applied to the ullage

Does the method detect the presence of water in the bottom of the tank ?

Detects any hole in the tank system causing inflow or outflow but does not measure the flowrate

How does the method identify the presence of vapour pockets ?

Not applicable underfill test method used

How does the method correct for the presence of vapour pockets ?

Not applicable. undefill test method used.

How does the test method determine when tank deformation has stopped following delivery of product?

Not applicable. does not affect principle of operation.

Are the methods sensors calibrated before each test ?

The equipment is tested for "leak tight" on a sealed test piece prior to each test programme. Absolute pressure values are not important to the principle, therefore precise pressure calibration is not necessary. The sensor is however calibrated against a Mercury Manometer at the 6 monthly service period. Low battery condition is indicated on the display panel

## INTERPRETING TEST RESULTS.

What effect is used to declare the tank to be leaking? (List all modes used by the method).

The results are tabulated and then plotted in graphical form. When conditions are stable any significant drop in pressure indicates a loss of product or gas. Comparison can be made to a "calibration leak"

If a change in volume is used to detect leaks, what threshold value for product volume change (gallon per hour) is used to declare that a tank is leaking?

A loss of product indicated by a drop in pressure of more than 0.5 mb

Under what conditions are test results considered inconclusive?

When large changes in ambient temperature or pressure occur during the test period

## EXCEPTIONS

Are there any conditions under which a test should not be conducted?

When the requirements set out in the manual are not met

What are acceptable deviations from the standard testing protocol?

When product or ullage limits are exceeded.

What elements of the test procedure are left to the discretion of the testing personnel on-site?

1) The waiting period and length of test.

2) The provisional assessment

SIGNED ____________ DATE 11-5-94

PSL. PRECISION TANK TESTING EQUIPMENT.
MANUFACTURED BY.
CARL DENBY
PIPER SERVICES LTD
PENNINE VIEW INDUSTRIAL ESTATE
GELDERD ROAD
BATLEY
WEST YORKSHIRE. WF17 9NF

SIGNED J. S. Mulligan DATE 11th May 1994.

J. S. MULLIGAN
CHIEF EXPERIMENTAL OFFICER
UNIVERSITY OF LEEDS INOVATIONS LTD
175 WOODHOUSE LANE
LEEDS.
LS2 3AR

Failure Rate from 900 Tank Sample



| AREA | DATE | TANK | SUCTION | FILL | VENT |
|---|---|---|---|---|---|
| Avon | 01/03/95 | | | Fail | |
| Cambridgeshire | 03/05/95 | | | | Fail |
| | 03/05/96 | | | | Fail |
| Cheshire | 13/10/94 | Fail | | | |
| | 18/11/94 | | | | Fail |
| | 07/01/95 | Fail | | | |
| | 07/01/95 | Fail | Fail | | |
| | 07/01/95 | | Fail | | |
| | 04/02/96 | | Fail | | |
| | 04/02/96 | | Fail | | |
| | 05/02/95 | | Fail | | |
| | 05/02/95 | | Fail | | |
| | 05/02/95 | | | | Fail |
| | 05/02/95 | | | | Fail |
| | 06/02/95 | | | | Fail |
| | 06/02/95 | | | | Fail |
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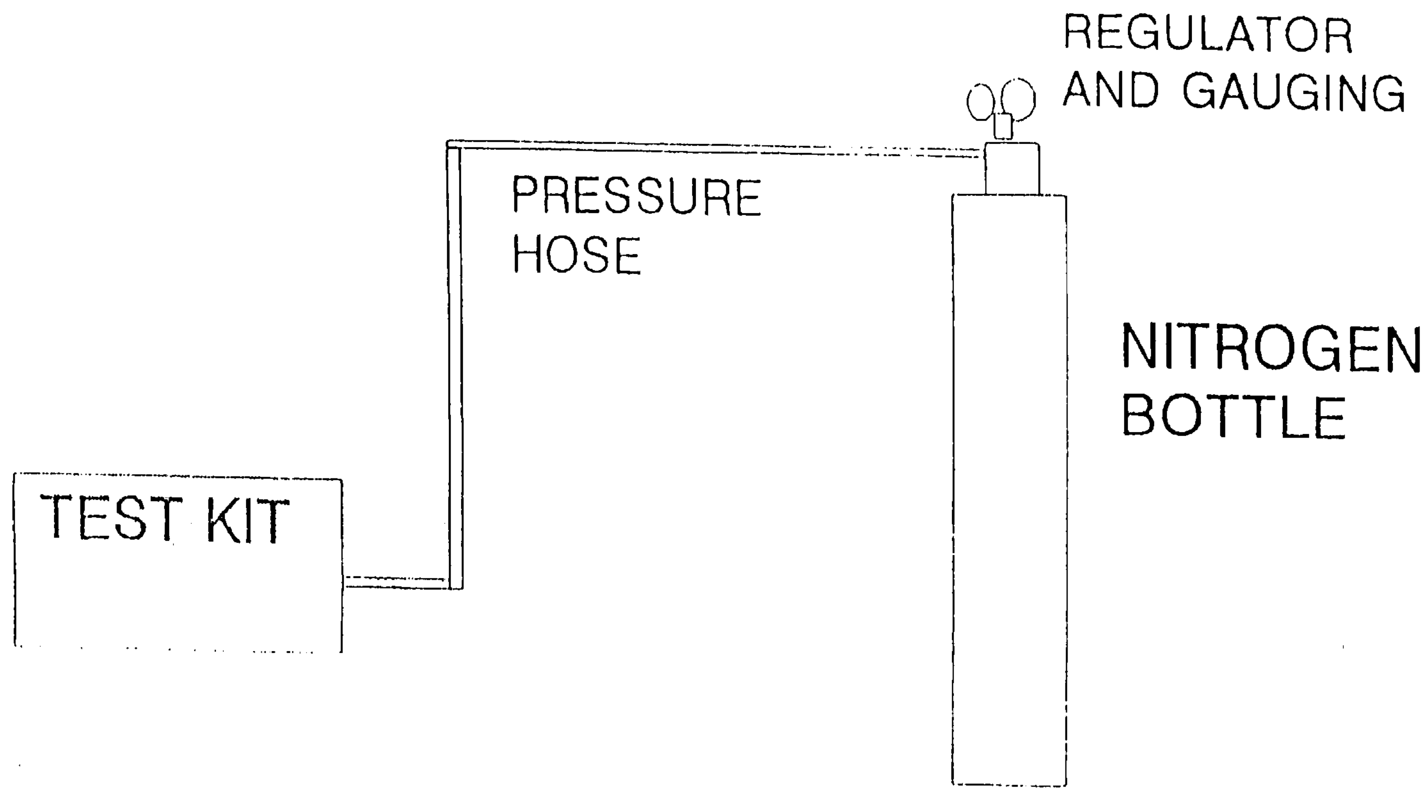
| | 06/02/95 | | Fail | | |
| | 06/02/95 | | Fail | | |
| | 06/02/95 | | Fail | | |
| | 06/02/95 | | Fail | | |
| | 01/07/95 | | | Fail | |
| | 01/07/95 | | Fail | | |
| | 01/07/95 | | | | Fail |
| | 01/07/95 | | | Fail | |
| Clwyd | 06/02/95 | | | Fail | |
| Cumbria | 11/11/94 | | | Fail | |
| | 01/12/94 | Fail | | | |
| | 19/01/95 | | | Fail | |
| Dorset | 23/06/96 | | | Fail | |
| | 23/06/96 | | | | Fail |
| | 01/08/95 | | | Fail | |
| | 01/08/95 | | | | Fail |
| Essex | 05/06/96 | | | | Fail |
| Glamorgan (W) | 07/02/95 | | | | Fail |
| Glamorgan (S) | 25/04/95 | | | | Fail |
| Gloucestershire | 14/02/95 | | | | Fail |
| Grtr' Manchester | 19/05/95 | | | | Fail |
| | 19/06/96 | | | Fail | Fail |
| | 19/06/96 | | | Fail | Fail |
| | 19/06/96 | | | Fail | |
| Hampshire | 08/02/95 | | | | Fail |
| | 08/02/95 | | | | Fail |
| | 28/02/95 | | Fail | Fail | |
| | 28/02/96 | | | | Fail |
| Herefordshire | 21/12/94 | | | | Fail |
| | 21/12/94 | | | | Fail |
| | 09/05/95 | | | | Fail |
| Hertfordshire | 18/12/94 | | | | Fail |
| Humberside | 07/03/95 | | Fail | | Fail |
| Kant | 06/07/96 | | | | Fail |
| | 07/07/95 | Fail | | | |

| AREA | DATE | TANK | SUCTION | FILL | VENT |
|---|---|---|---|---|---|
| Lancashire | 24/02/95 | | Fail | | Fail |
| | 09/03/95 | | | Fail | |
| | 10/05/95 | | | | Fail |
| | 10/05/95 | | | Fail | |
| Lincolnshire | 28/10/94 | Fail | | | |
| London | 15/02/95 | | | | Fail |
| | 06/07/95 | | | | Fail |
| | 07/07/95 | Fail | | | |
| Midlands (W) | 17/09/94 | Fail | | | Fail |
| | 16/11/94 | | | | Fail |
| | 01/02/95 | | | | Fail |
| | 04/02/95 | | | | Fail |
| | 03/03/95 | Fail | | | |
| | 03/03/95 | Fail | | | |
| | 30/03/95 | | | | Fail |
| | 30/03/95 | | | | Fail |
| | 07/04/95 | | | Fail | |
| | 10/04/95 | | | | Fail |
| | 19/05/95 | | | | Fail |
| | 24/06/95 | | | Fail | |
| Norfolk | 13/09/94 | | | | Fail |
| | 15/09/94 | | | | Fail |
| | 07/11/94 | | | | Fail |
| | 10/11/94 | | | | Fail |
| | 07/12/94 | | | | Fail |
| | 28/04/95 | | | | Fail |
| | 28/04/95 | | | | Fail |
| Northamptonshire | 28/11/94 | Fail | | | |
| | 01/12/94 | Fail | | | |
| Northumberland | 19/04/95 | | | | Fail |
| | 19/04/95 | | | | Fail |
| [illegible] | [illegible] | | | | [illegible] |
| Strathclyde | 14/01/95 | | | | Fail |
| | 14/01/95 | | | | Fail |
| | 16/01/95 | | | Fail | |
| | 18/01/95 | | | Fail | |
| | 18/01/95 | | | Fail | |
| | 13/02/95 | | Fail | Fail | |
| | 13/02/95 | | | Fail | |
| | 13/02/95 | | | Fail | |
| Sunderland | 25/11/94 | | | | Fail |
| | 25/11/94 | | | | Fail |
| Warwickshire | 30/11/94 | Fail | | | |
| | 19/08/95 | | | | Fail |
| Yorkshire (N) | 07/10/94 | Fail | | | |
| | 27/10/94 | | | | Fail |
| | 12/11/94 | | | Fail | |
| | 12/11/94 | | | Fail | |
| | 12/11/94 | | | Fail | |
| | 12/11/94 | | | Fail | |
| | 13/12/94 | | | | Fail |
| | 07/07/95 | | | | Fail |

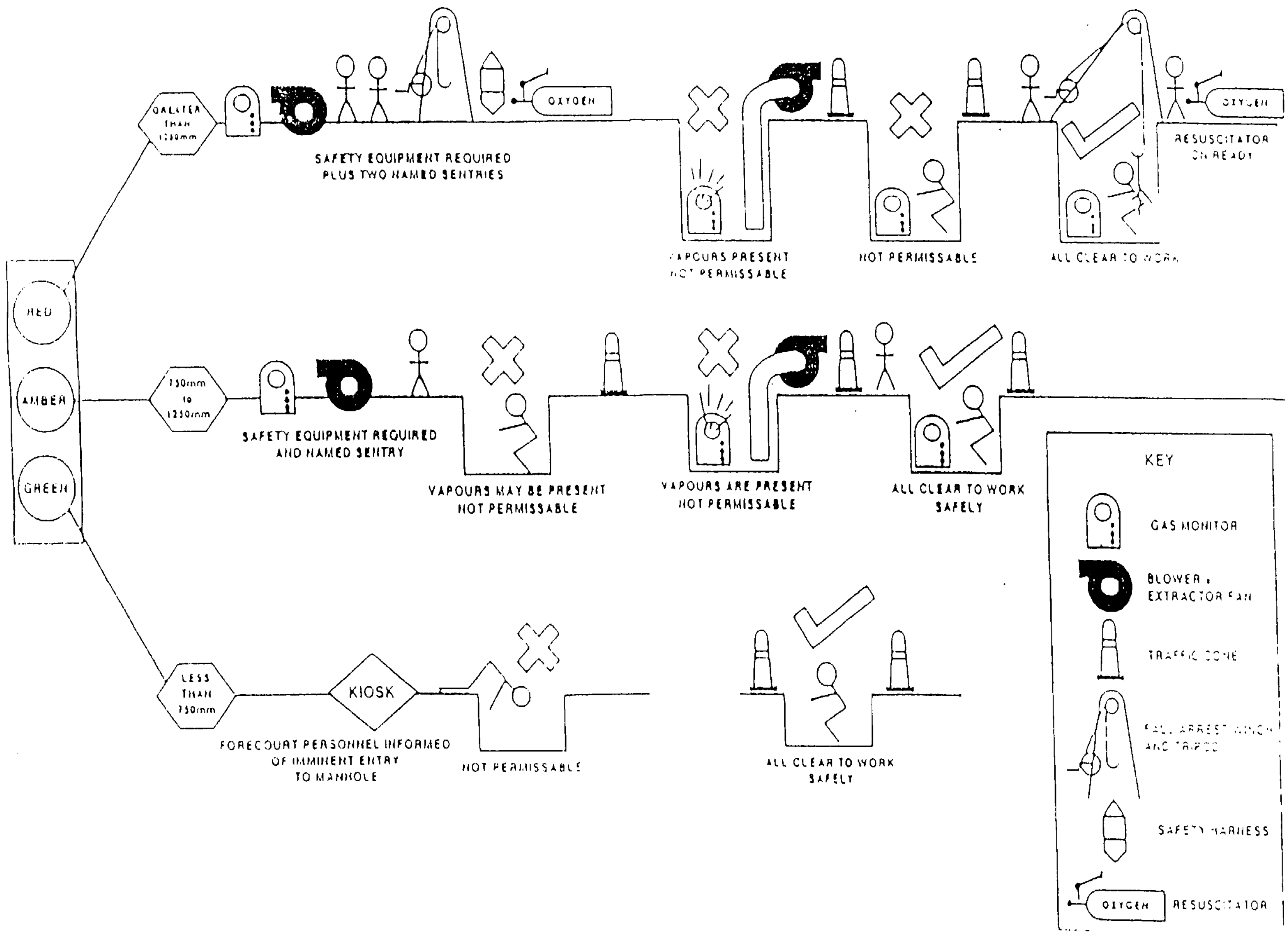
| AREA | DATE | TANK | SUCTION | FILL | VENT |
|---|---|---|---|---|---|
| Yorkshire (N) Ctd | 25/08/95 | Fail | | | Fail |
| Yorkshire (S) | 16/11/94 | | | | Fail |
| | 17/11/94 | | | | Fail |
| | 16/12/94 | | | Fail | |
| | 16/02/95 | | | | Fail |
| | 08/03/95 | | | Fail | |
| | 05/06/95 | Fail | | | Fail |
| | 06/09/94 | | | | Fail |
| | 13/09/94 | | | Fail | Fail |
| | 13/10/94 | | Fail | | |
| | 29/10/94 | | | Fail | |
| | 02/11/94 | | | | Fail |
| | 10/12/94 | Fail | | | |
| | 07/03/96 | | | Fail | |
| | 31/03/96 | | Fail | | |
| | 06/04/95 | | | | Fail |

# APPENDIX 10

NITROGEN PRESSURE APPLIED TO TESTED TANK MUST BE THROUGH TEST KIT.



# GUIDELINES REGARDING SAFETY ON ENTERING MANCHAMBERS



### Ground-Water Monitoring

Ground-water monitoring senses the presence of liquid product floating on the ground water. This method requires installation of monitoring wells at strategic locations in the ground near the tank and along the piping runs. To discover if leaked product has reached ground water, these wells can be checked periodically by hand or continuously with permanently installed equipment. This method cannot be used at sites where ground water is more than 20 feet below the surface.

### Vapor Monitoring

Vapor monitoring senses and measures product "fumes" in the soil around the tank and piping to determine the presence of a leak. This method requires installation of carefully placed monitoring wells. Vapor monitoring can be performed manually on a periodic basis or continuously using permanently installed equipment.

