



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460  
Mail Code 5401G

SEPT. 11, 1998

OFFICE OF SOLID WASTE AND EMERGENCY  
RESPONSE

**MEMORANDUM**

SUBJECT: *List of Leak Detection Evaluations for Underground Storage Tank Systems - Fifth Edition*

FROM: Anna Hopkins Virbick, Director  
Office of Underground Storage Tanks

TO: Addressees (see below) and All Interested Parties

The purpose of this cover memo is to transmit the attached list and to provide additional information about its appropriate use and about EPA's involvement with it. Previous editions of the List of Leak Detection Evaluations have been very helpful tools to the underground storage tank (UST) community, and we are pleased to make this new edition available.

**As only one hard copy is being sent to each location, if you are not the appropriate person in your organization to receive this, please forward it to the correct person and provide us with updated address information.**

**The List and Its Use**

The List contains information on underground storage tank and piping leak detection system evaluations that have met certain criteria. The evaluations must have been performed by an independent third party, in accordance with EPA or equivalent test procedures, and with leak rates blind to the evaluator. The List includes evaluations that followed either an EPA protocol, a national voluntary consensus standard, or other accepted test procedures developed by an independent third party.

The List of Leak Detection Evaluations is based on reviews by the **independent** National Work Group on Leak Detection Evaluations, consisting of state and EPA UST program staff. Therefore, this List is not an EPA list. Furthermore, neither EPA nor the work group approve or will approve leak detection systems. Approval or acceptance of systems is the responsibility of the implementing agency -- in most cases the state environmental agency, which should be contacted regarding the approval or acceptance of leak detection systems in a particular area.

There is an Under Review section that lists evaluations about which the work group has received information, and is either reviewing or has requested additional information needed to clarify the evaluation. **Listing of an evaluation as "under review" in no way implies that the evaluation does or does not meet the review criteria.**

The List includes a user survey; after familiarizing yourself with the List, please take a moment to provide your feedback. The List also includes a separate listing of protocols under which listed evaluations were performed. Finally, the first of several optional maintenance checklists have been added; these can help users get the most out of leak detection systems.

We believe that the List will continue to be of great benefit to those throughout the UST community. However, please remember that it has inherent limitations. It is based on evaluations, which are one-time events, often conducted in a lab setting according to protocols that do not test all aspects of a system. Therefore, appearance on the List does not mean that a particular system will work or comply with regulations at any particular site. For these reasons, the List cannot be the final word; you should base your decisions on all available sources of information.

### **Distribution**

This edition is being distributed in hard copy and made available in electronic form. The previous edition was made available only electronically. The work group updates the List periodically, as new evaluations and information are reviewed. The most recent version is always available in electronic form for downloading, viewing, and printing via the Internet at:

<http://www.epa.gov/OUST/pubs/index.htm>

It is available in Microsoft Word (the original version), WordPerfect 5.1, and Adobe's Portable Document Format (PDF). For help with access, contact Hal White at [white.hal@epa.gov](mailto:white.hal@epa.gov) or at (703)603-7177.

To save paper and expense, we limit the distribution of paper copies of this large document. We send paper copies to vendors, associations, EPA UST offices, state UST offices, and others who request it -- one copy to each organization at each location. In addition, a limited number of printed copies will be made available through EPA's National Center for Environmental Publications, (800)490-9198.

**Additional information**

If you have an evaluation to submit or if you have comments about a particular listing, please see the list of work group leads for the various types of leak detection systems and contact the appropriate lead. Comments and new information are welcomed.

I hope that this package is helpful to you. If you have questions about our distribution of the List, please contact David Wiley. He may be reached by e-mail at [wiley.david@epamail.epa.gov](mailto:wiley.david@epamail.epa.gov), by phone at (703)603-7178, by fax at (703)603-9163, or by U.S. Mail at the letterhead address above.

Attachment: ***List of Leak Detection Evaluations for Underground Storage Tank Systems - Fifth Edition***

**Addressees:**

State UST Contacts  
UST/LUST Regional Program Managers  
Region 10 Operations Offices' UST/LUST Contacts  
Vendors appearing on List of Leak Detection Evaluations  
Anthony Tafuri, NRMRL Edison  
Members of National Work Group on Leak Detection Evaluations  
Stephen Crimando, Association of State and Territorial Solid Waste Management Officials (ASTSWMO)  
American Society Of Petroleum Operations Engineers (A.S.P.O.E.)  
Larry Magni, American Petroleum Institute  
Arlene Alexander, National Association of Convenience Stores  
Thomas West, National Association of Texaco Wholesalers  
Bob Renkes, Petroleum Equipment Institute  
Kristen Manos, Petroleum Marketers Association of America  
Mark Morgan, Petroleum Transportation and Storage Association  
Roy Littlefield, Service Station Dealers of America  
Tom Osborne, Society of Independent Gasoline Marketers of America

**cc (cover only):**

Regional Program Managers' Supervisors  
Kathy Nam, OGC  
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OUST Management Team  
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# ADEM

ALABAMA

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT



September 11, 1998

**MEMORANDUM**

TO: Vendors of Leak Detection Equipment/Procedures and Other Interested Parties

FROM: Curt D. Johnson, Chairperson

RE: National Work Group on Leak Detection Evaluation's List of Leak Detection Evaluations for underground storage tank systems - Fifth Edition

If you are reading this memo, you have received our latest edition of the list. We would appreciate any comments you have concerning the list. Please provide comment by using the list of leak detection evaluations user survey and send survey to me at the address, phone number, fax number or e-mail address listed on the next page.

If you need to contact other members in the work group, the same information is included for them on the next page. Also, the work group team and team leaders are listed on the page following the member list to help you determine who you may need to contact.

Please send new evaluations and/or protocols to be evaluated by the work group to **the team leader and all the members of the team**. To enable the work group to properly review the third-party tests, **one (1) copy** of all applicable information indicated in the enclosed "Leak Detection Equipment Review - Document List" must be sent to the team leader and each team member.

Since the first draft list was sent out back in January of 1995, the list has sometimes been referred to as the "EPA work group list of approved leak detection equipment". The work group and EPA are concerned that similar statements may begin to appear in sales literature distributed by vendors. We request that you do not refer to the list in this way for the following reasons.

1. **This is not an EPA or EPA work group list.** This draft list was prepared by an **independent** work group consisting of state and EPA members.
2. **Neither EPA nor the work group approve leak detection equipment or procedures.** The draft list does not include "approved" leak detection equipment/procedures. It includes leak detection equipment/procedures that the work group reviewed and confirmed, were third-party tested in accordance with either an EPA or other acceptable test protocol, and the test confirmed that the equipment/procedures meet EPA performance standards. Approval or acceptance of leak detection equipment and procedures is the responsibility of the implementing agency, which in most cases is the state environmental agency.

We try to send only 1 copy of the list per company per location. If you received more than 1 copy at your location, or if the copy needs to be sent to another person, please notify me and we will make the necessary corrections.

Enclosure: Work Group Members, Work Group Teams, Leak Detection Equipment Review-Document List, List of Leak Detection Evaluations User Survey

## WORK GROUP MEMBERS

MEMBER	ADDRESS	PHONE/FAX/E-MAIL
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## WORK GROUP TEAMS

TEAM	LEADER	MEMBERS
Automatic Tank Gauging (ATG) Systems and Volumetric Tank Tightness Test (VTTT) Methods	Russ Brauksieck	Beth DeHaas Ed Olson
Continuous In-Tank Leak Detection Systems	Shahla Farahnak	Beth DeHaas Jennifer Bravinder
Non-Volumetric Tank Tightness Test Methods	Jeff Tobin	Shahla Farahnak John Kneece
Pipeline Leak Detection Systems	Jeff Tobin	John Kneece Ed Olson
Statistical Inventory Reconciliation (SIR) Methods	Jon Reeder	Jennifer Bravinder David Wiley John Kneece
Sensor and Vacuum Methods	David Wiley	Jon Reeder
List Administration and Surveys	Curt Johnson	David Wiley

## LEAK DETECTION EQUIPMENT REVIEW - DOCUMENT LIST

This information lists the documentation required for review of third-party evaluation of underground storage tank and line leak detection equipment or test methods.

1. A complete third-party evaluation report, including:

- ☐ a. Details of the evaluation procedure if the EPA standard procedure was not used for the evaluation. If the EPA evaluation procedure was used, list any deviations or modifications to the procedure.
- ☐ b. Complete set of all the EPA required attachment sheets.
- ☐ c. Individual test logs and/or field notes.
- ☐ d. Statistical calculations and any applicable graphs or charts generated during the evaluation.
- ☐ e. A statement from the evaluator confirming that all equipment at the test site was properly maintained and calibrated to the level of accuracy necessary for a valid evaluation.
- ☐ 2. An outline of the manufacturer's operating procedures for the equipment/method. The summary procedure must be dated and include a revision number, if applicable. A copy of the summary procedure must be provided to the third-party evaluator for enclosure in the report. Also required is a statement from the manufacturer confirming the use of the submitted procedure during the evaluation.
- ☐ 3. Complete installation/operations manual for the equipment/method.
- ☐ 4. A sample of the test report (including field work-sheets) which will be submitted to the owner/local implementing agency.
- ☐ 5. Outline of the test procedures in high groundwater areas. These procedures should be reviewed for adequacy by the third-party evaluator and a statement to that effect should be included with the report.
- ☐ 6. Outline of the test procedures for manifold tank systems. These procedures should be reviewed for adequacy by the third-party evaluator and a statement to that effect should be included with the report.
- ☐ 7. An affidavit from the manufacturer confirming that there are no mutual financial interests between the equipment manufacturer and the third-party evaluator.
- ☐ 8. A resume, including all applicable formal training and experience, from personnel who conducted the evaluation.
- ☐ 9. Equipment calibration procedures and manufacturer recommended schedule of calibration.

## Leak Detection Equipment Review - Document List (Continued)

- ☐10. The name, address, and phone number of the technical personnel serving as the manufacturer's representative for the response to the regulatory agency questions on the equipment or test method.
- ☐11. Correspondence letters from state agencies who have reviewed the equipment/method.
- 12. Following documentation for all permanently-installed leak detection equipment:
  - ☐a. A list of installers authorized by the manufacturer to install the leak detection equipment.
  - ☐b. A list of service personnel authorized by the manufacturer to conduct the annual functional test (required for all leak detection equipment).
  - ☐c. An outline of the maintenance procedure (including a list of the parts or functions of the system to be checked, calibrated, or programmed) for the annual functional test by authorized service personnel.
  - ☐d. An outline (1-2 pages) "Equipment Check Guidelines for Inspectors" prepared by the manufacturer. This summary should guide local agency inspectors on proper field procedures to follow when inspecting equipment for proper operation, for attempting to access the stored history (for alarms or failed tests) to determine compliance with state requirements.
  - ☐e. A sample of the reports generated and/or printed by the equipment (for all equipment models), and an explanation of the items in the report, if not self-explanatory.
  - ☐f. Information on how the control panel modules connected to the various probes are labeled. The information on the panel should be directly comparable to the equipment name, model/part/probe number which will be included in the committee's list. If necessary, a permanent label containing that information should be affixed to the panel.
- 13. Following documentation for the methods using tracer analysis:
  - ☐a. Name and certification of the laboratory analyzing vapor samples.
  - ☐b. Quality Assurance Manual of the laboratory.
  - ☐c. Method and amount of tracer injection.
  - ☐d. Vapor sample collection method and chain of custody records.
  - ☐e. Third-party certification for capability of the test-method to detect leaks from the ullage portion of the tank.



## LIST OF LEAK DETECTION EVALUATIONS USER SURVEY

1. I work in the following state(s) \_\_\_\_\_

2. My main job function is (circle one)

Regulatory (Circle M for manager, I for inspector)

Leak Detection Vendor (manufacturer and/or service co.)

Financial responsibility insurance/assurance agency

Tank owner/operator

Other (specify) \_\_\_\_\_

3. I have used the list while working with UST systems and release detection. (YES) (NO)

Comments:

4. I have reviewed the national List of Leak Detection Evaluations and find it (circle all that apply)

Easy to follow

Good format

Useful for my work

Up to date

Complete

Accurate

Difficult to follow

Poor format

Of no use for my work

Outdated

Incomplete

Inaccurate

Comments:

5. I would benefit from receiving training on the use and applications of the list. (YES) (NO)

Comments:

6. I feel the National Work Group List of Leak Detection Evaluations has improved upon the quality of leak detection equipment and its use in my state(s). (YES) (NO)

Comments:

7. I would like for the National Work Group on Leak Detection Evaluations to continue to focus on improving the quality of leak detection equipment and services by continuing to review third party evaluations. (YES) (NO)

Comments:

8. I still have the following concerns about leak detection equipment in my state (circle all that apply).

Equipment quality

Improper equipment installation

Improper equipment servicing/calibration/maintenance (Owner or Service Co.)

Inadequate field services (tank and line tightness testing, sample collection, etc.)

Inadequate regulatory authority for addressing vendors/service companies which provides services of questionable quality.

Comments:

9. I have the following suggestions on how the Work Group could provide further assistance to me in addressing my concerns related to leak detection.

10. I have the following additional comments on the list (negative, positive, and suggestions for improvement are welcomed, attach additional pages if more space is needed).

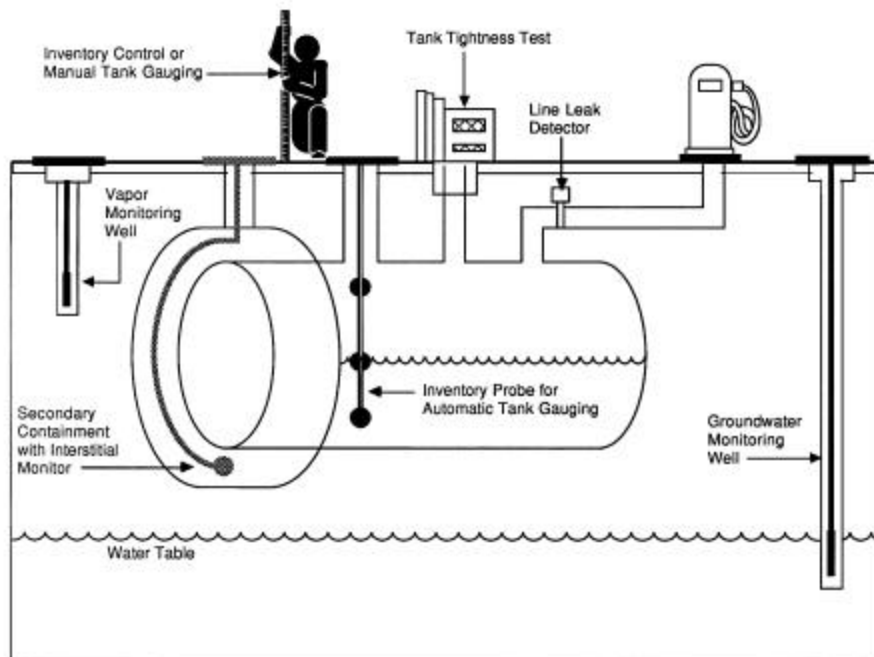
PLEASE SEND COMPLETED SURVEY TO: CURT JOHNSON, ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT P.O. BOX 301463, MONTGOMERY, AL 36130-1463

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## FIFTH EDITION

# LIST OF LEAK DETECTION EVALUATIONS FOR UNDERGROUND STORAGE TANK (UST) SYSTEMS

September 11, 1998



# DISCLAIMER

This list of Leak Detection Evaluations was prepared by a work group consisting of State and EPA members and is limited to evaluations of leak detection equipment and procedures, or systems, that the work group has completed review of, and that were conducted by an independent third-party evaluator with leak rates blind to the vendor. This list includes evaluations conducted in accordance with either EPA Standard Test Procedures for Evaluating Leak Detection Methods (EPA/530/UST-90/004 through 010) or other acceptable protocols. The list includes an Under Review category, for evaluations which the work group's review could not be finalized prior to publication. The listing of system evaluations as "under review" in no way implies that the evaluations do or do not meet the criteria for which evaluations are reviewed.

## TABLE OF CONTENTS

<b>PART I - LEAK DETECTION TEST METHODS AND EQUIPMENT</b> <b>(Alphabetical by test method, then by vendor, next by equipment model,</b> <b>and finally by leak rate or operating principle.)</b>	<b>1</b>
AUTOMATIC ELECTRONIC LINE LEAK DETECTOR	2
AUTOMATIC MECHANICAL LINE LEAK DETECTOR	4
AUTOMATIC TANK GAUGING SYSTEM	4
CONTINUOUS IN-TANK LEAK DETECTION SYSTEM	7
DOUBLE WALLED TANK TIGHTNESS TEST	7
LARGE DIAMETER PIPELINE LEAK DETECTOR	7
LARGE TANK AUTOMATIC TANK GAUGING SYSTEM	7
LINE TIGHTNESS TEST METHOD	8
LIQUID-PHASE INTERSTITIAL DETECTOR	8
LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR	10
NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (TRACER)	11
NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)	11
NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (VACUUM)	12
PRESSURE/VACUUM INTERSTITIAL MONITOR	12
STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUALITATIVE)	13
STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)	13
VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR	13
VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)	14
VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL) (Edison Lab Protocol)	14
VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)	15

## TABLE OF CONTENTS

<b>PART II - LEAK DETECTION EQUIPMENT SPECIFICATIONS</b> <b>(Alphabetical by vendor, then by test method, next by equipment model,</b> <b>and finally by leak rate.)</b>	<b>16</b>
Absolute Precision Testing Systems	18
Advanced Tank Technology, Inc.	19
Advanced Telemetrics	20
Agar Corp.	21
Alert Technologies, Inc.	22
Andover Controls Corp.	26
Arizona Instrument Corp.	30
Armstrong Monitoring Corporation	35
Beaudreau Electronics, Inc.	37
Bell Avon, Inc.	39
Brooks KWK, Inc.	40
Caldwell Systems Corporation	41
Campo/Miller, Inc.	43
Computerizing, Inc.	49
Control Engineers	50
EBW, Inc.	54
EFA Technologies, Inc.	59
Egemin Naamloze Vennootschap	60
Emco Electronics, Tuthill Corp.	62
Engineered Systems, Inc.	78
Entropy Limited	79
Environment and Safety	81
Environmental Fuel Systems, Inc.	82
FCI Environmental, Inc.	83
FDR Services, Inc.	86

**PART II - LEAK DETECTION EQUIPMENT SPECIFICATIONS  
(CONTINUED)**

FE Petro, Inc.	87
Fluid Containment, Inc. (formerly O/C Tanks Corp.)	90
Gasboy International (formerly William M. Wilson's Sons)	91
Gems Sensors Inc. (formerly IMO Industries Inc.)	92
Gilbarco Environmental Products	93
Hasstech	119
Heath Consultants, Inc.	130
Horner EZY CHECK	133
Horner Products Inc.	139
HT Technologies, Inc.	143
Ibex Industries	144
INCON Intelligent Controls, Inc.	145
Keekor Environmental Products	161
Leak Detection Systems, Inc	162
Mallory Controls	163
Marley Pump Co.	166
Mine Safety Appliances	185
Omntec/Electro Levels Mfg., Inc.	187
One Plus Corp.	190
Patriot Sensors and Controls Corp. (formerly MagneTek)	191
PermAlert	195
Petro Vend, Inc.	201
Pneumercator Company, Inc.	211
ProTank, Inc.	213
Raychem Corp.	221
Ronan Engineering Co.	224
Schuster Instruments	229
The Simmons Corp.	230

**PART II - LEAK DETECTION EQUIPMENT SPECIFICATIONS  
(CONTINUED)**

SIR International, Inc.	232
SIR Monitor (formerly Environmental Management Technologies)	233
Sir Phoenix, Inc.	234
Soiltest, Inc.	235
Syscorp, Inc.	236
Tank Automation, Inc.	237
Tanknology - NDE	238
TeleData, Inc.	248
Tidel Engineering, Inc.	249
Tokheim Corp.	268
Tracer Research Corp.	269
Triangle Environmental, Inc.	272
Universal Sensors and Devices, Inc.	276
USTest, Inc.	281
USTMAN Industries, Inc.	286
Vaporless Manufacturing	290
Veeder-Root	294
Vista Research, Inc.	328
Warren Rogers Associates, Inc.	334
Warrick Controls, Inc.	336
Watson Systems, Inc. (formerly EnviroQuest Technologies Limited)	339
Western Environmental Resources	341
Xerxes Corp.	344



## TABLE OF CONTENTS

PART III - LEAK DETECTION EQUIPMENT THIRD PARTY EVALUATION UNDER REVIEW (Alphabetical by vendor, then by test method, next by equipment model.)	345
PART IV - ACCEPTABLE TEST PROTOCOLS (Alphabetical by test method, then by protocol date.)	348
PART V - LEAK DETECTION EQUIPMENT MAINTENANCE CHECKLIST	352
APPENDIX - GLOSSARY OF TERMS	359

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PART I  
LEAK DETECTION TEST METHODS  
AND EQUIPMENT

ALPHABETICAL BY TEST METHOD,

THEN BY VENDOR,

NEXT BY EQUIPMENT MODEL,

FINALLY BY LEAK RATE OR OPERATING  
PRINCIPLE

## AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX PIPELINE CAPACITY
Campo/Miller, Inc.	LS300 and LS300 N/C	3 gph/2.36 gph/35.36 gallons
	LS300-120 and LS300-120 XLC	3 gph/2.36 gph/35.36 gallons
	LS300-120 PLUS and LS300-120 PLUS A/S	3 gph/2.36 gph/35.36 gallons
	LS300-120 PLUS, AL; LS300-120 PLUS, AL, A/S and LS300-120 PLUS AL, LSI	3 gph/1.5 gph/163 gallons
	LS300-120 PLUS, AL; LS300-120 PLUS, AL, A/S and LS300-120 PLUS AL, LSI	0.2 gph/0.1 gph/163 gallons
	LS300-120 PLUS, AL; LS300-120 PLUS, AL, A/S and LS300-120 PLUS AL, LSI	0.1 gph/0.05 gph/163 gallons
Control Engineers	Line Leak Detector Model LLP2	3.0 gph/1.88 gph/89 gallons
	Line Leak Detector Model LLP2	0.1 gph/0.05 gph/89 gallons
Emco Electronics, Tuthill Corp.	EECO System LLD (Q0011)	3.0gph/2.0 gph/67.4 gal
	EECO System LLD (Q0011)	.2 gph/0.1293 gph/67.4 gal
	EECO System LLD (Q0011)	0.1 gph/0.0793 gph/67.4 gallons
	EECO System LLD (for Flexible Pipelines)	3.0 gph/2.0 gph/49.6 gallons
	EECO System LLD (for Flexible Pipelines)	0.1 gph/0.0793 gph/49.6 gallons
	EECO System LLD (for Flexible Pipelines)	0.1 gph/0.0793 gph/49.6 gallons
Gilbarco Environmental Products	Environmental Management Console (EMC) with Line Leak Detector, Series PA02630000501	3.0 gph/1.5 gph/158 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA02630000501	0.2 gph/0.1 gph/158 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA02630000501	0.1 gph/0.079 gph/ A system should not be declared tight if the test results indicate a loss that equals or exceeds this threshold./158 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA02630000501 (for Flexible Pipelines)	3.0 gph/1.5 gph/49.6 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA02630000501 (for Flexible Pipelines)	0.2 gph/0.1 gph/49.6 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA02630000501 (for Flexible Pipelines)	0.1 gph/0.079 gph/49.6 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA0263000060X	3.0 gph/1.88 gph/98.4 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA0263000060X	0.2 gph/0.17 gph/98.4 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA0263000060X	0.1 gph/0.05 gph/98.4 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA0263000060X (for Flexible Pipelines)	3.0 gph/1.5 gph/40.8 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA0263000060X (for Flexible Pipelines)	0.2 gph/0.17 gph/40.8 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA0263000060X (for Flexible Pipelines)	0.1 gph/0.05 gph/40.8 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA0263000100X, PA0277000060X	3.0 gph/2.5 gph/100 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA0263000100X, PA0277000060X	0.2 gph/0.17 gph/100 gallons
	Environmental Management Console (EMC) with Line Leak Detector, Series PA0263000100X, PA0277000060X	0.2 gph/0.17 gph/100 gallons

## AUTOMATIC ELECTRONIC LINE LEAK DETECTOR (CONTINUED)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX PIPELINE CAPACITY
Gilbarco Environmental Products	Environmental Management Console (EMC) with Line Leak Detector, Series PA0263000100X, PA0277000060X	0.1 gph/0.09 gph/100 gallons
Hasstech	LineTite Pipeline Leak Monitor	3.0 gph/2.0 gph/341 gallons
	LineTight Pipeline Leak Monitor Model 2001J	3.0 gph/2.5 gph/172 gallons
	LineTight Pipeline Leak Monitor Model 2001J	0.1 gph/0.079 gph/49.6 gallons
	LineTite Pipeline Leak Monitor	0.1 gph/0.062 gph/341 gallons
	LineTite Pipeline Leak Monitor (for Flexible Pipelines)	3.0 gph/2.0 gph/49.6 gallons
	LineTite Pipeline Leak Monitor (for Flexible Pipelines)	0.1 gph/0.062 gph/49.6 gallons
INCON Intelligent Controls, Inc.	TS-LLD Line Leak Detector	3 gph/1.5 gph/163 gallons
	TS-LLD Line Leak Detector	0.2 gph/0.1 gph/163 gallons
	TS-LLD Line Leak Detector	0.1 gph/0.05 gph/163 gallons
	TS-LLD Line Leak Detector (for Flexible Pipelines)	3 gph/1.5 gph/49.6 gallons
	TS-LLD Line Leak Detector (for Flexible Pipelines)	0.2 gph/0.1 gph/49.6 gallons
	TS-LLD Line Leak Detector (for Flexible Pipelines)	0.1 gph/0.05 gph/49.6 gallons
Marley Pump Co.	Red Jacket PPM 4000, RLM 9000, ST 1401L, and ST1801L	3.0 gph/2.0 gph/55.1 gallons
	Red Jacket PPM 4000, RLM 9000	0.2 gph/0.1 gph/55.1 gallons
	Red Jacket PPM 4000, RLM 9000	0.1 gph/0.047 gph/55.1 gallons
	Red Jacket PPM 4000, RLM 9000, ST 1401L, and ST1801L (for Flexible Pipelines)	0.2 gph/0.1 gph/27.6 gallons
	Red Jacket PPM 4000, RLM 9000, ST 1401L, and ST1801L (for Flexible Pipelines)	0.1 gph/0.05 gph/27.6 gallons
	Red Jacket ST 1401L, and ST1801L, CPT and Pro-Link	0.2 gph/0.1 gph/163 gallons
	Red Jacket ST 1401L, and ST1801L, CPT and Pro-Link	0.1 gph/0.047 gph/163 gallons
Ronan Engineering Co.	Ronan X-76 Automatic Line Leak Detector Version X-76 DM-4 Microprocessor and JT-H2 Line Pressure Sensor	3.0 gph/0.831 gph/45 gallons
	Ronan X-76 Automatic Line Leak Detector Version X-76 DM-4 Microprocessor and JT-H2 Line Pressure Sensor	0.1 gph/0.066 gph/45 gallons
Tidel Engineering, Inc.	LIPSPC-301-0730-001/LIP-301-0729-001 Line Integrity Probe and Submersible Pump Controller	3.0 gph/2.0 gph/129 gallons
	LIPSPC-301-0730-001/LIP-301-0729-001 Line Integrity Probe and Submersible Pump Controller	0.1 gph/0.06 gph/129 gallons
Veeder-Root	TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475	3.0 gph/1.5 gph/158 gallons
	TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475	0.2 gph/0.1 gph/158 gallons
	TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475	0.1 gph/0.079 gph/158 gallons
	TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475 (for Flexible Pipelines)	3.0 gph/1.5 gph/49.6 gallons
	TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475 (for Flexible Pipelines)	0.2 gph/0.1 gph/49.6 gallons
	TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475 (for Flexible Pipelines)	0.1 gph/0.079 gph/49.6 gallons
	TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484	3.0 gph/1.88 gph/98.4 gallons
	TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484	0.2 gph/0.17 gph/98.4 gallons
	TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484	0.1 gph/0.05 gph/98.4 gallons
	TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484 (for Flexible Pipelines)	3.0 gph/1.5 gph/40.8 gallons
	TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484 (for Flexible Pipelines)	0.2 gph/0.17 gph/40.8 gallons
	TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484 (for Flexible Pipelines)	0.1 gph/0.05 gph/40.8 gallons

## AUTOMATIC ELECTRONIC LINE LEAK DETECTOR (CONTINUED)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX PIPELINE CAPACITY
Veeder-Root	TLS 350, 350PC, 350R, 350 RPC Line Leak Detector, Series 8494 Pressurized Line Leak Detector, Series 8494	3.0 gph/2.5 gph/100 gallons
	TLS 350, 350PC, 350R, 350 RPC Line Leak Detector, Series 8494 Pressurized Line Leak Detector, Series 8494	0.2 gph/0.17 gph/100 gallons
	TLS 350, 350PC, 350R, 350 RPC Line Leak Detector, Series 8494 Pressurized Line Leak Detector, Series 8494	0.1 gph/0.09 gph/100 gallons

## AUTOMATIC MECHANICAL LINE LEAK DETECTOR

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX PIPELINE CAPACITY
FE Petro, Inc.	STP-MLD Pipeline Leak Detector	3.0 gph/2.0 gph/129.14 gallons
	STP-MLD-D Pipeline Leak Detector	3.0 gph/2.0 gph/341 gallons
	STP-MLD-E Line (Flexline) Leak Detector (for Flexible Pipelines)	3.0 gph/2.0 gph/49.6 gallons
Marley Pump Co.	Red Jacket DLD and XLD	3.0 gph/2.0 gph/129 gallons
	Red Jacket FX1/FX2	3.0 gph/2.0 gph/FX1:316 gallons and FX2:362 gallons
	Red Jacket FX1/FX2 Flexline (for Flexible Pipelines)	3.0 gph/2.0 gph/49 gallons
	Red Jacket FX1D,FX2D,FX2DV Installed in the Big-Flow	3.0 gph/2.0 gph/362 gallons
	Red Jacket XLP	3.0 gph/2.0 gph/129 gallons
	Red Jacket XLP (for Flexible Pipelines)	3.0 gph/2.0 gph/48.9 gallons
Tokheim Corp.	Tokheim Pressure Monitor, Models PM 101 and 585A-PM	3.0 gph/2.25 gph/78 gallons
Vaporless Manufacturing	Vaporless LD 2000 and LD 2000S	3.0 gph/1.7 gph/129 gallons
	Vaporless LD 2000E and LD 2000E-S	3.0 gph/2.0 gph/59.6 gallons
	Vaporless LD 2000T and LD 2000T-S	3.0 gph/2.5 gph/129 gallons
	Vaporless LD 3000 and LD 3000S	3.0 gph/2.0 gph/320 gallons

## AUTOMATIC TANK GAUGING SYSTEM

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Alert Technologies, Inc.	Alert Model 2000 In-Tank Mass Measurement Probe System (Mass Buoyancy Probe)	0.2 gph/0.1 gph/15,000 gallons
Andover Controls Corp.	Andover Infinity Versions CX9400, CX9200, CX9000,CMX240 (Magnetostrictive Probe)	0.2 gph/0.1 gph/30,000 gallons
	Andover Infinity Versions CX9000, CX9200, and CMX240 (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	Andover Infinity Versions CX9000, CX9200, and CMX240 (Magnetostrictive Probe)	0.1 gph/0.05 gph/15,000 gallons
	Versions AC8+/AC256+ (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
Arizona Instrument Corp.	Encompass MTS IPAM #17-903 (Magnetostrictive Probe #17-9300)	0.2 gph/0.1 gph/15,000 gallons
	Encompass USF IPAM #17-901 (Ultrasonic Probe #17-9100)	0.2 gph/0.1 gph/15,000 gallons
Caldwell Systems Corporation	Tank Manager (Ultrasonic Probe)	0.2 gph/0.1 gph/20,000 gallons
	Tank Manager (Ultrasonic Probe)	0.1 gph/0.05 gph/20,000 gallons
Control Engineers	CEI 3000 Tank Level Module – Version TLP2 Normal/Rapid Test Mode (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	CEI 3000 Tank Level Module - Version TLP2 Normal/Rapid Test Mode (Magnetostrictive Probe)	0.1 gph/0.05 gph/15,000 gallons

## AUTOMATIC TANK GAUGING SYSTEM (CONTINUED)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
EBW, INC.	Auto-Stik II and Auto-Stik Jr. (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	Auto-Stik II and Auto-Stik Jr. (Magnetostrictive Probe)	0.1 gph/0.05 gph/15,000 gallons
Egemin Naamloze Vennootschap	ESPI III (Mass Buoyancy Probe)	0.2 gph/0.075 gph/15,000 gallons
	ESPI IV (Mass Buoyancy Probe)	0.2 gph/0.1 gph/15,000 gallons
Emco Electronics Division, Tuthill Corp.	EECO System TLM/0.2 gph Precision Test (Q0400-4xx Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	EECO System TLM/0.1 gph Precision Test (Q0400-4xx Magnetostrictive Probe)	0.1 gph/0.05 gph/15,000 gallons
	EECO System TLM/0.2 gph Quick Test (Q0400-4xx Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	EECO System TLM/0.1 gph Quick Test (Q0400-4xx Magnetostrictive Probe)	0.1 gph/0.05 gph/15,000 gallons
Engineered Systems, Inc.	Image II (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
Environment and Safety	EASI Level-Tru (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
Gasboy International (formerly William M. Wilson's Sons)	Gasboy TMS 500 (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
Gilbarco Environmental Products	EMC Environmental Management Console, EMC Basic Monitoring System Tank Monitor 2, 3, 2.1, and 3.1, PAO238000XXXX (Capacitance Probe)	0.2 gph/0.1 gph/15,000 gallons
	EMC Environmental Management Console EMC Basic Monitoring System Tank Monitor 2.1,3.1, PAO264XXX0000 (Capacitance Probe)	0.2 gph/0.126 gph/15,000 gallons
	EMC Environmental Management Console EMC Basic Monitoring System Tank Monitor 2.1, 3.1, PAO264XXX0000 (Capacitance Probe)	0.1 gph/0.071 gph/15,000 gallons
	EMC Environmental Management Console EMC Basic Monitoring System Tank Monitor 2.1, 3.1, PAO265XXX0000 (Magnetostrictive Probe)	0.2 gph/0.093 gph/15,000 gallons
	EMC Environmental Management Console, EMC Basic Monitoring System Tank Monitor 2.1, 3.1, PAO265XXX0000 (Magnetostrictive Probe)	0.1 gph/0.071 gph/15,000 gallons
Hasstech	Tank Compliance Center, Model 700 (7100 Series Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	Tank Compliance Center, Model 700 (7100 Series Magnetostrictive Probe)	0.1 gph/0.05 gph/15,000 gallons
INCON Intelligent Controls, Inc.	TS 1000/1001/2001 (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	TS 1000/1001/2001 (Magnetostrictive Probe)	0.1 gph/0.05 gph/15,000 gallons
	TS 1000/1001/2001 Incon LL2 Magnetostrictive Probe	0.2 gph/0.1 gph/30,000 gallons
	TS 2000 (Magnetostrictive Probe)	0.2 gph/0.058 gph/15,000 gallons
Keekor Environmental Products	TankTite Leak Detection Kernel Version 1.0 with Keeprobe K7 (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons

## AUTOMATIC TANK GAUGING SYSTEM (CONTINUED)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Marley Pump Co.	Red Jacket ATM System, Version RLM 5000, 5001, and 9000 (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	Sonic Technology (ST) 1400-1800 Series Tank Monitoring System ATG Automatic Tank Gauging Monitor, LLM Series Liquid Level Monitor, FMS Fuel Management Monitor (Ultrasonic Probe)	0.2 gph/0.1 gph/18,000 gallons
	Sonic Technology (ST) 1400-1800 Series Tank Monitoring System ATG Automatic Tank Gauging Monitor, LLM Series Liquid Level Monitor, FMS Fuel Management Monitor (Ultrasonic Probe)	0.1 gph/0.05 gph/18,000 gallons
Omntec/Electro Levels Mfg., Inc.	OEL 8000 (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	OEL 8000 (Magnetostrictive Probe)	0.1 gph/0.05 gph/15,000 gallons
Patriot Sensors and Controls Corp. (formerly MagneTek)	7021 Digital Tank Gauge (7030 Series Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	7021 Digital Tank Gauge (7030 Series Magnetostrictive Probe)	0.1 gph/0.05 gph/15,000 gallons
	7021 Digital Tank Gauge (7100 Series Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	7021 Digital Tank Gauge (7100 Series Magnetostrictive Probe)	0.1 gph/0.05 gph/15,000 gallons
Petro Vend, Inc.	Petrosonic III (Version 4.05 Model 613, 4 inch, Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	Site Sentinel Model II and III (Model 613, 2 inch, Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	Site Sentinel Model II and III, (Model 613, 4 inch, Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	Site Sentinel Model II and III, (Model 613, 4 inch, Magnetostrictive Probe)	0.1 gph/0.06 gph/15,000 gallons
Ronan Engineering Co.	X-76 ETM and X-76 ETM-4X (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	X-76 ETM and X-76 ETM-4X (Magnetostrictive Probe)	0.1 gph/0.05 gph/15,000 gallons
Tidel Engineering, Inc.	Tidel Environmental Monitoring System, 3500 Series (Ultrasonic Probes #401-0009, #401-0010 and #401-0023)	0.2 gph/0.1 gph/15,000 gallons
	Tidel Environmental Monitoring System, EMS 2000, 3000, and 3500 Series (Ultrasonic Probes #401-0009 and #401-0010)	0.2 gph/0.1 gph/15,000 gallons
	Tidel Environmental Monitoring System, EMS 2000, 3000, and 3500 Series (Ultrasonic Probes #401-0021 and #401-0022)	0.2 gph/0.1 gph/15,000 gallons
	Tidel Environmental Monitoring System, EMS 4000 (Ultrasonic Probe #312-9000)	0.2 gph/0.1 gph/15,000 gallons
	Tidel Environmental Monitoring System, EMS 4000 (Ultrasonic Probe #312-9000)	0.1 gph/0.05 gph/15,000 gallons
	Tidel Environmental Monitoring System, EMS 4000 (Ultrasonic Probe #312-9001)	0.2 gph/0.1 gph/15,000 gallons
	Tidel Environmental Monitoring System, EMS 4000 (Ultrasonic Probe #312-9001)	0.1 gph/0.05 gph/15,000 gallons
Universal Sensors and Devices, Inc.	TICS-1000 (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
USTest, Inc.	UST 2001 (Quick Test) (Ultrasonic Probe)	0.2 gph/0.1 gph/15,000 gallons
	UST 2001 (Ultrasonic Probe)	0.1 gph/0.05 gph/15,000 gallons
Veeder-Root	TLS-250/250i/300/300C/300i/300PC/350/350PC/350R/350RPC UST ATGS (8473 and 8493 Magnetostrictive Probes)	0.1 gph/0.071 gph/15,000 gallons



## AUTOMATIC TANK GAUGING SYSTEM (CONTINUED)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Veeder-Root	TLS-250/250i/300/300C/300i/300PC/350/350PC/350R/350RPC UST ATGS (Models 8473 and 8493 Magnetostrictive Probes)	0.2 gph/0.126 gph/15,000 gallons
	TLS-200/200i/250i/300/300c/300i/350/350pc/350r/350rpc UST ATGS (7842 Digital Sensing Capacitance Probe)	0.2 gph/0.1 gph/15,000 gallons
	TLS-200/200i/250i/300/300c/300i/300pc/350/350pc/350r/350rpc UST ATGS (8472 Digital Sensing Capacitance Probe)	0.2 gph/0.126 gph/15,000 gallons
	TLS-200/200i/250i/300/300c/300i/300pc/350/350pc/350r/350rpc UST ATGS (8472 Digital Sensing Capacitance Probe)	0.1 gph/0.071 gph/15,000 gallons
	TLS-200/200i/250/250i/300/300c/300i/300pc/350/350pc/350r/350rpc UST ATGS (8473 Digital Sensing Magnetostrictive Probe)	0.2 gph/0.093 gph/15,000 gallons
	TLS-200/200i/250/250i/300/300c/300i/300pc/350/350pc/350r/350rpc UST ATGS (8473 Digital Sensing Magnetostrictive Probe)	0.1 gph/0.071 gph/15,000 gallons

## CONTINUOUS IN-TANK LEAK DETECTION SYSTEM

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Gilbarco Environmental Products	EMC Series with CSLD, PA0265XXXX100, PA0300XXXX100 (Magnetostrictive Probe)	0.2 gph/0.16 gph/38,170 gallons
Veeder-Root	TLS Series 300/400 Monitoring Systems with CSLD versions 8473 and 8493 (Magnetostrictive Probes)	0.2 gph/0.16 gph/38,170 gallons

## DOUBLE WALLED TANK TIGHTNESS TEST

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Fluid Containment, Inc. (formerly O/C Tanks Corp.)	Hydrostatic Precision Tank Test for DWT-Type II Tanks	0.1 gph/0.05 gph without dispensing and 0.07 gph with dispensing/30,000 gallons
Xerxes Corp.	Xerxes Trucheck Hydrostatic Monitoring System	0.1 gph/0.05 gph/30,000 gallons

## LARGE DIAMETER PIPELINE LEAK DETECTOR

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX PIPELINE CAPACITY
EFA Technologies, Inc.	LeakNet	3.0 gph/2.2 gph/116,230 gallons
Vista Research, Inc.	Model LT-100 Version 1.0 Manual Method	0.2 gph/0.177 gph/3,400 gallons
	Model LT-100 Version 1.0 Manual Method	0.1 gph/0.077 gph/3,400 gallons
	Model LT-100 Version 1.0 Primary Method	0.2 gph/0.148 gph/3,400 gallons
	Model LT-100 Version 1.0 Primary Method	0.1 gph/0.060 gph/3,400 gallons
	Model LT-100 Version 1.0 Segmented Method	0.2 gph/0.174 gph/3,400 gallons
	Model LT-100 Version 1.0 Segmented Method	0.1 gph/0.074 gph/3,400 gallons

## LARGE TANK AUTOMATIC TANK GAUGING SYSTEM

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Universal Sensors and Devices, Inc.	LTC-1000 (Mass Buoyancy Probe)	1.4 gph/0.7 gph/2,000,000 gallons
	LTC-2000 (Differential Pressure Probe)	3.0 gph/1.5 gph/2,000,000 gallons

## LINE TIGHTNESS TEST METHOD

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX PIPELINE CAPACITY
Hasstech	AcuRite	0.1 gph/0.01 gph/75 gallons
Heath Consultants, Inc.	Petro Tite Line Tester	0.1 gph/0.01 gph/129 gallons
Horner EZY-Chek	EZY-Chek Manual Line Leak Detector	0.1 gph/0.05 gph/129 gallons
	EZY-Chek II Automatic Line Leak Detector	0.1 gph/0.05 gph/129 gallons
ProTank, Inc.	LTH-5000 Line Tester	0.1 gph/0.05 gph/40 gallons
	LTP-5000 Line Tester	0.1 gph/0.05 gph/41 gallons
Tanknology - NDE	Proline Test Series III, Version 1.0	0.1 gph/0.05 gph/41 gallons
	PTK-88	0.1 gph/0.05 gph/40 gallons
	TLD-1	0.1 gph/0.05 gph/50 gallons
Tracer Research Corp.	Tracer Tight Line Test	0.1 gph/A leak is declared when tracer chemical is detected outside of the pipeline.
Triangle Environmental, Inc.	TEI Model LT-3, Version 1.0	0.1 gph/0.05 gph/80 gallons
Western Environmental Resources	Model PLT-100R	0.1 gph/0.05 gph/80 gallons

## LIQUID-PHASE INTERSTITIAL DETECTOR

VENDOR	EQUIPMENT NAME	OPERATING PRINCIPLE
Arizona Instrument Corp.	Soil Sentry Liquid 330(17-330-A/17-330-B), TLM-830, ENCOMPASS APAM Probes 17-141A, 17-142A, 17-143A, 17-144A	refraction
Beaudreau Electronics, Inc.	Model 404 Pump Cut-Off	float switch
	Model 406 Pump Cut-Off	refractive index of liquids
EBW, Inc.	AUTO-STIK Discriminating Sensors LS-5, LS-35	float switch and product permeability
	Liquid Sensor System LS-3A, LS-30A, LS-7	float switch
Emco Electronics, Tuthill Corp.	EECO System, Leak Sensor II, Leak Sensor Jr. Thermistor and Proximity probes	thermal conductivity, proximity switch
	EECO 2000, 3000, Leak Sensor II, Leak Sensor Jr. Systems; Q0001-005	float switch
	EECO 1500, 2000, 3000 Systems Q0003-005	float switch
	EECO 1500, 2000, 3000 Systems; Q0003-001, Q0003-002 Sensors	not specified
	EECO 1500, 2000, 3000 Systems Q0003-003, Q0003-006, Q0003-009 Sensors	not specified
Gilbarco Environmental Products	PA02590XXX000	float switch
	PA02591144000	float switch
	PA02592000000	float switch
INCON Intelligent Controls, Inc.	Tank Sentinel TS-1000EFI TSP-DIS BriteSensor	opto-electric
	Tank Sentinel TS-1000EFI TSP-HIS BriteSensor	magnetic switch
	Tank Sentinel TS-1000/TS-2000 TSP-EIS Standard Sensor, TSP-PS Liquid Contact Sensor	opto-electric
	Tank Sentinel TS-1000/TS-2000 TSP-HLS Standard Sensor, TSP-ULS Standard Sensor	magnetic switch
Marley Pump Co.	Red Jacket Electronics Combination High Level/Low Level Sensor (RE400-179-5 to RE400-199-5), Hydrostatic Sensor (RE400-042-5)	float switch
	Red Jacket Electronics RE400-058-5, RE400-059-5, RE400-147-5, RE400-148-5, RE400-111-5, RE400-203-5, RE400-204-5, RE400-180-5	various: float switch, except RE400-203-5 (electrical conductivity and optical), RE400-204-5 (conductive polymer), and RE400-180-5 (optical)
	Red Jacket PPM 4000 with Optical Liquid Discrimination Sensor	optical sensor

## LIQUID-PHASE INTERSTITIAL DETECTOR (CONTINUED)

VENDOR	EQUIPMENT NAME	OPERATING PRINCIPLE
Omntec/Electro Levels Mfg., Inc.	L-LL-R-1, LS-ASC, PDS-ASC, PDWS-1, PDWF-1	all: refractive index of liquids; PDS-ASC, PDWS-1, and PDWF-1: electrical conductivity
PermAlert	PAL-AT Models AT20C, AT50C, AT40K PHL Hydrocarbon Sensor	electrical conductivity
	TankWatch Models PHM10, PHMS Combination Hydrocarbon/Water Probe	electrical conductivity
	TankWatch Models PHM10, PHMS Hydrocarbon Probe	electrical conductivity
Petro Vend, Inc.	Petrosentry IV, Petrosentry VIII, SiteSentinel Liquid Sensor	thermal conductivity
	Petrosentry IV, Petrosentry VIII, SiteSentinel Universal Reservoir Sensor	float switch
	Petrosentry IV, Petrosentry VIII, SiteSentinel Universal Sump Sensor	float switch
Pneumercator Company, Inc.	LC1000, E-14-29, E-700-1, LDE-700, LDE-740, TMS 3000 LS600AB, LS600LDBN, LS610, RSU800	float switch
	LDE 700, LDE 740, LDE 9000 Sensor Probe Models 9-901, 9-902, 9-903	Capacitance
Ronan Engineering Co.	Liquid Sensor System LS-3 N.C., LS-3 N.O., LS-30, LS-7, HVA, LS-3SS, LS-1	float switch
Tidel Engineering, Inc.	EMS-3500 with Containment Sump Probes Part 301-0642	magnetic switch/float and hydrocarbon sensitive polymer
	EMS-3500 with Liquid Discriminatory Probes Part 301-0635	electrical conductivity/hydrocarbon sensitive polymer
	EMS-3500 Tidel Detector No. 301-0752-001	float switch
Universal Sensors and Devices, Inc.	Leak Alert System Models LAL-100, LA-01, LA-02, LA-04, LA-X4, LA-08, DLS-01, LS-20, LS-36, LS-70, CATLAS Liquid Sensor LALS-1	thermal conductivity
Veeder-Root	TLS-250, TLS 250I Plus, ILS 250, ILS 350, TLS- 300/300c/300i/300pc, TLS-350 Series Interstitial Liquid Sensor for Steel Tanks (0794390-420, -460)	float switch
	TLS-250I, TLS 250I Plus, ILS 250, ILS 350, TLS- 300/300c/300i/300pc, TLS-350 Series Interstitial Liquid Sensor for Fiberglass Tanks (0794390-401, 404, 407, 409)	float switch
	TLS-250I, TLS 250I Plus, ILS 250, ILS 350, TLS-300c/300i/300pc, TLS-350 Series Liquid Sensor for Sumps (0794390-206)	float switch
	TLS-350 Series Discriminating Interstitial Liquid Sensor (794380-341)	capacitance change/ultrasonic
	TLS-350 Series, TLS-300/300I Dispenser Pan Sensor(794380-322) and Discriminating Containment Sump Sensor(794380-352)	product permeable, reed switch/float
	Dispenser Pan Sensor (847900-001) and Differentiating Dispenser Pan Sensor (847900-002) With Dispenser Control Interface	product permeable, product soluble, reed switch/float
	TLS-350 Series Dispenser Pan Sensor(794380-320) and Containment Sump Sensor(794380-350, 360)	electrical conductivity/ultrasonic
	TLS-350 Series, TLS-300/300I Dual and Single Stage Hydrostatic Sensors (794380-301, -302)	float switch
	TLS-350 Series, TLS-300/300I Solid-State Pan/Sump Sensor (794380-321, -351), Piping Sump Sensor (794380-208, -209), Micro Sensor (794380-340)	ultrasonic/float switch
Warrick Controls, Inc.	DMS-47X-X-X(-X), DMS-57X-X-X(-X) Monitoring Panels Models DLP-1-NC, DLP-2-NC, DLP-2-NO sensors	float switch
	Model DFP-25 Sensor	product solubility

## LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

VENDOR	EQUIPMENT NAME	OPERATING PRINCIPLE
Advanced Tank Technology, Inc.	Leak Tracer Dye (LTD)	product solubility - color development
Agar Corp.	LEAKWISE Groundwater Monitor ID-220 Series Hydrocarbon on Water Detector System	radio frequency (RF) attenuation
Armstrong Monitoring Corporation	ALERTMASTER 5100 Leak Detection Cable AMC-5007	electrical conductivity
Brooks KWK, Inc.	Leak Detection Systems, KW-140 / KW-240 Monitors with Type 1 Sensor and Type 2 Sensor	product soluble
EBW, Inc.	AUTO-STIK Discriminating Sensors LS-10,LS-15,LS-20	float switch and product permeability
FCI Environmental, Inc.	Analog Hydrocarbon Probe AHP-100 and Digital Hydrocarbon Probe DHP 100	fiber optic chemical sensor
Gems Sensors Inc. (formerly IMO Industries Inc.)	Gems Smartwell Portable Monitor model WPM-535 with Groundwater Probe model WP-535	conductive polymer
Gilbarco Environmental Products	Environmental Management Console (EMC) Groundwater Sensor, series PA02700XX0001	electrical conductivity
INCON Intelligent Controls, Inc.	Tank Sentinel TS-1000EFI TSP-DDS BriteSensor, TSP-DTS BriteSensor	magnetic switch, float, and hydrocarbon sensitive polymer
	Tank Sentinel TS-1000EFI TSP-MWS BriteSensor Groundwater Probe	hydrocarbon-sensitive polymer
Mallory Controls	Pollulert Probes MD221G/T, MD221G/TRA	electrical conductivity
	Pollulert Probes MD241R, MD241RRA, MD241G, MD241GRA	electrical conductivity
One Plus Corp.	Leak Edge Models 100-3001, 100-4001	product permeable
PermAlert	PAL-AT Models AT20C, AT50C, AT40K AGW Sensor Cable	impedance change
	PAL-AT Models AT20C, AT50C, AT40K with PHFW Hydrocarbon Probe and Type 1 or Type 2 Sensor	product soluble
	PAL-AT Models AT20C, AT50C, AT40K TFH Hydrocarbon Sensor Cable	impedance change
Petro Vend, Inc.	SiteSentinel 30-3206, -3207, -3210 Sensors	product permeable
Raychem Corp.	TraceTek Alarm and Locator Modules TT502 Fuel Sensing Cable	electrical conductivity
	TraceTek Alarm and Locator Modules TT3000 Fuel Sensing Cable	electrical conductivity
	TraceTek Alarm and Locator Modules TT5000 Fuel Sensing Cable	electrical conductivity
Tidel Engineering, Inc.	EMS-3500 with Monitoring Well Probe Part 301-0641	conductivity via resistor ladder network
	EMS-3500 with Sheen Probes Part 301-0687	electrical conductivity/hydrocarbon sensitive polymer
	EMS-3500 Tidel Detector No. 301-0762	electrical conductivity/hydrocarbon sensitive polymer
	Tidel Detector No. 301-0324-001 and 301-0325-001	electrical conductivity
	Tidel Detector No. 301-0326-001 and 301-0326-002	electrical conductivity
Veeder-Root	350 Series UST Monitoring Systems: Models ILS-350, TLS- 350/350r/350pc/350rpc Groundwater Sensor (794380-621, -622, -624)	electrical conductivity

## NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (TRACER)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD MAX TANK CAPACITY
Tracer Research Corp.	Tracer Tight	0.1 gph/ A system should not be declared tight when tracer chemical is detected outside of the tank./No volume limitation

## NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX ULLAGE CAPACITY
Alert Technologies, Inc.	Alert Ullage System Model 1050 (Pressure and Vacuum Test)	0.1 gph/ A system should not be declared tight if the ratio of the ultrasonic signal (when the tank is under pressure or vacuum) to the background signal (prior to pressurization or evacuation) equals or exceeds 1.5 for either 12 kHz or 25 kHz frequency band./6,000 gallons
	Alert Ullage System Model 1050 X (Vacuum Test)	0.1 gph/ A system should not be declared tight if the ratio of the ultrasonic signal (when the tank is under vacuum) to the background signal (prior to evacuation) equals or exceeds 1.5 for either 12 kHz or 25 kHz frequency band./24,000 gallons
ProTank, Inc.	UTA-5000 Ullage Tester (Vacuum or Pressure Test)	0.1 gph/ A system should not be declared tight when the acoustic signal detected is different from the baseline. Baseline is the acoustic signal before tank is pressurized or evacuated./16,500 gallons max ullage volume
	UTF-5000 Ullage Tester (Pressure Test)	0.1 gph/ A system should not be declared tight when the make-up gas flow rate into ullage equals or exceeds 0.275 cubic feet/hour./7,500 gallons max ullage volume
	UTFP-5000 Ullage Tester (Pressure Test)	0.1 gph/ A system should not be declared tight when the pressure decay trend equals or exceeds $\pm 0.016$ psi/hr./10,260 gallons max ullage volume
Tanknology - NDE	UST Ullage Test - Version U2 (Pressure Test)	0.1 gph/ A system should not be declared tight when the pressure decay trend equals or exceeds $\pm 0.016$ psi/hr./10,260 gallons max ullage volume
	U3 Ullage Test (Vacuum or Pressure Test)	0.1 gph/ A system should not be declared tight when the acoustic signal detected is different from the baseline. Baseline is the acoustic signal before tank is pressurized or evacuated./16,500 gallons max ullage volume
	UTS-4T Ullage Test (Pressure Test)	0.1 gph/ A system should not be declared tight when the make-up gas flow rate into ullage equals or exceeds 0.275 cubic feet/hour./7,500 gallons max ullage volume
Triangle Environmental, Inc.	TEI Ullage Test, Version 1.0 (Vacuum Test)	0.1 gph/ A system should not be declared tight when an increase in the acoustic noise level (above background) of the tank under vacuum is detected due to air or water ingress./15,000 gallons
USTest, Inc.	UST 2000/U (Pressure and Vacuum Test)	0.1 gph/ A system should not be declared tight when there is a substantial increase in the acoustic noise signal (when the tank is under pressure or vacuum) above the background signal (prior to pressurization or evacuation) in the frequency interval of 10 kHz to 20 kHz., 7,550 gallons (vacuum).

## NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (VACUUM)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Horner EZY CHECK	EZY 3	0.1 gph/ A system should not be declared tight when the vacuum decay is more than 1 inch water column pressure for non-volatile products and 10% of the lower determined vapor pressure for volatile products. A system should also not be declared tight if any water ingress is detected./50,000 gallons
Protank, Inc.	Fast Test (Underfill Test)	0.1 gph/ A system should not be declared tight when the acoustic signal detected is different from the baseline. Baseline is the acoustic signal before tank is evacuated./30,000 gallons
Tanknology – NDE	Quick Test (Underfill Test)	0.1gph/A system should not be declared tight when the acoustic signal detected is different than the baseline. Baseline is the acoustic signal before the tank is evacuated./30,000gallons
	VacuTest	0.1 gph/ A system should not be declared tight when: sonic emission of air ingress is detected in ullage area and/or; sonic emission of bubbles formed by air ingress is detected in productfilled portion of the tank and/or; water ingress is detected at the bottom of the tank./75,000 gallons
Triangle Environmental, Inc.	TEI System 5000, Version 1.0	0.1 gph/ A system should not be declared tight when the acoustic noise level of the tank under vacuum is greater than the calibrated background acoustic noise level (prior to evacuation)/20,000 gallons.

## PRESSURE/VACUUM INTERSTITIAL MONITOR

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Bell Avon, Inc.	VIGILANT Leak Detection System	0.1 gph / A system alarms when changes in interstitial vacuum exceed a predetermined change in slope versus time curve. / 15,000 gallons
HT Technologies, Inc.	Vakumatik Models V 60 and V 70 Ex	0.1 gph/ System alarms when liquid enters interstitial space and vacuum decreases (pressure increases) above 34 millibars./20,000 gallons

## STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUALITATIVE)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Entropy Limited	Precision Tank Inventory Control System, Version 90	0.1 gph/0.04 gph/15,000 gallons
Horner Products, Inc.	SIR PRO 1 Version 1.0	0.2 gph/0.1 gph/18,000 gallons
	SIR PRO 1 Version 2.0	0.1 gph/0.05 gph/18,000 gallons
Syscorp, Inc.	Store Vision Version E.2	0.2 gph/0.0834 gph/12,000 gallons
USTMAN Industries, Inc.	YES SIR 90	0.2 gph/0.1 gph/15,000 gallons

## STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Advanced Telemetrics	Tanknetics SIR Version 2.1	0.2 gph/0.10 gph/45,000 gallons
Computerizing, Inc.	Computank V. 3.0	0.1 gph/0.05 gph/18,000 gallons
Entropy Limited	Precision Tank Inventory Control System Rev. 90	0.1 gph/0.05 gph/22,500 gallons
Horner Products, Inc.	SIR PRO 1 Version 3.0	0.2 gph/0.1 gph/33,000 gallons
	SIR PRO 1 Version 4.0	0.1 gph/0.05 gph/33,000 gallons
SIR International, Inc.	Mitchell's SIR Program v.2.6 12-13-91	0.1 gph/0.05 gph/18,000 gallons
SIR Monitor (formerly Environmental Management Technologies)	SIR Monitor	0.1 gph/0.05 gph/18,000 gallons
Sir Phoenix, Inc.	SIR PHOENIX	0.1 gph/0.05 gph/18,000 gallons
TeleData, Inc.	TankMate Version 3.20	0.1 gph/0.05 gph/60,000 gallons
The Simmons Corp.	SIR 5.7	0.1 gph/0.05 gph/18,000 gallons
	SIR 5.7 LM	0.1 gph/0.05 gph/45,000 gallons
USTMAN Industries, Inc.	USTMAN SIR 1.91	0.1 gph/0.1 gph/18,000 gallons
	USTMAN SIR Version 94.1	0.1 gph/0.05 gph/30,000 gallons
	USTMAN SIR Version 95.2 and 95.2a	0.1 gph/0.05 gph/60,000 gallons
Warren Rogers Associates, Inc.	WRA Statistical Inventory Analysis, Version 5.1	0.1 gph/0.05 gph/18,000 gallons
	WRA Statistical Inventory Analysis, Version 5.2	0.1 gph/0.05 gph/36,000 gallons
Watson Systems, Inc. (formerly EnviroQuest Technologies Limited)	Enviro Tite SIR (also known as SIRAS 99.6)	0.1 gph/0.05 gph/18,000 gallons
	SIRAS Software System, Versions 2.0 and 2.8.3	0.1 gph/0.05 gph/30,000 gallons

## VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

VENDOR	EQUIPMENT NAME	OPERATING PRINCIPLE
Arizona Instrument Corp.	Soil Sentry Twelve-X	metal oxide semiconductor
	Soil Sentry Twelve-X	metal oxide semiconductor
Armstrong Monitoring Corp.	ALERTMASTER 5100 Vapor Sensor AMC F4000	metal oxide semiconductor
Emco Electronics, Tuthill Corp.	EECO 1500, 2000, 3000, Leak Sensor, Leak Sensor II, Leak Sensor Jr.; Q0002-001	adsistor
	EECO 1500, 2000, 3000, Leak Sensor, Leak Sensor II, Leak Sensor Jr.; Q0002-005	metal oxide semiconductor
Environmental Fuel Systems, Inc.	Fuel Finder Version IV	adsorption sampling
FCI Environmental, Inc.	Analog Hydrocarbon Probe AHP-100	fiber optic
	Digital Hydrocarbon Probe DHP-100	fiber optic
FDR Services, Inc.	GasPak Vapor Monitoring System	product permeable detector
Gilbarco Environmental Products	PA02660000000	adsistor
Mallory Controls	Pollulert Probes MD221V, MD221VRA, MD210V, MD210VRA	adsistor
Mine Safety Appliances	Tankgard P/N 481532 S/N 03095	metal oxide semiconductor
	Tankgard VIII P/N 488803 S/N 00389	metal oxide semiconductor



## VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

VENDOR	EQUIPMENT NAME	OPERATING PRINCIPLE
Petro Vend, Inc.	Petrosentry TLD III	metal oxide semiconductor
	SiteSentinel Smart Module and Vapor Sensor	metal oxide semiconductor
Tidel Engineering, Inc.	EMS-3000 301-0328-001, 301-0330-001	adsistor
	EMS-3500 Vapor Sensor Probe Part No. 301-0634	adsistor
Tracer Research Corp.	Tracer Tight	chromatographic (looks for chemical tracer)
Universal Sensors and Devices, Inc.	Leak Alert System Models LAL-100, LA -01, LA-02, LA -04, LA -X4, LA-08, CATLAS LAVS-1 MOS Vapor Sensor	metal oxide semiconductor
Veeder-Root	ILS 350, TLS-350 Series Adsistor Vapor Probes (794390-700)	adsistor
Warrick Controls, Inc.	Model 5700 Meter PVP-2 Sensor	adsistor

## VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Absolute Precision Testing Systems	APT/BKG 1000	0.05 gph/0.02587 gph/6,000 gallons
Heath Consultants, Inc.	Petro Comp	0.1 gph/0.05 gph/15,000 gallons
	Petro Tite II	0.1 gph/0.05 gph/15,000 gallons
Horner EZY Check	Horner EZY-Chek I	0.1 gph/0.05 gph/12,000 gallons
	Horner EZY-Chek II	0.1 gph/0.05 gph/12,000 gallons
Ibex Industries	Ibex Precision Test System	0.1 gph/0.05 gph/18,000 gallons
Leak Detection Systems, Inc.	Tank Auditor, Version RTD V.2.16	0.1 gph/0.05 gph/15,000 gallons.
Schuster Instruments	Tel-A-Leak 1	0.1 gph/0.05 gph/15,000 gallons
Soiltest, Inc.	Soiltest Ainlay Tank Tegrity Tester, S-3	0.1 gph/0.05 gph/15,000 gallons
Tank Automation, Inc.	Automated Precision Tank Testing System (APTT System) R-2	0.1 gph/0.05 gph/15,000 gallons
Western Environmental Resources	AES System II	0.1 gph/0.05 gph/15,000 gallons
	AES System II - (Large Tanks)	0.1 gph/0.05 gph/75,000 gallons

## VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL) (EDISON LAB PROTOCOL)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Hasstech	Leak Computer Tank Test System	0.1 gph/0.05 gph/12,000 gallons



## VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Alert Technologies, Inc.	Alert Model 1000	0.1 gph/0.05 gph/30,000 gallons
Hasstech	Leak Computer Tank Test System	0.1 gph/0.05 gph/15,000 gallons
Homer EZY CHECK	Horner EZY-Chek II	0.1 gph/0.05 gph/12,000 gallons
ProTank, Inc.	VU-5000 Underfill Tester	0.1 gph/0.05 gph/18,000 gallons
	VUP-5000 Underfill Tester	0.1 gph/0.05 gph/18,000 gallons
Tanknology - NDE	Computerized VPLT Testing System	0.1 gph/0.05 gph/18,000 gallons
	Sure Test - Assured Tight System, Series IV	0.1 gph/0.05 gph/18,000 gallons
Triangle Environmental, Inc.	TEI System 4000, Version 1.0	0.1 gph/0.05 gph/15,000 gallons
USTest, Inc.	UST 2000/LL	0.1 gph/0.05 gph/15,000 gallons
	UST 2000/P	0.1 gph/0.05 gph/45,000 gallons

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PART II  
LEAK DETECTION EQUIPMENT  
SPECIFICATIONS

ALPHABETICAL BY COMPANY,

THEN BY TEST METHOD,

NEXT BY EQUIPMENT MODEL,

FINALLY BY LEAK RATE

**Absolute Precision Testing Systems**

## APT/BKG 1000

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)**

<b>Certification:</b>	Leak rate of 0.05 gph with $P_D=99.2310\%$ and $P_{FA}=0.5451\%$ .
<b>Leak Threshold:</b>	0.02587 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil #4, fuel oil #6 and solvents.
<b>Tank Capacity:</b>	Maximum of 6,000 gallons. Tank must be minimum 100% full.
<b>Waiting Time:</b>	Minimum of 36 hours between delivery and testing. Minimum of 1.5 hours between "topping off" and testing. Total minimum waiting time is 36 hours. There must be no dispensing or delivery during waiting time.
<b>Test Period:</b>	Minimum of 1 hour, 48 minutes. Volume data is collected and recorded by a computer. Leak rate is calculated from 1 minute of test. There must be a minimum of 10 tests performed to conclusively declare a tank tight or declare a leak. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined by a resistance temperature sensor.
<b>Groundwater:</b>	Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a height difference of 6 feet between product and water level.
<b>Calibration:</b>	Level sensors are calibrated before each test. Temperature sensor must be checked and calibrated if necessary in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifold tank system.

Absolute Precision Testing Systems  
P.O. Box 6715  
Bloomington, IN 47407  
Tel: (800) 355-2780

Evaluator: Dixon Consulting Inc.  
Tel: (812)332-4144

Date of Evaluation: 12/05/95

**Advanced Tank Technology, Inc.**

## Leak Tracer Dye (LTD)

## LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

**Detector:**

Output type: qualitative  
 Sampling frequency: intermittent  
 Operating principle: product solubility - color development

**Test Results:**

	unleaded gasoline	synthetic gasoline
Accuracy (%)	100 (above 23 ppm)	100 (above 8 ppm)
Detection time (min:sec)	<00:01	<00:01
Fall time (min:sec)	N/A*	N/A
Lower detection limit (cm)	<0.32	<0.32

\*See glossary.

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, JP-4 jet fuel, toluene, xylene(s).

**Manufacturer's specifications:** LTD develops color in alcohols, ketones, solvents, and PCBs as well as petroleum products.

**Comments:** EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.

Detector is not reusable, and must be replaced after contact with hydrocarbons.

Detector is listed as "intermittent" because it must be checked periodically; it does not automatically alarm when hydrocarbon is detected.

Advanced Tank Technology, Inc.  
 820 N. Sylvania  
 Fort Worth, TX 76111  
 Tel: (817) 831-3246

Evaluator: Scientific Information Services  
 Tel: Not Available

Date of Evaluation: 02/02/93

## Advanced Telemetrics

Tanknetics SIR Version 2.1

### STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

- Certification:** Leak rate of 0.2 gph with  $P_D=99.9\%$  and  $P_{FA}=0.1\%$ .  
Leak rate of 0.1 gph with  $P_D=99.9\%$  and  $P_{FA}=0.5\%$ .
- Leak Threshold:** 0.10 for leak rate of 0.2 gph.  
0.05 for leak rate of 0.1 gph  
A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 45,000 gallons for single tanks or manifold tank systems with no more than 4 tanks in system.
- Data Requirement:** Minimum of 28 days of product level and flow through data.
- Comments:** This method **has** been evaluated for manifold tank systems using an acceptable protocol.  
51% of the data sets were from manifold tank systems.  
Of 41 data sets submitted for evaluation, all were analyzed with conclusive results.  
Median monthly throughput of tanks evaluated was 18,897 gallons.  
Leak rates ranging from 0.043 to 0.234 gph were used in evaluation.  
Data sets evaluated were supplied by evaluator.

Advanced Telemetrics  
520 Cave  
San Antonio, TX. 78209  
Tel: (800) 382-1482

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 1/28/97

**Agar Corp.**

LEAKWISE Groundwater Monitor  
ID-220 Series Hydrocarbon on Water Detector System

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

**Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: radio frequency (RF) attenuation

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	<00:01	<00:01
Fall time (min:sec)	<00:01	<00:01
Lower detection limits (cm)		
"Standard" setting	0.16	0.32
"Sensitive" setting	0.03	0.03

**Specificity Results:**

Activated: unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s), water.

**Manufacturer's specifications:**

Operating range:

Resolution : 0.5 mm of hydrocarbon on water or brine  
 Variation : groundwater fluctuation of +/- 1 meter standard (larger variations optional)  
 Oil thickness : 0.3 - 25 mm optional (higher ranges available)  
 Temperature : 0 - 70 degrees C (higher available)

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Detector is reusable.  
 Color coded signal lights indicate the presence of air, water, and hydrocarbon liquid when activated (yellow, green, and red, respectively).

Agar Corp.  
 P.O. Box 802127  
 Houston, TX 77280-2127  
 Tel: (713) 464-4451

Evaluator: Ken Wilcox Associates, Inc.  
 Tel: (816) 443-2494

Date of Evaluation: 11/15/91

**Alert Technologies, Inc.**Alert Model 2000 In-Tank Mass Measurement Probe System  
(Mass Buoyancy Probe)**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=95.4\%$  and  $P_{FA}=4.6\%$  (calculated based on a 1-hour test).
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil, waste oil, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 15 hours between delivery and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Product measurement not required. System measures product mass (which is not affected by temperature) instead of product volume.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.175 inch (0.27 inch for waste oil).  
Minimum detectable change in water level is 0.088 inch (0.031 inch for waste oil).
- Calibration:** Mass measurement probe and water sensor must be checked and calibrated if necessary in accordance with manufacturer's instructions.  
System is battery operated and does not automatically generate a hard copy of the leak test result. However, a hard copy of the results can be obtained by transfer of data to another unit (see manufacturer's instructions for further details).  
System is not equipped with any alarms (e.g. high water alarm, or failed leak test alarm).
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
2000-X model (which was certified for use on tanks up to 30,000 gal capacity) and 2000-XB model (which was certified for use on tanks up to 72,948 gallons) are still under review.

Alert Technologies, Inc.  
5400 NewPort Dr., Suite 13  
Rolling Meadows, IL 60008  
Tel: (708) 392-0060

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 03/11/91



**Alert Technologies, Inc.**Alert Ullage System Model 1050  
(Pressure and Vacuum Test)**NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight if the ratio of the ultrasonic signal (when the tank is under pressure or vacuum) to the background signal (prior to pressurization or evacuation) equals or exceeds 1.5 for either 12 kHz or 25 kHz frequency band.
- Applicability:** Gasoline, diesel, aviation fuel, heavy fuel oils #2 through #6, waste oil, and solvents.
- Tank Capacity:** Maximum ullage volume is 6,000 gallons.
- Waiting time:** None between delivery and testing if test is conducted after an underfilled tank tightness test.
- Test Period:** Minimum of 5 minutes.  
Test data are acquired and recorded by a computer.
- Test Pressure:** Net pressure of 1.5 psi or vacuum of 1.0 psi must be maintained in ullage. Pressure or vacuum must be maintained in the tank with a loss of less than 0.4 psi.
- Temperature:** Ultrasonic and background signals are independent of product temperature.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is present outside ullage, vacuum test in ullage must not be used. Pressure test must be conducted using a net pressure of 1.5 psi in the ullage.
- Calibration:** System must be calibrated before each test.
- Comments:** Manifold tank systems must be isolated prior to test.  
Evaluated using unleaded gasoline.  
Tests only ullage portion of tank.  
Product-filled portion of tank must be tested using an underfilled test method.  
Vibration due to nearby equipment or dripping condensation may interfere with test.  
Microphone was located 25 feet away from leak source during evaluation.  
Vacuum test method may not be effective in some backfill (such as clay) because it may plug holes in tank.  
If soil is saturated with product, air or water ingress may not be detected by vacuum test. A well point in the backfill may help identify presence of this condition.

Alert Technologies, Inc.  
5400 NewPort Dr., Suite 13  
Rolling Meadows, IL 60008  
Tel: (708) 392-0060

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/15/92

**Alert Technologies, Inc.****Alert Ullage System Model 1050 X (Vacuum Test)****NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight if the ratio of the ultrasonic signal (when the tank is under vacuum) to the background signal (prior to evacuation) equals or exceeds 1.5 for either 12 kHz or 25 kHz frequency band.
- Applicability:** Gasoline, diesel, aviation fuel, heavy fuel oils #2 through #6, waste oil, and solvents.
- Tank Capacity:** Maximum ullage volume is 24,000 gallons.
- Waiting time:** None between delivery and testing if test is conducted after an underfilled tank tightness test.
- Test Period:** Minimum of 5 minutes.  
Test data are acquired and recorded by a computer.
- Test Pressure:** Vacuum of 1.5 psi must be maintained in ullage.  
Vacuum must be maintained in the tank with a loss of less than 0.4 psi.  
Zero pressure (background) must produce a flat line response.
- Temperature:** Ultrasonic and background signals are independent of product temperature.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is present outside ullage, test must not be used.
- Calibration:** System must be calibrated before each test.
- Comments:** Manifold tank systems must be isolated prior to test.  
Evaluated using #4 fuel oil.  
Tests only ullage portion of tank.  
Product-filled portion of tank must be tested using an underfilled test method.  
Vibration due to nearby equipment or dripping condensation may interfere with test.  
Microphone was located 25 feet away from leak source during evaluation.  
Vacuum test method may not be effective in some backfill (such as clay) because it may plug holes in tank.  
If soil is saturated with product, air or water ingress may not be detected by vacuum test. A well point in the backfill may help identify presence of this condition.

Alert Technologies, Inc.  
5400 NewPort Dr., Suite 13  
Rolling Meadows, IL 60008  
Tel: (708) 392-0060

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 02/28/94

**Alert Technologies, Inc.****Alert Model 1000**

<b>Certification:</b>	<b>VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)</b> Leak rate of 0.1 gph with $P_D=98.2\%$ and $P_{FA}=1.8\%$ for 2 hr test. Leak rate of 0.1 gph with $P_D=99.8\%$ and $P_{FA}=0.2\%$ for 4 hr test.
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents. Other liquids may be tested after consultation with the manufacturer.
<b>Tank Capacity:</b>	Maximum of 30,000 gallons. Tank must be between 20 and 95% full.
<b>Waiting time:</b>	Minimum of 1 hour between delivery and testing. Minimum of 1 minute between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Minimum of 2 hours to achieve $P_D = 98.2\%$ and $P_{FA} = 1.8\%$ . Minimum of 4 hours to achieve $P_D = 99.8\%$ and $P_{FA} = 0.2\%$ . Test data are acquired and recorded by a computer. Leak rate is calculated from the data determined to be valid by statistical analysis. There must be no dispensing or delivery during test.
<b>Temperature:</b>	System measures product mass (which is not affected by temperature) instead of product volume.
<b>Groundwater:</b>	Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 2 psi at bottom of tank during test. There must be a difference of at least 73 inches between groundwater level and product level to provide a net pressure of 2 psi at bottom of tank during test.
<b>Calibration:</b>	Load cell must be calibrated before each test.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Alert Technologies, Inc.  
 5400 NewPort Dr., Suite 13  
 Rolling Meadows, IL 60008  
 Tel: (708) 392-0060

Evaluator: Ken Wilcox Associates  
 Tel: (816) 443-2494

Date of Evaluation: 02/28/94

**Andover Controls Corp.**

Andover Infinity  
 Versions CX9400, CX9200, CX9000, CMX240  
 (Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D = 95.4\%$ and $P_{FA} = 4.6\%$ .
<b>Leak Threshold:</b>	0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil #4, and solvents. Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.
<b>Tank Capacity:</b>	Maximum of 30,000 gallons. Tank must be between 50 and 95% full.
<b>Waiting Time:</b>	Minimum of 6 hours between delivery and testing. Minimum of 3 hours between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Minimum of 6 hours. Test data are acquired and recorded by a computer. Leak rate is calculated as the average of subsets of all data collected. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined by a minimum of 3 resistance temperature detectors (RTDs).
<b>Water Sensor:</b>	Must be used to detect water ingress Minimum detectable water level in the tank is 0.35 inches Minimum detectable change in water level is 0.0028 inch.
<b>Calibration:</b>	RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Andover Controls Corp.  
 300 Brickstone Square  
 Andover, MA 01810  
 Tel: (508) 470-0555

Evaluator: Ken Wilcox Associates  
 Tel: (816) 443-2494

Date of Evaluation: 01/20/97

## Andover Controls Corp.

Andover Infinity  
Versions CX9000, CX9200, and CMX240  
(Magnetostrictive Probe)

### AUTOMATIC TANK GAUGING SYSTEM

- Certification:** Leak rate of 0.2 gph with  $P_D=99.9\%$  and  $P_{FA} <0.1\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6 and solvents.  
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
Minimum of 3 hours between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 6 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated as the average of subsets of all data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 3 resistance temperature detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.35 inch.  
Minimum detectable change in water level is 0.003 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Andover Controls Corp.  
300 Brickstone Square  
Andover, MA 01810  
Tel: (508) 470-0555

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 05/24/93

**Andover Controls Corp.**

Andover Infinity  
Versions CX9000, CX9200, and CMX240  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D=97.6\%$  and  $P_{FA}=2.4\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, and solvents.  
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
Minimum of 3 hours between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 6 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated as the average of subsets of all data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 3 resistance temperature detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.35 inch.  
Minimum detectable change in water level is 0.003 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Andover Controls Corp.  
300 Brickstone Square  
Andover, MA 01810  
Tel: (508) 470-0555

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 05/24/93

**Andover Controls Corp.**

Versions AC8+/AC256+  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=99.5\%$  and  $P_{FA}=0.5\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
Minimum of 4 hours between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 6 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated as the difference between first and last data collected, divided by elapsed time between first and last volume changes observed.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 3 resistance temperature detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.99 inch.  
Minimum detectable change in water level is 0.01 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Andover Controls Corp.  
300 Brickstone Square  
Andover, MA 01810  
Tel: (508) 470-0555

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 02/03/92

**Arizona Instrument Corp.**

Encompass MTS IPAM #17-903  
(Magnetostrictive Probe #17-9300)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 97.80\%$  and  $P_{FA} = 2.2\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents. Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 3 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 6 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 resistance temperature detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.29 inches.  
Minimum detectable change in water level is 0.0034 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
Encompass software provides for remote access capabilities.

Arizona Instrument Corp.  
4114 E. Wood St.  
Phoenix, AZ 85040-1941  
Tel: (800) 528-7411

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 08/22/94



**Arizona Instrument Corp.**

Encompass USF IPAM #17-901  
(Ultrasonic Probe #17-9100)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 99.94\%$  and  $P_{FA} = 2.06\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents. Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 3 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 6 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is obtained by a single temperature sensor that measures change in ultrasonic wave velocity.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.86 inches.  
Minimum detectable change in water level is 0.012 inch.
- Calibration:** Temperature sensor and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
Encompass software provides for remote access capabilities.

Arizona Instrument Corp.  
4114 E. Wood St.  
Phoenix, AZ 85040-1941  
Tel: (800) 528-7411

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 08/22/94

**Arizona Instrument Corp.**

Soil Sentry Liquid 330(17-330-A/17-330-B), TLM-830, ENCOMPASS APAM  
Probes 17-141A, 17-142A, 17-143A, 17-144A

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: refraction

**Test Results:**

	<u>unleaded gasoline</u>	<u>synthetic gasoline</u>	<u>diesel fuel</u>	<u>water</u>
Accuracy (%)	100	100	N/D**	N/D
Detection time (min:sec)	00:03	00:03	N/D	N/D
Fall time (hr:min:sec)	Manual reset	Manual reset	N/D	N/D
Lower detection limits (cm)				
17-141A	0.25	0.28	0.15	0.1
17-142A	0.25	0.30	0.18	0.18
17-143A	0.03	0.15	0.03	0.13
17-144A	0.28	0.30	0.30	0.15

\*\* See glossary.

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene\*, xylene(s), water.

\*Only 17-143A was tested with toluene.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.

Detectors are listed as interstitial due to intended use.

Test procedures used were a combination of EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors," March 1990, and EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods," March 1990.

Detector is reusable.

Although ENCOMPASS APAM (Accessory Probe Access Module) was not included in evaluations, according to manufacturer, probes perform in the same manner when connected to any one of these 3 systems.

Arizona Instrument Corp.  
4114 E. Wood St.  
Phoenix, AZ 85040-1941  
Tel: (800)528-7411

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Dates of Evaluation: 12/29/92 and 01/08/93

**Arizona Instrument Corp.****Soil Sentry Twelve-X****VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: quantitative  
 Sampling frequency: continuous  
 Operating principle: metal oxide semiconductor

**Test Results:**

	unleaded gasoline	synthetic gasoline	JP-4 jet fuel	JP-5 jet fuel
Accuracy* (%)	170	120	120	N/D***
Bias* (%)	60	8.0	1.8	N/D
Precision* (%)	6.3	7.7	18	N/D
Detection time (min:sec)	12:20	12:27	12:33	N/D
Fall time (min:sec)	11:53	11:53	11:55	N/D
Lower detection limit (ppm)	150	140	60	92**

\* For tests conducted with 1000 ppm of test gas.

\*\* Testing was done using a JP-5 jet fuel concentration of 90 ppm in humidified air.

\*\*\* See glossary.

**Specificity Results:**

Percentages:	
unleaded gasoline	170
synthetic gasoline	110
n-hexane	110
JP-4 jet fuel	90
toluene	43
xylene( s)	22

**Manufacturer's specifications:**

Calibration is recommended on an annual basis, or whenever the sensor or the main printed circuit board is replaced.

**Comments:**

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Please note that the following specification sheet is a separate evaluation for this same system.

Arizona Instrument Corp.  
 4114 E. Wood St.  
 Phoenix, AZ 85040-1941  
 Tel: (800)528-7411

Evaluator: Radian Corp.  
 Tel: (512) 454-4797

Dates of Evaluation: 12/28/90 and 04/17/91

Arizona Instrument Corp.

Soil Sentry Twelve-X

VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: quantitative  
Sampling frequency: continuous  
Operating principle: metal oxide semiconductor

Test Results:

	<u>diesel fuel *</u>	<u>JP-8 jet fuel*</u>
Accuracy (%)	N/D**	N/D
Bias	-20 ppm @ 50 ppm	N/D
Precision	12 ppm	N/D
Detection time (min)	15	15
Fall time (min)	15	15
Lower detection limit	10 ppm	<0.01 gal/hr

\* A limited number of tests were conducted to determine the response of the system to diesel and JP-8 jet fuel.

\*\* See glossary.

Specificity Results:

Activated: diesel fuel, JP-8 jet fuel.

Manufacturer's specifications:

Calibration is recommended on an annual basis, or whenever the sensor or the main printed circuit board is replaced.

Comments:

Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluation Leak Detection Methods: Vapor-Phase Out-of-Tank Product Detectors," March 1990, and Radian

Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 6, 1990.

Please note that the previous specification sheet is a separate evaluation for this same system.

Arizona Instrument Corp.  
4114 E. Wood St.  
Phoenix, AZ 85040-1941  
Tel: (800)528-7411

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 02/16/92

**Armstrong Monitoring Corporation**

ALERTMASTER 5100  
Leak Detection Cable AMC-5007

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: electrical conductivity

**Test Results:\***

	unleaded
	<u>gasoline</u>
Accuracy (%)	100
Detection time (min:sec)	00:35
Fall time (min:sec)	02:30
Lower detection limit (cm)	0.04

\*For tests conducted with 0.32 cm of floating product.

**Specificity Results:**

Activated: unleaded gasoline.

**Manufacturer's specifications:**

Operating temperature: 32 degrees F to 104 degrees F (0 degrees C to 40 degrees C).

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
Detector is reusable.

Armstrong Monitoring Corporation  
215 Colonnade Road South  
Nepean, Ontario, Canada K2E 7K3  
Tel: (613) 225-9531

Evaluator: Environment Canada  
Tel: (613) 991-1108

Date of Evaluation: 12/03/92

**Armstrong Monitoring Corporation**

ALERTMASTER 5100  
Vapor Sensor AMC F4000

**VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR**

**Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: metal oxide semiconductor

**Test Results:**

	<u>benzene</u>
Accuracy (%)	100
Detection time (min:sec)	00:10
Fall time (min:sec)	04:02
Lower detection limit (ppm)	300

**Specificity Results:**

Activated: benzene.

**Comments:**

Detector is reusable.

Armstrong Monitoring Corporation  
215 Colonnade Road South  
Nepean, Ontario, Canada K2E 7K3  
Tel: (613) 225-9531

Evaluator: Environment Canada  
Tel: (613) 991-1108

Date of Evaluation: 12/03/92

**Beaudreau Electronics, Inc.****Model 404 Pump Cut-Off****LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: float switch

**Test Results:**

	<u>unleaded gasoline</u>	<u>water</u>	<u>diesel fuel</u>
Accuracy (%)			
Detection time (min:sec)	<00:01	<00:01	<00:01
Fall time (hr:min:sec)	manual reset	manual reset	manual reset
Precision (in)	0.0124	0.0067	0.0167
Lower detection limit (in)	0.89	0.68	0.72

**Specificity Results:**

Activated: unleaded gasoline, diesel fuel, water.  
 Manufacturer and evaluator claim sensor will respond to any liquid.

**Manufacturer's Specifications:**

Manufacturer states that system requires no calibration.

**Comments:**

Test procedures used were "Alternative Test Procedures for Evaluation of Leak Detection Methods: Evaluation of Liquid Level Sensors," September 1996, by Ken Wilcox Associates.  
 Detector is reusable, but must be manually reset after activating.

Beaudreau Electronics, Inc.  
 23 Industrial Drive  
 Waterford, CT 06285-9715  
 Tel: (203)443-6570

Evaluator: Ken Wilcox Associates  
 Tel: (816) 443-2494  
 Date of Evaluation: 07/20/94

Beaudreau Electronics, Inc.

Model 406 Pump Cut-Off

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: refractive index of liquids

Test Results:

	unleaded gasoline	water	diesel fuel
Accuracy (%)	100	100	100
Detection time (min:sec)	<00:01	<00:01	<00:01
Fall time (hr:min:sec)	manual reset	manual reset	manual reset
Precision (std. dev.)	0.003474	0.005329	0.001923
Lower detection limit (in)	0.357	0.369	0.321
Probability of detection (%)	100	100	100
Probability of false alarm (%)	0	0	0

Specificity Results:

Activated: unleaded gasoline, diesel fuel, water.  
Manufacturer and evaluator claim sensor will respond to any liquid.

Manufacturer's Specifications:

Manufacturer states that system requires no calibration.

Comments:

Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluation of Leak Detection Methods: Evaluation of Liquid Level Sensors, Liquid-Phase Out-of-Tank Product Detectors," March 1990.  
Detector is reusable, but must be cleaned after activating in order to reset.

Beaudreau Electronics, Inc.  
23 Industrial Drive  
Waterford, CT 06285-9715  
Tel: (203)443-6570

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
  
Date of Evaluation: 07/20/94



**Bell Avon, Inc.**

## VIGILANT Leak Detection System

## PRESSURE/VACUUM INTERSTITIAL MONITOR

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** System alarms when changes in interstitial vacuum exceed a predetermined change in slope versus time curve.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil.  
After consultation with the manufacturer, other liquids may be tested which are compatible with flexible liner.
- Tank Capacity:** Maximum of 15,000 gallons based on interstitial volume resulting when flexible liner is properly fitted and held in position against rigid tank wall.  
No minimum product level during test.
- Waiting Time:** Minimum of 20 minutes between delivery and testing.
- Test Period:** Minimum of 40 minutes.
- Comments:** System is located within the interstitial space between a properly fitted and installed flexible liner inside a rigid tank.  
Flexible liner is held in position by maintaining a vacuum on interstitial space.  
Interstitial space is tested continuously.  
System allows for permeation of vapor from stored substance into interstitial space.  
Vapor recovery of product vapor from interstitial space is feasible when required.  
Vapors discharged from vacuum pump must meet applicable air quality standards.  
Baseline characteristics of tank behavior must be determined during setup of the system.  
System detects breaches in either flexible internal liner or rigid tank.  
Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods," March 1990.

Bell Avon, Inc.  
1200 Martin Luther King, Jr. Blvd.  
Picayune, MS 39466-5427  
Tel: (601) 799-1217

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 11/16/95

**Brooks KWK, Inc.**Leak Detection Systems,  
KW-140 / KW-240 Monitors with Type 1 Sensor and Type 2 Sensor**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: product soluble

**Test Results:****Type 1 Sensor:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	00:24	00:09
Fall time (min:sec)	N/A*	N/A
Lower detection limit (cm)	0.01	0.01

**Type 2 Sensor:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	14:39	08:45
Fall time (min:sec)	N/A	N/A
Lower detection limit (cm)	0.01	0.01

\* See glossary.

**Specificity Results:****Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A jet fuel, toluene, xylene(s).**Manufacturer's specifications:**

Type 1 sensor is recommended by manufacturer for detecting liquid and vapor gasoline, alcohol-blend fuels, and JP-4 jet fuel in wet or dry monitor wells.

Type 2 sensor is recommended by manufacturer for detecting fuel oils #1 and #2, A2M, JP-4 jet fuel, JP-5 jet fuel, unleaded gasoline, and alcohol blend fuels in wet monitoring wells only.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
 Detector is not reusable, and must be replaced after contact with hydrocarbons.  
 Formerly manufactured by In-Situ, Inc.

Brooks KWK, Inc.

RR 7, Box 141  
 Wellsboro, PA 16901  
 Tel: (717) 724-6448

Evaluator: Carnegie Mellon Research  
 Institute  
 Tel: (412) 268-3495

Date of Evaluation: 07/29/91

**Caldwell Systems Corporation**

Tank Manager  
(Ultrasonic Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=99.9\%$  and  $P_{FA}=0.1\%$ .
- Leak Threshold:** 0.10 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 20,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 12 hours, 25 minutes between delivery and testing.  
Minimum of 15 minutes between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 3 hours, 15 minutes.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined from the measurement of the change in the speed of sound.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.921 inch.  
Minimum detectable change in water level is 0.0315 inch.
- Calibration:** Probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
Water sensor, temperature sensor and product level monitor are contained in a single ultrasonic probe.

Caldwell Systems Corp.  
1200 Diamond Circle, Unit K  
Lafayette, CO 80026  
Tel: (303) 604-6180

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 04/22/96

**Caldwell Systems Corporation**

Tank Manager  
(Ultrasonic Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D=96.7\%$  and  $P_{FA}=3.3\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 20,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 12 hours, 25 minutes between delivery and testing.  
Minimum of 15 minutes between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 3 hours, 15 minutes.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined from the measurement of the change in the speed of sound.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.921 inch.  
Minimum detectable change in water level is 0.0315 inch.
- Calibration:** Probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
Water sensor, temperature sensor and product level monitor are contained in a single ultrasonic probe.

Caldwell Systems Corp.  
1200 Diamond Circle, Unit K  
Lafayette, CO 80026  
Tel: (303) 604-6180

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 04/22/96

**Campo/Miller, Inc.**

LS300 and LS300 N/C

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 3 gph with $P_D = 96.2\%$ and $P_{FA} = 0\%$ .
<b>Leak Threshold:</b>	2.36 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuels, fuel oils #4 and #6, waste oil, kerosene, and solvents.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at operating pressure.
<b>Pipeline Capacity:</b>	Maximum of 35.36 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is 10 seconds. Test data are acquired and recorded by a microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset leak threshold. Single leak test to determine if pipeline is leaking. Dispenser shutdown, indicator light and alarm activation if leak is declared.
<b>Calibration:</b>	Manufacturer recommends a weekly self check, activated by the operator, and a full functional test every 30 days, estimated to take 5 minutes to perform.

Campo/Miller, Inc.  
P. O. Box 1809  
Porterville, CA 93258  
Tel: (209) 781-6862

Evaluator: Jetronix Engineering Laboratories  
Tel: (213) 377-4668  
Rev. by Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 06/01/91, Rev. 09/09/94

**Campo/Miller, Inc.**

LS300-120 and LS300-120 XLC

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3 gph with  $P_D = 96.2\%$  and  $P_{FA} = 0\%$ .
- Leak Threshold:** 2.36 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, fuel oils #4 and #6, waste oil, kerosene, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 35.36 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 10 seconds, but can be adjusted between 10 seconds and 2 minutes, 30 seconds depending on the bulk modulus\* of the piping system.  
Test data are acquired and recorded by a microprocessor.  
\*See glossary.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset leak threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, indicator light and alarm activation if leak is declared.
- Calibration:** Manufacturer recommends a weekly self check, activated by the operator, and a full functional test every 30 days, estimated to take 5 minutes to perform.

Campo/Miller, Inc.  
P. O. Box 1809  
Porterville, CA 93258  
Tel: (209) 781-6862

Evaluator: Jetronix Engineering Laboratories  
Tel: (213) 377-4668  
Rev. by Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 06/01/91, Rev. 09/09/94

**Campo/Miller, Inc.**

LS300-120 PLUS and LS300-120 PLUS A/S

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3 gph with  $P_D = 96.2\%$  and  $P_{FA} = 0\%$ .
- Leak Threshold:** 2.36 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, fuel oils #4 and #6, waste oil, kerosene, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 35.36 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 10 seconds, but can be adjusted between 10 seconds and 2 minutes, 30 seconds depending on the bulk modulus\* of the piping system.  
Test data are acquired and recorded by a microprocessor.  
\*See glossary
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, indicator light and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Campo/Miller, Inc.  
P. O. Box 1809  
Porterville, CA 93258  
Tel: (209) 781-6862

Evaluator: Jetronix Engineering Laboratories  
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Rev. by Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 06/01/91, Rev. 09/09/94

**Campo/Miller, Inc.**

LS300-120 PLUS, AL; LS300-120 PLUS, AL, A/S and LS300-120 PLUS AL, LSI

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3 gph with  $P_D = 100\%$  and  $P_{FA} = 0\%$ .
- Leak Threshold:** 1.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, fuel oils #4 and #6, waste oil, kerosene, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 163 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 10 minutes.  
Test data are acquired and recorded by a microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline every 45 minutes.  
Preset threshold.  
Triplicate testing to determine if pipeline is leaking.  
Dispenser shutdown, indicator light and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Campo/Miller, Inc.  
P. O. Box 1809  
Porterville, CA 93258  
Tel: (209) 781-6862

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 06/23/95



**Campo/Miller, Inc.**

LS300-120 PLUS, AL; LS300-120 PLUS, AL, A/S and LS300-120 PLUS AL,LSI

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D = 100\%$  and  $P_{FA} = 0\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, fuel oils #4 and #6, waste oil, kerosene, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 163 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 3 hours between dispensing and testing.
- Test Period:** Minimum of 25 minutes.  
Test data are acquired and recorded by a microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline when pump has been idle for 3 hours.  
Preset threshold.  
Triplicate testing to determine if pipeline is leaking.  
Dispenser shutdown, indicator light and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Campo/Miller, Inc.  
P. O. Box 1809  
Porterville, CA 93258  
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Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 06/23/95

**Campo/Miller, Inc.**

LS300-120 PLUS, AL; LS300-120 PLUS, AL, A/S and LS300-120 PLUS AL,LSI

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D = 100\%$ and $P_{FA} = 0\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuels, fuel oils #4 and #6, waste oil, kerosene, and solvents.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at operating pressure.
<b>Pipeline Capacity:</b>	Maximum of 163 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum of 6 hours between dispensing and testing.
<b>Test Period:</b>	Minimum of 34 minutes. Test data are acquired and recorded by a microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline when pump has been idle for 6 hours. Preset threshold. Triplicate testing to determine if pipeline is leaking. Dispenser shutdown, indicator light and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Campo/Miller, Inc.  
P. O. Box 1809  
Porterville, CA 93258  
Tel: (209) 781-6862

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 06/23/95

**Computerizing, Inc.**

Computank V. 3.0

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.5\%$  and  $P_{FA}=2\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 18,000 gallons.
- Data Requirement:** Minimum of 30 days of usable product level and flow through data are required.
- Comments:** Not evaluated using data from manifold tank systems.  
Of 41 data sets submitted for evaluation, 17 were not analyzed.  
Median monthly throughput of tanks evaluated was 2,340 gallons.  
Leak rates of 0.05, 0.1, and 0.2 gph were used in evaluation.  
Data sets evaluated were supplied by evaluator.

