UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

November 9, 2001

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

MEMORANDUM

SUBJECT: ***List of Leak Detection Evaluations for Underground Storage Tank Systems (9th Edition***)

FROM: Cliff Rothenstein, Director /s/
Office of Underground Storage Tanks

TO: Addressees (*see below*) and All Interested Parties

This memorandum provides information on the purpose and limitations of the 9th edition of the *List of Leak Detection Evaluations for Underground Storage Tank Systems*. Previous editions of the *List* have been very helpful tools for underground storage tank (UST) regulators, the regulated community, and leak detection equipment vendors. We are pleased to make this new edition available on our website for wider dissemination.

Contents of the *List*

The *List of Leak Detection Evaluations for Underground Storage Tank Systems* is based on reviews conducted by the independent National Work Group on Leak Detection Evaluations (NWGLDE), which is made up of state and EPA UST program staff. NWGLDE is not an EPA workgroup, and the *List* is not an EPA list but a NWGLDE list. The *List* is a compilation of underground storage tank and piping leak detection system evaluations that have met certain criteria developed by the NWGLDE.

There is an Under Review section in the *List* that lists evaluations that NWGLDE has received and for which it is requesting additional information. The *List* also contains a separate listing of protocols under which the included evaluations were performed. Finally, some optional maintenance checklists are included; these can help users get the most out of leak detection systems.

Limitations

We believe that the *List* will continue to be of great benefit to regulators, the regulated community, and equipment vendors. 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 may 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; users should base their decisions on all available sources of information. Users should contact the appropriate implementing agency in their particular area regarding the approval or acceptance of leak detection systems.

Distribution of the *List*

NWGLDE updates the *List* periodically as it reviews new evaluations and information. The most recent version is made available to the Agency by the Chair of NWGLDE and is then posted for wider public dissemination in electronic form on our website. The *List* can be downloaded, viewed, and printed from the internet at http://www.epa.gov/OUST/pubs/index.htm. It is available in Adobe Portable Document Format (PDF) and Microsoft Word in rich text format (RTF). (For help with access contact Hal White at white.hal@epa.gov or at (703) 603-7177.)

In the past, EPA has printed hard copies of the *List*. However, beginning with the previous edition (as previously announced in the 7th) the *List* will be available only in electronic format.

Information from the Chair of NWGLDE

On October 22, 2001, the Chair of the NWGLDE wrote a memorandum to vendors of leak detection equipment and systems regarding this ninth (and latest) edition of the *List*. This memorandum is reprinted as part of the *List* and contains important information about it. There are a few issues which I call to your attention here and are discussed in more detail in the Chair's memo:

- Neither EPA nor NWGLDE approves or will approve leak detection systems for compliance in any particular location. Approval or acceptance is the responsibility of the implementing agency, in most cases the state environmental agency.

- For an evaluation to be included in the *List*, an independent third party must have performed it in accordance with EPA or other accepted test procedures ("protocols").

- If a problem is discovered with a third party test after a system data sheet has been added to the *List*, or if a listed system is modified by a vendor in such a way that changes affect how it detects and/or quantifies a leak, NWGLDE will give the vendor reasonable time to provide the necessary information to clarify or modify the listing.

Additional Information

If you have an evaluation to submit, or if you have comments about a particular listing, please see the instructions in the NWGLDE memorandum reprinted in the *List*. Comments are always welcome.

I hope our distribution of this product is helpful to you. If you have questions about the distribution, please contact Tim Smith; he can be reached by e-mail at smith.timr@epa.gov, by phone at (703) 603-7158, by fax at (703) 603-9163, and by mail at the letterhead address above.

Addressees:

UST/LUST Regional Program Managers
State UST Contacts
Anthony Tafuri, NRMRL Edison
Vendors appearing on List of Leak Detection Evaluations
Members of National Work Group on Leak Detection Evaluations
Stephen Crimaudo, Ass'n of State and Territorial Solid Waste Mgt. Officials
American Society of Petroleum Operations Engineers
Prentiss Searles, American Petroleum Institute
Judy Turner, National Association of Convenience Stores
Thomas West, National Association of Texaco Wholesalers
Bob Renkes, Petroleum Equipment Institute
Melissa Young, Petroleum Marketers Association of America
Mark Morgan, Petroleum Transportation & Storage Association
Roy Littlefield, Service Station Dealers of America
Tom Osborne, Society of Independent Gasoline Marketers of America
Kathy Nam, OGC
Joan Olmstead, OECA
OUST Management Team
OUST Desk Officers

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ADEM

ALABAMA

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

October 18, 2001

MEMORANDUM

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

FROM: Curt D. Johnson, NWGLDE Chair CDJ

RE: ***National Work Group on Leak Detection Evaluation's (NWGLDE) List of Leak Detection Evaluations for underground storage tank systems - Ninth Edition***

Following this memo (and the attachments), you will find the latest edition of our list. The list is only available electronically. If a hard copy is desired, the list will have to be down loaded and printed. The most recent version of the list is always available in electronic form for downloading, viewing, and printing via the Internet at:

http://www.epa.gov/swerust1/ustsystm/nwgolde.htm

The list is available in Adobe's Portable Document Format (PDF) and Microsoft Word in rich text format (RTF). For help with access, contact Hal White at white.hal@epa.gov or at (703) 603-7177.

If you need to contact members of the work group, the latest information is included for them after this memo. Also, the work group team and team leaders are listed on the page following the member list to help you determine whom you may need to contact.

Please send new third party evaluations to be reviewed by the work group to **the team leader and all the members of the team**. To enable the work group to properly review the evaluations, **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.

In the interest of expediting third party evaluation reviews, maintaining consistency among evaluations, and adhering to the accepted evaluation protocols, the NWGLDE has adopted the following policies:

1. **In order for an evaluation to be listed, third party evaluation reports must clearly state which protocol was used to conduct the evaluation. The Work Group will not review any evaluations that do not follow either:**

a. An EPA protocol, or

b. An alternative protocol, e.g., a national voluntary consensus standard or other accepted test procedures developed by an independent third party. ***Currently, one mechanism to achieve this is to submit these protocols to an ad hoc committee organized by the University of Wisconsin's Department of Engineering Professional Development (Contact Mr. Jack Quigley at 608.265.2083 or, quigley@engr.wisc.edu). If found to conform with the minimum requirements as described in the "Forward" to each of the EPA protocols, an ad hoc committee should recommend that the protocol be added to the List. For planning purposes, anticipate at least nine months for review by the ad hoc committee and addition to the List by the Work Group.***

2. **Changes to a listed protocol need to be discussed with the Work Group before testing, or before continuing testing if the evaluator identifies concerns during testing. Regular communication with Work Group members can expedite an evaluation's review.**
3. **If a problem is discovered with a third party test after a system data sheet has been added to the List, or if a listed system is modified by the vendor in such a way that the changes affect how it detects and/or quantifies a leak, the vendor shall be given a reasonable time period to provide the necessary information to clarify or modify the listing. The data sheet listing may be removed from Part II of the List and instead listed in the "Under Review" section if:**
   a. The vendor must re-evaluate the system,
   b. The vendor fails to meet the time frame set by the Work Group,
   c. The vendor fails to respond to take the appropriate actions.

   The system data sheet may be reinstated on the List after all third party test concerns are resolved. If concerns cannot be resolved or if there is no response from the vendor, the system will no longer appear on the List. ***Please note that the listing of an evaluation as "Under Review" at any time in no way implies that the evaluator does or does not meet the review criteria.***

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 list was prepared by an **independent** work group consisting of state and EPA members.

2. **Neither EPA nor the work group approves 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 has reviewed. This review has confirmed that the leak detection equipment/procedures were third party tested in accordance with either an EPA or other acceptable test protocol. The review also confirmed that the equipment/procedures met EPA performance standards under test conditions. 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 would appreciate any comments you have concerning the list. Please provide comment by completing the attached user survey and sending the survey to me at the address, phone number, fax number or e-mail address listed on the next page.

Attachments: Work Group Members, Work Group Teams, Leak Detection Equipment Review Document List, List of Leak Detection Evaluations User Survey, Latest Edition of List of Leak Detection Evaluations for UST Systems

WORK GROUP MEMBERS

MEMBER	ADDRESS	PHONE/FAX/E-MAIL
Curt D. Johnson, Chair	Alabama Department of Environmental Management PO Box 301463 Montgomery, AL 36130-1463	(334) 271-7986 Fax (334) 270-5631 cdj@adem.state.al.us
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Beth DeHaas	Maine Department of Environmental Protection Statehouse Station No. 17 Augusta, ME 04333	(207) 287-2651 Fax (207) 287-7826 beth.dehaas@state.me.us
Tim Smith	USEPA (Mail Address) (Fed Ex Address) 1301 Pennsylvania Ave. Northwest 5402G Washington, DC 20460 1235 Jefferson Davis Hwy. 13th Floor Arlington, VA 22202	(703) 603-7158 Fax (703) 603-0175 smith.timr@epamail.epa.gov
John Kneece	South Carolina Department of Health and Environmental Control 2600 Bull Street Columbia, SC 29201	(803) 898-4364 Fax (803) 898-4330 kneeceje@columb26.dhec.state.sc.us
Jon Reeder	Florida Department of Environmental Protection 3804 Coconut Palm Drive Tampa, FL 33619-8318	(813) 744-6100 Ext. 472 Fax (813) 744-6125 jon.reeder@dep.state.fl.us
Mike Kadri	Michigan Department of Environmental Quality ST Division PO Box 30157 Lansing, MI 48909-7657	(517) 335-7204 Fax (517) 335-2245 kadrim@state.mi.us
Mark Lenox	Missouri Department of Natural Resources Technical Assistance Program PO Box 176 Jefferson City, MO 65102	(573) 526-2421 Fax (573) 526-5808 nrlenom@mail.dnr.state.mo.us
Shaheer Muhanna	Georgia DNR - EPD 4244 International Parkway, Suite 104 Atlanta, GA 30354	(404) 362-2579 Fax (404) 362-2654 SHAHEER_MUHANNA@mail.dnr.state.ga.us
John Cernero	USEPA Region 6 1445 Ross Avenue Dallas, TX 75202	(214) 665-2233 Fax (214) 665-7263 cernero.john@epa.gov

WORK GROUP TEAMS

TEAM	LEADER	MEMBERS
Automatic Tank Gauging (ATG) and Volumetric Tank Tightness Test (VTTT) Methods	Beth Dehaas	Mike Kadri Jon Reeder
Continuous In-Tank Leak Detection Methods	Shahla Farahnak	Shaheer Muhanna
Non-Volumetric Tank Tightness Test Methods	John Kneece	Mark Lenox
Pipeline Leak Detection Methods	Mike Kadri	John Kneece Mark Lenox
Statistical Inventory Reconciliation (SIR) Methods	Jon Reeder	Shaheer Muhanna
Sensor and Vacuum Methods	Tim Smith	Shahla Farahnak
List Administration and Surveys	Curt Johnson	Tim Smith Jon Reeder

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/systems.

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. A 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/system. 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. A complete installation/operations manual for the equipment/system.

☐ 4. A sample of the test report (including field work-sheets) which will be submitted to the owner/local implementing agency.

☐ 5. An 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. An outline of the test procedures for manifolded 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/system.

☐11. Correspondence letters from state agencies who have reviewed the equipment/system.

12. The 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. The following documentation for the systems using tracer analysis:

☐a. The name and certification of the laboratory analyzing vapor samples.

☐b. Quality Assurance Manual of the laboratory.

☐c. The method and amount of tracer injection.

☐d. The vapor sample collection method and chain of custody records.

☐e. The third party certification for capability of the system 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 Work Group on Leak Detection Evaluations' list 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 on Leak Detection Evaluations' list 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 (attach additional pages if more space is needed).

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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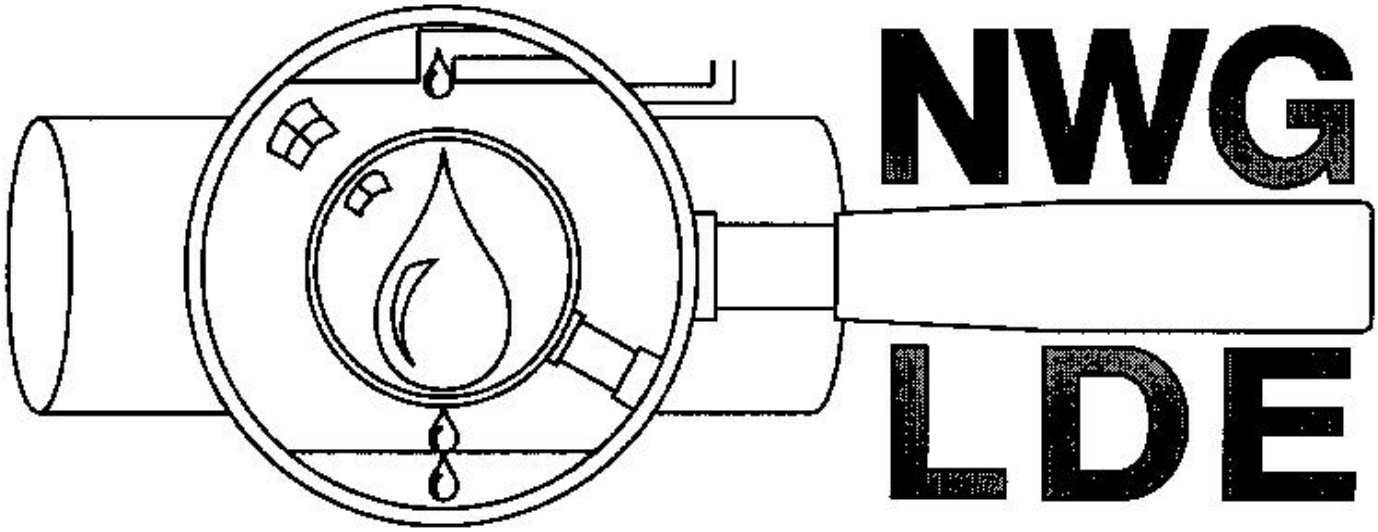
NINTH EDITION

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

November 21, 2001



DISCLAIMER

Appearance on this list is not to be construed as and endorsement by any regulatory agency nor is it any guarantee of the performance or the method or equipment. Equipment should be installed and operated in accordance with all applicable law and regulations.

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.

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PART I

LEAK DETECTION TEST METHODS AND EQUIPMENT/SYSTEMS

ALPHABETICAL BY TEST METHOD,

THEN BY VENDOR,

NEXT BY EQUIPMENT/SYSTEM 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, LS300 N/C, LS300-120, LS300-120 XLC, LS300-120 PLUS, LS300-120 PLUS A/S	3 gph/2.36 gph/35.36 gallons
	LS300-120 PLUS AL, LS300-120 PLUS AL A/S, LS300-120 PLUS AL LSI	3 gph/1.5 gph/163 gallons 0.2 gph/0.1 gph/163 gallons 0.1 gph/0.05 gph/163 gallons
Control Engineers	Line Leak Detector, Model LLP2	3.0 gph/1.88 gph/89 gallons 0.1 gph/0.05 gph/89 gallons
Emco Electronics, Tuthill Transfer Systems	EECO System LLD (Q0011)	3.0 gph/2.0 gph/67.4 gallons 0.2 gph/0.1293 gph/67.4 gallons 0.1 gph/0.0793 gph/67.4 gallons
	EECO System LLD (for Flexible Pipelines)	3.0 gph/2.0 gph/49.6 gallons 0.1 gph/0.0793 gph/49.6 gallons
INCON Intelligent Controls, Inc.	TS-LLD Line Leak Detector	3.0 gph/1.5 gph/163 gallons 0.2 gph/0.1 gph/163 gallons 0.1 gph/0.05 gph/163 gallons
	TS-LLD Line Leak Detector (for Flexible Pipelines)	3.0 gph/1.5 gph/49.6 gallons 0.2 gph/0.1 gph/49.6 gallons 0.1 gph/0.05 gph/49.6 gallons
Marconi Commerce Systems (formerly Gilbarco Environmental Products)	EMC Environmental Management Console with Line Leak Detector, Series PA02630000501	3.0 gph/1.5 gph/158 gallons 0.2 gph/0.1 gph/158 gallons 0.1 gph/0.079 gph/158 gallons
	EMC Environmental Management Console with Line Leak Detector, Series PA02630000501 (for Flexible Pipelines)	3.0 gph/1.5 gph/49.6 gallons 0.2 gph/0.1 gph/49.6 gallons 0.1 gph/0.079 gph/49.6 gallons
	EMC Environmental Management Console with Line Leak Detector, Series PA0263000060X	3.0 gph/1.88 gph/98.4 gallons 0.2 gph/0.17 gph/98.4 gallons 0.1 gph/0.05 gph/98.4 gallons
	EMC Environmental Management Console with Line Leak Detector, Series PA0263000060X (for Flexible Pipelines)	3.0 gph/1.5 gph/40.8 gallons 0.2 gph/0.17 gph/40.8 gallons 0.1 gph/0.05 gph/40.8 gallons
	EMC, EMC-PC, EMC Enhanced, EMC-PC Enhanced, LMS Environmental Management Consoles with Line Leak Detector, Series PA0263000100X, PA0277000060X	3.0 gph/2.5 gph/100 gallons 0.2 gph/0.17 gph/100 gallons 0.1 gph/0.09 gph/100 gallons
Marley Pump Co.	Red Jacket PPM 4000, RLM 9000	3.0 gph/2.0 gph/55.1 gallons 0.2 gph/0.1 gph/55.1 gallons 0.1 gph/0.047 gph/55.1 gallons
	Red Jacket PPM 4000, RLM 9000, ST 1401L, ST1801L (for Flexible Pipelines)	0.2 gph/0.1 gph/27.6 gallons 0.1 gph/0.05 gph/27.6 gallons
	Red Jacket ST 1401L, ST1801L, CPT, ProLink	3.0 gph/1.5 gph/172 gallons 0.2 gph/0.1 gph/163 gallons 0.1 gph0.047gph/163 gallon

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR (CONTINUED)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX PIPELINE CAPACITY
Petro Vend, Inc.	LineTite Pipeline Leak Monitor	3.0 gph/2.0 gph/341 gallons 0.1 gph/0.062 gph/341 gallons
	LineTite Pipeline Leak Monitor (for Flexible Pipelines)	3.0 gph/2.0 gph/49.6 gallons 0.1 gph/0.062 gph/49.6 gallons
	LineTight Pipeline Leak Monitor Model 2001J	3.0 gph/2.5 gph/172 gallons 0.1 gph/0.05 gph/172 gallons
	LineTight Pipeline Leak Monitor Model 2001J (for Flexible Pipelines)	3.0 gph/2.5 gph/39.5 gallons 0.1 gph/0.05 gph/39.5 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 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 0.1 gph/0.06 gph/129 gallons
Vaporless Manufacturing	Vaporless LD-2100 or PLC-5000 with 98LD-2000PLC (for Rigid and Flexible Pipelines)	3.0 gph/2.5 gph/172 gallons (rigid), 39.5 gallons (flexible) 0.2 gph/0.136 gph/172 gallons (rigid), 39.5 gallons (flexible) 0.1 gph/0.068 gph/172 gallons (rigid), 39.5 gallons (flexible)
Veeder-Root	TLS-350, 350PC, 350R, 350RPC, 350Plus Line Leak Detector, Series 8475	3.0 gph/1.5 gph/158 gallons 0.2 gph/0.1 gph/158 gallons 0.1 gph/0.079 gph/158 gallons
	TLS-350, 350PC, 350R, 350RPC, 350Plus Line Leak Detector, Series 8475 (for Flexible Pipelines)	3.0 gph/1.5 gph/49.6 gallons 0.2 gph/0.1 gph/49.6 gallons 0.1 gph/0.079 gph/49.6 gallons
	TLS 350, 350PC, 350R, 350RPC, 350Plus Line Leak Detector, Series 8484	3.0 gph/1.88 gph/98.4 gallons 0.2 gph/0.17 gph/98.4 gallons 0.1 gph/0.05 gph/98.4 gallons
	TLS 350, 350PC, 350R, 350RPC, 350Plus, LLD-300 Line Leak Detector, Series 8484 (for Flexible Pipelines)	3.0 gph/1.5 gph/40.8 gallons 0.2 gph/0.17 gph/40.8 gallons 0.1 gph/0.05 gph/40.8 gallons
	TLS 350, 350PC, 350R, 350RPC, 350Plus, LLD-300 Line Leak Detector, Series 8494, Pressurized Line Leak Detector, Series 8494	3.0 gph/2.5 gph/100 gallons 0.2 gph/0.17 gph/100 gallons 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 Flexline Line Leak Detector (for Flexible Pipelines)	3.0 gph/2.0 gph/49.6 gallons
	STP-MLD-HC Pipeline Leak Detector	3.0 gph/2.0 gph/172 gallons
	STP-MLD-HCD Pipeline Leak Detector	3.0 gph/2.0 gph/172 gallons
Marley Pump Co.	Red Jacket DLD, XLD	3.0 gph/2.0 gph/129 gallons
	Red Jacket FX1,FX2,FX1V,FX2V	3.0 gph/2.0 gph/316 gallons (FX1,FX1V), 3.0 gph/2.0 gph/362 gallons (FX2,FX2V)
	Red Jacket FX1,FX2,FX1V,FX2V Flexline (for Flexible Pipelines)	3.0 gph/2.0 gph/49 gallons
	Red Jacket FX1D,FX2D, FX1DV, FX2DV Installed in the Big-Flow	3.0 gph/2.0 gph/362 gallons
	Red Jacket FX1DV, FX2DV Installed in the Big-Flow (for Flexible Pipelines)	3.0 gph/2.0 gph/39.4 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, 585A-PM	3.0 gph/2.25 gph/78 gallons
Vaporless Manufacturing	Vaporless LD-2000, LD-2000S	3.0 gph/1.7 gph/129 gallons
	Vaporless LD-2000E, LD-2000E-S (for Flexible Pipelines)	3.0 gph/2.0 gph/59.6 gallons
	Vaporless LD-2000T, LD-2000T-S	3.0 gph/2.5 gph/129 gallons
	Vaporless 98LD-2000, 99LD-2000, 99LD-2200, LD-2200 Scout (for Rigid and Flexible Pipelines)	3.0 gph/2.5 gph/172 gallons (rigid), 39.5 gallons (flexible)
	Vaporless LD-3000, LD-3000S	3.0 gph/2.0 gph/320 gallons

AUTOMATIC TANK GAUGING METHOD

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Advanced Telemetrics, Ltd.	Model 1100LD Version 1.07	0.2 gph/0.1 gph/30,000 gallons
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 CX9900, CX9400, CX9200, CX9000,CMX240 (Magnetostrictive Probe)	0.2 gph/0.1 gph/30,000 gallons
	Andover Infinity, Versions CX9000, CX9200, CMX240 (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons 0.1 gph/0.05 gph/15,000 gallons
	Versions AC8+, AC256+ (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
Barton Instrument Systems, LLC	Barton 3500 ATG	0.2 gph/0.1 gph/75,000 gallons
Caldwell Systems Corp.	Tank Manager (Ultrasonic Probe)	0.2 gph/0.1 gph/ 20,000 gallons 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 0.1gph0.05 gph/15,000 gallons
EBW, Inc.	Auto-Stik II, Auto-Stik Jr. (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons 0.1 gph/0.05 gph/15,000 gallons
Endress+Hauser Systems and Gauging (formerly Coggins Systems, Inc.)	Leak Manager with Barton 3500 ATG	0.2 gph/0.1 gph/75,000 gallons
Egemin Naamloze Vennootschap	E'SPI III (Mass Buoyancy Probe)	0.2 gph/0.075 gph/15,000 gallons
	E'SPI IV (Mass Buoyancy Probe)	0.2 gph/0.1 gph/15,000 gallons
Emco Electronics, Tuthill Transfer Systems	EECO System 1000, 1500, 2000, 3000 and Galaxy 0.2 gph Precision Test and Quick Test (Q0400-4xx Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	EECO System 1000, 1500, 2000, 3000 and Galaxy 0.1 gph Precision Test and 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
Hasstech	Tank Compliance Center, Model 700 (7100 Series Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons 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 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
Marconi Commerce Systems (formerly Gilbarco Environmental Products)	EMC Environmental Management Console EMC Basic Monitoring System Tank Monitors 2, 3, 2.1, 3.1,PAO238000XXXX (Capacitance Probe)	0.2 gph/0.1 gph/15,000 gallons

AUTOMATIC TANK GAUGING METHOD (CONTINUED)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Marconi Commerce Systems (formerly Gilbarco Environmental Products)	EMC Environmental Management Console EMC Basic Monitoring System Tank Monitors 2.1,3.1, PAO264XXX0000 (Capacitance Probe)	0.2 gph/0.126 gph/15,000 gallons 0.1 gph/0.071 gph/15,000 gallons
	EMC Environmental Management Console EMC Basic Monitoring System Tank Monitors 2.1, 3.1, PAO265XXX0000 (Magnetostrictive Probe)	0.2 gph/0.093 gph/15,000 gallons 0.1 gph/0.071 gph/15,000 gallons
	EMC/PC Series Monitoring Systems PA0265 and PA0300 (Magnetostrictive Probe)	0.2 gph/0.126 gph/20,000 gallons
Marley Pump Co.	Prolink System, RJE Probes # RE-400-094 thru 112-5 (Magnetostrictive Probe)	0.2 gph/-0.116 gph to declare a **leak**/18,000 gallons 0.2 gph/0.084 gph to declare a **gain**/18,000 gallons 0.1 gph/-0.065 gph to declare a **leak**/18,000 gallons 0.2 gph 0.035 gph to declare a **gain**/18,000 gallons
	Red Jacket ATM System, Version RLM 5000, 5001, 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 0.1 gph/0.05 gph/18,000 gallons
NESCO (formerly 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
OMNTEC Mfg., Inc.	OEL 8000, K-OEL 8000, OEL 8000 II, K-OEL 8000 II (MTG - XX Magnetostrictive Probe, 4 inch dia Floats)	0.2 gph/0.1 gph/30,000 gallons
OMNTEC Mfg., Inc.	OEL 8000, K-OEL 8000 (MTG - XX Magnetostrictive Probe, 4 inch dia Floats)	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 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 0.1 gph/0.05 gph/15,000 gallons
Petro Vend, Inc.	Petrosonic III (Version 4.05 Model 613, 4 inch dia Floats, Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	Site Sentinel Models II and III (Model 613, 2 inch dia Floats, Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons
	Site Sentinel Models II and III, (Model 613, 4 inch dia Floats, Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons 0.1 gph/0.06 gph/15,000 gallons
	Site Sentinel Models 1, II and III (Model 924, 2 inch dia Floats, Magnetostrictive Probe)	0.2 gph/ 0.1 gph/20,000 gallons
	Site Sentinel Models 1, II and III, (Model 924, 4 inch dia Floats, Magnetostrictive Probe)	0.2 gph/0.1 gph/20,000 gallons 0.1 gph/0.053 gph/20,000 gallons

AUTOMATIC TANK GAUGING METHOD (CONTINUED)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX PRODUCT SURFACE AREA
Pneumercator Company, Inc.	TMS 2000, TMS 3000 (Magnetostricitive Probe)	0.2 gph/0.1 gph/20,000 gallons 0.1 gph/0.05 gph/20,000 gallons
Ronan Engineering Co.	X-76 ETM, X-76 ETM-4X (Magnetostrictive Probe)	0.2 gph/0.1 gph/15,000 gallons 0.1 gph/0.05 gph/15,000 gallons
	X76CTM Series Monitoring System (Series 7100 Magnetostrictive Probe, X76MP Series Magnetostrictive Probe)	0.2 gph/0.1 gph, Precision Test, Series 7100 Probe/20,000 gallons 0.2 gph/0.115 gph, Precision Test, X76MP Series Probe/20,000 gallons 0.2 gph/0.115 gph, Quick Test, Series 7100 Probe/20,000 gallons 0.2 gph/0.129 gph, Quick Test, X76MP Series Probe/20,000 gallons 0.1 gph/0.05 gph, 0.1gph Test, Series 7100 Probe /20,000 gallons 0.1 gph/0.066 gph, 0.1gph Test, X76MP Series Probe /20,000 gallons
	X76CTM Series Monitoring System (MTS UST Series Magnetostrictive Probe)	0.2 gph/0.124 gph, Precision Test/20,000 gallons 0.2 gph/0.168 gph, Quick Test/20,000 gallons 0.1 gph/0.067 gph, 0.1gph Test/20,000 gallons
Ronan Engineering Co	X76CTM Series Monitoring System (Veeder-Root 8463/8473/8493 Series Magnetostrictive Probe)	0.2 gph/0.1 gph, Precision Test/20,000 gallons 0.2 gph/0.128 gph, Quick Test/20,000 gallons 0.1 gph/0.06 gph, 0.1gph Test/20,000 gallons
Sound Products Manufacturing, Inc. (formerly USTest, Inc.)	UST 2001 and UST 2001 Quick Test (Ultrasonic Probe)	0.2 gph (Quick Test)/0.1 gph/15,000 gallons 0.1 gph/0.05 gph/15,000 gallons
Tidel Engineering, Inc.	Tidel Environmental Monitoring System, 3500 Series (Ultrasonic Probes #401-0009, #401-0010, #401-0023)	0.2 gph/0.1 gph/15,000 gallons
	Tidel Environmental Monitoring System, EMS 2000, 3000, 3500 Series (Ultrasonic Probes #401-0009, #401-0010, #401-0021, #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 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 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
Veeder-Root	TLS-200, 200i, 250i, 300, 300C, 300i, 350, 350PC, 350R, 350RPC, 350Plus UST ATGS (Model 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, 350Plus UST ATGS (Model 8472 Digital Sensing Capacitance Probe)	0.2 gph/0.126 gph/15,000 gallons 0.1 gph/0.071 gph/15,000 gallons
	TLS-200, 200i, 250, 250i, 300, 300C, 300i, 300PC, 350, 350PC, 350R, 350RPC, 350Plus UST ATGS (Model 8473 Digital Sensing Magnetostrictive Probe)	0.2 gph/0.093 gph/15,000 gallons 0.1 gph/0.071 gph/15,000 gallons
	TLS-250, 250i, 300, 300C, 300i, 300PC, 350, 350PC, 350R, 350RPC, 350Plus UST ATGS (Models 8473, 8493 Magnetostrictive Probes)	0.2 gph/0.126 gph/15,000 gallons 0.1 gph/0.071 gph/15,000 gallons
	TLS Series 300, 350, 350R, 350Plus (Models 8463, 8473, 8493 Magnetostrictive Probes)	0.2 gph/0.126 gph/20,000 gallons 0.1 gph/0.071 gph/20,000 gallons
	TLS Series 300, 350, 350R, 350Plus (Models 8463, 8473, 8493 Magnetostrictive Probes)	0.2 gph/0.126 gph/30,000 gallons