### Secondary Containment with Interstitial Monitoring

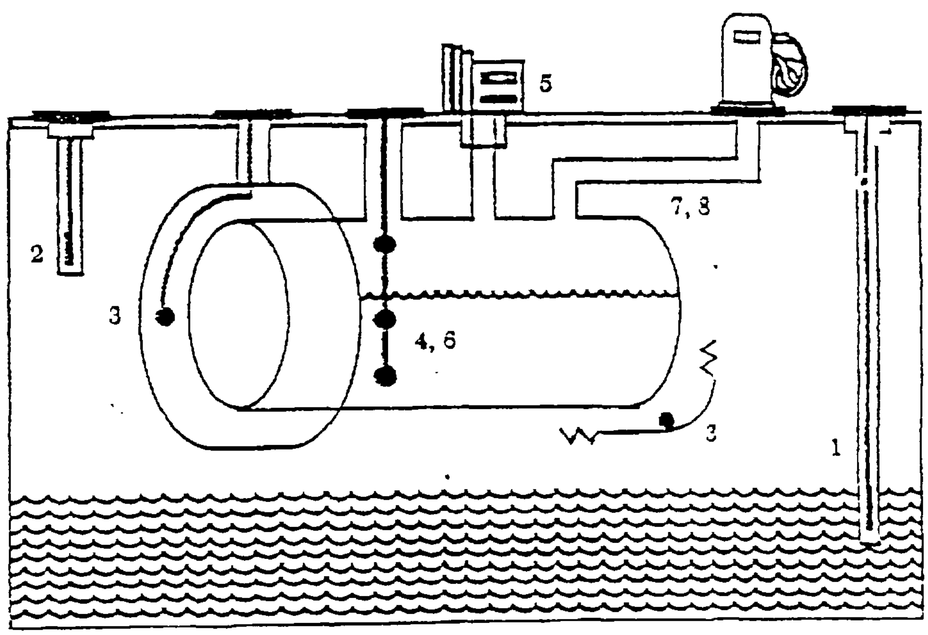
Secondary containment consists of placing a barrier -- by using a vault, liner, or double-walled structure -- around the UST. Leaked product from the inner tank or piping is directed towards an "interstitial" monitor located between the inner tank or piping and the outer barrier. Interstitial monitoring methods range from a simple dip stick to a continuous automated vapor or liquid sensor permanently installed in the system.

### Automatic Tank Gauging Systems

Monitors permanently installed in the tank are linked electronically to a nearby control device to provide information on product level and temperature. During a test period of several hours when nothing is put into or taken from the tank, these monitors are used to automatically calculate the changes in product volume that can indicate a leaking tank.

## Leak Detection Methods for Tanks and Piping

1- Ground-Water Monitoring
2- Vapor Monitoring
3- Secondary Containment with Interstitial Monitoring
4- Automatic Tank Gauging Systems
5- Tank Tightness Testing and Inventory Control
6- Manual Tank Gauging
7- Leak Detection for Underground Suction Piping
8- Leak Detection for Pressurized Underground Piping



DEPARTMENT OF ENVIRONMENTAL AND HYDRAULIC ENGINEERING
Polytechnic UNIVERSITY OF VALENCIA
Apartado de Correos 22012
46071 VALENCIA

Translated into English November 1996

# REPORT ABOUT THE NONVOLUMETRIC PSL PROCEDURE-TEST FOR THE VERIFICATION OF TANKING AND DETECTION OF LEAKS IN TANKS.

Produced by: "U.D. Mecanica" of Fluids of the Department of Environmental and Hydraulic Engineering of the University of Valencia
Petitioner: NET, S.A.

Valencia, September 16, 1996

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# INDEX

1. - Main advantages of the PSL test

2. - Trials done for the verification of the PSL procedure

3. -Certification of the trials done

# ADDITIONAL INFORMATION

1. - Selection of twelve of the trials done

2. - Selection of photographs taken during the trials

3. - Certification Document

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## 1.- MAIN ADVANTAGES OF THE PSL TEST

Among the main advantages of the PSL test, the following five can be cited:

a) Its LOW COST

The system's reduced application cost, its quick use and mobility all contribute to the low test price.

b) Its EASY use

The system's necessary equipment is portable and does not require any special technical ability to operate, if the personnel who will be using it, has been adequately trained and prepared in an information course, equipped with the corresponding accreditation.

c) Its TECHNICAL CAPABILITY

The PSL procedure-test can detect leaks much smaller that those required in the international guidlines, surpassing the requirements of the "EPA" (Environmental Protection Agency.)

d) Its REPUTATION

Its reputation is well endorsed by the Certifications and many favorable Reports possessed at an international level.

e) It REQUIREMENTS and CERTIFICATIONS

The PSL procedure test possesses the requirements corresponding to the fullfilment of the EPA/530/UST-90/005 norm issued in March of 1990: "Standard procedure's trials to evaluate the leak detection methods: non-volumetric methods for tanking trials"

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## 2. - TRIALS DONE TO PROVE THE PSL PROCEDURE

### 1. - Objective

Experimental proof of the effectiveness of the PSL procedure-test, done exclusively for NET, S.A, in Spain to verify the tank integrity of closed atmospheric storage tanks and its capability of detecting leaks in such storage tanks and the hydraulic installation associated with such.

This procedure can also detect the leaks when the tanking system is empty and also allows for calibrating the liquid level measuring instruments.

### 2. - Place and date

The tests took place in NET, S.A., C/ Alcora #311, Almassora (Castellon). These tests took place September 2-13 of 1996.

### 3. - Professional Staff present when the trials took place

The trials were done by the Mechanical Fluids Educational Unit of the Polytechnic University of Valencia, represented by Professor Dr. Antonio Fabian Vela Gasulla.

### 4. - Conditions of the trials

With the objective being to effectively prove the validity and guarantee of the procedure, the trials took place on different days, at different times of the day, therefore the environmental conditions were different concerning temperature,

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humidity, interior pressure and atmospheric pressure. The test always obtained satisfactory results that are clear enough, which proves the validity of the employed method and minimum influences by the environmental conditions in its quality. This important conclusion is the result of the physical foundation of the procedure.

The verification system installed, consisted of a closed cylindric atmospheric tank, and the connected hydraulic system, made up of accessories and pipes.

The main dimensions of the tank,with a total volume of 20,000 liters are:

Diameter: 2200 mm.
Length: 5470 mm.
Side wall thickness: 5mm.
End wall thickness: 6mm.

The cited tank has an entirely accessible exterior which allowed for the causing of defects and the quantity of rigourously produced leaks.

**5. Description and results of the trials done.**

1. Verification, calibration and proving of the equipment used with primary standards like the tanking to be tested.

2. Proving of the tanking trial through the application of the PSL procedure test, repeating the test at different liquid levels and different pressures. The values ranged from 0-2,0 m.y intervals, -60 to +180 millibars respectively.

3.The detection of a series of leaks, because of the caused defects in the tank wall and previously guaranteed defects leading to the detection of leaks less than 140 ml/hr. with sufficient clarity and guarantee. The defects were caused in the tank wall in contact with the liquid phase as well as the fluid's gaseous phase.

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4. The final proving of the tanking,once the defect caused by the leak is found, is totally eliminated.

In addition to what has been cited above, the procedure test has been verified by an independent organization authorized by the EPA (Environmental Protection Agency)- ATG Precision- fulfilling the requiremnets of the EPA /530/90/

This PSL Test was proved in the cited installation,property of NET,S.A., complying with all the requirements.

6. Environmental safety and impact

The application of the PSL Procedure Test, following the methodology described in the proceding sections, guarantees a greater security than other procedures based on tests at higher atmospheric pressures. Since the compression of the empty space caused inside the tank is relatively low, the risk of an explosion is next to none.

In reference to the possible environmental impact, the application of this method assures the impossibility of emission to the environment located around the tank. This avoids any environmental impact.

## 3. CERTIFICATION OF THE TRIALS DONE

7. Conclusions

Based on the complete documentation contributed, EPA certification granted, tests done and its physical foundations, the corresponding Technical Report and Certification of the validity and dependibility of the PSL Procedure Test can be granted.

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The Mechanical Fluids Educational Unit of the Department of Environmental and Hydraulic Engineering of the Polytechnic University of Valencia

CERTIFIES:

that the non-volumetric method of proving tanking, named PSL Procedure Test, for the verification of testing in closed atmosphere tanks,all associated accessories and all piping systems done exclusively for NET S.A. Calle Mendizabal, #123, Burjasot, Valencia, was evaluated according to that established in the Environmental Protection Agency Federal Bureau of the United States of America( EPA/530/UST-90/005 , March 1,1990)

that ,as a result of the above evaluation,and at this time,this favourable technical report for this procedure is granted. The procedure has been able to detect leaks less than 140 ml/hr. with sufficient clarity and guarantee. Therefore, the conclusion is that the procedure is considered satisfactory and reliable for proving tanking and the detection of leaks in tanks.

that the application of the procedure in the cited fluid storage installations presents minimum risks of the deterioration of the tank and avoids environmental impact during its use.

Valencia, September 16,1996

CONCESIONARIO EXCLUSIVO D... TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSL

**NET, s. a.**

Location: Ubicación

Tank #: Tanque nº 2 Date: Fecha 5/9/96 Test #: Test nº 1

Fuel type: Tipo de combustible AGUA Water

Tank capacity: Capacidad del tanque 20000 l

Current capacity: Capacidad actual 16000 l

Filled Pipes: Ø Tubería llenado

Vented Pipes: Ø Tubería venteo

Tank suction pipes: Ø Tubería succión a bomba

done by: Realizado por: [signature]

proven by: Comprobado por: J. Almela

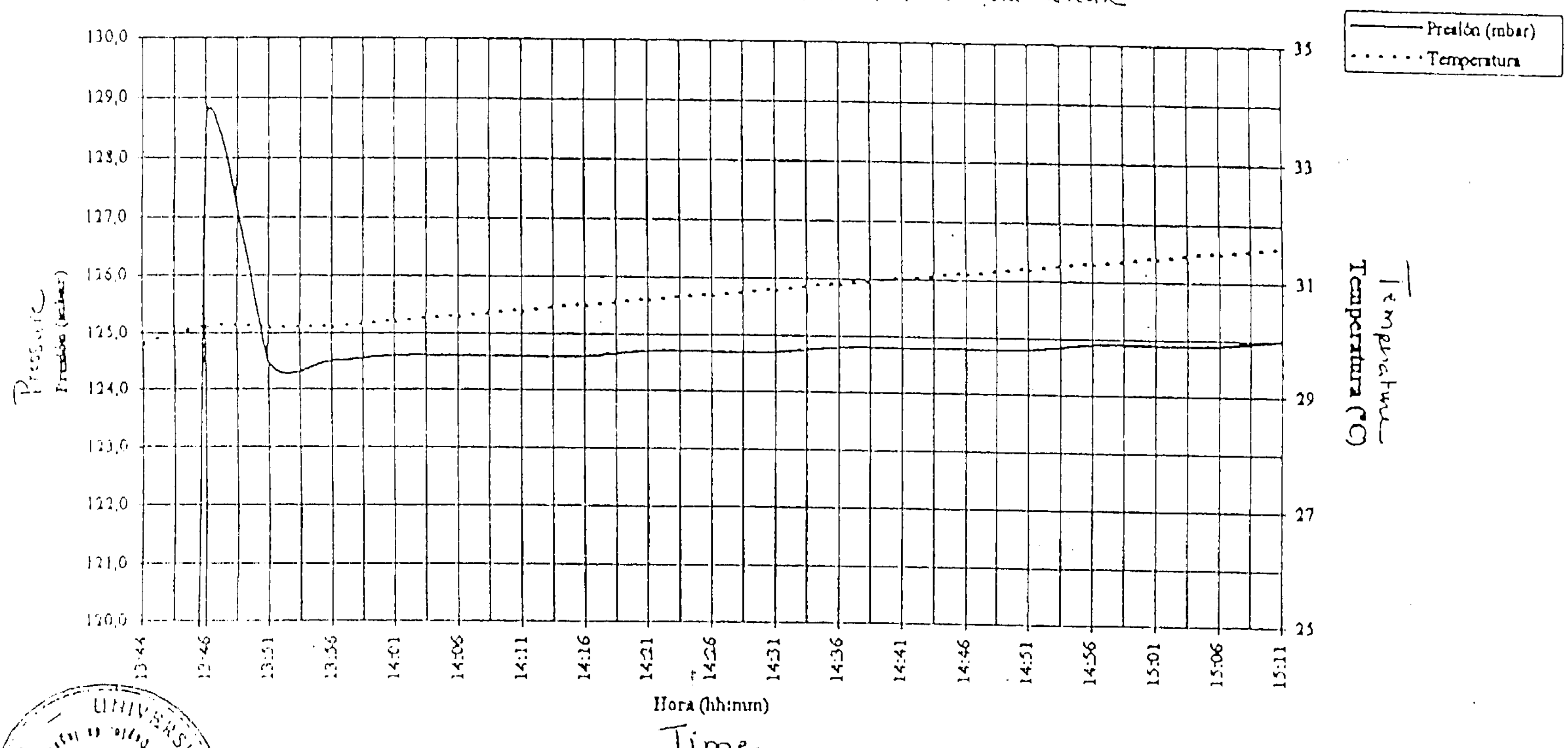
| Time<br>Tiempo | Pressure<br>Presión | (+/-) | Calibration<br>Calibración | Air Temp.<br>T. Aire | Barometric Pressure<br>P. Barométrica | Notes<br>Notas |
|---|---|---|---|---|---|---|
| 13:44 | - | | | 29'8°C | 1012 mbar | Comienzo 00.1 |
| 13:46 | 128'4 | | | 30'1°C | | |
| 13:51 | 124'5 | -3'9 | | 30'1°C | | |
| 13:56 | 124'5 | 0'0 | | 30'1°C | | |
| 14:01 | 124'6 | +0'1 | | 30'2°C | | |
| 14:06 | 124'6 | 0'0 | | 30'3°C | | |
| 14:11 | 124'6 | 0'0 | | 30'4°C | | |
| 14:16 | 124'6 | 0'0 | | 30'5°C | | |
| 14:21 | 124'7 | +0'1 | | 30'6°C | | |
| 14:26 | 124'7 | 0'0 | | 30'7°C | | |
| 14:31 | 124'7 | 0'0 | | 30'8°C | | |
| 14:36 | 124'8 | +0'1 | | 30'9°C | | |
| 14:41 | 124'8 | 0'0 | | 31'0°C | | |
| 14:46 | 124'8 | 0'0 | | 31'1°C | | |
| 14:51 | 124'8 | 0'0 | | 31'2°C | | |
| 14:56 | 124'9 | +0'1 | | 31'3°C | | |
| 15:01 | 124'9 | 0'0 | | 31'4°C | | |
| 15:06 | 124'9 | 0'0 | | 31'5°C | | |
| 15:11 | 125'0 | 0'0 | | 31'6°C | 1012 mbar | End of Test<br>FIN DE TEST |
| | | | | Conclusion: no leaks<br>CONCLUSIÓN: NO EXISTE FUGA | | |
| | | | | | | |
| | | | | | | |

Gráfico 050996-1

| | |
|---|---|
| *Empresa* Company | NBT, S.A. |
| *Fecha* Date | 5/09/96 |
| *Capacidad Tanque* Tank capacity | 20.000 lt |
| *Capacidad Actual* Current capacity | 16.000 lt |
| *Tipo combustible* type of fuel | Agua Water |
| *Tipo de prueba* type of test | Sobrepresión Super (Compression) Pressure |

| | |
|---|---|
| *Fuga real* Real Leak | 0 ml/h |
| *Fuga amplificada* Amplified Leak | 0 ml/h |
| *Temperatura inicial* Initial temp | 29,8 °C |
| *Temperatura final* Final temp. | 31,6 °C |
| *Presión barométrica inicial* In. barometric pressure | 1012 mbar |
| *Presión barométrica final* Final barometric pressure | 1012 mbar |

**Tanque con agua sin fuga**
Tank with water without a leak




CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSI

NET, s. a.

1/1

CONCESIONARIO EXCLUSIVO
TEST DE PRECISIÓN
PARA PRUEBAS DE ESTANQUEIDAD

PSL

NET, s. a.

Location:
Ubicación ______________________

Tank no.
Tanque nº 2 Date Fecha 6/9/96 Test nº 1

Type of fuel
Tipo de combustible AGUA Water

Capacity of tank
Capacidad del tanque 20000 l

Current Capacity
Capacidad actual 19200 l

Ø Tubería llenado ______________________

Ø Tubería venteo ______________________

Ø Tubería succión a bomba ______________________

Done by:
Realizado por:

Proven by:
Comprobado por:
J. Almela

| Tiempo (Time) | Presión (Pressure) | (+/-) | Calibración (Calibration) | T. Aire (Air Temp.) | P. Barométrica (Barometric Pressure) | Notas (Notes) |
|---|---|---|---|---|---|---|
| 14:18 | – | | | 30'6°C | 1013 mbar | Comienzo 00.0 |
| 14:22 | 194'2 | | | 30'8°C | | |
| 14:27 | 190'9 | -3'3 | | 30'8°C | | |
| 14:32 | 190'9 | 0 | | 30'8°C | | |
| 14:37 | 190'8 | -0'1 | | 30'8°C | | |
| 14:42 | 190'7 | -0'1 | | 30'8°C | | |
| 14:47 | 190'5 | -0'2 | | 30'8°C | | |
| 14:52 | 190'3 | -0'2 | | 30'8°C | | |
| 14:57 | 190'0 | -0'3 | | 30'8°C | | |
| 15:02 | 189'7 | -0'3 | | 30'9°C | | End of test FIN DE TEST |
| | | | | CONCLUSION => EXISTE FUGA | | |
| | | | | Conclusion: | leak | exists |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
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UNIDAD DOCENTE MECÁNICA DE FLUIDOS — U.P.V.