Computerizing, Inc.  
PO Box 99  
Scottsboro, AL 35768  
Tel: (205) 259-1805

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 09/17/92

## Control Engineers

### Line Leak Detector Model LLP2

#### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 3.0 gph with  $P_D = 100\%$  and  $P_{FA} = 0\%$ .
- Leak Threshold:** 1.88 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, and aviation fuel.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 89 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is approximately 10 seconds.  
Test data are acquired and recorded by a permanently installed microprocessor.  
Calculations are automatically performed by a microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, indicator light and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** Control Engineers no longer manufactures this equipment.  
The company and rights for this product were sold to Veeder-Root.  
For product support information, contact Veeder-Root.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 561-2700

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 07/18/94

**Control Engineers**Line Leak Detector  
Model LLP2**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, and aviation fuel.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at operating pressure.
<b>Pipeline Capacity:</b>	Maximum of 89 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum of 15 minutes between dispensing and testing.
<b>Test Period:</b>	Minimum of 30 minutes. Test data are acquired and recorded by a permanently installed microprocessor. Calculations are automatically performed by a microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Dispenser shutdown, indicator light and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
<b>Comments:</b>	Control Engineers no longer manufactures this equipment. The company and rights for this product were sold to Veeder-Root. For product support information, contact Veeder-Root.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 561-2700

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 07/18/94

**Control Engineers**

CEI 3000 Tank Level Module - Version TLP2  
 Normal/Rapid Test Mode  
 (Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 95.0\%$  and  $P_{FA} = 0.1\%$  in normal test mode.  
 Leak rate of 0.2 gph with  $P_D = 95.0\%$  and  $P_{FA} = 5.0\%$  in rapid test mode.
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, and aviation fuel.
- Tank Capacity:** Maximum of 15,000 gallons.  
 Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 6 hours, 40 minutes between delivery and testing.  
 There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 4 hours for normal test mode and 1 hour, 12 minutes for rapid test mode.  
 Test data are acquired and recorded by a microprocessor.  
 Leak rate is calculated from data determined to be valid by statistical analysis.  
 There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 temperature resistance detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
 Minimum detectable water level in the tank is 0.49 inch.  
 Minimum detectable change in water level is 0.05 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
 Tests only portion of tank containing product.  
 As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
 EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
 Control Engineers no longer manufactures this equipment. The company and rights for this product were sold to Veeder-Root. For product support information, contact Veeder-Root.

Veeder-Root  
 125 Powder Forest Dr.  
 Simsbury, CT 06070-2003  
 Tel: (860) 561-2700

Evaluator: Midwest Research Institute  
 Tel: (816) 753-7600

Date of Evaluation: 05/27/92

**Control Engineers**

CEI 3000 Tank Level Module - Version TLP2  
 Normal/Rapid Test Mode  
 (Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D = 99.2\%$  and  $P_{FA} = 0.08\%$  in normal test mode.  
 Leak rate of 0.1 gph with  $P_D = 95.0\%$  and  $P_{FA} = 5.0\%$  in rapid test mode.
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, and aviation fuel
- Tank Capacity:** Maximum of 15,000 gallons.  
 Tank must be minimum 95% full.
- Waiting Time:** Minimum of 6 hours, 40 minutes between delivery and testing.  
 There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 6 hours, 23 minutes for normal test mode and 2 hours, 40 minutes for rapid test mode.  
 Test data are acquired and recorded by a microprocessor.  
 Leak rate is calculated from data determined to be valid by statistical analysis.  
 There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 temperature resistance detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
 Minimum detectable water level in the tank is 0.49 inch.  
 Minimum detectable change in water level is 0.05 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
 Tests only portion of tank containing product.  
 As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
 EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
 Control Engineers no longer manufactures this equipment. The company and rights for this product were sold to Veeder-Root. For product support information, contact Veeder-Root.

Veeder-Root  
 125 Powder Forest Dr.  
 Simsbury, CT 06070-2003  
 Tel: (860) 561-2700

Evaluator: Midwest Research Institute  
 Tel: (816) 753-7600

Date of Evaluation: 05/21/92

**EBW, INC.**

Auto-Stik II and Auto-Stik Jr.  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=99.9\%$  and  $P_{FA}=0.1\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, and solvents.  
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
Minimum of 6 hours between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from average of subsets of all data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.49 inch.  
Minimum detectable water level change is 0.0052 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
Auto Stik Jr. is used with up to 4 magnetostrictive probes and can handle up to 8 input sensors.  
Auto Stik II is used with up to 16 magnetostrictive probes and can handle up to 64 input sensors.

EBW, INC.  
2814 McCracken Ave.  
Muskegon, MI 49443  
Tel: (800) 475-5151

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 08/20/93



**EBW, INC.**

Auto-Stik II and Auto-Stik Jr.  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D=98.3\%$  and  $P_{FA}=1.7\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, and solvents.  
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
Minimum of 2 hours between dispensing and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from average of subsets of all data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.49 inch.  
Minimum detectable water level change is 0.0052 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
Auto Stik Jr. is used with up to 4 magnetostrictive probes and can handle up to 8 input sensors.  
Auto Stik II is used with up to 16 magnetostrictive probes and can handle up to 64 input sensors.

EBW, INC.  
2814 McCracken Ave.  
Muskegon, MI 49443  
Tel: (800) 475-5151

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 08/20/93

**EBW, Inc.****AUTO-STIK Discriminating Sensors  
LS-5, LS-35****LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: float switch and product permeability

**Test Results:**

	LS-5			LS-35		
	unleaded gasoline	diesel fuel	water	unleaded gasoline	diesel fuel	water
Float switch						
Accuracy (%)	100	100	100	100	100	100
Detection time (sec)	<1	<1	<1	<1	<1	<1
Fall time (sec)	<1	<1	<1	<1	<1	<1
Lower detection limit (in)	1.317	1.234	1.516	1.317	1.234	1.156
Polymer strip						
Accuracy (%)	100	100	N/R*	100	100	N/R
Detection time (min)	~7	~60	N/A*	~7	~60	N/A
Fall time (sec)	N/A	N/A	N/A	N/A	N/A	N/A
Lower detection limit (in)	<0.014	<0.014	N/A	<0.014	<0.014	N/A

\*See glossary.

**Specificity Results:**

**Activated:** unleaded gasoline, diesel fuel, water.

Manufacturer and evaluator claim that sensors will respond to any liquid, except for the polymer strip sensor, which will not respond to water.

**Manufacturer's Specifications:**

Operating temperatures for LS-5 are -40 degrees F to 150 degrees F (-40 degrees C to 65.5 degrees C).

Operating temperatures for LS-30A are -40 degrees F to 140 degrees F (-40 degrees C to 60 degrees C).

There is no manufacturer's recommended maintenance schedule.

**Comments:**

Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluating

Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors," and from EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods," March 1990.

Polymer sensor can be reset by exposing it to air.

Detector is reusable.

Evaluation also included the LS-10, LS-15, and LS-20 liquid-phase out-of-tank product detectors which are listed separately.

EBW, INC.  
 2814 McCracken Ave.  
 Muskegon, MI 49443  
 Tel: (800) 475-5151

Evaluator: Ken Wilcox Associates  
 Tel: (816) 443-2494

Date of Evaluation: 07/05/94

**EBW, Inc.**Liquid Sensor System  
LS-3A, LS-30A, LS-7**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: float switch

**Test Results:**

	LS-3A N.C. (normally closed)			LS-3A N.O. (normally open)		
	unleaded gasoline	diesel fuel	water	unleaded gasoline	diesel fuel	water
Accuracy (%)	100	100	100	100	100	100
Detection time (sec)	<1	<1	<1	<1	<1	<1
Fall time (sec)	<1	<1	<1	<1	<1	<1
Lower detection limit (cm)	2.59	2.36	2.08	2.59	2.39	2.08

	LS-30A (low level)			LS-30A (high level)			LS-7	
	unleaded gasoline	diesel fuel	water	unleaded gasoline	diesel fuel	water	unleaded gasoline	water
Accuracy (%)	100	100	100	100	100	100	100	100
Detection time (min:sec)	<1	<1	<1	<1	<1	<1	<1	<1
Fall time (hr:min:sec)	<1	<1	<1	<1	<1	<1	<1	<1
Lower detection limit (cm)	8.79	8.48	8.15	23.65	23.04	22.78	1.09	0.81

**Specificity Results:**

Activated: unleaded gasoline, diesel fuel (except LS-7), water.

Sensors will respond to any liquid which has sufficient depth and density to raise float.

**Manufacturer's Specifications:**

Operating temperatures for LS-3A are -40 degrees F to 180 degrees F (-40 degrees C to 82.2 degrees C).

Operating temperatures for LS-30A are -40 degrees F to 140 degrees F (-40 degrees C to 60 degrees C).

Minimum specific gravity for LS-7A is 0.70.

There is no manufacturer's recommended maintenance schedule.

**Comments:**

Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluating

Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors," March 1990

Detector is reusable.

Evaluator: Ken Wilcox Associates

EBW, Inc.  
 2814 McCracken Ave.  
 Muskegon, MI 49443  
 Tel: (800)475-5151

Tel: (816) 443-2494

Date of Evaluation: 04/20/93

**EBW, Inc.**

AUTO-STIK Discriminating Sensors  
LS-10,LS-15,LS-20

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

**Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: float switch and product permeability

**Test Results:**

	LS-10,LS-15,LS-20		
	unleaded gasoline	diesel	water
Float Switch			
Accuracy (%)	100	100	100
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	2.870	2.822	2.667
Polymer Strip			
Accuracy (%)	100	100	N/R*
Detection time (min)	~7	~60	N/A*
Fall time (sec)	N/A	N/A	N/A
Lower detection limit (in)	<0.014	<0.014	N/A

\*See glossary.

**Specificity Results:**

**Activated:** unleaded gasoline, diesel fuel, and water.

Manufacturer and evaluator claim sensors will respond to any liquid, except polymer strip will not respond to water.

**Manufacturer's specifications:**

Operating temperature: -20 degrees F to 150 degrees F ( -28.9 degrees C to 65.5 degrees C).

There is no manufacturer's recommended maintenance schedule.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluation Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors," March 1990, and from EPA's "Standard Test Procedures for Evaluating Leak Detection Methods:Nonvolumetric Tank Tightness Testing Methods," March 1990.

Polymer sensor can be reset by exposing it to air.

Detector is reusable.

This evaluation also included the LS-5 and LS-35 interstitial detectors, which are listed separately.

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 Tel: (800)475-5151

Evaluator: Ken Wilcox Associates  
 Tel: (816) 443-2494

Date of Evaluation: 07/05/94

**EFA Technologies, Inc.****LeakNet****LARGE DIAMETER PIPELINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph at 10 psi with  $P_D = 100\%$  and  $P_{FA} = 0\%$ .
- Leak Threshold:** 2.2 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, fuel oil #4, waste oil, and solvents.
- Specification:** System tests pressurized bulk material transfer pipelines.  
Suitable for all pressurized steel, plastic, fiberglass, or concrete pipelines.  
System is used as an equivalent 3 gph line leak detector.  
Leak detection flow rates are proportional to pressure in pipeline.  
Testing is conducted while the product is not flowing in the pipeline.  
Pipeline must be full and under pressure.  
Gravity feed pipelines under constant static head pressure may be tested with system.
- Pipeline Capacity:** Maximum of 116,230 gallons.  
System tested on 58,115 gallon pipeline.  
Use of pipeline test protocol allows methods to be used on pipelines twice the volume of test pipeline. Contact manufacturer prior to using on pipelines exceeding 58,115 gallons through 116,230 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 2 to 5 minutes.  
Test data are acquired and recorded by a computer.  
Calculations are automatically performed by computer.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline at least once per hour under static conditions.  
Continuous operation during flowing conditions (however, thresholds are higher due to hydraulic noise in pipeline).  
Declares leak if current changes in pressure exceed tuning parameters, or if pressure fluctuates in a manner that is characteristic of a leak.  
Dispensers shutdown, indicator light and alarm activation if leak is declared.
- Calibration:** System must be checked annually. Standard electronic field instruments used by the system require normal annual inspection and calibration checks.
- Comments:** Designed to replace a mechanical line leak detector to detect equivalent 3 gph releases at 10 psi on large pipelines at pressures higher than those found at typical service station.

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116 20th St.  
Sacramento, CA 95814  
Tel: (916) 443-8842

Evaluator: Ms. Terri Regan - Naval Facilities Engineering  
Service Center  
Tel: (202) 433-5196  
Date of Evaluation: 09/26/95

**Egemin Naamloze Vennootschap****E'SPI III  
(Mass Buoyancy Probe)****AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=97.9\%$  and  $P_{FA}=1.1\%$ .
- Leak Threshold:** 0.075 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 7 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 5 hours, 30 minutes.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from average of subsets of all collected data.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is obtained by a single moving quartz crystal temperature sensor.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.253 inch.  
Minimum detectable change in water level is 0.029 inch.
- Calibration:** Temperature sensor and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

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Bredabaan 1201 - 2900  
Schoten, Belgium  
Tel: 011-32-3-03/645 27 90

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Date of Evaluation: 12/21/90

**Egemin Naamloze Vennootschap****E'SPI IV  
(Mass Buoyancy Probe)****AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D=97.2\%$ and $P_{FA}=0.3\%$ .
<b>Leak Threshold:</b>	0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil, and solvents.
<b>Tank Capacity:</b>	Maximum of 15,000 gallons. Tank must be between 50 and 95% full.
<b>Waiting Time:</b>	Minimum of 6 hours between delivery and testing. There must be no dispensing or delivery during waiting time.
<b>Test Period:</b>	Minimum of 2 hours, 15 minutes. Test data are acquired and recorded by a computer. Leak rate is calculated from average of subsets of all collected data. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined by a minimum of 5 thermistors.
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.253 inch. Minimum detectable change in water level is 0.029 inch.
<b>Calibration:</b>	Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 12/21/90

**Emco Electronics, Tuthill Corp.**

EECO System LLD (Q0011)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D = 100\%$  and  $P_{FA} = 0\%$ .
- Leak Threshold:** 2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 67.4 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 2 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 12/31/93



**Emco Electronics, Tuthill Corp.**

EECO System LLD (Q0011)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D = 100\%$  and  $P_{FA} = 0\%$ .
- Leak Threshold:** 0.1293 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 67.4 gallons.
- Waiting Time:** None between delivery and testing.  
Ranges from 0 to 1 hour, 27 minutes between dispensing and testing.
- Test Period:** Minimum of 9 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Date of Evaluation: 07/18/94

**Emco Electronics, Tuthill Corp.**

EECO System LLD (Q0011)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D = 100\%$  and  $P_{FA} = 0\%$
- Leak Threshold:** 0.0793 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 67.4 gallons.
- Waiting Time:** None between delivery and testing.  
Ranges from 0 to 2 hours, 48 minutes between dispensing and testing.
- Test Period:** Minimum of 31 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Date of Evaluation: 12/31/93

**Emco Electronics, Tuthill Corp.**

EECO System LLD  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D = 100\%$  and  $P_{FA} = 0\%$
- Leak Threshold:** 2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Specification:** System tests flexible pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 49.6 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 11 minutes, 24 seconds.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Ken Wilcox Associates  
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Date of Evaluation: 07/18/94

**Emco Electronics, Tuthill Corp.**

EECO System LLD  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D = 100\%$  and  $P_{FA} = 0\%$
- Leak Threshold:** 0.0793 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Specification:** System tests flexible pipelines.  
Tests are conducted at average pressure of 10 psi.
- Pipeline Capacity:** Maximum of 49.6 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 14 minutes between dispensing and testing.
- Test Period:** Minimum of 9 hours.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Date of Evaluation: 07/18/94

**Emco Electronics Division, Tuthill Corp.**

**EECO System TLM/0.2 gph Precision Test  
(Q0400-4xx Magnetostrictive Probe)**

**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.2 gallons per hour with $P_D=99.1\%$ and $P_{FA}=0.9\%$ .
<b>Leak Threshold:</b>	0.1 gph A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel and fuel oil #4. Other liquids maybe tested after consultation with the manufacturer.
<b>Capacity:</b>	Maximum of 15,000 gallons. Tanks less than 95% full may be tested. Minimum product level required based on tank diameter as follows - <b>48"</b> dia/ min 8.5"; <b>64"</b> dia/ min 10.5"; <b>72"</b> dia/ min 11.5"; <b>96"</b> dia/ min 14"; <b>126"</b> dia/ min 18".
<b>Waiting Time:</b>	Between delivery and testing ranges from 1 to 6 hours depending on tank conditions. None between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Average of 2 hours, 46 minutes during evaluation. Test data are acquired and recorded by a microprocessor which automatically determines test time based on tank size and product level. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Probe contains 5 resistance temperature detectors (RTD's) to monitor product temperature. At least one RTD must be submerged in product during testing.
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.66 inches. Minimum detectable change in water level is 0.039 inches.
<b>Calibration:</b>	RTDs and probe must be checked regularly and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifolded tanks. Tests only the portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank which routinely contains product

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Date of Evaluations: 12/23/93 and 07/23/97

**Emco Electronics Division, Tuthill Corp.**

**EECO System TLM/0.1 gph Precision Test  
(Q0400-4xx Magnetostrictive Probe)**

**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.1 gallons per hour with $P_D=99\%$ and $P_{FA}=1\%$ .
<b>Leak Threshold:</b>	0.05 gph A system should not be declared tight if the test result indicates a loss or gain which equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil #4. Other liquids maybe tested after consultation with the manufacturer.
<b>Capacity:</b>	Maximum of 15,000 gallons. Tanks less than 95% full may be tested. Minimum product level required based on tank diameter as follows - <b>48"</b> dia/ min 8.5"; <b>64"</b> dia/ min 10.5"; <b>72"</b> dia/ min 11.5"; <b>96"</b> dia/ min 14"; <b>126"</b> dia/ min 18".
<b>Waiting Time:</b>	Minimum of 6 hours between delivery and testing. None between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Minimum of 3 hours, 45 minutes. During the evaluation, test duration averaged 3 hours 45 minutes at 95% full and 5 hours 58 minutes at 50% full. Test data are acquired and recorded by a microprocessor which automatically determines test time based on tank size and product level. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Probe contains 5 resistance temperature detectors (RTD's) to monitor product temperature. At least one RTD must be submerged in product during testing.
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.66 inches. Minimum detectable change in water level is 0.039 inches.
<b>Calibration:</b>	RTDs and probe must be checked regularly and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifolded tanks. Tests only the portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank which routinely contains product

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Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 02/08/94 and 09/19/97

**Emco Electronics, Tuthill Corp.**

**EECO System TLM/0.2 gph Quick Test  
(Q0400-4xx Magnetostrictive Probe)**

**AUTOMATIC TANK GUAGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.2 gallons per hour with $P_D=95.4\%$ and $P_{FA}=4.6\%$ .
<b>Leak Threshold:</b>	0.1 gph A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold
<b>Applicability:</b>	Gasoline, diesel, aviation fuel and fuel oil #4. Other liquids maybe tested after consultation with the manufacturer.
<b>Capacity:</b>	Maximum of 15,000 gallons. Tanks less than 95% full may be tested. Minimum product level required based on tank diameter as follows - <b>48"</b> dia/ min 8.5"; <b>64"</b> dia/ min 10.5"; <b>72"</b> dia/ min 11.5"; <b>96"</b> dia/ min 14"; <b>126"</b> dia/ min 18".
<b>Waiting Time:</b>	Between delivery and testing ranges from 1 to 6 hours depending on tank conditions. None between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Average of 1 hour, 9 minutes during evaluation. Test data are acquired and recorded by a microprocessor which automatically determines test time based on tank size and product level. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Probe contains 5 resistance temperature detectors (RTD's) to monitor product temperature. At least one RTD must be submerged in product during testing.
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.66 inches. Minimum detectable change in water level is 0.039 inches.
<b>Calibration:</b>	RTDs and probe must be checked regularly and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifolded tanks. Tests only the portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank which routinely contains product

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Date of Evaluation: 12/23/93 and 07/23/97

**Emco Electronics Division, Tuthill Corp.**

EECO System TLM/0.1 gph Quick Test  
(Q0400-4xx Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.1 gallons per hour with $P_D=96\%$ and $P_{FA}=4\%$ .
<b>Leak Threshold:</b>	0.05 gph A system should not be declared tight if the test result indicates a loss or gain which equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil #4. Other liquids maybe tested after consultation with the manufacturer.
<b>Capacity:</b>	Maximum of 15,000 gallons. Tanks less than 95% full may be tested. Minimum product level required bas ed on tank diameter as follows - <b>48"</b> dia/ min 8.5"; <b>64"</b> dia/ min 10.5"; <b>72"</b> dia/ min 11.5"; <b>96"</b> dia/ min 14"; <b>126"</b> dia/ min 18".
<b>Waiting Time:</b>	Minimum of 6 hours between delivery and testing. None between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Minimum of 1 hour, 49 minutes. During the evaluation, test duration averaged 1 hour 48 minutes at 95% full and 2 hours 48 minutes at 50% full. Test data are acquired and recorded by a microprocessor which automatically determines test time based on tank size and product level. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Probe contains 5 resistance temperature detectors (RTD's) to monitor product temperature. At least one RTD must be submerged in product during testing.
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.66 inches. Minimum detectable change in water level is 0.039 inches.
<b>Calibration:</b>	RTDs and probe must be checked regularly and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifolded tanks. Tests only the portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank which routinely contains product

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Date of Evaluation: 02/08/94 and 09/19/97



**Emco Electronics, Tuthill Corp.**

EECO System, Leak Sensor II, Leak Sensor Jr.  
Thermistor and Proximity probes

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: thermal conductivity, proximity switch

**Test Results:**

	EECO system		Leak Sensor II		Leak Sensor Jr.	
	<u>unleaded gasoline</u>	<u>synthetic gasoline</u>	<u>unleaded gasoline</u>	<u>synthetic gasoline</u>	<u>unleaded gasoline</u>	<u>synthetic gasoline</u>
Accuracy (%)	100	100	100	100	100	100
Detection time (sec)	<5	<5	<5	<5	<5	<5
Fall time (sec)	manual reset	manual reset	manual reset	manual reset	manual reset	manual reset
Lower detection limits (cm)						
Thermistor	1.22	1.12	1.14	1.14	1.24	1.19
Proximity	0.97	1.04	1.12	1.17	1.12	1.17

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s), water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.

Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors," March 1990 and "Standard Test Procedures for Non-Volumetric Tank Tightness Test Methods," March 1990.

Detector is reusable.

Systems alarm if either water or product leaks into interstitial space.

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Date of Evaluation: 11/09/92

**Emco Electronics, Tuthill Corp.**

EECO 2000, 3000, Leak Sensor II, Leak Sensor Jr. Systems  
Q0001-005

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: float switch

**Test Results:**

Q0001-005 Interstitial Space Flood Sensor

	gasoline		diesel		water	
	<u>up</u>	<u>down</u>	<u>up</u>	<u>down</u>	<u>up</u>	<u>down</u>
Lower detection limit (cm)	31.06	5.49	30.78	5.36	30.35	5.03
Detection time (sec)	<1	<1	<1	<1	<1	<1
Fall time (sec)	<1	<1	<1	<1	<1	<1

**Specificity Results:**

Activated: unleaded gasoline, diesel fuel, water.

**Manufacturer's Specifications:**

Temperature range: -13 to 158F (-25 to 70C).  
Interstitial liquid level should be adjusted to center of sensor.

**Comments:**

Primary use is interstitial or annular space of a double-walled tank partially filled with brine solution. Activates alarm if any significant gain or loss of solution occurs.  
Evaluator claims sensor will respond to any liquid.  
EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
Test procedures used were Ken Wilcox Associates' "Alternative Test Procedures for Evaluating Leak Detection Methods: Liquid Level Sensors," September 1996.  
Detector is reusable.

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Date of Evaluation: 10/18/96

**Emco Electronics, Tuthill Corp.**EECO 1500, 2000, 3000 Systems  
Q0003-005**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: float switch

**Test Results:**

Q0003-005 Wet Interstitial Sensor

	gasoline		diesel		water	
	<u>up</u>	<u>down</u>	<u>up</u>	<u>down</u>	<u>up</u>	<u>down</u>
Lower detection limit (cm)	30.73	6.73	30.78	6.60	30.12	4.29
Detection time (sec)	<1	<1	<1	<1	<1	<1
Fall time (sec)	<1	<1	<1	<1	<1	<1

**Specificity Results:**

Activated: unleaded gasoline, diesel fuel, water.

**Manufacturer's Specifications:**

Temperature range: -13 to 158F (-25 to 70C).

Interstitial liquid level should be adjusted to center of sensor.

**Comments:**

Primary use is interstitial or annular space of a double-walled tank partially filled with brine solution.

Activates alarm if any significant gain or loss of solution occurs.

Evaluator claims sensor will respond to any liquid.

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.

Test procedures used were Ken Wilcox Associates' "Alternative Test Procedures for Evaluating Leak

Detection Methods: Liquid Level Sensors," September 1996.

Detector is reusable.

Emco Electronics, Tuthill Corp.  
 114 MacKenan Dr.  
 Cary, NC 27511  
 Tel: (800) 342-6125

Evaluator: Ken Wilcox Associates  
 Tel: (816) 443-2494

Date of Evaluation: 10/18/96

**Emco Electronics, Tuthill Corp.**

EECO 1500, 2000, 3000 Systems  
Q0003-001, Q0003-002 Sensors

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: not specified

**Test Results:**

	gasoline		diesel		water	
	<u>low</u>	<u>high</u>	<u>low</u>	<u>high</u>	<u>low</u>	<u>high</u>
Q0003-001 Discriminating Dispenser Pan Sensor						
Lower detection limit (cm)	3.38	19.91	3.30	19.86	3.20	19.66
Detection time (sec)	1-24	1-24	<1	<1	<1	<1
Fall time (sec)	hr	hr	Clean	Clean	1	<1
	Clean	Clean			1	
Q0003-002 Discriminating STP Sump Sensor						
Lower detection limit (cm)	3.12	28.37	3.07	28.24	3.00	28.04
Detection time (sec)	1-24	1-24	<1	<1	<1	<1
Fall time (sec)	hr	hr	Clean	Clean	1	<1
	Clean	Clean			1	

**Specificity Results:**

Activated: unleaded gasoline, diesel fuel, water.

**Manufacturer's Specifications:**

Detects low water, high water, fuel.

Temperature range: -40 to 150F (-40 to 65C)

Remove sensor from sump/pan while servicing filters and pumps to prevent accidental exposure to fuel.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Ken Wilcox Associates' "Alternative Test Procedures for Evaluating Leak Detection Methods: Liquid Level Sensors," September 1996.

These sensors have high and low level alarms with high and low detection limits.

Evaluator claims sensor will respond to any liquid.

Q0003-001 and Q0003-002 must be cleaned after exposure to product.

Evaluator: Ken Wilcox Associates

Emco Electronics, Tuthill Corp.

114 MacKenan Dr.

Cary, NC 27511

Tel: (800) 342-6125

Tel: (816) 443-2494

Date of Evaluation: 10/18/96

**Emco Electronics, Tuthill Corp.**

EECO 1500, 2000, 3000 Systems  
Q0003-003, Q0003-006, Q0003-009 Sensors

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: not specified

**Test Results:**

	gasoline	diesel	water
<b>Q0003-003 Discriminating Interstitial Sensor</b>			
Lower detection limit (cm)	1.68	1.68	1.85
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
<b>Q0003-006 Liquid Only Interstitial Sensor</b>			
Lower detection limit (cm)	1.35	1.55	1.78
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
<b>Q0003-009 Liquid Float Sensor</b>			
Lower detection limit (cm)	2.54	2.49	2.21
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1

**Specificity Results:**

Activated: unleaded gasoline, diesel fuel, water.

**Manufacturer's Specifications:**

Temperature range Q0003-003, -006: -4 to 176F (-20 to 80C); Q0003-009: -40 to 180F (-40 to 82C).

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Ken Wilcox Associates' "Alternative Test Procedures for Evaluating Leak Detection Methods: Liquid Level Sensors," September 1996. These sensors have high and low level alarms with high and low detection limits. Evaluator claims sensor will respond to any liquid.

Emco Electronics, Tuthill Corp.  
114 MacKenan Dr.  
Cary, NC 27511  
Tel: (800) 342-6125

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 10/18/96

**Emco Electronics, Tuthill Corp.**

EECO 1500, 2000, 3000, Leak Sensor, Leak Sensor II, Leak Sensor Jr.  
Q0002-001

**VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: adsistor

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>	JP-4 <u>jet fuel</u>
Accuracy* (%)	100	0	100
Detection time* (min:sec)	19:32	N/A**	09:16
Fall time* (hh:mm:ss)	00:32:30	N/A	>01:05:33
Lower detection limit (ppm)	1000	>1000	500

\*For tests conducted with 1000 ppm of test gas.

\*\* See Glossary

**Specificity Results:**

Activated: unleaded gasoline, JP-4 jet fuel.

**Comments:**

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Emco Electronics, Tuthill Corp.  
114 MacKenan Dr.  
Cary, NC 27511  
Tel: (800) 342-6125

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 11/12/96

**Emco Electronics, Tuthill Corp.**

EECO 1500, 2000, 3000, Leak Sensor, Leak Sensor II, Leak Sensor Jr.  
Q0002-005

**VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: metal oxide semiconductor

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>	JP-4 <u>jet fuel</u>
Accuracy* (%)	100	100	100
Detection time* (min:sec)	00:30	00:28	01:01
Fall time* (min:sec)	03:34	02:40	05:33
Lower detection limit (ppm)	100	100	100

\*For tests conducted with 1000 ppm of test gas.

**Specificity Results:**

Activated: unleaded gasoline, synthetic gasoline, n-hexane, JP-4 jet fuel, toluene, xylene(s).

**Comments:**

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Emco Electronics, Tuthill Corp.  
114 MacKenan Dr.  
Cary, NC 27511  
Tel: (800) 342-6125

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 10/18/96

**Engineered Systems, Inc.**

Image II  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 96.6\%$  and  $P_{FA} = 3.4\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 90% full.
- Waiting Time:** Minimum of 8 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 6 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from average of subsets of all collected data.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 resistance temperature detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.83 inch.  
Minimum detectable water level change is 0.0116 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Engineered Systems Inc.  
2001 W. Campus Dr.  
Tempe, AZ 85282  
Tel: (602) 438-1362

Evaluator: Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494

Date of Evaluation: 08/20/93



## Entropy Limited

### Precision Tank Inventory Control System, Version 90

#### STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUALITATIVE)

- Certification:** Leak rate of 0.1 gph with  $P_D=97.9\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.04 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4.
- Tank Capacity:** Maximum of 15,000 gallons.
- Data Requirement:** Minimum of 64 days of product level and flow through data.
- Comments:** Not evaluated using data from manifold tank systems.  
Of 120 data sets submitted for evaluation, 13 were not evaluated and 16 were inconclusive.  
Median monthly throughput of tanks evaluated was 42,835 gallons.  
Data sets evaluated were supplied by evaluator.

Entropy Limited  
S. Great Rd.  
Lincoln, MA 01773  
Tel: (617) 259-8901

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 04/02/91

**Entropy Limited**

Precision Tank Inventory Control System Rev. 90

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.5\%$  and  $P_{FA}<0.5\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4.
- Tank Capacity:** Maximum of 22,500 gallons for single tanks. Maximum of 60,000 gallons for manifolded tank systems. Maximum of 3 tanks in a manifolded system.
- Data Requirement:** Minimum of 30 days of product level and flow through data.
- Comments:** 32% of data sets evaluated were from manifold tank systems.  
Of 56 data sets submitted for evaluation, 6 were not analyzed due to unusable data and none were inconclusive.  
Median monthly throughput of tanks evaluated was 52,207 gallons.  
Leak rates ranging from 0.0497 to 0.203 gph were used in evaluation.  
Data sets evaluated were supplied by evaluator.

Entropy Limited  
S. Great Rd.  
Lincoln, MA 01773  
Tel: (617) 259-8901

Evaluator: Simpson, Gumpertz and Heger, Inc.  
Tel: (617) 643-2000

Date of Evaluation: 11/30/93

**Environment and Safety**

EASI Level-Tru  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D=95.4\%$ and $P_{FA}=4.6\%$ .
<b>Leak Threshold:</b>	0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil #4, antifreeze, brake fluid, transmission fluid, and solvents.
<b>Tank Capacity:</b>	Maximum of 15,000 gallons. Tank must be between 50 and 95% full.
<b>Waiting Time:</b>	Minimum of 4 hours, 6 minutes between delivery and testing. There must be no dispensing or delivery during waiting time.
<b>Test Period:</b>	Minimum of 3 hours, 36 minutes. Test data are acquired and recorded by a computer. Leak rate is calculated from data collected over the entire range of test period. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined by a minimum of 5 resistance temperature detectors (RTDs).
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.896 inch. Minimum detectable change in water level is 0.023 inch.
<b>Calibration:</b>	RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Environment and Safety, Inc.  
252 Welsh Pool Rd.  
Exton, PA 19341-1313  
Tel: Unlisted

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 04/11/91

**Environmental Fuel Systems, Inc.**

## Fuel Finder Version IV

## VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

**Detector:**

Output type: quantitative  
 Sampling frequency: intermittent  
 Operating principle: adsorption sampling

**Test Results:**

	<u>benzene</u>	<u>2-methylbutane</u>
Accuracy (%) [Avg. Reading]	106.8 [1647 ppm]	122.7 [1380 ppm]
Bias (%)	64.5	38.2
Precision (%)	22.3	53.2
Detection time (min:sec)	N/A*	N/A
Fall time (min:sec)	N/A	N/A
Lower detection limit (ppm)	77	116

\* See glossary.

**Specificity Results:**

Percentages:

benzene	147.7
n-butane	90.7
n-hexane	55.7
isobutane	51.1
2-methylpentane	143.7
toluene	66.5

Environmental Fuel Systems, Inc.  
 P.O. Box 1899  
 Bandera, TX 78003  
 Tel: (800) 375-7747

Evaluator: Carnegie Mellon Research Institute  
 Tel: (412) 268-3495

Date of Evaluation: 04/20/93

**FCI Environmental, Inc.**

Analog Hydrocarbon Probe AHP-100 and  
Digital Hydrocarbon Probe DHP-100

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: fiber optic chemical sensor

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min)	<8	<8
Fall time (min)	<5	<5
Lower detection limit (cm)	<0.01	<0.01

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s).

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Detector is reusable.

FCI Environmental, Inc.  
1181 Grier Dr., Bldg. B  
Las Vegas, NV 89119  
Tel: (800) 510-3627

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 01/15/94

## FCI Environmental, Inc.

## Analog Hydrocarbon Probe AHP-100

## VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

**Detector:**

Output type: quantitative

Sampling frequency: continuous

Operating principle: fiber optic

**Test Results:**

	EPA March 1990 protocol			Radian June 1990 protocol	
	<u>xylene</u>	<u>benzene</u>	<u>2-methylbutane</u>	<u>unleaded gasoline</u>	<u>synthetic gasoline</u>
Relative accuracy* (%)	2	35	N/R*	12	22
Bias (%)	1	-23	N/R	-7	-2
Precision (%)	1	11	N/R	4	15
Detection time (min)	<1	<1	N/R	<1	<1
Fall time (min)	<1	<1	N/R	<1	<1
Lower Detect. Limit (ppm)	84	519	N/R	137	220

\* See glossary.

**Lower detection limit for other fuels (ppm):**

<u>diesel</u>	<u>JP-4 jet fuel</u>	<u>JP-8 jet fuel</u>	<u>synthetic fuel</u>	<u>p-xylene</u>	<u>kerosene</u>	<u>unleaded gasoline</u>
1.01	3.08	2.22	3.43	2.60	2.18	2.02

**Specificity Results (%) (corrected for sensitivity differences):**

EPA March 1990 protocol		Radian June 1990 protocol	
benzene	76	unleaded gasoline	93
toluene	96	synthetic gasoline	98
p-xylene	101	JP-4 jet fuel	105
synthetic gasoline	100	n-hexane	N/R
trimethylbenzene	107	xylene	103
methane	N/R		
butane	N/R		
2-methylbutane	N/R		
pentane	N/R		

**Comments:**

Test procedures used were a combination of EPA's "Standard Test Procedures for Evaluation Leak Detection Methods: Vapor-Phase Out-of-Tank Product Detectors, "March 1990, and Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 6, 1990.

FCI Environmental, Inc.  
1181 Grier Dr., Bldg. B  
Las Vegas, NV 89119  
Tel: (800) 510-3627

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/07/94 and 12/05/94

## FCI Environmental, Inc.

## Digital Hydrocarbon Probe DHP -100

## VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

**Detector:**

Output type: quantitative  
 Sampling frequency: continuous  
 Operating principle: fiber optic

**Test Results:**

	EPA March 1990 protocol			Radian June 1990 protocol	
	<u>xylene</u>	<u>benzene</u>	<u>2-methylbutane</u>	<u>unleaded gasoline</u>	<u>synthetic gasoline</u>
Relative accuracy* (%)	0	17	N/R	18	29
Bias (%)	0	-9	N/R	1	-12
Precision (%)	0	11	N/R	9	10
Detection time (min)	<1	<1	N/R	<1	<1
Fall time (min)	<1	<1	N/R	<1	<1
Lower Detect. Limit (ppm)	45	280	N/R	73	118

\* See glossary.

**Specificity Results (%) (corrected for sensitivity differences):**

EPA March 1990 protocol		Radian June 1990 protocol	
benzene	89	unleaded gasoline	101
toluene	97	synthetic gasoline	88
p-xylene	100	JP-4 jet fuel	109
synthetic gasoline	92	n-hexane	108
trimethylbenzene	104	xylene	N/R
methane	N/R		
butane	N/R		
2-methylbutane	N/R		
pentane	N/R		

**Comments:**

Test procedures used were a combination of EPA's "Standard Test Procedures for Evaluation Leak Detection Methods: Vapor-Phase Out-of-Tank Product Detectors," March 1990, and Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 6, 1990.

FCI Environmental, Inc.  
 1181 Grier Dr., Bldg. B  
 Las Vegas, NV 89119  
 Tel: (800) 510-3627

Evaluator: Ken Wilcox Associates  
 Tel: (816) 443-2494

Date of Evaluation: 03/07/94

**FDR Services, Inc.**

## GasPak Vapor Monitoring System

## VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

**Detector:**

Output type: quantitative  
 Sampling frequency: intermittent  
 Operating principle: product permeable detector

**Test Results:** (averages of multiple concentrations)

	<u>benzene</u>	<u>heptane, 3-methyl</u>	<u>hexane</u>	<u>Iso-octane</u>	<u>pentane, 2,4-dimethyl</u>	<u>pentane, 2,3,4-trimethyl</u>	<u>toluene</u>	<u>m-xylene</u>
Accuracy (%)	103	102	107	103	105	104	104	99
Bias (%)	-1	1	2	1	1	1	1	-6
Precision (%)	2	2	4	2	3	3	3	4
Lower detection limit (ppm)	1	1	1	1	3	1	1	4
Specificity (%)	100	100	102	101	101	100	100	94

**Specificity Results:** See results above.

**Comments:**

Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Vapor-Phase Out-of-Tank Product Detectors," March 1990. Detection times were not directly measured. However, evaluator states, "experiential evidence predicts that the detector response will reach 'alarm' conditions (30% of maximum fresh fuel response) at a distance of 5 meters in slightly over one day."

Each cartridge is used once, then replaced by another.

GasPak is produced and analyzed by Fayette Environmental Services, Inc., with exclusive marketing and implementation rights assigned to FDR Services, Inc.

FDR Services, Inc.  
 P.O. Box 3930  
 Bryan, TX 77805  
 Tel: (214)506-0588

Evaluator: David G. Bray, Ph.D.  
 University of Missouri - Columbia  
 Tel: (573) 882-2439  
 Date of Evaluation: 07/27/94



**FE Petro, Inc.**

STP-MLD Pipeline Leak Detector

**AUTOMATIC MECHANICAL LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 3.0 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil #4, and some solvents.
<b>Specification:</b>	System tests fiberglass and steel pipelines. Tests are conducted at operating pressure.
<b>Pipeline Capacity:</b>	Maximum of 129.14 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is less than 30 seconds.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Restricted flow to dispenser if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

FE Petro, Inc.  
P.O. Box 139  
McFarland, WI 53558  
Tel: (608) 838-8786

Evaluator: Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494

Date of Evaluation: 07/01/92

**FE Petro, Inc.**

STP-MLD-D Pipeline Leak Detector

**AUTOMATIC MECHANICAL LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 3.0 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Diesel
<b>Specification:</b>	System tests steel and fiberglass pipelines. Tests are conducted at operating pressure.
<b>Pipeline Capacity:</b>	Maximum for rigid system is 341 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Average response time is 1 minute.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Restricted flow to dispenser if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

FE Petro, Inc.  
P.O. Box 139  
McFarland, WI 53558  
Tel: (608) 838-8786

Evaluator: Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494

Date of Evaluation: 04/30/94

**FE Petro, Inc.**STP-MLD-E Line (Flexline) Leak Detector  
(for Flexible Pipelines)**AUTOMATIC MECHANICAL LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 3.0 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and some solvents.
<b>Specification:</b>	System tests flexible pipelines. Tests are conducted at operating pressure.
<b>Pipeline Capacity:</b>	Maximum of 49.6 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Average response time is 3 minutes.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Restricted flow to dispenser if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
<b>Comments:</b>	Enviroflex line with a bulk modulus* of 1,280 was used during evaluation. *See glossary.

FE Petro, Inc.  
P.O. Box 139  
McFarland, WI 53558  
Tel: (608) 838-8786

Evaluator: Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494

Date of Evaluation: 03/24/94

**Fluid Containment, Inc.**  
**(formerly O/C Tanks Corp.)**

Hydrostatic Precision Tank Test for DWT-Type II Tanks

**DOUBLE WALLED TANK TIGHTNESS TEST**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.9\%$  and  $P_{FA}=1.2\%$  without dispensing.  
 Leak rate of 0.1 gph with  $P_D=95\%$  and  $P_{FA}=5.0\%$  with dispensing.
- Leak Threshold:** 0.05 gph without dispensing and 0.07 gph with dispensing. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 30,000 gallons.  
 Tank must be between 0 and 100% full.  
 Maximum tank diameter is 10 feet.
- Waiting Time:** Minimum of 24 hours between delivery and testing.  
 Minimum of 3 hours between "topping off" the annular space with liquid and testing.  
 There must be no delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
 A leak is not declared unless the threshold is exceeded in two tests, separated by at least 8 hours which are performed without dispensing and with minimal changes in groundwater elevation above bottom of tank as described below.
- Other Limitations:** Volume of trapped vapor must not exceed 20 gallons.  
 Change in barometric pressure must be less than 0.04 psia over the 4-hour test period.  
 Annular space must be at least 100% full with either water or antifreeze.  
 If groundwater is above bottom of tank, and no product is being dispensed during test, total change in groundwater elevation during test must be less than 1.5 inches per hour.  
 If groundwater is below bottom of tank or not changing during test, total change in product level during test must be less than 0.75 inch per hour.

Fluid Containment, Inc.	Evaluator: Vista Research
Route 20, Box 1380	Tel: (415) 966-1171
Conroe, TX 77301	
Tel: (800) 628-2657	Date of Evaluation: 05/15/91

**Gasboy International (formerly William M. Wilson's Sons)**Gasboy TMS 500  
(Magnetostrictive Probe)**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 99.91\%$  and  $P_{FA} = 0.09\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 3 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 temperature sensors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.04 inches.  
Minimum detectable change in water level is 0.011 inch.
- Calibration:** Temperature sensors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
System is no longer being manufactured although product support is still available.

Gasboy International  
P.O. Box 309  
Lansdale, PA 19446  
Tel: (215) 855-4631

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 05/10/91

**Gems Sensors Inc. (formerly IMO Industries Inc.)**

Gems Smartwell Portable Monitor model WPM-535  
with Groundwater Probe model WP-535

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: intermittent  
Operating principle: conductive polymer

\* Although sensor is a polymer strip which is mounted in the monitoring well, monitor is a hand held unit which is typically connected to sensor periodically - hence the "intermittent" designation.

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	09:31	07:05
Fall time (min:sec)	55:42	17:04
Lower detection limit (cm)	0.04	0.08

**Specificity Results:**

Activated: unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s).

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Detector is reusable.

Gems Sensors Inc.  
Cowles Rd.  
Plainville, CT 06062-1198  
Tel: (203) 747-3000

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 04/22/93

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA02630000501

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 1.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 158 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Response time is 14 seconds.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown, message display, and alarm activation if a leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Gilbarco Environmental Products  
7300 W. Friendly Ave.,  
Greensboro, NC 27410  
Tel: (336) 547-5000

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Rev. by Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494  
Date of Evaluation: 09/20/91, Rev. 04/12/93

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA02630000501

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	0.1 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and solvents.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at operating pressure. System will not function with a mechanical line leak detector installed in the pipeline.
<b>Pipeline Capacity:</b>	Maximum of 158 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
<b>Test Period:</b>	Response time is 6 minutes. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Pump shutdown, message display, and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Gilbarco Environmental Products  
7300 W. Friendly Ave.,  
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Evaluator: Midwest Research Institute  
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Rev. by Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494  
Date of Evaluation: 09/20/91, Rev. 04/12/93



## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA02630000501

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.1 gph with  $P_D=100.0\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.079 gph.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 158 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Response time is 14 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Rev. by Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494  
Date of Evaluation: 09/20/91, Rev. 04/12/93

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA02630000501  
(for Flexible Pipelines)

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 1.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 49.6 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Response time is 1 minute.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494

Date of Evaluation: 08/04/93

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA02630000501  
(for Flexible Pipelines)

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D=96\%$ and $P_{FA}=4\%$ .
<b>Leak Threshold:</b>	0.1 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and solvents.
<b>Specification:</b>	System tests pressurized flexible pipelines. Tests are conducted at operating pressure. System will not function with a mechanical line leak detector installed in the pipeline.
<b>Pipeline Capacity:</b>	Maximum of 49.6 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
<b>Test Period:</b>	Response time is 45 minutes to 8 hours, 51 minutes. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Pump shutdown, message display, and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494

Date of Evaluation: 08/04/93

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA02630000501  
(for Flexible Pipelines)

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.079 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 49.6 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Response time is 1 hour, 12 minutes to 12 hours, 54 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494

Date of Evaluation: 08/04/93

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA0263000060X

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

<b>Certification:</b>	Leak rate of 3.0 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	1.88 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and solvents.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at operating pressure. System will not function with a mechanical line leak detector installed in the pipeline.
<b>Pipeline Capacity:</b>	Maximum of 98.4 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum of 16 minutes between dispensing and testing.
<b>Test Period:</b>	Response time is 28.8 seconds. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Pump shutdown (optional), message display and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 08/07/91

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA0263000060X

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.20 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.17 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 98.4 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 45 minutes to 1 hour between dispensing and testing.
- Test Period:** Response time is 32 to 48 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Gilbarco Environmental Products  
7300 W. Friendly Ave.,  
Greensboro, NC 27410  
Tel: (336) 547-5000

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 12/18/96

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA0263000060X

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and solvents.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at operating pressure. System will not function with a mechanical line leak detector installed in the pipeline.
<b>Pipeline Capacity:</b>	Maximum of 98.4 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum of 2 hours, 30 minutes between dispensing and testing.
<b>Test Period:</b>	Response time is 18 minutes. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Pump shutdown (optional), message display and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Gilbarco Environmental Products  
7300 W. Friendly Ave.,  
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Tel: (336) 547-5000

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 08/07/91

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA0263000060X  
(for Flexible Pipelines)

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 1.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at 10 psi.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 40.8 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 13 minutes between dispensing and testing.
- Test Period:** Response time is 4 to 6 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Gilbarco Environmental Products  
7300 W. Friendly Ave.,  
Greensboro, NC 27410  
Tel: (336) 547-5000

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Date of Evaluation: 10/16/95



**Gilbarco Environmental Products**

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA0263000060X  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.17 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at 30 psi.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 40.8 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 4 minutes to 1 hour, 9 minutes between dispensing and testing.
- Test Period:** Response time is 40 minutes to 1 hour.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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7300 W. Friendly Ave.,  
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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 01/13/97

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA0263000060X  
(for Flexible Pipelines)

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 1.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at operating pressure, with leak rates equivalent to 45 psi line pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 40.8 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 1 to 4 hours between dispensing and testing.
- Test Period:** Response time is 45 minutes to 1 hour, 15 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 10/16/95

**Gilbarco Environmental Products**

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA0263000100X, PA0277000060X

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure, not to exceed 50 psi.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 100 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 2 seconds  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 05/08/96

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA0263000100X, PA0277000060X

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.2 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.17 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure, not to exceed 50 psi.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 100 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing is 45 minutes.
- Test Period:** Response time is 45 minutes  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Date of Evaluation: 05/08/96

## Gilbarco Environmental Products

Environmental Management Console (EMC)  
with Line Leak Detector, Series PA0263000100X, PA0277000060X

### AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	0.09 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and solvents.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at operating pressure, not to exceed 50 psi. System will not function with a mechanical line leak detector installed in the pipeline.
<b>Pipeline Capacity:</b>	Maximum of 100 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum of 2 hours between dispensing and testing.
<b>Test Period:</b>	Response time is 32 to 48 minutes. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Pump shutdown (optional), message display and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 05/08/96

## Gilbarco Environmental Products

EMC Environmental Management Console  
EMC Basic Monitoring System Tank Monitor 2, 3, 2.1, and 3.1 PAO238000XXXX  
(Capacitance Probe)

### AUTOMATIC TANK GAUGING SYSTEM

- Certification:** Leak rate of 0.2 gph with  $P_D=99\%$  and  $P_{FA}=1\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 8 hours, 18 minutes between delivery and testing.  
There is no dispensing or delivery during waiting time.
- Test Period:** Minimum of 5 hours.  
Test data are acquired and recorded by the system's computer.  
Leak rate is calculated from the difference between the first and last data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is obtained by a temperature averaging probe.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.40 inches.  
Minimum detectable water level change is 0.040 inch.
- Calibration:** Temperature averaging probe must be calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
Capacitance probes do not work with oxygenated fuels.