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX PRODUCT SURFACE AREA
ASTTest Services, Inc.	ASTTest Mass Balance Leak Detection System	[(product surface area in ft² ÷ 5,575 ft²) x 0.88 gph]/[(product surface area in ft² ÷ 5,575 ft²) x 0.44 gph]/13,938 ft²
Endress+Hauser Systems and Gauging (formerly Coggins Systems, Inc.)	Leak Manager and Remote Terminal Unit RTU/8130 (MTS Magnetostrictive Probe)	[(product surface area in ft² ÷ 616 ft²) x 0.2 gph]/[(product surface area in ft² ÷ 616 ft²) x 0.1 gph]/924 ft²
Endress+Hauser Systems and Gauging (formerly Coggins Systems, Inc.)	Leak Manager with Barton Series 3500 ATG (48 hour test) (72 hour test)	[(product surface area in ft² ÷ 6,082 ft²) x 2.0 gph]/[(product surface area in ft² ÷ 6,082 ft²) x 1.0 gph]/15,205 ft²
Mass Technology Corp.	Precision Mass Measurement System (24 hour test)	[(product surface area in ft² ÷ 1,257 ft²) x 0.1 gph]/[(product surface area in ft² ÷ 1,257 ft²) x 0.05 gph]/3,143 ft²
	Precision Mass Measurement System (48 hour test)	[(product surface area in ft² ÷ 6,082 ft²) x 0.294 gph]/[(product surface area in ft² ÷ 6,082 ft²) x 0.147 gph]/6,082 ft²
	Precision Mass Measurement System (72 hour test)	[(product surface area in ft² ÷ 14,200 ft²) x 0.638 gph]/[(product surface area in ft² ÷ 14,200 ft²) x 0.319 gph]/35,500 ft²
Tracer Research Corp.	Tracer ALD 2000 Automated Tank Tightness Test	0.1 gph/ A tank system should not be declared tight when tracer chemical or hydrocarbon greater that the background level is detected outside of the tank./Not limited by capacity
Universal Sensors and Devices, Inc.	LTC-1000 (Mass Buoyancy Probe)	[(product surface area in ft² ÷ 14,244 ft²) x 1.4 gph]/[(product surface area in ft² ÷ 14,244 ft²) x 0.7 gph]/35,610 ft²
	LTC-2000 (Differential Pressure Probe)	[(product surface area in ft² ÷ 14,244 ft²) x 3.0 gph]/[(product surface area in ft² ÷ 14,244 ft²) x 1.5 gph]/35,610 ft²
Vista Research, Inc. and Naval Facilities Engineering Service Center	LRDP-24 (V1.0.2, V1.0.3)	[(product surface area in ft² ÷ 6,082 ft²) x 2.0 or 3.0 gph]/[(product surface area in ft² ÷ 6,082 ft²) x (2.0 or 3.0 gph - 0.223 gph)]/15,205 ft²
	LRDP-48 (V1.0.2, V1.0.3)	[(product surface area in ft² ÷ 6,082 ft²) x 2.0 or 3.0 gph]/[(product surface area in ft² ÷ 6,082 ft²) x (2.0 or 3.0 gph - 0.188 gph)]/15,205 ft²
	LRDP-24 (V1.1)	[(product surface area in ft² ÷ 6,082 ft²) x 0.856 gph]/[(product surface area in ft² ÷ 6,082 ft²) x 0.632 gph]/15,205 ft²
	LRDP-48 (V1.1)	[(product surface area in ft² ÷ 6,082 ft²) x 0.749 gph]/[(product surface area in ft² ÷ 6,082 ft²) x 0.563 gph]/15,205 ft²

CONTINUOUS IN-TANK LEAK DETECTION METHOD

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Emco Electronics, Tuthill Transfer Systems	EECO System 1000,1000EG, 1500, 2000, 3000 and Galaxy ATG Systems (Q0400-4xx Magnetostrictive Probe)	0.2 gph/0.1 gph/35,000 gallons
Marconi Commerce Systems (formerly Gilbarco Environmental Products)	EMC Series with CSLD, PAO265XXXX100, PA0300XXXX100 (Magnetostrictive Probe)	0.2 gph/0.16 gph/38,170 gallons
Veeder-Root	TLS-300i, 300J, 350, 350R, 350Plus Monitoring Systems with CSLD (Models 8473, 8493 Magnetostrictive Probes)	0.2 gph/0.16 gph/38,170 gallons

DOUBLE WALLED TANK TIGHTNESS TEST METHOD

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Containment Solutions Inc. (formerly Fluid Containment which was formerly O/C Tanks)	Hydrostatic Precision Tank Test for DWT-Type II Tanks	0.1 gph/0.05 gph without dispensing/30,000 gallons 0.1gph/0.07 gph with dispensing/30,000 gallons
Steel Tank Institute	Permatank Precision Interstitial Vacuum Monitor	0.1 gph/0.01 gph/50,000 gallons
Xerxes Corp.	Xerxes Trucheck Hydrostatic Monitoring System	0.1 gph/0.05 gph/30,000 gallons

LARGE DIAMETER PIPELINE LEAK DETECTION METHOD

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX PIPELINE CAPACITY
Caldon, Inc.	Caldon PF2000 Pipeline Leak Detection System for Bulk Pipelines	10 gph/8 gph/212,000 gallons
EFA Technologies, Inc.	LeakNet	3.0 gph/2.2 gph/116,230 gallons
Tracer Research Corp.	Tracer ALD 2000 Automated Line Tightness Test	0.1 gph/A pipeline system should not be declared tight when tracer chemical or hydrocarbon greater than the background level is detected outside of the pipeline./not limited by capacity
Vista Research, Inc.	Model HT-100 Monitoring Method and Line Tightness Test Method, Version 1.0, Version 1.1	0.004% of line capacity in gph for Version 1.0 /0.00282% of line volume in gph/612,954 gallons 0.00209% of line capacity in gph for Version 1.1 /0.000916% of line volume in gph/612,954 gallons
	Model HT-100-n Monitoring Method and Line Tightness Test Method, Version 1.0, Version 1.1	0.004% ÷ √(n) of line capacity in gph for Version 1.0 /0.00282% ÷ √(n) of line volume in gph; where n is the # of tests averaged together/612,954 gallons 0.00209% ÷ √(n) of line capacity in gph for Version 1.1 /0.000916% ÷ √(n) of line volume in gph; where n is the # of tests averaged together/612,954 gallons
	Model LT-100 Monthly Monitoring Method and Line Tightness Test Method, Version 1.0 (Manual Method)	0.2 gph/0.177 gph/3,400 gallons 0.1 gph/0.077 gph/3,400 gallons
	Model LT-100 Monthly Monitoring Method and Line Tightness Test Method, Version 1.0 (Primary Method)	0.2 gph/0.148 gph/3,400 gallons 0.1 gph/0.06 gph/3,400 gallons
	Model LT-100 Monthly Monitoring Method and Line Tightness Test Method, Version 1.0 (Segmented Method)	0.2 gph/0.174 gph/3,400 gallons 0.1 gph/0.074 gph/3,400 gallons
	Model LT-100a Monthly Monitoring Method and Line Tightness Test Method, Version 1.0	0.2 gph at 50 psi/0.148 gph/3,400 gallons 0.1 gph at 50 psi/0.06 gph/3,400 gallons
	Model LT-100a Monthly Monitoring Method and Line Tightness Test Method, Version 1.0 (Segmented Method)	0.2 gph at 50 psi/0.174 gph/3,400 gallons 0.1 gph at 50 psi/0.074 gph/3,400 gallons
	Model LT-100a Hourly and Monthly Monitoring Method and Line Tightness Test Method, Version 2.0 (Segmented Method)	3.0 gph/2.936 gph/3,400 gallons 0.2 gph/0.136 gph/3,400 gallons

LINE TIGHTNESS TEST METHOD

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX PIPELINE CAPACITY
Estabrook EZY CHEK Systems (formerly 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
Heath Consultants, Inc.	Petro Tite Line Tester	0.1 gph/0.05 gph/129 gallons
Heath Consultants, Inc.	Petro Tite Line Tester (for Flexible Pipelines)	0.1 gph/0.05 gph/49.6 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
	TLD-1 (Flexible Pipelines)	0.1 gph/0.05 gph/50 gallons
Tracer Research Corp.	Tracer Tight Line Test	0.1 gph and 0.005gph/A pipeline system should not be declared tight when tracer chemical is detected outside of the pipeline/not limited by capacity
Training and Services Corp.	AcuRite	0.1 gph/0.01 gph/150 gallons
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
Beaudreau Electronics, Inc.	Models 404, 406 Pump Cut-Offs	float switch (Model 404), refractive index of liquids (Model 406)
Beaudreau Electronics, Inc.	Models 510, 516 Discriminating Sensors	polymer strip, hyrocarbon-only (Model 510), optical sensor and conductivity (Model 516)
Caldwell Systems Corp.	Tank Manager Liquid Sensor, Version TMLIQ	ultrasonic
Containment Solutions, Inc. (formerly Fluid Containment which was formerly O/C Tanks)	FCI Liquid Filled Interstitial Monitor Tank Model DWT6 with Model FHRB 810 Level Sensor	float switch
	DDAS 910 Discriminating Sensor for Dry Annular Spaces; DCBS 900 Discriminating Sensor for Collars, Bulkheads, Sumps	capacitance change
	FOVF 600B, FOVF 600S Non-Discriminating Sensors for High Level Overfill (Brass, Steel); FCBS 700 Non-Discriminating Sensors for Collars, Bulkheads, Sumps; FDAS 710 Non-Discriminating Sensor for Dry Annular Spaces; FHRB 810 Non-Discriminationg Sensor for Reservoirs	float switch
EBW, Inc.	AUTO-STIK Sensors LS-5, LS-7, LS-10, LS-15, LS-20, LS-35, LS-3A, LS-30A	float switch
Emco Electronics, Tuthill Transfer Systems	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 Interstitial Space Flood Sensor, and EECO 1500, 2000, 3000 Systems Q0003-005 Wet Interstitial Sensor	float switch

LIQUID-PHASE INTERSTITIAL DETECTOR (CONTINUED)

VENDOR	EQUIPMENT NAME	OPERATING PRINCIPLE
Emco Electronics, Tuthill Transfer Systems	EECO 1500, 2000, 3000 Systems with Q0003-001 Discriminating Dispenser Pan Sensor, Q0003-002 Discriminating STP Sump Sensor, Q0003-003 Discriminating Interstitial Sensor, Q0003-006 Liquid Only Interstitial Sensor, Q0003-009 Liquid Float Sensor	float switch and polymer strip (Q0003-001, Q0003-002), optical prism and conductivity (Q0003-003), optical prism (Q0003-006), float switch (Q0003-009)
INCON Intelligent Controls, Inc.	Tank Sentinel TS-1000EFI with TSP-DIS BriteSensor, Tank Sentinel TS-1000/TS-2000 with TSP-EIS Standard Sensor and TSP-PS Liquid Contact Sensor	opto-electric
	Tank Sentinel TS-1000EFI with TSP-HIS BriteSensor, Tank Sentinel TS-1000/TS-2000 with TSP-HLS Standard Sensor and TSP-ULS Standard Sensor	magnetic switch
Marconi Commerce Systems (formerly Gilbarco Environmental Products)	PA02590XXX000, PA02591144000, PA02592000000	float switch
Marley Pump Co.	Red Jacket Electronics RE400-179-5 to RE400-199-5 Combination High Level/Low Level Sensor, RE400-042-5 Hydrostatic Sensor, Red Jacket PPM 4000 with Optical Liquid Discrimination Sensor	float switch (RE400-179-5 to RE400-199-5, RE400-042-5) optical sensor (PPM4000)
	Red Jacket Electronics RE400-058-5, RE400-059-5, RE400-147-5, RE400-148-5 Overfill Sensor, RE400 111-5 Sump Sensor, RE400-203-5 Optical Liquid Discrimination Sensor, RE400-204-5 Dispenser Pan Monitor, RE400-180-5 Liquid Refraction Sensor	float switch (RE400-058-5, RE400-059-5, RE400-147-5, RE400-148-5, RE400-111-5), electrical conductivity and optical (RE400-203-5), conductive polymer (RE400-204-5), optical (RE400-180-5)
NESCO (formerly Arizona Instrument Corp.)	Soil Sentry Liquid 330 (17-330-A/17-330-B), TLM-830, ENCOMPASS APAM with Probes 17-141A, 17-142A, 17-143A, 17-144A	refraction
OMNTEC Mfg., Inc	Controller Models OEL 8000 11, K-OEL 8000 11 with Liquid level Sensors BX-L, BX-LS, BX-LWF, BX-RES	optical sensor
	Controller Models OEL 8000 11, K-OEL 8000 11 with Liquid level Sensors BX-PDS, BX-PDWF, BX-PDWS	optical sensor, conductivity
	L-LL-R-1, LS-ASC, PDS-ASC, PDWS-1, PDWF-1	refractive index of liquids (all), electrical conductivity (PDS-ASC, PDWS-1, PDWF-1)
PermAlert	PAL-AT Models AT20C, AT50C, AT40K with PHL Hydrocarbon Sensor	electrical conductivity
	TankWatch Models PHM10, PHMS with Combination Hydrocarbon/Water Probe, Hydrocarbon Probe	electrical conductivity
Petro Vend, Inc.	Petrosentry IV, Petrosentry VIII, SiteSentinel Liquid Sensor, Universal Sump Sensor, Universal Reservoir Sensor	thermal conductivity (Liquid Sensor) float switch (Universal Sump Sensor, Universal Reservoir Sensor)
Pneumercator Company, Inc.	LC 1000 Series, E-14-29, E-700-1, LDE-700, LDE-740, TMS 2000, TMS 3000 with Level Sensor Models LS600AB, LS600LDBN, LS610, RSU800	float switch
	LDE 700, LDE 740, LDE 9000 with Sensor Probe Models 9-901, 9-902, 9-903	capacitance
	TMS 2000, TMS 3000 with ES820-100 Non-Discriminating Liquid Sensor, ES820-200 Discriminating LiquidSensor	optical sensor

LIQUID-PHASE INTERSTITIAL DETECTOR (CONTINUED)

VENDOR	EQUIPMENT NAME	OPERATING PRINCIPLE
Preferred Utilities Manufacturing Corporation	TG-EL-D3 Controller with HD-A1 Sensor	optical sensor, electrical conductivity
Ronan Engineering Co.	Ronan Controller Models X76S; X76VS; X76LV C; TRS76; X76ETM, LVCS; X76CTM-N4; X76ETM-4X; X76-4X, -3, -6, -9, -12; X76AST-4X with Ronan Sensors LS-3 N.C.; LS-3 N.O.; LS-30; LS-7; HVA; LS-3SS; LS-1	float switch
Simone Engineering, Inc.	Magnetrol Model 918 Ultrasonic Point Level Switch with ABB Automation Freelance 2000 Control System	electrical conductivity, ultrasonic
Tidel Engineering, Inc.	EMS-3500 with Liquid Discriminatory Probes Part 301-0635, Containment Sump Probes Part 301-0642, Tidel Detector #301-0752-001	electrical conductivity/hydrocarbon sensitive polymer (part 301-0635) magnetic switch/float and hydrocarbon sensitive polymer (part 301-0642) float switch (#301-0752-001)
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 with LALS-1 Liquid Sensor	thermal conductivity
Veeder-Root	ILS-250, ILS-350, TLS-250i, 250i Plus, 300, 300C, 300i, 300PC, TLS-350 Series with Interstitial Liquid Sensor for Fiberglass Tanks 0794390-401, 404, 407, 409 Interstitial Liquid Sensor for Steel Tanks 0794390-420, 460 Liquid Sensor for Sumps 0794390-206	float switch
	TLS-350 Series with Interstitial Liquid Sensor 794380-341, Dispenser Pan Sensor 794380-320, Discriminating Containment Sump Sensor(794380-350, Discriminating Fibertrench Sensor 794380-360, 361, 362	capacitance change/ultrasonic (794380-341) electrical conductivity/ultrasonic (794380-320, 350, 360, 361, 362)
	TLS-350 Series,TLS-300, 300i with Dispenser Pan Sensor 794380-322, Discriminating Containment Sump Sensor 794380-352	product permeable, reed switch/float
	Dispenser Pan Sensor 847990-001 and Differentiating Dispenser Pan Sensor 847990-002 with Dispenser Control Interface	product permeable, reed switch/float
	TLS-350 Series, TLS-300, 300i with Dual and Single Stage Hydrostatic Sensors 794380-301, 302	float switch
	TLS-300C, 300i, 300PC, 350, 350PC, 350R, 350RPC with Solid-State Pan/Sump Sensor 794380-321, 351, Piping Sump Sensor 794380-208, 209, Micro Sensor 794380-340	product permeable, ultrasonic/float switch
Warrick Controls, Inc.	DMS-47X-X-X(-X), DMS-57X-X-X(-X) Monitoring Panels with 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 Corp.	AMC 5100 with Leak Detection Cable AMC-5007	electrical conductivity
Brooks KWK, Inc.	Leak Detection Systems KW-140, KW-240 Monitors with Types 1, 2 Sensors	product soluble
EBW, Inc.	AUTO-STIK Discriminating Sensors LS-5, LS-10, LS-15, LS-20, LS-35	product permeability
FCI Environmental, Inc.	Analog Hydrocarbon Probe AHP-100, 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
INCON Intelligent Controls, Inc.	Tank Sentinel TS-1000EFI with TSP-DDS BriteSensor, TSP-DTS BriteSensor, TSP-MWS BriteSensor Groundwater Probe	magnetic switch and float (TSP-DDS BriteSensor, TSP-DTS BriteSensor) hydrocarbon sensitive polymer (all)
Mallory Controls	Pollulert Probes MD221G/T, MD221G/TRA, MD241R, MD241RRA, MD241G, MD241GRA	electrical conductivity
Marconi Commerce Systems (formerly Gilbarco Environmental Products)	EMC Environmental Management Console Groundwater Sensor Series PA02700XX0001	electrical conductivity
One Plus Corp.	Leak Edge Models 100-3001, 100-4001	product permeable
PermAlert	PAL-AT Models AT20C, AT50C, AT40K with AGW Sensor Cable, TFH Hydrocarbon Sensor Cable	impedance change
	PAL-AT Models AT20C, AT50C, AT40K with PHFW Hydrocarbon Probe and Type 1 or Type 2 Sensor	product soluble
Petro Vend, Inc.	SiteSentinel Controller with Combination Sensors Part #30-3224 (Consists of Part #30-3221-1A, #30-3219-12), #30-3225 (Consists of Part #30-3221-2, #30-3219-12)	float switch (part #30-3221-1A, #30-3221-2) product permeable (part #30-3219-12)
	SiteSentinel Controller with Hydrocarbon Sensitive Polymer Cables Part #30-3206, #30-3207-nn, #30-3210-nn, #30-3219-12	product permeable
	SiteSentinel Controller with Single Float Switches Part #30-3221-1, #30-3221-1A, #30-2111-1B Brine Reservoir Sensor and Dual Float Sensor Part #30-3221-2	float switch
Raychem Corp.	TraceTek Alarm and Locator Modules TT502, TT5000, TT3000 Fuel Sensing Cable	electrical conductivity
Tidel Engineering, Inc.	EMS-3500 with Monitoring Well Probe Part 301-0641, Sheen Probes Part 301-0687, Tidel Detector #301-0762	conductivity via resistor ladder network (part 301-0641) electrical conductivity/hydrocarbon sensitive polymer (part 301-0687, #301-0762)
	Tidel Detector #301-0324-001, #301-0325-001, #301-0326-001, #301-0326-002	electrical conductivity
Veeder-Root	350 Series UST Monitoring Systems Models ILS-350, TLS-350, 350R, 350PC, 350RPC with Groundwater Sensors 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 and 0.005gph/A tank system should not be declared tight when tracer chemical is detected outside of the tank./not limited by capacity

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 tank 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 tank 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 tank 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
	UTF-5000 Ullage Tester (Pressure Test)	0.1 gph/ A tank 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
	UTFP-5000 Ullage Tester (Pressure Test)	0.1 gph/ A tank system should not be declared tight when the pressure decay trend equals or exceeds ± 0.016 psi/hr./10,260 gallons
Sound Products Manufacturing, Inc. (formerly USTest, Inc.)	UST 2000/U (Pressure and Vacuum Test)	0.1 gph/ A tank system should not be declared tight when there is a substantial increase in the acoustic noise s ignal (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 (pressure test), 5,250 gallons (vacuum test).
Tanknology - NDE	UST Ullage Test, Version U2 (Pressure Test)	0.1 gph/ A tank system should not be declared tight when the pressure decay trend equals or exceeds ± 0.016 psi/hr./10,260 gallons
	UTS-4T Ullage Test (Pressure Test)	0.1 gph/ A tank 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
	U3 Ullage Test (Vacuum or Pressure Test)	0.1 gph/ A tank 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
Triangle Environmental, Inc.	TEI Ullage Test, Version 1.0 (Vacuum Test)	0.1 gph/ A tank 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

NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (VACUUM)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
Estabrook EZY CHEK Systems (formerly Horner EZY CHEK)	EZY 3	0.1 gph/ A tank 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, or when water ingress is detected by the water sensor./50,000 gallons
	EZY 3 Locator Plus	0.1 gph/ A tank system should not be declared tight when the acoustic signal detected is different from the baseline signal before a vacuum is placed on the tank, or when water ingress is detected by the water sensor./50,000 gallons
Protank, Inc.	Fast Test (Underfill Test)	0.1 gph/ A tank 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)	0.1 gph/A tank 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./30,000 gallons
	VacuTect	0.1 gph/ A tank 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./75,000 gallons
Triangle Environmental, Inc.	TEI System 5000, Version 1.0	0.1 gph/ A tank 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/ 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, V 70 Ex	0.1 gph/ System alarms when liquid enters interstitial space and vac uum decreases (pressure increases) above 34 millibars./20,000 gallons
Steel Tank Institute	Permatank Interstitial Vacuum Monitor Liquid Leaks	0.1gph/ A tank system should not be declared tight when the vacuum decreases (pressure increases) 5 inches or more of mercury over the test period specified for each tank size./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, Versions 1.0, 2.0	0.2 gph/0.1 gph/18,000 gallons (Version 1.0) 0.1 gph/0.05 gph/18,000 gallons (Version 2.0)
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, Ltd.	Tanknetics SIR, Version 2.1	0.2 gph/0.10 gph/45,000 gallons 0.1 gph/0.05 gph/45,000 gallons
Computerizing, Inc.	Computank, Version 3.0	0.1 gph/0.05 gph/18,000 gallons
Entropy Limited	Precision Tank Inventory Control System Revision 90	0.1 gph/0.05 gph/22,500 gallons
EviroSIR LLC	EnviroSIR Version 1.0	0.2 gph/0.15 gph/45,000 gallons 0.1 gph/0.05 gph/45,000 gallons
Horner Products, Inc.	SIR PRO 1 Versions 3.0	0.2 gph/0.1 and 0.16gph/45,000 gallons
	SIR PRO 1 Versions 4.0	0.1 gph/0.05 gph/33,000 gallons
Precision Tank Service, Inc.	TotalSir Version 1.0	0.2 gph/0.1 and 0.16gph/45,000 gallons
Simmons Corp.	SIR 5.7	0.1 gph/0.05 gph/18,000 gallons
	SIR 5.7 LM	0.2 gph/0.10 gph/45,000 gallons 0.1 gph/0.05 gph/45,000 gallons
SIR International, Inc.	Mitchell's SIR Program Version 2.6	0.1 gph/0.05 gph/45,000 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
	SIR Phoenix LEOMA V01.50	0.2 gph/0.01 gph/18,000 gallons for single tanks, and 45,000 gallons for manifolded tanks
TeleData, Inc.	TankMate, Version 3.20	0.1 gph/0.05 gph/60,000 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, Versions 95.2, 95.2A, 95.2B	0.1 gph/0.05 gph/60,000 gallons (Version 95.2) 0.2 gph/0.1 gph/60,000 gallons (Version 95.2A) 0.2 gph/0.16 gph/60,000gallons(Version 95.2B)
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)	SIRAS Software System Versions 2.0, 2.8.3	0.2 gph/0.1 gph/30,000 gallons 0.1 gph/0.05 gph/30,000 gallons

VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

VENDOR	EQUIPMENT NAME	OPERATING PRINCIPLE
Armstrong Monitoring Corp.	AMC 5100, Vapor Sensor A MC F4000	metal oxide semiconductor
Emco Electronics, Tuthill Transfer Systems	EECO 1500, 2000, 3000, Leak Sensor, Leak Sensor II, Leak Sensor Jr. with Q0002-001, 005 Sensors	adsistor(Q0002-001), metal oxide semiconductor (Q0002-005)
Environmental Fuel Systems, Inc.	Fuel Finder Version IV	adsorption sampling
FCI Environmental, Inc.	Analog Hydrocarbon Probe AHP-100, Digital Hydrocarbon Probe DHP-100	fiber optic
FDR Services, Inc.	GasPak Vapor Monitoring System	product permeable detector
HNU Systems, Inc.	PI-101 with 11.7 EV Probe #101397; HW-101 with 11.7 EV Probe #170214; ISPI-101 with 10.2 EV Probe #111100; DL-101 with 10.2 EV Probe #167085	photoionization detector
Mallory Controls	Pollulert Probes MD221V, MD221VRA, MD210V, MD210VRA	adsistor
Marconi Commerce Systems (formerly Gilbarco Environmental Products)	PA02660000000	adsistor
Mine Safety Appliances	Tankgard, P/N 481532, and Tankgard VIII, P/N 488803	metal oxide semiconductor
NESCO (formerly Arizona Instrument Corp.)	Soil Sentry Twelve-X	metal oxide semiconductor
Petro Vend, Inc.	Petrosentry TLD III, SiteSentinel, Smart Module and Vapor Sensor	metal oxide semiconductor
Petro Vend, Inc.	SiteSentinel Controller with Vapor Sensor Part #30-3222,	metal oxide semiconductor (part #30-3222), optical sensor (part #30-3223)
Tidel Engineering, Inc.	EMS-3000, 301-0328-001, 301-0330-001, and 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 LAV-100, LA-01, LA-02, LA-04, LA-X4, LA-08, CATLAS with LAVS-1 MOS Vapor Sensor	metal oxide semiconductor
Veeder-Root	ILS-350, TLS-350 Series with Adsistor Vapor Probe 794390-700	adsistor
Warrick Controls, Inc.	Model 5700 Meter with 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
Estabrook EZY CHEK Systems (formerly Horner EZY CHEK)	EZY-Chek I	0.1 gph/0.05 gph/12,000 gallons
	EZY-Chek II	0.1 gph/0.05 gph/12,000 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
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

VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL) (CONTINUED)

VENDOR	EQUIPMENT NAME	LEAK RATE/THRESHOLD/ MAX TANK CAPACITY
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
Estabrook EZY CHEK Systems (Formerly Horner EZY CHEK)	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
Sound Products Manufacturing, Inc. (formerly 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
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

PART II

LEAK DETECTION TEST METHODS AND EQUIPMENT/SYSTEMS

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)

Certification: Leak rate of 0.05 gph with P_D = 99.2310% and P_{FA} = 0.5451%.

Leak Threshold: 0.02587 gph. A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 6,000 gallons.
Tank must be minimum 100% full.

Waiting Time: 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.

Test Period: Minimum of 1 hour, 48 minutes.
Volume data is collected and recorded by system’s 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.

Temperature: Average for product is determined by a resistance temperature sensor.

Groundwater: Depth to groundwater in tank excavation 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.

Calibration: Level sensors must be calibrated before each test.
Temperature sensor must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded tank system.

Absolute Precision Testing Systems
P.O. Box 6715
Bloomington, IN 47407
Tel: Unavailable

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
Detection time (sec)	<1	<1
Fall time	N/A*	N/A
Lower detection limit (cm)	<0.32	<0.32

*See glossary.