UNIVERSIDAD POLITÉCNICA — VALENCIA

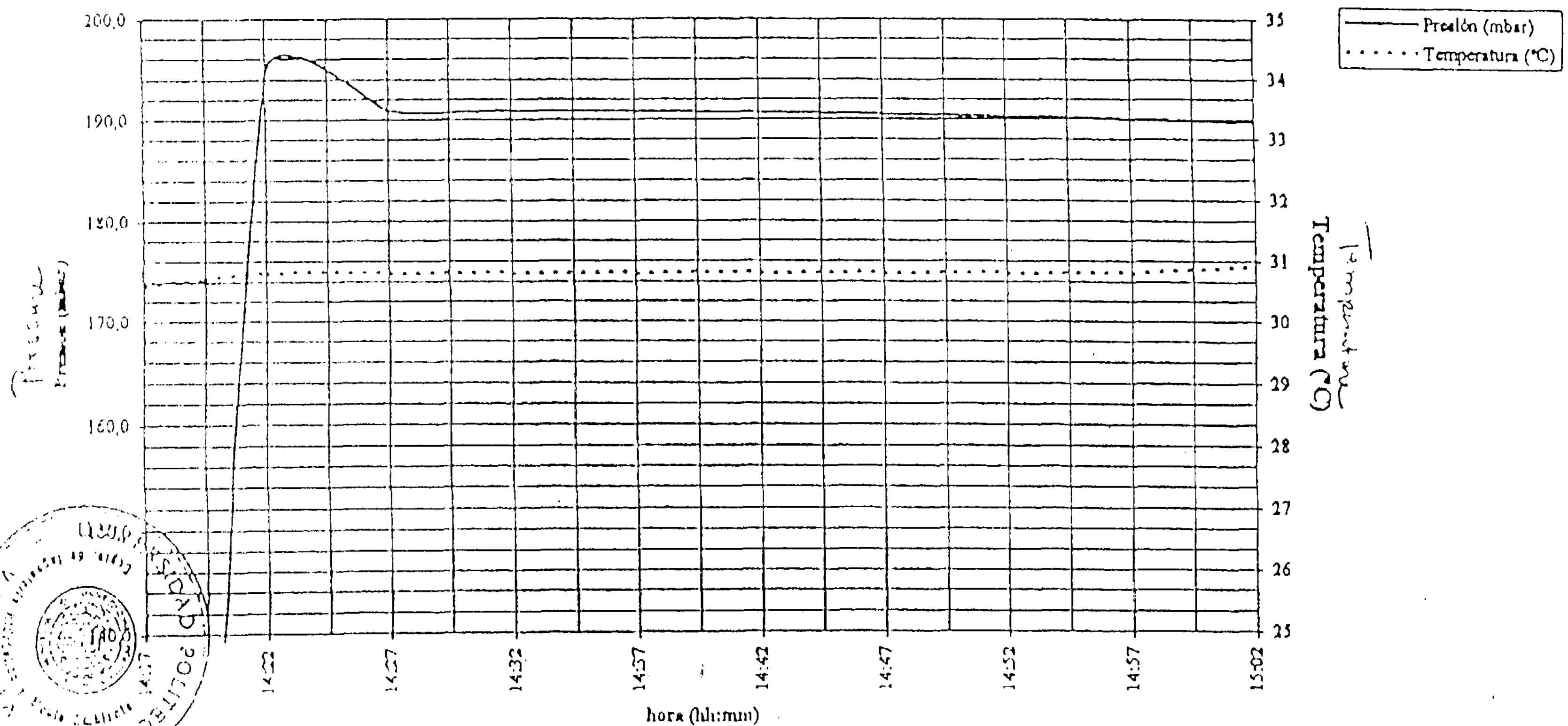
Gráfico 060996-1

| | |
|---|---|
| *Empresa* Company | NBT, S.A. |
| *Fecha* Date | 6/09/96 |
| *Capacidad Tanque* Tank capacity | 20.000 lt |
| *Capacidad Actual* Current capacity | 19.200 lt |
| *Tipo combustible* Type of fuel | Agua Water |
| *Tipo de prueba* Type of test | Sobrepresión Compression |

| | |
|---|---|
| *Fuga real* Real leak | 180 ml/h |
| *Fuga amplificada* Amplified leak | 375 ml/h |
| *Temperatura inicial* Initial temp | 30,6 °C |
| *Temperatura final* Final temp | 30,8 °C |
| *Presión barométrica inicial* Initial bar. pressure | 1013 mbar |
| *Presión barométrica final* Final barometric pressure | 1013 mbar |

Tank with 180 ml/hr. leak

**Tanque con fuga de 180 ml/h**




Time

CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSI

NEI, S.A.

1/1

CONCESIONARIO EXCLUSIVO
TEST DE PRECISIÓN
PARA PRUEBAS DE ESTANQUEIDAD

PSL

NET, s. a.

Ubicación / Location

Tanque nº / Tank # 2   Fecha / Date 6/9/96   Test nº 2

Tipo de combustible / Type of fuel: AGUA Water

Capacidad del tanque / Tank capacity: 20000 lt

Capacidad actual / Current capacity: 19200 lt

Ø Tubería llenado

Ø Tubería venteo

Ø Tubería succión a bomba

Realizado por: / Done by:

Comprobado por: / Proven by: J. Almeda

| Tiempo / Time | Presión / Pressure | (+/-) | Calibración / Calibration | T. Aire / Air Temp | P. Barométrica / Barometric Pressure | Notas / Notes |
|---|---|---|---|---|---|---|
| 14:55 | - | | | 30'7°C | 1013 mbar | Comienzo 00.0 |
| 15:00 | -135'2 | | | 30'7°C | | |
| 15:05 | -132'6 | +2'6 | | 30'7°C | | |
| 15:10 | -130'2 | +2'4 | | 30'7°C | | |
| 15:15 | -128'0 | +2'2 | | 30'7°C | | |
| 15:20 | -126'0 | +2'0 | | 30'7°C | | |
| 15:25 | -124'2 | +1'8 | | 30'7°C | | |
| 15:30 | -122'6 | +1'6 | | 30'7°C | | End of test<br>FIN DE TEST |

CONCLUSION => EXISTE FUGA

Conclusion - Leak exists

(Stamps: U.P.V. — Universidad Politécnica Valencia)

Gráfico 060996-2

| | |
|---|---|
| Empresa Company | NBT, S.A. |
| Fecha Date | 6/09/96 |
| Capacidad Tanque Tank capacity | 20,000 lt |
| Capacidad Actual current capacity | 19,200 lt |
| Tipo combustible Type of fuel | Agua Water |
| Tipo de prueba Type of test | Vacio Empty |

| | |
|---|---|
| Fuga real real leak | 180 ml/h |
| Fuga amplificada Amplified leak | - |
| Temperatura inicial Initial Temp | 30,7 °C |
| Temperatura final Final Temp | 30,7 °C |
| Presión barométrica inicial Initial barometric | 1013 mbar |
| Presión barométrica final Final barometric Pressure | 1013 mbar |

180 ml/h leak
**Fuga de 180 ml/h**


CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSL

NET, s. a.

1/1

CONCESIONARIO EXCLUSIVO
TEST DE PRECISIÓN
PARA PRUEBAS DE ESTANQUEIDAD

PSL

NET, s. a.

Location:
Ubicación
Tank n. Date
Tanque nº 2 Fecha 7/9/96 Test nº 1
Type of fuel Super gasoline on Surface
Tipo de combustible GASOLINA SUPER EN SUPERFICIE
Done by:
Realizado por:

Capacidad del tanque 20000 l

Capacidad actual 19000 l

Proven by:
Comprobado por:

Ø Tubería llenado

Ø Tubería venteo

Ø Tubería succión a bomba

| Tiempo (Time) | Presión (Pressure) | (+/-) | Calibración (Calibration) | T. Aire (Air Temp) | P. Barométrica (Barometric Pressure) | Notas (Notes) |
|---|---|---|---|---|---|---|
| 10:45 | | | | 23'6°C | 1014 mbar | Comienzo -00.1 |
| 10:47 | 135'5 | | | 24'1°C | Stopped → DEJAMOS DE | inserting INTRODUCIR $N_2$ |
| 10:52 | 133'4 | -2'1 | | 24'0°C | | |
| 10:57 | 138'6 | +5'2 | | 24'2°C | | |
| 11:02 | 143'0 | +4'4 | | 24'5°C | | |
| 11:07 | 146'0 | +3'0 | | 24'7°C | | |
| 11:12 | 148'9 | +2'9 | | 25'0°C | 1015 mbar | |
| 11:17 | 150'4 | +1'5 | | 25'2°C | | |
| 11:22 | 152'0 | +1'6 | | 25'5°C | | |
| 11:27 | 153'4 | +1'4 | | 25'8°C | | |
| 11:32 | 154'5 | +1'1 | | 26'1°C | 1014 mbar | |
| 11:37 | 155'7 | +1'2 | | 26'3°C | | |
| 11:42 | 156'4 | +0'7 | | 26'4°C | | |
| 11:47 | 156'8 | +0'4 | | 26'6°C | | |
| 11:52 | 157'3 | +0'5 | | 26'8°C | | |
| 11:57 | 157'6 | +0'3 | | 26'9°C | | |
| 12:02 | 158'0 | +0'4 | | 27'1°C | | |
| 12:07 | 158'3 | +0'3 | | 27'4°C | | |
| 12:12 | 158'5 | +0'2 | | 27'5°C | | |
| 12:17 | 158'8 | +0'3 | | 27'7°C | | |
| 12:22 | 159'1 | +0'3 | | 27'8°C | | Continued page 2 |
| | | | | | | SIGUE EN HOJA 2 |

Continued page 2 / SIGUE EN HOJA 2

CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSL

NET, s. a.

Ubicación

Tanque nº 2 Fecha 7/9/96 Test nº 1

Tipo de combustible GASOLINA SUPER EN SUPERFICIE

Capacidad del tanque 20000 l

Capacidad actual 19000 l

Ø Tubería llenado

Ø Tubería venteo

Ø Tubería succión a bomba

Realizado por:

Comprobado por: J. Almela

HOJA 2

| Tiempo | Presión | (+/-) | Calibración | T. Aire | P. Barométrica | Notas |
|---|---|---|---|---|---|---|
| 12:27 | 159'3 | +0'2 | | 27'9°C | 1014 mbar | continued from Pag 1<br>SIGUE DE HOJA 1 |
| 12:32 | 159'6 | +0'3 | | 28'1°C | | |
| 12:37 | 159'8 | +0'2 | | 28'3°C | | |
| 12:42 | 159'9 | +0'1 | | 28'4°C | | |
| 12:47 | 160'1 | +0'2 | | 28'6°C | | |
| 12:52 | 160'2 | +0'1 | | 28'7°C | | |
| 12:57 | 160'2 | 0'0 | | 28'8°C | | |
| 13:02 | 160'2 | 0'0 | | 29'0°C | | FIN DE TEST |
| | | | | CONCLUSION => NO EXISTE FUGA | | |
| | | | | Conclusion no existing leak | | |
| | | | | | | |
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U.P.V.

UNIVERSIDAD POLITÉCNICA

PSL

**NET, s. a.**

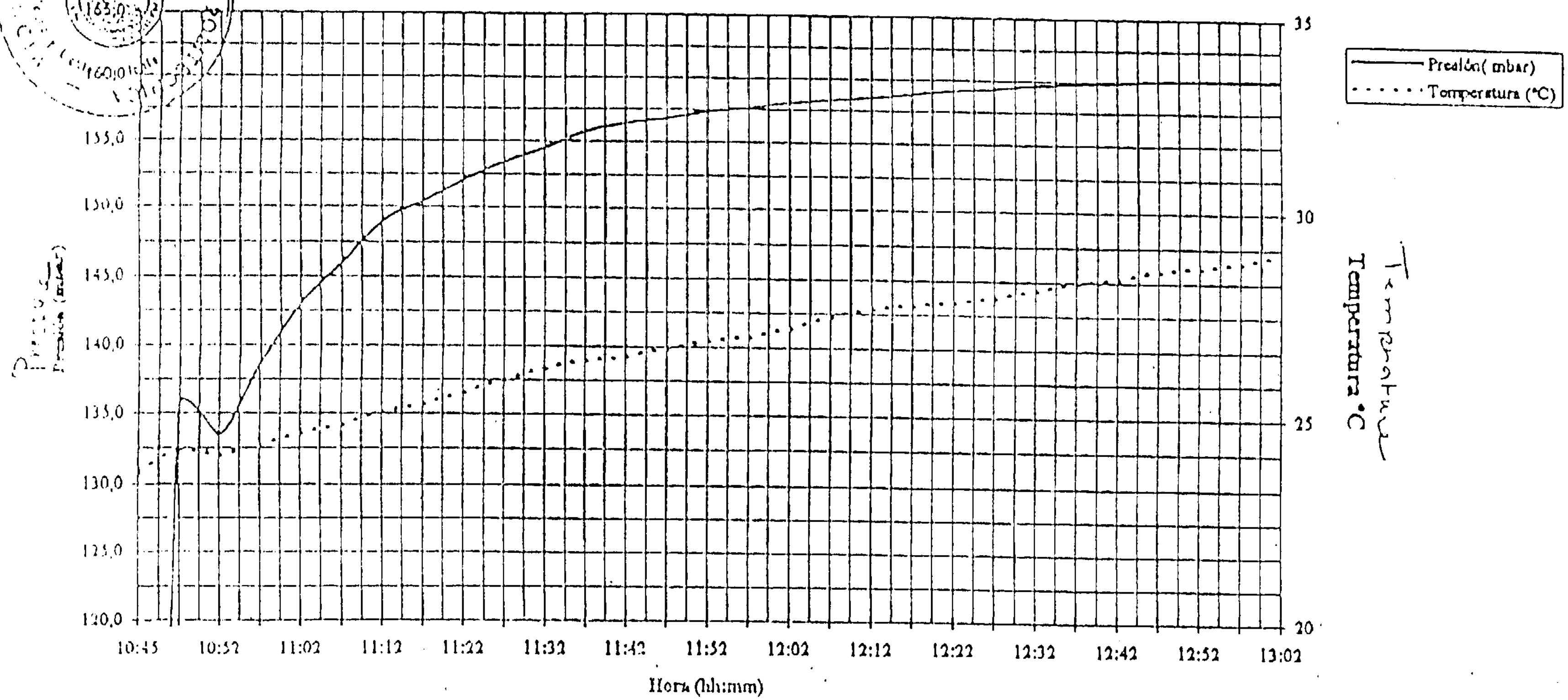


Gráfico 070996-1

| | |
|---|---|
| Empresa (Company) | NET, S.A. |
| Fecha (Date) | 7/09/96 |
| Capacidad Tanque (Capacity) | 20.000 lt |
| Capacidad Actual (Current Capacity) | 19.000 lt |
| Tipo combustible | Gasolina Súper (Super gas) |
| Tipo de prueba | Sobrepresión (Compression) |

| | |
|---|---|
| Fuga real (real leak) | 0 ml/h |
| Fuga amplificada (amplified leak) | 0 ml/h |
| Temperatura inicial (Initial temp) | 23,6 °C |
| Temperatura final (Final temp) | 29,0 °C |
| Presión barométrica inicial (in. pressure) | 1014 mbar |
| Presión barométrica final (Final barometric pressure) | 1014 mbar |

Tanque sin fuga
Tank with no leak




UNIDAD DOCENTE MECÁNICA DE FLUIDOS
DPTO. DE INGENIERÍA HIDRÁULICA Y MEDIO AMBIENTE
U. P. V.

UNIVERSIDAD POLITÉCNICA DE VALENCIA

CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSL

NET, s. a.

Location:
Ubicación

Tank #
Tanque nº 2

Date
Fecha 7/9/96

Test nº 2

Type of fuel: Super gasoline on surface
Tipo de combustible GASOLINA SUPER EN SUPERFICIE

Done by:
Realizado por:

Capacidad del tanque 20000 l

Current capacity
Capacidad actual 19000 l

Proven by:
Comprobado por: J. Almela

Ø Tubería llenado

Ø Tubería venteo

Ø Tubería succión a bomba

Time / Pressure / Calibration / Air Temp / Barometric Pressure / Notes — HOJA 1 Page 1

| Tiempo | Presión | (+/-) | Calibración | T. Aire | P. Barométrica | Notas |
|---|---|---|---|---|---|---|
| 11:49 | | | | 25'8°C | 1014 mbar | Comienzo -00'1 |
| 11:51 | 139'4 | | | 27'3°C | | |
| 11:56 | 135'4 | -4'0 | | 27'2°C | | |
| 12:01 | 139'5 | +4'1 | | 27'4°C | | |
| 12:06 | 142'9 | +3'4 | | 27'7°C | | |
| 12:11 | 145'7 | +2'8 | | 27'9°C | | |
| 12:16 | 147'6 | +1'9 | | 28'1°C | 1013 mbar | |
| 12:21 | 149'3 | +1'7 | | 28'3°C | | |
| 12:26 | 150'5 | +1'2 | | 28'5°C | | |
| 12:31 | 151'5 | +1'0 | | 28'6°C | | |
| 12:36 | 152'3 | +0'8 | | 28'9°C | | |
| 12:41 | 152'9 | +0'6 | | 29'1°C | | |
| 12:46 | 153'4 | +0'5 | | 29'2°C | | |
| 12:51 | 153'7 | +0'3 | | 29'4°C | | |
| 12:56 | 153'9 | +0'2 | | 29'5°C | | |
| 13:01 | 153'9 | 0 | | 29'6°C | | |
| 13:06 | 153'9 | 0 | | 29'7°C | | |
| 13:11 | 153'8 | -0'1 | | 29'8°C | | |
| 13:16 | 153'6 | -0'2 | | 29'7°C | 1012 mbar | |
| 13:21 | 153'3 | -0'3 | | 30'0°C | | |
| 13:26 | 152'9 | -0'4 | | 30'1°C | | Continued Page 2 |
| | | | | | | SIGUE EN HOJA 2 |

UNIDAD DOCENTE MECÁNICA DE FLUIDOS — UNIVERSIDAD POLITÉCNICA

CONCESIONARIO EXCLUSIVO
TEST DE PRECISIÓN
PARA PRUEBAS DE ESTANQUEIDAD

PSL

**NET, s. a.**

Ubicación ____________________

Tanque nº 2 Fecha 7/4/96 Test nº 2

Tipo de combustible GASOLINA SUPER EN SUPERFICIE (Super gasoline on surface)

Capacidad del tanque 20000 l

Capacidad actual 19000 l

Ø Tubería llenado ____________

Ø Tubería venteo ____________

Ø Tubería succión a bomba ____________

Realizado por: [signature]

Comprobado por: [signature]

HOJA 2

| Tiempo | Presión | (+/-) | Calibración | T. Aire | P. Barométrica | Notas |
|---|---|---|---|---|---|---|
| 13:31 | 152'4 | -0'5 | | 30'2 ºC | 1012 mbar | Continued from Page 1 SIGUE DE HOJA 1 |
| 13:36 | 151'8 | -0'6 | | 30'8 ºC | | |
| 13:41 | 151'1 | -0'7 | | 30'4 ºC | | End of Test FIN DE TEST |
| | | | | Conclusion: leak exists CONCLUSION => EXISTE FUGA | | |
| | | | | | | |

UNIDAD DOCENTE MECÁNICA DE FLUIDOS U.P.V.