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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Date of Evaluation: 05/14/93

**Gilbarco Environmental Products**

EMC Environmental Management Console  
 EMC Basic Monitoring System Tank Monitor 2.1,3.1, PAO264XXX0000  
 (Capacitance Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=99\%$  and  $P_{FA}=0.2\%$ .
- Leak Threshold:** 0.126 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
 Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 8 hours, 18 minutes between delivery and testing.  
 There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
 Test data are acquired and recorded by the system's computer.  
 Leak rate is calculated from the difference between the first and last data collected.  
 There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
 Minimum detectable water level in the tank is 1.52 inches.  
 Minimum detectable change in water level is 0.027 inch.
- Calibration:** Thermistors and probe must be calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
 Tests only portion of tank containing product.  
 As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
 EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
 Capacitance probes do not work with oxygenated fuels.

Gilbarco Environmental Products  
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 Tel: (336) 547-5000

Evaluator: Midwest Research Institute  
 Tel: (816) 753-7600  
 Date of Evaluation: 05/14/93

**Gilbarco Environmental Products**

EMC Environmental Management Console  
 EMC Basic Monitoring System Tank Monitor 2.1, 3.1, PAO264XXX0000  
 (Capacitance Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D=99\%$  and  $P_{FA}=0.1\%$ .
- Leak Threshold:** 0.071 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
 Tank must be minimum 95% full.
- Waiting Time:** Minimum of 8 hours, 15 minutes between delivery and testing.  
 Minimum of 30 minutes between dispensing and testing.  
 There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
 Test data are acquired and recorded by the system's computer.  
 Leak rate is calculated from the difference between the first and last data collected.  
 There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
 Minimum detectable water level in the tank is 1.52 inches.  
 Minimum detectable water level change is 0.027 inch.
- Calibration:** Thermistors and probe must be calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
 Tests only portion of tank containing product.  
 As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
 EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
 Capacitance probes do not work with oxygenated fuels.

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Date of Evaluation: 05/14/93



**Gilbarco Environmental Products**

EMC Environmental Management Console  
 EMC Basic Monitoring System Tank Monitor 2.1, 3.1, PAO265XXX0000  
 (Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=99\%$  and  $P_{FA}=0.1\%$ .
- Leak Threshold:** 0.093 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
 Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 8 hours, 18 minutes between delivery and testing.  
 Minimum of 30 minutes between dispensing and testing.  
 There must be no delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
 Test data are acquired and recorded by the system's computer.  
 Leak rate is calculated from the difference between the first and last data collected.  
 There must be no dispensing during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
 Minimum detectable water level in the tank is 0.544 inch.  
 Minimum detectable change in water level is 0.027 inch.
- Calibration:** Thermistors and probe must be calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
 Tests only portion of tank containing product.  
 As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
 EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

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Date of Evaluation: 05/14/93

**Gilbarco Environmental Products**

EMC Environmental Management Console  
 EMC Basic Monitoring System Tank Monitor 2.1, 3.1, PAO265XXX0000  
 (Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D=99\%$  and  $P_{FA}=1\%$ .
- Leak Threshold:** 0.071 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents. Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
 Tank must be minimum 95% full.
- Waiting Time:** Minimum of 8 hours, 15 minutes between delivery and testing.  
 Minimum of 30 minutes between dispensing and testing.  
 There must be no delivery during waiting time.
- Test Period:** Minimum of 3 hours.  
 Test data are acquired and recorded by the system's computer.  
 Leak rate is calculated from the difference between the first and last data collected.  
 There must be no dispensing during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
 Minimum detectable water level in the tank is 0.544 inch.  
 Minimum detectable change in water level is 0.027 inch.
- Calibration:** Thermistors and probe must be calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
 Tests only portion of tank containing product.  
 As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
 EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

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Evaluator: Midwest Research Institute  
 Tel: (816) 753-7600  
 Date of Evaluation: 03/14/95

**Gilbarco Environmental Products**

EMC Series with CSLD, PA0265XXXX100, PA0300XXXX100  
(Magnetostrictive Probe)

**CONTINUOUS IN-TANK LEAK DETECTION SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.16 gph for single tanks at 99% operating mode.  
0.15 gph for manifold tank systems at 99% operating mode.  
A system should not be declared tight, and a message is printed for the operator, if the test results indicate a loss or gain that exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, waste oil, and solvents.
- Tank Capacity:** Maximum of 38,170 gallons for single tanks and for all tanks manifolded together.  
Contact manufacturer for tank system applications if total tank capacity exceeds 30,000 gallons.
- Throughput:** Monthly maximum of 221,890 gallons.
- Waiting Time:** Minimum of 3 hours between delivery and testing.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.54 inch.  
Minimum detectable change in water level is 0.027 inch.
- Calibration:** Thermistors and probe must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.  
System set-up menu must be checked to verify that the 99% operating mode option has been selected.
- Comments:** During installation, the set-up menu provides a choice between a 99% or a 95% operating mode. This evaluation covers only the 99% operating mode. At this time, there is no evaluation covering the 95% mode.  
System reports a quantitative result of pass or fail.  
Evaluated using both single and manifold tank systems.  
System collects data at naturally occurring product levels without interfering with normal tank operation, and discards data from unstable periods when system performs test.  
Data can be collected at any level above 12 inches of product.  
Leak rates above 1 gph are either reported as "fail" or as "no idle."  
For valid monthly testing, a conclusive test report must be produced for each tank every month.  
Systems warns the operator if there are no "passing" tests completed during the month. For very active tanks, a tank shut down may become necessary in order for the system to collect enough quiet-time data for a test.  
Test procedure used was Midwest Research Institute's "Evaluation of Continuous In-Tank Leak Detection Systems," April 17, 1995.  
Constant and variable leaks were mathematically induced into tight tank test records which were collected by systems installed at various active tank sites.  
The data base for evaluation of the system included sites with vapor recovery and blending dispensers.  
Tanks used in this evaluation contained gasoline and diesel.

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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 06/10/96

**Gilbarco Environmental Products**

PA02590XXX000

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: float switch

**Test Results: \***

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Response time (min)	3.66	3.45
Recovery time (min)	<1	<1
Product activation height (cm)	1.28	1.27
Lower detection limit (cm)	1.84	1.65

\*At a flow rate of 0.19 gal/hr in 7.6 cm diameter test chamber.

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2, water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.  
Detector is reusable.

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Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 07/17/92

**Gilbarco Environmental Products**

PA02591144000

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: float switch

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Response time (min)	6.00	6.51
Recovery time (min)	<1	<1
Product activation height (cm)	3.67	3.62
Lower detection limit (cm)	4.05	4.17

**Specificity Results:**

**Activated:** diesel fuel, synthetic fuel, heating oil #2, water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems":  
Final Report - November 11, 1991.  
Detector is reusable.

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Evaluator: Carnegie Mellon Research Institute  
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Date of Evaluation: 07/17/92

**Gilbarco Environmental Products**

PA02592000000

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: float switch

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Response time (min)	8.19	8.49
Recovery time (min)	<1	<1
Product activation height (cm)	4.12	3.95
Lower detection limit (cm)	4.67	4.36

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2, water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems":  
Final Report - November 11, 1991.  
Detector is reusable.

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Date of Evaluation: 07/17/92

**Gilbarco Environmental Products**

Environmental Management Console (EMC)  
Groundwater Sensor, series PA02700XX0001

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: electrical conductivity

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	08:55	06:18
Fall time (min:sec)	54:50	26:02
Lower detection limit (cm)	0.02	0.02

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s).

**Calibration:**

Sensor must be checked annually for operability or in accordance with manufacturer's instructions and calibrated/replaced if necessary.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Detector is reusable.

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Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 11/20/91

**Gilbarco Environmental Products**

PA02660000000

**VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: adsistor

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>	JP-4 <u>jet fuel</u>
Accuracy (%)	100	0	100
Detection time (min:sec)	7:46	N/A*	17:01
Fall time (min:sec)	2:38	N/A	3:05
Lower detection limit (ppm)	500	>1000	500

\*See glossary.

**Specificity Results:**

Activated: unleaded gasoline, JP-4 jet fuel.

Not activated: synthetic gasoline, n-hexane, toluene, xylene(s).

**Comments:**

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods,"  
June 29, 1990.

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Date of Evaluation: 07/24/92



**Hasstech**

## LineTite Pipeline Leak Monitor

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 3.0 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, and aviation fuel.
<b>Specification:</b>	System tests fiberglass and steel pipelines. Tests are conducted at operating pressure. System will not function with a mechanical line leak detector installed on the pipeline.
<b>Pipeline Capacity:</b>	Maximum of 341 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is 1 to 26 minutes. Test data are acquired and recorded by a permanently installed microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Dispenser shutdown, message display, and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Dates of Evaluation: 10/15/91 and 04/10/94

**Hasstech**

## LineTight Pipeline Leak Monitor Model 2001J

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure, not to exceed 50 psi.
- Pipeline Capacity:** Maximum of 172 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 1-5 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Manual testing of pipeline.  
Preset threshold.  
Single test with multiple data acquisition cycles to determine if pipeline is leaking.  
Dispenser shutdown and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Date of Evaluation: 04/15/97

**Hasstech**

## LineTight Pipeline Leak Monitor Model 2001J

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	0.079 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and solvents.
<b>Specification:</b>	System tests pressurized flexible pipelines. Tests are conducted at operating pressure, not to exceed 50 psi. System will not function with a mechanical line leak detector installed in the pipeline.
<b>Pipeline Capacity:</b>	Maximum of 49.6 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum between dispensing and testing is 15 minutes.
<b>Test Period:</b>	Response time is 1 hour, 12 minutes to 12 hours, 54 minutes. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Manual testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Dispenser shutdown and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Date of Evaluation: 08/04/93

**Hasstech**

## LineTite Pipeline Leak Monitor

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	0.062 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, and aviation fuel.
<b>Specification:</b>	System tests fiberglass and steel pipelines. Tests are conducted at operating pressure. System will not function with a mechanical line leak detector installed in the pipeline.
<b>Pipeline Capacity:</b>	Maximum of 341 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is 1 hour, 30 minutes to 12 hours, 30 minutes. Test data are acquired and recorded by a permanently installed microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Dispenser shutdown, message display, and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Dates of Evaluation: 10/15/91 and 04/10/94

**Hasstech**LineTite Pipeline Leak Monitor  
(for Flexible Pipelines)**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 3.0 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	2.0 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, and aviation fuel.
<b>Specification:</b>	System tests flexible pipelines. Tests are conducted at operating pressure. System will not function with a mechanical line leak detector installed on the pipeline.
<b>Pipeline Capacity:</b>	Maximum of 49.6 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is 1 to 6 minutes. Test data are acquired and recorded by a permanently installed microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Dispenser shutdown, message display, and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Dates of Evaluation: 10/15/91 and 04/10/94

**Hasstech**

LineTite Pipeline Leak Monitor  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.062 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, and aviation fuel.
- Specification:** System tests flexible pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 49.6 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 2 hours, 18 minutes to 5 hours.  
Test data are acquired and recorded by a permanently installed microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Dates of Evaluation: 10/15/91 and 04/10/94

**Hasstech**

Tank Compliance Center, Model 700  
(7100 Series Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D=99.9\%$ and $P_{FA}=0.1\%$ .
<b>Leak Threshold:</b>	0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, solvents and other substances with a specific gravity $>0.6$ and a viscosity $<1500$ cp.
<b>Tank Capacity:</b>	Maximum of 15,000 gallons. Tank must be between 50 and 95% full.
<b>Waiting Time:</b>	Minimum of 2 hours between delivery and testing. Minimum of 2 hours between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Minimum of 2 hours. Test data are acquired and recorded by a computer. Leak rate is calculated from data determined to be valid by statistical analysis. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined by a minimum of 5 thermistors.
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.186 inch. Minimum detectable change in water level is 0.0048 inch.
<b>Calibration:</b>	Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

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Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/14/95

**Hasstech**

Tank Compliance Center, Model 700  
(7100 Series Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.6\%$  and  $P_{FA}=0.4\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, solvents and other substances with a specific gravity  $>0.6$  and a viscosity  $<1500$  cp.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 2 hours between delivery and testing.  
Minimum of 2 hours between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 6 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.1860 inch.  
Minimum detectable change in water level is 0.0048 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

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Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/14/95



**Hasstech**

## AcuRite

**LINE TIGHTNESS TEST METHOD**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	0.01 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and fuel oil #4.
<b>Specification:</b>	System tests fiberglass and steel pipelines. Tests are conducted at 150% operating pressure. Mechanical line leak detector must be removed from pipeline for duration of test.
<b>Pipeline Capacity:</b>	Maximum of 75 gallons.
<b>Waiting Time:</b>	Minimum of 6 hours between delivery and testing. Minimum of 30 minutes between dispensing and testing.
<b>Test Period:</b>	Minimum of 30 minutes. Test data are acquired and recorded manually. Manual calculations are performed by the operator on site.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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6985 Flanders Dr.  
San Diego, CA 92121  
Tel: (619) 457-5880

Evaluator: Lamar University  
Tel: (409) 880-8788  
Date of Evaluation: 03/25/91

**Hasstech****Leak Computer Tank Test System****VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL) (Edison Lab Protocol)**

- Certification:** Leak rate of 0.1 gph with  $P_D=95\%$  and  $P_{FA}=5\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents. Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 12,000 gallons.  
Tank must be minimum 100% full.
- Waiting Time:** Test data are acquired and recorded by a computer that calculates a leak rate every minute, and determines waiting time for satisfactory data (test is finished when the standard deviation of 30 sequential leak rates is less than half of the last leak rate determined).  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 1 hour, 10 minutes.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery of product during test.
- Temperature:** Average for product is determined by a minimum of 7 thermistors.
- Groundwater:** If depth to groundwater in backfill cannot be determined, tank must pass a two level test with at least a 3 foot difference in product level.  
If depth to groundwater in backfill can be determined, a single level test can be conducted provided a minimum net pressure of 1 psi exists at bottom of tank during test.
- Calibration:** Level sensor must be calibrated before each test.  
Thermistors must be checked annually and calibrated if necessary.
- Comments:** Not evaluated using manifold tank systems.  
Evaluated at EPA Edison Risk Reduction Engineering Laboratory prior to the EPA standard protocols being written.

Hasstech  
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Tel: (619) 457-5880

Evaluator: U.S. EPA Risk Reduction Engineering Laboratory  
Tel: (201) 321-6631

Date of Evaluation: 11/88

**Hasstech****Leak Computer Tank Test System****VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D > 99\%$  and  $P_{FA} < 1.0\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents. Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 90% full.
- Waiting Time:** Test data are acquired and recorded by a computer that calculates a leak rate every minute, and determines waiting time for satisfactory data (test is finished when the standard deviation of 30 sequential leak rates is less than half of the last leak rate determined).  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 1 hour, 10 minutes.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 7 thermistors.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 1 psi at bottom of tank during test.
- Calibration:** Level sensor must be calibrated before each test.  
Thermistors must be checked annually and calibrated if necessary.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Hasstech  
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Tel: (619) 457-5880

Evaluator: Law Engineering Industrial Services  
Tel: (800) 672-6601

Date of Evaluation: 04/17/91

**Heath Consultants, Inc.**

Petro Tite Line Tester

**LINE TIGHTNESS TEST METHOD**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=99.99\%$ and $P_{FA}=0.37\%$ .
<b>Leak Threshold:</b>	0.01 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil.
<b>Specification:</b>	System tests fiberglass and steel pipelines. Tests are conducted at 150% operating pressure. Mechanical line leak detector must be removed from pipeline for duration of test.
<b>Pipeline Capacity:</b>	Maximum of 129 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Minimum of 1 hour (four 15 minute readings).; A 1 hour pretest at or above test pressure is conducted to eliminate the effects of pipe deflection/stretch on the results. Test data are acquired and recorded manually.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Heath Consultants, Inc.  
9030 Monroe Rd.  
Houston, TX 77061  
Tel: (800) 432-8487

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/11/91

**Heath Consultants, Inc.****Petro Comp****VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99\%$  and  $P_{FA}=0.98\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, solvents, alcohols and water.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 100% full.  
An automatic product leveler must be used to maintain a constant product level during test.
- Waiting Time:** None between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 2 hours after the completion of the high level circulation.  
Test data are acquired and recorded by a computer after the completion of the high level circulation.  
Leak rate is calculated based on cumulative volume change during low level test (generally based on 1 hour average volume change).  
Product must be mixed continuously throughout test period.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a single temperature sensor.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 4 psi at bottom of tank during test.
- Calibration:** Temperature sensor is self calibrating.  
Level sensor must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.

Heath Consultants, Inc.  
9030 Monroe Rd.  
Houston, TX 77061  
Tel: (800)432-8487

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 12/15/90

**Heath Consultants, Inc.**

**Petro Tite II**

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99\%$  and  $P_{FA}=1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 100% full.  
An automatic product leveler must be used to maintain a constant product level during test.
- Waiting Time:** None between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
Test data are acquired and recorded manually.  
Leak rate calculated based on cumulative volume change during low level test (generally based on 1 hour average volume change).  
Product must be mixed continuously throughout test period.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a single DTS-2000 digital sensor.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 4 psi at bottom of tank during test.
- Calibration:** Sensor calibration must be checked at each use and the DTS-2000 recertified a minimum of once every 3 years.
- Comments:** Not evaluated using manifold tank systems.

Heath Consultants, Inc.  
9030 Monroe Rd.  
Houston, TX 77061  
Tel: (800)432-8487

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 11/01/90

**Horner EZY CHECK**

## EZY-Chek Manual Line Leak Detector

**LINE TIGHTNESS TEST METHOD**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=98.0\%$ and $P_{FA}=1\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.
<b>Specification:</b>	System tests fiberglass and steel pipelines. Tests are conducted at 150% operating pressure. Mechanical line leak detector must be removed from pipeline for duration of test.
<b>Pipeline Capacity:</b>	Maximum of 129 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Minimum of 1 hour, 30 minutes. Data are collected every 15 minutes. Testing period consists of a monitor mode and test mode. Data are collected in the monitor mode until two consecutive records are within 0.01 gallon of each other. Four data points must be taken in test mode for a final gph result. Test data are acquired and recorded manually. Manual calculations performed by the operator on site.
<b>Calibration:</b>	No temperature sensors used. No calibration required. System must be checked annually in accordance with manufacturer's instructions.

Horner EZY CHECK  
719 Scheurmann St.  
Essexville, MI 48732  
Tel: (517)891-9868

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 07/09/92

## Horner EZY CHECK

### EZY-Chek II Automatic Line Leak Detector

#### LINE TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gph with  $P_D=99.0\%$  and  $P_{FA}=1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.
- Specification:** System tests fiberglass and steel pipelines.  
Tests are conducted at 150% operating pressure.
- Pipeline Capacity:** Maximum of 129 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Minimum of 2 hours.  
Data are collected every 30 seconds.  
Testing period consists of a monitor mode and test mode.  
Data are collected in monitor mode until two consecutive 15 minute records are within 0.01 gallon of each other. Then an additional 15 minutes is required in monitor mode before start of test mode.  
Data are collected in test mode for 1 hour, 7 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- Calibration:** Sensors must be calibrated before each test.

Horner EZY CHECK  
719 Scheurmann St.  
Essexville, MI 48732  
Tel: (517)891-9868

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 07/13/92



**Horner EZY CHECK****EZY 3****NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (VACUUM)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when the vacuum decay is more than 1 inch water column pressure for non-volatile products and 10% of the lower determined vapor pressure for volatile products. A system should also not be declared tight if any water ingress is detected.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents.
- Tank Capacity:** Maximum of 12,000 gallons if groundwater is not present.  
Maximum of 50,000 gallons if groundwater is present and a vacuum of 1.0 to 1.7 psi can be maintained.  
For gasoline, ullage volume must be between 800 and 2,500 gallons.  
For diesel, ullage volume must be between 500 and 1,500 gallons.
- Waiting Time:** None between delivery and testing.
- Test Period:** Minimum of 2 hours, 30 minutes for gasoline (1 hour, 30 minutes vapor equilibrium recirculation time plus 1 hour test period).  
Minimum of 1 hour, 30 minutes for diesel and less volatile products (30 minutes vapor equilibrium recirculation time plus 1 hour test period).  
The vapor equilibrium recirculation time is the time required to apply a vacuum and to saturate ullage with vapors.  
Test data are acquired and recorded manually.
- Test Pressure:** Vacuum must be maintained between 1.0 to 1.7 psi at bottom of tank.  
Vacuum must not be greater than 4.0 psi in ullage.
- Temperature:** Vacuum decay is independent of product temperature.
- Water Sensor:** Conductivity water sensor must be used to detect water ingress and must be calibrated for every test.  
Minimum detectable water level is 0.014 inch.  
Minimum detectable change in water level is 0.0095 inch.  
Minimum water level in the tank must be adjusted to 0.014 inch before sensor calibration begins.  
Actual water ingress test period depends on tank size and must be calculated in accordance with manufacturer's instructions, but must be a minimum of 1 hour.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, water sensor must be used and test time extended to ensure water ingress detection during test.
- Comments:** Not evaluated using manifold tank systems.  
Evaluated using gasoline and diesel.  
Test may not be effective in some backfill (such as clay) because it may plug holes in tank.  
If soil is saturated with product, air or water ingress may not be detected by vacuum test. A well point in backfill may help identify presence of this condition.

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Tel: (517)891-9868

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Dates of Evaluation: 08/23/94 and 02/08/95

## Horner EZY CHECK

### Horner EZY-Chek I

#### VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)

- Certification:** Leak rate of 0.1 gph with  $P_D=99\%$  and  $P_{FA}=1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.
- Tank Capacity:** Maximum of 12,000 gallons.  
Tank must be minimum 100% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
Minimum of 3 hours between "topping off" and testing.  
Total minimum waiting time is 6 hours.  
There must be no product dispensing or delivery during waiting time.
- Test Period:** Minimum of 1 hour, 30 minutes (30 minute monitor period, plus 1 hour test period).  
Testing must continue until data meets manufacturer's stop test criteria.  
Volume data are collected and recorded by a strip chart recorder.  
Leak rate is calculated from data of last 1 hour of test period.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a resistance temperature detector (RTD) and displayed on an LCD readout.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide net pressure of 2-4 psi at bottom of tank.  
Groundwater level must be stable prior to and during test.
- Calibration:** Level sensors must be calibrated before each test.
- Comments:** Not evaluated using manifold tank systems.

Horner EZY CHECK  
719 Scheurmann St.  
Essexville, MI 48732  
Tel: (517)891-9868

Evaluator: W. A. Kibbe and Associates  
Tel: (517) 797-2425

Date of Evaluation: 10/03/90

**Horner EZY CHECK**

## Horner EZY-Chek II

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.95\%$  and  $P_{FA}=0.05\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.
- Tank Capacity:** Maximum of 12,000 gallons.  
Tank must be minimum 100% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
Minimum of 3 hours between "topping off" and testing.  
Total minimum waiting time is 6 hours.  
There must be no delivery or dispensing during waiting time.
- Test Period:** Minimum of 1 hour, 40 minutes (33 minutes monitor mode and 1 hour, 7 minutes test mode).  
At the conclusion of test mode, data are checked for the manufacturer's stop test criteria. If data do not meet the criteria, testing must continue.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from last 1 hour, 7 minutes of test period data.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a resistance temperature detector (RTD).
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide net pressure of 2-4 psi at bottom of tank.  
Groundwater level must be stable prior to and during test.
- Calibration:** Load cell must be calibrated before each use.
- Comments:** Not evaluated using manifold tank systems.

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719 Scheurmann St.  
Essexville, MI 48732  
Tel: (517)891-9868

Evaluator: W. A. Kibbe and Associates  
Tel: (517) 797-2425

Date of Evaluation: 09/18/90

## Horner EZY CHECK

### Horner EZY-Chek II

#### VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)

- Certification:** Leak rate of 0.1 gph with  $P_D=95.79\%$  and  $P_{FA}=4.21\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.
- Tank Capacity:** Maximum of 12,000 gallons.  
Tank must be between 98 and 100% full.
- Waiting Time:** Minimum of 8 hours between delivery and testing.  
There must be no product dispensing or delivery during waiting time.
- Test Period:** Minimum of 1 hour, 40 minutes (33 minutes monitor mode and 1 hour, 7 minutes test mode).  
At the conclusion of test mode, data are checked for the manufacturer's stop test criteria. If data do not meet the criteria, testing must continue.  
Test data are acquired and recorded by a computer.  
Leak rate calculated from last 1 hour, 7 minutes of test period data.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a resistance temperature detector (RTD).
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 1 psi at bottom of tank during test. If this cannot be accomplished, then the tank cannot be tested using this method.
- Calibration:** Load cell must be calibrated before each use.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Horner EZY CHECK  
719 Scheurmann St.  
Essexville, MI 48732  
Tel: (800)443-0711

Evaluator: W. A. Kibbe and Associates  
Tel: (517) 797-2425

Date of Evaluation: 06/25/90

**Horner Products Inc.**

SIR PRO 1 Version 1.0

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUALITATIVE)**

- Certification:** Leak rate of 0.2 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 18,000 gallons.
- Data Requirement:** Minimum of 30 days of product level and flow through data.
- Comments:** Not evaluated using data from manifolded tanks.  
Of 120 data sets submitted for evaluation, 10 were inconclusive.  
Median monthly throughput of tanks evaluated was 13,640 gallons.  
Leak rate of 0.2 gph was used in evaluation.  
Data sets evaluated were supplied by evaluator.

Horner Products Inc.  
104 Little Killarney Beach  
Bay City, MI 48706  
Tel: (800)443-0711

Evaluator: Petro Works  
Tel: (913) 681-9379

Date of Evaluation: 04/07/93

**Horner Products Inc.**

**SIR PRO 1 Version 2.0**

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUALITATIVE)**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=100\%$ and $P_{FA}=0\%$ . Version 2.0 is designed to meet annual test requirements.
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and fuel oil #4.
<b>Tank Capacity:</b>	Maximum of 18,000 gallons.
<b>Data Requirement:</b>	Minimum of 30 days of product level and flow through data.
<b>Comments:</b>	Not evaluated using data from manifold tank systems. Of 120 data sets submitted for evaluation, 9 were inconclusive. Median monthly throughput of tanks evaluated was 11,828 gallons. Leak rate of 0.1 gph was used in evaluation. Data sets evaluated were supplied by evaluator.

Horner Products Inc.  
104 Little Killarney Beach  
Bay City, MI 48706  
Tel: (800)443-0711

Evaluator: Petro Works  
Tel: (913) 681-9379

Date of Evaluation: 04/07/93

**Horner Products Inc.**

SIR PRO 1 Version 3.0

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.2 gph with  $P_D > 99\%$  and  $P_{FA} < 1\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 33,000 gallons for single tanks. Size limits using an acceptable protocol for manifold tank systems have not been determined.
- Data Requirement:** Minimum of 30 days of product level and flow through data.
- Comments:** Not evaluated for manifold tank systems using an acceptable protocol.  
73% of data sets were from manifold tank systems.  
Of 41 data sets submitted for evaluation, 4 were inconclusive.  
Median monthly throughput of tanks evaluated was 22,370 gallons.  
Leak rates ranging from 0.05 to 0.216 gph were used in evaluation.  
Data sets evaluated were supplied by evaluator.

Horner Products Inc.  
104 Little Killarney Beach  
Bay City, MI 48706  
Tel: (800)443-0711

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 04/07/93

**Horner Products Inc.**

**SIR PRO 1 Version 4.0**

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=98\%$  and  $P_{FA}=2\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 33,000 gallons for single tanks. Size limits using an acceptable protocol for manifold tank systems have not been determined.
- Data Requirement:** Minimum of 30 days of product level and flow through data.
- Comments:** Not evaluated for manifold tank systems using an acceptable protocol.  
73% of data sets were from manifold tank systems.  
Of 41 data sets submitted for evaluation, 4 were inconclusive.  
Median monthly throughput of tanks evaluated was 22,370 gallons.  
Leak rates ranging from 0.05 to 0.216 gph were used in evaluation.  
Data sets evaluated were supplied by evaluator.

Horner Products Inc.  
212 Morton St.  
104 Little Killarney Beach  
Tel: (800)443-0711

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 07/18/95



**HT Technologies, Inc.****Vakumatik Models V 60 and V 70 Ex****PRESSURE/VACUUM INTERSTITIAL MONITOR**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	System alarms when liquid enters interstitial space and vacuum decreases (pressure increases) above 34 millibars.
<b>Applicability:</b>	Gasoline, diesel. After consultation with the manufacturer, other liquids may be tested which are compatible with flexible liner.
<b>Tank capacity:</b>	Maximum of 20,000 gallons based on interstitial volume resulting when flexible liner is properly fitted and held in position against rigid tank wall. No minimum product level during test.
<b>Waiting time:</b>	None between delivery and testing.
<b>Test Period:</b>	Minimum of 120 hours.
<b>Comments:</b>	System tests the interstitial space between a properly fitted and installed flexible liner inside a rigid tank, or between the rigid walls of a double-walled tank. Flexible liner is held in position by maintaining a vacuum on interstitial space. Interstitial space is tested continuously. System allows for permeation of vapor from stored substance into interstitial space. Vapor discharged from vacuum pump must meet applicable air quality standards. System detects breaches in either flexible internal liner or rigid tank walls. Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods," March 1990. Reasonable temperature variations will not cause an alarm or missed detection.

HT Technologies  
4360 Brownsboro Rd.  
Louisville, KY 40207  
Tel: (602) 893-4000

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 08/17/97, Rev. 01/28/98

**Ibex Industries****Ibex Precision Test System****VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=99.5\%$ and $P_{FA}=0.5\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil #4, and solvents.
<b>Tank Capacity:</b>	Maximum of 18,000 gallons. Tank must be between 92 and 100% full.
<b>Waiting Time:</b>	Minimum of 12 hours between delivery and testing. Minimum of 3 hours between "topping off" and testing. There must be no product dispensing or delivery during waiting time.
<b>Test Period:</b>	Minimum of 1 hour. Test data are acquired and recorded by a computer. Leak rate calculated from data determined valid by statistical analysis. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined by a minimum of 6 temperature sensors.
<b>Groundwater:</b>	Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide net pressure of 2-4 psi on bottom of tank during test.
<b>Calibration:</b>	Level sensors must be calibrated before each test. Temperature sensors must be calibrated semi-annually.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product.

Ibex Industries  
 Moved and left no forwarding address  
 or phone number.

Evaluator: Applied Research Center  
 Tel: (805) 664-2173

Date of Evaluation: 01/18/91

**INCON Intelligent Controls, Inc.**

## TS-LLD Line Leak Detector

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 3 gph with $P_D = 100\%$ and $P_{FA} = 0\%$ .
<b>Leak Threshold:</b>	1.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuels, and fuel oil #4.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at operating pressure.
<b>Pipeline Capacity:</b>	Maximum of 163 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is 3 minutes. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Dispenser shutdown, numerical "fail" code display and LED alarm light activation if leak is declared.
<b>Calibration:</b>	System must be checked annually in accordance with manufacturer's instructions.

INCON Intelligent Controls, Inc.  
74 Industrial Park Rd.  
Saco, ME 04072  
Tel: (800) 872-3455

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 07/06/95

**INCON Intelligent Controls, Inc.****TS-LLD Line Leak Detector****AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D = 100\%$  and  $P_{FA} = 0\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, and fuel oil #4.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 163 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 50 minutes to 8 hours for rigid piping.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, numerical "fail" code display and LED alarm light activation if leak is declared.
- Calibration:** System must be checked annually in accordance with manufacturer's instructions.
- Comments:** After 28 days have elapsed since the last passing monthly line leak test, system shuts off the submersible pump.  
System display will flash number of days since the last passing test.  
Operator may reset button to enable dispensing for a 24 hour period.  
This procedure may be used for a maximum of 4 days.  
After 32 days have elapsed since last monthly test, system will disable dispensing and automatically initiate a test, and system will not authorize dispensing until a test is passed or system is serviced.

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Tel: (816) 443-2494  
Date of Evaluation: 07/06/95

**INCON Intelligent Controls, Inc.**

## TS-LLD Line Leak Detector

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D = 100\%$ and $P_{FA} = 0\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuels, and fuel oil #4.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at operating pressure.
<b>Pipeline Capacity:</b>	Maximum of 163 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum of 8 hours between dispensing and testing.
<b>Test Period:</b>	Response time is 40 minutes. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Dispenser shutdown, numerical "fail" code display and LED alarm light activation if leak is declared.
<b>Calibration:</b>	System must be checked annually in accordance with manufacturer's instructions.

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Tel: (816) 443-2494

Date of Evaluation: 07/06/95

**INCON Intelligent Controls, Inc.**

TS-LLD Line Leak Detector  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 3 gph with $P_D = 100\%$ and $P_{FA} = 0\%$ .
<b>Leak Threshold:</b>	1.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuels, and fuel oil #4.
<b>Specification:</b>	System tests flexible pipelines. Tests are conducted at operating pressure.
<b>Pipeline Capacity:</b>	Maximum of 49.6 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is 3 minutes. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Dispenser shutdown, numerical "fail" code display and LED alarm light activation if leak is declared.
<b>Calibration:</b>	System must be checked annually in accordance with manufacturer's instructions.

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Date of Evaluation: 07/06/95

**INCON Intelligent Controls, Inc.**TS-LLD Line Leak Detector  
(for Flexible Pipelines)**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D = 100\%$ and $P_{FA} = 0\%$ .
<b>Leak Threshold:</b>	0.1 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuels, and fuel oil #4.
<b>Specification:</b>	System tests flexible pipelines. Tests are conducted at operating pressure.
<b>Pipeline Capacity:</b>	Maximum of 49.6 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is 2 hours, 21 minutes. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Dispenser shutdown, numerical "fail" code display and LED alarm light activation if leak is declared.
<b>Calibration:</b>	System must be checked annually in accordance with manufacturer's instructions.
<b>Comments:</b>	After 28 days have elapsed since the last passing monthly line leak test, system shuts off the submersible pump. System display will flash number of days since the last passing test. Operator may reset button to enable dispensing for a 24 hour period. This procedure may be used for a maximum of 4 days. After 32 days have elapsed since last monthly test, system will disable dispensing, and automatically initiate a test, and system will not authorize dispensing until a test is passed or system is serviced.

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Date of Evaluation: 07/06/95

**INCON Intelligent Controls, Inc.**

TS-LLD Line Leak Detector  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D = 100\%$ and $P_{FA} = 0\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuels, and fuel oil #4.
<b>Specification:</b>	System tests flexible pipelines. Tests are conducted at operating pressure.
<b>Pipeline Capacity:</b>	Maximum of 49.6 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum of 8 hours between dispensing and testing.
<b>Test Period:</b>	Response time is 50 minutes. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Dispenser shutdown, numerical "fail" code display and LED alarm light activation if leak is declared.
<b>Calibration:</b>	System must be checked annually in accordance with manufacturer's instructions.

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Date of Evaluation: 07/06/95



**INCON Intelligent Controls, Inc.**

TS 1000/1001/2001  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=99.9\%$  and  $P_{FA}=0.1\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel and fuel oil #4.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tanks less than 95% full may be tested.  
Minimum product level required based on tank diameter is as follows:  
**48"** dia/ min 12"; **64"** dia/ min 14"; **72"** dia/ min 15"; **96"** dia/ min 17.5";  
**126"** dia/min. 21.5".
- Waiting Time:** Minimum of 6 hours 1 minute between delivery and testing.  
None between dispensing and testing.  
There must be no delivery during waiting time
- Test Period:** Length of the test is determined automatically based on quality of test data.  
Average data collection time during evaluation was 5 hours 10 minutes.  
Test data are acquired and recorded by a microprocessor.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during the test.
- Temperature:** Probe contains 5 thermistors to monitor product temperature. At least one thermistor must be submerged in product during testing.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.208 inch.  
Minimum detectable water level change is 0.011 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As the product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
TS1000 and 1001 can support up to 4 tanks. TS2001 can support up to 8 tanks.

INCON Intelligent Controls, Inc.  
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Tel: (800) 872-3455

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 08/05/92 and 09/05/97

**INCON Intelligent Controls, Inc.**

TS 1000/1001/2001  
Incon LL2 Magnetostrictive Probe

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gallons per hour with  $P_D=95.7\%$  and  $P_{FA}=4.3\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel and fuel oil #4.  
Other liquids may be tested after consultation with the manufacturer.
- Capacity:** Maximum of 30,000 gallons.  
Tanks less than 95% full may be tested.  
Minimum product level required based on tank diameter as follows:  
**48"** dia/ min 12"; **64"** dia/ min 14"; **72"**dia/ min 15"; **96"** dia/ min 17.5"; **126"**dia/min. 21.5".
- Waiting Time:** Minimum of 4 hours 9 minute between delivery and testing.  
Minimum of 2 hours between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period** The length of the test is determined automatically based on quality of test data.  
Average data collection time during the evaluation was 6 hours, 51 minutes.  
Test data is acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during the test.
- Temperature:** Probe contains 5 thermistors to monitor product temperature. At least one thermistor must be submerged in product during testing.
- Water Sensor:** Must be used to detect water ingress. Minimum detectable water level in the tank is 0.208 inches. Minimum detectable water level change is 0.011 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** This equipment was not evaluated using manifolded tanks.  
Tests only the portion of the tank containing product.  
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product. TS1000 and 1001 can support up to 4 tanks. TS2001can support up to 8 tanks.

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Evaluator: Ken Wilcox Associates  
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Date of Evaluation: 05/14/98

**INCON Intelligent Controls, Inc.**

TS 1000/1001/2001  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=99.9\%$ and $P_{FA}=0.1\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel and fuel oil #4. Other liquids may be tested after consultation with the manufacturer.
<b>Tank Capacity:</b>	Maximum of 15,000 gallons. Tanks less than 95% full may be tested. Minimum product level required based on tank diameter is as follows: <b>48"</b> dia/ min 12"; <b>64"</b> dia/ min 14"; <b>72"</b> dia/ min 15"; <b>96"</b> dia/ min 17.5"; <b>126"</b> dia/min. 21.5".
<b>Waiting Time:</b>	Minimum of 5 hours 18 minutes between delivery and testing. None between dispensing and testing. There must be no delivery during waiting time
<b>Test Period:</b>	Length of the test is determined automatically based on quality of test data. Average data collection time during evaluation was 5 hours 44 minutes. Test data are acquired and recorded by a microprocessor. Leak rate is calculated from data determined to be valid by statistical analysis. There must be no dispensing or delivery during the test.
<b>Temperature:</b>	Probe contains 5 thermistors to monitor product temperature. At least one thermistor must be submerged in product during testing.
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.208 inch. Minimum detectable water level change is 0.011 inch.
<b>Calibration:</b>	Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product. As the product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product. TS1000 and 1001 can support up to 4 tanks. TS2001 can support up to 8 tanks.

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Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 09/05/97

**INCON Intelligent Controls, Inc.**

TS 2000  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=99.9\%$  and  $P_{FA}=0.5\%$ .
- Leak Threshold:** 0.058 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil, and waste oil.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
Minimum of 2 hours between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 3 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 resistance temperature detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.04 inches.  
Minimum detectable water level change is 0.011 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
TS 2000 can support up to 4 tanks.

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Evaluator: Ken Wilcox Associates  
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Date of Evaluation: 05/10/91

**INCON Intelligent Controls, Inc.**

Tank Sentinel TS-1000EFI  
TSP-DIS BriteSensor

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: opto-electric

**Test Results:**

	unleaded <u>gasoline</u>	<u>water</u>	synthetic <u>gasoline</u>	diesel <u>fuel</u>	heating <u>oil #2</u>
Accuracy (%)	100	100	100	100	100
Detection time (min:sec)	03:13	03:18	03:17	3:00	3:02
Fall time (min)	<01	<01	<01	<01	<01
Lower detection limit (cm)					
product activation height	1.60	1.92	N/D*	N/D	N/D

\* See glossary.

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, diesel fuel, heating oil #2, water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.  
Detector is reusable.

INCON Intelligent Controls, Inc.  
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Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 12/09/94

**INCON Intelligent Controls, Inc.**

Tank Sentinel TS-1000EFI  
TSP-HIS BriteSensor

**LIQUID-PHASE INTERSTITIAL DETECTOR**

**Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: magnetic switch

**Test Results:**

	50 % by weight Ethylene glycol in water		30 % by weight Calcium chloride in water	
	<u>up</u>	<u>down</u>	<u>up</u>	<u>down</u>
Accuracy (%)	100	100	100	100
Response time (min:sec)	17.41	16:47	17:28	16:56
Recovery time (min)	<1	<1	<1	<1
Lower Detection Limit (cm)				
Product activation height	19.56	2.53	19.40	2.50

**Specificity Results:**

Activated: 50 % by weight Ethylene glycol in water, 30 % by weight Calcium chloride in water.

**Comments:**

Intended to monitor level of either ethylene glycol or calcium chloride solutions in interstitial or annular space of a double-walled tank. Activates if any significant gain or loss of solution occurs.  
Test procedures used were modified by evaluator from Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.  
Detector is reusable.

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Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495  
  
Date of Evaluation: 03/20/95

**INCON Intelligent Controls, Inc.**

Tank Sentinel TS-1000/TS-2000  
TSP-EIS Standard Sensor, TSP-PS Liquid Contact Sensor

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: opto-electric

**Test Results:**

TSP-EIS	<u>unleaded gasoline</u>	<u>water</u>	<u>synthetic gasoline</u>	<u>diesel fuel</u>	<u>heating oil #2</u>
Accuracy (%)	100	100	100	100	100
Detection time (min:sec)	03:01	03:07	03:17	3:00	3:02
Fall time (min)	<01	<01	<01	<01	<01
Lower detection limit (cm)					
product activation height	1.50	N/D*	N/D	N/D	N/D

**Test Results:**

TSP-PS	<u>unleaded gasoline</u>	<u>water</u>	<u>synthetic gasoline</u>	<u>diesel fuel</u>	<u>heating oil #2</u>
Accuracy (%)	100	100	100	100	100
Detection time (min:sec)	01:14	01:25	01:13	01:10	01:16
Fall time (min)	<01	<01	<01	<01	<01
Lower detection limit (cm)					
product activation height	1.37	N/D	N/D	N/D	N/D

\* See glossary.

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, diesel fuel, heating oil #2, water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.  
Detector is reusable.

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Evaluator: Carnegie Mellon Research Institute  
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Dates of Evaluations: EIS - 01/30/96; PS - 07/02/93

**INCON Intelligent Controls, Inc.**

Tank Sentinel TS-1000/TS-2000  
TSP-HLS Standard Sensor, TSP-ULS Standard Sensor

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: magnetic switch

**Test Results:**

TSP-HLS	unleaded <u>gasoline</u>	<u>water</u>	synthetic <u>gasoline</u>	diesel <u>fuel</u>	heating <u>oil #2</u>
Accuracy (%)	100	100	100	100	100
Detection time (min:sec)	10:09	09:25	10:14	09:55	10:25
Fall time (min)	<01	<01	<01	<01	<01
Lower detection limit (cm)					
product activation height	5.64	N/D*	N/D	N/D	N/D

**Test Results:**

TSP-ULS	unleaded <u>gasoline</u>	<u>water</u>	synthetic <u>gasoline</u>	diesel <u>fuel</u>	heating <u>oil #2</u>
Accuracy (%)	100	100	100	100	100
Detection time (min:sec)	03:50	03:34	03:49	03:50	03:41
Fall time (min)	<01	<01	<01	<01	<01
Lower detection limit (cm)					
product activation height	2.70	N/D	N/D	N/D	N/D

\* See glossary.

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, diesel fuel, heating oil #2, water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.  
Detector is reusable.

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Evaluator: Carnegie Mellon Research Institute  
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Date of Evaluations: 01/30/96



**INCON Intelligent Controls, Inc.**

Tank Sentinel TS-1000EFI  
TSP-DDS BriteSensor, TSP-DTS BriteSensor

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: magnetic switch, float, and hydrocarbon sensitive polymer

**Test Results:**

TSP-DDS	unleaded <u>gasoline</u>	water - <u>low level</u>	water - <u>high level</u>	synthetic <u>gasoline</u>	diesel <u>fuel</u>	heatin <u>oil #2</u>
Accuracy (%)	100	100	100	100	100	100
Detection time (min:sec)	05:35	06:02	06:09	06:00	38:43	38:16
Fall time (min:sec)	34:27	<01:00	<01:00	28:53	> 60:00	> 60:00
Lower detection limits (cm)						
product activation height	0.50	N/D*	3.16	N/D	N/D	N/D
product thickness on water	0.04	N/D	N/D	N/D	N/D	N/D

**Test Results:**

TSP-DTS	unleaded <u>gasoline</u>	water - <u>low level</u>	water - <u>high level</u>	synthetic <u>gasoline</u>	diesel <u>fuel</u>	heatin <u>oil #2</u>
Accuracy (%)	100	100	100	100	100	100
Detection time (min:sec)	06:02	06:02	06:13	05:59	38:43	38:16
Fall time (min:sec)	22:28	<01:00	<01:00	28:53	> 60:00	> 60:00
Lower detection limits (cm)						
product activation height	0.50	N/D	3.16	N/D	N/D	N/D
product thickness on water	0.04	N/D	N/D	N/D	N/D	N/D

\* See glossary.

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, diesel fuel, heating oil #2, water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991. The procedures for lower detection limit for product thickness were EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors," March 1990. Detector is reusable.

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Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluations: 12/09/94

**INCON Intelligent Controls, Inc.**

Tank Sentinel TS-1000EFI  
TSP-MWS BriteSensor Groundwater Probe

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR**

**Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: hydrocarbon-sensitive polymer

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	10:13	06:42
Fall time (min:sec)	26:52	14:43
Lower detection limit (cm)	0.04	0.04

**Specificity Results:**

Activated: unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s).

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
Detector is reusable.