Specificity Results:

Activated: unleaded gasoline (above 23 ppm), synthetic gasoline (above 8 ppm), n-hexane, diesel, jet-A fuel, JP-4 jet fuel, toluene, xylene(s).

Manufacturer's specifications:

Leak Tracer Dye develops color in alcohols, ketones, solvents, and PCBs as well as petroleum products.

Comments:

Sensors are not reusable, and must be replaced after contact with hydrocarbons.
Sensor 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: (800) 526-31446

Evaluator: Scientific Information Services
Tel: Not Available
Date of Evaluation: 02/02/93

Advanced Telemetrics, Ltd.

Model 1100LD Version 1.07

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 98.9% and P_{FA} = 1.1%.

Leak Threshold: 0.1 gph. A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 30,000 gallons.
Tanks less than 95% full may be tested.
Minimum product level required is 10 inches.

Waiting Time: Determined automatically based on quality of tank data.
Average during evaluation was 8 hours, 56 minutes between delivery and testing.
Dispensing during waiting time may extend waiting time.
There must be no delivery during waiting time.

Test Period: Determined automatically based on quality of tank data.
Average during evaluation was 3 hours, 39 minutes.
Test data are acquired and recorded by a microprocessor.
There must be no dispensing or delivery during test.

Temperature: Average for product is determined by probe containing 5 or more IC (solid state) temperature sensors.
At least one IC temperature sensor must be submerged in product during test.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.5 inch.
Minimum detectable change in water level is 0.03 inch.

Calibration: IC (solid state) temperature sensors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Evaluated in automatic mode where a test is run whenever conditions in tank are quiet for a sufficient amount of time.
If test is run manually, vendor recommends waiting at least 7 hours after delivery and allowing the automatic tank gauge to determine minimum test period to avoid inconclusive results.
Not evaluated using manifolded 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.

Advanced Telemetrics, Ltd.
8800 Tradeway
San Antonio, TX. 78217
Tel: (800) 382-1482

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 04/03/98

Advanced Telemetrics, Ltd.

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 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 45,000 gallons for single tanks.
Maximum of 45,000 gallons cumulative capacity for manifolded tank systems with no more than 4 tanks in system.

Data Requirement: Minimum of 28 days of product level and flow through data.

Comments: 51% of data sets evaluated were from manifolded 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, Ltd
8800 Tradeway
San Antonio, TX. 78217
Tel: (800) 382-1482

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 01/28/97

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 gasoline	synthetic gasoline
Detection time (sec)	<1	<1
Fall time (sec)	<1	<1
Lower detection limits (cm)		
"Standard" setting	0.16	0.32
"Sensitive" setting	0.03	0.03

Specificity Results (in addition to above):
Activated: n-hexane, diesel, 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:
Sensors are reusable.
Color coded signal lights indicate the presence of air, water, and hydrocarbon liquid when activated (yellow, green, and red, respectively).

Agar Corp.
1600 Townhurst
Houston, TX 77403
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 METHOD

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 tank 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.
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 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 system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 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).

Alert Technologies, Inc.
5400 NewPort Dr., Suite 13
Rolling Meadows, IL 60008
Tel: (847) 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 tank 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, fuel oils #4, waste oil.
Other liquids may be tested after consultation with the manufacturer.

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 system' 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 tank excavation 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: Manifolded 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 underfill 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 tank excavation 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 tank excavation backfill may help identify presence of this condition.

Alert Technologies, Inc.
5400 NewPort Dr., Suite 13
Rolling Meadows, IL 60008
Tel: (847) 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 tank 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, fuel oils #4, waste oil.
Other liquids may be tested after consultation with the manufacturer.

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 system's 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 tank excavation backfill must be determined.
If groundwater is present outside ullage, test must not be used.

Calibration: System must be calibrated before each test.

Comments: Manifolded 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 underfill 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 tank excavation 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 tank excavation backfill may help identify presence of this condition.

Alert Technologies, Inc.
5400 NewPort Dr., Suite 13
Rolling Meadows, IL 60008
Tel: (847) 392-0060

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 02/28/94

Alert Technologies, Inc.

Alert Model 1000

VOLUMETRIC TANK TIGHTNESS TEST METHOD (UNDERFILL)

Certification: Leak rate of 0.1 gph with P_D = 98.2% and P_{FA} = 1.8% for 2 hour test.
Leak rate of 0.1 gph with P_D = 99.8% and P_{FA} = 0.2% for 4 hour test.

Leak Threshold: 0.05 gph. A tank 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.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 30,000 gallons.
Tank must be between 20 and 95% full.

Waiting time: Minimum of 1 hour between delivery and testing.
Minimum of 1 minute between dispensing and testing.
There must be no delivery during waiting time.

Test Period: 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 system's computer.
Leak rate is calculated from the data determined to be valid by statistical analysis.
There must be no dispensing or delivery during test.

Temperature: System measures product mass (which is not affected by temperature) instead of product volume.

Groundwater: Depth to groundwater in tank excavation 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.

Calibration: Load cell must be calibrated before each test.

Comments: Not evaluated using manifolded 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: (847) 392-0060

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 02/28/94

Andover Controls Corp.

Andover Infinity
Versions CX9900, CX9400, CX9200, CX9000, CMX240
(Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 95.4% and P_{FA} = 4.6%.

Leak Threshold: 0.1 gph. A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 30,000 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 system's 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 0.0028 inch.

Calibration: RTDs and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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: (978) 470-0555

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 01/20/97

Andover Controls Corp.

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

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with $P_D = 99.9\%$ and $P_{FA} < 0.1\%$.
Leak rate of 0.1 gph with $P_D = 97.6\%$ and $P_{FA} = 2.4\%$.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank 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.
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 system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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: (978) 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 METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.5% and P_{FA} = 0.5%.

Leak Threshold: 0.1 gph. A tank 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.
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 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 system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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: (978) 470-0555

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 02/03/92

Armstrong Monitoring Corp.

AMC 5100 with
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 gasoline
Detection time (sec)	35
Fall time (min:sec)	02:30
Lower detection limit (cm)	0.04

*For tests conducted with 0.32 cm of floating product.

Manufacturer's specifications:
Operating temperature: 32 degrees F to 104 degrees F (0 degrees C to 40 degrees C).

Comments:
Sensors are reusable.

Armstrong Monitoring Corp.
215 Colonnade Road South
Nepean, Ontario, Canada K2E 7K3
Tel: (800) 465-5777

Evaluator: Environment Canada
Tel: (613) 991-1108
Date of Evaluation: 12/03/92

Armstrong Monitoring Corp.

AMC 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:

	benzene
Detection time (sec)	10
Fall time (min:sec)	04:02
Lower detection limit (ppm)	300

Comments:
Sensors are reusable.

Armstrong Monitoring Corp.
215 Colonnade Road South
Nepean, Ontario, Canada K2E 7K3
Tel: (800) 465-5777

Evaluator: Environment Canada
Tel: (613) 991-1108
Date of Evaluation: 12/03/92

ASTTest Services, Inc.

ASTTest Mass Balance Leak Detection System

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tank with PSA of 5,575 ft², leak rate is 0.88 gph with P_D = 95% and P_{FA} = 5%.
For other tank sizes, leak rate equals [(PSA in ft² ÷ 5,575 ft²) x 0.88 gph].
Example: For a tank with PSA = 10,000 ft²; leak rate = [(10,000 ft² ÷ 5,575 ft²) x 0.88 gph] = 1.578 gph.
Leak rate may not be scaled below 0.2 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 5,575 ft², leak threshold is 0.44 gph.
For other tank sizes, leak threshold equals [(PSA in ft² ÷ 5,575 ft²) x 0.44 gph].
Example: For a tank with PSA = 10,000 ft²; leak threshold = [(10,000 ft² ÷ 5,575 ft²) x 0.44 gph] = 0.789 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Diesel, aviation fuel, fuel oil, kerosene.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks larger than 50,000 gallons.
Maximum product surface area (PSA) is 13,938 ft² (approximately 133 ft diameter).
Performance not sensitive to product level.

Waiting Time: Minimum of 48 hours after delivery or dispensing. Valve leaks and pump drain-back may mask a leak. Allow sufficient waiting time to minimize these effects.
There must be no dispensing or delivery during waiting time.

Test Period: Minimum of 48 hours.
There must be no dispensing or delivery during test.

Temperature: Average for product is determined by a minimum of 10 thermistors.

Water Sensor: None. Water leaks are measured as changes in level inside tank.

Calibration: Level and temperature sensors must be checked regularly and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: 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.
Evaluated in a nominal 2,000,000 gallon, vertical aboveground tank with product surface area (PSA) of 5,575 ft². Tests conducted in a vertical wall underground tank may achieve better results.

ASTTest Services, Inc.
2336 Hamlet Drive
Melbourne, FL 32934
Tel: (407) 242-1474

Evaluator: Albert Machlin, P.E.
Tel: (212) 675-5868
Date of Evaluation: 11/98

Barton Instrument Systems, LLC

Barton 3500 ATG

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 95.3% and P_{FA} = 4.7%.

Leak Threshold: 0.1 gph. A tank 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 with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 75,000 gallons.
Tank must be between 50 and 95% full.

Waiting Time: Minimum of 4 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 24 hours.
Test data are acquired and recorded by system's computer.
Leak rate is calculated from the average of subsets of all data collected.
There must be no dispensing or delivery during test.

Temperature: Measurement of product temperature is not required by this system.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.509 inch.
Minimum detectable change in water level is 0.225 inch.

Calibration: Probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Barton Instrument Systems, LLC
900 S. Turnbull Canyon Road
City of Industry, CA 91745
Tel: (626) 961-2547

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 03/15/00

Beaudreau Electronics, Inc.

Models 404, 406 Pump Cut-Offs

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: float switch (Model 404),
refractive index of liquids (Model 406)

Test Results:

Model 404	unleaded gasoline	diesel	water
Detection time (sec)	<1	<1	<1
Fall time	manual reset	manual reset	manual reset
Precision (in)	0.0124	0.0167	0.0067
Lower detection limit (in)	0.89	0.72	0.68
Model 406			
Detection time (sec)	<1	<1	<1
Fall time	manual reset	manual reset	manual reset
Precision - standard deviation (in)	0.003474	0.001923	0.005329
Lower detection limit (in)	0.357	0.321	0.369

Specificity Results:

Manufacturer and evaluator claim sensors will respond to any liquid.

Manufacturer's Specifications:

Manufacturer states that system requires no calibration.

Comments:

Sensors are reusable.

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.

Models 510, 516 Discriminating Sensors

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type:	qualitative, discriminating
Sampling frequency:	continuous
Operating principle:	polymer strip, hydrocarbon-only (Model 510), optical sensor and conductivity (Model 516)

Test Results:

Model 510	unleaded gasoline	diesel	water
Detection time	5-10 min	1-2 hr	<1 sec
Fall time (sec)	Replaceable	Replaceable	<1
Precision - standard deviation (in)	<0.0001	<0.0001	0.0045
Lower detection limit (in)	0.058	0.058	11.566
Model 516			
Detection time (sec)	<1	<1	<1
Fall time	<1	<1	<1
Precision - standard deviation (in)	0.0038	0.0032	0.0020
Lower detection limit (in)	0.340	0.369	0.389

Specificity Results:

Manufacturer claims sensors will respond to any liquid. No additional materials tested.

Manufacturer's Specifications:

Model 510 is designed to work with Beaudreau Model 404-4 or Model 500 Controllers.
Model 516 is designed to work with Beaudreau Model 500 or Model 512 Controllers and will not work with Model 404-4 Controller.

Comments:

The polymer strip used in Model 510 is designed to be replaceable when needed. If the polymer strip contacts hydrocarbon fuels, the cap on the sensor will need to be removed and the polymer strip disconnected and properly disposed of. A new polymer strip must then be inserted into the connector before reusing the sensor. The design allows the end-user to reuse the sensor immediately (some polymer strips need to be dried out for 24 to 48 hours) and also lowers the risk of false alarms caused by partially dried out polymer strips.
Model 516 is designed to be placed in a sensor well in bottom of a containment sump with at least one other sensor mounted higher as a high-water cut-off.
Both models were not evaluated for the ability to detect a layer of hydrocarbon on water.
Manufacturer claims both models require no calibration.

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: 04/28/99
(Revised 03/02/01)

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, waste oil.
Other liquids may be tested which are compatible with flexible liner after consultation with the manufacturer.

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 discharged from vacuum pump must meet applicable air quality standards.
Vapor recovery of product vapor from interstitial space is feasible when required.
System detects breaches in either flexible internal liner or rigid tank walls.

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 Types 1, 2 Sensors

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

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

Test Results:

Type 1 Sensor	unleaded gasoline	synthetic gasoline
Detection time (sec)	24	9
Fall time	N/A*	N/A
Lower detection limit (cm)	0.01	0.01
Type 2 Sensor		
Detection time (min:sec)	14:39	08:45
Fall time	N/A	N/A
Lower detection limit (cm)	0.01	0.01

* See glossary.

Specificity Results (in addition to above):
Activated: n-hexane, diesel, 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:
Sensors are 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

Caldon, Inc.

Caldon PF2000 Pipeline Leak Detection System for Bulk Pipelines

LARGE DIAMETER PIPELINE LEAK DETECTION METHOD

Certification: Leak rate of 10 gph at 100 psi with $P_D > 95\%$ and $P_{FA} < 5\%$.
(EPA defined equivalent 3.0 gph at 10 psi).

Leak Threshold: 8 gph. A pipeline system should not be declared tight if pressure decay or change in rate of decay in protected segment indicates a leak that exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests fiberglass or steel piping up to 18 inches diameter.
Tests are normally conducted at operating pressures of 50 to 150 psi, but system may not work at pressures less that 75 psi, and may need to be 100 psi or higher.
System may be used on pipelines pressurized up to 400 psi

Pipeline Capacity: Maximum of 212,000 gallons.
Evaluation conducted on straight piping runs with capacities to 106,000 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Variable up to 15 minutes.

System Features: Permanent installation on pipeline.
Automatic testing under static conditions.
Preset thresholds.
Single test to determine if pipeline is leaking.
Message display or printout, alarm activation if leak is declared.
Test data acquisition and calculation by system's computer.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: According to vendor, system works in a complex piping network, can detect leaks developed between static test times, and is capable of detecting gradually increasing leaks once they reach the system's detection range. However, not all these features were demonstrated during this evaluation or other field demonstration testing.

Caldon, Inc.
1070 Banksville Ave.
Pittsburgh, PA 15216
Tel: (412) 341-9920

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 10/15/98

Caldwell Systems Corp.

Tank Manager
(Ultrasonic Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with $P_D = 99.9\%$ and $P_{FA} = 0.1\%$.
Leak rate of 0.1 gph with $P_D = 96.7\%$ and $P_{FA} = 3.3\%$.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank 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.
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 system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.
600 South Sunset Street, Unit D
Longmont, CO 80501
Tel: (303) 684-8436

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 04/22/96

Caldwell Systems Corp.

Tank Manager Liquid Sensor, Version TMLIQ

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

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

Test Results:

Horizontal Position	unleaded gasoline	diesel	water
Response time (sec)	<1	<1	<1
Recovery time (sec)	<1	<1	<1
Lower detection limit (cm)	1.28	1.30	2.43
Precision - standard deviation (cm)	0.05	0.06	0.25
Vertical Position			
Response time (sec)	<1	<1	<1
Recovery time (sec)	<1	<1	<1
Lower detection limit (cm)	8.56	7.59	9.27
Precision - standard deviation (cm)	0.22	0.11	0.44

Specificity Results:

Evaluator claims sensor will detect fuels or other liquids.

Comments:

Sensor is designed to alarm only when liquid is present from one end of sensor to the other. Therefore, sensor orientation (vertical or horizontal) will effect lower detection limit.
Sensors are reusable.

Caldwell Systems Corp.
600 South Sunset Street, Unit D
Longmont, CO 80501
Tel: (303) 684-8436

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

Date of Evaluation: 11/09/98

Campo/Miller, Inc.

LS300, LS300 N/C, LS300-120, LS300-120 XLC, LS300-120 PLUS, 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 pipeline 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, waste oil, kerosene.
Other liquids may be tested after consultation with the manufacturer.

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 for LS300, LS300 N/C.
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 for LS300-120, LS300-120 XLC, LS300-120 PLUS, LS300-120 PLUS A/S.
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 leak test to determine if pipeline is leaking.
Pump 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 for LS300, LS300 N/C, LS300-120, LS300-120 XLC.
System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions for LS300-120 PLUS, LS300-120 PLUS A/S.

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

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

Campo/Miller, Inc.

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

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.5 gph for leak rate of 3.0 gph.
0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A pipeline 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, waste oil, kerosene.
Other liquids may be tested after consultation with the manufacturer.

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 for leak rate of 3.0 gph.
Minimum of 3 hours between dispensing and testing for leak rate of 0.2 gph.
Minimum of 6 hours between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is 10 minutes for leak rate of 3.0 gph.
Minimum of 25 minutes for leak rate of 0.2 gph.
Minimum of 34 minutes for leak rate of 0.1 gph.
Test data are acquired and recorded by a microprocessor.

System Features: Permanent installation on pipeline.
Automatic testing of pipeline every 45 minutes for leak rate of 3.0 gph.
Automatic testing of pipeline when pump has been idle for 3 hours for leak rate of 0.2 gph.
Automatic testing of pipeline when pump has been idle for 6 hours for leak rate of 0.1 gph.
Preset threshold.
Triplicate testing to determine if pipeline is leaking.
Pump shutdown, indicator light and alarm activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated 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, Version 3.0

STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

Certification: Leak rate of 0.1 gph with P_D = 99.5% and P_{FA} = 2%.
"If a method meets the requirement for detecting a leak rate of 0.1 gph, it will meet the requirement for 0.2 gph.", according to "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods", EPA/530/UST-90/007, June 1990, Section 7.2.3, page 30.

Leak Threshold: 0.05 gph. A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

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 manifolded 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: (256) 259-1805

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 09/17/92

Containment Solutions, Inc. (formerly Fluid Containment and O/C Tanks)

Hydrostatic Precision Tank Test for DWT-Type II Tanks

DOUBLE WALLED TANK TIGHTNESS TEST METHOD

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 tank 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 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.

Containment Solutions, Inc.
5150 Jefferson Chemical
Conroe, TX 77301-6834
Tel: (800) 628-2657

Evaluator: Vista Research
Tel: (415) 966-1171
Date of Evaluation: 05/15/91

Containment Solutions, Inc. (formerly Fluid Containment and O/C Tanks)

FCI Liquid Filled Interstitial Monitor
Tank Model DWT6 with Model FHRB 810 Level Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:
Output type: qualitative, non-discriminating (aqueous solution only)
Sampling frequency: continuous
Operating principle: float switch

Test Results:
System is capable of detecting leaks of 0.1 gph or smaller within one month for all size tanks manufactured by Containment Solutions, Inc. at time of evaluation. Estimated time to activate alarm, given a leak rate of 0.1 gph and assuming initial reservoir is 2 inches below full, ranges from 4 hours for a 500 gallon tank to 267 hours for a 50,000 gallon tank. Minimum detectable leak for alarm within one month ranges from 0.0047gph for a 500 gallon tank to 0.0185 gph for a 50,000 gallon tank, if initial reservoir level is 50%. Other test results listed below.

Evaluation variable	Range of conditions	Estimated range of effect for gasoline on brine level (in)
Product level change in tank	From 0% to 90%	2.0
Water table changes	48 inches change	1.6
Temperature changes	From 40 to 100 degrees F.	1.8
Vapor trapped in interstice (with temperature change)	45 gallons air trapped (with temperature change from 40 to 100 degrees F.)	<2

Manufacturer's Specifications:
Fluid in reservoir must be filled to proper level.
When alarm condition exists, or annually, sensor must be removed and tested in a bucket of water, according to manufacturer's instructions.

Comments:
Evaluation conducted on DWT6 20,000 gallon tank with a R28 reservoir and FHRB 810 sensor.
Evaluation parameters included: tank product level changes, water table changes, temperature changes, measurement of trapped vapor in the interstice, leak effects on the liquid-filled interstice, and scaling factors (application to various tank sizes).
System was not evaluated for ability to detect layer of hydrocarbon on water.

Containment Solutions, Inc.
5150 Jefferson Chemical
Conroe, TX 77301-6834
Tel: (800) 628-2657

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 06/15/98

Containment Solutions, Inc. (formerly Fluid Containment and O/C Tanks)

DDAS 910 Discriminating Sensor for Dry Annular Spaces; DCBS 900 Discriminating Sensor for Collars, Bulkheads, Sumps

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: capacitance change

Test Results:

DDAS 910 Discriminating Sensor for Dry Annular Spaces	unleaded gasoline	synthetic gasoline
Accuracy (%)	100	100
Detection time (sec)	<1	<1
Fall time (sec)	manual reset	manual reset
Lower detection limit (in)	0.32	0.36
DCBS 900 Discriminating Sensor for Collars, Bulkheads, Sumps		
Accuracy (%)	100	100
Detection time (sec)	<1	<1
Fall time (sec)	manual reset	manual reset
Lower detection limit (in)	0.76	0.74

Specificity Results (in addition to above):

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

Comments:

Control panel models:
CPF 1, CPF 2, CPF 3, CPF 4 for liquid level sensors;
CPI 1D, CPI 1H, CPI 1N inventory control for liquid level sensors and 1 tank;
CPD 1, CPD 2, CPD 4 for discriminating liquid level sensors;
CPI 4 inventory control for liquid level sensors and up to 4 tanks;
BOMC battery operated control cap for liquid level sensors;
CCF 1DA battery operated control cap for dry annulus monitoring;
CCF 2 battery operated control cap for hydrostatic reservoir monitoring.

Containment Solutions, Inc.
5150 Jefferson Chemical
Conroe, TX 77301-6834
Tel: (800) 628-2657

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 06/11/1999

Containment Solutions, Inc. (formerly Fluid Containment and O/C Tanks)

FOVF 600B, FOVF 600S Non-Discriminating Sensors for High Level Overfill (Brass, Steel); FCBS 700 Non-Discriminating Sensor for Collars, Bulkheads, Sumps; FDAS 710 Non-Discriminating Sensor for Dry Annular Spaces; FHRB 810 Non-Discriminating Sensor for Reservoirs

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

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

Test Results:

FOVF 600B, FOVF 600S Non-Discriminating Sensors for High Level Overfill (brass, steel)	unleaded gasoline	diesel	water
Lower detection limit (in)	3.32	3.26	3.18
Precision-standard deviation (in)	0.0051	0.0025	0.0037
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
FCBS 700 Non-Discriminating Sensors for Collars, Bulkheads, Sumps			
Lower detection limit (in)	0.99	0.97	0.87
Precision-standard deviation (in)	0.0040	0.0027	0.0043
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
FDAS 710 Non-Discriminating Sensors for Dry Annular Spaces			
Lower detection limit (in)	0.44	0.43	0.42
Precision-standard deviation (in)	0.0025	0.0041	0.0031
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
FHRB 810 Non-Discriminating Sensors for Reservoirs - Low Level Float			
Lower detection limit (in)	2.57	2.53	2.31
Precision-standard deviation (in)	0.0042	0.111	0.0042
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
FHRB 810 Non-Discriminating Sensors for Reservoirs - High Level Float			
Lower detection limit (in)	13.31	13.24	13.01
Precision-standard deviation (in)	0.0080	0.0061	0.0042
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1

Comments:

Control panel models:
CPF 1, CPF 2, CPF 3, CPF 4 for liquid level sensors;
CPI 1D, CPI 1H, CPI 1N inventory control for liquid level sensors and 1 tank;
CPD 1, CPD 2, CPD 4 for discriminating liquid level sensors;
CPI 4 inventory control for liquid level sensors and up to 4 tanks;
BOMC battery operated control cap for liquid level sensors;
CCF 1DA battery operated control cap for dry annulus monitoring;
CCF 2 battery operated control cap for hydrostatic reservoir monitoring.

Containment Solutions, Inc.
5150 Jefferson Chemical
Conroe, TX 77301-6834
Tel: (800) 628-2657

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 06/11/1999

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 rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.88 gph for leak rate of 3.0 gph.
0.05 gph for leak rate of 0.1 gph.
A pipeline 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 89 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing for leak rate of 3.0 gph.
Minimum of 15 minutes between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is approximately 10 seconds for leak rate of 3.0 gph.
Minimum of 30 minutes for leak rate of 0.1 gph.
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.
Pump shutdown, indicator light and alarm activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated 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.

Former Owner: Control Engineers
Current Owner: 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 METHOD

Certification: Leak rate of 0.2 gph with P_D = 95.0% and P_{FA} = 0.1% for normal test mode.
Leak rate of 0.2 gph with P_D = 95.0% and P_{FA} = 5.0% for rapid test mode.
Leak rate of 0.1 gph with P_D = 99.2% and P_{FA} = 0.08% for normal test mode.
Leak rate of 0.1 gph with P_D = 95.0% and P_{FA} = 5.0% for rapid test mode.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1gph.
A tank 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.

Tank Capacity: Maximum of 15,000 gallons.
Tank must be between 50 and 95% full for leak rate of 0.2 gph.
Tank must be minimum 95% full for leak rate of 0.1 gph.

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 and for leak rate of 0.2 gph.
Minimum of 6 hours, 23 minutes for normal test mode and 2 hours, 40 minutes for rapid test mode and for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Former Owner: Control Engineers
Current Owner: 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, 05/27/92

EBW, Inc.

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

AUTOMATIC TANK GAUGING METHOD

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 = 98.3% and P_{FA} = 1.7%.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank 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.
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 for leak of 0.2 gph.
Minimum of 2 hours between dispensing and testing for leak of 0.1 gph.
There must be no delivery during waiting time for leak of 0.2 gph.
There must be no dispensing or delivery during waiting time for leak of 0.1 gph.

Test Period: Minimum of 4 hours.
Test data are acquired and recorded by system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 St.
Muskegon, MI 49441-3421
Tel: (800) 475-5151

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 08/20/93

EBW, Inc.

AUTO-STIK Sensors
LS-5, LS-7, LS-10, LS-15, LS-20, LS-35, LS-3A, LS-30A

LIQUID-PHASE INTERSTITIAL DETECTOR

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

Test Results:

	unleaded gasoline	diesel	water
LS-5, LS-35 (float switches)			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (cm)	1.317	1.23	1.156
LS-10, LS-15, LS-20 (float switches)			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	2.870	2.822	2.667
LS-3A (N.C. and N.O.)			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (cm)	2.59	2.38	2.08
LS-30A (low level)			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (cm)	8.79	8.48	8.15
LS-30A (high level)			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (cm)	23.65	23.04	22.78
LS-7			
Detection time (sec)	<1	N/A	<1
Fall time (sec)	<1	N/A	<1
Lower detection limit (cm)	1.09	N/A	0.81

*See glossary.

Specificity Results:
Manufacturer and evaluator claim that sensors will respond to any liquid.

Manufacturer's Specifications:
There is no manufacturer's recommended maintenance schedule.

Comments:
Sensors are reusable.

EBW, Inc.
2814 McCracken St.
Muskegon, MI 49441-3421
Tel: (800) 475-5151

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 04/20/93, 07/05/94

EBW, Inc.

AUTO-STIK Discriminating Sensors
LS-5, LS-10, LS-15, LS-20, LS-35

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:
Output type: qualitative
Sampling frequency: continuous
Operating principle: product permeability

Test Results:

LS-5, LS-35 (polymer strips)	unleaded gasoline	diesel	water
Detection time (min)	~7	~60	N/A*
Fall time (sec)	N/A	N/A	N/A
Lower detection limit (cm)	<0.014	<0.014	N/A
LS-10, LS-15, LS-20 (polymer strips)			
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:
Manufacturer and evaluator claim sensors will respond to any liquid, except 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:
Sensors can be reset by exposing them to air.
Sensors are reusable.

EBW, Inc.
2814 McCracken St.
Muskegon, MI 49441-3421
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 DETECTION METHOD

Certification: Leak rate of 3.0 gph at 10 psi with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.2 gph. A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 system 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 system's computer.
Calculations are automatically performed by system's 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).
Declaration of leak if current changes in pressure exceed tuning parameters, or if pressure fluctuates in a manner that is characteristic of a leak.
Pump shutdown, indicator light and alarm activation if leak is declared.

Calibration: System must be checked annually. Standard electronic field instruments used by the system requires 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.

EFA Technologies, Inc.
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 METHOD

Certification: Leak rate of 0.2 gph with P_D = 97.9% and P_{FA} = 1.1%.

Leak Threshold: 0.075 gph. A tank 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 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 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 system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Egemin Naamloze Vennootschap
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 METHOD

Certification: Leak rate of 0.2 gph with P_D = 97.2% and P_{FA} = 0.3%.

Leak Threshold: 0.1 gph. A tank 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.
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.
There must be no dispensing or delivery during waiting time.

Test Period: Minimum of 2 hours, 15 minutes.
Test data are acquired and recorded by system's 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 thermistors.

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: Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Egemin Naamloze Vennootschap
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Schoten, Belgium
Tel: 011-32-3-03/645 2790

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

Date of Evaluation: 12/21/90

Emco Electronics, Tuthill Transfer Systems

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 rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.0 gph for leak rate of 3.0 gph.
0.1293 gph for leak rate of 0.2 gph.
0.0793 gph for leak rate of 0.1 gph.
A pipeline 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.