UNIVERSIDAD POLITÉCNICA

Gráfico 070996-2

Concesionario Exclusivo del
Test de Precisión
para Pruebas de Estanqueidad

PSL

**NET, s. a.**

1/1

| | |
|---|---|
| Fecha | 7/09/96 |
| Capacidad Tanque | 20.000 lt |
| Capacidad Actual | 19.000 lt |
| Tipo combustible | Gasolina Súper |
| Tipo de prueba | Sobrepresión |

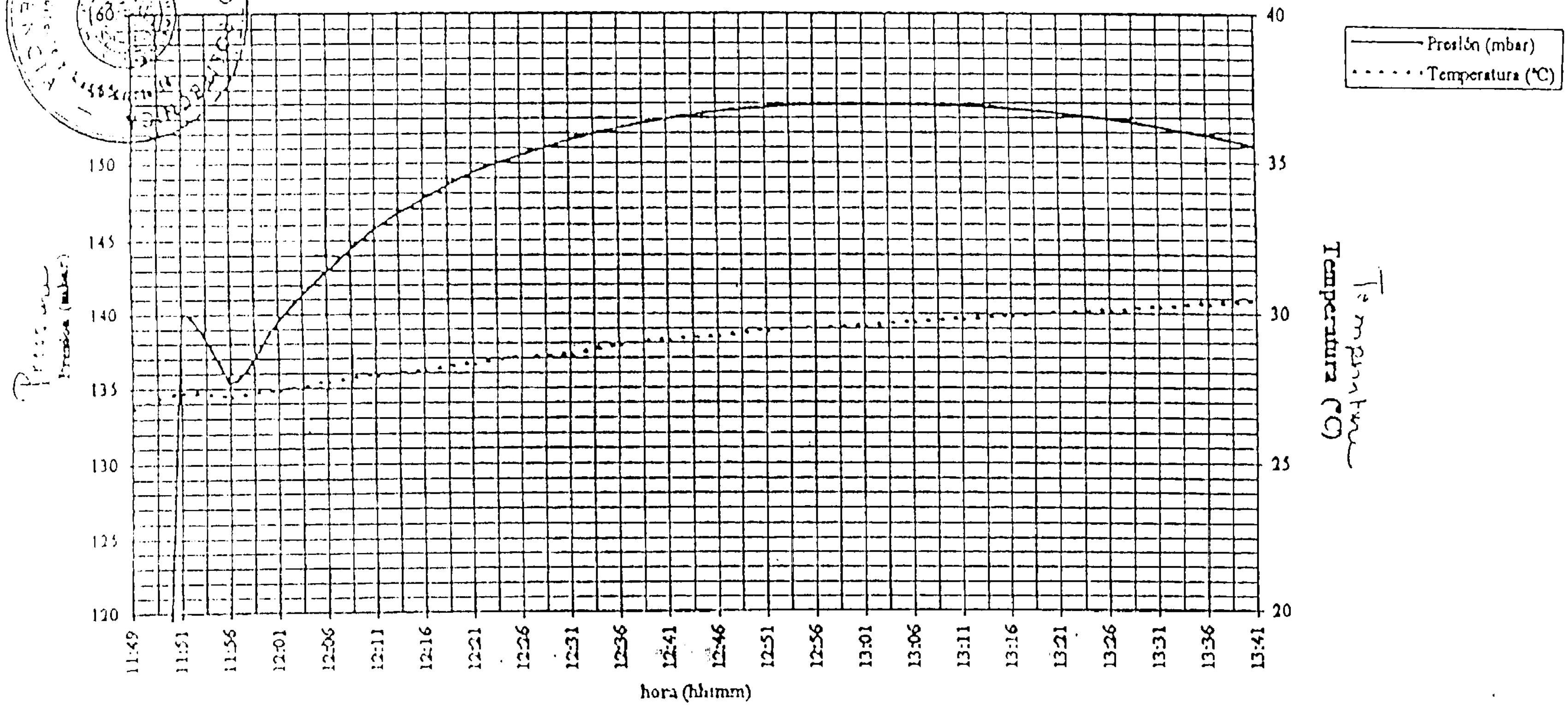
Date Tank capacity Current Fuel Type of Test Super gasoline Compression

| | |
|---|---|
| Fuga real | 280 ml/h |
| Temperatura inicial | 26,8 °C |
| Temperatura final | 30,4 °C |
| Presión barométrica inicial | 1014 mbar |
| Presión barométrica final | 1012 mbar |

Real leak Initial temp. Final temp. In. Bar. Pr. Final Barometric Pressure

**Fuga de 280 ml/h**

280 ml/hr leak




Time Temperature Pressure

NET, s. a.

CONCESIONARIO EXCLUSIVO
TEST DE PRECISIÓN
PARA PRUEBAS DE ESTANQUEIDAD

PSL

Determinación Certificado

Graph 1 : Determining a leak

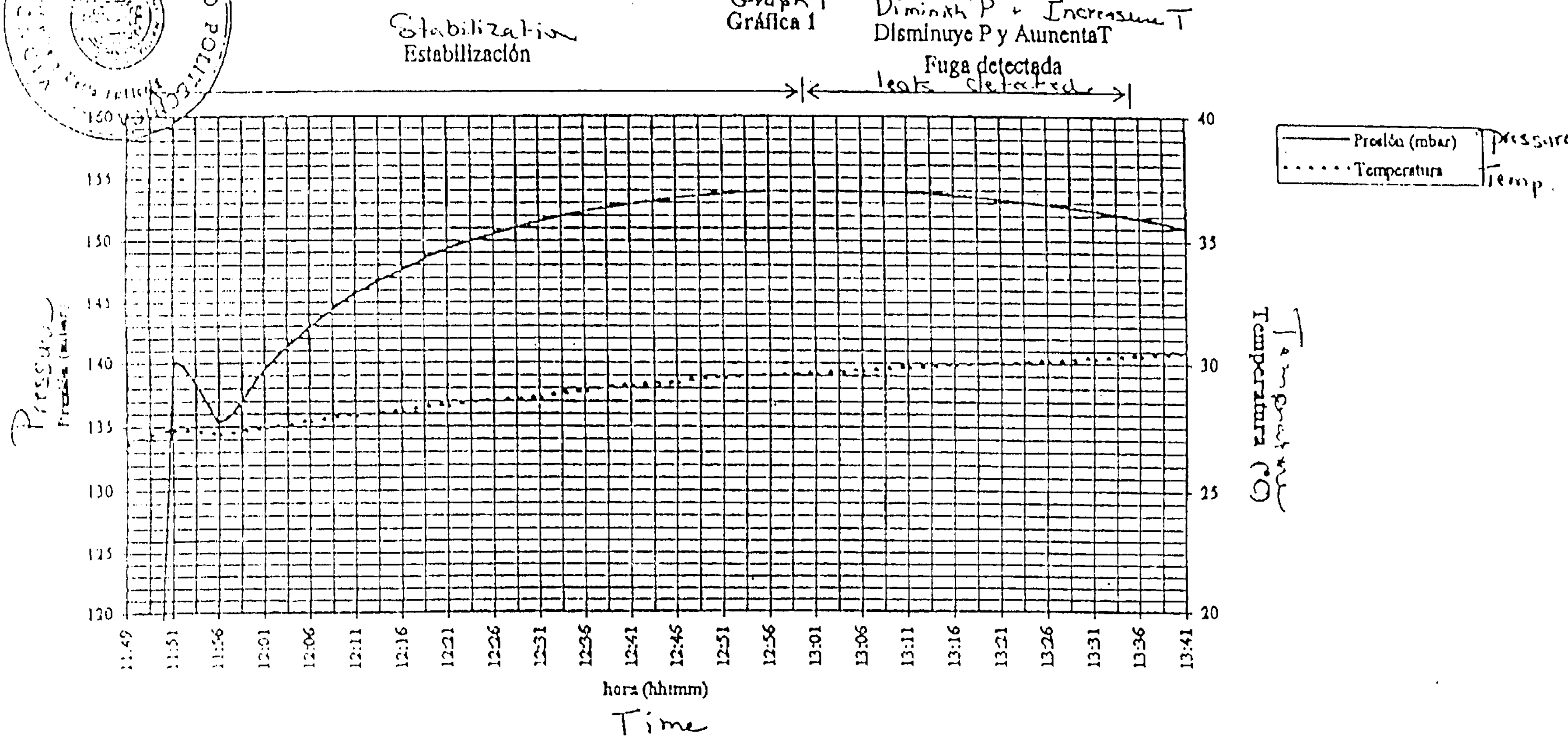
# Gráfica 1: Determinación de una fuga

| | |
|---|---|
| *Fecha* Date | 7/09/96 |
| *Capacidad Tanque* | 20.000 lt |
| *Capacidad Actual* | 19.000 lt |
| *Tipo combustible* | Gasolina Súper (Super Gasoline) |
| *Tipo de prueba* | Sobrepresión (Compression) |

| | |
|---|---|
| *Fuga real* Real leak | 280 ml/h |
| *Temperatura inicial* Initial Temp | 26,8 °C |
| *Temperatura final* Final Temp | 30,4 °C |
| *Presión barométrica inicial* In. Bar. Pr. | 1014 mbar |
| *Presión barométrica final* Final | 1012 mbar |

Barometric Pressure

Graph 1
Gráfica 1

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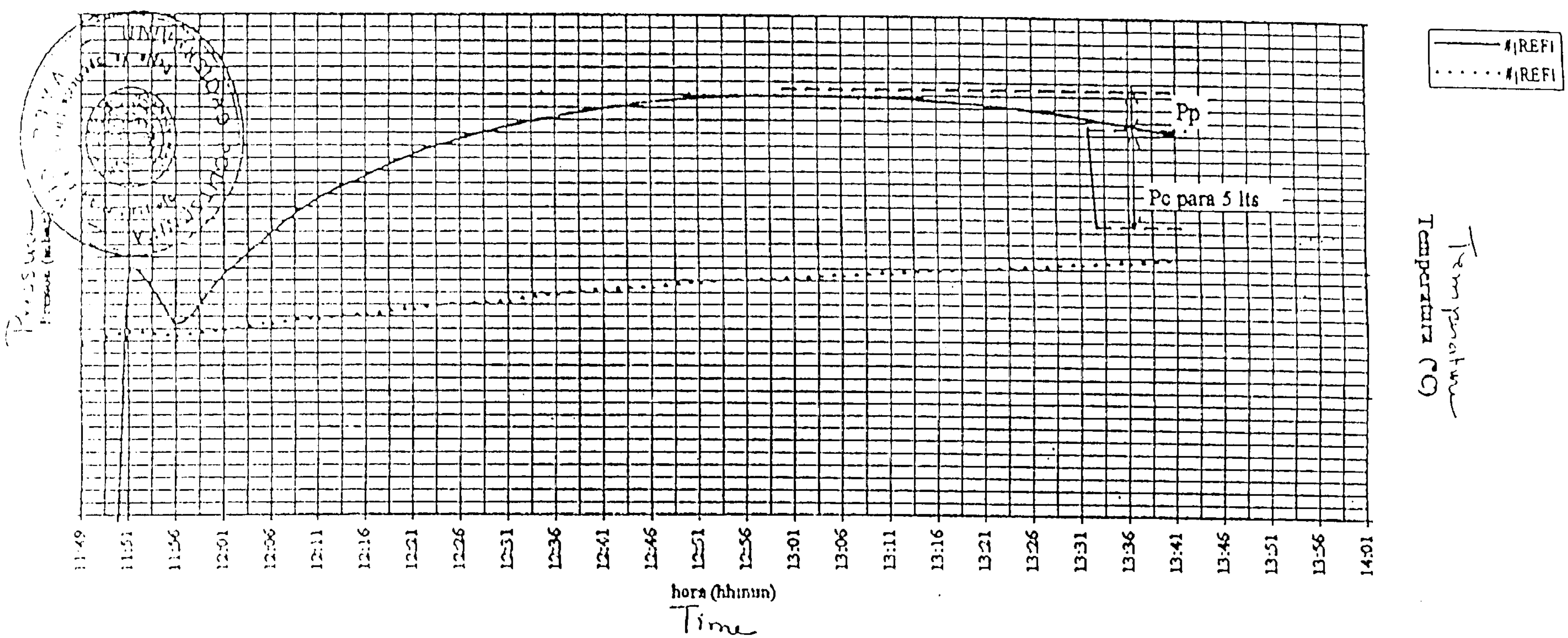
UNIVERSIDAD POLITÉCNICA – VALENCIA

Graph 3: Calibration

## Gráfica 3: Calibración

Graph 3
**Gráfica 3**




Descent of Pc = -6,0 mb → Vc (volume of the air chamber) = 1000 lts

Con un descenso de Pc = -6,0 mbar => Vc (volúmen de la cámara de aire) = 1000 lts

CONCESIONARIO EXCLUSIV
TEST DE PRECISIÓN
PARA PRUEBAS DE ESTANQUEIDAD

PSL

# NET, s. a.

Location:
Ubicación

Tank #
Tanque nº 2 Date Fecha 9/9/96 Test nº 1

Type of fuel: Super gasoline on Surface
Tipo de combustible GASOLINA SUPER EN SUPERFICIE

Capacidad del tanque 20000 l

Current Capacity
Capacidad actual 18100 l

Ø Tubería llenado

Ø Tubería venteo

Ø Tubería succión a bomba

Done by:
Realizado por:

Proven by:
Comprobado por: J. Almela

Page 1
HOJA 1

| Time / Tiempo | Pressure / Presión | (+/-) | Calibration / Calibración | Air Temp. / T. Aire | Barometric Pressure / P. Barométrica | Notes / Notas |
|---|---|---|---|---|---|---|
| 18:57 | - | | | 22'8°C | 1014 mbar | Comienzo 00:0 |
| 19:02 | 120'3 | | | 22'7°C | | |
| 19:07 | 123'2 | +2'9 | | 22'6°C | | |
| 19:12 | 129'1 | +5'9 | | 22'5°C | | |
| 19:17 | 134'0 | +4'9 | | 22'4°C | | |
| 19:22 | 138'1 | +4'1 | | 22'3°C | | |
| 19:27 | 141'8 | +3'7 | | 22'2°C | | |
| 19:32 | 144'9 | +3'1 | | 22'1°C | | |
| 19:37 | 147'7 | +2'8 | | 22'0°C | | |
| 19:42 | 149'9 | +2'2 | | 21'9°C | 1015 mbar | |
| 19:47 | 151'7 | +1'8 | | 21'8°C | | |
| 19:52 | 153'1 | +1'4 | | 21'6°C | | |
| 19:57 | 154'3 | +1'2 | | 21'4°C | | |
| 20:02 | 155'3 | +1'0 | | 21'3°C | | |
| 20:07 | 156'1 | +0'8 | | 21'1°C | | |
| 20:12 | 156'8 | +0'7 | | 21'0°C | | |
| 20:17 | 157'4 | +0'6 | | 20'9°C | | |
| 20:22 | 157'8 | +0'4 | | 20'8°C | | |
| 20:27 | 158'1 | +0'3 | | 20'7°C | | |
| 20:32 | 158'3 | +0'2 | | 20'5°C | | |
| 20:37 | 158'4 | +0'1 | | 20'3°C | | Continued on Page 2 |
| | | | | | | SIGUE EN HOJA 2 |

CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSL

**NET, s. a.**

Location: Ubicación

Tank #: Tanque nº 2   Date: Fecha 9/9/96   Test nº 1

Type of fuel: Tipo de combustible Super gasoline on surface / GASOLINA SUPER EN SUPERFICIE

Tank capacity: Capacidad del tanque 20000 l

Current capacity: Capacidad actual 18100 l

Ø Tubería llenado

Ø Tubería venteo

Ø Tubería succión a bomba

Done by: Realizado por:

Proven by: Comprobado por: J. Almela

Page 2 HOJA 2

| Time / Tiempo | Pressure / Presión | (+/-) | Calibration / Calibración | Air Temp / T. Aire | Barometric Pressure / P. Barométrica | Notes / Notas |
|---|---|---|---|---|---|---|
| 20:42 | 158'4 | 0'0 | | 20'2 °C | 1015 mbar | SIGUE DE HOJA 1 |
| 20:47 | 158'4 | 0'0 | | 20'1 °C | | |
| 20:52 | 158'3 | -0'1 | | 20'1 °C | | |
| 20:57 | 158'2 | -0'1 | | 20'1 °C | | |
| 21:02 | 158'1 | -0'1 | | 20'1 °C | | |
| 21:07 | 157'9 | -0'2 | | 20'1 °C | | |
| 21:12 | 157'9 | -0'2 | | 20'1 °C | | |
| 21:17 | 157'6 | -0'3 | | 20'0 °C | | |
| 21:22 | 157'3 | -0'3 | | 20'0 °C | | |
| 21:27 | 156'9 | -0'4 | | 20'0 °C | | |
| 21:32 | 156'5 | -0'4 | | 20'0 °C | | |
| 21:37 | 156'0 | -0'5 | | 20'0 °C | | |
| 21:42 | 155'5 | -0'5 | | 20'0 °C | | |
| 21:47 | 155'0 | -0'5 | | 20'0 °C | | |
| 21:52 | 154'5 | -0'5 | | 20'0 °C | | |
| 21:57 | 153'9 | -0'6 | | 19'9 °C | | |
| 22:02 | 153'3 | -0'6 | | 19'9 °C | | |
| 22:07 | 152'7 | -0'6 | | 19'9 °C | | |
| 22:12 | 152'1 | -0'6 | | 19'9 °C | | End of Test / FIN DE TEST |
| | | | | | | |
| | | | | CONCLUSIÓN => EXISTE FUGA | | |
| | | | | Conclusion — leak exists | | |
| | | | | | | |

Inscripción en el Registro Mercantil de Madrid ... 16/31

Gráfico 090996-1

Concesionario Exclus... el Test de Precisión para Pruebas de Estanqueidad

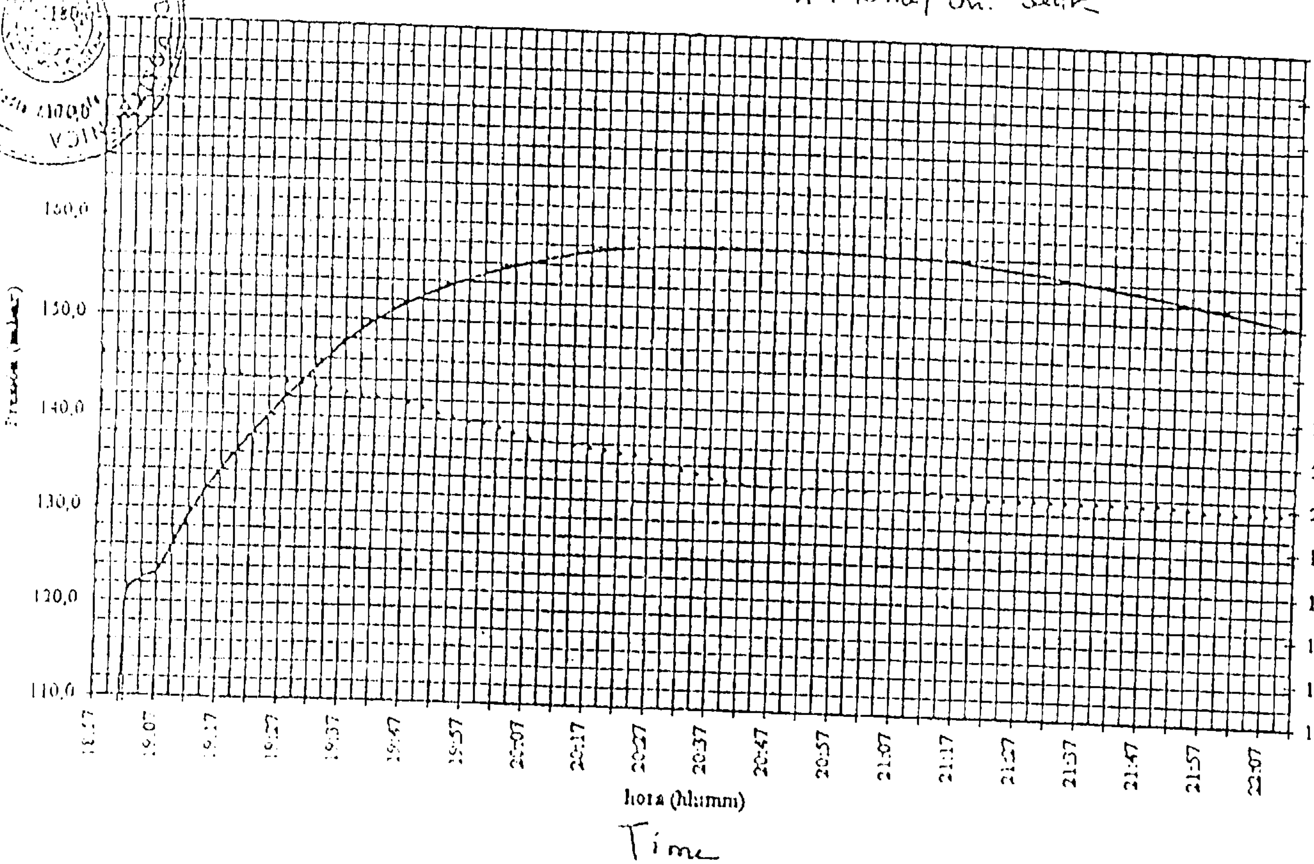
**NET, s. a.**

| | |
|---|---|
| Empresa (Company) | NET, S.A. |
| Fecha (Date) | 9/09/96 |
| Capacidad Tanque (Tank capacity) | 20.000 lt |
| Capacidad Actual (Current capacity) | 18.100 lt |
| Tipo combustible (Type of fuel) | Gasolina Súper (Super gasoline) |
| Tipo de prueba (Type of Test) | Sobrepresión (Compression) |

| | |
|---|---|
| Fuga real (Real leak) | 140 ml/h |
| Fuga amplificada (Amplified leak) | - |
| Temperatura inicial (Initial Temp.) | 22,8 °C |
| Temperatura final (Final Temp.) | 19,9 °C |
| Presión barométrica inicial (Initial) | 1014 mbar |
| Presión barométrica final (Final) (Barometric Pressure) | 1015 mbar |

## Tanque con fuga de 140 ml/h

Tank with 140 ml/h leak



CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD — PSL

**NET, s. a.**

Location:
Ubicación

Tank #
Tanque nº 2 Date Fecha 10/4/96 Test nº 1

Type of Fuel
Tipo de combustible AIRE Air

Done by:
Realizado por:

Tank Capacity
Capacidad del tanque 20000 l

Current Capacity
Capacidad actual VACIO Empty

Ø Tubería llenado

Proven by:
Comprobado por: J. Almeda

Ø Tubería venteo

Ø Tubería succión a bomba

Page 1
HOJA 1

Time / Pressure / Calibration / Air Temp. / Barometric Pressure / Notes

| Tiempo | Presión | (+/-) | Calibración | T. Aire | P. Barométrica | Notas |
|---|---|---|---|---|---|---|
| 13:36 | | | | 24'1 °C | 1015 mbar | Comienzo 00.0 |
| 13:41 | 160'6 | | | 24'3 °C | | |
| 13:46 | 150'3 | -10'3 | | 24'2 °C | | |
| 13:51 | 149'2 | -1'1 | | 24'0 °C | | |
| 13:56 | 148'9 | -0'3 | | 23'9 °C | | |
| 14:01 | 148'8 | -0'1 | | 23'8 °C | | |
| 14:06 | 148'7 | -0'1 | | 23'7 °C | | |
| 14:11 | 148'5 | -0'2 | | 23'7 °C | | |
| 14:16 | 148'4 | -0'1 | | 23'6 °C | | |
| 14:21 | 148'4 | 0'0 | | 23'7 °C | | |
| 14:26 | 148'1 | -0'3 | | 23'7 °C | | |
| 14:31 | 148'1 | 0'0 | | 23'8 °C | | |
| 14:36 | 148'0 | -0'1 | | 23'9 °C | | |
| 14:41 | 147'8 | -0'2 | | 23'9 °C | | |
| 14:46 | 147'7 | -0'1 | | 24'0 °C | | |
| 14:51 | 147'5 | -0'2 | | 24'0 °C | | |
| 14:56 | 147'4 | -0'1 | | 24'0 °C | 1014 mbar | |
| 15:01 | 147'2 | -0'2 | | 24'0 °C | | |
| 15:06 | 147'0 | -0'2 | | 24'0 °C | | |
| 15:11 | 146'9 | -0'1 | | 24'0 °C | | |
| 15:16 | 146'7 | -0'2 | | 24'0 °C | | Continued on Page 2 |
| | | | | | | SIGUE EN HOJA 2 |

UNIDAD DOCENTE MECÁNICA DE FLUIDOS E. T. S. INGENIERÍA HIDRÁULICA Y ENERGÍA

CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSL

NET, s. a.

Location:
Ubicación

Tank #
Tanque nº 2 Date Fecha 10/9/96 Test nº 1

Type of fuel
Tipo de combustible AIRE Air

Done by:
Realizado por:

Capacidad del tanque 20000 l

Current capacity
Capacidad actual VACIO ~~Air~~ Empty

Proven by:
Comprobado por: J. Almela

Ø Tubería llenado

Ø Tubería venteo

Ø Tubería succión a bomba

Page 2
HOJA 2

| Time<br>Tiempo | Pressure<br>Presión | (+/-) | Calibration<br>Calibración | Air Temp.<br>T. Aire | Barometric Pressure<br>P. Barométrica | Notes<br>Notas |
|---|---|---|---|---|---|---|
| 15:21 | 146'3 | -0'4 | | 24'0°C | 1014 mbar | Continued from Pag 1<br>SIGUE DE HOJA 1 |
| 15:26 | 146'0 | -0'3 | | 23'4°C | | |
| 15:31 | 145'9 | -0'1 | | 23'4°C | | |
| 15:36 | 145'6 | -0'3 | | 23'4°C | | End of test |
| 15:41 | 145'4 | -0'2 | | 23'4°C | | FIN DE TEST |
| | | | | CONCLUSION => EXISTE FUGA | | |
| | | | | Conclusion: leak exists | | |

UNIDAD DOCENTE MECÁNICA DE FLUIDOS — U.P.V.

UNIVERSIDAD POLITÉCNICA

CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSL

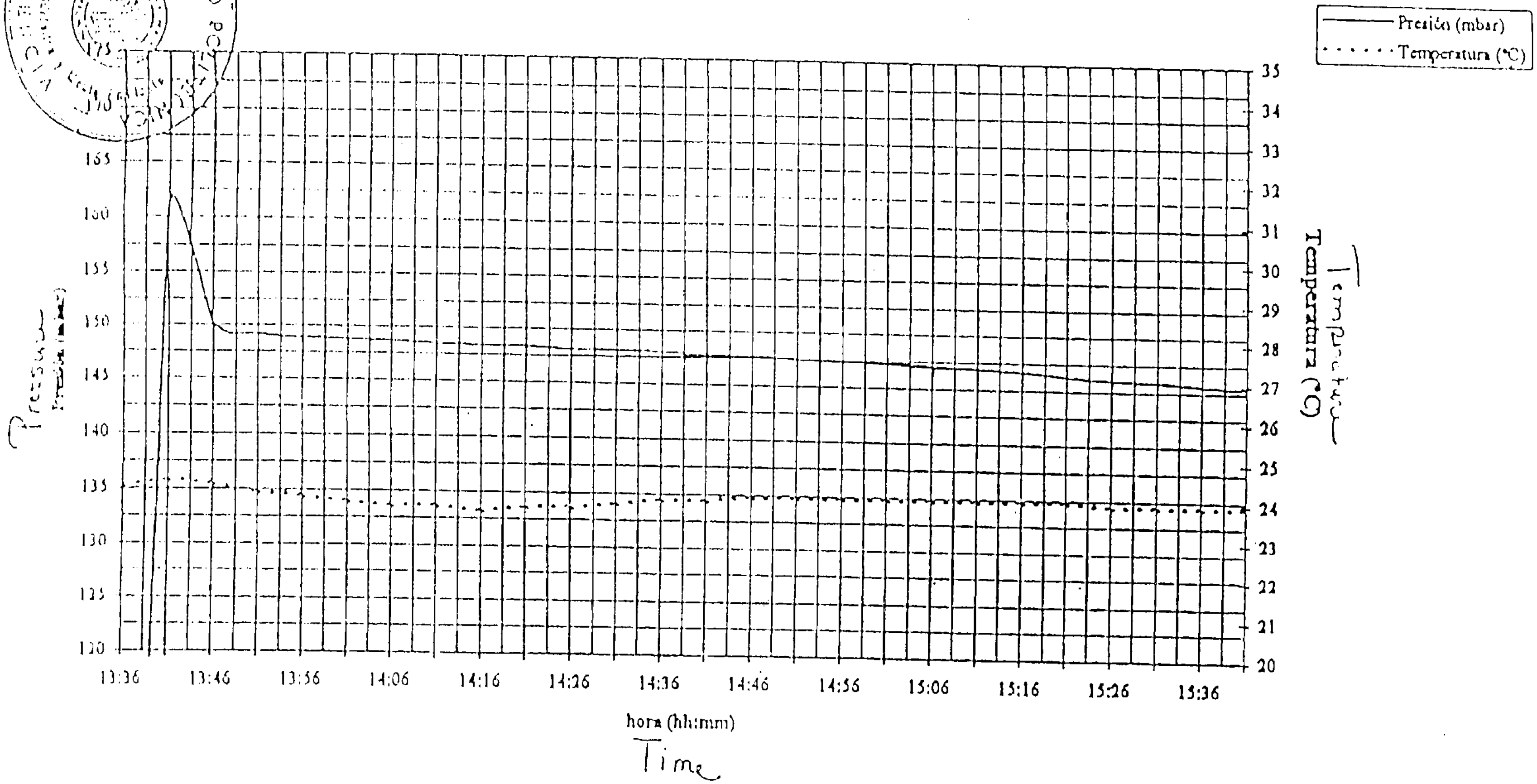
**NET, s. a.**

| | |
|---|---|
| Empresa [Company] | NET, S.A. |
| Fecha [Date] | 10/09/96 |
| Capacidad Tanque [Tank capacity] | 20.000 lt |
| Capacidad Actual [Current capacity] | 00 lt |
| Tipo combustible [Type of fuel] | Aire [Air] |
| Tipo de prueba | Sobrepresión [Compression] |

| | |
|---|---|
| Diámetro de fuga [Diameter of leak] | 0,5 mm |
| Temperatura inicial [Initial Temp] | 24,1 °C |
| Temperatura final [Final Temp.] | 24,0 °C |
| Presión barométrica inicial [In. Barometric Pressure] | 1015 mbar |
| Presión barométrica final [Final Barometric Pressure] | 1014 mbar |

0.5mm air leak

**Fuga de aire de 0,5 mm**




UNIDAD DOCENTE MECÁNICA DE FLUIDOS · U.P.V.

UNIVERSIDAD POLITÉCNICA · VALENCIA

CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSL

NET, s. a.

Location: Ubicación

Tank #: Tanque nº 2 — Date: Fecha 10/9/96 — Test nº 2

Type of fuel: Tipo de combustible AIRE Air

Capacidad del tanque 20000 l

Capacidad actual VACIO Empty

Ø Tubería llenado

Ø Tubería venteo

Tank suction piping: Ø Tubería succión a bomba

Done by: Realizado por: [signature]

Proven by: Comprobado por: J. Almela

| Time: Tiempo | Pressure: Presión | (+/-) | Calibration: Calibración | Air Temp: T. Aire | Barometric Pressure: P. Barométrica | Notes: Notas |
|---|---|---|---|---|---|---|
| 15:38 | [illegible] | | | 24'1°C | 1014 mbar | Comienzo 00.0 |
| 15:43 | 145'3 | | | 23'9°C | | |
| 15:48 | 137'4 | -7'9 | | 23'8°C | | |
| 15:53 | 130'4 | -7'0 | | 23'7°C | | |
| 15:58 | 124'0 | -6'4 | | 23'7°C | | End of Test |
| 16:03 | 117'6 | -6'4 | | 23'6°C | | FIN DE TEST |
| | | | | CONCLUSION => EXISTE FUGA | | |
| | | | | Conclusion - Leak exists | | |

UNIDAD DOCENTE MECANICA DE FLUIDOS — UNIVERSIDAD POLITECNICA VALENCIA — U.P.V.