INCON Intelligent Controls, Inc.  
74 Industrial Park Rd.  
Saco, ME 04072  
Tel: (800) 872-3455

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495  
  
Date of Evaluation: 02/19/96

**Keekor Environmental Products**

TankTite Leak Detection Kernel Version 1.0 with Keeprobe K7  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=95.4\%$  and  $P_{FA}=4.6\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 90% full.
- Waiting Time:** Minimum of 8 hours, 6 minutes between delivery and testing.  
Minimum of 15 minutes after a maximum dispensing rate of 50 gallons per minute.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 3 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated as the average of subsets of all data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 resistance temperature detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.41 inch.  
Minimum detectable water level change is 0.0013 inch.
- Calibration:** Execution of Probe Check diagnostic routine is recommended prior to leak detect tests to ensure sensor is fully operational and in calibration.  
Annual preventative maintenance should be performed per manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Keekor Environmental Products  
14806 N. 74th St.  
Scottsdale, AZ 85267-4830  
Tel: (602) 443-0001

Evaluator: Arizona State University  
Tel: (602) 965-3185

Date of Evaluation: 10/25/94

**Leak Detection Systems, Inc.**

Tank Auditor, Version RTD V.2.16

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.98\%$  and  $P_{FA}=0.02\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold, except as noted below.  
If using two level testing, the level is changed by 3 feet between the two tests and a system should not be declared tight if the net change between the two tests is greater than 0.02 gph.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 100% full.
- Waiting Time:** Minimum is variable depending on site conditions, but not be less than 6 hours between delivery and testing.  
Minimum of 1 hour between "topping off" and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 1 hour.  
Test data are acquired and recorded by a computer.  
Leak rate calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a temperature averaging probe.
- Groundwater:** If depth to groundwater cannot be determined, two tests must be performed with a level change of at least 3 feet between tests. If depth to groundwater in backfill can be determined and it is above bottom of the tank, product level must be adjusted to provide height differential of 3 feet between product and groundwater in backfill during test.
- Calibration:** Temperature averaging probe and level sensors must be calibrated before each test.
- Comments:** Not evaluated using manifold tank systems.  
Evaluation of system did not include a field evaluation of groundwater compensation by two level testing.

Leak Detection Systems, Inc.  
106 Longwater Dr.  
Norwell, MA 02061  
Tel: (617) 878-7766

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 11/29/91

**Mallory Controls**

Pollulert Probes MD221G/T, MD221G/TRA

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: electrical conductivity

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>	JP-4 <u>jet fuel</u>
Accuracy (%)	100	100	100
Detection time (sec)	4	7	2
Fall time (sec)	3	4	4
Lower detection limit (cm)	0.08-0.32	0.08-0.32	0.08-0.32

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, JP-4 jet fuel, toluene, xylene(s).

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Evaluation was conducted using probe FD221G/TRA.

According to manufacturer, probes beginning with "MD" have identical performance as older probes beginning with "FD."

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Liquid-Phase ASTM-Formatted Methods," June 29, 1990.

Detector is reusable.

Detector has been discontinued by manufacturer.

Mallory Controls  
 2831 Waterfront Pkwy. E. Dr.  
 Indianapolis, IN 46214  
 Tel: Not Available

Evaluator: Radian Corp.  
 Tel: (512) 454-4797

Date of Evaluation: 07/08/91

**Mallory Controls**

Pollulert Probes MD241R, MD241RRA, MD241G, MD241GRA

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR**

**Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: electrical conductivity

**Test Results:**

	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
Accuracy (%)	100	100	100
Detection time (sec)	2	2	1
Fall time (sec)	1	2	2
Lower detection limit (cm)	0.16-0.32	0.16-0.32	0.16-0.32

**Specificity Results:**

Activated: unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, JP-4 jet fuel, toluene, xylene (s).

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Evaluation was conducted using probe FD241R. According to manufacturer, probes beginning with "MD" have identical performance as older probes beginning with "FD." Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Liquid-Phase ASTM-Formatted Methods," June 29, 1990. Detector is reusable. Detector has been discontinued by manufacturer.

Mallory Controls  
2831 Waterfront Pkwy. E. Dr.  
Indianapolis, IN 46214  
Tel: Not available

Evaluator: Radian Corp.  
Tel: (512) 454-4797  
Date of Evaluation: 07/08/91

**Mallory Controls**

Pollulert Probes MD221V, MD221VRA, MD210V, MD210VRA

**VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: adsistor

**Test Results:**

	<u>unleaded gasoline</u>	<u>synthetic gasoline</u>	<u>JP-4 jet fuel</u>
Accuracy (%)	100	100	100
Detection time (sec)	91	65	86
Fall time (min:sec)	5:39	4:23	9:38
Lower detection limit (ppm)	10 to 100	10 to 500	10 to 50

**Specificity Results:**

Activated: unleaded gasoline, synthetic gasoline, JP-4 jet fuel, toluene, xylene(s).

Not Activated: n-hexane.

**Comments:**

Evaluation was conducted using probe FD221V.

According to manufacturer, probes beginning with "MD" have identical performance as older probes beginning with "FD."

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Detector has been discontinued by manufacturer.

Mallory Controls  
 2831 Waterfront Pkwy. E. Dr.  
 Indianapolis, IN 46214  
 Tel: Not available.

Evaluator: Radian Corp.  
 Tel: (512) 454-4797

Date of Evaluation: 07/08/91

**Marley Pump Co.**

Red Jacket PPM 4000, RLM 9000, ST 1401L, and ST1801L

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 3.0 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, solvents, methanol, ethanol, and gasoline blends with methanol and ethanol.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at 5-10 psi.
<b>Pipeline Capacity:</b>	Maximum of 55.1 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is 2 minutes. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Recording and display of day, date, and time of conclusive test. Dispenser shutdown, message display, and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
<b>Comments:</b>	PPM 4000 is a stand alone automatic electronic line leak detector. RLM 9000 is a combination of RLM 5000 and PPM 4000 automatic electronic line leak detectors. ST1401L is a combination of ST 1400 automatic tank gauge and the ST 1401L automatic electronic line leak detector. ST 1801L is a combination of ST1800 automatic tank gauge and ST 1801L automatic electronic line leak detector.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/07/91, Rev. 04/94



**Marley Pump Co.**

Red Jacket PPM 4000, RLM 9000

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, solvents, methanol, ethanol, and gasoline blends with methanol and ethanol.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at 5-10 psi.
- Pipeline Capacity:** Maximum of 55.1 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 10 minutes to 3 hours.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Recording and display of day, date, and time of conclusive test.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** PPM 4000 is a stand alone automatic electronic line leak detector.  
RLM 9000 is a combination of RLM 5000 automatic tank gauge and PPM 4000 automatic electronic line leak detector.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/07/91, Rev. 04/94

**Marley Pump Co.**

Red Jacket PPM 4000, RLM 9000

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	0.047 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, solvents, methanol, ethanol, and gasoline blends with methanol and ethanol.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at 5-10 psi.
<b>Pipeline Capacity:</b>	Maximum of 55.1 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is 2 hours, 30 minutes to 3 hours. Test data are acquired and recorded by a microprocessor. Calculations are automatically performed by the microprocessor.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Recording and display of day, date, and time of conclusive test. Dispenser shutdown, message display, and alarm activation if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
<b>Comments:</b>	PPM 4000 is a stand alone automatic electronic line leak detector. RLM 9000 is a combination of RLM 5000 automatic tank gauge and PPM 4000 automatic electronic line leak detector.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/07/91, Rev. 04/94

**Marley Pump Co.**

Red Jacket PPM 4000, RLM 9000, ST 1401L, and ST 1801L  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, solvents, methanol, ethanol, and gasoline blends with methanol and ethanol.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at 10 to 12 psi.
- Pipeline Capacity:** Maximum of 27.6 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 9 minutes to 2 hours, 30 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Recording and display of day, date, and time of conclusive test.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** PPM 4000 is a stand alone automatic electronic line leak detector.  
RLM 9000 is a combination of RLM 5000 automatic tank gauge and PPM 4000 automatic electronic line leak detector.  
ST 1401L is a combination of ST 1400 automatic tank gauge and ST 1401L automatic electronic line leak detector.  
ST1801L is a combination ST1800 automatic tank gauge and ST1801L automatic electronic line leak detector.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 07/28/96, Rev. 01/31/97

**Marley Pump Co.**

Red Jacket PPM 4000, RLM 9000, ST 1401L, and ST 1801L  
(for flexible pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel oil #4, solvents, methanol, ethanol, and gasoline blends with methanol and ethanol.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at operating pressure to the equivalence of 45 psi.
- Pipeline Capacity:** Maximum of 27.6 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 26 minutes to 4 hours.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Recording and display of day, date, and time of conclusive test.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** PPM 4000 is a stand alone automatic electronic line leak detector.  
RLM 9000 is a combination of RLM 5000 automatic tank gauge and PPM 4000 automatic electronic line leak detector.  
ST 1401L is a combination of ST 1400 automatic tank gauge and ST 1401L automatic line leak detector.  
ST 1801L is a combination of ST 1800 automatic tank gauge and ST 1801L automatic line leak detector.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 07/28/96, Rev. 01/31/97

**Marley Pump Co.**

Red Jacket ST 1401L and ST 1801L, CPT and PRO-Link

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, solvents, methanol, ethanol, and gasoline blends with methanol and ethanol.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure equivalent to 30 psi.
- Pipeline Capacity:** Maximum of 163 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 2 minutes to 4 hours.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Recording and display of day, date, and time of conclusive test.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** ST 1401L is a combination of ST 1400 automatic tank gauge and ST 1401L automatic electronic line leak detector.  
ST 1801L is a combination of ST 1800 automatic tank gauge and ST 1801L automatic electronic line leak detector.  
CPT is an electronic line leak detector component.  
Pro-Link is a combination of an automatic tank gauge and an automatic electronic line leak detector.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 07/28/96, Rev. 01/31/97

**Marley Pump Co.**

Red Jacket ST 1401L, and ST1801L, CPT and Pro-Link

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.047 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, solvents, methanol, ethanol, and gasoline blends with methanol and ethanol.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at 10-20 psi.
- Pipeline Capacity:** Maximum of 163 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 4 minutes to 4 hours, 45 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Recording and display of day, date, and time of conclusive test.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** The ST1401L is a combination of ST 1400 automatic tank gauge and ST 1401L automatic electronic line leak detector.  
The ST 1801L is a combination of ST1800 automatic tank gauge and ST 1801L automatic electronic line leak detector.  
CPT is an electronic line leak detector component.  
Pro-Link is a combination of an automatic tank gauge and an automatic electronic line leak detector.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 07/28/96, Rev. 01/31/97

**Marley Pump Co.**

Red Jacket DLD and XLD

**AUTOMATIC MECHANICAL LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 3.0 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel and solvents.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at 8-12 psi.
<b>Pipeline Capacity:</b>	Maximum of 129 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is 6 seconds.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Restricted flow to dispenser if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 12/21/90

**Marley Pump Co.**

Red Jacket FX1/FX2

**AUTOMATIC MECHANICAL LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and some solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at 8-12 psi.
- Pipeline Capacity:** Maximum of 316 gallons for FX1 and 362 gallons for FX2.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.  
Stabilization time up to 45 minutes may be required after dispensing when temperature extremes are present.
- Test Period:** Response time is less than 5 minutes.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Restricted flow to dispenser if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/14/94, Rev. 06/01/94



**Marley Pump Co.**

Red Jacket FX1/FX2 Flexline  
(for Flexible Pipelines)

**AUTOMATIC MECHANICAL LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and some solvents.
- Specification:** System tests pressurized flexible pipelines.
- Pipeline Capacity:** Maximum of 49 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is less than 3 minutes.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Restricted flow to dispenser if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** Enviroflex pipeline with a bulk modulus\* of 1,280 psi was used during this evaluation.  
To perform a valid test, time delays must be integrated into electronic dispensing equipment or retrofitted in junction box. Without this delay, there is no guarantee that a nozzle will be closed for sufficient time to allow leak detector to perform pipeline test and provide uninterrupted service.

\*See glossary.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/22/94

**Marley Pump Co.**

Red Jacket FX1D, FX2D, FX2DV  
Installed in the Big-Flow

**AUTOMATIC MECHANICAL LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 362 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is less than 3 minutes.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Restricted flow to dispenser if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/15/94, Rev. 07/30/96

**Marley Pump Co.**

Red Jacket XLP

**AUTOMATIC MECHANICAL LINE LEAK DETECTOR**

<b>Certification:</b>	Leak rate of 3.0 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel and solvents.
<b>Specification:</b>	System tests pressurized fiberglass and steel pipelines. Tests are conducted at 15-22 psi.
<b>Pipeline Capacity:</b>	Maximum of 129 gallons.
<b>Waiting Time:</b>	None between delivery and testing. None between dispensing and testing.
<b>Test Period:</b>	Response time is 6 seconds.
<b>System Features:</b>	Permanent installation on pipeline. Automatic testing of pipeline. Preset threshold. Single test to determine if pipeline is leaking. Restricted flow to dispenser if leak is declared.
<b>Calibration:</b>	System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/22/94

**Marley Pump Co.**

Red Jacket XLP  
(for Flexible Pipelines)

**AUTOMATIC MECHANICAL LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 48.9 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is less than 3 minutes.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Restricted flow to dispenser if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 04/19/93

**Marley Pump Co.**

Red Jacket ATM System,  
Version RLM 5000, 5001, and 9000  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 3 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from all data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 temperature sensors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.04 inches.  
Minimum detectable water level change is 0.011 inch.
- Calibration:** Temperature sensors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 04/02/91

**Marley Pump Co.**

Sonic Technology (ST) 1400-1800 Series Tank Monitoring System  
ATG Automatic Tank Gauging Monitor, LLM Series Liquid Level Monitor  
FMS Fuel Management Monitor  
(Ultrasonic Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 18,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 10 hours between delivery and testing.  
None between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 2 hours, 21 minutes.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from all data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a variable number of temperature sensors spaced at approximately 6-inch intervals.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.112 inch.  
Minimum detectable water level change is 0.011 inch.
- Calibration:** Temperature sensors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
System was previously known as LT1 Automatic Product Level Monitor and was manufactured by Level Tech, Inc. (purchased by Marley 9/91).

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: ADA Technologies  
Tel: (303) 792-5615

Date of Evaluation: 09/30/92

**Marley Pump Co.**

Sonic Technology (ST) 1400-1800 Series Tank Monitoring System  
 ATG Automatic Tank Gauging Monitor, LLM Series Liquid Level Monitor,  
 FMS Fuel Management Monitor  
 (Ultrasonic Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.9\%$  and  $P_{FA}=0.01\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, and some solvents.
- Tank Capacity:** Maximum of 18,000 gallons.  
 Tank must be between 95 and 100% full.
- Waiting Time:** Minimum of 12 hours between delivery and testing.  
 None between dispensing and testing.  
 There must be no delivery during waiting time.
- Test Period:** Minimum of 2 hours, 21 minutes.  
 Test data are acquired and recorded by a computer.  
 Leak rate is calculated from all data collected.  
 There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a variable number of temperature sensors spaced at approximately 6-inch intervals.
- Water Sensor:** Must be used to detect water ingress.  
 Minimum detectable water level in the tank is 0.112 inch.  
 Minimum detectable water level change is 0.011 inch.
- Calibration:** Temperature sensors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
 Tests only portion of tank containing product.  
 As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
 EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
 System was previously known as LT1 Automatic Product Level Monitor and was manufactured by Level Tech, Inc. (purchased by Marley 9/91).

Marley Pump Co.  
 9650 Alden Street  
 Lenexa, KS 66215  
 Tel: (888) 262-7539

Evaluator: ADA Technologies, Inc.  
 Tel: (303) 792-5615

Date of Evaluation: 09/25/92

**Marley Pump Co.**

Red Jacket Electronics Combination High Level/Low Level Sensor  
(RE400-179-5 to RE400-199-5), Hydrostatic Sensor (RE400-042-5)

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: float switch

**Test Results:**

	unleaded gasoline		diesel fuel		water	
	<u>high</u>	<u>low</u>	<u>high</u>	<u>low</u>	<u>high</u>	<u>low</u>
RE400-179-5 to RE400-199-5						
Accuracy (%)	100	100	100	100	100	100
Detection time (sec)	<1	<1	<1	<1	<1	<1
Fall time (sec)	<1	<1	<1	<1	<1	<1
Lower detection limit (cm)	N/D*	3.80	N/D	4.26	N/D	3.53
RE400-042-5						
Accuracy (%)	100	100	100	100	100	100
Detection time (sec)	<1	<1	<1	<1	<1	<1
Fall time (sec)	<1	<1	<1	<1	<1	<1
Lower detection limit (cm)	30.42	4.93	30.22	4.61	29.93	4.19

\*See glossary.

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s), water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were modified from U.S. EPA's "Standard Test Procedures for Evaluation of Leak Detection Methods: Liquid-Phase Out-of-Tank Liquid Product Detectors," March 1990.

Evaluator claims sensor will respond to any liquid once threshold has been exceeded.

For RE400-179-5 to RE400-199-5, model numbers and high level detection limit vary with length of sensor.

Detector is reusable.

Marley Pump Co.  
9650 Alden Street  
Lenexa, KS 66215  
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 06/01/95



**Marley Pump Co.**

Red Jacket Electronics RE400-058-5, RE400-059-5, RE400-147-5, RE400-148-5, RE400-111-5, RE400-203-5, RE400-204-5, RE400-180-5

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: various: float switch, except RE400-203-5 (electrical conductivity and optical), RE400-204-5 (conductive polymer), and RE400-180-5 (optical)

**Test Results:**

	unleaded gasoline	diesel fuel	water
RE400-058-5, RE400-059-5, RE400-147-5, RE400-148-5 Overfill Sensor			
Accuracy (%)	100	100	100
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (cm)	2.97	2.82	2.57
RE400-111-5 Sump Sensor			
Accuracy (%)	100	100	100
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (cm)	3.60	3.41	3.20
RE400-203-5 Optical Liquid Discrimination Sensor			
Accuracy (%)	100	100	100
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (cm)	1.17	1.12	1.10
RE400-204-5 Dispenser Pan Monitor			
Accuracy (%)	100	100	100
Detection time (hr:min:sec)	<00:30:00	<02:00:00	<00:00:01
Fall time (hr:min:sec)	<01:20:00	1-2 days	<00:00:01
Lower detection limit (cm)	0.44	0.44	1.08
RE400-180-5 Liquid Refraction Sensor			
Accuracy (%)	100	100	100
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (cm)	1.17	1.12	1.10

**Specificity Results:**

Activated: unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s), water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were modified from U.S. EPA's "Standard Test Procedures for Evaluation of Leak Detection Methods: Liquid-Phase Out-of-Tank Liquid Product Detectors," March 1990. Evaluator claims sensors will respond to any liquid once threshold has been exceeded. For RE400-179-5 to RE400-199-5, model numbers and high level detection limit vary with length of sensor. For RE400-204-5, after exposure to diesel, sensor reading may not return to pre-contaminated level. Detectors are reusable.

Marley Pump Co.  
 9650 Alden Street  
 Lenexa, KS 66215  
 Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates  
 Tel: (816) 443-2494

Date of Evaluation: 06/01/95

**Marley Pump Co.**

## Red Jacket PPM 4000 with Optical Liquid Discrimination Sensor

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: optical sensor

**Test Results: \***

	unleaded <u>gasoline</u>	synthetic <u>fuel</u>	diesel <u>fuel</u>	heating <u>oil #2</u>	<u>water</u>
Accuracy (%)	100	100	100	100	100
Response time (min)	2.19	2.20	1.93	2.23	2.81
Recovery time (min)	< 1	< 1	< 1	< 1	< 1
Product activation height (cm)	1.08	1.10	1.03	1.07	1.20
Lower detection limit (cm)	0.30	N/D**	N/D	N/D	N/D

\*At a flow rate of 0.13 gal/hr in a 4.8 cm diameter test chamber.

\*\* See glossary.

**Specificity Results:**

Activated: unleaded gasoline, diesel fuel, synthetic fuel, heating oil #2, water.

**Manufacturer's specifications:**

Manufacturer's instructions do not specify procedures or schedules for maintenance or calibration.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.

Detector is listed as interstitial due to intended use.

Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Evaluation lists all PPM, RLM, and ST models, including the Multiplexer Unit; however, evaluation procedures were performed using model PPM 4000.

Detector is reusable.

Marley Pump Co.  
 9650 Alden Street  
 Lenexa, KS 66215  
 Tel: (888) 262-7539

Evaluator: Carnegie Mellon Research Institute  
 Tel: (412) 268-3495

Date of Evaluation: 04/28/92

**Mine Safety Appliances**

Tankgard  
P/N 481532 S/N 03095

**VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: quantitative  
Sampling frequency: continuous  
Operating principle: metal oxide semiconductor

**Test Results:**

	<u>benzene</u>	<u>2-methylbutane</u>
Accuracy (%)	100	100
Detection time (sec)	5	16
Fall time (min:sec)	04:12	04:42
Lower detection limit (ppm)	12.5	12.5

**Specificity Results:**

Activated (100%): benzene, n-butane, n-hexane, 2-methylpentane, toluene, isobutane.

**Manufacturer's specifications:**

Maximum Wire Distance: 500 ft using 18 AWG  
Response Time: 30 seconds  
Recover Time: 1 minute maximum  
Sensor Life: 2 year warranty

Mine Safety Appliances  
P. O. Box 427  
Pittsburgh, PA 15230  
Tel: (412) 776-8600

Evaluator: Carnegie Mellon Research Institution  
Tel: (412) 268-3495

Date of Evaluation: 03/26/91

Mine Safety Appliances

Tankgard VIII  
P/N 488803 S/N 00389

VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: quantitative  
Sampling frequency: continuous  
Operating principle: metal oxide semiconductor

Test Results:

	<u>benzene</u>	<u>2-methylbutane</u>
Accuracy (%)	100	100
Detection time (sec)	5	16
Fall time (min:sec)	04:12	04:42
Lower detection limit (ppm)	12.5	12.5

Specificity Results:

Activated (100%): benzene, n-butane, n-hexane, 2-methylpentane, toluene, isobutane.

Manufacturer's specifications:

Maximum Wire Distance: 500 ft using 18 AWG.  
Response Time: 30 seconds.  
Recover Time: 1 minute maximum.  
Sensor Life: 2 year warranty.

Mine Safety Appliances  
P. O. Box 427  
Pittsburgh, PA 15230  
Tel: (412) 776-8600

Evaluator: Carnegie Mellon Research Institution  
Tel: (412) 268-3495  
  
Date of Evaluation: 03/28/91

**Omntec/Electro Levels Mfg., Inc.**

OEL 8000  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=99.9\%$  and  $P_{FA}=0.1\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 6 hours, 30 minutes between delivery and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.055 inch.  
Minimum detectable change in water level is 0.011 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Omntec/Electro Levels Mfg., Inc.  
1993 Pond Rd.  
Ronkonkoma, NY 11779  
Tel: (516) 981-2001

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 01/17/96

**Omntec/Electro Levels Mfg., Inc.**

OEL 8000  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D=97.8\%$  and  $P_{FA}=2.2\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, solvents.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 6 hours, 30 minutes between delivery and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.055 inch.  
Minimum detectable change in water level is 0.011 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Omntec/Electro Levels Mfg., Inc.  
1993 Pond Rd.  
Ronkonkoma, NY 11779  
Tel: (516) 981-2001

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 01/17/96

**Omntec/Electro Levels Mfg., Inc.**

L-LL-R-1, LS-ASC, PDS-ASC, PDWS-1, PDWF-1

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: all: refractive index of liquids; PDS-ASC, PDWS-1, and PDWF-1: also electrical conductivity

**Test Results:**

	L-LL-R-1 (low level)			L-LL-R-1 (high level)		
	unleaded			unleaded		
	<u>gasoline</u>	<u>diesel fuel</u>	<u>water</u>	<u>gasoline</u>	<u>diesel fuel</u>	<u>water</u>
Accuracy (%)	100	100	100	100	100	100
Detection time (sec)	< 1	< 1	< 1	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1	< 1	< 1	< 1
Lower detection limit (cm)	6.63	6.53	6.45	21.7	21.8	21.7
	PDWS-1			PDWF-1		
	unleaded			unleaded		
	<u>gasoline</u>	<u>diesel fuel</u>	<u>water</u>	<u>gasoline</u>	<u>diesel fuel</u>	<u>water</u>
Accuracy (%)	100	100	100	100	100	100
Detection time (sec)	< 1	< 1	< 1	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1	< 1	< 1	< 1
Lower detection limit (cm)	1.93	1.85	1.63	1.60	1.67	1.02
	PDS-ASC/LS-ASC					
	unleaded					
	<u>gasoline</u>	<u>diesel fuel</u>	<u>water</u>			
Accuracy (%)	100	100	100			
Detection time (sec)	< 1	< 1	< 1			
Fall time (sec)	< 1	< 1	< 1			
Lower detection limit (cm)	2.24	2.11	1.42			

**Specificity Results:**

Activated: unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s), water.

**Manufacturer's specifications:**

LS and PD series responds to any liquid with an index of refraction different than air. PD series responds to any conducting liquid.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.

Detectors are listed as interstitial due to intended use.

Test procedures used were modified from EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors," March 1990, and EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Non-Volumetric Tank Tightness Test Methods," March 1990.

Detector is reusable.

Omntec/Electro Levels Mfg., Inc.  
 1993 Pond Rd.  
 Ronkonkoma, NY 11779  
 Tel: (516) 467-5787

Evaluator: Ken Wilcox Associates  
 Tel: (816) 443-2494

Date of Evaluation: 06/12/93

One Plus Corp.

Leak Edge  
Models 100-3001, 100-4001

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: product permeable

Test Results:

	unleaded gasoline	synthetic gasoline
Accuracy (%)	100	100
Detection time (hr:min:sec)	00:05:41	00:05:14
Fall time (hr:min:sec)	00:30:39	00:18:36
Lower detection limit (cm)	0.02	0.02

Specificity Results:

Activated: unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s).

Manufacturer's specifications:

Operating temperatures: Sensor is -40 degrees C to 74 degrees C; Monitor Module is -20 degrees C to 49 degrees C.

Comments:

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
Detector is reusable.

One Plus Corp.  
1955 Shermer Rd., Suite 100  
Northbrook, IL 60062  
Tel: (708) 498-0955

Evaluator: Underwriters Laboratories Inc.  
Tel: (847) 272-8800

Date of Evaluation: 12/17/91



**Patriot Sensors and Controls Corp. (formerly MagneTek)**7021 Digital Tank Gauge  
(7030 Series Magnetostrictive Probe)**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 99.96\%$  and  $P_{FA} = 0.044\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, solvents and other substances with a specific gravity  $>0.6$  and a viscosity  $<1500$  cp.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 2 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by a 7021 controller (computer).  
Leak rate calculated from data determined to be statistically valid.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 1 resistance temperature detector (RTD).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.947 inch.  
Minimum detectable water level change is 0.0254 inch.
- Calibration:** RTD and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
System may also be used to test at a minimum product height of 18 inches or a 14% full tank, whichever is higher, if the leak rate is set at 0.1 gallons per hour ( $P_D = 95.34\%$  and  $P_{FA} = 4.66\%$ ).

Patriot Sensors and Controls Corp.  
1080 N. Crooks Rd.  
Clawson, MI 48017-1097  
Tel: (810) 435-0700

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 02/07/91

**Patriot Sensors and Controls Corp. (formerly MagneTek)**

7021 Digital Tank Gauge  
(7030 Series Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D = 95.34\%$  and  $P_{FA} = 4.66\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, solvents and other substances with a specific gravity  $>0.6$  and a viscosity  $<1500$  cp.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 8 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by a 7021 controller (computer).  
Leak rate calculated from data determined to be statistically valid.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 1 resistance temperature detector (RTD).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.947 inch.  
Minimum detectable water level change is 0.0254 inch.
- Calibration:** RTD and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
System may also be used to test a minimum product height of 18 inches or a 14% full tank, whichever is higher, if leak rate is set at 0.1 gph.

Patriot Sensors and Controls Corp.  
1080 N. Crooks Rd.  
Clawson, MI 48017-1097  
Tel: (810) 435-0700

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 02/07/91

**Patriot Sensors and Controls Corp. (formerly MagneTek)**

7021 Digital Tank Gauge  
(7100 Series Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 99.9\%$  and  $P_{FA} = 0.1\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, solvents, and other substances with a specific gravity > 0.6 and a viscosity < 1500 cp.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 2 hours between delivery and testing.  
Minimum of 2 hours between dispensing and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
Test data are acquired and recorded by a computer.  
Leak rate calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.186 inch.  
Minimum detectable water level change is 0.0048 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Patriot Sensors and Controls Corp.  
1080 N. Crooks Rd.  
Clawson, MI 48017-1097  
Tel: (810) 435-0700

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 03/14/95

**Patriot Sensors and Controls Corp. (formerly MagneTek)**

7021 Digital Tank Gauge  
(7100 Series Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D = 99.6\%$  and  $P_{FA} = 0.4\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, solvents and other substances with a specific gravity  $>0.6$  and a viscosity  $<1500$  cp.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 2 hours between delivery and testing.  
Minimum of 2 hours between dispensing and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 6 hours.  
Test data are acquired and recorded by a computer.  
Leak rate calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.186 inch.  
Minimum detectable water level change is 0.0048 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Patriot Sensors and Controls Corp.  
1080 N. Crooks Rd.  
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Tel: (810) 435-0700

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 03/14/95

**PermAlert**

PAL-AT Models AT20C, AT50C, AT40K  
PHL Hydrocarbon Sensor

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: electrical conductivity

**Test Results: \***

	unleaded
	<u>gasoline</u>
Accuracy (%)	100
Response time (min)	1.13
Recovery time (min)	8.83
Product activation height (cm)	0.53
Lower detection limit (cm)	0.38

\*At a flow rate of 0.13 gal/hr in a 4.8 cm diameter test chamber.

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2.  
Not activated: water.

**Comments:**

Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems":  
Final Report - November 11, 1991.  
Detector is reusable.

PermAlert  
7720 N. Lehigh Ave.  
Niles, IL 60714-3491  
Tel: (847) 966-2190

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 02/05/92

PermAlert

TankWatch Models PHM10, PHMS  
Combination Hydrocarbon/Water Probe

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: electrical conductivity

Test Results: \*

	unleaded <u>gasoline</u>	<u>water</u>
Accuracy (%)	100	100
Response time (min)	0.30	<1
Recovery time (min)	1.97	1.68
Product activation height (cm)	0.18	0.80
Lower detection limit (cm)	0.56	1.93

\*At a flow rate of 0.13 gal/hr in a 4.8 cm diameter test chamber.

Specificity Results:

Activated: diesel fuel, synthetic fuel, heating oil #2.

Comments:

Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems":  
Final Report - November 11, 1991.  
Detector is reusable.

PermAlert  
7720 N. Lehigh Ave.  
Niles, IL 60714-3491  
Tel: (847) 966-2190

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495  
  
Date of Evaluation: 06/16/92

**PermAlert**

TankWatch Models PHM10, PHMS  
Hydrocarbon Probe

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: electrical conductivity

**Test Results: \***

	unleaded <u>gasoline</u>
Accuracy (%)	100
Response time (min)	0.25
Recovery time (min)	2.33
Product activation height (cm)	0.17
Lower detection limit (cm)	0.38

\*At a flow rate of 0.14 gal/hr in a 4.8 cm diameter test chamber.

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2.  
Not activated: water.

**Comments:**

Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems":  
Final Report - November 11, 1991.  
Detector is reusable.

PermAlert  
7720 N. Lehigh Ave.  
Niles, IL 60714-3491  
Tel: (847) 966-2190

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 06/16/92

**PermAlert**

PAL-AT Models AT20C, AT50C, AT40K  
AGW Sensor Cable

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: impedance change

**Test Results: \***

	unleaded gasoline		
	1/3	2/3	MER
	MER**	MER	
	<u>1348 ft.</u>	<u>2644 ft.</u>	<u>3982 ft.</u>
Accuracy (%)	100	100	100
Response time (min)	9.92	6.25	21.28
Recovery time (min)	1.0	1.0	1.0
Product activation height (cm)	2.03	1.13	5.00
Detection length (cm)	116.3	64.8	286.1
Lower detection limits (cm)			
Product activation height	N/D**	N/D	5.1
Detection length	N/D	N/D	295.6

\*At a flow rate of 0.14 gal/hr in test chamber.

\*\* See glossary.

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2, water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. System can monitor interstitial spaces.

Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Evaluation also covered quantitative leak location.

Detector is reusable.

PermAlert  
7720 N. Lehigh Ave.  
Niles, IL 60714-3491  
Tel: (847) 966-2190

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 01/17/92



**PermAlert**

PAL-AT Models AT20C, AT50C, AT40K  
with PHFW Hydrocarbon Probe and Type 1 or Type 2 Sensor

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: product soluble

**Test Results:**

Type 1 Sensor:	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	00:24	00:09
Fall time (min:sec)	N/A*	N/A
Lower detection limit (cm)	0.01	0.01
Type 2 Sensor:		
Accuracy (%)	100	100
Detection time (min:sec)	14:39	08:45
Fall time (min:sec)	N/A*	N/A
Lower detection limit (cm)	0.01	0.01

\* See glossary.

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s).

**Manufacturer's specifications:**

Operating temperature range is 0 degrees F to 90 degrees F.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Detector is not reusable; sensor filament must be replaced after contact with hydrocarbons.

PermAlert  
7720 N. Lehigh Ave.  
Niles, IL 60714-3491  
Tel: (847) 966-2190

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 09/15/92

**PermAlert**

PAL-AT Models AT20C, AT50C, AT40K  
TFH Hydrocarbon Sensor Cable

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: impedance change

**Test Results: \***

	unleaded gasoline		
	1/3	2/3	MER
	MER**	MER	
	<u>1368 ft.</u>	<u>2685 ft.</u>	<u>4046 ft.</u>
Accuracy (%)	100	100	100
Response time (min)	3.40	7.48	16.21
Recovery time (min)	>60	>60	>60
Product activation height (cm)	0.65	1.33	3.53
Detection length (cm)	27.7	56.8	150.4
Lower detection limits (cm)			
Product activation height	N/D**	N/D	3.6
Detection length	N/D	N/D	152.9

\*At a flow rate of 0.16 gal/hr in test chamber.

\*\* See glossary.

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2.

Not Activated: water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. System can monitor interstitial spaces.

Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Evaluation also covered quantitative leak location.

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7720 N. Lehigh Ave.  
Niles, IL 60714-3491  
Tel: (847) 966-2190

Evaluator: Carnegie Mellon Research  
Institute  
Tel: (412) 268-3495

Date of Evaluation: 02/11/92

**Petro Vend, Inc.**

Petrosonic III  
(Version 4.05 Model 613, 4 inch, Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=99.07\%$  and  $P_{FA}=0.93\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 12 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated as the difference between the first and last data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 resistance temperature detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.92 inch.  
Minimum detectable change in water level is 0.02 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
Petrosonic III version 4.04 is an older model automatic tank gauging system, which is no longer being manufactured.

Petro Vend, Inc.  
6900 Santa Fe Dr.  
Hodgkins, IL 60525-9909  
Tel: (708) 485-4200

Evaluator: Underwriters Laboratories, Inc.,  
Tel: (847) 272-8800

Date of Evaluation: 11/04/94

**Petro Vend, Inc.**

Site Sentinel Model II and III,  
(Model 613, 2 inch, Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=96.55\%$  and  $P_{FA}=3.45\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 12 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated as the difference between the first and last data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 resistance temperature detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 2.47 inches.  
Minimum detectable change in water level is 0.037 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Petro Vend, Inc.  
6900 Santa Fe Dr.  
Hodgkins, IL 60525-9909  
Tel: (708) 485-4200

Evaluator: Underwriters Laboratories, Inc.,  
Tel: (847) 272-8800

Date of Evaluation: 11/04/94

**Petro Vend, Inc.**

Site Sentinel Model II and III,  
(Model 613, 4 inch, Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=99.82\%$  and  $P_{FA}=0.18\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 12 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated as the difference between the first and last data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 resistance temperature detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.92 inch.  
Minimum detectable change in water level is 0.02 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Petro Vend, Inc.  
6900 Santa Fe Dr.  
Hodgkins, IL 60525-9909  
Tel: (708) 485-4200

Evaluator: Underwriters Laboratories, Inc.,  
Tel: (847) 272-8800

Date of Evaluation: 11/04/94

**Petro Vend, Inc.**

Site Sentinel Model II and III,  
(Model 613, 4 inch, Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.95\%$  and  $P_{FA}=0.35\%$ .
- Leak Threshold:** 0.06 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 90% full.
- Waiting Time:** Minimum of 12 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated as the difference between the first and last data collected.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 resistance temperature detectors (RTDs).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.92 inch.  
Minimum detectable change in water level is 0.02 inch.
- Calibration:** RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Petro Vend, Inc.  
6900 Santa Fe Dr.  
Hodgkins, IL 60525-9909  
Tel: (708) 485-4200

Evaluator: Underwriters Laboratories, Inc.,  
Tel: (847) 272-8800

Date of Evaluation: 11/04/94

**Petro Vend, Inc.**

Petrosentry IV, Petrosentry VIII, SiteSentinel  
Liquid Sensor

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: thermal conductivity

**Test Results: \***

	unleaded <u>gasoline</u>
Accuracy (%)	100
Response time (min)	0.51
Recovery time (min)	<1
Product activation height (cm)	0.35
Lower detection limit (cm)	0.76

\*At a flow rate of 0.14 gal/hr in a 4.8 cm diameter test chamber.

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2, water.

**Comments:**

Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems":  
Final Report - November 11, 1991.  
Detector is reusable.

Petro Vend, Inc.  
6900 Santa Fe Dr.  
Hodgkins, IL 60525-9909  
Tel: (708) 485-4200

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 10/15/92

Petro Vend, Inc.

Petrosentry IV, Petrosentry VIII, SiteSentinel  
Universal Reservoir Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: float switch

Test Results: \*

	<u>50 % by weight Ethylene glycol in water</u>		<u>30 % by weight Calcium chloride in water</u>	
	<u>Up</u>	<u>Down</u>	<u>Up</u>	<u>Down</u>
Accuracy (%)	100	100	100	100
Response time (min)	19.62	16.86	17.77	15.91
Recovery time (min)	<1	<1	<1	<1
Product activation height (cm)	20.9	5.90	20.5	5.95

\*At a flow rate of 0.21 gal/hr in test chamber.

Specificity Results:

Not applicable

Comments:

Intended to monitor level of either ethylene glycol or calcium chloride solutions in the interstitial or annular space of a double-walled tank.  
Activates an alarm if any significant gain or loss of solution occurs.  
Test procedures used were modified by evaluator from Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.  
Detector is reusable.

Petro Vend, Inc.  
6900 Santa Fe Dr.  
Hodgkins, IL 60525-9909  
Tel: (708) 485-4200

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495  
  
Date of Evaluation: 10/15/92



**Petro Vend, Inc.**

Petrosentry IV, Petrosentry VIII, SiteSentinel  
Universal Sump Sensor

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: float switch

**Test Results: \***

	unleaded
	<u>gasoline</u>
Accuracy (%)	100
Response time (min)	8.32
Recovery time (min)	<1
Product activation height (cm)	3.37
Lower detection limit (cm)	3.97

\*At a flow rate of 0.20 gal/hr in a 7.8 cm diameter test chamber.

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2, water.

**Comments:**

Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems":  
Final Report - November 11, 1991.  
Detector is reusable.

Petro Vend, Inc.  
6900 Santa Fe Dr.  
Hodgkins, IL 60525-9909  
Tel: (708) 485-4200

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 10/15/92

Petro Vend, Inc.

SiteSentinel  
30-3206, -3207, -3210 Sensors

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: product permeable

Test Results:

	unleaded gasoline	synthetic gasoline
Accuracy (%)	100	100
Detection time (hr:min:sec)	00:01:41	00:05:14
Fall time (hr:min:sec)	07:28:44	00:18:36
Lower detection limit (cm)	0.02	0.02

Specificity Results:

Activated: unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s).

Manufacturer's specifications:

Conductive polymer.

Comments:

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
Detector is reusable.

Petro Vend, Inc.  
6900 Santa Fe Dr.  
Hodgkins, IL 60525-9909  
Tel: (708) 485-4200

Evaluator: Underwriters Laboratories, Inc.  
Tel: (847) 272-8800  
  
Date of Evaluation: 12/10/92

**Petro Vend, Inc.**

## Petrosentry TLD III

## VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

**Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: metal oxide semiconductor

**Test Results:**

	<u>benzene</u>	<u>2-methylbutane</u>
Accuracy (%)	100	100
Detection time (min:sec)	00:05	00:16
Fall time (min:sec)	04:12	00:42
Lower detection limit (ppm)	12.5	12.5

**Specificity Results:**

Activated: benzene, n-butane, n-hexane, isobutane, 2-methylpentane, toluene.

**Manufacturer's specifications:**

Maximum Wire Distance: 500 ft using 18 AWG

Petro Vend, Inc.  
6900 Santa Fe Dr.  
Hodgkins, IL 60525-9909  
Tel: (708) 485-4200

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 03/26/91

Petro Vend, Inc.

SiteSentinel  
Smart Module and Vapor Sensor

VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: metal oxide semiconductor

Test Results:

	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
Accuracy* (%)	100	100	100
Detection time (min:sec)	00:05	00:07	00:10
Fall time (min:sec)	06:30	03:35	04:26
Lower detection limit (ppm)	10	10	10

\*For tests conducted with 1000 ppm of test gas.

Specificity Results:

Activated: unleaded gasoline, synthetic gasoline, n-hexane, JP-4 jet fuel, toluene, xylene(s).

Comments:

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Petro Vend, Inc.  
6900 Santa Fe Dr.  
Hodgkins, IL 60525-9909  
Tel: (708) 485-4200

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495  
  
Date of Evaluation: 04/16/92

**Pneumercator Company, Inc.**

LC1000, E-14-29, E-700-1, LDE-700, LDE-740, TMS 3000  
 LS600AB, LS600LDBN, LS610, RSU800

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: float switch

**Test Results:**

	LS600AB			LS600LDBN			LS610	
	unleaded	diesel	water	unleaded	diesel	water	unleaded	diesel
	gasoline			gasoline			gasoline	
Accuracy (%)	100	100	100	100	100	100	100	100
Detection time (sec)	<1	<1	<1	<1	<1	<1	<1	<1
Fall time (sec)	<1	<1	<1	<1	<1	<1	<1	<1
Lower detection limit (in)	3.32	3.28	3.18	0.99	0.97	0.87	0.44	0.43

	RSU800 (low level)			RSU800 (high level)		
	unleaded	diesel	water	Unleaded	diesel	water
	gasoline			Gasoline		
Accuracy (%)	100	100	100	100	100	100
Detection time (min)	<1	<1	<1	<1	<1	<1
Fall time (min)	<1	<1	<1	<1	<1	<1
Lower detection limit (ppm)	2.57	2.53	2.31	13.31	13.24	13.01

**Specificity Results:**

Activated: unleaded gasoline, diesel fuel, water.

Manufacturer and evaluator claim sensor will respond to any liquid.

**Comments:**

Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors" and from EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods."  
 Detector is reusable.

Pneumercator Company, Inc.  
 120 Finn Court  
 Farmingdale, NY 11735  
 Tel: (516) 293-8450

Evaluator: Ken Wilcox Associates  
 Tel: (816) 443-2494

Date of Evaluation: 01/22/96

**Pneumercator Company, Inc.**

LDE 700, LDE 740, LDE 9000  
Sensor Probe Models 9-901, 9-902, 9-903

**LIQUID-PHASE INTERSTITIAL DETECTOR**

**Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: capacitance

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	<00:01	<00:01
Fall time (hr:min:sec)	Manual reset	Manual reset
Lower detection limit (cm)		
9-901	0.32	0.36
9-902	0.36	0.34
9-903	0.76	0.74

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s), water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were a combination of EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors" and EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods." Detector is reusable.

Pneumercator Company, Inc.  
120 Finn Court  
Farmingdale, NY 11735  
Tel: (516) 293-8450

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
  
Date of Evaluation: 12/14/93

**ProTank, Inc.**

## LTH-5000 Line Tester

**LINE TIGHTNESS TEST METHOD**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=99.8\%$ and $P_{FA}=1.3\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and fuel oil, and solvents.
<b>Specification:</b>	System tests fiberglass and steel pipelines. Tests are conducted at 150% operating pressure. Mechanical line leak detector must be removed from pipeline for duration of test.
<b>Pipeline Capacity:</b>	Maximum of 40 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum of 1 hour between dispensing and testing.
<b>Test Period:</b>	Minimum of 10 minutes. Repeat 10 minute cycles are necessary if data does not meet the manufacturer's criteria. Test data are acquired and recorded manually. Manual calculations are performed by operator on site.
<b>Calibration:</b>	Sensors must be calibrated before each test.

ProTank, Inc.  
3545 Lomita Blvd., Suite G  
Torrance, CA 90505  
Tel: (800) 438-1111

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 02/14/91

**ProTank, Inc.**

LTP-5000 Line Tester

**LINE TIGHTNESS TEST METHOD**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.0\%$  and  $P_{FA}=0.1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4, fuel oil #6, and solvents.
- Specification:** System tests fiberglass and steel pipelines.  
Tests are conducted at 150% operating pressure.  
Mechanical line leak detector must be removed from pipeline for duration of test.
- Pipeline Capacity:** Maximum of 41 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 1 hour between dispensing and testing.
- Test Period:** Minimum of 1 hour.  
Pipe deflection, vapor pockets, and large temperature differences may produce inconsistent readings.  
Testing to continue until stable conditions are present.  
Test data are acquired and recorded manually.  
Manual calculations are performed by operator on site.
- Calibration:** Sensors must be calibrated before each test.

ProTank, Inc.  
3545 Lomita Blvd., Suite G  
Torrance, CA 90505  
Tel: (800) 438-1111

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 08/30/91



**ProTank, Inc.**

UTA-5000 Ullage Tester  
(Vacuum or Pressure Test)

**NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when the acoustic signal detected is different from the baseline.  
Baseline is the acoustic signal before tank is pressurized or evacuated.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents.
- Tank Capacity:** Maximum ullage volume is 16,500 gallons.
- Waiting Time:** None between delivery and testing
- Test Period:** A few minutes to determine background noise and a leak.  
Depends on background noise at the site and on the size of the leak.  
After the desired pressure has been reached, the tank should be allowed to settle for 10 minutes.
- Test Pressure:** Vacuum of 1 psi must be maintained in ullage by a vacuum blower, or total pressure at bottom of tank of 4 psi must be maintained using nitrogen.
- Temperature:** Acoustic signal is independent of product temperature.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above product level, vacuum test should not be used.  
Pressure test may only be used if net pressure can be maintained at a minimum 1 psi throughout ullage during test. If this requires more than 5 psi total pressure at tank bottom, the ullage test must not be used.
- Comments:** Not evaluated using manifold tank systems.  
Evaluated using diesel fuel.  
Tests only ullage portion of the tank.  
Product-filled portion of tank must be tested with an underfilled test method.  
Microphone was 25 feet away from the leak source during evaluation.  
If background noise is too high, test is inconclusive.  
Noise signals are tape recorded (not digitally recorded).  
Vacuum test method may not be effective in some backfill (such as clay) because it may plug holes in tank.  
If soil is saturated with product, air or water ingress may not be declared by vacuum test. A well point in backfill may help identify presence of this condition.

ProTank, Inc.  
3545 Lomita Blvd., Suite G  
Torrance, CA 90505  
Tel: (800) 438-1111

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 01/15/93

**ProTank, Inc.**

UTF-5000 Ullage Tester  
(Pressure Test)

**NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=95.24\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when the make-up gas flow rate into ullage equals or exceeds 0.275 cubic feet/hour.
- Applicability:** Gasoline, diesel, aviation fuel, heavy fuel oil #4, and solvents.
- Tank Capacity:** Maximum ullage volume is 7,500 gallons.
- Waiting time:** Minimum of 2 hours between delivery and testing.
- Test Period:** Minimum of 20 minutes, consisting of 2 consecutive 10-minute test periods. Test data are acquired and recorded manually.
- Test Pressure:** Pressure must be increased in ullage such that total pressure at bottom of tank does not exceed 5.0 psi.  
Pressure must be maintained for a minimum of 5 minutes per 1,000 gallons of ullage.  
At conclusion of this stabilization period, ullage pressure must be reduced by 0.5 psi for remainder of test.
- Temperature:** Ullage must be monitored for rate of temperature change, which must not exceed manufacturer's tabulated values.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above product level, net pressure must exceed 1 psi in the ullage during test. If this requires more than 5 psi total pressure at tank bottom, the ullage test must not be used.
- Comments:** Not evaluated using manifold tank systems.  
Evaluated using diesel fuel.  
Tests only ullage portion of tank.  
Product-filled portion of tank must be tested using a volumetric underfilled test method.