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 for leak rate of 3.0 gph.
Ranges from 0 to 1 hour, 27 minutes between dispensing and testing for leak rate of 0.2 gph.
Ranges from 0 to 2 hours, 48 minutes between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is 2 minutes for leak rate of 3.0 gph.
Minimum of 9 minutes for leak rate of 0.2 gph.
Minimum of 31 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Emco Electronics, Tuthill Transfer Systems
114-300 MacKenan Dr.
Cary, NC 27511
Tel: (919) 460-6000

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 12/31/93, 07/18/94

Emco Electronics, Tuthill Transfer Systems

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 rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.0 gph for leak rate of 3.0 gph.
0.0793 gph for leak rate of 0.1 gph.
A pipeline 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.

Specification: System tests flexible pipelines.
Tests are conducted at operating pressure for leak rate of 3.0 gph.
Tests are conducted at average pressure of 10 psi for leak rate of 0.1 gph.

Pipeline Capacity: Maximum of 49.6 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing for leak rate of 3.0 gph.
Minimum of 14 minutes between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is 11 minutes, 24 seconds for leak rate of 3.0 gph.
Minimum of 9 hours for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Emco Electronics, Tuthill Transfer Systems
114-300 MacKenan Dr.
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Tel: (919) 460-6000

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 07/18/94

Emco Electronics, Tuthill Transfer Systems

EECO System 1000, 1500, 2000, 3000 and Galaxy 0.2 gph Precision Test and Quick Test (Q0400-4xx Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.1% and P_{FA} = 0.9% for Precision Test.
Leak rate of 0.2 gph with P_D = 95.4% and P_{FA} = 4.6% for Quick Test.

Leak Threshold: 0.1 gph. A tank 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.
Other liquids with known coefficients of expansion and density 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 as follows: **48"** dia/min 8.5"; **64"** dia/min 10.5"; **72"** dia/min 11.5"; **96"** dia/min 14": 1**26"** dia/min 18".
For other tank diameters, see evaluation report.

Waiting Time: 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.

Test Period: Average of 2 hours, 46 minutes during Precision Test evaluation.
Average of 1 hour, 9 minutes during Quick Test 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.

Temperature: Probe contains 5 resistance temperature detectors (RTDs) to monitor average product temperature. At least one RTD must be submerged in product during test.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.66 inches.
Minimum detectable change in water level is 0.039 inches.

Calibration: RTDs and probe must be checked regularly and, if necessary, 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.

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Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 12/23/93, 06/20/94
08/17/95, 07/28/97, 11/17/99

Emco Electronics, Tuthill Transfer Systems

EECO System 1000, 1500, 2000, 3000 and Galaxy 0.1 gph Precision Test and Quick Test (Q0400-4xx Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.1 gph with P_D = 99% and P_{FA} = 1% for Precision Test.
Leak rate of 0.1 gph with P_D = 96% and P_{FA} = 4% for Quick Test.

Leak Threshold: 0.05 gph. A tank system should not be declared tight if the test result indicates a loss or gain which equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.
Other liquids with known coefficients of expansion and density 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 as follows: **48"** dia/min 8.5"; **64"** dia/min 10.5"; **72"** dia/min 11.5"; **96"** dia/min 14"; **126"** dia/min 18".
For other tank diameters, see evaluation report.

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, 45 minutes for Precision Test.
Average of 3 hours 45 minutes at 95% full and 5 hours 58 minutes at 50% full during Precision Test evaluation.
Minimum of 1 hour, 49 minutes for Quick Test.
Average of 1 hour 48 minutes at 95% full and 2 hours 48 minutes at 50% full during Quick Test 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.

Temperature: Probe contains 5 resistance temperature detectors (RTDs) to monitor average product temperature.
At least one RTD must be submerged in product during test.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.66 inches.
Minimum detectable change in water level is 0.039 inches.

Calibration: RTDs and probe must be checked regularly and, if necessary, 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.

Emco Electronics, Tuthill Transfer Systems
114-300 MacKenan Dr.
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Tel: (919) 460-6000

Evaluator: Midwest Research Institute
Tel: (816) 753-7600
Dates of Evaluation: 02/08/94, 09/19/97
01/04/00

Emco Electronics, Tuthill Transfer Systems

EECO System 1000, 1000EG, 1500, 2000, 3000 and Galaxy ATG Systems (Q0400-4xx Magnetostrictive Probe)

CONTINUOUS IN-TANK LEAK DETECTION METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.1% and P_{FA} = 0.9%.

Leak Threshold: 0.1 gph for single and manifolded tanks.
A tank 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.

Applicability: Gasoline, diesel, aviation fuel.
The system is designed primarily for use with petroleum fuels. Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 35,000 gallons for single tanks and for up to 2 tanks manifolded together.

Throughput: Monthly maximum of 130,000 gallons.

Waiting Time: Minimum of 6 hours stabilization time is allowed between delivery and data collection.

Test Period: Average data collection time is 12 days. During evaluation, data collection time ranged from 1 to 31 days.
Data sampling frequency is at least once per minute.
System collects data at naturally occurring product levels without interfering with normal tank operation and discards data from unstable periods when system performs test.

Temperature: Average for product is determined by a minimum of 5 sensors.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.66 inch.
Minimum detectable change in water level is 0.039 inch.

Calibration: Temperature sensors are factory calibrated.
Probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: System reports a quantitative result of pass or fail.
Evaluated using both single and manifolded tank systems.
Data can be collected when the product level is between 9% and 94.9% of tank volume.
System distinguishes large leak rates (> 1gph) from dispensing activities and reports those as "fail".
For valid monthly testing, a conclusive test report must be produced for each tank every month.
System warns 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.
The 6-hour stabilization period after delivery may result in the system not testing the top portion of a very active tank. In this situation, a periodic test in the shut-down mode with a high product level should be used to test the entire portion of tank that routinely contains product.
Because the database for evaluation of the system did not include sites with vapor recovery or blending dispensers, use is limited to sites with no vapor recovery or blending dispensers. Vendor is in process of amending evaluation for application at sites with vapor recovery systems.
Evaluated using gasoline.

Emco Electronics, Tuthill Transfer Systems
114-300 MacKenan Dr.
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Tel: (919) 460-6000

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 03/13/00

Emco Electronics, Tuthill Transfer Systems

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

Specificity Results (in addition to above):
Activated: n-hexane, diesel, jet-A fuel, toluene, xylene(s), water.

Comments:
Sensors are reusable.
Systems alarm if either water or product leaks into interstitial space.

Emco Electronics, Tuthill Transfer Systems
114-300 MacKenan Dr.
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Tel: (919) 460-6000

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 11/09/92

Emco Electronics, Tuthill Transfer Systems

EECO 2000, 3000, Leak Sensor II, Leak Sensor Jr. Systems
with Q0001-005 Interstitial Space Flood Sensor
and
EECO 1500, 2000, 3000 Systems
with Q0003-005 Wet Interstitial Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

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

Test Results:

Q0001-005 Interstitial	unleaded gasoline		diesel		water	
Space Flood Sensor	high*	low*	high	low	high	low
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
Q0003-005 Wet Interstitial Sensor						
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

*The "high" and "low" refer to high and low level alarm points of hydrostatic sensors.

Specificity Results:
Evaluator claims sensors will respond to any liquid.

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 solution level exceeds upper or lower limits.
Sensors are reusable.

Emco Electronics, Tuthill Transfer Systems
114-300 MacKenan Dr.
Cary, NC 27511
Tel: (919) 460-6000

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 10/18/96

Emco Electronics, Tuthill Transfer Systems

EECO 1500, 2000, 3000 Systems
Q0003-001 Discriminating Dispenser Pan Sensor, Q0003-002 Discriminating STP Sump Sensor, Q0003-003 Discriminating Interstitial Sensor, Q0003-006 Liquid Only Interstitial Sensor, Q0003-009 Liquid Float Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type:	qualitative
Sampling frequency:	continuous
Operating principle:	float switch and polymer strip (Q0003-001, Q0003-002), optical prism and conductivity (Q0003-003), optical prism (Q0003-006), float switch (Q0003-009)

Test Results:

	unleaded gasoline		diesel		water	
Q0003-001 Discriminating Dispenser Pan Sensor (float switch, polymer strip)	high*	low*	high	low	high	low
Lower detection limit (cm)	19.91	3.38	19.86	3.30	19.66	3.20
Detection time (sec)	1-24hr	1-24hr	<1	<1	<1	<1
Fall time (sec)	clean	clean	clean	clean	<1	<1
Q0003-002 Discriminating STP Sump Sensor (float switch, polymer strip)						
Lower detection limit (cm)	28.37	3.12	28.24	3.07	28.04	3.00
Detection time (sec)	1-24hr	1-24hr	<1	<1	<1	<1
Fall time (sec)	clean	clean	clean	clean	<1	<1
Q0003-003 Discriminating Interstitial Sensor (optical prism, conductivity)						
Lower detection limit (cm)	1.68		1.68		1.85	
Detection time (hr)	<1		<1		<1	
Fall time (sec)	<1		<1		<1	
Q0003-006 Liquid Only Interstitial Sensor (optical prism)						
Lower detection limit (cm)	1.35		1.55		1.78	
Detection time (hr)	<1		<1		<1	
Fall time (sec)	<1		<1		<1	
Q0003-009 Liquid Float Sensor (float switch)						
Lower detection limit (cm)	2.54		2.49		2.21	
Detection time (hr)	<1		<1		<1	
Fall time (sec)	<1		<1		<1	

*The "high" and "low" refer to high and low level alarm points of hydrostatic sensors.

Specificity Results:
Evaluator claims sensors will respond to any liquid.

Comments:
Q0003-001 and Q0003-002 sensors must be cleaned with rubbing alcohol, or dish soap and water after exposure to product.
Sensors are reusable if not completely saturated with product.

Emco Electronics, Tuthill Transfer Systems
114-300 MacKenan Dr.
Cary, NC 27511
Tel: (919) 460-6000

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 10/18/96

Emco Electronics, Tuthill Transfer Systems

EECO 1500, 2000, 3000, Leak Sensor, Leak Sensor II, Leak Sensor Jr.
with Q0002-001, Q00002-005 Sensors

VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: adsistor (Q0002-001sensor), metal oxide semiconductor (Q0002-005 sensor)

Test Results:

Q0002-001 Sensor	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
Accuracy* (%)	100		100
Detection time* (min:sec)	19:32		09:16
Fall time* (hh:mm:ss)	00:32:30		>01:05:33
Lower detection limit (ppm)	1000		500
Q0002-005 Sensor			
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.
** See Glossary

Specificity Results (in addition to above):

Activated: n-hexane, toluene, xylene(s).

Comments:

Q0002-001 sensor is not for use with synthetic gasoline.

Emco Electronics, Tuthill Transfer Systems
114-300 MacKenan Dr.
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Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Date of Evaluation: 11/12/96, 10/18/96

Endress+Hauser Systems and Gauging
(formerly Coggins Systems, Inc.)

Leak Manager with Barton 3500 ATG

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 95.3% and P_{FA} = 4.7%.

Leak Threshold: 0.1 gph. A tank 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 with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 75,000 gallons.
Tank must be between 50 and 95% full.

Waiting Time: Minimum of 4 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 24 hours.
Test data are acquired and recorded by system's computer.
Leak rate is calculated from the average of subsets of all data collected.
There must be no dispensing or delivery during test.

Temperature: Measurement of product temperature is not required by this system.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.509 inch.
Minimum detectable change in water level is 0.225 inch.

Calibration: Probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Endress+Hauser Systems and Gauging
5834 Peachtree Corners East
Norcross, Ga 30092
Tel: (770) 447-9202

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 03/15/00

Endress+Hauser Systems and Gauging
(formerly Coggins Systems, Inc.)

Leak Manager and RemoteTerminal Unit RTU/8130
(MTS Magnetostrictive Probe)

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tanks with PSA of 616 ft², leak rate is 0.2 gph with P_D = 96.4% and P_{FA} = 3.6%
For other tank sizes, leak rate equals [(PSA in ft² ÷ 616 ft²) x 0.2 gph].
Example: For a tank with PSA = 900 ft²; leak rate = [(900 ft² ÷ 616 ft²) x 0.2 gph] = 0.29 gph.
Leak rate may not be scaled below 0.2 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 616 ft², leak threshold is 0.1 gph.
For other tank sizes, leak threshold equals [(PSA in ft² ÷ 616 ft²) x 0.1 gph].
Example: For a tank with PSA = 900 ft²; leak threshold = [(900 ft² ÷ 616ft²) x 0.1 gph] = 0.1gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks larger than 50,000 gallons.
Maximum product surface area (PSA) is 924 ft².
Product must be at full operating level.

Waiting Time: Minimum of 4 hours, 26 minutes after delivery or dispensing.

Test Period: Minimum of 24 hours.
There must be no dispensing or delivery during test.

Temperature: Average for product is determined by a minimum of 5 resistance temperature detectors (RTDs).
Product temperature change during test should not exceed 0.72 degrees F.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.238 inch.
Minimum detectable change in water level is 0.0017 inch.

Calibration: Probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: 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.
Leak Manager uses PC-based software to process probe data.
Remote Terminal Unit (RTU/8130) contains software embedded in a CPU housed in a stand-alone console.
Evaluated in a nominal 50,000 gallon vertical underground tank with product surface area (PSA) of 616 ft².
The maximum product level in the tank during test was 65% (32,500 gallons).

Endress+Hauser Systems and Gauging
5834 Peachtree Corners East
Norcross, GA 30092
Tel: (770) 447-9202

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 11/24/98

Endress+Hauser Systems and Gauging
(formerly Coggins Systems, Inc.)

Leak Manager with Barton Series 3500 ATG (48 hour test) (72 hour test)

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft², leak rate is 2.0 gph with P_D = 97.8% and P_{FA} = 2.2% for 48 hour test and P_D = 98.5% and P_{FA} = 1.5% for 72 hour test.
For other tank sizes, leak rate equals [(PSA in ft² ÷ 6,082 ft²) x 2.0 gph].
Example: For a tank with PSA = 10,000 ft²; leak rate = [(10,000 ft² ÷ 6,082 ft²) x 2.0 gph] = 3.29 gph.
Calculated minimum detectable leak rate is 1.59 gph with P_D = 95% and P_{FA} = 5% for 48 hour test and 1.44 gph with P_D = 95% and P_{FA} = 5% for 72 hour test.
Leak rate may not be scaled below 0.2 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft², leak threshold is 1.0 gph.
For other tank sizes, leak threshold equals [(PSA in ft² ÷ 6,082 ft²) x 1.0 gph].
Example: For a tank with PSA = 10,000 ft²; leak threshold = [(10,000 ft² ÷ 6,082 ft²) x 1.0 gph] = 1.64 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks 50,000 gallons or smaller.
Maximum product surface area (PSA) is 15,205 ft².
Performance not sensitive to product level.

Waiting Time: Minimum of 12 hours, 20 minutes after delivery or dispensing. Valve leaks and pump drain-back may mask a leak. Allow sufficient waiting time to minimize these effects.
Waiting times during evaluation ranged from 7.3 to 17.2 hours.

Test Period: Minimum of 48 hours (48 hour test).
Minimum of 72 hours (72 hour test).
There must be no dispensing or delivery during test.

Temperature: Measurement not required by this system.

Water Sensor: None. Water leaks are measured as increase in mass inside tank.

Calibration: The differential pressure sensor must be checked regularly and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: 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.
Evaluated in a nominal 600,000 gallon, vertical underground tank with product surface area (PSA) of 6,082 ft².

Endress+Hauser Systems and Gauging
5834 Peachtree Corners East
Norcross, GA 30092
Tel: (770) 447-9202

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 05/20/98

Engineered Systems, Inc.

Image II
(Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 96.6% and P_{FA} = 3.4%.

Leak Threshold: 0.1 gph. A tank 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 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 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 system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

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 manifolded 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, Revision 90

STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

Certification: Leak rate of 0.1 gph with P_D = 99.5% and P_{FA} < 0.5%.
"If a method meets the requirement for detecting a leak rate of 0.1 gph, it will meet the requirement for 0.2 gph.", according to "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods", EPA/530/UST-90/007, June 1990, Section 7.2.3, page 30.

Leak Threshold: 0.05 gph. A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 22,500 gallons for single tanks.
Maximum of 60,000 gallons cumulative capacity for manifolded tank systems with no more than 3 tanks in system.

Data Requirement: Minimum of 30 days of product level and flow through data.

Comments: 32% of data sets evaluated were from manifolded 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 METHOD

Certification: Leak rate of 0.2 gph with P_D = 95.4% and P_{FA} = 4.6%.

Leak Threshold: 0.1 gph. A tank 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.
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 4 hours, 6 minutes between delivery and testing.
There must be no dispensing or delivery during waiting time.

Test Period: Minimum of 3 hours, 36 minutes.
Test data are acquired and recorded by system's computer.
Leak rate is calculated from data collected over the entire range of test period.
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 0.896 inch.
Minimum detectable change in water level is 0.023 inch.

Calibration: RTDs and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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: Unavailable

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:

	benzene	2-methylbutane
Accuracy (%) [Avg. Reading]	106.8 [1647 ppm]	122.7 [1380 ppm]
Bias (%)	64.5	38.2
Precision (%)	22.3	53.2
Detection time	N/A*	N/A
Fall time	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

EnviroSIR LLC

EnviroSIR Version 1.0

STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

Certification: Leak rate of 0.2 gph with P_D = 97.4% and P_{FA} = 0.1%
Leak rate of 0.1 gph with P_D = 97.4% and P_{FA} = 2.6%

Leak Threshold: 0.15 for leak rate of 0.2 gph.
0.05 for leak rate of 0.1 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 45,000 gallons for single tanks.
Maximum of 45,000 gallons cumulative capacity for manifolded tank systems with no more than 4 tanks in the system.

Data Requirement: Minimum of 28 days of usable product level and flow through data.

System Features: Method of data analysis that system employs, and was used during evaluation process, is exclusive of any external control by vendor.
System consists of a fully automated software package with embedded algorithms for conducting leak detection testing. Consequently, third party evaluation procedure demonstrated that system can be used in-house with no requirement for direct vendor participation, except in certain rare cases when system generates a flag that requires a vendor trained and certified specialist to analyze data and make the final decision.
System incorporates context-sensitive "Help" information.

Evaluation Features: Evaluator tested this system for in-house use. Computer program disk along with instructional documentation was supplied by vendor to evaluator.
Evaluator, without vendor involvement, analyzed required data and performed evaluation using program disk and accompanying documentation. Vendor was not present during evaluation.
This system was also evaluated using a leak threshold of 0.1gph for leak rate of 0.2 gph and is available at the user's request.

Comments: 53% of data sets evaluated were from manifolded tank systems.
Of 43 data sets submitted for evaluation, all were analyzed with conclusive results.
Median monthly throughput for tanks evaluated was 18,897 gallons.
Leak rates of 0.05, 0.10, and 0.20 gph were used in evaluation.
Data sets evaluated were supplied by evaluator.

EnviroSIR LLC
1003 East Saint Mary Blvd., P.O. Box 52565
Lafayette, LA 70505
Tel: (318) 233-2383

Evaluator: Ken Wilcox Associates, Inc.
Tel: (816) 443-2494
Date of Evaluation: 10/20/98

Estabrook EZY CHEK Systems (formerly Horner EZY CHEK)

EZY-Chek Manual Line Leak Detector

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gph with P_D = 98.0% and P_{FA} = 1%.

Leak Threshold: 0.05 gph. A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 129 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: 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.

Calibration: No temperature sensors used.
No calibration required.
System must be checked annually in accordance with manufacturer's instructions.

Estabrook EZY CHEK Systems
1505 Woodside Ave.
Essexville, MI 48732
Tel: (877) 368-7215

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 07/09/92

Estabrook EZY CHEK Systems (formerly Horner EZY CHEK)

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 pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 in accordance with manufacturer's instructions before each test.

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Tel: (877) 368-7215

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 07/13/92

Estabrook EZY CHEK Systems (formerly Horner EZY CHEK)

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 tank 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, or when water ingress is detected by the water sensor.

Applicability: Gasoline, diesel, aviation fuel, fuel oils #4, waste oil.
Other liquids may be tested after consultation with the manufacturer.

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) when groundwater is below bottom of tank.
Minimum of 1 hour, 30 minutes for diesel and less volatile products (30 minutes vapor equilibrium recirculation time* plus 1 hour test period) when groundwater is below bottom of tank.
Minimum of 1 hour when groundwater is above bottom of tank. Test period based on water ingress depends on tank size and must be calculated in accordance with manufacturer's instructions.
Test data are acquired and recorded manually.
*The vapor equilibrium recirculation time is the time required to apply a vacuum and to saturate ullage with vapors.

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 tank must be adjusted to 0.014 inch before calibrating the sensor.

Groundwater: Depth to groundwater in tank excavation 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 manifolded tank systems.
Evaluated using gasoline and diesel.
Test may not be effective in some tank excavation 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 tank excavation backfill may help identify presence of this condition.

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1505 Woodside Ave.
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Tel: (877) 368-7215

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 08/23/94, 02/08/95

Estabrook EZY CHEK Systems (formerly Horner EZY CHEK)

EZY 3 Locator Plus

NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (VACUUM)

Certification: Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 1.6%.

Leak Threshold: A tank system should not be declared tight when the acoustic signal detected is different from the baseline signal before a vacuum is placed on the tank, or when water ingress is detected by the water sensor.

Applicability: Gasoline, diesel, aviation fuel, fuel oils #4, waste oil.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 30,000 gallons. Ullage volume must exceed the greater of 1% of tank volume or 50 gallons.
Maximum of 30,000 gallons per tank for manifolded tank systems with microphone, water sensor and pressure monitoring gauges in each tank.

Waiting Time: None between delivery and testing.

Test Period: When groundwater level in tank excavation backfill is below bottom of tank: A few minutes to determine background noise and about 2 minutes to run the test after desired vacuum is reached.
When groundwater level in tank excavation backfill is above bottom of tank: The time it takes for water ingress to increase the water level in the tank to allow the water sensor to detect the "minimum detectable change in water level" (see "Water Sensor" section below). Test period based on water ingress is dependent on tank size. For example, the test period is 36 minutes for a 10,000 gallon (96' dia x324" lg) tank.
Before starting test, water sensor must be calibrated to "minimum detectable water level" (see "Water Sensor" section below) according to manufacturer's instructions.

Test Pressure: Pressure differential across tank wall at bottom of tank must be at least 0.5 psig.
Pressure differential across tank wall is equal to the absolute value of vacuum applied to tank, plus pressure of tank excavation backfill on tank, plus groundwater pressure on tank, minus pressure of liquid in tank.

Temperature: Acoustic signal is independent of product temperature.

Water Sensor: Conductivity water sensor must be used to detect water ingress and must be calibrated for every test when groundwater level in tank excavation backfill is above bottom of tank.
Minimum detectable water level is 0.014 inch.
Minimum detectable change in water level is 0.0095 inch.
Minimum water level in tank must be adjusted to at least 0.014 inch (sensor's minimum detectable water level) before calibrating sensor and starting test.

Groundwater: If groundwater level in tank excavation backfill is above bottom of tank, water sensor must be used and test time extended to ensure water ingress detection during test.
Groundwater level in tank excavation backfill must be determined by observation well or soil probe in tank excavation backfill.

Comments: Microphone was 25 ft away from leak source during evaluation.
Although not tested on empty tanks, a third party acoustics specialist has certified the device is equally effective when tanks are empty as when tanks contain product.
Test may be inconclusive if there is high background noise.
Vacuum test method may not be effective in some tank excavation backfill (such as clay) because it may plug holes in tank.
If free product is present in tank excavation backfill, a leak in the free product zone may not be detected by a vacuum test method.
An observation well or soil probe in tank excavation backfill may help determine backfill material, water level in tank excavation backfill, and free product.
Manufacturer must certify operator at least every 2 years.
More than 4 psi pressure differential across the tank wall at any location in the tank could damage tank.

Estabrook EZY CHEK Systems
1505 Woodside Ave.
Essexville, MI 48732
Tel: (877) 368-7215

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 07/28/00

Estabrook EZY CHEK Systems (formerly Horner EZY CHEK)

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 tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

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 a LCD readout.

Groundwater: Depth to groundwater in tank excavation 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 in accordance with manufacturer's instructions before each test.

Comments: Not evaluated using manifolded tank systems.

Estabrook EZY CHEK Systems
1505 Woodside Ave.
Essexville, MI 48732
Tel: (877) 368-7215

Evaluator: W. A. Kibbe and Associates
Tel: (517) 797-2425
Date of Evaluation: 10/03/90

Estabrook EZY CHEK Systems (formerly Horner EZY CHEK)

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 tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

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 system's 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 tank excavation 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 in accordance with manufaturer's instructions before each use.

Comments: Not evaluated using manifolded tank systems.

Estabrook EZY CHEK Systems
1505 Woodside Ave.
Essexville, MI 48732
Tel: (877) 368-7215

Evaluator: W. A. Kibbe and Associates
Tel: (517) 797-2425
Date of Evaluation: 09/18/90

Estabrook EZY CHEK Systems (formerly Horner EZY CHEK)

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 tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

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 system's 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 tank excavation 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 system.

Calibration: Load cell must be calibrated in accordance with manufacturer's instructions before each use.

Comments: Not evaluated using manifolded 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.

Estabrook EZY CHEK Systems
1505 Woodside Ave.
Essexville, MI 48732
Tel: (877) 368-7215

Evaluator: W. A. Kibbe and Associates
Tel: (517) 797-2425
Date of Evaluation: 06/25/90

FCI Environmental, Inc.

Analog Hydrocarbon Probe AHP-100, 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 gasoline	synthetic gasoline
Detection time (min)	<8	<8
Fall time (min)	<5	<5
Lower detection limit (cm)	<0.01	<0.01

Specificity Results (in addition to above):

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

Comments:

Sensors are 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, 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 (for tests conducted with 1000 ppm test gas):

AHP-100	unleaded gasoline	synthetic gasoline	xylene	benzene	2-methylbutane
Relative accuracy* (%)	12	22	2	35	N/R*
Bias (%)	-7	-2	1	-23	N/R
Precision (%)	4	15	1	11	N/R
Detection time (min)	<1	<1	<1	<1	N/R
Fall time (min)	<1	<1	<1	<1	N/R
Lower Detection Limit (ppm)	137	220	84	519	N/R
DHP-100					
Relative accuracy* (%)	18	29	0	17	N/R
Bias (%)	1	-12	0	-9	N/R
Precision (%)	9	10	0	11	N/R
Detection time (min)	<1	<1	<1	<1	N/R
Fall time (min)	<1	<1	<1	<1	N/R
Lower Detection Limit (ppm)	73	118	45	280	N/R

* See glossary.

Test Results (for tests conducted with 10 ppm test gas):

AHP-100	unleaded gasoline	synthetic gasoline	diesel	JP-4 jet fuel	JP-8 jet fuel	p-xylene	kero-sene
Lower Detection Limit (ppm)	9.25	13.26	5.79	5.26	10.89	12.94	14.65

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

	AHP-100	**DHP-100**		**AHP-100**	**DHP-100**
unleaded gasoline	93	101	xylene	103	N/R
synthetic gasoline**	100	92	toluene	96	97
synthetic gasoline***	98	88	pentane	N/R	N/R
JP-4 jet fuel	105	109	methane	N/R	N/R
benzene	76	89	butane	N/R	N/R
trimethylbenzene	107	104	2-methylbutane	N/R	N/R
p-xylene	101	100	n-hexane	N/R	108

** EPA March 1990 protocol
*** Radian June 1990 protocol

Comments:
1000 ppm tests used a certified blend of concentrated gas to simulate a leak. 10 ppm test used a measured quantity of liquid product to simulate a leak.

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

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 03/07/94, 12/05/94

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):

	benzene	heptane, 3-methyl	hexane	Iso-octane
Accuracy (%)	103	102	107	103
Bias (%)	-1	1	2	1
Precision (%)	2	2	4	2
Lower detection limit (ppm)	1	1	1	1
Specificity (%)	100	100	102	101

	pentane, 2,4-dimethyl	pentane, 2,3,4-trimethyl	toluene	m-xylene
Accuracy (%)	105	104	104	99
Bias (%)	1	1	1	-6
Precision (%)	3	3	3	4
Lower detection limit (ppm)	3	1	1	4
Specificity (%)	101	100	100	94

Specificity Results:

See results above.

Comments:

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.
219 North Main St., Suite 202
Bryan, TX 77803
Tel: (800) 337-5325

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

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.0 gph. A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests fiberglass and steel pipelines.
Tests are conducted at operating pressure.

Pipeline Capacity: Maximum of 129.14 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Response time is less than 30 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 annually and, if necessary, calibrated 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

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.0 gph. A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Diesel

Specification: System tests steel and fiberglass pipelines.
Tests are conducted at operating pressure.

Pipeline Capacity: Maximum for rigid system is 341 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Average 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.
Restricted flow to dispenser if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated 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 Flexline Line Leak Detector
(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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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: Average response time is 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Enviroflex pipeline 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

FE Petro, Inc.

STP-MLD-HC Pipeline Leak Detector

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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests rigid pipelines.
Tests are conducted at operating pressure.

Pipeline Capacity: Maximum of 172 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Response time is less than 30 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 annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Test conducted using gasoline in 200 feet of 3.25 inch fiberglass pipe.

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: 11/07/00

FE Petro, Inc.