Gráfico 100996-2

| | |
|---|---|
| Empresa Company | NBT, S.A. |
| Fecha Date | 10/09/96 |
| Capacidad Tanque Tank Capacity | 20.000 lt |
| Capacidad Actual Current Capacity | 00 lt |
| Tipo combustible | Aire Air |
| Tipo de prueba | Sobrepresión |

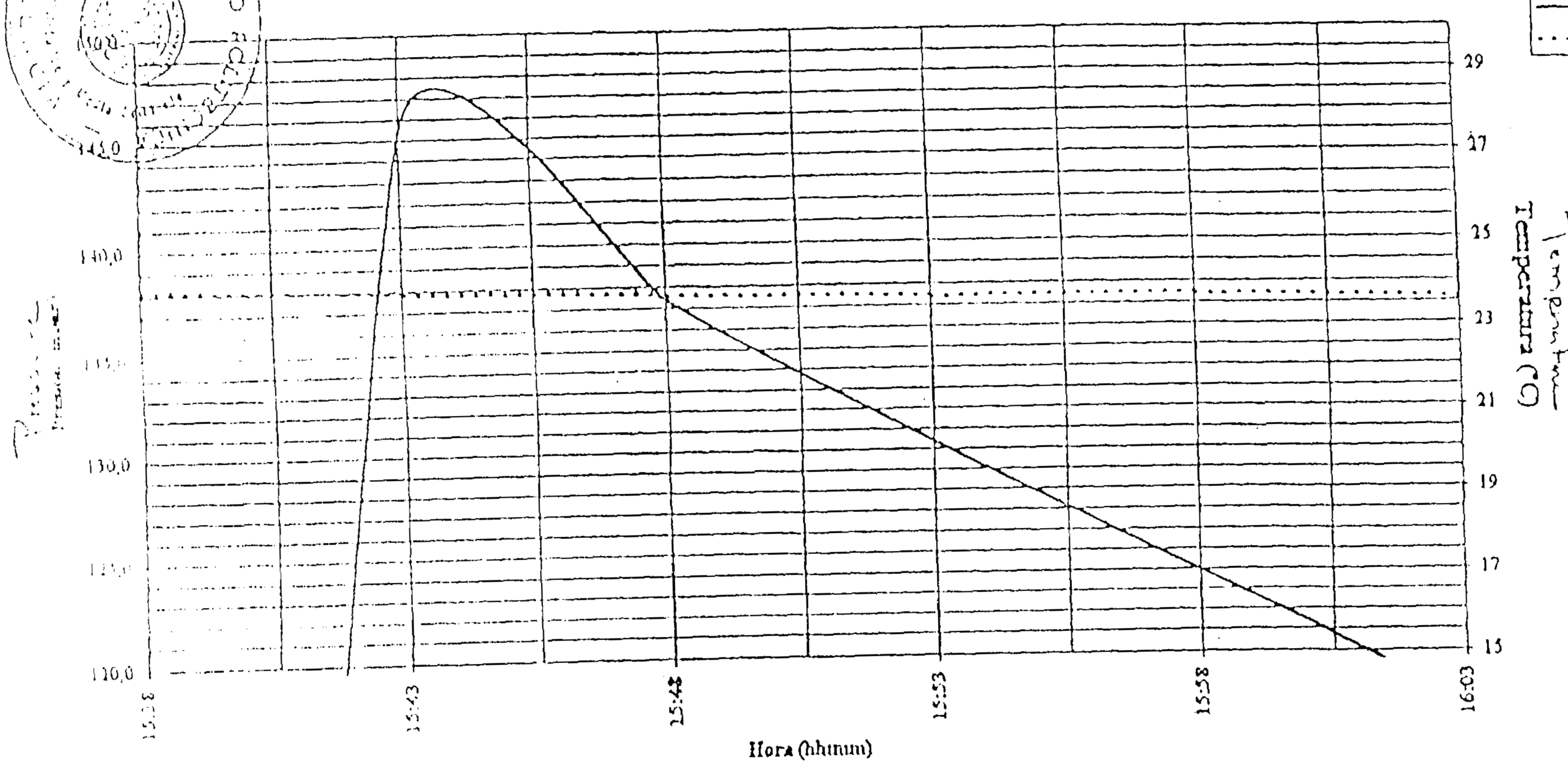
Compression

| | |
|---|---|
| Diámetro de fuga Diameter of leak | 1,5 mm |
| Temperatura inicial Initial Temp | 23,9 °C |
| Temperatura final Final Temp | 23,6 °C |
| Presión barométrica inicial In. Bar. Pr. | 1014 mbar |
| Presión barométrica final Final | 1014 mbar |

Barometric Pressure

1.5 mm. air leak

Fuga de aire de 1,5 mm




CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

NBT, s.a.

1/1

CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSL

NET, s. a.

Location: Ubicación

Tank n. Tanque nº 2 Date Fecha 10/4/96 Test nº 3

Type of fuel Tipo de combustible AIRE Air

Tank capacity Capacidad del tanque 20000 l

Current capacity Capacidad actual VACIO Empty

Ø Tubería llenado

Ø Tubería venteo

Ø Tubería succión a bomba

Done by: Realizado por:

Proven by: Comprobado por: J. Almela

| Time Tiempo | Pressure Presión | (+/-) | Calibration Calibración | Air Temp. T. Aire | Barometric Pressure P. Barométrica | Notes Notas |
|---|---|---|---|---|---|---|
| 16:48 | – | | | 22'8°C | 1014 mbar | Comienzo 00.1 |
| 16:53 | -60'0 | | | 22'2°C | | |
| 16:58 | -58'6 | +1'4 | | 22'3°C | | |
| 17:03 | -58'0 | +0'6 | | 22'2°C | | |
| 17:08 | -57'6 | +0'4 | | 22'1°C | | |
| 17:13 | -57'4 | +0'2 | | 22'0°C | | |
| 17:18 | -57'1 | +0'3 | | 22'0°C | | |
| 17:23 | -56'7 | +0'4 | | 22'0°C | | |
| 17:28 | -56'3 | +0'4 | | 21'9°C | 1015 mbar | |
| 17:33 | -56'1 | +0'2 | | 21'8°C | | |
| 17:38 | -55'8 | +0'3 | | 21'7°C | | |
| 17:43 | -55'5 | +0'3 | | 21'6°C | | |
| 17:48 | -55'2 | +0'3 | | 21'5°C | | End of test |
| 17:53 | -54'9 | +0'3 | | 21'4°C | | FIN DE TEST |
| | | | | CONCLUSION => EXISTE FUGA | | |
| | | | | Conclusion: leak exists | | |

UNIDAD DOCENTE MECÁNICA DE FLUIDOS U.P.V.

UNIVERSIDAD POLITÉCNICA VALENCIA

CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

NET, s. a.

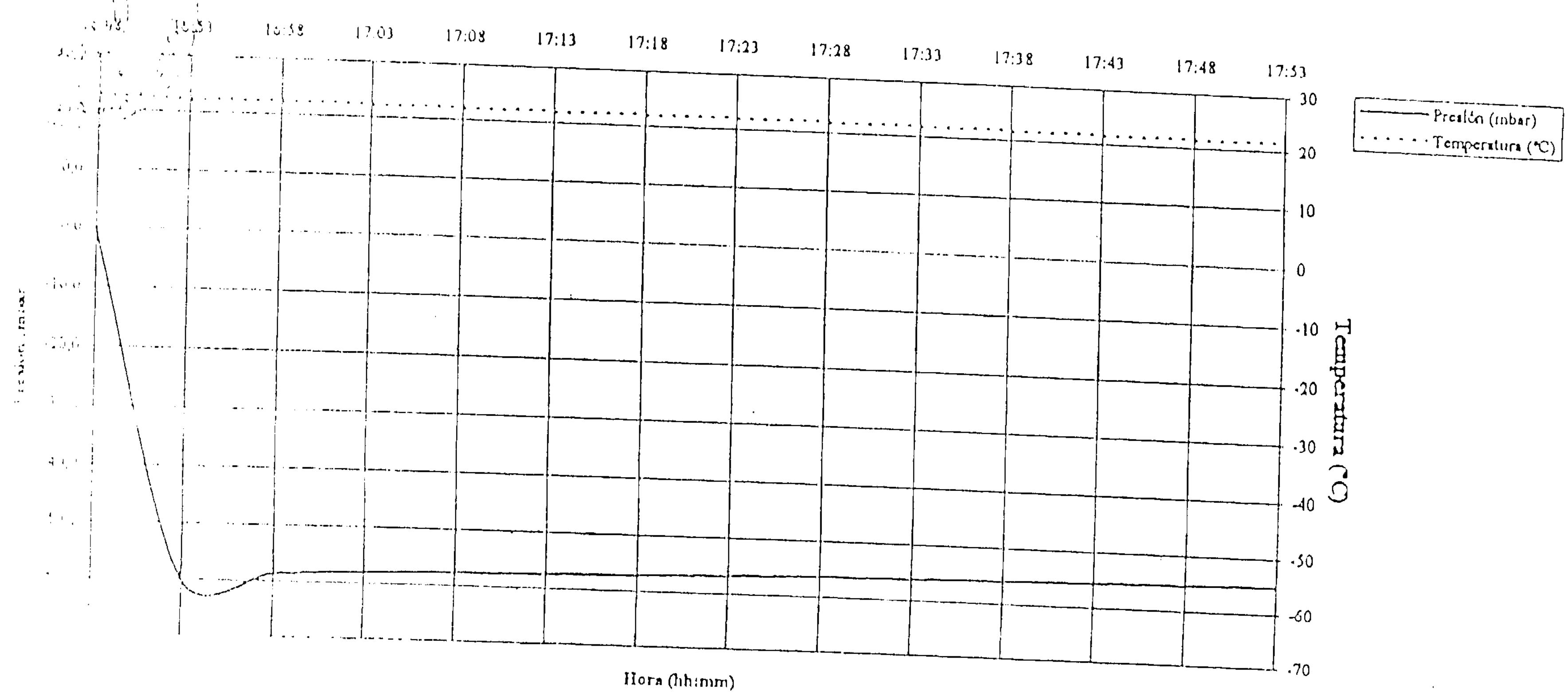
1/1

Gráfico 100996-3

| | |
|---|---|
| Empresa | NET, S.A. |
| Fecha | 10/09/96 |
| Capacidad Tanque | 20.000 lt |
| Capacidad Actual | 00 lt |
| Tipo combustible | Aire |
| Tipo de prueba | Vacío |

| | |
|---|---|
| Fuga real | 0,5 mm |
| Temperatura inicial | 22,8 °C |
| Temperatura final | 21,4 °C |
| Presión barométrica inicial | 1014 mbar |
| Presión barométrica final | 1015 mbar |

Fuga de aire de 0,5 mm



CONCESIONARIO EXCLUSIVO
TEST DE PRECISIÓN
PARA PRUEBAS DE ESTANQUEIDAD

PSL

**NET, s. a.**

Location:
Ubicación ______

Tank #
Tanque nº 2 Date Fecha 11/4/96 Test nº 1

Type of fuel Super gasoline on surface
Tipo de combustible GASOLINA SUPER EN SUPERFICIE

Tank capacity
Capacidad del tanque 20000 l

Current capacity
Capacidad actual 19000 l

Ø Tubería llenado ______

Ø Tubería venteo ______

Ø Tubería succión a bomba ______

Done by:
Realizado por: [signature]

Proven by:
Comprobado por: [signature] J. Almeida

| Time<br>Tiempo | Pressure<br>Presión | (+/-) | Calibration<br>Calibración | Air Temp<br>T. Aire | Barometric Pressure<br>P. Barométrica | Notes<br>Notas |
|---|---|---|---|---|---|---|
| | | | | | 1014 mbar | Comienzo 00.1 |
| 15:00 | -125'2 | | | 26'2ºC | | |
| 15.05 | -122'6 | +2'6 | | 26'2ºC | | |
| 15:10 | -120'2 | +2'4 | | 26'3ºC | | |
| 15.15 | -118'0 | +2'2 | | 26'3ºC | | |
| 15:20 | -116'0 | +2'0 | | 26'3ºC | | |
| 15:25 | -114'2 | +1'8 | | 26'4ºC | | |
| 15:30 | -112'6 | +1'6 | | 26'4ºC | 1013 mbar | |
| 15.35 | -111'2 | +1'4 | | 26'4ºC | | |
| 15:40 | -110'0 | +1'2 | | 26'5ºC | | |
| 15:45 | -109'0 | +1'0 | | 26'5ºC | | |
| 15:50 | -108'2 | +0'8 | | 26'5ºC | | detected leak<br>DETECTADA FUGA |
| 15:55 | -107'6 | +0'6 | | 26'5ºC | | |
| 16:00 | -107'2 | +0'4 | | 26'5ºC | | |
| 16 05 | -107'0 | +0'2 | | 26'6ºC | 1012 mbar | |
| 16 10 | -107'0 | 0'0 | | 26'6ºC | | |
| 16 15 | -107'0 | 0'0 | | 26'5ºC | | Stopping of leak<br>DETENCIÓN DE LA FUGA |
| 16 20 | -107'0 | 0'0 | | [illegible] | | |
| 16.25 | -107'0 | 0'0 | | [illegible] | | |
| 16 30 | -107'0 | 0'0 | | [illegible] | | Localization<br>LOCALIZACIÓN [illegible] |
| 16 [illegible] | [illegible] | 0'0 | | [illegible] | | of liquid's free level<br>DEL NIVEL LIBRE DEL<br>LÍQUIDO |

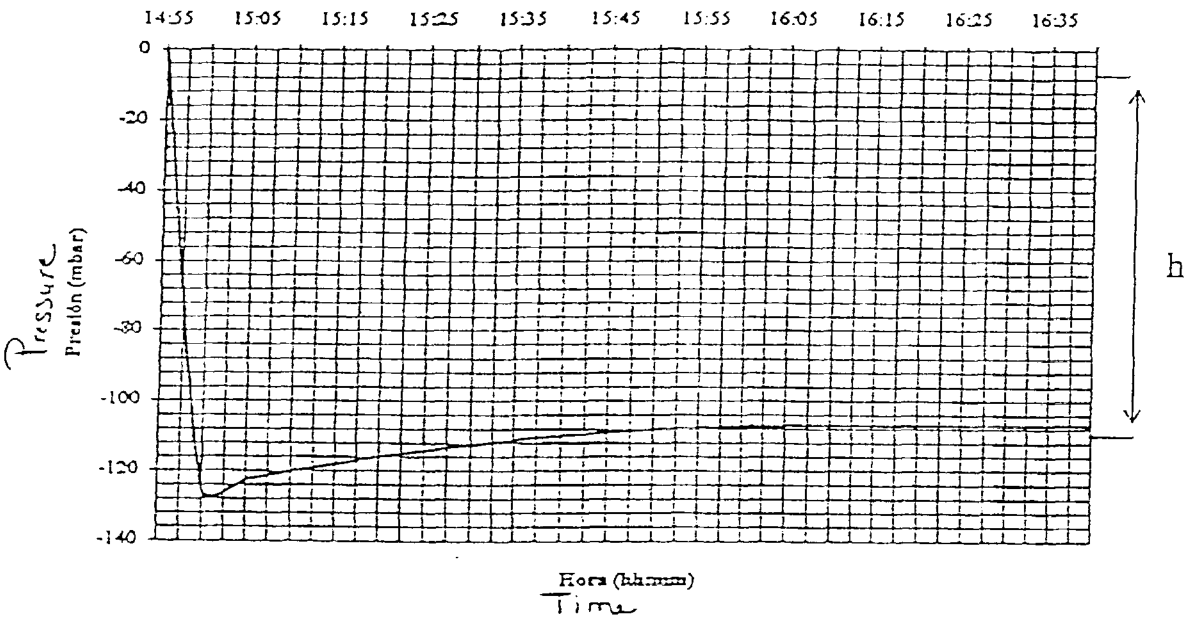
Graph 2: Determining the height of the leak

## Gráfica 2: Determinación de la altura de la Fuga

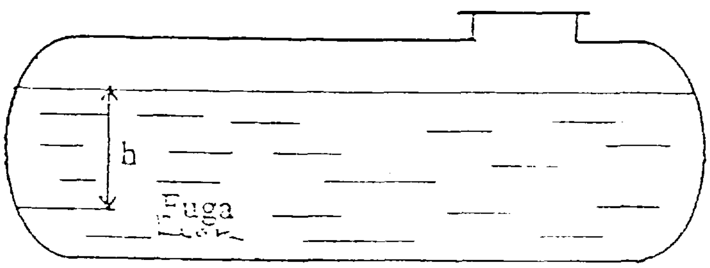
| | |
|---|---|
| Fecha Date | 11/09/96 |
| Capacidad Tanque | 20.000 lt |
| Capacidad Actual | 19.000 lt |
| Tipo combustible | Gasolina Súper |
| Tipo de prueba | Vacio Empty |

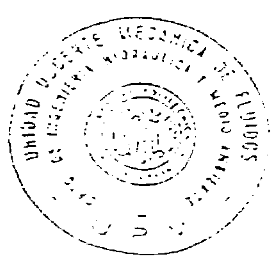
| | |
|---|---|
| Fuga real Real leak | 230 ml/h |
| Temperatura inicial Initial Temp | 26,8 °C |
| Temperatura final Final Temp | 30,4 °C |
| Presión barométrica inicial | 1014 mbar |
| Presión barométrica final | 1012 mbar |

Gráfica 2
Graph #2




Estabilización a -107,0 mbar => h= 107 cm (aprox.)
Stabilization at 107.0mbar → h = 107cm (approx.)