ProTank, Inc.  
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Torrance, CA 90505  
Tel: (800) 438-1111

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 12/04/92

**ProTank, Inc.**

UTFP-5000 Ullage Tester  
(Pressure Test)

**NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=95.24\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when the pressure decay trend equals or exceeds  $\pm 0.016$  psi/hr.
- Applicability:** Gasoline, diesel, aviation fuel, heavy fuel oils #2 through #6, and solvents.
- Tank Capacity:** Maximum ullage volume is 10,260 gallons.
- Waiting time:** Minimum of 2 hours between delivery and testing.
- Test Period:** Minimum of 30 minutes (after data trend has been established).
- Test Pressure:** Total pressure of 4.0 psi must be applied at bottom of tank.
- Temperature:** Ullage must be monitored during test, and a correction factor is applied to account for temperature changes. If ullage temperature changes exceed 5 degrees F, test must not be conducted.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above product level, net pressure must be maintained at a minimum of 1 psi in the ullage during test.
- Comments:** Not evaluated using manifold tank systems.  
Evaluated using diesel fuel.  
Tests only ullage portion of tank.  
Product-filled portion of tank must be tested using a volumetric underfilled test method.

ProTank, Inc.  
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Tel: (800) 438-1111

Evaluator: ADA Technologies, Inc.  
Tel: (303) 792-5615

Date of Evaluation: 04/10/92

**ProTank, Inc.**

Fast Test  
(Underfill Test)

**NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (VACUUM)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when the acoustic signal detected is different from the baseline.  
Baseline is the acoustic signal before tank is evacuated.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4, waste oil, and solvents.
- Tank Capacity:** Maximum product volume of 30,000 gallons. Tank product level must be between 7 and 86 inches.
- Waiting Time:** None between delivery and testing
- Test Period:** A few minutes to determine background noise and a leak.  
Depends on background noise at the site and on size of leak.
- Test Pressure:** Vacuum of 0.5 psi beyond the vacuum required to overcome the tank bottom pressure\* must be maintained in ullage by a vacuum blower.
- Temperature:** Acoustic signal is independent of product temperature.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above the tank bottom, this test method may not be used.
- Comments:** Not evaluated using manifold tank systems.  
Evaluated using diesel fuel.  
Tests only portion of tank containing product.  
Ullage portion of tank must be tested with an ullage test method.  
Microphone was 25 feet away from the leak source during evaluation.  
If background noise is too high, test is inconclusive.  
Noise signals are tape recorded (not digitally recorded).  
Vacuum test method may not be effective in some backfill (such as clay) because it may plug holes in tank.  
If soil is saturated with product, air or water ingress may not be declared by vacuum test. A well point in backfill may help identify presence of this condition.

\* Net vacuum applied = 0.5 psi + [inches of product level x the specific gravity of product x 0.036].

ProTank, Inc.  
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Torrance, CA 90505  
Tel: (800) 438-1111

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 06/25/96

**ProTank, Inc.**

## VU-5000 Underfill Tester

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.9\%$  and  $P_{FA}=0.1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, solvents, and other products.
- Tank Capacity:** Maximum of 18,000 gallons.  
Tank must contain minimum 24 inches of product.
- Waiting Time:** Must be long enough between delivery and testing to ensure a temperature change of less than 0.09 degrees F per hour, typically a minimum of 2 hours.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from average over data window.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is typically determined by 5 thermistors.  
A minimum of 1 thermistor is required.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 1 psi at bottom of tank during test. (There must be a difference of at least 37 inches between groundwater level and product level to provide a net pressure of 1 psi at bottom of tank during test.)
- Calibration:** Thermistors must be checked annually and calibrated if necessary.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

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Torrance, CA 90505  
Tel: (800) 438-1111

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 02/15/93

**ProTank, Inc.**

VUP-5000 Underfill Tester

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.99\%$  and  $P_{FA}=0.005\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil, waste oil, and solvents.
- Tank Capacity:** Maximum of 18,000 gallons.  
Tank must be between 11 and 95% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
None between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 3 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from average of subsets of all collected data.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by temperature sensor probes.  
A minimum 12 inches of product must be present for the temperature probes to operate properly.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted during test to provide a minimum net pressure of 1 psi at bottom of tank during test. (There must be a difference of at least 37 inches between groundwater level and product level to provide a net pressure of 1 psi at bottom of tank during test.)
- Calibration:** Temperature probes and floats must be checked for proper operation prior to each test.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

ProTank, Inc.  
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Tel: (800) 438-1111

Evaluator: ADA Technologies  
Tel: (303) 792-5615

Date of Evaluation: 09/09/92

**Raychem Corp.**TraceTek Alarm and Locator Modules  
TT502 Fuel Sensing Cable**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: electrical conductivity

**Test Results: \***

	unleaded gasoline		
	1/3 MER** <u>334 m</u>	2/3 MER <u>665 m</u>	MER <u>995 m</u>
Accuracy (%)	100	100	100
Response time (min)	22.11	17.13	19.42
Recovery time (min)	N/A**	N/A	N/A
Product activation height (cm)	1.53	1.53	1.53
Detection length (cm)	61	61	61
Lower detection limits (cm)			
Product activation height	N/D**	N/D	0.77
Detection length	N/D	N/D	10

\*At a flow rate of 0.17 gal/hr in test chamber.

\*\* See glossary.

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2.

Not Activated: water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991. Evaluation also covered quantitative leak location.

Raychem Corp.  
 300 Constitution Dr.  
 Menlo Park, CA 94025-1164  
 Tel: (415) 361-3333

Evaluator: Carnegie Mellon Research Institute  
 Tel: (412) 268-3495

Date of Evaluation: 05/15/92

**Raychem Corp.**TraceTek Alarm and Locator Modules  
TT3000 Fuel Sensing Cable**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: electrical conductivity

**Test Results:**

	3% by weight salt in water			other solutions**
	1/3 MER*	2/3 MER	MER	MER
	<u>508 m</u>	<u>1016 m</u>	<u>1524 m</u>	<u>1524</u>
Accuracy (%)	100	100	100	100
Response time (min)	<1	<1	<1	<1
Recovery time (min)	<1	<1	<1	<1
Product activation height (cm)	<0.3	<0.3	<0.3	<0.3
Detection length (cm)	<15.2	<15.2	<15.2	<15.2
Lower detection limits (cm)				
Product activation height	N/D*	N/D	<0.3	N/D
Detection length	N/D	N/D	<5.08	N/D

\* See glossary.

\*\* 5 % by volume oil in 3 % by weight salt water, 10 % by volume oil in 3 % by weight salt water, 0.1 M hydrochloric acid (HCl), 0.1 M sodium hydroxide (NaOH).

**Specificity Results:**

**Activated:** water, 5 % by volume oil in 3 % by weight salt water, 10 % by volume oil in 3 % by weight salt water, 0.1 M hydrochloric acid (HCl), 0.1 M sodium hydroxide (NaOH).

**Not Activated:** synthetic fuel, diesel fuel, unleaded gasoline, JP-8 fuel.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991. Evaluation also covered quantitative leak location.

Raychem Corp.  
 300 Constitution Dr.  
 Menlo Park, CA 94025-1164  
 Tel: (415) 361-3333

Evaluator: Carnegie Mellon Research Institute  
 Tel: (412) 268-3495

Date of Evaluation: 02/20/98



**Raychem Corp.**TraceTek Alarm and Locator Modules  
TT5000 Fuel Sensing Cable**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: electrical conductivity

**Test Results:**

	unleaded gasoline		
	1/3 MER <sup>*</sup> <u>508 m</u>	2/3 MER <u>1016 m</u>	MER <u>1524 m</u>
Accuracy (%)	100	100	100
Response time (min)	12.02	9.18	7.51
Recovery time (min)	N/A	N/A	N/A
Product activation height (cm)	0.74	0.74	0.74
Detection length (cm)	30.5	30.5	30.5
Lower detection limits (cm)			
Product activation height	N/D*	N/D	0.74
Detection length	N/D	N/D	10

\* See glossary.

**Specificity Results:**

**Activated:** diesel fuel, synthetic fuel, heating oil #2, jet A fuel.

**Not Activated:** water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems" : Final Report - November 11, 1991  
 Evaluation also covered quantitative leak location.  
 Detector (cable) is not reusable.

Raychem Corp.  
 300 Constitution Dr.  
 Menlo Park, CA 94025-1164  
 Tel: (415) 361-3333

Evaluator: Carnegie Mellon Research Institute  
 Tel: (412) 268-3495

Date of Evaluation: 12/20/95

**Ronan Engineering Co.**

Ronan X-76 Automatic Line Leak Detector  
Version X-76 DM-4 Microprocessor and JT-H2 Line Pressure Sensor

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.831 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 45 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 20 seconds.  
Test data are acquired and recorded by a permanently installed microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Ronan Engineering Co.  
21200 Oxnard St.  
Woodland Hills, CA 91365  
Tel: (800)634-0085

Evaluator: Midwest Research  
Institute  
Tel: (816) 753-7600  
Date of Evaluation: 10/04/91

**Ronan Engineering Co.**

Ronan X-76 Automatic Line Leak Detector  
Version X-76 DM-4 Microprocessor and JT-H2 Line Pressure Sensor

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.066 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 45 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 2 hours between dispensing and testing.
- Test Period:** Response time is 20 minutes.  
Test data are acquired and recorded by a permanently installed microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Tel: (800)634-0085

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 10/04/91

**Ronan Engineering Co.**

X-76 ETM and X-76 ETM-4X  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 99.96\%$  and  $P_{FA} = 0.044\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full if the system leak threshold is set at 0.1 gph.  
System may also be used to test at a minimum product height of 12 inches or a 14% full tank, whichever is higher, if the leak threshold is set at 0.049 gph. This threshold is calculated based on  $P_D = 95\%$  and  $P_{FA} = 5\%$ .
- Waiting Time:** Minimum of 2 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by a computer.  
Leak rate calculated from data determined to be statistically valid.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 1 resistance temperature detector (RTD).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.947 inch.  
Minimum detectable water level change is 0.0254 inch.
- Calibration:** RTD and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
X76ETM-4X console has different housing which allows it to be mounted outside.

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Tel: (800)634-0085

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 02/07/91

**Ronan Engineering Co.**

X-76 ETM and X-76 ETM-4X  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D = 95.34\%$  and  $P_{FA} = 4.66\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 8 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by a computer.  
Leak rate calculated from data determined to be statistically valid.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 1 resistance temperature detector (RTD).
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.947 inch.  
Minimum detectable water level change is 0.0254 inch.
- Calibration:** RTD and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
X76ETM-4X console has different housing which allows it to be mounted outside.

Ronan Engineering Co.  
21200 Oxnard St.  
Woodland Hills, CA 91365  
Tel: (800)634-0085

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 11/21/91

**Ronan Engineering Co.**

Liquid Sensor System  
 LS-3 N.C., LS-3 N.O., LS-30, LS-7, HVA, LS-3SS, LS-1

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: float switch

**Test Results:**

	<u>LS-3 N.C. (normally closed)</u>		<u>LS-3 N.O. (normally open)</u>		<u>HVA</u>	
	<u>unleaded</u>	<u>water</u>	<u>unleaded</u>	<u>water</u>	<u>unleaded</u>	<u>water</u>
	<u>gasoline</u>	<u>water</u>	<u>gasoline</u>	<u>water</u>	<u>gasoline</u>	<u>water</u>
Accuracy (%)	100	100	100	100	100	100
Detection time (sec)	<1	<1	<1	<1	<1	<1
Fall time (sec)	<1	<1	<1	<1	<1	<1
Lower detection limit (cm)	2.77	2.31	2.31	1.70	0.84	0.71
	<u>LS-30 (low level)</u>		<u>LS-30 (high level)</u>		<u>LS-7</u>	
	<u>unleaded</u>	<u>water</u>	<u>unleaded</u>	<u>water</u>	<u>unleaded</u>	<u>water</u>
	<u>gasoline</u>	<u>water</u>	<u>gasoline</u>	<u>water</u>	<u>gasoline</u>	<u>water</u>
Accuracy (%)	100	100	100	100	100	100
Detection time (min:sec)	<1	<1	<1	<1	<1	<1
Fall time (hr:min:sec)	<1	<1	<1	<1	<1	<1
Lower detection limit (cm)	N/D*	4.72	N/D	15.24	1.09	0.81

\*See Glossary

**Specificity Results:**

Activated: unleaded gasoline, water.

**Comments:**

Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluating

Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors," March 1990

Detectors are reusable.

LS-3SS is identical to LS-3 N.C. and LS-3 N.O. except that LS-3SS also tests for methanol and has a stainless steel float.

The only difference between LS-1 and LS-3 is that LS-1 is smaller in diameter.

Ronan Engineering Co.  
 21200 Oxnard St.  
 Woodland Hills, CA 91365  
 Tel: (800) 634-0085

Evaluator: Ken Wilcox Associates  
 Tel: (816) 443-2494

Date of Evaluation: 02/06/92

**Schuster Instruments**

## Tel-A-Leak 1

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.86\%$  and  $P_{FA}=0.14\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 100% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
Minimum of 1 hour between "topping off" and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 1 hour.  
Test data are acquired and recorded manually and by a computer.  
Leak rate calculated from average of the last 10 consecutive 6 minute readings.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 10 temperature sensors.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide net pressure of 2-4 psi at bottom of tank during test.
- Calibration:** Temperature sensors must be checked annually and calibrated annually.
- Comments:** Not evaluated using manifold tank systems.

Schuster Instruments  
211 E. Grove St.  
Kawkawlin, MI 48631  
Tel: (517) 684-6638

Evaluator: W. A. Kibbe and Associates  
Tel: (517) 797-2425

Date of Evaluation: 11/26/90

**The Simmons Corp.**

**SIR 5.7**

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.0\%$  and  $P_{FA}=1.0\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Motor vehicle fuels.
- Tank Capacity:** Maximum of 18,000 gallons.
- Data Requirement:** Minimum of 30 days of product level and flow through data.
- Comments:** Not evaluated using manifold tank systems.  
Of 41 data sets submitted for evaluation, all were analyzed with conclusive results.  
Median monthly throughput of tanks evaluated was 7,000 gallons.  
Leak rates ranging from 0.05 to 0.2 gph were used in evaluation.  
Data sets evaluated were supplied by evaluator.

The Simmons Corp.  
106 E. Main Street  
Richardson, TX 75081-3327  
Tel: (800) 848-8378

Evaluator: S.S.G. Associates  
Tel: (601) 234-1179  
Date of Evaluation: 12/15/92



**The Simmons Corp.**

**SIR 5.7 LM**

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.0\%$  and  $P_{FA}=1.0\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Motor vehicle fuels.
- Tank Capacity:** Maximum of 45,000 gallons for single tank or for manifold tank systems with no more than 4 tanks in system.
- Data Requirement:** Minimum of 29 days of product level and flow through data.
- Comments:** Evaluated for manifold tank systems using an acceptable protocol.  
59% of datasets evaluated were from manifold tank systems.  
7% of datasets evaluated used data collected by ATGs.  
Of 41 datasets submitted for evaluation, all were analyzed with conclusive results.  
Median monthly throughput of tanks evaluated was 40,165 gallons.  
Leak rates of 0.05, 0.01 and 0.2 gph were used in evaluation.  
Data sets evaluated were supplied by evaluator.

The Simmons Corp.  
106 E. Main Street  
Richardson, TX 75081-3327  
Tel: (800) 848-8378

Evaluator: S.S.G. Associates  
Tel: (601) 234-1179  
Date of Evaluation: 10/28/95

**SIR International, Inc.**

Mitchell's SIR Program v.2.6 12-13-91

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=98\%$  and  $P_{FA}=2\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 18,000 gallons.
- Data Requirement:** Minimum of 32 days of product level and flow through data.
- Comments:** Not evaluated using manifold tank systems.  
Of 41 data sets submitted for evaluation, 24 "best" analyses were returned and 17 data sets were not analyzed.  
Median monthly throughput of tanks evaluated was 6313 gallons.  
Leak rates of 0.049 to 0.21 gph were used in evaluation.  
Data sets used in this evaluation were supplied by evaluator.

SIR International, Inc.  
10235 W. Little York Rd., Suite 257  
Houston, TX 77040  
Tel: (713) 937-6886

Evaluator: Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 01/27/92

## SIR Monitor (formerly Environmental Management Technologies)

### SIR Monitor

#### STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

- Certification:** Leak rate of 0.1 gph with  $P_D=99\%$  and  $P_{FA}=1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 18,000 gallons.
- Data Requirement:** Minimum of 90 days of product level and flow through data are required before making the first evaluation. Following the first evaluation, subsequent evaluations are made based on minimum of 30 days of data.
- Comments:** Not evaluated using data from manifold tank systems.  
Of 41 data sets submitted for evaluation, 5 were inconclusive.  
Median monthly throughput of tanks evaluated was 14,600 gallons.  
Leak rates of 0.05, 0.1, and 0.2 gph were used in evaluation.  
Data sets evaluated were supplied by vendor.

SIR Monitor  
P.O. Box 2791  
Murfreesboro, TN 37133  
Tel: (615) 895-2872

Evaluator: Nathan Adams, Middle TN State Univ.  
Tel: (615) 898-2644

Date of Evaluation: 11/05/92

**Sir Phoenix, Inc.**

**SIR PHOENIX**

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.0\%$  and  $P_{FA}=1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 18,000 gallons.
- Data Requirement:** Minimum of 90 days of product level and flow through data are required before making the first evaluation. Following the first evaluation, subsequent evaluations are made based on minimum of 30 days of data.
- Comments:** Not evaluated using manifold tank systems.  
Of 41 data sets submitted for evaluation, 5 were inconclusive.  
Median monthly throughput of tanks evaluated was 14,600 gallons.  
Leak rates of 0.05, 0.1, and 0.2 gph were evaluated.  
Data sets evaluated were supplied by vendor.

Sir Phoenix, Inc.

9 Ford Rd., P.O. Box 229  
Leoma, TN 38468  
Tel: (615) 852-4121

Evaluator: Nathan Adams, Middle TN State  
Univ.  
Tel: (615) 898-2644

Date of Evaluation: 11/05/92

**Soiltest, Inc.**

## Soiltest Ainlay Tank 'Tegrity Tester, S-3

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99\%$  and  $P_{FA}=1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 100% full.
- Waiting Time:** Minimum of 10 hours between delivery and testing.  
Minimum of 2 hours between "topping off" and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 1 hour, 30 minutes.  
Test data are acquired and recorded manually and by a strip chart recorder.  
Leak rate is calculated from last 1 hour, 30 minutes of test period data.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 3 thermistors.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide net pressure of 2-4 psi at the bottom of tank during test.
- Calibration:** Level sensors must be calibrated before each test.  
Thermistors must be checked annually and calibrated if necessary.
- Comments:** Not evaluated using manifold tank systems.

Soiltest, Inc.  
86 Albrecht Dr., P. O. Box 8004  
Lake Bluff, IL 60044-8004  
Tel: (800) 323-1242

Evaluator: Law Engineering Industrial Services  
Tel: (800) 672-6601

Date of Evaluation: 11/28/90

**Syscorp, Inc.**

Store Vision Version E.2

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUALITATIVE)**

- Certification:** Leak rate of 0.2 gph with  $P_D=95.7\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.0834 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 12,000 gallons.
- Data Requirement:** Minimum of 29 days of product level and flow through data.
- Comments:** Not evaluated using manifold tank systems.  
Of 120 data sets submitted for evaluation, 32 were inconclusive.  
Median monthly throughput of tanks evaluated was 8,097 gallons.  
Leak rate of 0.2 gph was used in evaluation.  
Data sets evaluated were supplied by evaluator.

Syscorp, Inc.  
1513 Huffman Rd., Suite 202  
Birmingham, AL 35215  
Tel: (205) 853-0004

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Date of Evaluation: 09/30/93

**Tank Automation, Inc.**Automated Precision Tank Testing System (APTT System)  
R-2**VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99\%$  and  $P_{FA}=1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, solvents, and other compatible products.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 100% full.
- Waiting Time:** Minimum of 10 hours, 30 minutes between delivery and testing.  
Minimum of 2 hours, 30 minutes between "topping off" and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 1 hour.  
Test data are acquired and recorded manually for level measurement and by computer for temperature measurement.  
Leak rate is calculated from last 1 hour of test period data.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 10 thermistors.
- Groundwater:** Groundwater presence must be determined to a depth of 5 feet below grade in backfill. Product level must be a minimum of 5 feet 6 inches above grade to ensure a minimum net pressure of 1 psi at bottom of tank during test.
- Calibration:** Thermistors and level sensors must be checked annually and calibrated if necessary.
- Comments:** Not evaluated using manifold tank systems.

Tank Automation, Inc.  
P.O. Box 1395  
Wall, NJ 07719  
Tel: (908) 280-2233

Evaluator: Wildwood Engineering  
Tel: Not Available  
Date of Evaluation: 11/14/90

## Tanknology - NDE

### Proline Test Series III, Version 1.0

#### LINE TIGHTNESS TEST METHOD

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=99.0\%$ and $P_{FA}=0.1\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oils #4 and #6, and solvents.
<b>Specification:</b>	System tests fiberglass and steel pipelines. Tests are conducted at 150% operating pressure. Mechanical line leak detector must be removed from pipeline for duration of test.
<b>Pipeline Capacity:</b>	Maximum of 41 gallons.
<b>Waiting Time:</b>	None between delivery and testing Minimum of 1 hour between dispensing and testing.
<b>Test Period:</b>	Minimum of 1 hour. Pipe deflection, vapor pockets, and large temperature differences may produce inconsistent readings, testing to continue until stable conditions are present. Test data are acquired and recorded manually. Manual calculations are performed by the operator on site.
<b>Calibration:</b>	Sensors must be calibrated before each test.

Tanknology - NDE  
8900 Shoal Creek Blvd., Building 200  
Austin, TX 78757  
Tel: (800) 800-4633

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Date of Evaluation: 08/30/91



**Tanknology - NDE**

PTK-88

**LINE TIGHTNESS TEST METHOD**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=99.8\%$ and $P_{FA}=1.3\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil, and solvents.
<b>Specification:</b>	System tests fiberglass and steel pipelines. Tests are conducted at 150% operating pressure. Mechanical line leak detector must be removed from pipeline for duration of test.
<b>Pipeline Capacity:</b>	Maximum of 40 gallons.
<b>Waiting Time:</b>	None between delivery and testing. Minimum of 1 hour between dispensing and testing.
<b>Test Period:</b>	Minimum of 10 minutes. Repeat 10 minute cycles are necessary if data does not meet the manufacturer's criteria. Test data are acquired and recorded manually. Manual calculations are performed by the operator on site.
<b>Calibration:</b>	Sensors must be calibrated before each test.

Tanknology - NDE  
8900 Shoal Creek Blvd., Building 200  
Austin, TX 78757  
Tel: (800) 800-4633

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 02/14/91

## Tanknology - NDE

### TLD-1

#### LINE TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gph with  $P_D=99.5\%$  and  $P_{FA}=0.5\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, and aviation fuel.
- Specification:** System tests fiberglass and steel pipelines.  
Tests are conducted at 150% operating pressure.  
Mechanical line leak detector must be removed from pipeline for duration of test.
- Pipeline Capacity:** Maximum of 50 gallons.
- Waiting Time:** Testing may begin immediately after test system is installed in the line.
- Test Period:** Response time is 30 minutes to 6 hours.  
Test may not be ended until pass/fail criteria set by manufacturer has been met.  
Pipe deflection, vapor pockets, and large temperature differences may produce inconsistent readings. Testing must continue until stable conditions are present.  
Test data are acquired and recorded manually.

Tanknology - NDE  
8900 Shoal Creek Blvd., Building 200  
Austin, TX 78757  
Tel: (800) 800-4633

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 12/29/91

**Tanknology - NDE**

## UST Ullage Test - Version U2 (Pressure Test)

**NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=95.24\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	A system should not be declared tight when the pressure decay trend equals or exceeds $\pm 0.016$ psi/hr.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, heavy fuel oils #2 through #6, and solvents.
<b>Tank Capacity:</b>	Maximum ullage volume is 10,260 gallons.
<b>Waiting time:</b>	Minimum of 2 hours between delivery and testing.
<b>Test Period:</b>	Minimum of 30 minutes (after data trend has been established).
<b>Test Pressure:</b>	Total pressure of 4.0 psi must be applied at bottom of tank.
<b>Temperature:</b>	Ullage must be monitored during test, and a correction factor is applied to account for temperature changes. If ullage temperature changes exceed 5 degrees F, test must not be conducted.
<b>Groundwater:</b>	Depth to groundwater in backfill must be determined. If groundwater is above product level, net pressure must be maintained at a minimum of 1 psi in the ullage during test.
<b>Comments:</b>	Not evaluated using manifold tank systems. Evaluated using diesel fuel. Tests only ullage portion of tank. Product-filled portion of tank must be tested using a volumetric underfilled test method.

Tanknology - NDE  
8900 Shoal Creek Blvd., Building 200  
Austin, TX 78757  
Tel: (800) 800-4633

Evaluator: ADA Technologies, Inc.  
Tel: (303) 792-5615

Date of Evaluation: 04/10/92

**Tanknology - NDE**

## UTS-4T Ullage Test (Pressure Test)

**NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=95.24\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when the make-up gas flow rate into ullage equals or exceeds 0.275 cubic feet/hour.
- Applicability:** Gasoline, diesel, aviation fuel, heavy fuel oil #4, and solvents.
- Tank Capacity:** Maximum ullage volume is 7,500 gallons.
- Waiting time:** Minimum of 2 hours between delivery and testing.
- Test Period:** Minimum of 20 minutes, consisting of 2 consecutive 10-minute test periods. Test data are acquired and recorded manually.
- Test Pressure:** Pressure must be increased in ullage such that total pressure at bottom of tank does not exceed 5.0 psi.  
Pressure must be maintained for a minimum of 5 minutes per 1,000 gallons of ullage.  
At conclusion of this stabilization period, ullage pressure must be reduced by 0.5 psi for remainder of test.
- Temperature:** Ullage must be monitored for rate of temperature change, which must not exceed manufacturer's tabulated values.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above product level, net pressure must exceed 1 psi in the ullage during test. If this requires more than 5 psi total pressure at tank bottom, the ullage test must not be used.
- Comments:** Not evaluated using manifold tank systems.  
Evaluated using diesel fuel.  
Tests only ullage portion of tank.  
Product-filled portion of tank must be tested using a volumetric underfilled test method.

Tanknology - NDE  
8900 Shoal Creek Blvd., Building 200  
Austin, TX 78757  
Tel: (800) 800-4633

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 12/04/92

**Tanknology - NDE**

U3 Ullage Test  
(Vacuum or Pressure Test)

**NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when the acoustic signal detected is different from the baseline.  
Baseline is the acoustic signal before tank is pressurized or evacuated.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents.
- Tank Capacity:** Maximum ullage volume is 16,500 gallons.
- Waiting Time:** None between delivery and testing
- Test Period:** A few minutes to determine background noise and a leak.  
Depends on background noise at the site and on the size of the leak.  
After the desired pressure has been reached, the tank should be allowed to settle for 10 minutes.
- Test Pressure:** Vacuum of 1 psi must be maintained in ullage by a vacuum blower, or total pressure at bottom of tank of 4 psi must be maintained using nitrogen.
- Temperature:** Acoustic signal is independent of product temperature.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above product level, vacuum test should not be used.  
Pressure test may only be used if net pressure can be maintained at a minimum 1 psi throughout ullage during test. If this requires more than 5 psi total pressure at tank bottom, the ullage test must not be used.
- Comments:** Not evaluated using manifold tank systems.  
Evaluated using diesel fuel.  
Tests only ullage portion of the tank.  
Product-filled portion of tank must be tested with an underfilled test method.  
Microphone was 25 feet away from the leak source during evaluation.  
If background noise is too high, test is inconclusive.  
Noise signals are tape recorded (not digitally recorded).  
Vacuum test method may not be effective in some backfill (such as clay) because it may plug holes in tank.  
If soil is saturated with product, air or water ingress may not be declared by vacuum test. A well point in backfill may help identify presence of this condition.

Tanknology - NDE  
8900 Shoal Creek Blvd., Building 200  
Austin, TX 78757  
Tel: (800) 800-4633

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 01/15/93

**Tanknology - NDE****Quick Test  
(Underfill Test)****NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD(VACUUM)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when the acoustic signal detected is different from the baseline.  
Baseline is the acoustic signal before tank is evacuated.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4, waste oil, and solvents.
- Tank Capacity:** Maximum product volume of 30,000 gallons. Tank product level must be between 7 and 86 inches.
- Waiting Time:** None between delivery and testing
- Test Period:** A few minutes to determine background noise and a leak.  
Depends on background noise at the site and on size of leak.
- Test Pressure:** Vacuum of 0.5 psi beyond the vacuum required to overcome the tank bottom pressure\* must be maintained in ullage by a vacuum blower.
- Temperature:** Acoustic signal is independent of product temperature.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above the tank bottom, this test method may not be used.
- Comments:** Not evaluated using manifold tank systems.  
Evaluated using diesel fuel.  
Tests only portion of tank containing product.  
Ullage portion of tank must be tested with an ullage test method.  
Microphone was 25 feet away from the leak source during evaluation.  
If background noise is too high, test is inconclusive.  
Noise signals are tape recorded (not digitally recorded).  
Vacuum test method may not be effective in some backfill (such as clay) because it may plug holes in tank.  
If soil is saturated with product, air or water ingress may not be declared by vacuum test. A well point in backfill may help identify presence of this condition.

\* Net vacuum applied = 0.5 psi + [inches of product level x the specific gravity of product x 0.036].

Tanknology - NDE  
8900 Shoal Creek Blvd., Building 200  
Austin, TX 78757  
Tel: (800) 800-4633

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 06/25/96

**Tanknology - NDE****VacuTest****NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (VACUUM)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when:  
sonic emission of air ingress is detected in ullage area and/or;  
sonic emission of bubbles formed by air ingress is detected in product-filled portion of the tank and/or;  
water ingress is detected at the bottom of the tank.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, and waste oil.  
Water miscible products limit the effectiveness of water ingress detection.
- Tank Capacity:** Maximum of 75,000 gallons.  
The test is generally conducted with tank between 60 and 90% full.  
The test may be performed at minimum 5% full if the total ullage volume does not exceed 20,000 gallons.
- Waiting Time:** None between delivery and testing.
- Test Period:** Minimum of 1 hour to declare a tank tight (after vacuum is reached) if backfill is dry (no water is detected in backfill prior to or at the conclusion of test). No specified minimum to declare a tank "non-tight". If water is present in backfill, minimum test period for declaring a tank tight is calculated based on the tank size, amount of water present in the tank prior to test, tank tilt, type of the water sensor and its location. Manufacturer's time charts should be checked for appropriate test periods. When test relies on detection of water ingress, minimum test period to declare a tank tight (if the measurements are taken at the low end of the tank) is 4 hours for the printed circuit board water sensor (test period may be shorter for tanks smaller than 1500 gallons) and 1 hour for the magnetostrictive water sensor. When water is present in backfill, an inclinometer must be used to determine and record tank tilt. Tank tilt may also be determined by taking readings at both ends of the tank. Water sensor should always be used at the low end of the tank. If water measurements are not taken at the low end of tank, extended test periods may be required to detect any water ingress.
- Test Pressure:** Vacuum must not be greater than 0.5 psi at bottom of tank.
- Temperature:** Sonic emission is independent of product temperature.
- Water Sensor:** Must be used at the low point of the tank to detect water ingress. Magnetostrictive sensor minimum detectable water level is 0.017 inch, and minimum detectable water level change is 0.001 inch. Printed circuit board sensor minimum detectable water level is 0.022 inch, and minimum detectable water level change is 0.016 inch.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, test time must be extended to allow sufficient time to detect water ingress of 0.1 gph.
- Comments:** Evaluated for manifold tank systems using two 20,000 gallon tanks during the 02/20/96 evaluation. Evaluated using gasoline, diesel, and JP-4. Microphone should be located within 60 feet from any possible leak source. Vacuum test method may not be effective in some backfill (such as clay) because it may plug holes in tank. If soil is saturated with product, air or water ingress may not be detected by vacuum test. A well point in backfill may help identify presence of this condition.

Tanknology - NDE  
8900 Shoal Creek Blvd., Building 200  
Austin, TX 78757  
Tel: (800) 800-4633

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Dates of Evaluation: 09/08/92, 02/20/92, 01/18/94,  
10/28/91 and 02/23/96

**Tanknology - NDE**

## Computerized VPLT Testing System

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.9\%$  and  $P_{FA}=0.1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, solvents, and other products.
- Tank Capacity:** Maximum of 18,000 gallons.  
Tank must contain minimum 24 inches of product.
- Waiting Time:** Must be long enough between delivery and testing to ensure a temperature change of less than 0.09 degrees F per hour, typically a minimum of 2 hours.  
None between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from average over data window.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is typically determined by 5 thermistors.  
A minimum of 1 thermistor is required.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 1 psi at bottom of tank during test. (There must be a difference of at least 37 inches between groundwater level and product level to provide a net pressure of 1 psi at bottom of tank during test.)
- Calibration:** Thermistors must be checked annually and calibrated if necessary.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Tanknology - NDE  
8900 Shoal Creek Blvd., Building 200  
Austin, TX 78757  
Tel: (800) 800-4633

Evaluator: Ken Wilcox Assoc.  
Tel: (816) 443-2494

Date of Evaluation: 02/15/93



**Tanknology - NDE**

## Sure Test - Assured Tight System, Series IV

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=99.99\%$ and $P_{FA}=0.005\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil, waste oil, and solvents.
<b>Tank Capacity:</b>	Maximum of 18,000 gallons. Tank must be between 11 and 95% full.
<b>Waiting Time:</b>	Minimum of 6 hours between delivery and testing. None between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Minimum of 3 hours. Test data are acquired and recorded by a computer. Leak rate is calculated from average of subsets of all collected data. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined by temperature probes. A minimum 12 inches of product must be present for the temperature probes to operate properly.
<b>Groundwater:</b>	Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted during test to provide a minimum net pressure of 1 psi at bottom of tank during test. (There must be a difference of at least 37 inches between groundwater level and product level to provide a net pressure of 1 psi at bottom of tank during test.)
<b>Calibration:</b>	Temperature probes and floats must be checked for proper operation prior to each test.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Tanknology - NDE  
8900 Shoal Creek Blvd., Building 200  
Austin, TX 78757  
Tel: (800) 800-4633

Evaluator: ADA Technologies  
Tel: (303) 792-5615

Date of Evaluation: 09/09/92

**TeleData, Inc.**

**TankMate Version 3.20**

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=99.8\%$ and $P_{FA}=0.02\%$ for both single and manifolded tanks.
<b>Leak Threshold:</b>	0.05 gph. A leak is declared if the estimated leak rate is statistically significant and continuous.
<b>Applicability:</b>	Gasolines, diesels, and kerosene.
<b>Tank Capacity:</b>	Maximum of 60,000 gallons for single tank or manifold tank systems with no more than three tanks in the system.
<b>Data Requirement:</b>	Minimum of 15 days of data is required.
<b>Comments:</b>	<p>Evaluated for manifold tank systems using an acceptable protocol.</p> <p>46% of data sets evaluated were from manifold tank systems.</p> <p>Of 41 data sets submitted for evaluation, all were analyzed with conclusive results.</p> <p>Median monthly throughput of tanks evaluated was 53,349 gallons.</p> <p>Leak rates of 0.05, 0.10, and 0.20 gph were used in the evaluation.</p> <p>Data sets evaluated were supplied by the evaluator.</p>

TeleData, Inc.  
43 East Ocean Blvd.  
Stuart, FL 34994  
Tel: (561) 219-4661

Evaluator: Piotr Blass, Ph.D.  
Tel: (407) 369-3467  
Date of Evaluation: 05/15/97

**Tidel Engineering, Inc.**

LIPSPC-301-0730-001/LIP-301-0729-001  
Line Integrity Probe and Submersible Pump Controller

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.0 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 129 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 1 minute.  
Test data are acquired and recorded by a permanently installed microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 02/02/93

**Tidel Engineering, Inc.**

LIPSPC-301-0730-001/LIP-301-0729-001  
Line Integrity Probe and Submersible Pump Controller

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.06 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 129 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 1 hour, 30 minutes.  
Test data are acquired and recorded by a permanently installed microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Dispenser shutdown, message display, and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
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Tel: (800) 678-7577

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 02/02/93

**Tidel Engineering, Inc.**

Tidel Environmental Monitoring System, 3500 Series  
(Ultrasonic Probes #401-0009, #401-0010 and #401-0023)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 95.3\%$  and  $P_{FA} = 4.7\%$  for 2 hour test.  
Leak rate of 0.2 gph with  $P_D = 99.5\%$  and  $P_{FA} = 0.5\%$  for 4 hour test.
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 2 hours, 29 minutes between delivery and testing.  
Minimum of 15 minutes after dispensing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 2 hours to achieve  $P_D = 98.6\%$  and  $P_{FA} = 1.4\%$ .  
Minimum of 4 hours to achieve  $P_D = 99.5\%$  and  $P_{FA} = 0.5\%$ .  
Test data are acquired and recorded by the microprocessor contained within the EMS console.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined from the measurement of the change in the speed of sound.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.48 inches.  
Minimum detectable water level change is 0.035 inch.
- Calibration:** Temperature sensors and ultrasonic probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** The water sensor, temperature sensor, and product level monitor are contained in a single ultrasonic probe.  
Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/16/95

**Tidel Engineering, Inc.**

Tidel Environmental Monitoring System, EMS 2000, 3000, and 3500 Series  
(Ultrasonic Probes #401-0009 and #401-0010)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 96.2\%$  and  $P_{FA} = 3\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 2 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 6 hours.  
Test data are acquired and recorded by a microprocessor contained within the EMS console.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 temperature sensors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.48 inches.  
Minimum detectable water level change is 0.035 inch.
- Calibration:** Temperature sensors and ultrasonic probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
EMS 2000 and 3000 Series are no longer manufactured by Tidel.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 06/07/93

**Tidel Engineering, Inc.**

Tidel Environmental Monitoring System, EMS 2000, 3000, and 3500 Series  
(Ultrasonic Probes #401-0021 and #401-0022)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 99.91\%$  and  $P_{FA} = 0.09\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 2 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 6 hours.  
Test data are acquired and recorded by a microprocessor contained within the EMS console.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 temperature sensors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.48 inches.  
Minimum detectable water level change is 0.035 inch.
- Calibration:** Temperature sensors and ultrasonic probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
EMS 2000 and 3000 Series are no longer manufactured by Tidel.

Tidel Engineering, Inc.  
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Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 06/07/93

**Tidel Engineering, Inc.**

Tidel Environmental Monitoring System, EMS 4000  
(Ultrasonic Probe #312-9000)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 97.4\%$  and  $P_{FA} = 2.6\%$  for 2 hour test.  
Leak rate of 0.2 gph with  $P_D = 99.9\%$  and  $P_{FA} = 0.1\%$  for 4 hour test.
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil. Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 2 hours, 29 minutes between delivery and testing.  
Minimum of 15 minutes between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 2 hours to achieve  $P_D = 97.4\%$  and  $P_{FA} = 1.8\%$ .  
Minimum of 4 hours to achieve  $P_D = 99.9\%$  and  $P_{FA} = 0.1\%$ .  
Test data are acquired and recorded by the microprocessor contained within the EMS console.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined from the measurement of the change in the speed of sound.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.045 inches.  
Minimum detectable water level change is 0.053 inch.
- Calibration:** Gain adjustment on probe must be checked annually and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
This is a longer version of model #312-9001.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/16/95



**Tidel Engineering, Inc.**

Tidel Environmental Monitoring System, EMS 4000  
(Ultrasonic Probe #312-9000)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D = 98.6\%$  and  $P_{FA} = 1.4\%$  for a 5 hour test.  
Leak rate of 0.1 gph with  $P_D = 99.7\%$  and  $P_{FA} = 0.3\%$  for a 6 hour test.
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil. Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 2 hours, 29 minutes between delivery and testing.  
Minimum of 15 minutes between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 5 hours to achieve  $P_D = 98.6\%$  and  $P_{FA} = 1.4\%$ .  
Minimum of 6 hours to achieve  $P_D = 99.7\%$  and  $P_{FA} = 0.3\%$ .  
Test data are acquired and recorded by the microprocessor contained within the EMS console.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined from the measurement of the change in the speed of sound.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.045 inches.  
Minimum detectable water level change is 0.053 inch.
- Calibration:** Gain adjustment on probe must be checked annually and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
This is a longer version of model #312-9001.

Tidel Engineering, Inc.  
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Tel: (800) 678-7577

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/16/95

**Tidel Engineering, Inc.**

Tidel Environmental Monitoring System, EMS 4000  
(Ultrasonic Probe #312-9001)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D = 99.9\%$  and  $P_{FA} = 0.1\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil. Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 2 hours, 23 minutes between delivery and testing.  
Minimum of 15 minutes between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
Test data are acquired and recorded by the microprocessor contained within the EMS console.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined from the measurement of the change in the speed of sound.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.045 inches.  
Minimum detectable water level change is 0.053 inch.
- Calibration:** Gain adjustment on probe must be checked annually and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
This is a shorter version of model #312-9000.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/16/95

**Tidel Engineering, Inc.**Tidel Environmental Monitoring System, EMS 4000  
(Ultrasonic Probe #312-9001)**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D = 97.9\%$  and  $P_{FA} = 2.1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil. Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 2 hours, 23 minutes between delivery and testing.  
Minimum of 15 minutes between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 4 hours.  
Test data are acquired and recorded by the microprocessor contained within the EMS console.  
Leak rate is calculated from data determined to be valid by statistical analysis.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined from the measurement of the change in the speed of sound.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.045 inches.  
Minimum detectable water level change is 0.053 inch.
- Calibration:** Gain adjustment on probe must be checked annually and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
This is a shorter version of the model #312-9000.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/16/95

**Tidel Engineering, Inc.**

EMS-3500  
with Liquid Discriminatory Probes Part 301-0635

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: electrical conductivity/hydrocarbon sensitive polymer

**Test Results: \***

	<u>unleaded gas oline</u>	<u>water</u>
Accuracy (%)	100	100
Response time (min)	3.59	0.96
Recovery time (min)	13.18	<1
Product activation height (cm)	1.76	0.49
Lower detection limit (cm)	4.19	1.52

\* At a flow rate of 0.04 gal/hr in a 2.54 cm diameter test chamber.

**Specificity Results:**

Activated: diesel fuel (at liquid height of 1.78 cm), synthetic fuel (at 2.30 cm), heating oil #2 (at 2.30 cm).

**Comments:**

Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems":  
Final Report - November 11, 1991.  
Detector is reusable.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 01/29/93

**Tidel Engineering, Inc.**

EMS-3500  
with Containment Sump Probes Part 301-0642

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: magnetic switch/float and hydrocarbon sensitive polymer

**Test Results: \***

	unleaded gasoline	water	
		<u>low</u>	<u>high</u>
Accuracy (%)	100	100	100
Response time (min)	6.39	4.76	4.12**
Recovery time (min)	>60	<1	<1
Product activation height (cm)	2.27	4.31	19.22
Lower detection limit (cm)	2.32	4.31	N/A***

\* At a flow rate of 0.89 gal/hr in test chamber of diameter 12.6 cm.

\*\* Larger test chamber and flow rate of 1.51 gal/hr.

\*\*\* See glossary.

**Specificity Results:**

Activated at 2.27 cm height: diesel fuel, synthetic fuel, heating oil #2.

**Comments:**

Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems":  
Final Report - November 11, 1991.

Probe was tested to determine its capability of detecting hydrocarbons floating on water.

A Lower detection limit thickness of 0.04 cm was declared, on average, in 16 minutes, 41 seconds with recovery time averaging 12 minutes, 55 seconds.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 02/17/93

**Tidel Engineering, Inc.**

EMS-3500  
Tidel Detector No. 301-0752-001

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: float switch

**Test Results: \***

	50 % by weight Ethylene glycol in water		30 % by weight Calcium chloride in water	
	<u>up</u>	<u>down</u>	<u>up</u>	<u>down</u>
Accuracy (%)	100	100	100	100
Response time (min)	21.91	30.10	22.27	31.08
Recovery time (min)	<1	<1	<1	<1
Product activation height (cm)	28.92	2.75	28.82	2.48

\* At a flow rate of 0.26 gal/hr in test chamber.

**Specificity Results:**

Not applicable

**Comments:**

Intended to monitor the level of either ethylene glycol or calcium chloride solutions in interstitial or annular space of a double-walled tank.

Activates an alarm if any significant gain or loss of solution occurs.

Test procedures used were modified by the evaluator from Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Detector is reusable.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 04/20/93

**Tidel Engineering, Inc.**

EMS-3500  
with Monitoring Well Probe Part 301-0641

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: conductivity via resistor ladder network

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	00:04	00:07
Fall time (min:sec)	<01:00	<01:00
Lower detection limit (cm)	0.32	0.32

**Specificity Results:**

Activated (100%): unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, JP-4 jet fuel, toluene, xylene(s).

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Detector is reusable.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 02/02/93

**Tidel Engineering, Inc.**

EMS-3500  
with Sheen Probes Part 301-0687

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: electrical conductivity/hydrocarbon sensitive polymer

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	07:45	03:35
Fall time (min:sec)	18:01	16:57
Lower detection limit (cm)	0.02	0.04

**Specificity Results:**

Activated (100%): unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, JP-4 jet fuel, toluene, xylene(s).

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Detector is reusable.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 01/31/93



Tidel Engineering, Inc.

EMS-3500  
Tidel Detector No. 301-0762

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

**Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: electrical conductivity/hydrocarbon sensitive polymer

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	9:31	7:05
Fall time (min:sec)	55:42	17:04
Lower detection limit (cm)	0.04	0.08

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s).

**Manufacturer's specifications:**

Groundwater probe used to detect free floating hydrocarbons in monitoring wells.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
Detector is reusable.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 03/18/93

**Tidel Engineering, Inc.**

Tidel Detector No. 301-0324-001 and 301-0325-001

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: electrical conductivity

**Test Results:**

	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
Accuracy (%)	100	100	100
Detection time (sec)	2	2	1
Fall time (sec)	1	2	2
Lower detection limit (cm)	0.16-0.32	0.16-0.32	0.16-0.32

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, JP-4 jet fuel, toluene, xylene(s).

**Manufacturer's specifications:**Detector No.301-0324-001

Application: Liquid sensor, water, used in 4" monitoring well.  
 Sensor: Magnetism and conductivity pins.  
 Detection Range: 1/8" floating product on groundwater or 1.5" free product.

Detector No.301-0325-001

Application: Liquid sensor, water or hydrocarbon used in reservoir, sump or pipeline trench.  
 Sensor: Magnetism and conductivity pins.  
 Detection Range: 1/8" floating product on groundwater or 1.5" free product.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
 Detector is reusable.

Tidel Engineering, Inc.  
 2310 McDaniel Dr.  
 Carrollton, TX 75006  
 Tel: (800) 678-7577

Evaluator: Radian Corp.  
 Tel: (512) 454-4797

Date of Evaluation: 07/08/91

**Tidel Engineering, Inc.**

Tidel Detector No. 301-0326-001 and 301-0326-002

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: electrical conductivity

**Test Results:**

	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
Accuracy (%)	100	100	100
Detection time (sec)	4	7	2
Fall time (sec)	3	4	4
Lower detection limit (cm)	0.08-0.32	0.08-0.32	0.08-0.32

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, JP-4 jet fuel, toluene, xylene(s).

**Manufacturer's specifications:**Detector No.301-0326-001

Application: Liquid sensor, water, used in 2" monitoring well.  
 Sensor: Magnetism and conductivity pins.  
 Detection Range: 1/8" floating product on groundwater or 2.5" free product.

Detector No.301-0326-002

Application: Liquid sensor, water, used in annulus of double wall steel tanks.  
 Sensor: Magnetism and conductivity pins.  
 Detection Range: 1/8" floating product on groundwater or 2.5" free product.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
 Detector is reusable.