STP-MLD-HCD Pipeline Leak Detector

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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Diesel, kerosene.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests rigid pipelines.
Tests are conducted at operating pressure.

Pipeline Capacity: Maximum of 172 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Response time is less than 30 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 annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Test conducted using diesel in 200 feet of 3.25 inch fiberglass pipe.

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: 11/07/00

Gasboy International (formerly William M. Wilson's Sons)

Gasboy TMS 500
(Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.1% and P_{FA} = 0.09%.

Leak Threshold: 0.1 gph. A tank 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 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.
There must be no dispensing or delivery during waiting time.

Test Period: Minimum of 3 hours.
Test data are acquired and recorded by system's 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 sensors.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 1.04 inch.
Minimum detectable change in water level is 0.011 inch.

Calibration: Temperature sensors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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
707 North Valley Forge Rd.
Lansdale, PA 19446-0309
Tel: (215) 855-4631

Evaluator: Ken Wilcox Associates, Inc.
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

Test Results:

	unleaded gasoline	synthetic gasoline
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 (in addition to above):

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

Comments:

Sampling frequency is designated as "intermittent" because polymer strip is permanently mounted in monitoring well, while monitor is a hand held unit which is periodically connected to sensor.
Sensors are reusable.

Gems Sensors Inc.
1 Cowles Rd.
Plainville, CT 06062-1198
Tel: (800) 378-1600

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Date of Evaluation: 04/22/93

Hasstech

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

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with $P_D = 99.9\%$ and $P_{FA} = 0.1\%$.
Leak rate of 0.1 gph with $P_D = 99.6\%$ and $P_{FA} = 0.4\%$.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank 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.
Other liquids with known coefficients of expansion and density and where specific gravity is > 0.6 and viscosity is < 1500 cp may be tested after consultation with manufacturer.

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 2 hours for leak rate of 0.2 gph.
Minimum of 6 hours for leak rate of 0.1 gph.
Test data are acquired and recorded by system's 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 0.186 inch.
Minimum detectable change in water level is 0.0048 inch.

Calibration: Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 no longer being manufactured and no support is available.

Hasstech
out of business

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 03/14/95

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 tank 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.
Other liquids with known coefficients of expansion and density 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 system's 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 system's 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 tank excavation 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 tank excavation 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 and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded tank systems.
Evaluated at EPA Edison Risk Reduction Engineering Laboratory prior to the EPA standard protocols being written.
System no longer being manufactured and no support is available.

Hasstech
out of business

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 tank 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.
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 minimum 90% full.

Waiting Time: Test data are acquired and recorded by system's 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 system's 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 tank excavation 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 no longer being manufactured and no support is available.

Hasstech
out of business

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

Certification: Leak rate of 0.1 gph with P_D = 99.99% and P_{FA} = 0.37%.

Leak Threshold: 0.05 gph. A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold. Vendor claims this equipment can detect leaks at .01 gph, and trains operators to declare leaks at .01 gph.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.

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 129 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Minimum of 1 hour pretest at or above test pressure (determines the effects of pipe deflection and stretch on test results) followed by minimum of 1 hour (four 15 minute readings) test period at test pressure.
Test data are acquired and recorded manually.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Heath Consultants, Inc.
9030 Monroe Rd.
Houston, TX 77061
Tel: (713) 947-9292

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 03/11/91

Heath Consultants, Inc.

Petro Tite Line Tester
(for Flexible Pipelines)

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gph with P_D = 99.99% and P_{FA} = 0.37%.

Leak Threshold: 0.05 gph. A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold. Vendor claims this equipment can detect leaks at .01 gph, and trains operators to declare leaks at .01 gph.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.

Specification: System tests flexible pipelines.
Tests are conducted at 60 psi.
Mechanical line leak detector must be removed from pipeline for duration of test.

Pipeline Capacity: Maximum of 49.6 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Minimum 1 hour pretest at 90 psi (determines the effects of pipe deflection and stretch on test results), followed by 30 minute restabilization period at 60 psi, followed by 1 hour (four 15 minute readings) test period at 60 psi.
Test data are acquired and recorded manually.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Heath Consultants, Inc.
9030 Monroe Rd.
Houston, TX 77061
Tel: (713) 947-9292

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 12/07/94

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 tank 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.
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 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 system's 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 tank excavation 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded tank systems.

Heath Consultants, Inc.
9030 Monroe Rd.
Houston, TX 77061
Tel: (713) 947-9292

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 tank 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 tank excavation 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, if necessary, calibrated in accordance with manufacturer's instructions. The DTS-2000 digital sensor must be recertified a minimum of once every 3 years.

Comments: Not evaluated using manifolded tank systems.

Heath Consultants, Inc.
9030 Monroe Rd.
Houston, TX 77061
Tel: (713) 947-9292

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

HNU Systems, Inc.

PI-101 with 11.7 EV Probe #101397, HW-101 with 11.7 EV Probe #170214, ISPI-101 with 10.2 EV Probe #111100, DL-101 with 10.2 EV Probe #167085

VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: quantitative
Sampling frequency: intermittent
Operating principle: photoionization detector

Test Results:

PI-101	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
Accuracy* (%) - average reading	29.1 (730 ppm)	12.3 (884 ppm)	29.6 (737 ppm)
Detection time* (sec)	31	21	26
Fall time* (sec)	52	14	49
Lower detection limit (ppm)	14.2	11.7	29.7
HW-101			
Accuracy* (%) - average reading	12.6 (888 ppm)	8.5 (1076 ppm)	5.7 (953 ppm)
Detection time* (sec)	20	25	24
Fall time* (sec)	49	10	49
Lower detection limit (ppm)	31.8	21.1	26.8
ISPI-101			
Accuracy* (%) - average reading	63.6 (360 ppm)	59.1 (415 ppm)	70.8 (300 ppm)
Detection time* (sec)	20	21	35
Fall time* (sec)	40	10	37
Lower detection limit (ppm)	2.3	5.8	5.1
DL-101			
Accuracy* (%)	63.3	56.2	59.5
Detection time* (sec)	45	22	51
Fall time* (min:sec)	01:03	00:14	01:01
Lower detection limit (ppm)	11.0	5.8	5.0

*For tests conducted with 1000 ppm of test gas

Specificity Results (in addition to above):

Activated: n-hexane, toluene, xylene(s)

HNU Systems, Inc.
160 Charlemont St.
Newton, MA 02461-1992
Tel: (617) 964-6690

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Dates of Evaluation: 02/5/92, 02/5/92, 03/5/92, 11/28/91

Horner Products, Inc.

SIR PRO 1 Versions 1.0, 2.0

STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUALITATIVE)

Certification: Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0% for Version 1.0.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0% for Version 2.0.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 18,000 gallons.

Data Requirement: Minimum of 30 days of product level and flow through data.

System Features: Method of data analysis that system employs, and was used during evaluation process, is exclusive of any external control by vendor.
System consists of a fully automated software package with embedded algorithms for conducting leak detection testing. Consequently, third party evaluation procedure demonstrated that system can be used in-house with no requirement for direct vendor participation.

Evaluation Features: Evaluator tested this system for in-house use. Computer program disk along with instructional documentation was supplied by vendor to evaluator. Evaluator, without vendor involvement, analyzed required data and performed evaluation using program disk and accompanying documentation. Vendor was present as an observer during evaluation.

Comments: Not evaluated using data from manifolded tanks.
Of 120 data sets submitted for evaluation, 10 were inconclusive for Version 1.
Of 120 data sets submitted for evaluation, 9 were inconclusive for Version 2.
Median monthly throughput of tanks evaluated was 13,640 gallons for Version 1.
Median monthly throughput of tanks evaluated was 11,828 gallons for Version 2.
Leak rate of 0.2 gph was used in evaluation for Version 1.
Leak rate of 0.1 gph was used in evaluation for Version 2.
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 Versions 3.0

STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

Certification: Leak rate of 0.2 gph with P_D > 99.9% and P_{FA} < 0.1% for leak threshold of 0.1 gph.
Leak rate of 0.2 gph with P_D > 97.2% and P_{FA} < 0.1% for leak threshold of 0.16 gph.

Leak Threshold: 0.1 and 0.16 gph for leak rate of 0.2 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 45,000 gallons for single tanks.
Maximum of 45,000 gallons cumulative capacity for manifolded tank systems with no more than 4 tanks in system.

Data Requirement: Minimum of 23 days of product level and flow through data.

System Features: Method of data analysis that system employs, and was used during evaluation process, is exclusive of any external control by vendor.
System consists of a fully automated software package with embedded algorithms for conducting leak detection testing. Consequently, third party evaluation procedure demonstrated that system can be used in-house with no requirement for direct vendor participation.

Evaluation Features: This system was tested for in-house use. Vendor, with evaluator present, analyzed required data and performed evaluation using program disk only. Results were presented to evaluator directly from the computer without additional vendor involvement.

Comments: 73% of data sets were from manifolded tank systems.
Of 41 data sets submitted for evaluation, 4 were inconclusive.
Median monthly throughput of tanks evaluated was 22,370 gallons.
Leak rates of 0.05, 0.1, and 0.2 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, 07/18/95, 06/16/00

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 tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 33,000 gallons for single tanks. Size limits using an acceptable protocol for manifolded tank systems have not been determined.

Data Requirement: Minimum of 30 days of product level and flow through data.

Comments: Not evaluated for manifolded tank systems using an acceptable protocol.
73% of data sets were from manifolded 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, V 70 Ex

PRESSURE/VACUUM INTERSTITIAL MONITOR

Certification: Leak rate of 0.1 gph with P_D =100% and P_{FA} =0%.

Leak Threshold: System alarms when liquid enters interstitial space and vacuum decreases (pressure increases) above 34 millibars.

Applicability: Gasoline, diesel.
Other liquids may be tested, which are compatible with flexible liner, after consultation with the manufacturer.

Tank Capacity: 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.

Waiting Time: None between delivery and testing.

Test Period: Minimum of 120 hours.

Comments: 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.
Reasonable temperature variations will not cause an alarm or missed detection.

HT Technologies
4360 Brownsboro Rd.
Louisville, KY 40207
Tel: (888) 287-9595

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 08/17/97, 01/28/98

Ibex Industries

Ibex Precision Test System

VOLUMETRIC TANK TIGHTNESS TEST METHOD (OVERFILL)

Certification: Leak rate of 0.1 gph with P_D = 99.5% and P_{FA} = 0.5%.

Leak Threshold: 0.05 gph. A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 18,000 gallons.
Tank must be between 92 and 100% full.

Waiting Time: 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.

Test Period: Minimum of 1 hour.
Test data are acquired and recorded by system's computer.
Leak rate is calculated from data determined valid by statistical analysis.
There must be no dispensing or delivery during test.

Temperature: Average for product is determined by a minimum of 6 temperature sensors.

Groundwater: Depth to groundwater in tank excavation 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.

Calibration: Level sensors must be calibrated in accordance with manufacturer's instructions before each test.
Temperature sensors must be calibrated in accordance with manufacturer's instructions semi-annually.

Comments: Not evaluated using manifolded 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

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.5 gph for leak rate of 3.0 gph.
0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A pipeline 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.

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 for leak rate of 3.0 gph and 0.2 gph.
Minimum of 8 hours between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is 3 minutes for leak rate of 3.0 gph.
Response time is 50 minutes to 8 hours for leak rate of 0.2 gph.
Response time is 40 minutes for leak rate of 0.1 gph.
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, numerical “fail” code display and LED alarm light activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer’s instructions.

Comments: **For test using leak rate of 0.2 gph only:**
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.

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
(for Flexible Pipelines)

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.5 gph for leak rate of 3.0 gph.
0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A pipeline 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.

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 for leak rate of 3.0 gph and 0.2 gph.
Minimum of 8 hours between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is 3 minutes for leak rate of 3.0 gph.
Response time is 2 hours, 21 minutes for leak rate of 0.2 gph.
Response time is 50 minutes for leak rate of 0.1 gph.
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, numerical "fail" code display and LED alarm light activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: **For test using leak rate of 0.2 gph only:**
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.

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 1000, 1001, 2001
(Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

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} = 0.1%.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank 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.
Other liquids with known coefficients of expansion and density 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".
For other tank diameters, see evaluation report.

Waiting Time: Minimum of 6 hours 1 minute between delivery and testing for leak rate of 0.2 gph.
Minimum of 5 hours 18 minutes between delivery and testing for leak rate of 0.1 gph.
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 for leak rate of 0.2 gph.
Average data collection time during evaluation was 5 hours 44 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.
TS1000 and 1001 can support up to 4 tanks. TS2001 can support up to 8 tanks.

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

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 08/05/92, 09/05/97

INCON Intelligent Controls, Inc.

TS 1000, 1001, 2001
(Incon LL2 Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 95.7% and P_{FA} = 4.3%.

Leak Threshold: 0.1 gph. A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank 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". For other diameters, see evaluation report.

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 system's 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, if necessary, 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 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.

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: 05/14/98

INCON Intelligent Controls, Inc.

TS 2000
(Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.9% and P_{FA} = 0.5%.

Leak Threshold: 0.058 gph. A tank 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.
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 delivery during waiting time.

Test Period: Minimum of 3 hours.
Test data are acquired and recorded by system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

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: 05/10/91

INCON Intelligent Controls, Inc.

Tank Sentinel TS-1000EFI with TSP-DIS BriteSensor,
Tank Sentinel TS-1000/TS-2000 with
TSP-EIS Standard Sensor and TSP-PS Liquid Contact Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

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

Test Results:

	unleaded gasoline	synthetic gasoline	diesel fuel	heating oil #2	water
TSP-DIS BriteSensor					
Detection time (min:sec)	03:13	03:17	3:00	3:02	03:18
Fall time (min)	<1	<1	<1	<1	<1
Product activation height (cm)	1.60	N/D*	N/D	N/D	1.92
Lower Detection Limit (cm)	1.60	1.60	1.50	1.50	1.62
TSP-EIS Standard Sensor					
Detection time (min:sec)	03:01	03:17	3:00	3:02	03:07
Fall time (min)	<1	<1	<1	<1	<1
Product activation height (cm)	1.50	N/D	N/D	N/D	N/D
Lower Detection Limit (cm)	1.50	1.60	1.50	1.50	1.50
TSP-PS Liquid Contact Sensor					
Detection time (min:sec)	01:14	01:13	01:10	01:16	01:25
Fall time (min)	<1	<1	<1	<1	<1
Product activation height (cm)	1.37	N/D	N/D	N/D	N/D
Lower Detection Limit (cm)	1.22	1.21	1.20	1.24	1.32

* See glossary.

Comments:

TSP-DIS BriteSensor was evaluated with Tank Sentinel TS-1000EFI.
TSP-EIS Standard Sensor and TSP-PS Liquid Contact Sensor were evaluated with Tank Sentinel TS-1000/TS-2000.
Sensors are 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
Dates of Evaluation: 12/09/94, 01/30/96, 07/02/93

INCON Intelligent Controls, Inc.

Tank Sentinel TS-1000EFI with TSP-HIS BriteSensor,
Tank Sentinel TS-1000/TS-2000 with
TSP-HLS Standard Sensor and TSP-ULS Standard Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

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

Test Results:

TSP-HIS BriteSensor	50% by weight ethylene glycol in water		30% by weight calcium chloride in water	
	high*	low*	high	low
Response time (min:sec)	17:41	16:47	17:28	16:56
Recovery time (min)	<1	<1	<1	<1
Product activation height (cm)	19.56	2.53	19.40	2.50

TSP-HLS Standard Sensor	unleaded gasoline	synthetic gasoline	diesel	heating oil #2	water
Detection time (min:sec)	10:09	10:14	09:55	10:25	09:25
Fall time (min)	<1	<1	<1	<1	<1
Product activation height (cm)	5.64	N/D**	N/D	N/D	N/D
Lower detection limit (cm)	5.03	5.03	4.93	5.17	4.77
TSP-ULS Standard Sensor					
Detection time (min:sec)	03:50	03:49	03:50	03:41	03:34
Fall time (min)	<1	<1	<1	<1	<1
Product activation height (cm)	2.70	N/D	N/D	N/D	N/D
Lower detection limit (cm)	1.93	1.97	1.93	1.80	1.80

*The "high" and "low" refer to high and low level alarm points of hydrostatic sensors.
** See glossary.

Comments:

TSP-HIS BriteSensor is 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.
Sensors are 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 Evaluations: 03/20/95, 01/30/96

INCON Intelligent Controls, Inc.

Tank Sentinel TS-1000EFI with
TSP-DDS BriteSensor, TSP-DTS BriteSensor, TSP-MWS BriteSensor Groundwater Probe

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: magnetic switch and float (TSP-DDS, TSP-DTS BriteSensor), and hydrocarbon sensitive polymer (all)

Test Results:

	unleaded gasoline	synthetic gasoline	diesel	heating oil #2	water low level	water high level
TSP-DDS BriteSensor						
Detection time (min:sec)	05:35	06:00	38:43	38:16	06:02	06:09
Fall time (min:sec)	34:27	28:53	> 60:00	> 60:00	<01:00	<01:00
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
TSP-DTS BriteSensor						
Detection time (min:sec)	06:02	05:59	38:43	38:16	06:02	06:13
Fall time (min:sec)	22:28	28:53	<01:00	<01:00	> 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
TSP-MWS BriteSensor Groundwater Probe						
Detection time (min:sec)	10:13	06:42				
Fall time (min:sec)	26:52	14:43				
Lower detection limit (cm)						
Product thickness on water	0.04	0.04				

* See glossary.

Specificity Results (additional for TSP-MWS BriteSensor Groundwater Probe):
Activated: n-hexane, diesel, jet-A fuel, toluene, xylene(s).

Comments:
Sensors are 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
Dates of Evaluations: 12/09/94, 02/19/96

Keekor Environmental Products

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

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 95.4% and P_{FA} = 4.6%.

Leak Threshold: 0.1 gph. A tank 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.
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 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 system's 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 in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 tank 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 tank 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.
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 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 system's 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 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 tank excavation 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 tank excavation backfill during test.

Calibration: Temperature averaging probe and level sensors must be calibrated in accordance with manufacturer's instructions before each test.

Comments: Not evaluated using manifolded 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, MD241R, MD241RRA, MD241G, MD241GRA

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

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

Test Results:

MD221G/T, MD221G/TRA*	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
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
MD241R, MD241RRA, MD241G, MD241GRA**			
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

*Evaluation was conducted using probe FD221G/TRA.
**Evaluation was conducted using probe FD241R.

Specificity Results (in addition to above):

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

Comments:

According to manufacturer, probes beginning with "MD" have identical performance as older probes beginning with "FD."
Sensors are reusable.
Manufacturer no longer produces, services, or supports this equipment.

Mallory Controls
2831 Waterfront Pkwy. E. Dr.
Indianapolis, IN 46214
Tel: (317) 328-4000

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:

	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
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 (in addition to above):

Activated: 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.”
Manufacturer no longer produces, services, or supports this equipment.

Mallory Controls
2831 Waterfront Pkwy. E. Dr.
Indianapolis, IN 46214
Tel: (317) 328-4000

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

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

EMC Environmental Management Console
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 rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.5 gph for leak rate of 3.0 gph.
0.1 gph for leak rate of 0.2 gph.
0.079 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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 system's computer.

Test Period: Response time is 14 seconds for leak rate of 3.0 gph.
Response time is 6 minutes for leak rate of 0.2 gph.
Response time is 14 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27420
Tel: (910) 547-5000

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

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

EMC Environmental Management Console
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 rate of 0.2 gph with P_D = 96% and P_{FA} = 4%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.5 gph for leak rate of 3.0 gph.
0.1 gph for leak rate of 0.2 gph.
0.079 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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 system's computer.

Test Period: Response time is 1 minute for leak rate of 3.0 gph.
Response time is 45 minutes to 8 hours, 51 minutes for leak rate of 0.2 gph.
Response time is 1 hour, 12 minutes to 12 hours, 54 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27410
Tel: (336) 547-5000

Evaluator: Ken Wilcox Associates, Inc.
Tel: (816) 443-2494
Date of Evaluation: 08/04/93

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

EMC Environmental Management Console
with Line Leak Detector, Series PA0263000060X

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.88 gph for leak rate of 3.0 gph.
0.17 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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 for leak rate of 3.0 gph.
Minimum of 45 minutes to 1 hour between dispensing and testing for leak rate of 0.2 gph.
Minimum of 2 hours, 30 minutes between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is 28.8 seconds for leak rate of 3.0 gph.
Response time is 32 to 48 minutes for leak rate of 0.2 gph.
Response time is 18 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27410
Tel: (336) 547-5000

Evaluator: Midwest Research Institute
Tel: (816) 753-7600
Date of Evaluation: 08/07/91, 12/18/96

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

EMC Environmental Management Console
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 rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 1.0 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.5 gph for leak rate of 3.0 gph.
0.17 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the m anufacturer.

Specification: System tests pressurized flexible pipelines.
Tests are conducted at 10 psi for leak rate of 3.0 gph.
Tests are conducted at 30 psi for leak rate of 0.2 gph.
Tests are conducted at operating pressure equivalent to 45 psi line for leak rate of 0.1 gph.
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 for leak rate of 3.0 gph.
Minimum of 4 minutes to 1 hour, 9 minutes between dispensing and testing for leak rate of 0.2 gph.
Minimum of 1 to 4 hours between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is 4 to 6 minutes for leak rate of 3.0 gph.
Response time is 40 minutes to 1 hour for leak rate of 0.2 gph.
Response time is 45 minutes to 1 hour, 15 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Marconi Commerce Systems
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, 01/13/97

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

EMC, EMC-PC, EMC Enhanced, EMC-PC Enhanced, LMS Environmental Management Consoles 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 rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.5 gph for leak rate of 3.0 gph.
0.17 gph for leak rate of 0.2 gph.
0.09 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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 for leak rate of 3.0 gph.
Minimum of 45 minutes between dispensing and testing for leak rate of 0.2 gph.
Minimum of 2 hours between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is less than 1 minute for leak rate of 3.0 gph.
Response time is 30 to 45 minutes for leak rate of 0.2 gph.
Response time is 32 to 48 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27410
Tel: (336) 547-5000

Evaluator: Midwest Research Institute
Tel: (816) 753-7600
Date of Evaluation: 05/08/96

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

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

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99% and P_{FA} = 1%.

Leak Threshold: 0.1 gph. A tank 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 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 8 hours, 18 minutes between delivery and testing.
There must be no dispensing or delivery during waiting time.

Test Period: Minimum of 5 hours.
Test data are acquired and recorded by 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 change in water level is 0.040 inch.

Calibration: Temperature averaging probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27410
Tel: (336) 547-5000

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

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

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

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99% and P_{FA} = 0.2%.
Leak rate of 0.1 gph with P_D = 99% and P_{FA}= 0.1%.

Leak Threshold: 0.126 gph for leak rate of 0.2 gph.
0.071 gph for leak rate of 0.1 gph.
A tank 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 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 for leak rate of 0.2 gph.
Tank must be minimum 95% full for leak rate of 0.1 gph.

Waiting Time: Minimum of 8 hours, 18 minutes between delivery and testing for leak rate of 0.2 gph.
There must be no dispensing or delivery during waiting time for leak rate of 0.2 gph.
Minimum of 8 hours, 15 minutes between delivery and testing for leak rate of 0.1 gph.
Minimum of 30 minutes between dispensing and testing for leak rate of 0.1 gph.
There must be no delivery during waiting time for leak rate of 0.1 gph.

Test Period: Minimum of 2 hours.
Test data are acquired and recorded by 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 checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27410
Tel: (336) 547-5000

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

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

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

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with $P_D = 99\%$ and $P_{FA} = 0.1\%$.
Leak rate of 0.1 gph with $P_D = 99\%$ and $P_{FA} = 1\%$.

Leak Threshold: 0.093 gph for leak rate of 0.2 gph.
0.071 gph for leak rate of 0.1 gph.
A tank 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 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 for leak rate of 0.2 gph.
Tank must be minimum 95% full for leak rate of 0.1 gph.

Waiting Time: Minimum of 8 hours, 18 minutes between delivery and testing for leak rate of 0.2 gph.
Minimum of 8 hours, 15 minutes between delivery and testing for leak rate of 0.1 gph.
Minimum of 30 minutes between dispensing and testing.
There must be no delivery during waiting time.

Test Period: Minimum of 2 hours for leak rate of 0.2 gph.
Minimum of 3 hours for leak rate of 0.1 gph.
Test data are acquired and recorded by 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 0.544 inch.
Minimum detectable change in water level is 0.027 inch.

Calibration: Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27410
Tel: (336) 547-5000

Evaluator: Midwest Research Institute
Tel: (816) 753-7600
Date of Evaluation: 05/14/93, 03/14/95

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

EMC/PC Series Monitoring Systems
PA0265 and PA0300
(Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.5% and P_{FA} = 1.6%.

Leak Threshold: 0.126 gph. A tank 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 with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 20,000 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"; **132"** dia/min 39". For other tank diameters see evaluation report.

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 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 probe which contains 5 thermistors.
At least two thermistors must be submerged in product during test.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.66 inch.
System is programmed to report water depth only when it exceeds 0.75 inch.
Minimum detectable change in water level is 0.005 inch.

Calibration: Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27410
Tel: (366) 547-5000

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 06/29/98

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

EMC Series with CSLD, PAO265XXXX100, PA0300XXXX100
(Magnetostrictive Probe)

CONTINUOUS IN-TANK LEAK DETECTION METHOD

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 manifolded tank systems at 99% operating mode.
A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

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 stabilization time is allowed between delivery and data collection.

Test Period: Data collection time ranges from 5 to 28 days.
Data sampling frequency is every 1 to 4 seconds.
System collects data at naturally occurring product levels without interfering with normal tank operation, and discards data from unstable periods when system performs 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 0.54 inch.
Minimum detectable change in water level is 0.027 inch.

Calibration: Thermistors and probe must be checked annually and, if necessary, calibrated 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 manifolded tank systems.
System distinguishes large leak rates (> 1gph) from dispensing activities and reports those 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.
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.

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27410
Tel: (336) 547-5000

Evaluator: Midwest Research Institute
Tel: (816) 753-7600
Date of Evaluation: 06/10/96

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

PA02590XXX000, PA02591144000, PA02592000010

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

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

Test Results:

PA02590XXX000	unleaded gasoline	synthetic gasoline
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
PA02591144000		
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
PA02592000010		
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 (in addition to above):

Activated: diesel, heating oil #2, water.

Comments:

Sensors are reusable.

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27410
Tel: (336) 547-5000

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Date of Evaluation: 07/17/92, 04/22/98

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

EMC Environmental Management Console 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 gasoline	synthetic gasoline
Detection time (min:sec)	8:55	6:18
Fall time (min:sec)	54:50	26:02
Lower detection limit (cm)	0.02	0.02

Specificity Results (in addition to above):
Activated: n-hexane, diesel, jet-A fuel, toluene, xylene(s).

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

Comments:
Sensors are reusable.

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27410
Tel: (336) 547-5000

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Date of Evaluation: 11/20/91

Marconi Commerce Systems (formerly Gilbarco Environmental Products)

PA02660000000

VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

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

Test Results:

	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
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:

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

Marconi Commerce Systems
7300 W. Friendly Ave.
Greensboro, NC 27410
Tel: (336) 547-5000

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Date of Evaluation: 07/24/92

Marley Pump Co.

Red Jacket PPM 4000, RLM 9000

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.0 gph for leak rate of 3.0 gph.
0.1 gph for leak rate of 0.2 gph.
0.047 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel, methanol, ethanol, gasoline blends with methanol and ethanol.
Other liquids may be tested after consultation with the manufacturer.

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 2 minutes for leak rate of 3.0 gph.
Response time is 10 minutes to 3 hours for leak rate of 0.2 gph.
Response time is 2 hours, 30 minutes to 3 hours for leak rate of 0.1 gph.
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.
Pump shutdown, message display, and alarm activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated 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.
500 East 59th St., P.O. Box 3888
Davenport, IA 52807
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 03/07/91, 0494

Marley Pump Co.

Red Jacket PPM 4000, RLM 9000, ST 1401L, 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 rate of 0.1 gph with P_D = 100% and P_{FA}= 0%.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel, methanol, ethanol, gasoline blends with methanol and ethanol.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests pressurized flexible pipelines.
Tests are conducted at 10 to 12 psi for leak rate of 0.2 gph.
Tests are conducted at operating pressure equivalent to 45 psi for leak rate of 0.1 gph.

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 for leak rate of 0.2 gph.
Response time is 26 minutes to 4 hours for leak rate of 0.1 gph.
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.
Pump shutdown, message display, and alarm activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated 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.
ST 1801L is a combination ST1800 automatic tank gauge and ST 1801L automatic electronic line leak detector.

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Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 07/28/96, 01/31/97

Marley Pump Co.

Red Jacket ST 1401L, ST 1801L, CPT, ProLink

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.5 gph for leak rate of 3.0 gph.
0.1 gph for leak rate of 0.2 gph.
0.047 gph for leak rate of 0.1 gph.
A pipeline 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, methanol, ethanol, gasoline blends with methanol and ethanol.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests pressurized fiberglass and steel pipelines.
Tests are conducted at 10-25 psi for leak rate of 3.0 gph.
Tests are conducted at operating pressure equivalent to 30 psi for leak rate of 0.2 gph.
Tests are conducted at 10-20 psi for leak rate of 0.1 gph.