CONCESIONARIO EXCLUSIVO
TEST DE PRECISIÓN
PARA PRUEBAS DE ESTANQUEIDAD

PSL

**NET, s. a.**

Location:
Ubicación ______

Tank # 2
Tanque nº 2 — Date / Fecha 12/9/96 — Test nº 1

Type of Fuel
Tipo de combustible: AIRE Air

Done by: / Realizado por: [signature]

Capacidad del tanque: 20000 l

Current capacity
Capacidad actual: VACIO Empty

Ø Tubería llenado ______

Ø Tubería venteo ______

Ø Tubería succión a bomba ______

Proven by: / Comprobado por: J. Almela

| Tiempo (Time) | Presión (Pressure) | (+/-) | Calibración (Calibration) | T. Aire (Air Temp.) | P. Barométrica (Barometric Pressure) | Notas (Notes) |
|---|---|---|---|---|---|---|
| 14:05 | – | | | 24'0°C | 1011 mbar | Comienzo 00.1 |
| 14:10 | 170'6 | | | 24'1°C | | |
| 14:15 | 166'2 | -4'4 | | 24'2°C | | |
| 14:20 | 165'6 | -0'6 | | 24'2°C | | |
| 14:25 | 165'6 | 0'0 | | 24'2°C | 1010 mbar | |
| 14:30 | 165'7 | +0'1 | | 24'3°C | | |
| 14:35 | 165'8 | +0'1 | | 24'3°C | | |
| 14:40 | 165'8 | 0'0 | | 24'3°C | | |
| 14:45 | 165'9 | +0'1 | | 24'3°C | | |
| 14:50 | 166'0 | +0'1 | | 24'4°C | 1009 mbar | |
| 14:55 | 166'0 | 0'0 | | 24'4°C | | |
| 15:00 | 166'0 | 0'0 | | 24'5°C | | |
| 15:05 | 165'9 | -0'1 | | 24'5°C | 1008 mbar | |
| 15:10 | 165'9 | 0'0 | | 24'6°C | | |
| 15:15 | 165'8 | -0'1 | | 24'6°C | | |
| 15:20 | 165'8 | 0'0 | | 24'6°C | | |
| 15:25 | 165'7 | -0'1 | | 24'6°C | | |
| 15:30 | 165'7 | 0'0 | | [illegible] | [illegible] mbar | |
| 15:35 | 165'7 | 0'0 | | [illegible] | | |
| 15:40 | [illegible] | -0'1 | | [illegible] | | |
| 15:45 | [illegible] | 0'0 | | [illegible] | [illegible] mbar | End of Test |
| 15:50 | [illegible] | -0'1 | | [illegible] | | Fin de TEST |

[illegible]
[illegible]

Gráfica 120996-1

Concesionario Exclusivo del Test de Precisión para Pruebas de Estanqueidad

PSL

NET, s. a.

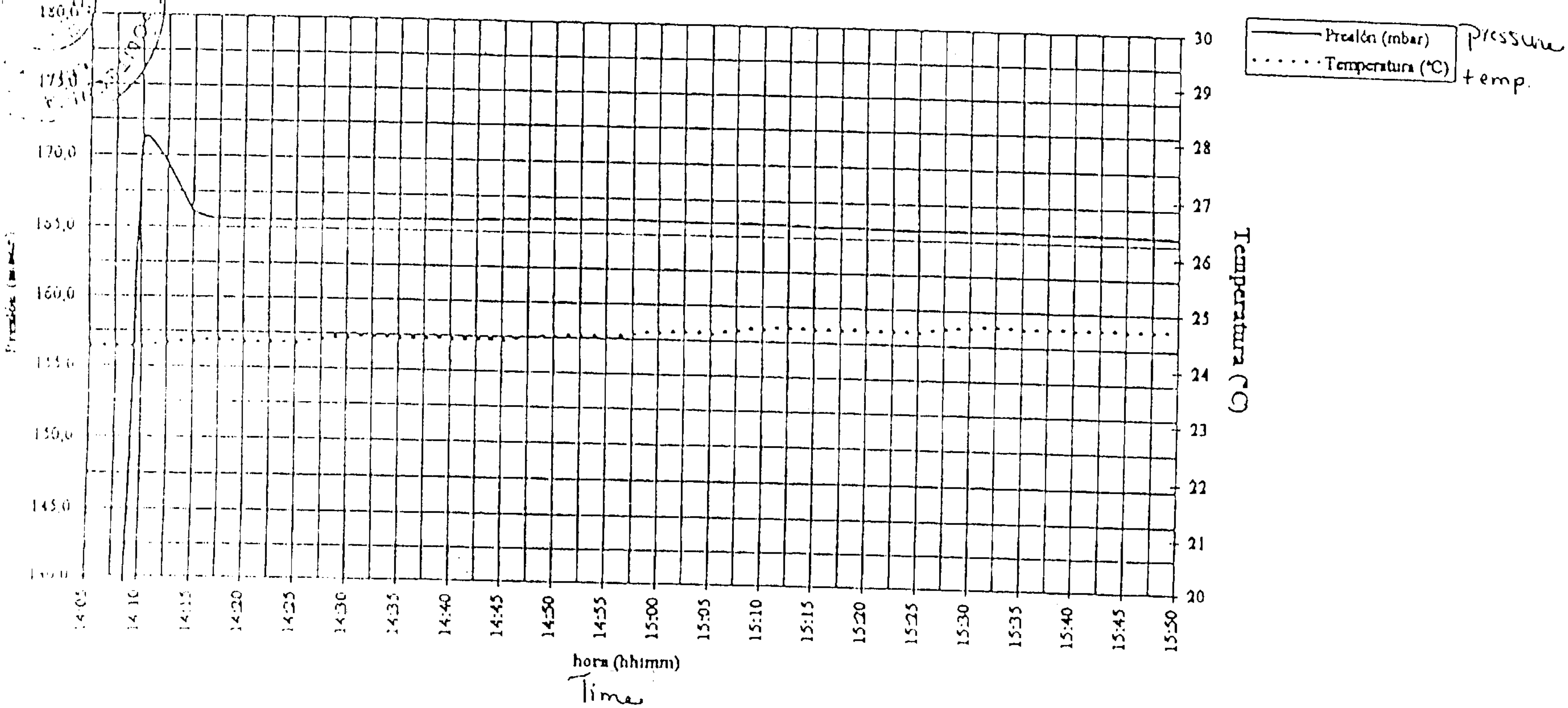
1/1

| | |
|---|---|
| Empresa (Company) | NET, S.A. |
| Fecha (Date) | 12/09/96 |
| Capacidad Tanque | 20.000 lt |
| Capacidad Actual | 00 lt |
| Tipo combustible | Aire (Air) |
| Tipo de prueba | Sobrepresión (Compressed) |

| | |
|---|---|
| Diámetro de fuga (diameter of leak) | 0,25 mm |
| Fuga co tanque lleno de agua (leak with tank filled with water) | 240 ml/h |
| Temperatura inicial | 24,1 °C |
| Temperatura final | 24,7 °C |
| Presión barométrica inicial | 1011 mbar |
| Presión barométrica final | 1006 mbar |

Tank with 0.25 mm. Diameter Air leak

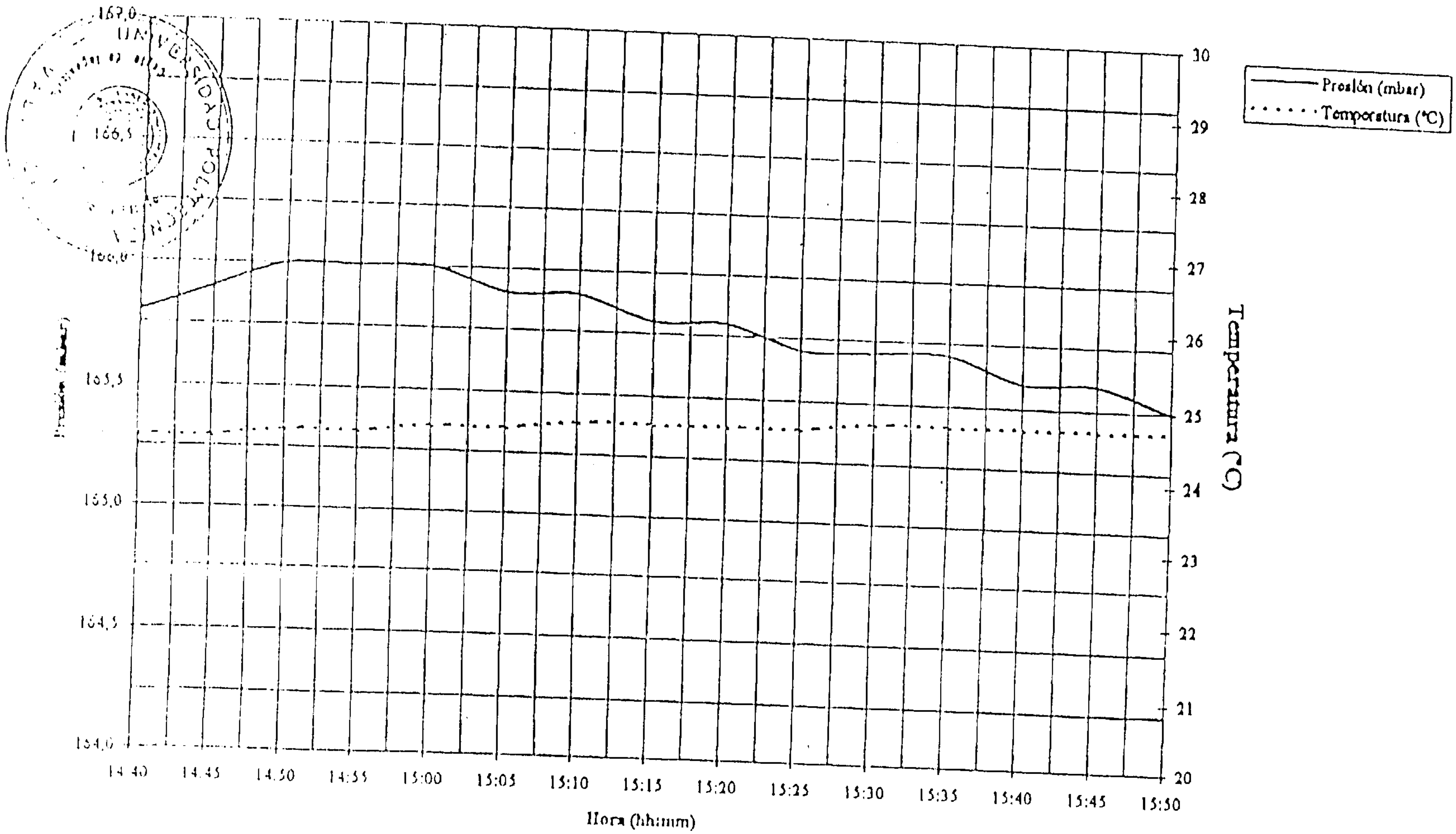
**Tanque con fuga de aire de D = 0,25 mm**



Gráfica 120996-1

Details of the 2:40 p.m. – 3:50 p.m. stretch

**Detalle del tramo desde las 14:40 h a las 15:50 h**



CONCESIONARIO EXCLUSIVO DEL TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

PSL

**NET, s. a.**

Location: Ubicación

Tank #: Tanque nº 2 | Date: Fecha 13/4/96 | Test nº 1

Tipo de combustible: AIRE Air

Capacidad del tanque: 20000 l

Capacidad actual: VACIO Empty

Ø Tubería llenado: 

Ø Tubería venteo: 

Ø Tubería succión a bomba: 

Realizado por: [signature]

Comprobado por: J. Almela [signature]

| Tiempo (Time) | Presión (Pressure) | (+/-) | Calibración (Calibration) | T. Aire (Air Temp.) | P. Barométrica (Barometric Pressure) | Notas (Notes) |
|---|---|---|---|---|---|---|
| 16:30 | - | | | 25'1°C | 1006 mbar | Comienzo 00.1 |
| 16:55 | -60'2 | | | 24'9°C | | |
| 17:00 | -58'8 | +1'6 | | 25'3°C | | |
| 17:05 | -58'1 | +0'5 | | 25'4°C | | |
| 17:10 | -57'6 | +0'5 | | 25'5°C | | |
| 17:15 | -57'2 | +0'4 | | 25'7°C | | |
| 17:20 | -56'8 | +0'4 | | 25'8°C | | |
| 17:25 | -56'4 | +0'4 | | 25'8°C | 1005 mbar | |
| 17:30 | -56'0 | +0'4 | | 25'7°C | | |
| 17:35 | -55'6 | +0'4 | | 25'7°C | | |
| 17:40 | -55'3 | +0'3 | | 25'7°C | | |
| 17:45 | -54'9 | +0'4 | | 25'6°C | | |
| 17:50 | -54'6 | +0'3 | | 25'6°C | | |
| 17:55 | -54'3 | +0'3 | | 25'6°C | | |
| 18:00 | -54'0 | +0'3 | | 25'5°C | | |
| 18:05 | -53'7 | +0'3 | | 25'4°C | | |
| 18:10 | -53'4 | +0'3 | | 25'3°C | 1006 mbar | |
| 18:15 | -53'2 | +0'2 | | 25'1°C | | |
| 18:20 | -53'0 | +0'2 | | 25'1°C | | End of Test |
| 18:25 | -52'7 | +0'3 | | 25'0°C | | FIN DE TEST |
| | | | | CONCLUSIÓN | NO EXISTE | FUGA |
| | | | | Conclusion | no leak | exists |

30/31

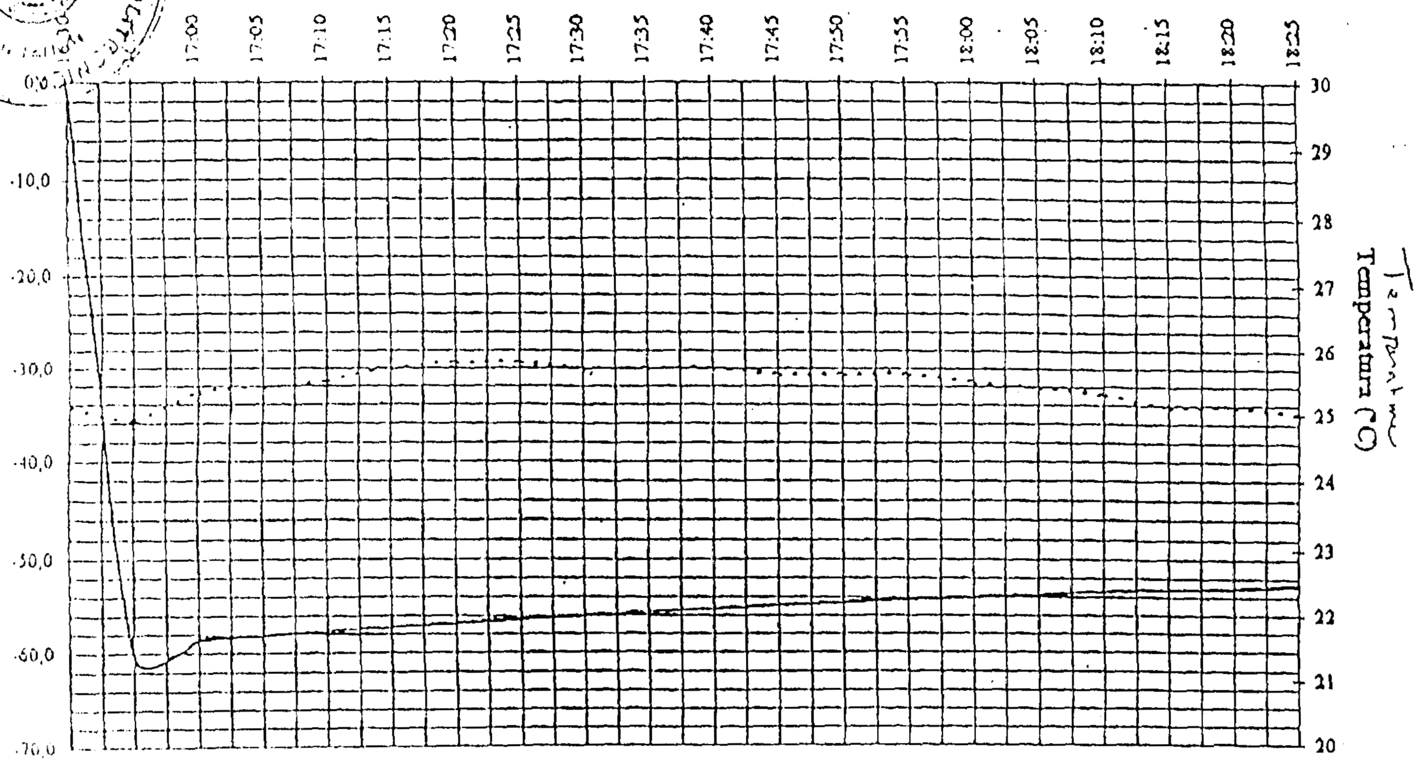
Gráfico 130996-1

| | |
|---|---|
| Empresa Company | NET, S.A. |
| Fecha Date | 13/09/96 |
| Capacidad Tanque | 20.000 lt |
| Capacidad Actual | 00 lt |
| Tipo combustible | Aire Air |
| Tipo de prueba | Vacio Empty |

| | |
|---|---|
| Diámetro de fuga Diameter of leak | 0,25 mm |
| Fuga con tanque lleno de agua leak with tank filled with water | 240 ml/h |
| Temperatura inicial | 28,1 °C |
| Temperatura final | 28,0 °C |
| Presión barométrica inicial | 1006 mbar |
| Presión barométrica final | 1004 mbar |

Tank with 0.25mm diameter leak

**Tanque con fuga de D = 0.25 mm**




CONCESIONARIO EXCLUSIVO DE TEST DE PRECISIÓN PARA PRUEBAS DE ESTANQUEIDAD

NET, S.A.