Tidel Engineering, Inc.  
 2310 McDaniel Dr.  
 Carrollton, TX 75006  
 Tel: (800) 678-7577

Evaluator: Radian Corp.  
 Tel: (512) 454-4797

Date of Evaluation: 07/08/91

**Tidel Engineering, Inc.**EMS-3000  
301-0328-001, 301-0330-001**VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: adsistor

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>	JP-4 <u>jet fuel</u>
Accuracy (%)	100	100	100
Detection time (sec)	91	65	86
Fall time (min:sec)	5:39	4:23	9:38
Lower detection limit (ppm)	10 to 100	10 to 500	10 to 50

**Specificity Results:**

Activated: unleaded gasoline, synthetic gasoline, JP-4 jet fuel, toluene, xylene(s)

Not Activated: n-hexane.

**Comments:**

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Radian Corp.  
Tel: (512) 454-4797

Date of Evaluation: 07/08/91

**Tidel Engineering, Inc.**

EMS-3500  
Vapor Sensor Probe Part No. 301-0634

**VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: adsistor

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>	JP-4 <u>jet fuel</u>
Accuracy* (%)	100	100	100
Detection time* (min:sec)	2:46	1:41	1:50
Fall time (hr:min:sec)	>1:00:00**	>1:00:00**	>1:00:00**
Lower detection limit (ppm)	100	500	100

\* For tests conducted with 1000 ppm of test gas.

\*\* The vapor sensor probe was recalibrated when it did not recover after 1 hour, from exposure to test vapors.

**Specificity Results:**

**Activated:** unleaded gasoline, synthetic gasoline, n-hexane, JP-4 jet fuel, toluene, xylene(s).

**Manufacturer's specifications:**

Vapor sensor probe for use in normally dry monitoring wells to detect hydrocarbon vapors.

Can be used in monitoring wells up to 20 feet deep.

The probe will alarm if it comes in contact with water and must be removed immediately to prevent damage to probe.

**Comments:**

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Tidel Engineering, Inc.  
2310 McDaniel Dr.  
Carrollton, TX 75006  
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 03/18/93

**Tokheim Corp.**

Tokheim Pressure Monitor, Models PM 101 and 585A -PM

**AUTOMATIC MECHANICAL LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.25 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, and alcohols.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at 150% operating pressure.
- Pipeline Capacity:** Maximum of 78 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 4 seconds.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Restricted flow to dispenser if leak is declared.
- Calibration:** System must be checked semi-annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** No longer manufactured by Tokheim Corporation.

Tokheim Corp.  
10501 Corporate Dr.  
Fort Wayne, IN 46801-0360  
Tel: (219) 423-2552

Evaluator: Vista Research  
Tel: (415) 966-1171

Date of Evaluation: 11/02/90

**Tracer Research Corp.**

## Tracer Tight Line Test

**LINE TIGHTNESS TEST METHOD**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0.0\%$ .
- Leak Threshold:** A system should not be declared tight when tracer chemical is detected outside of the pipeline.
- Applicability:** All fluid petroleum products and any other fluid with which an acceptable tracer is compatible.
- Waiting Time:** Minimum is normally 2 weeks after injection of the tracer into the tank, but must be no less than 1 week, and no more than 4 weeks. For very large systems, several days or weeks may be required to circulate tracer-labeled fuel through all parts of the system. Under these circumstances the 1 week waiting time begins after the tracer reaches the pipeline being tested.
- Tracer Dosage:** Dosage of tracer is a factor of tank size and frequency of tank refills according to manufacturer's recommendations.  
Tracer labeled product should be circulated through the pipeline before test period begins.  
Pressurized pipeline must be brought up to operating pressure or operated on a daily basis.
- Permeability:** Soil permeability must be sufficient for transport of tracer through backfill (greater than 1 Darcy).
- Probe:** Radius of influence of each probe is 10 feet. Locating pipelines should be done according to manufacturer's operating procedures for pipeline test results to be valid.
- Comments:** Presence of frozen, saturated soil surrounding the pipeline may limit effectiveness of test method.  
Presence of groundwater surrounding pipeline may also reduce effectiveness of test method (e.g. when applied to pipelines containing water-miscible products or products whose specific gravity is greater than 1).  
There is no volume limitation with this method.

Tracer Research Corp.  
3755 N. Business Center Dr.  
Tucson, AZ 85705  
Tel: (800) 989-9929

Evaluator: Ken Wilcox Associates (1991)  
Tel: (816) 443-2494  
Control Strategies Engineering (1992)  
Tel: (602) 682-8726  
Dates of Evaluation: 10/04/91 and 05/92

**Tracer Research Corp.****Tracer Tight****NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (TRACER)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when tracer chemical is detected outside of the tank.
- Applicability:** All fluid petroleum products and any other fluid with which an acceptable tracer is compatible.
- Tank Capacity:** This test method is not limited by capacity, however only portions of the tank system within 10 feet of sample collection point are tested.
- Waiting Time:** Ranges from 7 to 30 days (generally two weeks) after injection of the tracer into the tank.
- Tracer Dosage:** Dosage of tracer is a factor of tank size and frequency of tank refills according to manufacturer's recommendations.
- Permeability:** Soil permeability must be sufficient for transport of tracer through backfill (greater than 1 Darcy).
- Probe:** Radius of influence of each probe is 10 feet. Probes must be placed such that all possible locations and orientations are within the circle of influence.
- Groundwater:** Depth to groundwater in backfill must be determined. In order for a leak below groundwater to be indicated by the release of the tracer compound, the hydrostatic pressure of product in tank must exceed the hydrostatic pressure of groundwater during test. This is done by maintaining product level at least 6 inches over groundwater for a minimum 17 hours during first three days following addition of tracer to tank.  
In high groundwater situations, this method may be supplemented with measurement of water ingress, at the discretion of the regulatory agency.
- Comments:** Presence of frozen, saturated soil above bottom of tank may limit effectiveness of test method.  
Presence of groundwater above bottom of tank may also limit effectiveness of test method (e.g. when applied to tanks containing water-miscible products or products whose specific gravity is greater than 1).

Tracer Research Corp.  
3755 N. Business Center Dr.  
Tucson, AZ 85705  
Tel: (800) 989-9929

Evaluator: Ken Wilcox Associates (1990)  
Tel: (816) 443-2494  
Control Strategies Engineering (1992)  
Tel: (602) 682-8726  
Dates of Evaluation: 10/04/90 and 05/92



**Tracer Research Corp.****Tracer Tight****VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: quantitative  
 Sampling frequency: intermittent  
 Operating principle: chromatographic (looks for chemical tracer)

**Test Results:**Hydrocarbon detector (GC/FID)

	<u>xylene</u>	<u>benzene</u>	<u>2-methylbutane</u>	<u>gasoline</u>	<u>Tracer</u>
Accuracy (%)	<20	<20	<20	<20	N/R*
Bias (%)	0	0	0	0	N/R
Detection time (min)	<0.01	<0.01	<0.01	<0.01	N/R
Fall time (min)	<0.01	<0.01	<0.01	<0.01	N/R
Lower detection limit (ppm)	20	20	20	20	N/R

Tracer Detector

	<u>xylene</u>	<u>benzene</u>	<u>2-methylbutane</u>	<u>gasoline</u>	<u>Tracer</u>
Accuracy (%)	N/R	N/R	N/R	N/R	<20
Bias (%)	N/R	N/R	N/R	N/R	0
Detection time (min)	N/R	N/R	N/R	N/R	<0.01
Fall time (min)	N/R	N/R	N/R	N/R	<0.01
Lower detection limit (ppm)	N/R	N/R	N/R	N/R	10 <sup>-5</sup>

\* See glossary.

**Specificity Results:**

See above.

**Manufacturer's specifications:**

Soil permeability at the site must exceed 1 Darcy.

**Comments:**

Test procedures used were a combination of EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods," March 1990 and "recognized national standard of GC/FID hydrocarbon measurements."

Method utilizes a chromatographic measurement of a vapor sample collected monthly from the site. Hydrocarbon vapors and the added chemical tracer can be measured independently.

During evaluations, the tracer chemical was declared 159 out of 161 trials.

System evaluation included detectors, analytical procedures, sample containers, sampling procedures, sampling system, monitoring well materials and installations, and tracer mobility.

Tracer Research Corp.  
 3755 N. Business Center Dr.  
 Tucson, AZ 85705  
 Tel: (800)989-9929

Evaluator: Control Strategies Engineering  
 Tel: (602) 682-8726

Date of Evaluation: 05/05/92

**Triangle Environmental, Inc.**

TEI Model LT-3, Version 1.0

**LINE TIGHTNESS TEST METHOD**

- Certification:** Leak rate of 0.1 gph with  $P_D=100.0\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, and solvents.
- Specification:** System tests fiberglass and steel pipelines.  
Tests are conducted at 150% operating pressure.
- Pipeline Capacity:** Maximum of 80 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 15 minutes between dispensing and testing.
- Test Period:** Minimum of 15 minutes.  
Test data are acquired and recorded manually.  
Manual calculations are performed by the operator on site.
- Temperature:** Product change per hour must be less than 4 degrees F.
- Calibration:** Sensors must be checked annually and calibrated semi-annually in accordance with manufacturer's instructions.

Triangle Environmental, Inc.  
172 W. Verdugo Ave.  
Burbank, CA 91502-2132  
Tel: (818) 840-7020

Evaluator: United States Testing Company  
Tel: (213) 723-7181

Date of Evaluation: 03/03/92

**Triangle Environmental, Inc.**

## TEI Ullage Test, Version 1.0 (Vacuum Test)

**NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when an increase in the acoustic noise level (above background) of the tank under vacuum is detected due to air or water ingress.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, solvents, and light liquids.
- Tank Capacity:** Maximum ullage volume is 15,000 gallons.  
Microphone should be located within 24 feet of all points within the ullage.
- Waiting Time:** None if test is conducted after the underfilled tank test.
- Test Period:** Minimum of 1 minute.
- Test Pressure:** Vacuum of 1 psi must be maintained in ullage.  
If vacuum cannot be maintained, see manufacturer's instructions.
- Temperature:** Acoustic signal is independent of product temperature.
- Groundwater:** Depth to the groundwater in backfill must be determined. If groundwater is above product level, vacuum must be adequate to detect an ingress of groundwater.
- Calibration:** Sensors must be calibrated before each test.
- Comments:** Manifold tank systems must be isolated prior to test.  
Evaluated using unleaded gasoline.  
Tests only ullage portion of tank.  
Product-filled portion of tank must be tested using an underfilled test method.  
Microphone was 24 feet away from the leak source during evaluation.  
Headphones are used during test to listen for the signal of air ingress.  
Noise signals are tape recorded (not digitally recorded).  
Test method may not be effective in some backfill (such as clay) because it may plug holes in tank.  
If soil is saturated with product, air or water ingress may not be declared by vacuum test. A well point in backfill may help identify presence of this condition.

Triangle Environmental, Inc.  
172 W. Verdugo Ave.  
Burbank, CA 91502-2132  
Tel: (818) 840-7020

Evaluator: United States Testing Co. Inc.  
Tel: (213) 723-7181

Date of Evaluation: 05/05/93

**Triangle Environmental, Inc.**

TEI System 5000, Version 1.0

**NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (VACUUM)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when the acoustic noise level of the tank under vacuum is greater than the calibrated background acoustic noise level (prior to evacuation).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, solvents and light liquids.
- Tank Capacity:** Maximum of 20,000 gallons.  
Tank must be minimum 14% full.  
Microphone should be located within 24 feet of all points within the tank.
- Waiting Time:** None between delivery and testing.
- Test Period:** Minimum of 1 minute.
- Test Pressure:** Vacuum of 1 psi must be maintained in ullage.  
If vacuum cannot be maintained, see manufacturer's instructions.
- Temperature:** Acoustic signal is independent of product temperature.
- Groundwater:** Depth to groundwater in backfill must be determined.  
This method cannot be used if groundwater is above bottom of tank.
- Calibration:** Sensor must be calibrated before each test.
- Comments:** Manifold tank systems must be isolated prior to test.  
Evaluated using unleaded gasoline.  
Microphone was 24 feet away from the leak source during evaluation.  
Headphones are used during test to listen for the signal of air ingress.  
Noise signals are tape recorded (not digitally recorded).  
Vacuum test method may not be effective in some backfill (such as clay) because it may plug holes in tank.  
If soil is saturated with product, air or water ingress may not be declared by vacuum test. A well point in backfill may help identify presence of this condition.

Triangle Environmental, Inc.  
172 W. Verdugo Ave.  
Burbank, CA 91502-2132  
Tel: (818) 840-7020

Evaluator: United States Testing Co., Inc.  
Tel: (213) 723-7181

Date of Evaluation: 02/04/93

**Triangle Environmental, Inc.**

TEI System 4000, Version 1.0

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99\%$  and  $P_{FA}=4.8\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, fuel oil, waste oil, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 100% full.
- Waiting Time:** Minimum of 6 hours between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum is determined by a computer.  
Average was 4 hours during the evaluation.  
Leak rate is calculated from last 2 hours of test period data.  
Test data are acquired and recorded by computer.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 3 thermistors.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 1 psi at bottom of tank during test.
- Calibration:** Thermistors must be calibrated before each test.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
May also be used as an overfill test method.

Triangle Environmental, Inc.  
172 W. Verdugo Ave.  
Burbank, CA 91502-2132  
Tel: (818) 840-7020

Evaluator: United States Testing Company, Inc.  
Tel: (213) 723-7181

Date of Evaluation: 04/02/91

**Universal Sensors and Devices, Inc.**

TICS-1000  
(Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D = 96.6\%$ and $P_{FA} = 3.4\%$ .
<b>Leak Threshold:</b>	0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and solvents.
<b>Tank Capacity:</b>	Maximum of 15,000 gallons. Tank must be minimum 90% full.
<b>Waiting Time:</b>	Minimum of 8 hours between delivery and testing. None between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Minimum of 6 hours. Test data are acquired and recorded by a microprocessor. Leak rate is calculated from average of subsets of all collected data. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined by a minimum of 5 resistance temperature detectors (RTDs).
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.83 inch. Minimum detectable water level change is 0.0116 inch.
<b>Calibration:</b>	RTDs and probe must be checked and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Universal Sensors and Devices, Inc.  
9205 Alabama Ave., Unit C  
Chatsworth, CA 91311  
Tel: (800) 899-7121, (818) 998-7121

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 08/20/93

**Universal Sensors and Devices, Inc.**LTC-1000  
(Mass Buoyancy Probe)**LARGE TANK AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 1.4 gph with  $P_D = 97.2\%$  and  $P_{FA} = 2.8\%$ .  
This leak rate does not meet EPA requirements for monthly monitoring (0.2 gph) or tank tightness testing (0.1 gph).
- Leak Threshold:** 0.7 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, and solvents.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 2,000,000 gallons. Application of this method for larger tanks is currently under review to determine correct scaling factors for leak rate, threshold and test time versus tank size.  
Tank must be minimum 90% full.
- Waiting Time:** Minimum of 3 hours, 42 minutes between delivery and testing.  
None between dispensing and testing.
- Test Period:** Minimum of 49 hours.  
Test data are acquired and recorded by a computer.  
There must be no dispensing or delivery during test.
- Temperature:** System does not require measurement of product temperature.
- Water Sensor:** System does not use a water probe.  
Water ingress is detected by an increase in total mass of product in the tank.  
To monitor water continuously, a separate water sensing probe must be installed.
- Calibration:** The mass buoyancy probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Universal Sensors and Devices, Inc.  
9205 Alabama Ave., Unit C  
Chatsworth, CA 91311  
Tel: (800) 899-7121, (818) 998-7121

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 05/17/96

**Universal Sensors and Devices, Inc.****LTC-2000  
(Differential Pressure Probe)****LARGE TANK AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 3.0 gph with  $P_D = 98.8\%$  and  $P_{FA} = 1.2\%$ .  
This leak rate does not meet EPA requirements for monthly monitoring (0.2 gph) or tank tightness testing (0.1 gph).
- Leak Threshold:** 1.5 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, and solvents.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 2,000,000 gallons.  
Application of this method for larger tanks is currently under review to determine correct scaling factors for leak rate, threshold and test time versus tank size.  
Tank must be minimum 90% full.
- Waiting Time:** Minimum of 3 hours, 30 minutes between delivery and testing.  
None between dispensing and testing.
- Test Period:** Minimum of 48 hours, 18 minutes.  
Test data are acquired and recorded by a computer.  
There must be no dispensing or delivery during test.
- Temperature:** System does not require measurement of product temperature.
- Water Sensor:** System does not use a water probe.  
Water ingress is detected by a change in pressure at the bottom of the tank.  
To monitor water continuously, a separate water sensing probe must be installed.
- Calibration:** The differential pressure probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** To detect losses or gains in the tank, the system uses a differential pressure probe to measure changes in pressure at the bottom of the tank.  
Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Universal Sensors and Devices, Inc.  
9205 Alabama Ave., Unit C  
Chatsworth, CA 91311  
Tel: (800) 899-7121, (818) 998-7121

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 05/17/96



**Universal Sensors and Devices, Inc.**

Leak Alert System Models LAL-100, LA-01, LA-02, LA-04, LA-X4, LA-08, DLS-01, LS-20, LS-36, LS-70,  
CATLAS  
Liquid Sensor LALS-1

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: thermal conductivity

**Test Results:**

	unleaded
	<u>gasoline</u>
Accuracy (%)	100
Response time (min)	1.24
Recovery time (min)	<1
Product activation height (cm)	0.61
Lower detection limit (cm)	0.76

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2, water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.  
Detector is reusable.

Universal Sensors and Devices, Inc.  
9205 Alabama Ave., Unit C  
Chatsworth, CA 91311  
Tel: (800) 899-7121, (818) 998-7121

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Dates of Evaluation: 06/01/94, 04/22/97

**Universal Sensors and Devices, Inc.**

Leak Alert System Models LAL-100, LA-01, LA-02, LA-04, LA-X4, LA-08, CATLAS  
LAVS-1 MOS Vapor Sensor

**VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: metal oxide semiconductor

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>	JP-4 <u>jet fuel</u>
Accuracy (%)	100	100	100
Detection time (min:sec)	00:31	00:40	00:42
Fall time (min:sec)	4:43	4:25	4:30
Lower detection limit (ppm)	100	N/D*	N/D

\* See glossary.

**Specificity Results:**

Activated: unleaded gasoline, synthetic gasoline, JP-4 jet fuel, n-hexane, toluene, xylene(s).

**Comments:**

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Universal Sensors and Devices, Inc.  
9205 Alabama Ave., Unit C  
Chatsworth, CA 91311  
Tel: (800) 899-7121, (818) 988-7121

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 06/01/94

**USTest, Inc.**UST 2001 (Quick Test)  
(Ultrasonic Probe)**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D=97.5\%$ and $P_{FA}=2.5\%$ .
<b>Leak Threshold:</b>	0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, and aviation fuel. Other liquids may be tested after consultation with the manufacturer.
<b>Tank Capacity:</b>	Maximum of 15,000 gallons. Tank must be between 50 and 95% full.
<b>Waiting Time:</b>	Minimum of 4 hours between delivery and testing. Minimum of 15 minutes between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Minimum of 30 minutes. (see Comments section below) Test data are acquired and recorded by a computer. Leak rate is calculated from data determined to be valid by statistical analysis. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined from the measurement of the change in the speed of sound.
<b>Water Sensor:</b>	Must be used to detect water ingress. water is declared via an ultrasonic signal ranging to the water interface. Minimum detectable water level in the tank is less than 0.1 inch. Minimum detectable change in water level is 0.046 inch.
<b>Calibration:</b>	Probe must be checked regularly in accordance with manufacturer's instructions.
<b>Comments:</b>	With a test period of 1 hour, method has a $P_D = 99.9\%$ and a $P_{FA} = 0.1\%$ . Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

USTest, Inc.  
406 E. Madison St., Suite 2004  
Broussard, LA 70518  
Tel: (318) 839-1070

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 06/06/95

**USTest, Inc.**UST 2001  
(Ultrasonic Probe)**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=95.2\%$ and $P_{FA}=4.8\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, and aviation fuel. Other liquids may be tested after consultation with the manufacturer.
<b>Tank Capacity:</b>	Maximum of 15,000 gallons. Tank must be between 50 and 95% full.
<b>Waiting Time:</b>	Minimum of 4 hours between delivery and testing. Minimum of 15 minutes between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Minimum of 1 hour. (see Comments section below) Test data are acquired and recorded by a computer. Leak rate is calculated from data determined to be valid by statistical analysis. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined from the measurement of the change in the speed of sound.
<b>Water Sensor:</b>	Must be used to detect water ingress. water is declared via an ultrasonic signal ranging to the water interface. Minimum detectable water level in the tank is less than 0.1 inch. Minimum detectable change in water level is 0.046 inch.
<b>Calibration:</b>	Probe must be checked regularly in accordance with manufacturer's instructions.
<b>Comments:</b>	With a test period of 2 hours, method has a $P_D = 98.6\%$ and a $P_{FA} = 1.4\%$ . Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

USTest, Inc.  
406 E. Madison St., Suite 2004  
Broussard, LA 70518  
Tel: (318) 839-1070

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 06/06/95

**USTest, Inc.**

UST 2000/U  
(Pressure and Vacuum Test)

**NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (ULLAGE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** A system should not be declared tight when there is a substantial increase in the acoustic noise signal (when the tank is under pressure or vacuum) above the background signal (prior to pressurization or evacuation) in the frequency interval of 10 kHz to 20 kHz.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oils #2 through #6, waste oil, and solvents. Equipment is not in contact with the product.
- Tank Capacity:** Maximum ullage volume is 7,550 gallons for pressure test and 5,250 gallons for vacuum test.
- Waiting Time:** None if test is conducted after an underfilled tank tightness test.
- Test Period:** Minimum of 15 minutes (includes collection of background information).
- Test Pressure:** Net pressure of 2.0 psi or vacuum of 1.0 psi must be maintained in ullage.
- Temperature:** Acoustic Signal is independent of product temperature.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above product level, vacuum test must not be used. Pressure test must be conducted using net pressure exceeding 2.0 psi in the ullage.
- Calibration:** Test equipment must be checked by tester before each test.
- Comments:** Not evaluated using manifold tank systems.  
 Evaluated using unleaded gasoline as test product.  
 Tests only ullage portion of tank.  
 Product-filled portion of the tank must be tested using an underfilled test method.  
 Microphone was less than 8 feet, 6 inches from the leak source during evaluation.  
 If the background noise is too high, test is inconclusive.  
 Vibration due to nearby equipment or dripping condensation may interfere with test.  
 Vacuum test method may not be effective in some backfill (such as clay) because it may plug holes in tank.  
 If soil is saturated with product, air or water ingress may not be declared by vacuum test. A well point in backfill may help identify presence of this c

ondition.

USTest, Inc.  
406 E. Madison St., Suite 2004  
Broussard, LA 70518  
Tel: (318) 839-1070

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 03/24/92

**USTest, Inc.****UST 2000/LL****VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=98.12\%$  and  $P_{FA}=1.88\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, water, and kerosene.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 15% full. There must be at least 20 inches and not more than 67 inches of product in the tank.
- Waiting Time:** Ranges from 3 to 12 hours between delivery and testing.  
Testing may begin when the rate of product temperature change does not exceed 0.1 degree F per hour.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
Test data are acquired and recorded by a computer, which does a regression analysis to determine the leak rate.  
An ultrasonic device is used to measure changes in product level.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined from the measurement of the change in the speed of sound.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 1 psi at bottom of tank during test. (There must be a difference of at least 37 inches between groundwater level and product level to provide a net pressure of 1 psi at bottom of tank during test.)
- Calibration:** Temperature sensors and probes must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

USTest, Inc.  
406 E. Madison St., Suite 2004  
Broussard, LA 70518  
Tel: (318) 839-1070

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 06/09/94

**USTest, Inc.**

## UST 2000/P

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.9\%$  and  $P_{FA}=0.1\%$  for tanks up to 15,000 gallons, Leak rate of 0.1 gph with  $P_D=99.7\%$  and  $P_{FA}=0.3\%$  for tanks from 15,000 gallons up to 45,000 gallons.
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, waste oil, water, and kerosene.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 45,000 gallons.  
Tank must be minimum 78.6% full.
- Waiting Time:** Minimum for tanks up to 45,000 gallons must be determined from the manufacturer's chart of "Wait Time versus Tank Volume." This chart must be included in the tank test report.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum for tanks less than 10,000 gallons is one hour.  
Minimum for tanks from 10,000 to 45,000 gallons is determined from the manufacturer's chart of Differential Volume versus Test Duration.  
Line labeled  $P_D = 99.9\%$  must be used. This chart must be included in the tank test report.  
Test data are acquired and recorded by a computer, which does a regression analysis to determine the leak rate.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined from the measurement of the change in the speed of sound.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 1 psi at bottom of the tank during test.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

USTest, Inc.  
406 E. Madison St., Suite 2004  
Broussard, LA 70518  
Tel: (318) 839-1070

Evaluators: Midwest Research Institute  
Tel: (816) 753-7600  
and Ken Wilcox Associates  
Tel: (816) 443-2494  
Dates of Evaluation: 12/05/90 (1000-10000 gallons),  
and 08/04/92 (10000-45000 gallons)

**USTMAN Industries, Inc.**

YES SIR 90

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUALITATIVE)**

- Certification:** Leak rate of 0.2 gph with  $P_D=96.3\%$  and  $P_{FA}=3.9\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight when a consistent loss or gain equals or exceeds this threshold that is statistically significant from zero at the 5% confidence level.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 15,000 gallons.
- Data Requirement:** Minimum of 35 days of product level and flow through data.
- Comments:** Not evaluated using manifold tank systems.  
Of 120 data sets submitted for evaluation, 15 were inconclusive.  
Median monthly throughput of tanks evaluated was 15,867 gallons.  
Data sets evaluated were supplied by evaluator.

USTMAN Industries Inc.  
12265 W. Bayaud Ave., Suite 110  
Lakewood, CO 80228  
Tel: (800) 253-8054

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 12/17/90



**USTMAN Industries, Inc.**

USTMAN SIR 1.91

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=98.4\%$  and  $P_{FA}=1.6\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight when a consistent loss or gain equals or exceeds this threshold at the 5% level of significance.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 18,000 gallons.
- Data Requirement:** Minimum of 42 days of product level and flow through data.
- Comments:** Not evaluated using data from manifold tank systems.  
Of 41 data sets submitted for evaluation, 4 data sets were not analyzed and 7 were inconclusive.  
Median monthly throughput of tanks evaluated was 10,978 gallons.  
Leak rates ranging from 0.048 to 0.201 gph were used in evaluation.  
Data sets evaluated were supplied by evaluator.

USTMAN Industries Inc.  
12265 W. Bayaud Ave., Suite 110  
Lakewood, CO 80228  
Tel: (800) 253-8054

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 10/31/91

**USTMAN Industries, Inc.**

USTMAN SIR Version 94.1

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D \geq 99\%$  and  $P_{FA} \leq 1.0\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 30,000 gallons.
- Data Requirement:** Minimum of 30 days of product level and flow through data.
- Comments:** Evaluated using some data from manifold tank systems.  
Of 53 data sets submitted for evaluation, all were analyzed with conclusive results.  
Median monthly throughput of tanks evaluated was 25,408 gallons.  
Leak rates of 0.05, 0.1, and 0.2 gph were used in evaluation.  
Data sets evaluated were supplied by evaluator. Some data sets used USTMAN SIR 1.91 (0.1 gph) analysis as documentation that tanks were tight.

USTMAN Industries Inc.  
12265 W. Bayaud Ave., Suite 110  
Lakewood, CO 80228  
Tel: (800) 253-8054

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 03/31/94

**USTMAN Industries, Inc.**

USTMAN SIR Version 95.2A and 95.2

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.2 gph with  $P_D \geq 99.9\%$  and  $P_{FA} \leq 0.01\%$ .  
Leak rate of 0.1 gph with  $P_D \geq 99.2\%$  and  $P_{FA} \leq 0.08\%$ .
- Leak Threshold:** 0.1 for a leak rate of 0.2 gph.  
0.05 for a leak rate of 0.1 gph.
- A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 60,000 gallons for single tanks or manifold tank systems with no more than 4 tanks in system.
- Data Requirement:** Minimum of 30 days of product level and flow through data.
- Comments:** This method **has** been evaluated for manifold tank systems using an acceptable protocol.  
44% of the data sets were from manifold tank systems.  
Of 94 data sets submitted for evaluation, all were analyzed with conclusive results.  
Results obtained from combined data for USTMAN Version 94.1 and 95.2.  
Data used in the evaluation were obtained from manual tank sticking.  
Median monthly throughput of tanks evaluated was 25,376 gallons.  
Leak rates of 0.05, 0.1, and 0.2 gph were used in evaluation.  
Data sets evaluated were supplied by evaluator.

USTMAN Industries Inc.  
12265 W. Bayaud Ave., Suite 110  
Lakewood, CO 80228  
Tel: (800) 253-8054

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 12/12/95

## Vaporless Manufacturing

### Vaporless LD 2000 and LD 2000S

#### AUTOMATIC MECHANICAL LINE LEAK DETECTOR

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 1.7 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel and solvents.
- Specification:** System tests pressurized fiberglass or steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 129 gallons.
- Waiting Time:** None between dispensing and testing.  
None between delivery and testing.
- Test Period:** Response time is 5 seconds.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
LD2000 - restricted flow to dispenser if leak is declared.  
LD2000S - pump shutoff if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Vaporless Manufacturing  
9234 E. Valley Rd., Suite C  
Prescott Valley, AZ 86314  
Tel: (520) 775-5191

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 11/19/90

**Vaporless Manufacturing**

Vaporless LD 2000E and LD 2000E -S  
(for flexible pipelines)

**AUTOMATIC MECHANICAL LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel and solvents.
- Specification:** System tests flexible pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 59.6 gallons.
- Waiting Time:** None between dispensing and testing.  
None between delivery and testing.
- Test Period:** Response time is 30 seconds.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
LD2000E - restricted flow to dispenser if leak is declared.  
LD2000ES - pump shutoff if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** Enviroflex piping with a bulk modulus\* of 1,352 psi was used during evaluation.  
  
\*See glossary.

Vaporless Manufacturing  
9234 E. Valley Rd., Suite C  
Prescott Valley, AZ 86314  
Tel: (520) 775-5191

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 12/11/92

## Vaporless Manufacturing

### Vaporless LD 2000T and LD 2000T-S

#### AUTOMATIC MECHANICAL LINE LEAK DETECTOR

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 129 gallons.
- Waiting Time:** None between dispensing and testing.  
None between delivery and testing.
- Test Period:** Response time is 1 minute.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
LD2000T - restricted flow to dispenser if leak is declared.  
LD2000T-S - pump shutoff if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Vaporless Manufacturing  
9234 E. Valley Rd., Suite C  
Prescott Valley, AZ 86314  
Tel: (520) 775-5191

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 07/13/93

## Vaporless Manufacturing

Vaporless LD 3000 and LD 3000S

### AUTOMATIC MECHANICAL LINE LEAK DETECTOR

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.0 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel and solvents.
- Specification:** System tests pressurized steel and fiberglass pipelines.  
Tests are conducted at operating pressure.
- Pipeline Capacity:** Maximum of 320 gallons.
- Waiting Time:** None between dispensing and testing.
- Test Period:** Response time is 9 seconds.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
LD3000 - restricted flow to dispenser if leak is declared.  
LD3000S - pump shutoff if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Vaporless Manufacturing  
9234 E. Valley Rd., Suite C  
Prescott Valley, AZ 86314  
Tel: (520) 775-5191

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 08/20/93

**Veeder-Root**

TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 1.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 158 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Response time is 14 seconds.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown, message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Rev. by Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 09/20/91, Rev. 04/12/93



**Veeder-Root**

TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D=100.0\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 158 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Response time is 6 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown, message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Rev. by Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494  
Dates of Evaluation: 09/20/91, Rev. 04/12/93

**Veeder-Root**

TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.079 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 158 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Response time is 14 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown, message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Veeder-Root  
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Evaluator: Midwest Research Institute  
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Rev. by Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494  
Date of Evaluation: 09/20/91, Rev. 04/12/93

**Veeder-Root**

TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 1.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 49.6 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Response time is 1 minute.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown, message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 08/04/93

**Veeder-Root**

TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D=96\%$  and  $P_{FA}=4\%$ .
- Leak Threshold:** 0.1 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 49.6 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Response time is 45 minutes to 8 hours, 51 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown, message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Tel: (816) 443-2494

Date of Evaluation: 08/04/93

**Veeder-Root**

TLS-350, 350PC, 350R, 350RPC Line Leak Detector, Series 8475  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.079 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 49.6 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Response time is 1 hour, 12 minutes to 12 hours, 54 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown, message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 08/04/93

**Veeder-Root**

TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100.0\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 1.88 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 98.4 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 16 minutes between dispensing and testing.
- Test Period:** Response time is 28.8 seconds.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Veeder-Root  
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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Date of Evaluation: 08/07/91

**Veeder-Root**

TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D=100.0\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.17 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 98.4 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 45 minutes to 1 hour between dispensing and testing.
- Test Period:** Response time is 32 to 48 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Veeder-Root  
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Tel: (860) 651-2700

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 12/18/96

**Veeder-Root**

TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D=100.0\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 98.4 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 2 hours, 30 minutes between dispensing and testing.
- Test Period:** Response time is 18 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Veeder-Root  
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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Date of Evaluation: 08/07/91



**Veeder-Root**

TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484  
(for flexible pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100.0\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 1.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at 10 psi.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 40.8 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 13 minutes between dispensing and testing.
- Test Period:** Response time is 4 to 6 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 10/16/95

**Veeder-Root**

TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D=100.0\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.17 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at 30 psi.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 40.8 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 4 minutes to 1 hour, 9 minutes between dispensing and testing.
- Test Period:** Response time is 40 minutes to 1 hour.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Midwest Research Institute  
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Date of Evaluation: 01/31/97

**Veeder-Root**

TLS 350, 350PC, 350R, 350RPC Line Leak Detector, Series 8484  
(for Flexible Pipelines)

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D=100.0\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized flexible pipelines.  
Tests are conducted at operating pressure with leak rates equivalent to 45 psi line pressure.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 40.8 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 1 to 4 hours between dispensing and testing.
- Test Period:** Response time is 45 minutes to 1 hour, 15 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Midwest Research Institute  
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Date of Evaluation: 10/16/95

**Veeder-Root**

TLS 350, 350PC, 350R, 350 RPC Line Leak Detector, Series 8494  
Pressurized Line Leak Detector, Series 8494

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 3.0 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 2.5 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure, not to exceed 50 psi.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 100 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Response time is 2 seconds.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 05/08/96

**Veeder-Root**

TLS 350, 350PC, 350R, 350 RPC Line Leak Detector, Series 8494  
Pressurized Line Leak Detector, Series 8494

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.17 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure, not to exceed 50 psi.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 100 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum between dispensing and testing is 45 minutes.
- Test Period:** Response time is 45 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Automatic testing of pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

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Date of Evaluation: 05/08/96

**Veeder-Root**

TLS 350, 350PC, 350R, 350 RPC Line Leak Detector, Series 8494  
Pressurized Line Leak Detector, Series 8494

**AUTOMATIC ELECTRONIC LINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.09 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Specification:** System tests pressurized fiberglass and steel pipelines.  
Tests are conducted at operating pressure, not to exceed 50 psi.  
System will not function with a mechanical line leak detector installed in the pipeline.
- Pipeline Capacity:** Maximum of 100 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 2 hours between dispensing and testing.
- Test Period:** Response time is 32 to 48 minutes.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** Permanent installation on pipeline.  
Preset threshold.  
Single test to determine if pipeline is leaking.  
Pump shutdown (optional), message display and alarm activation if leak is declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** Testing of pipeline at this leak rate is normally initiated manually, but may be set to activate automatically.

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Tel: (860) 651-2700

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Date of Evaluation: 05/08/96

**Veeder-Root**

TLS-250/250i/300/300c/300i/300pc/350/350pc/350r/350rpc UST ATGS  
(Models 8473 and 8493 Magnetostrictive Probes)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gallons per hour with  $P_D=95.8\%$  and  $P_{FA}=0.9\%$ .
- Leak Threshold:** 0.071 gph. A system should not be declared tight if the test indicates a loss or gain that equals or exceeds the threshold.
- Applicability:** Gasoline, diesel, aviation fuel.  
Other liquids maybe tested after consultation with the manufacturer.
- Capacity:** Maximum of 15,000 gallons.  
Tanks less than 95% full may be tested.  
Minimum product level required is based on tank diameter as follows -  
**48"** dia./ min 18"; **64"** dia./ min 21"; **72"** dia./ min 24"; **96"** dia./ min 30";  
**126"** dia./ min 39".
- Waiting Time:** Minimum of 8 hours between delivery and testing.  
Minimum of 30 minutes between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 3 hours.  
Test data are acquired and recorded by the system's computer.  
Leak rate is calculated from the difference between the first and last data collected.  
There must be no dispensing during testing.
- Temperature:** Probe contains 5 thermistors to monitor product temperature. At least one thermistor must be submerged in product during testing.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.544 inches.  
System is programmed to report water depth only when it exceeds 0.75 inches.  
Minimum detectable change in water level is 0.027 inches.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifolded tank systems. Tests only the portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank which routinely contains product.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-7684  
Tel: (860) 651-2700

Midwest Research Institute

Date of Evaluation: 7/1/98

**Veeder-Root**

TLS-250/250i/300/300c/300i/300pc/350/350pc/350r/350rpc UST ATGS  
(Models 8473 and 8493 Magnetostrictive Probes)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gallons per hour with  $P_D=98.9\%$  and  $P_{FA}=0.3\%$ .
- Leak Threshold:** 0.126 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel.  
Other liquids maybe tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tanks less than 95% full may be tested.  
Minimum product level required is based on tank diameter as follows:  
**48"** dia./ min 18"; **64"** dia./ min 21"; **72"** dia./ min 24"; **96"** dia./ min 30";  
**126"** dia./ min 39". (For other lengths see Veeder-Root Drawing #331322-001)
- Waiting Time:** Minimum of 8 hours between delivery and testing.  
Minimum of 30 minutes between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
Test data are acquired and recorded by the system's computer.  
Leak rate is calculated from the difference between the first and last data collected.  
There must be no dispensing during test.
- Temperature:** Average for product is determined by probe which contains 5 thermistors . At least one thermistor must be submerged in product during test.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.544 inch.  
System is programmed to report water depth only when it exceeds 0.75 inch.  
Minimum detectable change in water level is 0.027 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank which routinely contains product.

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Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 09/04/97



**Veeder-Root**

TLS-200/200i/250i/300/300c/300i/350/350pc/350r/350rpc UST ATGS  
(7842 Digital Sensing Capacitance Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D=99\%$ and $P_{FA}=1\%$ .
<b>Leak Threshold:</b>	0.1 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and solvents.
<b>Tank Capacity:</b>	Maximum of 15,000 gallons. Tank must be between 50 and 95% full.
<b>Waiting Time:</b>	Minimum of 8 hours, 18 minutes between delivery and testing. There must be no dispensing or delivery during waiting time.
<b>Test Period:</b>	Minimum of 5 hours. Test data are acquired and recorded by the system's computer. Leak rate is calculated from the difference between the first and last data collected. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined by a temperature averaging probe.
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 1.40 inches. Minimum detectable change in water level is 0.040 inch.
<b>Calibration:</b>	Temperature averaging probe must be checked and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product. Capacitance probes do not work with oxygenated fuels.

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Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 05/14/93

**Veeder-Root**

TLS-200/200i/250i/300/300c/300i/300pc/350/350pc/350r/350rpc UST ATGS  
(8472 Digital Sensing Capacitance Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.2 gph with  $P_D=99\%$  and  $P_{FA}=0.2\%$ .
- Leak Threshold:** 0.126 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be between 50 and 95% full.
- Waiting Time:** Minimum of 8 hours, 18 minutes between delivery and testing.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 2 hours.  
Test data are acquired and recorded by the system's computer.  
Leak rate is calculated from the difference between the first and last data collected.  
There must be no dispensing during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 1.52 inches.  
Minimum detectable change in water level is 0.027 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.  
Capacitance probes do not work with oxygenated fuels.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 05/14/93

**Veeder-Root**

TLS-200/200i/250i/300/300c/300i/300pc/350/350pc/350r/350rpc UST ATGS  
(8472 Digital Sensing Capacitance Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=99\%$ and $P_{FA}=0.1\%$ .
<b>Leak Threshold:</b>	0.071 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and solvents.
<b>Tank Capacity:</b>	Maximum of 15,000 gallons. Tank must be minimum 95% full.
<b>Waiting Time:</b>	Minimum of 8 hours, 15 minutes between delivery and testing. Minimum of 30 minutes between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Minimum of 2 hours. Test data are acquired and recorded by the system's computer. Leak rate is calculated from the difference between the first and last data collected. There must be no dispensing during test.
<b>Temperature:</b>	Average for product is determined by a minimum of 5 thermistors.
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 1.52 inches. Minimum detectable change in water level is 0.027 inch.
<b>Calibration:</b>	Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product. Capacitance probes do not work with oxygenated fuels.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Date of Evaluation: 05/14/93

**Veeder-Root**

TLS-200/200i/250/250i/300/300c/300i/300pc/350/350pc/350r/350rpc UST ATGS  
(8473 Digital Sensing Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D=99\%$ and $P_{FA}=0.1\%$ .
<b>Leak Threshold:</b>	0.093 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, and solvents.
<b>Tank Capacity:</b>	Maximum of 15,000 gallons. Tank must be between 50 and 95% full.
<b>Waiting Time:</b>	Minimum of 8 hours, 18 minutes between delivery and testing. Minimum of 30 minutes between dispensing and testing. There must be no delivery during waiting time.
<b>Test Period:</b>	Minimum of 2 hours. Test data are acquired and recorded by the system's computer. Leak rate is calculated from the difference between the first and last data collected. There must be no dispensing during test.
<b>Temperature:</b>	Average for product is determined by a minimum of 5 thermistors.
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.544 inch. Minimum detectable change in water level is 0.027 inch.
<b>Calibration:</b>	Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifold tank systems. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 05/14/93

**Veeder-Root**

TLS-200/200i/250/250i/300/300c/300i/300pc/350/350pc/350r/350rpc UST ATGS  
(8473 Digital Sensing Magnetostrictive Probe)

**AUTOMATIC TANK GAUGING SYSTEM**

- Certification:** Leak rate of 0.1 gph with  $P_D=99\%$  and  $P_{FA}=1\%$ .
- Leak Threshold:** 0.071 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and waste oil, and solvents.  
Other liquids may be tested after consultation with the manufacturer.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 95% full.
- Waiting Time:** Minimum of 8 hours, 15 minutes between delivery and testing.  
Minimum of 30 minutes between dispensing and testing.  
There must be no delivery during waiting time.
- Test Period:** Minimum of 3 hours.  
Test data are acquired and recorded by the system's computer.  
Leak rate is calculated from the difference between the first and last data collected.  
There must be no dispensing during test.
- Temperature:** Average for product is determined by a minimum of 5 thermistors.
- Water Sensor:** Must be used to detect water ingress.  
Minimum detectable water level in the tank is 0.544 inch.  
Minimum detectable change in water level is 0.027 inch.
- Calibration:** Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.  
Tests only portion of tank containing product.  
As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected.  
EPA leak detection regulations require testing of the portion of the tank system which routinely contains product.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 03/14/95

**Veeder-Root**

**TLS Series 300/400 Monitoring Systems with CSLD  
(Models 8473 and 8493 Magnetostrictive Probes)**

**CONTINUOUS IN-TANK LEAK DETECTION SYSTEM**

<b>Certification:</b>	Leak rate of 0.2 gph with $P_D=100\%$ and $P_{FA}=0\%$ .
<b>Leak Threshold:</b>	0.16 gph for single tanks at 99% operating mode. 0.15 gph for manifold tank systems at 99% operating mode. A system should not be declared tight, and a message printed for the operator, if the test results indicate a loss or gain that exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, waste oil, and solvents.
<b>Tank Capacity:</b>	Maximum of 38,170 gallons for single tanks and for all tanks manifolded together. Contact manufacturer for tank system applications if total tank capacity exceeds 30,000 gallons.
<b>Throughput:</b>	Monthly maximum of 221,890 gallons.
<b>Waiting Time:</b>	Minimum of 3 hours between delivery and testing.
<b>Temperature:</b>	Average for product is determined by a minimum of 5 thermistors.
<b>Water Sensor:</b>	Must be used to detect water ingress. Minimum detectable water level in the tank is 0.54 inch. Minimum detectable change in water level is 0.027 inch.
<b>Calibration:</b>	Thermistors and probe must be checked annually and calibrated if necessary in accordance with manufacturer's instructions. System set-up menu must be checked to verify that the 99% operating mode option has been selected.
<b>Comments:</b>	During installation, the set-up menu provides a choice between a 99% or a 95% operating mode. This evaluation covers only the 99% operating mode. At this time, there is no evaluation covering the 95% mode. System reports a quantitative result of pass or fail. Evaluated using both single and manifold tank systems. System collects data at naturally occurring product levels without interfering with normal tank operation, and discards data from unstable periods when system performs test. Data can be collected at any level above 12 inches of product. Leak rates above 1 gph are either reported as "fail" or as "no idle." For valid monthly testing, a conclusive test report must be produced for each tank every month. Systems warns the operator if there are no "passing" tests completed during the month. For very active tanks, a tank shut down may become necessary in order for the system to collect enough quiet-time data for a test. Test procedure used was Midwest Research Institute's "Evaluation of Continuous In-Tank Leak Detection Systems," April 17, 1995. Constant and variable leaks were mathematically induced into tight tank test records which were collected by systems installed at various active tank sites. The data base for evaluation of the system included sites with vapor recovery and blending dispensers. Tanks used in this evaluation contained gasoline and diesel.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600  
Date of Evaluation: 06/10/96

**Veeder-Root**

TLS-250, TLS 250i Plus, ILS 250, ILS 350, TLS-300/300c/300i/300pc, TLS-350 Series  
 Interstitial Liquid Sensor for Steel Tanks (0794390-420, -460)

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: float switch

**Test Results:**

	unleaded <u>gasoline</u> *	synthetic <u>gasoline</u> **
Accuracy (%)	100	100
Response time (min)	6.00	6.51
Recovery time (min)	<1	<1
Product activation height (cm)	3.67	3.62
Lower detection limit (cm)	4.05	4.17

\*TLS-250, TLS 250i Plus, ILS 250

\*\* ILS 350, TLS-350

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2, water.

**Comments:**

Results shown are from July 1992 evaluation. April 1998 evaluation yielded similar results. EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991. Detector is reusable.

Veeder-Root  
 125 Powder Forest Dr.  
 Simsbury, CT 06070-2003  
 Tel: (860) 651-2700

Evaluator: Carnegie Mellon Research Institute  
 Tel: (412) 268-3495

Dates of Evaluation: 07/17/92, 04/22/98

**Veeder-Root**

TLS-250i, TLS 250i Plus, ILS 250, ILS 350, TLS-300/300c/300i/300pc, TLS-350 Series  
 Interstitial Liquid Sensor for Fiberglass Tanks (0794390-401, 404, 407, 409)

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: float switch

**Test Results:**

	unleaded gasoline*	synthetic gasoline**
Accuracy (%)	100	100
Response time (min)	3.66	3.45
Recovery time (min)	<1	<1
Product activation height (cm)	1.28	1.27
Lower detection limit (cm)	1.84	1.65

\* TLS-250, TLS 250i Plus, ILS 250

\*\* ILS 350, TLS-350

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2, water.

**Comments:**

Results shown are from July 1992. April 1998 evaluation yielded similar results.  
 EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
 Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.  
 Detector is reusable.

Veeder-Root  
 125 Powder Forest Dr.  
 Simsbury, CT 06070-2003  
 Tel: (860) 651-2700

Evaluator: Carnegie Mellon Research Institute  
 Tel: (412) 268-3495

Dates of Evaluation: 07/17/92, 04/22/98



**Veeder-Root**

TLS-250i, TLS 250i Plus, ILS 250, ILS 350, TLS-300c/300i/300pc, TLS-350 Series  
Liquid Sensor for Sumps (0794390-206)

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: float switch

**Test Results:**

	unleaded <u>gasoline</u> *	synthetic <u>gasoline</u> **
Accuracy (%)	100	100
Response time (min)	8.19	8.49
Recovery time (min)	<1	<1
Product activation height (cm)	4.12	3.95
Lower detection limit (cm)	4.67	4.36

\* TLS-250, TLS 250i Plus, ILS 250, at a flow rate of 0.15 gal/hr in 5.8 cm diameter test chamber.

\*\* ILS 350, TLS-350, at a flow rate of 0.14 gal/hr in 5.8 cm diameter test chamber.