Pipeline Capacity: Maximum of 172 gallons for leak rate of 3.0 gph.
Maximum of 163 gallons for leak rates of 0.2 gph and 0.1 gph.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Response time is 2 to 4 minutes for leak rate of 3.0 gph.
Response time is 2 minutes to 4 hours for leak rate of 0.2 gph.
Response time is 4 minutes to 4 hours, 45 minutes for leak rate of 0.1 gph.
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.
Pump shutdown, message display, and alarm activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: ST 1401L is a combination of ST 1400 automatic tank gauge and the 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.
ProLink is either a stand alone electronic automatic line leak detector, or a combination of and automatic tank gauge and an automatic electronic line leak detector.

Marley Pump Co.
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Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 12/16/96, 01/31/97

Marley Pump Co.

Red Jacket DLD, XLD

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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests pressurized fiberglass and steel pipelines.
Tests are conducted at 8-12 psi.

Pipeline Capacity: Maximum of 129 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Response time is 6 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 annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Marley Pump Co.
500 East 59th St., P.O. Box 3888
Davenport, IA 52807
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, FX1V, FX2V

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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests pressurized fiberglass and steel pipelines.
Tests are conducted at 8-12 psi.

Pipeline Capacity: Maximum of 316 gallons for FX1and FX1V.
Maximum of 362 gallons for FX2 and FX2V.

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, if necessary, calibrated in accordance with manufacturer's instructions.

Marley Pump Co.
500 East 59th St., P.O. Box 3888
Davenport, IA 52807
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 03/14/94, 06/01/94

Marley Pump Co.

Red Jacket FX1, FX2, FX1V, FX2V 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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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, if necessary, calibrated 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.
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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, FX1DV, 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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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, if necessary, calibrated in accordance with manufacturer's instructions.

Marley Pump Co.
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Davenport, IA 52807
Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 03/15/94, 07/30/96, 03/11/99

Marley Pump Co.

Red Jacket FX1DV, FX2DV
Installed in the Big-Flow
(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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Diesel.

Specification: System tests pressurized flexible pipelines.
Tests are conducted at operating pressure.

Pipeline Capacity: Maximum of 39.4 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 hourly 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, if necessary, calibrated in accordance with manufacturer's instructions.

Marley Pump Co.
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Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 03/15/94, 07/30/96, 03/11/99

Marley Pump Co.

Red Jacket XLP

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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests pressurized fiberglass and steel pipelines.
Tests are conducted at 15-22 psi.

Pipeline Capacity: Maximum of 129 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Response time is 6 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 annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Marley Pump Co.
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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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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, if necessary, calibrated in accordance with manufacturer's instructions.

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Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 04/19/93

Marley Pump Co.

Prolink System
RJE Probes # RE-400-094 thru 112-5
(Magnetostrictive Probes)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.95% and P_{FA} = 0.005%.
Leak rate of 0.1 gph with P_D = 95.2% and P_{FA} = 0.5%.

Leak Threshold: -0.116 gph to declare a **leak** for leak rate of 0.2 gph.
0.084 gph to declare a **gain** for leak rate of 0.2gph.
-0.065 gph to declare a **leak** for leak rate of 0.1 gph.
0.035 gph to declare a **gain** for leak rate of 0.1 gph.
A tank system should not be declared tight if the test indicates a loss or gain that equals or exceeds the threshold.

Applicability: Gasoline, diesel.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 18,000 gallons.
Tanks less than 95% full may be tested.
Minimum product level required is based on tank diameter as follows:
48" dia/ min 16"; **64"** dia/ min 21"; **72"** dia/ min 24"; **126"** dia/ min 41".
For other tank diameters, see evaluation report.

Waiting Time: Minimum of 13 hours 54 minutes between delivery and testing.
Minimum of 10 minutes between dispensing and testing.
There must be no delivery during waiting time.

Test Period: Minimum of 4 hours, 31 minutes for leak rate of 0.2 gph.
Minimum of 6 hours, 39 minutes for leak rate of 0.1 gph.
Test data are acquired and recorded by system's computer.
Leak rate is calculated from all the data collected during entire test period.
There must be no dispensing or delivery during testing.

Temperature: Probe contains 5 or more resistance temperature detectors (RTDs) to monitor product temperature.
At least one RTD must be submerged in product during testing.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.106 inches.
Minimum detectable change in water level is 0.058 inches.

Calibration: RTDs and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: System has a bias of -0.016 gph for leak rate of 0.2 gph.
System has a bias of -0.015 gph for leak rate of 0.1 gph.
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.

Marley Pump Co.
500 East 59th St., P.O. Box 3888
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Tel: (888) 262-7539

Evaluator: ADA Technologies, Inc.
Tel: (303) 792-5615
Date of Evaluation: 10/29/96

Marley Pump Co.

Red Jacket ATM System,
Version RLM 5000, 5001, and 9000
(Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 0.1 gph. A tank 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 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.
There must be no dispensing or delivery during waiting time.

Test Period: Minimum of 3 hours.
Test data are acquired and recorded by system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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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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 METHOD

Certification: Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 99.9% and P_{FA} = 0.01%.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1gph.
A tank 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 with known coefficients of expansion and density may be tested after consultation with the manufacturer.

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 for leak rate of 0.2 gph.
Minimum of 12 hours between delivery and testing for leak rate of 0.1 gph.
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 system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.
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Evaluator: ADA Technologies
Tel: (303) 792-5615
Date of Evaluation: 09/25/92, 09/30/92

Marley Pump Co.

Red Jacket Electronics
RE400-179-5 to RE400-199-5 Combination High Level/Low Level Sensor,
RE400-042-5 Hydrostatic Sensor, Red Jacket PPM 4000 with Optical Liquid Discrimination Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: float switch (RE400-179-5 to RE400-199-5 Combination High Level/Low level sensor, RE400-042-5 Hydrostatic Sensor),
optical sensor (Red Jacket PPM 4000 with Optical Liquid Discrimination Sensor)

Test Results:

RE400-179-5 to RE400-199-5 Combination High Level/Low Level Sensor	unleaded gasoline		diesel		water	
	high	low	high	low	high	low
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 Hydrostatic Sensor						
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

Red Jacket PPM 4000 with Optical Liquid Discrimination Sensor	unleaded gasoline	synthetic fuel	diesel	heating oil #2	water
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

*See glossary.

Specificity:

Evaluator claims RE400-179-5 to RE400-199-5 Combination High Level/Low Level Sensor and RE400-042-5 Hydrostatic Sensor will respond to any liquid once threshold has been exceeded.

Comments:

RE400-179-5 to RE400-199-5 Combination High Level/Low Level Sensor model numbers and high level detection limit vary with length of sensor.
PPM 4000 with Optical Liquid Discrimination Sensor evaluation lists all PPM, RLM, and ST models, including the Multiplexer Unit. However, evaluation procedures were performed using model PPM 4000.
Sensors are reusable.

Marley Pump Co.
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Tel: (888) 262-7539

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 06/01/95, 04/28/92

Marley Pump Co.

Red Jacket Electronics
RE400-058-5, RE400-059-5, RE400-147-5, RE400-148-5 Overfill Sensor, RE400-111-5 Sump Sensor, RE400-203-5 Optical Liquid Discrimination Sensor, RE400-204-5 Dispenser Pan Monitor, RE400-180-5 Liquid Refraction Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: float switch (RE400-058-5, RE400-059-5, RE400-147-5, RE400-148-5 Overfill Sensor, RE400-111-5 Sump Sensor),
electrical conductivity and optical (RE400-203-5 Optical Liquid Discrimination Sensor),
conductive polymer (RE400-204-5 Dispenser Pan Monitor),
optical (RE400-180-5 Liquid Refraction Sensor)

Test Results:

	unleaded gasoline	diesel	water
RE400-058-5, RE400-059-5, RE400-147-5, RE400-148-5 Overfill Sensor			
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			
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			
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			
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			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (cm)	1.17	1.12	1.10

Specificity Results (in addition to above):

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

Comments:

Evaluator claims sensors will respond to any liquid once threshold has been exceeded.
After exposure to diesel, RE400-204-5 Dispenser Pan Monitor reading may not return to pre-contaminated level.
Sensors are reusable.

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Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 06/01/95

Mass Technology Corp.

Precision Mass Measurement System (24 hour test)

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tanks with PSA of 1,257 ft² or less, leak rate is 0.1 gph with P_D = 97.9% and P_{FA} = 2.1%.
For tanks with larger PSA, leak rate equals [(PSA in ft² ÷ 1,257 ft²) x 0.1 gph].
Example: For a tank with PSA = 2,000 ft²; leak rate = [(2,000 ft² ÷ 1,257 ft²) x 0.1 gph] = 0.16 gph.
Calculated minimum detectable leak rate is 0.078 gph with P_D = 95% and P_{FA} = 5%.
Leak rate may not be scaled below 0.1 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 1,257 ft² or less, leak threshold is 0.05 gph.
For tanks with larger PSA, leak threshold equals [(PSA in ft² ÷ 1,257 ft²) x 0.05 gph].
Example: For a tank with PSA = 2,000 ft²; leak threshold = [(2,000 ft² ÷ 1,257 ft²) x 0.05 gph] = 0.08 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks.
Maximum product surface area (PSA) is 3,143 ft² (approximately 63 ft diameter).
Performance not sensitive to product level.

Waiting Time: Minimum of 1 hour, 6 minutes after delivery or dispensing. Valve leaks and pump drain-back may mask a leak. Allow sufficient waiting time to minimize these effects.
Waiting times during evaluation ranged from 62 minutes to 31 hours.

Test Period: Minimum of 24 hours.
There must be no dispensing or delivery during test.

Temperature: Measurement not required by this system.

Water Sensor: None. Water leaks are measured as increase in mass inside tank.

Calibration: Differential pressure sensor must be checked regularly in accordance with manufacturer's instructions.

Comments: 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.
Evaluated in a nominal 120,000 gallon, vertical underground tank with product surface area (PSA) of 1,257 ft².

Mass Technology Corp.
7 Cox Drive
Kilgore, TX 75662
Tel: (903) 986-3564

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 03/25/98

Mass Technology Corp.

Precision Mass Measurement System (48 hour test)

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft², leak rate is 0.294 gph with P_D = 95% and P_{FA} = 5%.
For other tank sizes, leak rate equals [(PSA in ft² ÷ 6,082 ft²) x 0.294 gph].
Example: For a tank with PSA = 4,000 ft²; leak rate = [(4,000 ft² ÷ 6,082 ft²) x 0.294 gph] = 0.19 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft², leak threshold is 0.147 gph.
For other tank sizes, leak threshold equals [(PSA in ft² ÷ 6,082 ft²) x 0.147 gph].
Example: For a tank with PSA = 4,000 ft²; leak threshold = [(4,000 ft² ÷ 6,082 ft²) x 0.147 gph] = 0.1gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks.
Maximum product surface area (PSA) is 6,082 ft² (approximately 88 ft diameter).
Performance not sensitive to product level.

Waiting Time: Minimum of 1 hour, 6 minutes after delivery or dispensing. Valve leaks and pump drain-back may mask a leak. Allow sufficient waiting time to minimize these effects.
Waiting times during evaluation ranged from 62 minutes to 31 hours.

Test Period: Minimum of 48 hours.
There must be no dispensing or delivery during test.

Temperature: Measurement not required by this system.

Water Sensor: None. Water leaks are measured as increase in mass inside tank.

Calibration: Differential pressure sensor must be checked regularly in accordance with manufacturer's instructions.

Comments: 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.
Evaluated in a nominal 600,000 gallon, vertical underground tank with product surface area (PSA) of 6,082 ft².

Mass Technology Corp.
7 Cox Drive
Kilgore, TX 75662
Tel: (903) 986-3564

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 03/25/98

Mass Technology Corp.

Precision Mass Measurement System (72 hour test)

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tanks with PSA of 14,200 ft², leak rate is 0.638 gph with P_D = 95% and P_{FA} = 5%.
For other tank sizes, leak rate equals [(PSA in ft² ÷ 14,200 ft²) x 0.638 gph].
Example: For a tank with PSA = 20,000 ft²; leak rate = [(20,000 ft² ÷ 14,200 ft²) x 0.638 gph] = 0.898 gph.
Leak rate may not be scaled below 0.2 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 14,200 ft², leak threshold is 0.319 gph.
For other tank sizes, leak threshold equals [(PSA in ft² ÷ 14,200 ft²) x 0.319 gph].
Example: For a tank with PSA = 20,000 ft²; leak threshold = [(20,000 ft² ÷ 14,200 ft²) x 0.319 gph] = 0.449 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks larger than 50,000 gallons.
Maximum product surface area (PSA) is 35,500 ft² (approximately 213 ft diameter).
Performance not sensitive to product level.

Waiting Time: Minimum of 1 hour, 6 minutes after delivery or dispensing. Valve leaks and pump drain-back may mask a leak. Allow sufficient waiting time to minimize these effects.
Waiting times during evaluation ranged from 8 minutes to 42.5 hours.

Test Period: Minimum of 72 hours.
There must be no dispensing or delivery during test.

Temperature: Measurement not required by this system.

Water Sensor: None. Water leaks are measured as increase in mass inside tank.

Calibration: Differential pressure sensor must be checked regularly in accordance with manufacturer's instructions.

Comments: 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.
Evaluated in a nominal 2,000,000 gallon, vertical underground tank with product surface area (PSA) of 14,200 ft².

Mass Technology Corp.
7 Cox Drive
Kilgore, TX 75662
Tel: (903) 986-3564

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 03/25/98

Mine Safety Appliances

Tankgard P/N 481532,Tankgard VIII P/N 488803

VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

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

Test Results:

	benzene	2-methylbutane
Detection time (sec)	5	16
Fall time (min:sec)	04:12	04:42
Lower detection limit (ppm)	12.5	12.5

Specificity Results (in addition to above):

Activated (100%): n-butane, n-hexane, 2-methylpentane, toluene, isobutane.

Manufacturer's specifications:

Maximum Wire Distance: 500 ft using 18 AWG
Response Time: 30 seconds
Recovery Time: 1 minute maximum
Sensor Life: 2 year warranty

Mine Safety Appliances
P. O. Box 427
Pittsburgh, PA 15230
Tel: (800) 672-4678

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Dates of Evaluation: 03/26/91, 03/28/91

NESCO (formerly Arizona Instrument Corp.)

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

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 97.80% and P_{FA} = 2.2%.

Leak Threshold: 0.1 gph. A tank 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.
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 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 system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

NESCO
4720 South Ash Ave.
Tempe, AZ 85282
Tel: (800) 229-2930

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

NESCO (formerly Arizona Instrument Corp.)

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

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.94% and P_{FA} = 2.06%.

Leak Threshold: 0.1 gph. A tank 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.
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 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 system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

NESCO
4720 South Ash Ave.
Tempe, AZ 85282
Tel: (800) 229-2930

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

NESCO (formerly Arizona Instrument Corp.)

Soil Sentry Liquid 330 (17-330-A/17-330-B), TLM-830, ENCOMPASS APAM with 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:

	unleaded gasoline	synthetic gasoline	diesel	water
Detection time (sec)	3	3	N/D*	N/D
Fall time	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 (in addition to above):

Activated: n-hexane, jet-A fuel, toluene (Only 17-143A was tested with toluene), xylene(s).

Comments:

Detectors are listed as interstitial due to intended use.
Sensors are 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.

NESCO
4720 South Ash Ave.
Tempe, AZ 85282
Tel: (800) 229-2930

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 12/29/92, 01/08/93

NESCO (formerly 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	diesel fuel***	JP-4 jet fuel	JP-5 jet fuel	JP-8 jet fuel ***
Accuracy* (%)	170	120	N/D	120	N/D**	N/D
Bias* (%)	60	8.0	-20 ppm @ 50 ppm	1.8	N/D	N/D
Precision* (%)	6.3	7.7	12 ppm	18	N/D	N/D
Detection time (min:sec)	12:20	12:27	15:00	12:33	N/D	15:00
Fall time* (min:sec)	11:53	11:53	15:00	11:55	N/D	15:00
Lower detection limit (ppm)	150	140	10	60	92	<0.01 gal/hr

* For tests conducted with 1000 ppm of test gas.
** See glossary.
*** A limited number of tests were conducted to determine the response of the system to diesel and JP-8 jet fuel.

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.

NESCO
4720 South Ash Ave.
Tempe, AZ 85282
Tel: (800) 229-2930

Evaluator: Radian Corp.
Tel: (512) 454-4797
Dates of Evaluation: 12/28/90, 04/17/91
Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 02/16/92

OMNTEC Mfg., Inc.

OEL 8000, K-OEL 8000, OEL 8000 II, K-OEL 8000 II
(MTG - XX Magnetostrictive Probe, 4 inch dia Floats)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 97.8% and P_{FA} = 2.2%.

Leak Threshold: 0.1 gph. A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 30,000 gallons.
Tanks less than 95% full may be tested.
Minimum product level required is based on tank diameter as follows:
48" dia/ min 12"; **64"** dia/ min 15"; **72"** dia/ min 16"; **96"** dia/ min 20"; **126"** dia/ min 25"; **132"** dia/ min 26".
For other tank diameters, consult manufacturer.

Waiting Time: Minimum of 4 hours between delivery and testing.
There must be no delivery during waiting time.

Test Period: Minimum of 4 hours, 30 minutes.
Test data are acquired and recorded by the controller.
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 probe containing a minimum of 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 0.055 inch.
Minimum detectable change in water level is 0.011 inch.

Calibration: Probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 Mfg., Inc.
1993 Pond Rd.
Ronkonkoma, NY 11779
Tel: (631) 981-2001

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 01/17/96, 09/15/97
10/26/00

OMNTEC Mfg., Inc.

OEL 8000, K-OEL 8000
(MTG - XX Magnetostrictive Probe, 4 inch dia Floats)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.1 gph with P_D = 97.8% and P_{FA} = 2.2%.

Leak Threshold: 0.05 gph. A tank 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.
Other liquids with known coefficients of expansion and density 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 is based on tank diameter as follows:
48" dia/ min 12"; **64"** dia/ min 15"; **72"** dia/ min 16"; **96"** dia/ min 20"; **126"** dia/ min 25"; **132"** dia/ min 26".
For other tank diameters, consult manufacturer.

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 the controller.
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 probe containing a minimum of 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 0.055 inch.
Minimum detectable change in water level is 0.011 inch.

Calibration: Probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 Mfg., Inc.
1993 Pond Rd.
Ronkonkoma, NY 11779
Tel: (631) 981-2001

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 01/17/96, 09/15/97

OMNTEC Mfg., Inc.

Controller Models OEL 8000 11, K-OEL 8000 11 with
Liquid level sensors BX-L, BX-LS, BX-LWF, BX-RES

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative, non-discriminating
Sampling frequency: continuous
Operating principle: optical sensor

Test Results:

BX-L	unleaded gasoline	diesel	water
Detection time (sec)	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1
Lower detection limit (in)	0.63	0.46	0.40
BX-LS			
Detection time (sec)	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1
Lower detection limit (in)	0.464	0.468	0.500
BX-LWF			
Detection time (sec)	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1
Lower detection limit (in)	0.63	0.46	0.40
BX-RES			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Low level threshold - lower detection limit (in)	2.61	2.57	2.54
High level threshold - lower detection limit (in)	8.57	8.59	8.56

Specificity Results:

Manufacturer claims sensors will respond to any liquid after its threshold is exceeded. No additional materials tested.

Manufacturer's Specifications:

Manufacturer states that the sensors can also be tested from their location without removal. The test procedure is as follows: When the test button on the controller is pressed, the normally closed light beam is opened, which simulates an actual leak occurrence, sending an alarm signal to the controller. The controller responds to the alarm signal by turning on an audio/visual alarm and printing the test results.

OMNTEC Mfg., Inc.
1993 Pond Rd.
Ronkonkoma, NY 11779
Tel: (631) 981-2001

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 11/15/00

OMNTEC Mfg., Inc.

Controller Models OEL 8000 11, K-OEL 8000 11 with
Liquid level sensors BX-PDS, BX-PDWF, BX-PDWS

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative, discriminating
Sampling frequency: continuous
Operating principle: optical sensor, conductivity

Test Results:

BX-PDS	unleaded gasoline	diesel	water
Detection time (sec)	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1
Lower detection limit (cm)	0.464	0.468	0.500
BX-PDWF			
Detection time (sec)	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1
Lower detection limit (cm)	0.63	0.46	0.40
BX-PDWS			
Detection time (sec)	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1
Lower detection limit (cm)	0.464	0.468	0.500

Specificity Results:

Manufacturer claims sensors will respond to any liquid after its threshold is exceeded. No additional materials tested.

Manufacturer's Specifications:

Manufacturer states that the sensors can also be tested from their location without removal. The test procedure is as follows: When the test button on the controller is pressed, the normally closed light beam is opened, which simulates an actual leak occurrence, sending an alarm signal to the controller. The controller responds to the alarm signal by turning on an audio/visual alarm and printing the test results.

Comments:

Optic sensor BX-PDS also contains a conductivity sensor to determine if the product is hydrocarbon or water.

OMNTEC Mfg., Inc.
1993 Pond Rd.
Ronkonkoma, NY 11779
Tel: (631) 981-2001

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 11/15/00

OMNTEC 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: refractive index of liquids (all), electrical conductivity (PDS-ASC, PDWS-1, and PDWF-1)

Test Results:

L-LL-R-1 (low level)	unleaded gasoline	diesel	water
Detection time (sec)	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1
Lower detection limit (cm)	6.63	6.53	6.45
L-LL-R-1 (high level)			
Detection time (sec)	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1
Lower detection limit (cm)	21.7	21.8	21.7
LS-ASC , PDS-ASC			
Detection time (sec)	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1
Lower detection limit (cm)	2.24	2.11	1.42
PDWS-1			
Detection time (sec)	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1
Lower detection limit (cm)	1.93	1.85	1.63
PDWF-1			
Detection time (sec)	< 1	< 1	< 1
Fall time (sec)	< 1	< 1	< 1
Lower detection limit (cm)	1.60	1.67	1.02

Specificity Results (in addition to above):

Activated: synthetic gasoline, n-hexane, jet-A fuel, toluene, xylene(s).
LS and PD series responds to any liquid with an index of refraction different than air.
PD series responds to any conducting liquid.

Comments:

Detectors are listed as interstitial due to intended use.
Sensors are reusable.

OMNTEC Mfg., Inc.
1993 Pond Rd.

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

Ronkonkoma, NY 11779
Tel: (631) 981-2001

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
Detection time (min:sec)	5:41	5:14
Fall time (min:sec)	30:39	18:36
Lower detection limit (cm)	0.02	0.02

Specificity Results (in addition to above):
Activated: n-hexane, diesel, 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:
Sensors are reusable.

One Plus Corp.
3182 McArthur Blvd.
Northbrook, IL 60062
Tel: (847) 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 METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.96% and P_{FA} = 0.044%.
Leak rate of 0.1 gph with P_D = 95.34% and P_{FA} = 4.66%.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank 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.
Other liquids with known coefficients of expansion and density and where specific gravity is > 0.6 and viscosity is < 1500 cp may be tested after consultation with manufacturer.

Tank Capacity: Maximum of 15,000 gallons.
Tank must be between 50 and 95% full for leak rate of 0.2 gph.
Tank must have minimum product height of 18 inches, or be 14% full, whichever is higher, for leak rate of 0.1 gph.

Waiting Time: Minimum of 2 hours between delivery and testing for leak rate of 0.2 gph.
Minimum of 8 hours between delivery and testing for leak rate of 0.1 gph.
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 is 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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: 02/07/91

Patriot Sensors and Controls Corp. (formerly MagneTek)

7021 Digital Tank Gauge
(7100 Series Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

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 = 99.6% and P_{FA} = 0.4%.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank 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.
Other liquids with known coefficients of expansion and density and where specific gravity is > 0.6 and viscosity is < 1500 cp may be tested after consultation with manufacturer.

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 for leak rate of 0.2 gph.
Minimum of 6 hours for leak rate of 0.1 gph.
Test data are acquired and recorded by system's 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 0.186 inch.
Minimum detectable water level change is 0.0048 inch.

Calibration: Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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

PermAlert

PAL-AT Models AT20C, AT50C, AT40K with
PHL Hydrocarbon Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

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

Test Results:

	unleaded gasoline
Response time (min)	1.13
Recovery time (min)	8.83
Product activation height (cm)	0.53
Lower detection limit (cm)	0.38

Specificity Results (in addition to above):
Activated: synthetic gasoline, diesel, heating oil #2.
Not activated: water.

Comments:
Sensors are reusable.

PermAlert
7720 N. Lehigh Ave.
Niles, IL 60714-3491
Tel: (847) 966-2235

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Date of Evaluation: 02/05/92

PermAlert

TankWatch Models PHM10, PHMS with
Combination Hydrocarbon/Water Probe, Hydrocarbon Probe

LIQUID-PHASE INTERSTITIAL DETECTOR

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

Test Results:

Combination Hydrocarbon/Water Probe	unleaded gasoline	water
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
Hydrocarbon Probe		
Response time (min)	0.25	
Recovery time (min)	2.33	
Product activation height (cm)	0.17	
Lower detection limit (cm)	0.38	

Specificity Results (in addition to above):
Activated: synthetic gasoline, diesel, heating oil #2.

Comments:
Sensors are reusable.
Hydrocarbon probe is not activated by water.
Hydrocarbon/water probe does not discriminate between gasoline and water.

PermAlert
7720 N. Lehigh Ave.
Niles, IL 60714-3491
Tel: (847) 966-2235

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Date of Evaluation: 06/16/92

PermAlert

PAL-AT Models AT20C, AT50C, AT40K with
AGW Sensor Cable, 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 MER*	2/3 MER	MER
AGW Sensor Cable	1348 ft.	2644 ft.	3982 ft.
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
	1/3 MER	2/3 MER	MER
TFH Hydrocarbon Sensor Cable	1368 ft.	2685 ft.	4046 ft.
Response time (min)	3.40	7.48	16.21
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

* See glossary.

Specificity Results (in addition to above):
Activated: synthetic gasoline, diesel, heating oil #2, water (AGW Sensor Cable only).

Comments:
System can monitor interstitial spaces.
Evaluations also covered quantitative leak location.
AGW Sensor Cable is reusable.
TFH Hydrocarbon Sensor Cable is not reusable.
Lower detection limit is calculated at MER only. Cable is assumed to be equally or more sensitive at shorter lengths.

PermAlert
7720 N. Lehigh Ave.
Niles, IL 60714-3491
Tel: (847) 966-2235

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Dates of Evaluation: 01/17/92, 02/11/92

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 gasoline	synthetic gasoline
Detection time (sec)	24	9
Fall time	N/A*	N/A
Lower detection limit (cm)	0.01	0.01
Type 2 Sensor		
Detection time (min:sec)	14:39	08:45
Fall time	N/A	N/A
Lower detection limit (cm)	0.01	0.01

* See glossary.

Specificity Results (in addition to above):
Activated: n-hexane, diesel, jet-A fuel, toluene, xylene(s).

Manufacturer's specifications:
Operating temperature range is 0 degrees F to 90 degrees F.

Comments:
Sensors are not reusable; sensor filament must be replaced after contact with hydrocarbons.

PermAlert
7720 N. Lehigh Ave.
Niles, IL 60714-3491
Tel: (847) 966-2235

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Date of Evaluation: 09/15/92

Petro Vend, Inc.

LineTite Pipeline Leak Monitor

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.0 gph for leak rate of 3.0 gph.
0.062 gph for leak rate of 0.1 gph.
A pipeline 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 fiberglass and steel pipelines.
Tests are conducted at operating pressure.
System will not function with a mechanical line leak detector installed on the pipeline.

Pipeline Capacity: Maximum of 341 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Response time is 1 to 26 minutes for leak rate of 3.0 gph.
Response time is 1 hour, 30 minutes to 12 hours, 30 minutes for leak rate of 1.0 gph.
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.
Pump shutdown, message display, and alarm activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Formerly manufactured by Hasstech

Petro Vend, Inc.
6900 Santa Fe Dr.
Hodgkins, IL 60525-9909
Tel: (708) 485-4200

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 10/15/91, 04/10/94

Petro Vend, Inc.

LineTite Pipeline Leak Monitor
(for Flexible Pipelines)

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.0 gph for leak rate of 3.0 gph.
0.062 gph for leak rate of 0.1 gph.
A pipeline 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 flexible pipelines.
Tests are conducted at operating pressure.
System will not function with a mechanical line leak detector installed on 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 1 to 6 minutes for leak rate of 3.0 gph.
Response time is 2 hours, 18 minutes to 5 hours for leak rate of 0.1 gph.
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.
Pump shutdown, message display, and alarm activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Formerly manufactured by Hasstech

Petro Vend, Inc.
6900 Santa Fe Dr.
Hodgkins, IL 60525-9909
Tel: (708) 485-4200

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 10/15/91, 04/10/94

Petro Vend, Inc.

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 rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.5 gph for leak rate of 3.0 gph.
0.05 gph for leak rate of 0.1 gph.
A pipeline 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.

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 172 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Response time is 1 to 5 minutes for leak rate of 3.0 gph.
Response time is 2 hours, 10 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Formerly manufactured by Hasstech

Petro Vend, Inc.
6900 Santa Fe Dr.
Hodgkins, IL 60525-9909
Tel: (708) 485-4200

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 04/15/97, 05/28/98

Petro Vend, Inc.