1/1

**LFCDA**

London Fire Brigade
Albert Embankment, London SE1 7SD

LONDON FIRE AND CIVIL DEFENCE AUTHORITY

Chief Fire Officer & Chief Executive
B G Robinson

Telephone 0171 587 4586
Telex 918200
Facsimile 0171 587 4650
My reference FS/TPG5/P520
Your reference
Date 7 June 1995

Mr C. Denby
Piper Services (Yorks) Limited
Ahed House Estate
Dewsbury Road
Ossett
West Yorkshire
WF5 9ND

Dear Mr Denby,

**PETROLEUM (CONSOLIDATION) ACT 1928**
**PSL Leak Detection System**

I refer to your letter dated 9 May 1995, the Engineers Work Procedure submitted on 10 May 1995 (and the appendices sent by Meggitt Petroleum Systems on 17 May 1995) and the final EPA evaluation report from Ken Wilcox and Associates dated 2 May 1995.

The documentation has been examined and assessed and this Authority has no objection to the use of the PSL leak detection system for carrying out precision tank and line testing at premises licensed under the above legislation within out jurisdiction provided that :-

1 The tests are carried out as detailed in the above mentioned documentation

2 Tests are limited to tanks of a maximum capacity of 68,000 litres and that a maximum ullage space of 4,000 litres is used for test purposes (as specified in the report by KWA).

3 At least 48 hours prior notification of the intention to carry out a test is given to the Petroleum Officer at the Area Fire Safety Office.

4 Notification of the results of the tests are sent to the local Petroleum Officer as soon as possible after the tests have been carried out.

5 Only competent, trained PSL operators, as listed in the appendix to your letter dated 9 May 1995, are to carry out the test procedures. Any future changes to this list should be notified to this office to enable our records to be updated.

6 Tanks under test must have their fill points locked off to prevent unauthorised delivery and be labelled "TANK UNDER TEST - DO NOT FILL".

If I can be of any further assistance please do not hesitate to contact me on the above telephone number.

Yours sincerely,

R. HENNESSY
[illegible]

Following the demonstration of the PSL precision tank testing equipment at Oak Service Station, A45 (north), Pickford Green, Coventry witnessed by Petroleum Officers from this Service, I am pleased to inform you that the system is approved and recognised by the West Midlands Fire Service.

As you are aware, the responsibility rests with licensees of petroleum installations to notify the appropriate Divisional headquarters when a tank test is being undertaken. I would however, appreciate your co-operation by ensuring that at least 48 hours notice is given to this Service prior to the tank test being undertaken.

Yours faithfully,

Assistant Chief Officer
(Fire Prevention).

Mr C. Denby
Piper Services Ltd
11 Turner Lane
North Ferriby
North Humbersider
HU14 3DF

GREATER MANCHESTER
COUNTY FIRE SERVICE

P.A. Gribbin QFSM, M.I.Fire E,
County Fire Officer & Chief Executive

Your Reference

Our Reference CJC/LW/FP/L9.1/FP1061

Contact Stn O Cooper
Ext. 2083

Date 6 October, 1993

Piper Services (Yorks) Ltd
832/836 Holderness Road
Hull
North Humberside
HU9 3LP

For the attn of Mr C Derby

Dear Sir

PRECISION TESTING OF PETROLEUM SPIRIT STORAGE TANKS AND PIPEWORK

Thank you for your letter undated but received 4 October 1993.

Your company has now been included on the list compiled by this Fire Authority, of contractors approved to carry out the above mentioned periodic tests.

It is the responsibility of the company carrying out the testing of petroleum spirit storage installations to ensure safe practices are observed in accordance with the Health and Safety at Work Act 1974.

Work carried out within the GMC Fire Authority is monitored.

This Fire Authority reserves the right to remove the details of any company from the list of approved contractors without prior notice.

Please find enclosed a supply of form FP/PET/18 for your use.

Yours faithfully,

P Gribbin

COUNTY FIRE OFFICER
AND CHIEF EXECUTIVE

Headquarters: 146 Bolton Road, Swinton, Manchester M27 2US Telephone: 061-736 5866 Telex: 668105 Fax: 743 1777

North Yorkshire County Council
NORTH YORKSHIRE FIRE AND RESCUE SERVICE

C.D. Jones M.I.Fire E., F.B.I.M
County Fire Officer,
Fire Brigade Headquarters
Crosby Road
Northallerton
North Yorkshire DL6 1AB
Telephone Northallerton (STD 0609) 780150
Fax (STD 0609) 777038

Your Reference:

My Reference: FS/TJL/SL

When telephoning please ask for: Mr Lund
Ext. 243

25 August 1993

**PETROLEUM STORAGE TANK - PERIODIC TESTING**

I refer to your request to use the PSL Pressure Test method in the North Yorkshire area.

Following the test of an underground storage tank by yourself witnessed by Station Officer Williams of Scarborough Fire Safety Section, I am pleased to be able to tell you that this Authority has decided to allow the use of your equipment for the testing of storage tanks in the County of North Yorkshire.

If you have any questions regarding this matter please do not hesitate to contact the Officer whose name appears at the head of this letter.

Yours faithfully

C. D. Jones

County Fire Officer

C Denby Esq
Piper Services Ltd
11 Turner Lane
NORTH FERRIBY
North Humberside
HU14 2DR

*Serving England's Largest County*

West Yorkshire
Fire and Civil Defence
Authority

P. Kne  QFSM MIFireE
Assistant Chief Officer (Fire Safety)
Oakroyd Hall
Birkenshaw
West Yorkshire BD11 2DY
Telephone: 0274 682311
Fax: 0274 851315

My Ref FP16/1/3 RM/JB  Your Ref

20 September 1993

Mr R Marris Ext 2206 is dealing with this matter

For the attention of Mr D Mawer

Dear Sir

**FIRE SAFETY - PETROLEUM (CONSOLIDATION) ACT 1928 - PETROL FILLING STATIONS - STORAGE TANK TESTING**

I refer to your letter dated 15 June 1993 together with the certificate of conformity and method statement for the P S I. tank testing system.

The contents of your letter and associated documents are noted and I would confirm there will be no objection to the use of the P S I. system in this Authority's area subject to compliance with the relevant sections of the enclosed specification Nº 41.

Should you require any further information or wish to discuss any points regarding this matter, please do not hesitate to contact me.

Yours faithfully

R Marris

R Marris
Brigade Petroleum Officer

Piper Services (Yorks) Ltd
11 Turner Lane
North Ferriby
Humberside
HU14 3DF

Fire and Rescue Service
Chief Fire Officer Robert J King MIFireE

Hertfordshire
COUNTY COUNCIL

SERVICE HEADQUARTERS
Old London Road
Hertford SG13 7LD
Fax : 0992 550242

Telephone: 0992 584900
Ext : 252
Minicom : 0992 504153
Contact : ADO Kinnear
My Ref : GCK/AM/FSHQ/G71
Your Ref :
Date : 2 November 1993

Piper Services (Yorks) Ltd
832/836 Holderness Road
Hull
HU9 3LP

For the attention of Mr C Denby

Replied 5/11/93

Dear Sir

PSL PRECISION TANK TESTING SYSTEM

Thank you for your letter dated 26th October 1993 providing the additional technical data requested for testing underground petroleum storage tanks.

I have examined the data and confirm this Authority is prepared to sanction the use of this system on sites we licence provided that:-

a) a copy of the test certificates is forwarded to us within 10 working days of the test date (the certificate should be forwarded to the Area Petroleum Officer, as per the attached list) and

b) all operatives carrying out tests have available, on demand, documentary evidence that they have undergone training, in the form of your "Certificate of Competence", and

c) where removal of an "overfill prevent device" is considered necessary to carry out the tests, this is only done following consultation with this Authority, and

d) this Authority is notified at least 48 hours prior to the commencement of a test, giving full details of the site, number of tanks to be tested and the commencement time of works, in order that a site visit can be arranged to observe your working practices and the actual test.

We shall be pleased to receive written confirmation that items a) - d) above will be incorporated into your procedure for tests carried out within this Authority's area prior to the first test.

If further assistance is required, please do not hesitate to contact the writer.

Yours faithfully

Senior Fire Safety Officer

Trading Standards Department
Chief Officer M W Shipley, LLB, MITSA

Hinchingbrooke Cottage, Brampton Road,
Huntingdon, Cambridgeshire PE18 8NA
Telephone Huntingdon (0480) 457344
Fax Huntingdon (0480) 414958

Cambridgeshire
County Council

Mr C Denby
Piper Services (Yorks) Ltd
11 Turner Lane
North Ferriby
North Humberside
HU14 3DF

Our Ref: LBW601/cm

22 October 1993

Dear Mr Denby

**P.S.L. TANK TESTING SYSTEM**

Your documentation, sent to Mr Taylor of this Department, has been passed to me for consideration.

After careful perusal of the documents I can confirm that Cambridgeshire County Council will allow the above method of tank testing for underground petroleum spirit storage tanks within Cambridgeshire.

Any such tests must be carried out by competent persons trained and certified by Piper Services (Yorks) Ltd.

Yours sincerely

L W Wilson
Head of Safety & Licensing

MEGGITT
ELECTRONICS

MEGGITT
PETROLEUM
SYSTEMS

LECTRONIC
16B Hartlebury Trading Estate
Hartlebury
Nr, Kidderminster
Worcs DY10 4JB
telephone
(01299) 251251
fax
(01299) 250588

August 15th 1995.

To whom it may concern.

Lectronic have a lease use agreement with Kobal night Ltd for the use of the Piper tank testing system.
We have been using the system for some 10 months to date and have found the systems ease of use in both manpower and economy of requirements a great asset to our tank testing programme.
On the basis of the systems abilities and economics we have achieved contracts with Major U.K. retailers Principally B.P. but also others like Q8, with Fina, Texaco and Elf Oil utilising the service on a constant basis with discussions under review for formal contracts.
Training is extensive and thorough as would be expected and the opportunity to use the system is limited via Kobol Knight to high profile companies such as ourselves and assures integrity for its future use.
Lectronic are committed to the systems growth in the UK market and would expect it to do as well in the full global arena.

Yours Faithfully

John Smith
Manager Environmental Services

WAYNE

Wayne DRESSER

IM/eb/12.9

Kobal Knight Limited
Ahed House Estate
Dewsbury Road
Osset
West Yorkshire
WF5 9ND

12 September 1995

Attn: Mr K Denby

Dear Sirs

We are pleased to confirm our licensing agreement with your company for the PSL line and tank testing system. Having examined the various methods of testing available in the market our decision was based on the following factors:-

a. Tests tank, lines, fills & vents in one operation.
b. Ease of operation.
c. With correct voltage test can be completed within an hour.
d. Accuracy of results
e. Minimum of site downtime - other tanks can be kept in operation.
f. Very competitive price structure.
g. Support given by Kobal Knight.

Again we would stake our commitment to the system and look forward to a successful future.

Yours faithfully

**Iain MacLeod**
**Installation Manager**

# The Association o
# Container Recon(

*"Responsible Container Managem*

March 13, 1997

Mr. Alan I. Roberts
Associate Administrator for
Hazardous Materials Safety
Research & Special Programs Administration
Department of Transportation
Washington, DC 20590

Re: **Petition for rule making; reuse of plastic drums**

Dear Mr. Roberts:

The Association of Container Reconditioners (ACR) and the Steel Shipping Container Institute (SSCI) hereby petition the Department to institute expedited rule making under §106.31 of RSPA's procedural regulations. The petitioners believe a serious risk to safety in transportation exists that should not be allowed to continue, simply to accommodate the routine rule making processes.

In Docket No. HM-215A, published on December 29, 1994, RSPA adopted a change to §173.28(b)(7)(iii)(B) of the hazardous materials regulations to allow reuse of plastic packagings in dedicated service without leakproofness testing, provided the packaging was less than five years old. In timely petitions for reconsideration, a reversal of this abrupt change was sought. We continue in our belief that the rule making record was inadequate upon which to base such a major change, because the original notice proposing adjustments to §173.28 failed to advise the petitioners that such a subject was intended for public comment.

The notice did propose waiving the leakproofness test for stainless steel, monel and nickel packagings <u>with a thickness of not less than 1.5 times the minimum thickness prescribed for reuse of such packagings</u>. No such increased minimum thickness requirement was imposed upon plastic packagings, however. They may be constructed to the bare minimum required for reuse, and then may be reused for five years to transport liquid hazardous materials, without ever being subjected again to a leakproofness test.

On May 18, 1995, RSPA clarified the controlled distribution conditions under which this provision, but the exception waiving leakproofness testing for hazardous liquids was not retracted. RSPA cited several commenters who seemed to have understood that waiving

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leakproofness testing for plastic packagings having minimum wall thickness was appropriate for comment. The major associations involved with the reuse of non-bulk packagings, however, had no such notice and submitted no comments on the issue although they had strong positions on it, which were communicated in their petitions for reconsideration.

We believe this leakproofness exception for plastic packagings was ill-advised, and we believe a major transportation safety problem has been created as a result. In order to provide the factual basis upon which to reiterate our request to RSPA to correct this mistake, seven plastic drum reconditioners conducted a four-week study in January and February 1996. These companies and their employees are very familiar with the features of plastic drums, the rigors of the transportation environment, and the nature of failures encountered in reuse of plastic drums.

Even after thorough visual inspection and the rejection of drums having visible damage, the mechanical leakproofness test required of all reconditioned packagings for liquids detected failures at a rate of 2.14%. In other words, these drums first were scrutinized by people in the profession of preparing plastic drums for reuse. Despite this screening, which is all that the current regulations require, in excess of 2% of the drums still were found to be unfit for hazardous materials service because of leaks detected by pressurizing cleaned drums with air, per §173.28(b)(2)(c) and §178.604. A copy of the report summary is attached to this petition for rule making.

As was noted in an earlier ACR filing with RSPA, cracks encountered at closure and seam lines are virtually impossible to detect visually. A visual exam, therefore, is grossly inadequate in light of the frequency with which cracks can appear in these locations.

This is especially the case when one recognizes that the existing authorization to reuse plastic packaging does not require cleaning or removal of prior residues before conducting the visual inspection. The presence of the residue makes it unsafe and impractical to visually inspect the interior of the packaging -- something which is done routinely after cleaning in the reconditioning process. In addition, closures on returning plastic drums usually only have been hand-tightened and are not sealed. Again, it would be unsafe and impractical to expect those who reuse uncleaned containers to tip them upside down to check for punctures on the bottom, a common type of failure.

It is estimated that ten million new plastic drums are made each year in North America. An agency-authorized 2+% failure rate for this reused and untested hazardous materials packaging is unconscionable, and directly contrary to both the public interest and the duties of the Secretary of Transportation under the hazardous materials laws. Many of these plastic packagings are used for corrosive and toxic materials. We suspect that the majority of these units will leak on the filling line and may not make it as far as movement on a vehicle, but the filling and closure of UN-marked hazardous materials packaging is within the purview of the DOT regulations.

Therefore, based upon this data, the petitioners hereby request expedited notice-and-comment rule making to address the issue properly in a public forum, by proposing deletion of

§173.28(b)(7)(iii)(B) from the regulations. This change would retain the limited authorization granted to certain exceptional metal packagings, as well as the opportunity to seek RSPA's approval to skip leakproofness testing in a manner that assures equivalent performance to that prescribed in the regulations. It would remove the authorization to reuse minimum thickness plastic packagings, which we have shown to have an unacceptably high failure rate when subjected only to a visual inspection.

Thank you for your prompt consideration of our petition.

Respectfully submitted,

Paul W. Rankin
President
Association of Container Reconditioners

Daniel Gilligan
Executive Director
Steel Shipping Container Institute

cc: E. Pearlman
J. Moore
ACR Plastic Drum Committee

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# ACR PLASTIC DRUM LEAKPROOFNESS STUDY

Background.

Each business day for four weeks, from January 22-February 16, 1996, seven plastic drum reconditioners in the Association of Container Reconditioners (ACR) monitored their operations and completed written reports showing (1) each date, (2) the total number of drums prepared for processing by date, (3) the total number of drums rejected each day by visual inspection because of physical deformations, (4) the total number of drums rejected each day by visual inspection because of deficiencies other than physical deformations such as appearance, and (5) the total number of drums rejected each day after having been cleaned and processed through the stage of mechanical leakproofness testing. Mechanical leakproofness testing is performed as prescribed in §178.604. The results of this study were sent to Lawrence W. Bierlein, general counsel to ACR, for compilation.

Summary.

The consolidated data may be summarized as follows --

a. Total number of responders: 7 plastic drum reconditioning companies

b. Total number of plastic drums considered: 87,558

c. Total number of drums rejected based upon a visual examination revealing a deformation that could affect drum performance in transportation: 3,999 drums, or 4.57% of all drums surveyed.

d. Total number of drums rejected as a result of a visual inspection revealing a problem other than physical deformation: 8,217 or 9.39% of all drums surveyed.

e. Total number of drums passing visual inspections but failing the mechanical leakproofness test: 1,615. This is approximately 2.14% of all drums otherwise passing visual inspections (75,342) and 1.85% of all drums surveyed.

Conclusion.

Drums having visible physical inadequacies are rejected before being leakproofness tested by reconditioners. This visual inspection is the total extent of the examination required by DOT for reused plastic drums in dedicated service that have an age of no more than five years. (Plastic drums over five years in age do have to be leakproofness tested, but may be reused if this test is performed and the packaging is marked accordingly.) In addition to the visual examination for damage, reconditioners reject many drums for aesthetic reasons. Only drums visually determined by experienced personnel to be satisfactory for further use in shipping hazardous materials are processed through the mechanical leakproofness tester for pressurization and submersion. Actual results of four weeks' of examination by seven separate companies in different parts of the country show that 2.14% of the drums visually accepted for reuse in hazardous materials service fail the mechanical leakproofness test, i.e., based on this data hazardous materials leaks are permitted by the current regulatory provisions.

Information compiled by:

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