**Specificity Results:**

Activated: diesel fuel, synthetic fuel, heating oil #2, water.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991. Detector is reusable.

Veeder-Root

125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Carnegie Mellon Research  
Institute  
Tel: (412) 268-3495

Date of Evaluation: 07/17/92

**Veeder-Root**

TLS-350 Series  
Discriminating Interstitial Liquid Sensor (794380-341)

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: capacitance change/ultrasonic

**Test Results: \***

	unleaded <u>gasoline</u>	<u>water</u>
Accuracy (%)	100	100
Response time (min)	0.46	1.36
Recovery time (min)	<1	<1
Product activation height (cm)	0.23	0.69

\* At a flow rate of 0.94 gal/hr in 14.4 cm diameter test chamber.

**Specificity Results:**

Activated: diesel fuel (at liquid height of 0.37 cm), synthetic fuel (at 0.35 cm), heating oil #2 (at 0.43 cm).

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Detectors are listed as interstitial due to intended use.

Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Detector is reusable.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Date of Evaluation: 06/30/93

**Veeder-Root**

TLS-350 Series, TLS-300/300i  
 Discriminating Dispenser Pan Sensor (794380-322) and Discriminating Containment Sump Sensor  
 (794380-352)

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: product permeable, reed switch/float

**Test Results:**

	<u>polymer strip</u>		<u>float switches</u>	
<b>Discriminating Containment Sump Sensor</b>	unleaded		<u>water</u>	
	<u>gasoline</u>	<u>diesel</u>	<u>low</u>	<u>high</u>
Accuracy (%)	100	100	100	100
Response time (min)	~10	2-12 hrs	<1 sec	<1 sec
Recovery time (min)	N/A	N/A	<1 sec	<1 sec
Lower detection limit - height (cm)	N/D	N/D	3.48	31.2
Lower detection limit - thickness (cm)	0.0127	0.0127	N/A	N/A

**Discriminating Dispenser Pan Sensor**

	<u>polymer strip</u>		<u>float switches</u>	
	unleaded		<u>water</u>	
	<u>gasoline</u>	<u>diesel</u>	<u>low</u>	<u>high</u>
Accuracy (%)	100	100	100	100
Response time (min)	~10	2-12 hrs	<1 sec	<1 sec
Recovery time (min)	N/A	N/A	<1 sec	<1 sec
Lower detection limit - height (cm)	N/D	N/D	3.43	19.4
Lower detection limit - thickness (cm)	0.0127	0.0127	N/A	N/A

**Specificity Results:**

**Activated:** commercial gasoline, synthetic gasoline, diesel fuel, jet-A fuel, n-hexane, toluene, xylene(s), water

**Not activated:** polymer strip sensor did not respond to water

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures were modified by evaluator using EPA's "Standard Test Procedure for Evaluation Leak Detection Methods: Liquid-Phase Out-of-tank Liquid Product Detectors". Polymer strip is not reusable.

Veeder-Root  
 125 Powder Forest Dr.  
 Simsbury, CT 06070-2003  
 Tel: (860) 651-2700

Evaluator: Ken Wilcox Associates  
 Tel: (816) 795-7997

Dates of Evaluation: 01/02/95, 06/23/97, 04/20/98

**Veeder-Root**

Dispenser Pan Sensor (847900-001) and Differentiating Dispenser Pan Sensor (847900-002)  
With Dispenser Control Interface

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: product permeable, product soluble, reed switch/float

**Test Results:**

	unleaded <u>gasoline</u>	<u>diesel</u>	<u>water</u>
<b>Dispenser Pan Sensor</b>			
Detection time(sec)	<1	<1	<1
Minimum Product Level (in)	1.71	1.66	1.62
Precision (in)	0.006	0.004	0.008
<b>Differentiating Dispenser Pan Sensor</b>			
Minimum Product Thickness (in)	1/32	1/16	N/A*
Minimum Product Level (in)	N/D*	N/D*	6.39
Precision (in)	N/A**	N/A**	0.008
Detection Time (hr:min:sec)	00:06:30	00:19:50	<00:00:01

\*See glossary.

\*\*Tested at discrete levels only.

**Specificity Results:**

**Activated:** commercial gasoline, synthetic gasoline, diesel fuel, n-hexane, toluene, xylene(s), water

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
Detector is reusable.

These sensors do not require a console

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Ken Wilcox Associates, Inc.  
Tel: (816) 795-7997

Dates of Evaluation: 11/15/93

**Veeder-Root**

## TLS-350 Series

Dispenser Pan Sensor(794380-320) and Containment Sump Sensor(794380-350, 360)

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: electrical conductivity/ultrasonic

**Test Results:**

	unleaded <u>gasoline</u>	<u>low</u>	<u>water</u> <u>high</u>
Accuracy (%)	100	100	100
Response time (min)	6.59	4.60	5.00
Recovery time (min)	17.17	<1	<1
Product activation height (cm)	3.40	2.45	20.3

**Specificity Results:**

Activated: diesel fuel (at liquid height of 4.75 cm), synthetic fuel (at 2.58 cm), heating oil #2 (at 4.67 cm).

**Comments:**

Product activation height is initial height of product in chamber, not thickness of product on water. EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.  
 Detector is reusable.  
 Vendor states modified sensor 794380-360 has low and high level alarms 21" and 15 " higher, respectively.  
 Product thickness was not evaluated.

Veeder-Root  
 125 Powder Forest Dr.  
 Simsbury, CT 06070-2003  
 Tel: (860) 651-2700

Evaluator: Carnegie Mellon Research Institute  
 Tel: (412) 268-3495

Date of Evaluation: 05/26/93

**Veeder-Root**

TLS-350 Series, TLS-300/300i  
Dual and Single Stage Hydrostatic Sensors (794380-301, -302)

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: float switch

**Test Results: \***

	50 % by weight Ethylene glycol in water		30 % by weight Calcium chloride in water	
	<u>up</u>	<u>down</u>	<u>up</u>	<u>down</u>
Accuracy (%)	100	100	100	100
Response time (min)	22.52	35.75	20.46	37.07
Recovery time (min)	<1	<1	<1	<1
Product activation height (cm)	33.1	3.9	32.2	4.0

\* At a flow rate of 0.33 gal/hr in a test chamber of 7.8 cm diameter.

**Specificity Results:**

Not applicable

**Comments:**

Intended to monitor level of either ethylene glycol or calcium chloride solutions in interstitial or annular space of a double-walled tank.

Activates alarm if any significant gain or loss of solution occurs.

Test procedures used were modified by evaluator from Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Detector is reusable.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Carnegie Mellon Research Institute  
Tel: (412) 268-3495

Dates of Evaluation: 12/07/92, 03/16/98

**Veeder-Root**

TLS-350 / 350 PC / 350R / 350RPC  
Solid-State Pan/Sump Sensor (794380-321, -351), Piping Sump Sensor (794380-208, -209)  
Micro Sensor (794380-340)

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: product permeable, ultrasonic/float switch

**Test Results:**

	unleaded		
<b>Piping Sump Sensor (794380-208, -209)</b>	<u>gasoline</u>	<u>diesel</u>	<u>water</u>
Min. product level (cm)	3.51	3.40	3.03
Precision	0.011	0.011	0.011
Detection time (sec)	<1	<1	<1
<b>Solid-State Pan/Sump Sensor (794380-321, -351)</b>			
Minimum Product Thickness (cm)	2.60	2.50	2.60
Precision	0.010	0.010	0.010
Detection Time (sec)	<1	<1	<1
<b>Micro Sensor (794380-340)</b>			
Minimum Product Thickness (cm)	0.51	0.46	0.48
Precision	0.011	0.007	0.007
Detection Time (sec)	<1	<1	<1

**Specificity Results:**

unleaded gasoline, diesel fuel, water

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring. Test procedures used were modified by evaluator from EPA's "Standard Test Procedures for Evaluation of Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors," March 1990  
Detector is reusable.  
208 and 209 sensors are also compatible with 300 series.

Veeder-Root  
125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Ken Wilcox Associates, Inc.  
Tel: (816) 443-2494

Dates of Evaluation: 10/20/94

**Veeder-Root**

350 Series UST Monitoring Systems: Models ILS-350, TLS-350/350r/350pc/350rpc  
Groundwater Sensor (794380-621, -622, -624)

**LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: electrical conductivity

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>
Accuracy (%)	100	100
Detection time (min:sec)	08:55	06:18
Fall time (min:sec)	54:50	26:02
Lower detection limit (cm)	0.02	0.02

**Specificity Results:**

Activated: unleaded gasoline, synthetic gasoline, n-hexane, diesel fuel, jet-A fuel, toluene, xylene(s).

**Calibration:**

Sensor must be checked annually for operability or in accordance with manufacturer's instructions and calibrate/replaced if necessary.

**Comments:**

EPA and many states require detection of 1/8 inch (0.32 cm) of product for groundwater monitoring.  
Detector is reusable.

Veeder-Root

125 Powder Forest Dr.  
Simsbury, CT 06070-2003  
Tel: (860) 651-2700

Evaluator: Carnegie Mellon Research  
Institute

Tel: (412) 268-3495  
Dates of Evaluation: 11/20/91 (TLS-350) and  
07/28/92



**Veeder-Root**

ILS 350, TLS-350 Series  
 Adsistor Vapor Probes (794390-700)

**VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: adsistor

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>	JP-4 <u>jet fuel</u>
Accuracy (%)	100	0	100
Detection time (min:sec)	7:46	N/A*	17:01
Fall time (min:sec)	2:38	N/A	3:05
Lower detection limit (ppm)	500	>1000	500

\*See Glossary.

**Specificity Results:**

Activated: unleaded gasoline, JP-4 jet fuel

Not Activated: synthetic gasoline, n-hexane, toluene, xylene(s).

**Comments:**

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Veeder-Root  
 125 Powder Forest Dr.  
 Simsbury, CT 06070-2003  
 Tel: (860) 651-2700

Evaluator: Carnegie Mellon Research Institute  
 Tel: (412) 268-3495

Date of Evaluation: 07/24/92

**Vista Research, Inc.**

Model LT-100 Version 1.0 Manual Method

**LARGE DIAMETER PIPELINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D = 96\%$  and  $P_{FA} \leq 4\%$ .
- Leak Threshold:** 0.177 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, fuel oil #4, waste oil, and solvents.
- Specification:** System tests fiberglass or steel piping.  
Tests are conducted at operating pressure to a maximum of 200 psi.
- Pipeline Capacity:** Maximum of 3,400 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Minimum of 2 hours after setup and after pipeline is fully isolated.  
Test data are acquired and recorded manually.  
Calculations are performed by tester.
- System Features:** System may be permanently installed on pipeline to perform monthly monitoring or line tightness testing, or may be transported and set up to perform line tightness testing.  
A single 2-hour test is required consisting of a 1-hour monitoring period at operating pressure and a 1-hour monitoring period at atmospheric pressure.  
Preset threshold.  
Printed message and alarm activation if leak is declared.
- Calibration:** System must be calibrated in accordance with manufacturer's instructions during system setup.

Vista Research, Inc.  
100 View St.  
Mountain View, CA 94042  
Tel: (415) 966-1171

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 04/15/96

**Vista Research, Inc.**

## Model LT-100 Version 1.0 Manual Method

**LARGE DIAMETER PIPELINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D = 96\%$  and  $P_{FA} = 4\%$ .
- Leak Threshold:** 0.077 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, fuel oil #4, waste oil, and solvents.
- Specification:** System tests fiberglass or steel piping.  
Tests are conducted at operating pressure to a maximum of 200 psi.
- Pipeline Capacity:** Maximum of 3,400 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Minimum of 2 hours after setup and after pipeline is fully isolated.  
Test data are acquired and recorded manually.  
Calculations are performed by tester.
- System Features:** System may be permanently installed on pipeline to perform monthly monitoring or line tightness testing, or may be transported and set up to perform line tightness testing.  
A single 2-hour test is required consisting of a 1-hour monitoring period at operating pressure and a 1-hour monitoring period at atmospheric pressure.  
Preset threshold.  
Printed message and alarm activation if leak is declared.
- Calibration:** System must be calibrated in accordance with manufacturer's instructions during system setup.

Vista Research, Inc.  
100 View St.  
Mountain View, CA 94042  
Tel: (415) 966-1171

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 04/15/96

**Vista Research, Inc.**

Model LT-100 Version 1.0 Primary Method

**LARGE DIAMETER PIPELINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D = 97\%$  and  $P_{FA} \leq 3\%$ .
- Leak Threshold:** 0.148 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, fuel oil #4, waste oil, and solvents.
- Specification:** System tests fiberglass or steel piping.  
Tests are conducted at operating pressure to a maximum of 200 psi.
- Pipeline Capacity:** Maximum of 3,400 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Maximum of 2 hours after setup and after pipeline is fully isolated.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** System may be permanently installed on pipeline to perform monthly monitoring or line tightness testing, or may be transported and set up to perform line tightness testing.  
A single 2-hour test is required consisting of a 1-hour monitoring period at operating pressure, and a 1-hour monitoring period at atmospheric pressure.  
Preset threshold.  
Printed message and alarm activation if leak is declared.
- Calibration:** System must be calibrated in accordance with manufacturer's instructions during system setup.

Vista Research, Inc.  
100 View St.  
Mountain View, CA 94042  
Tel: (415) 966-1171

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 04/15/96

**Vista Research, Inc.****Model LT-100 Version 1.0 Primary Method****LARGE DIAMETER PIPELINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D = 97\%$  and  $P_{FA} = 3\%$ .
- Leak Threshold:** 0.060 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, fuel oil #4, waste oil, and solvents.
- Specification:** System tests fiberglass or steel piping.  
Tests are conducted at operating pressure to a maximum of 200 psi.
- Pipeline Capacity:** Maximum of 3,400 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Minimum of 2 hours after setup and after pipeline is fully isolated.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** System may be permanently installed on pipeline to perform monthly monitoring or line tightness testing, or may be transported and set up to perform line tightness testing.  
A single 2-hour test is required consisting of a 1 hour monitoring period at operating, and a 1 hour monitoring period at atmospheric pressure.  
Preset threshold.  
Printed message and alarm activation if leak is declared.
- Calibration:** System must be calibrated in accordance with manufacturer's instructions during system setup.

Vista Research, Inc.  
100 View St.  
Mountain View, CA 94042  
Tel: (415) 966-1171

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 04/15/96

**Vista Research, Inc.**

Model LT-100 Version 1.0 Segmented Method

**LARGE DIAMETER PIPELINE LEAK DETECTOR**

- Certification:** Leak rate of 0.2 gph with  $P_D = 97\%$  and  $P_{FA} = 3\%$ .
- Leak Threshold:** 0.174 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, fuel oil #4, waste oil, and solvents.
- Specification:** System tests fiberglass or steel piping.  
Tests are conducted at operating pressure to a maximum of 200 psi.
- Pipeline Capacity:** Maximum of 3,400 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Minimum of 2 hours after setup and after pipeline is fully isolated.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** System may be permanently installed on pipeline to perform monthly monitoring or line tightness testing, or may be transported and set up to perform line tightness testing.  
A single 2-hour test is required consisting of two 5-minute monitoring segments at atmospheric pressure spaced 25 minutes apart, and two 5-minute monitoring segments at operating pressure spaced 25 minutes apart.  
Preset threshold.  
Printed message and alarm activation if leak is declared.
- Calibration:** System must be calibrated in accordance with manufacturer's instructions during system setup.

Vista Research, Inc.  
100 View St.  
Mountain View, CA 94042  
Tel: (415) 966-1171

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 04/15/96

**Vista Research, Inc.**

## Model LT-100 Version 1.0 Segmented Method

**LARGE DIAMETER PIPELINE LEAK DETECTOR**

- Certification:** Leak rate of 0.1 gph with  $P_D = 97\%$  and  $P_{FA} = 3\%$ .
- Leak Threshold:** 0.074 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuels, fuel oil #4, waste oil, and solvents.
- Specification:** System tests fiberglass or steel piping.  
Tests are conducted at operating pressure to a maximum of 200 psi.
- Pipeline Capacity:** Maximum of 3,400 gallons.
- Waiting Time:** None between delivery and testing.  
None between dispensing and testing.
- Test Period:** Minimum of 2 hours after setup and after pipeline is fully isolated.  
Test data are acquired and recorded by a microprocessor.  
Calculations are automatically performed by the microprocessor.
- System Features:** System may be permanently installed on pipeline to perform monthly monitoring or line tightness testing, or may be transported and set up to perform line tightness testing.  
A single 2-hour test is required consisting of two 5-minute monitoring segments at atmospheric pressure spaced 25 minutes apart, and two 5-minute monitoring segments at operating pressure spaced 25 minutes apart.  
Preset threshold.  
Printed message and alarm activation if leak is declared.
- Calibration:** System must be calibrated in accordance with manufacturer's instructions during system setup.

Vista Research, Inc.  
100 View St.  
Mountain View, CA 94042  
Tel: (415) 966-1171

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 04/15/96

**Warren Rogers Associates, Inc.**

WRA Statistical Inventory Analysis, Version 5.1

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.98\%$  and  $P_{FA}=0.02\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 18,000 gallons.
- Data Requirement:** Minimum of 30 days of product level and flow through data.
- Comments:** Not evaluated using manifold tank systems.  
Of 41 data sets submitted for evaluation, all were analyzed with conclusive results.  
Median monthly throughput for tanks evaluated was 1000 gallons.  
Leak rates of 0.05, 0.1, and 0.20 gph were used in evaluation.  
A portion of data sets evaluated was supplied by vendor.

Warren Rogers Associates, Inc.  
747 Aquidneck Ave.  
Middletown, RI 02840  
Tel: (800) 972-7472

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 12/18/90



**Warren Rogers Associates, Inc.**

## WRA Statistical Inventory Analysis, Version 5.2

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.9\%$  and  $P_{FA}=0.1\%$  for both single and manifolded tanks.
- Leak Threshold:** 0.05 gph. Leak reported when there is a statistically significant loss at the 0.01 level of significance.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4
- Tank Capacity:** Maximum of 36,000 gallons. Maximum of 3 tanks in a manifolded system.
- Data Requirement:** Minimum of 30 days of product level and flow through data.
- Comments:** 50% of data sets evaluated were from manifolded tanks systems.  
82 data sets were submitted for evaluation. All were analyzed with conclusive results.  
Median monthly throughput of tanks evaluated was 52,207 gallons as of version 5.1. Median monthly throughput of separate manifolded tank evaluation was 14,944 gallons.  
Leak rates of 0.05, 0.10, and 0.20 gph were used in evaluation.  
All manifolded data sets evaluated were supplied by evaluator. A portion of the data sets drawn from the WRA 5.1 evaluation for tanks that were not manifolded were provided by the vendor.

Warren Rogers Associates, Inc.  
747 Aquidneck Ave.  
Middletown, RI 02840  
Tel: (401) 846-4747

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494  
Date of Evaluation: 12/08/97

**Warrick Controls, Inc.**

DMS-47X-X-X(-X), DMS-57X-X-X(-X) Monitoring Panels  
Models DLP-1-NC, DLP-2-NC, DLP-2-NO sensors

**LIQUID-PHASE INTERSTITIAL DETECTOR****Detector:**

Output type: qualitative  
Sampling frequency: continuous  
Operating principle: float switch

**Test Results\*:**

	unleaded <u>gasoline</u>	<u>diesel</u>	<u>water</u>
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Threshold (in)*	≤1.54	≤1.50	≤1.43
Precision (in)*	≤0.004	≤0.005	≤0.007

\*Results for threshold and precision varied slightly for each sensor; see evaluation for details.

**Specificity Results:**

Activated: water, unleaded gas, diesel.

**Comments:**

Test procedures used were Ken Wilcox Associates, Inc.s', "Alternative Test Procedures for Evaluating Leak Detection Methods: Evaluation of Liquid Level Sensors", November 1997.

Evaluator states that sensor will respond to any liquid once sensors' threshold has been exceeded.

Sensors are reuseable.

Warrick Controls, Inc.  
4237 Normandy Court  
Royal Oak, MI 48073  
Tel: (248) 549-4900

Evaluator: Ken Wilcox Associates, Inc.  
Tel: (816)443-2494

Date of Evaluation: 12/01/97

**Warrick Controls, Inc.**

## Model DFP-25 Sensor

## LIQUID-PHASE INTERSTITIAL DETECTOR

**Detector:**

Output type: qualitative  
 Sampling frequency: continuous  
 Operating principle: product solubility

**Test Results:**

	unleaded <u>gasoline</u> *	<u>diesel</u>	<u>water</u>
Detection time (hr:min:sec)	00:06:50	04:14:40	N/A
Fall time (min:sec)	N/A*	N/A	N/A
Lower detection limit (cm)	≤2.54	≤2.54	N/A

\* See glossary.

**Specificity Results:**

Activated: unleaded gasoline, #2 diesel.

Not Activated: water (in 12 hours).

**Comments:**

Sensor is activated when hydrocarbon-sensitive wax is dissolved, releasing a spring that activates an alarm.

Detector is not reusable, and must be replaced after contact with hydrocarbons.

Fall time is not applicable, since sensor must be replaced after activating.

Evaluator claims that this sensor will respond to any material that is capable of dissolving the hydrocarbon-sensitive wax, but will not respond to water.

Liquid level was set at 1 inch (2.54 cm) during test.

Test procedures used were Ken Wilcox Associates' "Alternative Test Procedures for Evaluating Leak Detection Methods: Evaluation of Liquid Level Sensors," September 1996.

Warrick Controls, Inc.  
 4237 Normandy Court  
 Royal Oak, MI 48073  
 Tel: (248) 549-4900

Evaluator: Ken Wilcox Associates, Inc.  
 Tel: (816)443-2494

Date of Evaluation: 11/18/96

**Warrick Controls, Inc.**

Model 5700 Meter  
PVP-2 Sensor

**VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR****Detector:**

Output type: quantitative  
Sampling frequency: continuous  
Operating principle: adsistor

**Test Results:**

	unleaded <u>gasoline</u>	synthetic <u>gasoline</u>	JP-4 <u>jet fuel</u>
Accuracy (%)	25.4	-100.0	157.1
Bias (%)	14.4	-100.0	108.3
Precision (%)	7.6	N/D*	20.4
Detection time (min)	>60	N/A*	>60
Fall time (min)	38	N/A	>60
Lower detection limit (ppm)	1353.3	N/D	N/D

\* See glossary.

**Specificity Results:**

**Not Activated:** unleaded gasoline, synthetic gasoline, n-hexane, JP-4 jet fuel, toluene, xylene(s).

**Comments:**

Test procedures used were Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Warrick Controls, Inc.

4237 Normandy Court  
Royal Oak, MI 48073  
Tel: (248) 549-4900

Evaluator: Carnegie Mellon Research  
Institute  
Tel: (412) 268-3495

Date of Evaluation: 09/10/91

**Watson Systems, Inc. (formerly EnviroQuest Technologies Limited)**

Enviro Tite SIR  
(also known as SIRAS 99.6)

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.1 gph with  $P_D=99.6\%$  and  $P_{FA}=0.4\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 18,000 gallons.
- Data Requirement:** Minimum of 31 days to make an SIR evaluation with minimum 95% confidence at the rate of 0.1 gph; 45 to 60 days for greater confidence.
- Comments:** Not evaluated using manifold tank systems.  
Of 41 data sets submitted for evaluation, 5 were not analyzed due to unusable data.  
Median monthly throughput for tanks evaluated was 16,700 gallons.  
Leak rates ranging from 0.0500 to 0.2043 were used in evaluation.  
Data sets evaluated were supplied by evaluator.

Watson Systems, Inc.  
4501 Madison  
Kansas City, MO 64111  
Tel: (816) 756-0774

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 04/03/92

**Watson Systems, Inc. (formerly EnviroQuest Technologies Limited)**

SIRAS Software System, Versions 2.8.3 and 2.0

**STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)**

- Certification:** Leak rate of 0.2 gph with  $P_D = 99.999\%$  and  $P_{FA} = 0.01\%$   
Leak rate of 0.1 gph with  $P_D = 99.3\%$  and  $P_{FA} = 0.7\%$
- Leak Threshold:** 0.05 for leak rate of 0.1 gph.  
0.1 for leak rate of 0.2 gph.  
A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 30,000 gallons.  
Size limits using an acceptable protocol for manifold tank systems have not been determined.
- Data Requirement:** Minimum of 30 days of usable product level and flow through data.
- Comments:** Not evaluated for manifold tank systems using an acceptable protocol.  
27% of data sets evaluated were from manifold tank systems.  
Of 56 data sets submitted for evaluation, 6 were not analyzed due to unusable data.  
Median monthly throughput for tanks evaluated was 73,518 gallons.  
Leak rates ranging from 0.0458 to 0.2500 gph were used in evaluation.  
Data sets evaluated were supplied by evaluator.

Watson Systems, Inc.  
4501 Madison  
Kansas City, MO 64111  
Tel: (816) 756-0774

Evaluator: Midwest Research Institute  
Tel: (816) 753-7600

Date of Evaluation: 08/23/93

## Western Environmental Resources

Model PLT-100R

### LINE TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gph with  $P_D=100\%$  and  $P_{FA}=0\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil, waste oil, and solvents.
- Specification:** System tests fiberglass and steel pipelines.  
Tests are conducted at 150% operating pressure.  
Mechanical line leak detector must be removed from pipeline for duration of test.
- Pipeline Capacity:** Maximum of 80 gallons.
- Waiting Time:** None between delivery and testing.  
Minimum of 1 hour between dispensing and testing.
- Test Period:** Minimum of 30 minutes.  
Test data are acquired and recorded manually.  
Two tests with no time between tests are required before a leak can be declared.
- Calibration:** System must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Western Environmental Resources  
PO Box 37  
Bakersfield, CA 93302  
Tel: (805) 326-0173

Evaluator: Vista Research  
Tel: (415) 966-1171

Date of Evaluation: 11/21/90

**Western Environmental Resources**

## AES System II

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)**

- Certification:** Leak rate of 0.1 gph with  $P_D=97.7\%$  and  $P_{FA}=2.3\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil, waste oil, and solvents.
- Tank Capacity:** Maximum of 15,000 gallons.  
Tank must be minimum 100% full.
- Waiting time:** Between delivery and the beginning of test, waiting time is included in the waiting time after "topping off".  
Between "topping off" and beginning test, waiting time is computer-dictated by real-time analysis of level and temperature data.  
Total waiting time is approximately 4 to 12 hours.  
There must be no dispensing or delivery during waiting time.
- Test Period:** Minimum of 2 hours (two 1-hour tests).  
Test data are acquired and recorded by a computer.  
Leak rate is calculated from the last 1 hour, 30 minutes of test period data.  
There must be no dispensing or delivery during test.
- Temperature:** Average for product is determined by a minimum of 5 temperature sensors.
- Groundwater:** Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 2 psi at bottom of the tank during test.
- Calibration:** Level sensors must be calibrated before each test in accordance with manufacturer's instructions.  
Temperature sensor must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** Not evaluated using manifold tank systems.

Western Environmental Resources  
PO Box 37  
Bakersfield, CA 93302  
Tel: (805) 326-1073

Evaluator: Vista Research  
Tel: (415) 966-1171  
Date of Evaluation: 12/20/90



**Western Environmental Resources**

## AES System II - (Large Tanks)

**VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)**

<b>Certification:</b>	Leak rate of 0.1 gph with $P_D=98.9\%$ and $P_{FA}=1.1\%$ .
<b>Leak Threshold:</b>	0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
<b>Applicability:</b>	Gasoline, diesel, aviation fuel, fuel oil, waste oil, and solvents.
<b>Tank Capacity:</b>	Maximum of 75,000 gallons. Tank must be minimum 100% full.
<b>Waiting Time:</b>	Minimum of 24 hours after delivery. Between "topping off" and beginning test, waiting time is computer-dictated by real-time analysis of level and temperature data and must be minimum of 1 hour. There must be no dispensing or delivery during waiting time.
<b>Test Period:</b>	Minimum of 4 hours. Test data are acquired and recorded by a computer. Leak rate is calculated from the last 3 hours of test period data. There must be no dispensing or delivery during test.
<b>Temperature:</b>	Average for product is determined by a minimum of 12 thermistors.
<b>Groundwater:</b>	Depth to groundwater in backfill must be determined. If groundwater is above bottom of tank, product level must be adjusted to provide a minimum net pressure of 2 psi at bottom of the tank during test.
<b>Calibration:</b>	Level sensors must be calibrated before each test in accordance with manufacturer's instructions. Thermistors must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
<b>Comments:</b>	Not evaluated using manifold tank systems.

Western Environmental Resources  
PO Box 37  
Bakersfield, CA 93302  
Tel: (805) 326-0173

Evaluator: Ken Wilcox Associates  
Tel: (816) 443-2494

Date of Evaluation: 02/28/92

**Xerxes Corp.**

Xerxes Truheck Hydrostatic Monitoring System

**DOUBLE WALLED TANK TIGHTNESS TEST**

- Certification:** Leak rate of 0.1 gph with  $P_D=99\%$  and  $P_{FA}=1\%$ .
- Leak Threshold:** 0.05 gph. A system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum of 30,000 gallons.  
Tank must be between 0 to 100% full.
- Waiting Time:** None between delivery and testing.
- Test Period:** Minimum of 10 hours.
- Groundwater:** Depth to groundwater in backfill must be determined before and after test.  
When groundwater level is above bottom of tank but below top, test should be repeated if groundwater level increases by more than 7 inches during test.  
When groundwater level is above tank, test should be repeated if groundwater level increases by more than 5 inches during test.

Xerxes Corp.  
7901 Xerxes Ave.  
Minneapolis, MN 55431  
Tel: (612) 887-1890

Evaluator: Robert Plunkett, Ph.D.  
Tel: (612) 338-0945

Date of Evaluation: 01/07/93

PART III  
LEAK DETECTION EQUIPMENT  
THIRD PARTY EVALUATIONS  
UNDER REVIEW

ALPHABETICAL BY VENDOR,  
THEN BY TEST METHOD,  
FINALLY BY EQUIPMENT MODEL,

<u>Test Method</u>	<u>Vendor</u>	<u>Equipment Model</u>	Revision Date: November 14, 1997 <u>Evaluator/Date of Evaluation</u>
Continuous ATG	<b>Alert Technologies</b>	3000 and 4000	Ken Wilcox Associates 02/20/92
Continuous ATG	<b>Arizona Instrument</b>	Encompass CSTT - Ultrasonic Probe Access Module	Ken Wilcox Associates 09/18/96
Large Tank Automatic Tank Gauging System	<b>Coggins System</b>	Leak Manager Leak Detection System with the Barton Series 3500 ATG	Ken Wilcox Associates 05/20/98
Vapor-Phase Product Detector	<b>HNU</b>	DL-101; HW-101; ISPI-101; PI-101	Carnegie Mellon Research Institute 11/28/91, 02/05/92, 03/05/92
Continuous Automatic Tank Gauge	<b>INCON Intelligent Controls, Inc.</b>	SCALD (Applies to Incon Controller Models TS 1000, TS 2000, TS 1001, TS 2001 Sensor Model TS-DLP)	Ken Wilcox Associates 09/14/95
Automatic Tank Gauge	<b>INCON Intelligent Controls, Inc.</b>	TS-1000, TS-1001 TS-2001 (30,000 gallon tank, low level testing)	Ken Wilcox Associates 05/14/98
Continuous Automatic Tank Gauge	<b>Marley Pump</b>	ST1400-1800, ATG, FMS, LLM	ADA Technologies 10/12/92
Automatic Tank Gauge	<b>Marley Pump</b>	ST1400-1800 Series, Versions ATG, FMS and LLM	ADA Technologies 10/12/92
Large Tank Automatic Tank Gauging System	<b>Mass Technology Corp.</b>	Precision mass measurement system 2 million gallon vertical tank	Ken Wilcox Associates 03/25/98
Large Tank Automatic Tank Gauging System	<b>Mass Technology Corp.</b>	Precision mass measurement system 120,000 gallon vertical tank	Ken Wilcox Associates 03/25/98
Vapor-Phase Product Detector	<b>Mine Safety Appliances</b>	Tank-Check	Carnegie Mellon Research Institute 05/31/91
Large Tank Automatic Tank Gauging System	<b>Naval Facilities Eng. Service Center and Vista Research, Inc.</b>	LRDP-24 and LRDP-24-5	Ken Wilcox Associates 01/29/98
Large Tank Automatic Tank Gauging System	<b>Naval Facilities Eng. Service Center and Vista Research, Inc.</b>	LRDP-48 and LRDP-48-4	Ken Wilcox Associates 01/29/98
Non-Volumetric Tank Tightness Test (Vacuum)	<b>NDE Environmental Corp.</b>	U3 Vacuum	Ken Wilcox Associates 06/25/96
Statistical Inventory Reconciliation (0.2 gph)	<b>SIR International, Inc.</b>	Mitchell's SIR Program (Version 2.7)	Ken Wilcox Associates 6/8/95

<b><u>Test Method</u></b>	<b><u>Vendor</u></b>	<b><u>Equipment Model</u></b>	<b><u>Evaluator/Date of Evaluation</u></b>
Statistical Inventory Reconciliation (0.1 gph)	<b>SIR International, Inc.</b>	Mitchell's SIR Program (Version 2.6)	Ken Wilcox Associates 6/8/95
Statistical Inventory Reconciliation (0.2 gph)	<b>Triangle Environmental, Inc.</b>	TRI SIR (Version 1.01)	Ken Wilcox Associates 8/23/95
Non-Volumetric Tank Tightness Test (Vacuum)	<b>SDT-USA</b>	SDT Model 150	Ken Wilcox Associates 03/01/96
Automatic Tank Gauging System	<b>Veeder-Root</b>	TLS 250/250i/300/350/PC Monitoring Systems with magnetostrictive probes to 0.1 gph	Midwest Research Institute 07/01/98
Automatic Tank Gauging System	<b>Veeder-Root</b>	TLS 300/350/PC Monitoring System with 8463/8473/8493 magnetostrictive probes as volumetric tightness test up to 20,000 gallon tanks	Ken Wilcox Associates 07/12/98
Automatic Tank Gauging System	<b>Veeder-Root</b>	TLS 300/350/PC Monitoring System with 8463/8473/8493 magnetostrictive probes as ATG monthly monitoring up to 30,000 gallon tanks	Ken Wilcox Associates 08/14/98
Automatic Tank Gauging System	<b>Veeder-Root</b>	TLS 300/350/PC Monitoring System with 8463/8473/8493 magnetostrictive probes as ATG for 0.1 gph up to 20,000 gallon tanks	Ken Wilcox Associates 07/06/98
Automatic Tank Gauging System	<b>Veeder-Root</b>	TLS 300/350/PC Monitoring System with 8463/8473/8493 magnetostrictive probes as ATG monthly monitoring up to 20,000 gallon tanks	Ken Wilcox Associates 06/29/98

# PART IV

## ACCEPTABLE TEST PROTOCOLS

ALPHABETICAL BY TEST METHOD, THEN BY  
PROTOCOL DATE

### **Automatic Tank Gauging Systems**

"Standard Test Procedures for Evaluating Leak Detection Methods: Automatic Tank Gauging Systems", EPA/530/UST-90/006, March 1990

### **Bulk Tank Testing**

"Alternative Test Procedures for Evaluating Leak Detection Methods: Evaluation of Bulk Field-constructed Tanks", Ken Wilcox Associates, February 1996

### **Continuous In-Tank Leak Detection Systems**

"Evaluation Protocol for Continuous In-Tank Leak Detection Systems", Midwest Research Institute, April 1995

### **Large Pipeline Leak Detection Systems**

"Modified Third-Party Testing Protocol for Large Pipeline Leak Detection", EFA Technologies, Inc., August 1995

### **Liquid-Phase Out-of-Tank and Interstitial Product Detectors**

"Standard Test Procedures for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors", EPA/530/UST-90/009, March 1990

"Development of Procedures to Assess the Performance of External Leak Detection Devices: Liquid-Phase ASTM-Formatted Methods - Revised Draft to Include JP -4 Jet Fuel", Radian Corporation, June 29, 1990

"Test Procedures for Third Party Evaluation Of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems", Carnegie Mellon Research Institute, November 11, 1991

"Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems", Carnegie Mellon Research Institute - Advanced Devices and Materials Group, November 11, 1991

"Alternative Test Procedures for Evaluating Leak Detection Methods: Evaluation of Liquid Level Sensors," Ken Wilcox Associates, Inc., September 1996. (Interstitial only.)

### **Non-volumetric Tank Tightness Testing Methods**

"Standard Test Procedures for Evaluating Leak Detection Methods: Non-volumetric Tank Tightness Testing Methods", EPA/530/UST-90/005, March 1990

### **Pipeline Leak Detection Systems**

"Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems", EPA/530/UST-90/010, September 1990

### **Pressure/Vacuum Interstitial Monitor**

"Alternative Test Procedures for Evaluating Leak Detection Methods: Evaluation of Vacuum Interstitial Monitoring Methods," Ken Wilcox Associates, Inc., September 1996.

### **Statistical Inventory Reconciliation Methods**

“Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods”, EPA/530/UST-90/007, June 1990

“Protocol for Determining Applicability of a SIR Method for Manifolded Tanks and Determining Size Limitation”, Developed under coordination by the SIR team of the National Work Group on Leak Detection Evaluations, November 1996

### **Vapor-Phase Out-of-tank Product Detectors**

“Standard Test Procedures for Evaluating Leak Detection Methods: Vapor-Phase Out-of-Tank Product Detectors”, EPA/530/UST-90/008, March 1990

“Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods”, Radian Corporation, June 6, 1990

“Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods”, Radian Corporation, June 29, 1990

### **Volumetric Tank Tightness Testing Methods**

“Standard Test Procedures for Evaluating Leak Detection Methods: Volumetric Tank Tightness Testing Methods”, EPA/530/UST-90/004, March 1990



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PART V  
LEAK DETECTION EQUIPMENT  
MAINTENANCE CHECKLISTS

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## ATG MAINTENANCE CHECKLIST

### Magnetostrictive and Ultrasonic Probes

Minimum procedures to be conducted by a *qualified service technician*.

Has all input wiring been inspected for proper entry and termination, including testing for ground faults?	Yes	No
Have the probe and sensors been checked for visible damage such as residue buildup, cracks, or breaks? <sup>1,2</sup>	Yes	No
Has the accuracy of the level sensor been tested? <sup>3</sup>	Yes	No
Has the accuracy of the water sensor been tested? <sup>4</sup>	Yes	No
Has the appropriateness of the high water level alarm setting been verified? <sup>5</sup>	Yes	No
Are all alarms activated and functioning properly?	Yes	No
Comments:		

1. Damaged probes must be cleaned or replaced as appropriate. Probes used in heavier products such as waste oil should be checked more frequently. Heavier products can leave deposits on the probe shaft and float assemblies that may restrict the measurement capacity of the probe.
2. Because the magnetostrictive probe consists of moving parts, its sensors can be damaged by excessive frictional wear as well as residue build-up. Residue build-up can affect the weight of the sensor as well as inhibit its ability to slide freely along the guide tube. Inaccuracies in the product level measurements could indicate a problem with the probe sensors. For additional testing of the probe sensors, perform the following test:
  - a. Remove the probe from the tank and place it carefully on the ground.
  - b. Place the water sensor flush with the bottom of the probe shaft and place the product float near the middle of the probe shaft.
  - c. Check the height reading on the tank gauge monitor (after allowing sufficient time for the monitor to respond).
  - d. Measure the distance from the bottom of the probe to the bottom of the product float and compare it with the reading on the monitor.
3. To test the accuracy of the product sensor:
  - a. Using the tank console monitor, take an initial fuel level reading.
  - b. Dispense one gallon of product into a calibrated container.
  - c. Using the tank console monitor, take a second fuel level reading.
  - d. Verify that the change in tank volume is one gallon.
4. To test the accuracy of the water sensor:
  - a. Remove probe from the tank.
  - b. By hand, move the water float up the probe to a point higher than the high-water alarm set point.
  - c. The monitor should respond with a high water alarm report. (The water height may also appear on the tank monitor display console.
  - d. Check this height against its actual location.
5. The high water level alarm should not be set so high that water ingress into the tank goes undetected for long periods of time.

**Disclaimer:** This checklist is not intended to tell the technician how to perform the maintenance and system check. Technicians should follow manufacturers' detailed instructions while making sure that all of the items on this checklist have been covered.

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## ATG MAINTENANCE CHECKLIST

### Mass Buoyancy Probes

Minimum procedures to be conducted by a *qualified service technician*.

Has all input wiring been inspected for proper entry and termination, including testing for ground faults?	Yes	No
Has the probe been checked for visible damage (such as residue buildup or cracks)? <sup>1</sup>	Yes	No
Has the battery been tested within the last 3 months?	Yes	No
Has the accuracy of the product sensor been tested? <sup>2</sup>	Yes	No
Has the accuracy of the water sensor been tested? <sup>3</sup>	Yes	No
Has the appropriateness of high-water level alarm setting been verified? <sup>4</sup>	Yes	No
Are all alarms activated and functioning properly?	Yes	No

Comments:

1. Damaged probes must be cleaned or replaced, as appropriate. The mass displacement probe is very susceptible to dirt and residue build-up and should be checked semi-annually and cleaned, if necessary. Mass displacement probes used in viscous products such as waste oil should be checked more frequently. Products of this type can leave heavy deposits on the probe which may inhibit the accuracy of the probe. Checking a reconciliation report and/or manual sticking could verify the system's accuracy.
2. To test the accuracy of the product sensor:
  - a. Using the tank console monitor, take an initial fuel level reading.
  - b. Dispense one gallon of product into a calibrated container.
  - c. Using the tank console monitor, take a second fuel level reading.
  - d. Verify that the change in tank volume is one gallon.
3. To test the accuracy of the water sensor: (Note: water sensor is separator from the mass buoyancy probe.)
  - a. Remove the probe from the tank.
  - b. By hand, move the water float up the probe to a point higher than the high water limit.
  - c. The monitor should respond with a high water alarm. (The water height may also appear on the tank monitor display console.)
  - d. Check this height against its actual location.
4. The high water level alarm should not be set so high that water ingress into the tank goes undetected for long periods of time.

**Disclaimer:** This checklist is not intended to tell the technician how to perform the maintenance and system check. Technicians should follow manufacturer's detailed instructions while making sure that all of the items on this checklist have been covered.

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## **APPENDIX GLOSSARY OF TERMS**

### **Accuracy:**

The degree to which the measured leak rate agrees with the induced leak rate on the average. If a method is accurate, it has a very small or zero bias.

### **Activated:**

Refers to the state of a qualitative detector's response when indicating the presence of product.

### **Bias:**

An indication of whether the device's measured leak rate consistently overestimates (positive bias) or underestimates (negative bias) the actual induced leak rate.

### **Bulk Modulus (of Elasticity):**

The ratio of hydrostatic pressure to the relative change it produces in volume.

### **Continuous Automatic Tank Gauging Systems (Continuous ATGS):**

These systems use an ATG probe to collect data continually and combine this with software to identify time intervals when there is no activity in the tank and the data are stable enough for analysis. An algorithm then combines data from a number of such periods until there is enough evidence to make a determination about the leak status of the tank. This type of system functions like an ATGS except that it does not require that the tank be taken out of service for a set period of several hours whenever a test is to be done. Instead, it uses data from shorter stable time periods and combines the results to estimate a leak rate and perform a test. The system may default to a standard or shut down ATG test (requiring the tank to be out of service for a few hours) at the end of the month if sufficient good quality have not been obtained over the month. These systems are designed to meet the monthly monitoring performance standard of detecting a leak of 0.20 gallon per hour or 150 gallons per month with 95% probability of detection and 5% probability of false alarm. They test the tank vessel itself.

### **Continuous Detector:**

Detectors that operate continuously, are always present and are never turned off.

### **Continuous In Tank Leak Detection Systems (CITLDS):**

These systems are designed to allow the tank to operate continuously or nearly continuously without interruption for leak detection tests. They typically have some sensors permanently installed in the tank, combined with a microprocessor in a console. In addition, they may be connected to the dispensing meters, allowing for automatic recording and use of dispensing data. There may also be a provision for direct input of data from a keyboard or pad, to allow for entry of delivery receipts, for example.

Currently there are three types of such continuous systems that are reaching the market. These three types are referred to as "Continuous ATGS," "Continual Reconciliation," and "Automatic Monthly Inventory Control."

### **Detection time:**

The sum of rise time and lag time.

### **Fall time:**

The elapsed time after a detector has responded to a test hydrocarbon and is removed and has recovered to 95% of its original baseline level or there is no detectable signal output.

### **False Alarm:**

Declaring a tank to be leaking when in fact it is tight.



## **GLOSSARY OF TERMS CONTINUED**

**Groundwater:**

Water table or water within the excavation around a tank.

**Induced Leak Rate:**

The actual leak rate, in gallons per hour (gph), used during the evaluation against which the results from a given test device will be compared.

**Intermittent Detector:**

Detectors that monitor on a regular basis. An intermittent detector may be a hand held device that is portable or a permanently installed device that is used to periodically test for the presence of product.

**Lag Time:**

The elapsed time from the detector's first contact with test product to the first detectable signal.

**Leak threshold:**

The measured leak rate at which the test method detects the tank to be leaking. This leak rate will always be less than or equal to the leak rate requirement for the various release detection methods given in 40 CFR § 280 Subpart D-Release Detection. (Please note that some states and other regulatory authorities may have different requirements). The minimum leak threshold for declaring a leak is experimentally determined from the results of the evaluation of the release detection method.

**Manifold tank systems:**

Tanks connected by piping that allow the tank system to function as a single tank. A typical manifolded tank system usually consists of two tanks connected by a siphon tube that permits the product in the tanks to be at the same level while product is being pumped out of only 1 tank.

**Measured Leak Rate:**

A positive number in gallons per hour (gph), measured by test device that indicates the amount of product leaking out of the tank. A negative number would indicate that something was being added to the tank. The performance of a method is based on how well the measured leak rate compares to the actual induced leak rate.

**MER:**

The Maximum Effective Range, the longest length of sensor cables and/or jumper cables that can be connected to form a leak detection network.

**N/A:**

Not Applicable

**N/D:**

Not Determined

**N/R:**

No Response

**Net Pressure:**

In this document this term refers to a pressure difference between the pressure in the tank and the pressure related to the groundwater. If the net pressure is positive, the pressure in the tank is greater than that due to groundwater. If net pressure is negative, the pressure in the tank is less than that due to groundwater.

**Nominal Leak Rate:**

The set or target leak rate to be achieved as closely as possible during the evaluation of a leak detection method. It is a positive number expressed in gallons per hour (gph).

## GLOSSARY OF TERMS CONTINUED

### Precision:

The degree of agreement of repeated measurements of the same parameter. Precision estimates reflect random error and are not affected by bias.

### Pressure:

In this document this term refers to a pressure which is at or above atmospheric. Any pressure reading at or above atmospheric is listed as positive; any pressure reading less than atmospheric (vacuum) is listed as negative.

### Probability of Detection, P(D):

The probability of detecting a leak of a given size, usually expressed as a percentage.

### Probability of False Alarm, P(FA):

The probability of declaring a tank to be leaking when it is tight, usually expressed as a percentage.

### Probe:

A component of a detection system that must come into contact with product before product can be declared or measured.

### Qualitative Responses:

The type of detector response that indicates only the presence or absence of product without determining the specific product concentration or thickness.

### Quantitative Response:

A type of detector response that quantifies the concentration or thickness of product present.

### Relative Accuracy:

A function of systematic error, or bias, and random error, or precision. Smaller values indicate better accuracy. See entry for "Accuracy."

### Resolution:

The smallest change in the quantity being measured which the measurement system is capable of detecting.

### Response Time:

A general term that refers to the more specific terms of lag time, rise time, and fall time.

### Rise Time:

The elapsed time from a detector's first detectable signal in response to the presence of product to an output that is 95% of full scale for a quantitative detector or activated for a qualitative detector.

### Specificity:

Specificity applies to vapor and liquid sensors and lists products or components of products that these sensors can detect. Specificity for quantitative sensors is the ratio of sensor output, or measured concentration, to the actual concentration of hydrocarbon test gas expressed as a percentage. Specificity for qualitative sensors is reported as activated if the sensor responds within 24 hours. Otherwise, specificity is reported as inactivated.

### Total Pressure:

In this document this term equals the sum of the pressure in ullage space and the pressure due to product head.

### Ullage:

The un-wetted portion of the tank, i.e. that portion of the tank not in contact with product.

### Vacuum:

In this document this term refers to any pressure that is less than atmospheric.