LineTight Pipeline Leak Monitor Model 2001J
(for Flexible Pipelines)

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.5 gph for leak rate of 3.0 gph.
0.05 gph for leak rate of 0.1 gph.
A pipeline 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.

Specification: 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.

Pipeline Capacity: Maximum of 39.5 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Response time is 1 minute for leak rate of 3.0 gph.
Response time is 6 hours, 37 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Formerly manufactured by Hasstech

Petro Vend, Inc.
6900 Santa Fe Dr.
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Tel: (708) 485-4200

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 04/15/97, 05/28/98

Petro Vend, Inc.

Petrosonic III
(Version 4.05 Model 613, 4 inch dia Float, Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.07% and P_{FA} = 0.93%.

Leak Threshold: 0.1 gph. A tank 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 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 12 hours between delivery and testing.
There must be no delivery during waiting time.
Minimum of 30 minutes between dispensing and testing.

Test Period: Minimum of 4 hours.
Test data are acquired and recorded by system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 Models II and III,
(Model 613, 2 inch dia Floats, Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 96.55% and P_{FA} = 3.45%.

Leak Threshold: 0.1 gph. A tank 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 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 12 hours between delivery and testing.
There must be no delivery during waiting time.
Minimum of 30 minutes between dispensing and testing.

Test Period: Minimum of 4 hours.
Test data are acquired and recorded by system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 Models II and III,
(Model 613, 4 inch dia Floats, Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.82% and P_{FA} = 0.18%.
Leak rate of 0.1 gph with P_D = 99.95% and P_{FA} = 0.35%.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.06 gph for leak rate of 0.1 gph.
A tank system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
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 for leak rate of 0.2 gph.
Tank must be minimum 90% full for leak rate of 0.1 gph.

Waiting Time: Minimum of 12 hours between delivery and testing.
There must be no delivery during waiting time.
Minimum of 30 minutes between dispensing and testing.

Test Period: Minimum of 2 hours for leak rate of 0.2 gph.
Minimum of 4 hours for leak rate of 0.1 gph.
Test data are acquired and recorded by system's 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 Models 1, II and III,
(Model 924, 2 inch dia Floats, Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 97.8% and P_{FA} = 2.2% for 30 minute test.
Leak rate of 0.2 gph with P_D = 99.4% and P_{FA} = 0.6% for 1 hour test.
Leak rate of 0.2 gph with P_D = 99.7% and P_{FA} = 0.3% for 2 hour test.
Leak rate of 0.2 gph with P_D = 99.9% and P_{FA} = 0.1% for 3 hour test.

Leak Threshold: 0.1 gph. A tank 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 with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 20,000 gallons.
Tank must be minimum 50% full for 1 hour test.
Tank must be minimum 14% full for 30 minute, 2 hour and 3 hour test. Minimum product level required based on 14% full tank and tank diameter is as follows: **48"** dia/min 9.5"; **120"** dia/min 24.7". For other tank diameters, consult manufacturer.

Waiting Time: Minimum of 8 hours between delivery and testing.
There must be no delivery during waiting time.
Minimum of 30 minutes between dispensing and testing.

Test Period: Variable: Minimum of 30 minutes, 1, 2 or 3 hours.
Test data are acquired and recorded by system's 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 probe containing 5 thermistors with the lowest thermistor located at the 10% tank volume level above the bottom of the tank.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.75 inch.
Minimum detectable change in water level is 0.08 inch.

Calibration: Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 11/06/00

Petro Vend, Inc.

Site Sentinel Models 1, II and III,
(Model 924, 4 inch dia Floats, Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification:
Leak rate of 0.2 gph with P_D = 97.8% and P_{FA} = 2.2% for 30 minute test.
Leak rate of 0.2 gph with P_D = 98.7% and P_{FA} = 1.3% for 1 hour test.
Leak rate of 0.2 gph with P_D = 99.2% and P_{FA} = 0.8% for 2 hour test.
Leak rate of 0.2 gph with P_D = 99.5% and P_{FA} = 0.5% for 3 hour test.
Leak rate of 0.1 gph with P_D = 96.9% and P_{FA} = 1.9% for 2 hour test.
Leak rate of 0.1 gph with P_D = 98.2% and P_{FA} = 1.0% for 3 hour test.

Leak Threshold:
0.1 gph for leak rate of 0.2 gph.
0.053 gph for leak rate of 0.1 gph.
A tank 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 with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity:
Maximum of 20,000 gallons.
Tank must be minimum 14% full for leak rate of 0.2 gph. Minimum product level required based on 14% full tank and tank diameter is as follows: **48"** dia/min 9.5"; **120"** dia/min 24.7". For other tank diameters, consult manufacturer.
Tank must be minimum 90% full for leak rate of 0.1 gph.

Waiting Time:
Minimum of 8 hours between delivery and testing for leak rate of 0.2 gph.
Minimum of 12 hours between delivery and testing for leak rate of 0.1 gph.
There must be no delivery during waiting time.
Minimum of 30 minutes between dispensing and testing.

Test Period:
Variable: Minimum of 30 minutes, 1, 2 or 3 hours for leak rate of 0.2 gph and minimum of 2 or 3 hours for leak rate of 0.1 gph.
Test data are acquired and recorded by system's 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 probe containing 5 thermistors with the lowest thermistor located at the 10% tank volume level above the bottom of the tank.

Water Sensor:
Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.848 inch.
Minimum detectable change in water level is 0.043 inch.

Calibration:
Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments:
Not evaluated using manifolded 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.
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Hodgkins, IL 60525-9909
Tel: (708) 485-4200

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 11/03/00

Petro Vend, Inc.

Petrosentry IV, Petrosentry VIII, SiteSentinel with
Liquid Sensor, Universal Sump Sensor, Universal Reservoir Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: thermal conductivity (Liquid Sensor), float switch (Universal Sump Sensor, Universal Reservoir Sensor)

Test Results:

Liquid Sensor	unleaded gasoline
Response time (min)	0.51
Recovery time (min)	<1
Product activation height (cm)	0.35
Lower detection limit (cm)	0.76
Universal Sump Sensor	
Response time (min)	8.32
Recovery time (min)	<1
Product activation height (cm)	3.37
Lower detection limit (cm)	3.97

Universal Reservoir Sensor	50% by weight ethylene glycol in water		30% by weight calcium chloride in water	
	high*	low*	high	low
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

*The "high" and "low" refer to high and low level alarm points of hydrostatic sensors.

Specificity Results (in addition to above for Liquid Sensor and Universal Sump Sensor):

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

Comments:

Universal Reservoir Sensor is intended to monitor level of either ethylene glycol or calcium chloride solutions in the interstitial or annular space of a double-walled tank.
Universal Reservoir Sensor activates an alarm if any significant gain or loss of solution occurs.
Sensors are 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 Controller with
Combination Sensors Part #30-3224 (Consists of Part #30-3221-1A, #30-3219-12),
#30-3225 (Consists of Part #30-3221-2, #30-3219-12)

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:
Output type: qualitative
Sampling frequency: continuous
Operating principle: float switch (part #30-3221-1A, #30-3221-2),
product permeable (part #30-3219-12)

Part #30-3224, #30-3225	unleaded gasoline	diesel
Detection time (sec)	13.602	24.104
Fall time	*	**

* Sensor must be cleaned and dried when exposed to hydrocarbons.
** Sensor must be replaced or threshold needs to be reset when exposed to diesel.

Specificity Results:
Evaluator indicates that sensors respond only to hydrocarbons.

Comments:
Evaluator indicates that since each of the sensors use the same polymer material; the results can be applied to any sensor with this material.

Petro Vend, Inc.
6900 Santa Fe Dr.
Hodgkins, IL 60525-9909
Tel: (708) 485-4200

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 8/3/00

Petro Vend, Inc.

SiteSentinel Controller with
Hydrocarbon Sensitive Polymer Cables Part #30-3206, #30-3207-nn, #30-3210-nn, #30-3219-12

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:
Output type: qualitative
Sampling frequency: continuous
Operating principle: product permeable

Test Results:

Part #30-3206, #30-3207-nn*, #30-3210-nn***, #30-3219-12**	unleaded gasoline	diesel
Detection time (min)	13.602	24.104
Fall time (min)	*	**

* Sensor must be cleaned and dried when exposed to hydrocarbons.
** Sensor must be replaced or threshold needs to be reset when exposed to diesel.
*** “nn” denotes a variable length in feet.

Specificity Results:
Evaluator indicates that sensors respond only to hydrocarbons.

Comments:
Evaluator indicates that since each of the sensors use the same polymer material, the results can be applied to any sensor with this material.

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
Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 8/3/00

Petro Vend, Inc.

SiteSentinel Controller with
Single Float Switches Part #30-3221-1, #30-3221-1A, #30-3221-1B
Brine Reservoir Sensor and Dual Float Sensor Part #30-3221-2

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

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

Part #30-3221-1	unleaded gasoline	diesel	water
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	1.225	1.171	1.123
Part #30-3221-1A			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	1.513	1.487	1.375
Part #30-3221-1B			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	0.876	0.828	0.562
Part #30-3221-2 (Brine Reservoir Sensor)			
Detection time (sec)	-	-	<1
Fall time (sec)	-	-	<1
Low level alarm - Lower detection limit (in)	-	-	2.495
High level alarm - Lower detection limit (in)	-	-	10.389
Part #30-3221-2 (Dual Float Sensor)			
Detection time (sec)	-	-	<1
Fall time (sec)	-	-	<1
Low level alarm - Lower detection limit (in)	-	-	2.533
High level alarm - Lower detection limit (in)	-	-	10.492

Specificity Results:
Evaluator indicates that single float sensors work with any liquid.

Comments:
Evaluator indicates that Sensor Part #30-3221-2 can operate either as a brine reservoir sensor or a dual float sensor based on orientation of the lower float.

Petro Vend, Inc.
6900 Santa Fe Dr.
Hodgkins, IL 60525-9909
Tel: (708) 485-4200

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 8/3/00

Petro Vend, Inc.

Petrosentry TLD III, 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:

Petrosentry TLD III	benzene	2-methylbutane
Detection time (sec)	5	16
Fall time (min:sec)	4:12	0:42
Lower detection limit (ppm)	12.5	12.5

SiteSentinel Smart Module and Vapor Sensor	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
Detection time (sec)	5	7	10
Fall time (min:sec)	6:30	3:35	4:26
Lower detection limit (ppm)	10	10	10

Specificity Results (in addition to above for Petrosentry TLD III):

Activated: n-hexane, toluene, n-butane, isobutane, 2-methylpentane.

Specificity Results (in addition to above for SiteSentinal Smart Module and Vapor Sensor):

Activated: n-hexane, toluene, xylene(s).

Manufacturer's specifications:

Petrosentry TLD III 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
Dates of Evaluation: 03/26/91, 04/16/92

Petro Vend, Inc.

SiteSentinel Controller with
Vapor Sensor Part #30-3222, Optical Sensor Part #30-3223

VAPOR-PHASE OUT-OF-TANK DETECTOR

Detector:
Output type: qualitative
Sampling frequency: continuous
Operating principle: metal oxide semiconductor (Part #30-3222), Optical (Part #30-3223)

Test Results:

Part #30-3222	Unleaded gasoline	diesel	water
Detection time (sec)	5.946	30.948	-
Fall time (sec)	*	**	-
Part #30-3223			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	0.571	0.561	0.592

*Evaluator notes that because of the geometry of the vapor sensors and their varied installation options, the threshold level was not measured.
** Evaluator notes that this sensor resets very slowly and that controller should be adjusted or replaced after each alarm.

Specificity Results:
Part #30-3222 responds to hydrocarbons only.
Part #3223 works with any liquid.

Comments:
Performance of these sensors degrades after exposure to high concentrations of hydrocarbons.

Petro Vend, Inc.
6900 Santa Fe Dr.
Hodgkins, IL 60525-9909
Tel: (708) 485-4200

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 8/3/00

Pneumercator Company, Inc.

TMS 2000, TMS 3000
(Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 95.0% and P_{FA} = 5% for 2 hour test.
Leak rate of 0.2 gph with P_D = 99.8% and P_{FA} = 0.2% for 4 hour test
Leak rate of 0.2 gph with P_D = 99.9% and P_{FA} = 0.1% for 8 hour test.
Leak rate of 0.1 gph with P_D = 95.3% and P_{FA} = 4.7% for 7 hour test.
Leak rate of 0.1 gph with P_D = 95.8% and P_{FA} = 4.2% for 8 hour test.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 20,000 gallons.
Tank must be between 20 and 95% full.

Waiting Time: Minimum of 8 hours between delivery and testing.
Minimum of 20 minutes between dispensing and testing.
There must be no delivery during waiting time.

Test Period: Minimum of 2 hours for leak rate of 0.2 gph.
Minimum of 7 hours for leak rate of 0.1 gph.
Test data are acquired and recorded by system's 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 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 0.488 inch.
Minimum detectable change in water level is 0.124 inch.

Calibration: Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Pneumercator Company, Inc.
120 Finn Court
Farmingdale, NY 11735
Tel: (613) 293-8450

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 07/15/97

Pneumercator Company, Inc.

LC 1000 Series, E-14-29, E-700-1, LDE-700, LDE-740, TMS 2000, TMS 3000 with Level Sensor Models LS600AB, LS600LDBN, LS610, RSU800

LIQUID-PHASE INTERSTITIAL DETECTOR

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

Test Results:

LS600AB	unleaded gasoline	diesel	water
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	3.32	3.28	3.18
LS600LDBN			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	0.99	0.97	0.87
LS610			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	0.44	0.43	0.42
RSU800 (low level)			
Detection time (min)	<1	<1	<1
Fall time (min)	<1	<1	<1
Lower detection limit (ppm)	2.57	2.53	2.31
RSU800 (high level)			
Detection time (min)	<1	<1	<1
Fall time (min)	<1	<1	<1
Lower detection limit (ppm)	13.31	13.24	13.01

Specificity Results:
Manufacturer and evaluator claim sensor will respond to any liquid.

Comments:
Sensors are reusable.

Pneumercator Company, Inc.
120 Finn Court
Farmingdale, NY 11735
Tel: (613) 293-8450

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 01/22/96
(Revised 03/02/01)

Pneumercator Company, Inc.

LDE 700, LDE 740, LDE 9000 with
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 gasoline	synthetic gasoline
Detection time (sec)	<1	<1
Fall time	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 (in addition to above):
Activated: n-hexane, diesel, jet-A fuel, toluene, xylene(s), water.

Comments:
Sensors are reusable.
Capacitance probes do not work with oxygenated fuels.

Pneumercator Company, Inc.
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Tel: (613) 293-8450

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 12/14/93

Pneumercator Company, Inc.

TMS 2000, TMS 3000 with
ES820-100 Non-Discriminating Liquid Sensor, ES820-200 Discriminating Liquid Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type:	qualitative
Sampling frequency:	continuous
Operating principle:	optical sensor

Test Results:

ES820-100 Non-Discriminating Liquid Sensor	unleaded gasoline	diesel	water
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	0.35	0.34	0.35
ES820-200 Discriminating Liquid Sensor			
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	0.36	0.38	0.39

Specificity Results:
Manufacturer claims sensors will respond to any liquid.

Pneumercator Company, Inc.
120 Finn Court
Farmingdale, NY 11735
Tel: (613) 293-8450

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 01/22/96
(Revised 03/02/01)

Precision Tank Service, Inc.

TotalSir Version 1.0

STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

Certification: Leak rate of 0.2 gph with $P_D > 99.9\%$ and $P_{FA} < 0.1\%$ for leak threshold of 0.1 gph.
Leak rate of 0.2 gph with $P_D > 97.2\%$ and $P_{FA} < 0.1\%$ for leak threshold of 0.16 gph.

Leak Threshold: 0.1 and 0.16 gph for leak rate of 0.2 gph. These leak thresholds are for evaluation purposes only.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the leak threshold calculated from the data set. This leak threshold may be different than the above leak thresholds.

Applicability: Gasoline, diesel, kerosene.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 45,000 gallons for single tanks.
Maximum of 45,000 gallons cumulative capacity for manifolded tank systems with no more than 4 tanks in system.

Data Requirement: Minimum of 23 days of product level and flow through data.

System Features: Method of data analysis that system employs, and was used during evaluation process, is exclusive of any external control by vendor.
System consists of a fully automated software package with embedded algorithms for conducting leak detection testing. Consequently, third party evaluation procedure demonstrated that system can be used in-house with no requirement for direct vendor participation.

Evaluation Features: This system was tested for in-house use. Vendor, with evaluator present, analyzed required data and performed evaluation using program disk only.
Results were presented to evaluator directly from the computer without additional vendor involvement.

Comments: Gains (water ingress) are investigated using current and previous month raw inventory data.
73% of data sets were from manifolded tank systems.
Of 41 data sets submitted for evaluation, 4 were inconclusive.
Median monthly throughput of tanks evaluated was 22,370 gallons.
Leak rates of 0.05, 0.1, and 0.2 gph were used in evaluation.
Data sets evaluated were supplied by evaluator.

Precision Tank Service, Inc.
P.O. Box 2040
Cornelius, NC 28031
Tel: (704) 892-8600

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 04/07/93, 07/18/95, 06/16/00, 08/27/01

Preferred Utilities Manufacturing Corporation

TG-EL-D3 Controller
with HD-A1 Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type:	qualitative, discriminating
Sampling frequency:	continuous
Operating principle:	optical sensor, electrical conductivity

Test Results:

HD-A1	unleaded gasoline	diesel	water
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1
Lower detection limit (in)	0.179	0.162	0.190

Specificity Results:
Manufacturer claims the sensor responds to any liquid after the sensor's threshold is exceeded. The sensor display on the controller indicates whether product is oil or water. No additional liquids tested.

Manufacturer's Specifications:
Manufacturer states that the HD-A1 leak sensor used with the TG-EL-D3 controller and a tank level sensor (TG-EL-LF, TG-EL-VF, or TG-EL-WF) is a system that is generally applied to oil tanks for boilers and emergency generators.

Comments:
This system is NOT sold for retail gasoline station applications.
Manufacturer recommends a periodic test for the system by the user. The test entails placing a magnet near the HD-A1 transmitter/sensor. When the magnetic "Test Switch" is activated, it simulates an oil leak. This completely tests the wiring to the sensor, the optical detector, the HD-A1 transmitter electronics, and the controller.

Preffered Utilities Manufacturing Corporation
31-35 South Street
Danbury, CT 06810
Tel: (203) 743-6741

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 10/12/00

ProTank, Inc.

LTH-5000 Line Tester

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gph with P_D = 99.8% and P_{FA} = 1.3%.

Leak Threshold: 0.05 gph. A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 40 gallons.

Waiting Time: None between delivery and testing.
Minimum of 1 hour between dispensing and testing.

Test Period: 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.

Calibration: Sensors must be calibrated in accordance with manufacturer's instructions 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 pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 in accordance with manufacturer's instructions 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 tank 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 oil #4, waste oil.
Other liquids may be tested after consultation with the manufacturer.

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 tank excavation 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 manifolded tank systems.
Evaluated using diesel.
Tests only ullage portion of the tank.
Product-filled portion of tank must be tested with an underfill 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 tank excavation 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 tank excavation 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 tank 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, fuel oil #4.
Other liquids may be tested after consultation with the manufacturer.

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 tank excavation 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 manifolded tank systems.
Evaluated using diesel.
Tests only ullage portion of tank.
Product-filled portion of tank must be tested using a volumetric underfill 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 tank system should not be declared tight when the pressure decay trend equals or exceeds ± 0.016 psi/hr.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4,.
Other liquids may be tested after consultation with the manufacturer.

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 tank excavation 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 manifolded tank systems.
Evaluated using diesel.
Tests only ullage portion of tank.
Product-filled portion of tank must be tested using a volumetric underfill test method.

ProTank, Inc.
3545 Lomita Blvd., Suite G
Torrance, CA 90505
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 tank 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 oil #4, waste oil.
Other liquids may be tested after consultation with the manufacturer.

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.
Net vacuum applied = 0.5 psi + [inches of product level x the specific gravity of product x 0.036].

Temperature: Acoustic signal is independent of product temperature.

Groundwater: Depth to groundwater in tank excavation backfill must be determined. If groundwater is above the tank bottom, this test system may not be used.

Comments: Not evaluated using manifolded tank systems.
Evaluated using diesel.
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 tank excavation 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 tank excavation 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: 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 tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

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 system's 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 tank excavation 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.
3545 Lomita Blvd., Suite G
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 tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

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 system's 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 tank excavation 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 manifolded 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.
3545 Lomita Blvd., Suite G
Torrance, CA 90505
Tel: (800) 438-1111

Evaluator: ADA Technologies
Tel: (303) 792-5615
Date of Evaluation: 09/09/92

Raychem Corp.

TraceTek Alarm and Locator Modules with TT502, TT5000, TT3000 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*	2/3 MER	MER
TT502	334 m	665 m	995 m
Response time (min)	22.11	17.13	19.42
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

TT5000	1/3 MER	2/3 MER	MER
	508 m	1016 m	1524 m
Response time (min)	12.02	9.18	7.51
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

	3% by weight salt in water			other solutions**
	1/3 MER	2/3 MER	MER	MER
TT3000	508 m	1016 m	1524 m	1524 m
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), 0.1M sodium hydroxide (NaOH).

Specificity Results (in addition to above for TT502 and TT5000):
Activated: synthetic gasoline, diesel, heating oil #2, jet A fuel (TT5000 only).
Not Activated: water.

Specificity Results (in addition to above for TT3000):
Activated: water
Not Activated: unleaded gasoline, synthetic gasoline, diesel, JP-8 fuel.

Comments:
Evaluation also covered quantitative leak location.
TT502, TT5000 Fuel Sensing cable is not reusable.
Lower detection limit is calculated at MER only, and cable is assumed to be equally or more sensitive at shorter lengths.

Raychem Corp.
300 Constitution Dr.
Menlo Park, CA 94025-1164
Tel: (650) 361-3333

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Dates of Evaluation: 05/15/92, 12/20/95, 02/20/98

Ronan Engineering Co.

Ronan X-76 Automatic Line Leak Detector with
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 rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 0.831 gph for leak rate of 3.0 gph.
0.066 gph for leak rate of 0.1 gph.
A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 for leak rate of 3.0 gph.
Minimum of 2 hours between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is 20 seconds for leak rate of 3.0 gph.
Response time is 20 minutes for leak rate of 0.1 gph.
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.
Pump shutdown, message display, and alarm activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Ronan Engineering Co.
21200 Oxnard St.
Woodland Hills, CA 91367
Tel: (800) 327-6626

Evaluator: Midwest Research Institute
Tel: (816) 753-7600
Date of Evaluation: 10/04/91

Ronan Engineering Co.

X76CTM Series Monitoring System with (Series 7100 Magnetostrictive Probe, X76MP Series Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.9% and P_{FA} = 0.1% for Precision Test with either probe.
Leak rate of 0.2 gph with P_D = 99.2% and P_{FA} = 0.1% for Quick Test with Series 7100 Probe.
Leak rate of 0.2 gph with P_D = 99.6% and P_{FA} = 0.1% for Quick Test with X76MP Series Probe.
Leak rate of 0.1 gph with P_D = 95.1% and P_{FA} = 4.9% for 0.1gph Test with Series 7100 Probe.
Leak rate of 0.1 gph with P_D = 95.1% and P_{FA} = 1.8% for 0.1gph Test with X76MP Series Probe.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph, Precision Test with Series 7100 Probe.
0.115 gph for leak rate of 0.2 gph, Precision Test with X76MP Series Probe.
0.115 gph for leak rate of 0.2 gph, Quick Test with Series 7100 Probe.
0.129 gph for leak rate of 0.2 gph, Quick Test with X76MP Series Probe.
0.05 gph for leak rate of 0.1 gph, 0.1gph Test with Series 7100 Probe.
0.066 gph for leak rate of 0.1 gph, 0.1gph Test with X76MP Series Probe.
A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 20,000 gallons.
Tanks less than 95% full may be tested.
Minimum product level required based on test mode as follows: For Quick Test with either probe, Precision Test with Series 7100 Probe, and 0.1gph Test with X76MP Series Probe, the minimum product level is computed as probe length divided by 6 plus 5 inches. For Precision Test with X76MP Series Probe and 0.1 gph Test with Series 7100 Probe, the minimum product level is 50% of tank capacity.

Waiting Time: Minimum of 1 hour between delivery and testing for Quick Test.
Minimum of 6 hours between delivery and testing for Precision Test and 0.1 gph Test.
There must be no delivery during waiting time.

Test Period: Minimum of 2 hours for all tests.
Test data are acquired and recorded by system's computer.
Leak rate is 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 probe with 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 0.661 inch.
Minimum detectable water level change is 0.011 inch.
System is default programmed to report a water depth only when it exceeds 3.5 inches.
System can be programmed to report a water depth of 0.661 inch and above.

Calibration: System must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Ronan Engineering Co.
21200 Oxnard St.
Woodland Hills, CA 91367
Tel: (800) 327-6626

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 08/15/99

Ronan Engineering Co.

X76CTM Series Monitoring System
(MTS UST Series Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.9% and P_{FA} = 0.1% for Precision Test.
Leak rate of 0.2 gph with P_D = 95.0% and P_{FA} = 0.1% for Quick Test.
Leak rate of 0.1 gph with P_D = 95.2% and P_{FA} = 2.5% for 0.1 gph Test

Leak Threshold: 0.124 gph for leak rate of 0.2 gph, Precision Test.
0.168 gph for leak rate of 0.2 gph, Quick Test.
0.067 gph for leak rate of 0.1 gph, 0.1 gph Test.
A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 20,000 gallons.
Tanks less than 95% full may be tested.
Minimum product level required based on test mode as follows: For Quick Test, the minimum product level is computed as probe length multiplied by 0.12 plus 5 inches. For Precision Test and 0.1 gph Test, the minimum product level is 50% of tank capacity.

Waiting Time: Minimum of 1 hour between delivery and testing for Quick Test.
Minimum of 6 hours between delivery and testing for Precision Test and 0.1 gph Test.
There must be no delivery during waiting time.

Test Period: Minimum of 2 hours for all tests.
Test data are acquired and recorded by system's computer.
Leak rate is 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 probe with 5 resistance temperature detectors (RTDs).
The bottom RTD must be submerged in at least 5 inches of product during test.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.874 inch.
Minimum detectable water level change is 0.011 inch.
System is default programmed to report a water depth only when it exceeds 3.5 inches.
System can be programmed to report a water depth of 0.874 inch and above.

Calibration: System must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Ronan Engineering Co.
21200 Oxnard St.
Woodland Hills, CA 91367
Tel: (800) 327-6626

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 08/15/99

Ronan Engineering Co.

X76CTM Series Monitoring System
(Veeder-Root 8463/8473/8493 Series Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.9% and P_{FA} = 0.1% for Precision Test.
Leak rate of 0.2 gph with P_D = 97.0% and P_{FA} = 0.1% for Quick Test.
Leak rate of 0.1 gph with P_D = 95.2% and P_{FA} = 0.8% for 0.1 gph Test

Leak Threshold: 0.1 gph for leak rate of 0.2 gph, Precision Test.
0.128 gph for leak rate of 0.2 gph, Quick Test.
0.06 gph for leak rate of 0.1 gph, 0.1 gph Test.
A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 20,000 gallons.
Tanks less than 95% full may be tested.
Minimum product level required based on tank diameter is as follows: **48"** dia/ min 18"; **64"** dia/ min 21"; **72"** dia/ min 24"; **96"** dia/ min 30"; **126"** dia/ min 39". Minimum product level required for other tank diameters; multiply probe length by 0.08 and add 5 inches.

Waiting Time: Minimum of 1 hour between delivery and testing for Quick Test.
Minimum of 6 hours between delivery and testing for Precision Test and 0.1 gph Test.
There must be no delivery during waiting time.

Test Period: Minimum of 2 hours for all tests.
Test data are acquired and recorded by system's computer.
Leak rate is 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 probe with 5 thermistors.
The bottom thermistor must be submerged in at least 5 inches of product during test.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.878 inch.
Minimum detectable water level change is 0.013 inch.
System is default programmed to report a water depth only when it exceeds 3.5 inches.
System can be programmed to report a water depth of 0.878 inch and above.

Calibration: System must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Ronan Engineering Co.
21200 Oxnard St.
Woodland Hills, CA 91367
Tel: (800) 327-6626

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 08/15/99

Ronan Engineering Co.

X-76 ETM, X-76 ETM-4X
(Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99.96% and P_{FA} = 0.044%.
Leak rate of 0.1 gph with P_D = 95.34% and P_{FA} = 4.66%.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank 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.
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 for leak rates of 0.2 and 0.1 gph.
Tank must have minimum product height of 12 inches or be 14% full, whichever is higher, when leak threshold is set at 0.049 gph (P_D = 95% and P_{FA} = 5%).

Waiting Time: Minimum of 2 hours between delivery and testing for leak rate of 0.2 gph.
Minimum of 8 hours between delivery and testing for leak rate of 0.1 gph.
There must be no dispensing or delivery during waiting time.

Test Period: Minimum of 4 hours.
Test data are acquired and recorded by system's computer.
Leak rate is 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 91367
Tel: (800) 327-6626

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 02/07/91, 11/21/91

Ronan Engineering Co.

Ronan Controller Models X76S; X76VS; X76LVC; TRS76; X76ETM, LVCS; X76CTM-N4; X76ETM-4X; X76-4X, -3, -6, -9, -12; X76AST-4X with
Ronan Sensor Models 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:

LS-3 N.C. (normally closed)	unleaded gasoline	water
Detection time (sec)	<1	<1
Fall time (sec)	<1	<1
Lower detection limit (cm)	2.77	2.31
LS-3 N.O. (normally open)		
Detection time (sec)	<1	<1
Fall time (sec)	<1	<1
Lower detection limit (cm)	2.31	1.70
LS-30 (high level)		
Detection time (sec)	<1	<1
Fall time (sec)	<1	<1
Lower detection limit (cm)	N/D*	15.24
LS-30 (low level)		
Detection time (sec)	<1	<1
Fall time (sec)	<1	<1
Lower detection limit (cm)	N/D	4.72
LS-7		
Detection time (sec)	<1	<1
Fall time (sec)	<1	<1
Lower detection limit (cm)	1.09	0.81
HVA		
Detection time (sec)	<1	<1
Fall time (sec)	<1	<1
Lower detection limit (cm)	0.84	0.71

*See Glossary

Comments:
Sensors 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 91367
Tel: (800) 327-6626

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 tank 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.
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 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 system's computer.
Leak rate is 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 tank excavation 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 in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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

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%.
"If a method meets the requirement for detecting a leak rate of 0.1 gph, it will meet the requirement for 0.2 gph.", according to "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods", EPA/530/UST-90/007, June 1990, Section 7.2.3, page 30.

Leak Threshold: 0.05 gph. A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 18,000 gallons.

Data Requirement: Minimum of 30 days of product level and flow through data.

Comments: Not evaluated using manifolded 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.

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

Simmons Corp.

SIR 5.7 LM

STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

Certification: Leak rate of 0.2 gph with P_D = 99.9% and P_{FA} = 0.0%.
Leak rate of 0.1 gph with P_D = 99.0% and P_{FA} = 1.0%.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 45,000 gallons for single tank.
Maximum of 45,000 gallons cumulative capacity for manifolded tank systems with no more than 4 tanks in system.

Data Requirement: Minimum of 29 days of product level and flow through data.

Comments: 59% of data sets evaluated were from manifolded tank systems.
7% of data sets evaluated used data collected by Automatic tank gauges.
Of 41 data sets 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.

Simmons Corp.
106 E. Main Street
Richardson, TX 75081-3327
Tel: (800) 848-8378

Evaluator: S.S.G. Associates
Tel: (601) 234-1179
Dates of Evaluation: 10/28/95, 02/15/00

Simone Engineering, Inc.

Magnetrol Model 918 Ultrasonic Point Level Switch with
ABB Automation Freelance 2000 Control System

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative, non-discriminating
Sampling frequency: continuous
Operating principle: electrical conductivity, ultrasonic

Test Results:

	trichloroethylene	acetone	water
Lower detection limit (in)	0.143	0.166	0.164
Detection time (sec)	<1	<1	<1
Fall time (sec)	<1	<1	<1

Specificity Results:

Evaluator claims sensors will respond to any liquid after threshold is exceeded.

Comments:

The Magnetrol Model 918 has not been evaluated for application with petroleum hydrocarbons. The sensor has been evaluated specifically for application in water, acetone, and trichloroethylene.
The ABB Automation Freelance 2000 was used to detect the 8 to 16 milliamp change that occurred in the Magnetrol sensor when it became submerged in product. Audible and visual alarms were activated when the sensor indicated that alarm conditions were present.

Simone Engineering, Inc.
2635 45th Street
Highland, IN 46322-2985
Tel: (219) 922-6750

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 01/27/00

SIR International, Inc.

Mitchell's SIR Program Version 2.6

STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

Certification: Leak rate of 0.1 gph with P_D = 99% and P_{FA} = 1%.
"If a method meets the requirement for detecting a leak rate of 0.1 gph, it will meet the requirement for 0.2 gph.", according to "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods", EPA/530/UST-90/007, June 1990, Section 7.2.3, page 30.

Leak Threshold: 0.05 gph. A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 45,000 gallons for single tanks.
Maximum of 45.000 gallons cumulative capacity for manifolded tank systems with no more than 4 tanks in system.

Data Requirement: Minimum of 23 days of product level and flow through data.

Comments: 68% of data sets evaluated were from manifolded tank systems.
Of 41 data sets submitted for evaluation, all were analyzed with conclusive results.
Median monthly throughput of tanks evaluated was 22,370 gallons.
Leak rates of 0.05, 0.1, and 0.2 gph were used in evaluation.
Data sets used in this evaluation were supplied by evaluator.
100% of inventory data used in this evaluation were gauge stick readings.

SIR International, Inc.
P.O. Box 700
Locust Grove, OK 74352
Tel: (918) 479-5800

Evaluator: Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 01/27/92, 06/8/95
07/27/97

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%.
"If a method meets the requirement for detecting a leak rate of 0.1 gph, it will meet the requirement for 0.2 gph.", according to "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods", EPA/530/UST-90/007, June 1990, Section 7.2.3, page 30.

Leak Threshold: 0.05 gph. A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

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 manifolded 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 Tennessee State University
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%.
"If a method meets the requirement for detecting a leak rate of 0.1 gph, it will meet the requirement for 0.2 gph.", according to "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods", EPA/530/UST-90/007, June 1990, Section 7.2.3, page 30.

Leak Threshold: 0.05 gph. A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

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 manifolded 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.
3533 Chuckanut Dr.
Bow, WA 98232
Tel: (360) 766-5332

Evaluator: Nathan Adams,
Middle Tennessee State University
Tel: (615) 898-2644
Date of Evaluation: 11/05/92

Sir Phoenix, Inc.

SIR Phoenix LEOMA V01.50

STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

Certification: Leak rate of 0.2 gph with $P_D > 99.3\%$ and $P_{FA} < 0.7\%$ for single tanks.
Leak rate of 0.2 gph with $P_D > 99.9\%$ and $P_{FA} < 0.1\%$ for manifolded tanks.

Leak Threshold: 0.1 gph for both single and manifolded tank systems.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 18,000 gallons for single tanks.
Maximum of 45.000 gallons cumulative capacity for manifolded tank systems with no more than 4 tanks in system.

Data Requirement: Minimum of 28 days of product level and flow through data.

Comments: 54% of data sets evaluated were from manifolded 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 of 0.05, 0.1, and 0.2 gph were used in evaluation.
Data sets used in this evaluation were supplied by evaluator.
Inventory data used in this evaluation were obtained from manual tank stick readings and automatic tank gauge readings.

SIR Phoenix, Inc.
3533 Chuckanut Dr.
Bow, WA 98232
Tel: (360) 766-5332

Evaluator: Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 12/18/00

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 tank 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 tank excavation 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 in accordance with manufacturer's instructions.
Thermistors must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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

Sound Products Manufacturing, Inc. (formerly USTest, Inc.)

UST 2001 and UST 2001 Quick Test
(Ultrasonic Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 97.5% and P_{FA} = 2.5% for Quick Test.
Leak rate of 0.1 gph with P_D = 95.2% and P_{FA} = 4.8%.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank 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 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 4 hours between delivery and testing.
Minimum of 15 minutes between dispensing and testing.
There must be no delivery during waiting time.

Test Period: Minimum of 30 minutes for leak rate of 0.2 gph (Quick Test). With a test period of 1 hour, system has P_D = 99.9% and P_{FA} = 0.1%.
Minimum of 1 hour for leak rate of 0.1 gph. With a test period of 2 hours, system has P_D = 98.6% and P_{FA} = 1.4%.
Test data are acquired and recorded by system's 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.
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.

Calibration: Probe must be checked regularly and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Sound Products Manufacturing, Inc.
(formerly USTest, Inc.)
435 Industrial Parkway
Lafayette, LA 70508
Tel: (337) 235-1184

Evaluator: Ken Wilcox Associates

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

Sound Products Manufacturing, Inc. (formerly 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 tank 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. The acoustic signal to noise ratio is preprogrammed into the system's computer and is not revealed to or adjustable by the operator.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, waste oil.
Other liquids may be tested after consultation with the manufacturer.
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 tank excavation 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 and, if necessary, calibrated by tester before each test.

Comments: Not evaluated using manifolded 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 underfill 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. Maximum background noise is preprogrammed into system's computer and not revealed to or adjustable by the technician.
Vibration due to nearby equipment or dripping condensation may interfere with test.
Vacuum test method may not be effective in some tank excavation 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 tank excavation backfill may help identify presence of this condition.

Sound Products Manufacturing, Inc.
(formerly USTest, Inc.)
435 Industrial Parkway
Lafayette, LA 70508
Tel: (337) 235-1184

Evaluator: Ken Wilcox Associates

Tel: (816) 443-2494
Date of Evaluation: 03/24/92

Sound Products Manufacturing, Inc. (formerly 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 tank 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, 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 system's 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 tank excavation 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Sound Products Manufacturing, Inc.
(formerly USTest, Inc.)
435 Industrial Parkway
Lafayette, LA 70508
Tel: (337) 235-1184

Evaluator: Ken Wilcox Associates

Tel: (816) 443-2494
Date of Evaluation: 06/09/94

Sound Products Manufacturing, Inc. (formerly 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 tank 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, 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 system's 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 tank excavation 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 manifolded 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.

Sound Products Manufacturing, Inc.
(formerly USTest, Inc.)
435 Industrial Parkway
Lafayette, LA 70508
Tel: (337) 235-1184

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), 08/04/92 (10000-45000 gallons)

Steel Tank Institute

Permatank Precision Interstitial Vacuum Monitor

DOUBLE WALLED TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gph with P_D = 100% and P_{FA} =0%.

Leak Threshold: 0.01 gph. A tank 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 50,000 gallons.

Waiting Time: None.

Test Period: 12 hours for tanks less than 10,000 gallons.
24 hours for tanks 10,000 gallons to 50,000 gallons.

Comments: System performs post installation tank tightness test of Steel Tank Institute's double wall Permatank prior to adding product to tank.
System conducts vacuum test on interstitial space between inner steel wall and outer fiberglass wall of Steel Tank Institute's Permatank and detects breaches in either inner or outer wall.
For use only on Permatank underground storage tanks manufactured by Steel Tank Institute.
Minimum initial vacuum on interstitial space is 13 inches mercury. Tank declared tight when vacuum decrease is less than 5 inches mercury over specified test period.
Vacuum readings must be recorded on Steel Tank Institute's installation checklist.

Steel Tank Institute
570 Oakwood Rd.
Lake Zurich, IL 60047
Tel: (847) 438-8265

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 03/25/93

Steel Tank Institute

Permatank Interstitial Vacuum Monitor
Liquid Leaks

PRESSURE/VACUUM INTERSTITIAL MONITOR

Certification: Leak rate of 0.1 gph with P_D = 100% and P_{FA} < 5%.

Leak Threshold: A tank system should not be declared tight when the vacuum decreases (pressure increases) 5 inches or more of mercury over the test period specified for each tank size. Vacuum prior to test must be minimum of 14 inches of mercury.

Applicability: Gasoline, diesel, water.

Tank Capacity: Maximum of 20,000 gallons. No minimum product level during test.

Waiting Time: None between delivery and testing.

Test Period: Test periods required for selected tank sizes to detect a leak rate of 0.1 gph:

Selected Tank Sizes	gasoline	diesel	water
500 gal	0.4 hr	5.0 hr	4.8 hr
5,000 gal	1.3 hr	16.2 hr	15.7 hr
8,000 gal	2.1 hr	24.9 hr	24.2 hr
20,000 gal	3.7 hr	44.8 hr	43.6 hr

Comments: System tests the interstitial space between inner steel wall and outer fiberglass wall of Steel Tank Institute's Permatank.
Interstitial space is tested continuously.
System detects breaches in either inner or outer tank walls.
System was not evaluated for ability to detect layer of hydrocarbons on water.
Evaluation did not cover any liquid sensors.

Steel Tank Institute
570 Oakwood Rd.
Lake Zurich, IL 60047
Tel: (847) 438-8265

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 04/24/94

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 tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 12,000 gallons.

Data Requirement: Minimum of 29 days of product level and flow through data.

Comments: Not evaluated using manifolded 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 tank 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.
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 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 system's 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 tank excavation 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded tank systems.

Tank Automation, Inc.
P.O. Box 1395
Wall, NJ 07719
Tel: (800) 762-4103

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

Certification: Leak rate of 0.1 gph with P_D = 99.0% and P_{FA} = 0.1%.

Leak Threshold: 0.05 gph. A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 the operator on site.

Calibration: Sensors must be calibrated before each test in accordance with manufacturer's instructions.

Tanknology - NDE
8900 Shoal Creek Blvd., Building 200
Austin, TX 78757
Tel: (877) 368-7215

Evaluator: Midwest Research Institute
Tel: (816) 753-7600
Date of Evaluation: 08/30/91

Tanknology - NDE

PTK-88

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gph with P_D = 99.8% and P_{FA} = 1.3%.

Leak Threshold: 0.05 gph. A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 40 gallons.

Waiting Time: None between delivery and testing.
Minimum of 1 hour between dispensing and testing.

Test Period: 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.

Calibration: Sensors must be calibrated before each test in accordance with manufacturer's instructions.

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Tanknology - NDE
8900 Shoal Creek Blvd., Building 200
Austin, TX 78757
Tel: (877) 368-7215

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 pipeline 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 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 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: (877) 368-7215

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 12/29/91

Tanknology - NDE

TLD-1
(for Flexible Pipelines)

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gph with P_D = 99.9% and P_{FA} = 0.1%.

Leak Threshold: 0.05 gph. A pipeline 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 flexible pipelines.
Tests are conducted at 150% operating pressure.
Mechanical line leak detector must be removed or isolated from pipeline for duration of test.

Pipeline Capacity: Maximum of 50 gallons.

Waiting Time: Average of 1 hour.

Test Period: 1 to 6 hours. Average is 2 hours 15 minutes.
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.

Comments: Enviroflex pipeline wih a bulk modulus* of 1,280 was used during evaluation.
*See glossary.

Tanknology - NDE
8900 Shoal Creek Blvd., Building 200
Austin, TX 78757
Tel: (877) 368-7215

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 04/30/94

Tanknology - NDE

UST Ullage Test, Version U2
(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 tank system should not be declared tight when the pressure decay trend equals or exceeds ± 0.016 psi/hr.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.
Other liquids may be tested after consultation with the manufacturer.

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 tank excavation 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 manifolded tank systems.
Evaluated using diesel.
Tests only ullage portion of tank.
Product-filled portion of tank must be tested using a volumetric underfill test method.

Tanknology - NDE
8900 Shoal Creek Blvd., Building 200
Austin, TX 78757
Tel: (877) 368-7215

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 tank 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, fuel oil #4.
Other liquids may be tested after consultation with the manufacturer.

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 tank excavation 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 manifolded tank systems.
Evaluated using diesel.
Tests only ullage portion of tank.
Product-filled portion of tank must be tested using a volumetric underfill test method.

Tanknology - NDE
8900 Shoal Creek Blvd., Building 200
Austin, TX 78757
Tel: (877) 368-7215

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 tank 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 oil #4, waste oil.
Other liquids may be tested after consultation with the manufacturer.

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 tank excavation 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 manifolded tank systems.
Evaluated using diesel.
Tests only ullage portion of the tank.
Product-filled portion of tank must be tested with an underfill 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 tank excavation 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 tank excavation backfill may help identify presence of this condition.

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8900 Shoal Creek Blvd., Building 200
Austin, TX 78757
Tel: (877) 368-7215

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 tank 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 oil #4, waste oil.
Other liquids may be tested after consultation with the manufacturer.

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.
Net vacuum applied = 0.5 psi + [inches of product level x the specific gravity of product x 0.036].

Temperature: Acoustic signal is independent of product temperature.

Groundwater: Depth to groundwater in tank excavation backfill must be determined.
If groundwater is above the tank bottom, this system may not be used.

Comments: Not evaluated using manifolded tank systems.
Evaluated using diesel.
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 tank excavation 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 tank excavation backfill may help identify presence of this condition.

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Evaluator : Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 06/25/96

Tanknology - NDE

VacuTect

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 tank 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 by the water sensor.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, waste oil.
Other liquids may be tested after consultation with the manufacturer.
Water miscible products limit the effectiveness of water ingress detection.

Tank Capacity: Maximum of 75,000 gallons.
Test is generally conducted with tank between 60 and 95% full. However, test may be performed at minimum 5% full if total ullage volume does not exceed 20,000 gallons.
Maximum of 30,000 gallons per tank and 60,000 gallons cumulative capacity for manifolded tank systems with microphone (hydrophone) and water sensor in each tank.

Waiting Time: None between delivery and testing.

Test Period: Minimum not specified to declare a tank "non-tight".
When water level in tank excavation backfi ll is below bottom of tank: Minimum of 1 hour to declare tank tight.
When water level in tank excavation backfill is above bottom of tank: Minimum to declare a tank tight may need to be extended because a water sensor must be used.
When water level in tank excavation backfill is not determined: Minimum to declare a tank tight may need to be extended because a water sensor must be used. To determine test period, water level in tank excavation backfill must be assumed to be just above bottom of tank.

When using a water sensor, the test period is determined based on tank size, water level inside tank prior to test, tank tilt, type of water sensor, water sensor location in the tank, and water level in tank excavation backfill relative to bottom of tank. Tank tilt is determined by an inclinometer, or by measuring tank bottom elevations at two points within tank. Water sensor is placed in low end of tank or in pre-existing cross section of water inside tank.
For example: For a printed circuit board water sensor, the test period to detect a 0.1 gph leak rate in a 10,000 gallon (96"dia x 324"lg) level tank without a striker plate and without water in the tank is 51 minutes for water ingress to contact the water sensor plus 38 minutes to allow the sensor to detect the "minimum detectable change in water level" (see "Water Sensor" section below).
For example: For a magnetostrictive water sensor, the test period to detect a 0.1 gph leak rate in a 10,000 gallon (96"dia x 324"lg) level tank without a striker plate and without water in the tank is 37 minutes for water ingress to contact the water sensor plus 2 minutes to allow the sensor to detect the "minimum detectable change in water level" (see "Water Sensor" section below).

Tanknology - NDE VacuTect Data Sheet Continued on Next Page

Tanknology - NDE

VacuTect (Continued from previous page)

Test Pressure: Required test pressure is a function of tank construction, burial depth, product level in the tank, and water level in tank excavation backfill.
Pressure differential across tank wall at the bottom of the tank must be at least 0.5 psi.
Pressure differential across the tank wall is equal to the absolute value of vacuum applied to tank, plus the pressure of the tank excavation backfill on tank, plus groundwater pressure on tank, minus pressure of liquid in tank.
If water level in tank excavation backfill is not determined by wells, probes or pump boxes in the tank excavation backfill, test pressure calculation must account for both:
1) water level just above bottom of tank to achieve minimum 0.5 psi at worst case condition, and
2) tank completely submerged to assure tank is not damaged from over pressurization.

Temperature: Sonic emission and water ingress are independent of product temperature.

Water Sensor: Must be used if water level in tank excavation backfill is above tank bottom or if water level in tank excavation backfill was not determined.
Printed circuit board sensor minimum detectable water level is 0.022 inch, and minimum detectable change in water level is 0.016 inch.
Magnetostrictive sensor minimum detectable water level is 0.017 inch, and minimum detectable change in water level 0.001 inch.

Groundwater: If groundwater level in tank excavation backfill is above bottom of tank, or if groundwater level in tank excavation backfill is not determined, test time must be sufficient to detect water ingress using one of the above water sensors.

Comments: Evaluated using gasoline, diesel, Jet-A, and JP-4.
Microphone (hydrophone) should be located within 60 feet of any possible leak source.
Vacuum test method may not be effective in some tank excavation backfill (such as clay) because it may plug holes in tank.
If free product is present in tank excavation backfill, a leak in the free product zone may not be detected by a vacuum test method.
A well point or observation well in the tank excavation backfill can help identify the presence of free product, tank excavation backfill material, and water elevation in the tank excavation backfill.
More that 4 psi pressure differential across the tank wall at any location in the tank could damage tank.

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Austin, TX 78757
Tel: (877) 368-7215

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 10/28/91, 09/18/92, 02/20/92, 01/18/94, 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 tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

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 system's 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 tank excavation 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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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Tel: (877) 368-7215

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)

Certification: Leak rate of 0.1 gph with P_D = 99.99% and P_{FA} = 0.005%.

Leak Threshold: 0.05 gph. A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

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 system's 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 tank excavation 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 in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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
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Tel: (877) 368-7215

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)

Certification: Leak rate of 0.1 gph with P_D = 99.8% and P_{FA} = 0.02% for both single and manifolded tank systems.
"If a method meets the requirement for detecting a leak rate of 0.1 gph, it will meet the requirement for 0.2 gph.", according to "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods", EPA/530/UST-90/007, June 1990, Section 7.2.3, page 30.

Leak Threshold: 0.05 gph. A tank system should not be declared tight if the estimated leak rate is statistically significant and continuous.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 60,000 gallons for single tank.
Maximum of 60,000 gallons cumulative capacity for manifolded tank systems with no more than 3 tanks in the system.

Data Requirement: Minimum of 15 days of data is required.

System Features: Method of data analysis that system employs, and was used during evaluation process, is exclusive of any external control by vendor.
System consists of a fully automated software package with embedded algorithms for conducting leak detection testing. Consequently, third party evaluation procedure demonstrated that system can be used in-house with no requirement for direct vendor participation.

Evaluation Features: Evaluator tested this system for in-house use. Computer program disk along with instructional documentation was supplied by vendor to evaluator.
Evaluator, without vendor involvement, analyzed required data and performed evaluation using program disk and accompanying documentation. Vendor was NOT present as an observer during evaluation.

Comments: 46% of data sets evaluated were from manifolded tank systems.
Of 41 data sets submitted for evaluation, all were analyzed with conclusive results.
Median monthly throughput of tanks evaluated was 53,349 gallons.
Leak rates of 0.05, 0.10, and 0.20 gph were used in the evaluation.
Data sets evaluated were supplied by the evaluator.

TeleData, Inc.
900 East Ocean Blvd., Suite 250
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 rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.0 gph for leak rate of 3.0 gph.
0.06 gph for leak rate of 0.1 gph.
A pipeline 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 for leak rate of 3.0 gph.
Response time is 1 hour, 30 minutes for leak rate of 0.1 gph.
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.
Pump shutdown, message display, and alarm activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

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: 02/02/93

Tidel Engineering, Inc.

Tidel Environmental Monitoring System, 3500 Series
(Ultrasonic Probes #401-0009, #401-0010, #401-0023)

AUTOMATIC TANK GAUGING METHOD

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 tank 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.
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, if necessary, 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 manifolded 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.
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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 2000, 3000, 3500 Series
(Ultrasonic Probes #401-0009, #401-0010, #401-0021, #401-0022)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 96.2% and P_{FA} = 3% for ultrasonic probes #401-0009 and #401-0010.
Leak rate of 0.2 gph with P_D = 99.91% and P_{FA} = 0.09% for ultrasonic probes #401-0021 and #401-0022.

Leak Threshold: 0.1 gph. A tank 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.
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 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 4000
(Ultrasonic Probe #312-9000)

AUTOMATIC TANK GAUGING METHOD

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 rate of 0.1 gph with P_D = 98.6% and P_{FA} = 1.4% for 5 hour test.
Leak rate of 0.1 gph with P_D = 99.7% and P_{FA} = 0.3% for 6 hour test.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank 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.
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 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% for leak rate of 0.2 gph.
Minimum of 4 hours to achieve P_D = 99.9% and P_{FA} = 0.1% for leak rate of 0.2 gph.
Minimum of 5 hours to achieve P_D = 98.6% and P_{FA} = 1.4% for leak rate of 0.1 gph.
Minimum of 6 hours to achieve P_D = 99.7% and P_{FA} = 0.3% for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 #312-9001)

AUTOMATIC TANK GAUGING METHOD

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 = 97.9% and P_{FA} = 2.1%.

Leak Threshold: 0.1 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A tank 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.
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 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 for leak rate of 0.2 gph.
Minimum of 4 hours for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.
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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.

EMS-3500
Liquid Discriminatory Probes Part 301-0635, Containment Sump Probes Part 301-0642,
Tidel Detector #301-0752-001

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type:	qualitative
Sampling frequency:	continuous
Operating principle:	electrical conductivity/hydrocarbon sensitive polymer (Liquid Discriminatory Probes Part 301-0635), magnetic switch/float and hydrocarbon sensitive polymer (Containment Sump Probes Part 301-0642), float switch (Tidel Detector #301-0752-001)

Test Results:

Liquid Discriminatory Probes Part 301-0635	unleaded gasoline	water
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

Containment Sump Probes Part 301-0642		high*	low*
Response time (min)	6.39	4.12	4.76
Recovery time (min)	>60	<1	<1
Product activation height (cm)	2.27	19.22	4.31
Lower detection limit (cm)	2.32	N/A**	4.31

	50% by weight ethylene glycol in water		30% by weight calcium chloride in water	
Tidel Detector #301-0752-001	high	low	high	low
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

*The "high" and "low" refer to high and low level alarm points of hydrostatic sensors.
**See Glossary

Specificity Results (in addition to above for Liquid Discriminatory Probes Part 301-0635 and Containment Sump Probes Part 301-0642):
Activated: synthetic gasoline, diesel, heating oil #2.

Comments:
Liquid Discriminatory Probes Part 301-0635 and Tidel Detector #301-0752-001 are reusable.
Containment Sump Probes Part 301-0642 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 Detector #301-0752-001 is intended to monitor the level of either ethylene glycol or calcium chloride solutions in interstitial or annular space of a double-walled tank. Detector activates an alarm if any significant gain or loss of solution occurs.

Tidel Engineering, Inc.
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Carrollton, TX 75006
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Dates of Evaluation: 01/29/93, 02/17/93, 04/20/93

Tidel Engineering, Inc.

EMS-3500 with
Monitoring Well Probe Part 301-0641, Sheen Probes Part 301-0687, Tidel Detector #301-0762

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: conductivity via resistor ladder network (Monitoring Well Probe Part 301-0641), electrical conductivity/hydrocarbon sensitive polymer (Sheen Probes Part 301-0687 and Tidel Detector #301-0762).

Test Results:

Monitoring Well Probe Part 301-0641	unleaded gasoline	synthetic gasoline
Detection time (min:sec)	0:04	0:07
Fall time (min)	<1	<1
Lower detection limit (cm)	0.32	0.32
Sheen Probes Part 301-0687		
Detection time (min:sec)	7:45	3:35
Fall time (min:sec)	18:01	16:57
Lower detection limit (cm)	0.02	0.04
Tidel Detector #301-0762		
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 (in addition to above):

Activated: n-hexane, diesel, jet-A fuel, JP-4 jet fuel (except Sheen Probes Part 301-0687), toluene, xylene(s).

Comments:

Sensors are reusable.

Tidel Engineering, Inc.
2310 McDaniel Dr.
Carrollton, TX 75006
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Dates of Evaluation: 02/02/93, 01/31/93, 03/18/93

Tidel Engineering, Inc.

Tidel Detector #301-0324-001, #301-0325-001, #301-0326-001, #301-0326-002

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

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

Test Results:

Tidel Detector #301-0324-001, #301-0325-001	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
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
Tidel Detector #301-0326-001, #301-0326-002			
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 (in addition to above):
Activated: n-hexane, diesel, jet-A fuel, toluene, xylene(s).

Manufacturer's specifications:
Tidel Detector #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.
Tidel Detector #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.
Tidel Detector #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.
Tidel Detector #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:
Sensors are reusable.
Lower detection limit has been statistically determined to be within the range specified above.

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
and
EMS-3500
Vapor Sensor Probe Part #301-0634

VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

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

Test Results:

EMS-3000			
301-0328-001, 301-0330-001	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
Detection time (min:sec)	1:31	1:05	1:26
Fall time (min:sec)	5:39	4:23	9:38
Lower detection limit (ppm)	10-100	10-500	10-50
EMS-3500			
Vapor Sensor Probe Part #301-0634			
Detection time (min:sec)	2:46	1:41	1:50
Fall time (hr)*	>1	>1	>1
Lower detection limit (ppm)	100	500	100

* The vapor sensor probe was recalibrated when it did not recover, after 1 hour, from exposure to test vapors.

Specificity Results (in addition to above for EMS-3000 301-0328-001, 301-0330-001):
Activated: toluene, xylene(s)
Not Activated: n-hexane.

Specificity Results (in addition to above for EMS-3500 Vapor Sensor Probe Part No. 301-0634):
Activated: n-hexane, toluene, xylene(s).

Manufacturer's specifications:
EMS-3500 Vapor Sensor Probe Part No. 301-0634 is for use in normally dry monitoring wells to detect hydrocarbon vapors. It 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:
EMS-3000 lower detection limit has been statistically determined to be within the range specified above.

Tidel Engineering, Inc.
2310 McDaniel Dr.
Carrollton, TX 75006
Tel: (800) 678-7577

Evaluator: Radian Corp.
Tel: (512) 454-4797
Dates of Evaluation: 07/08/91, 03/18/93

Tokheim Corp.

Tokheim Pressure Monitor, Models PM 101, 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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other liquids may be tested after consultation with the manufacturer.

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, if necessary, calibrated 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 ALD 2000 Automated Tank Tightness Test

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: A tank system should not be declared tight when tracer chemical or hydrocarbon greater than the background level is detected outside of the tank system.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, waste oil.
Other fluids which are compatible and soluble with an acceptable tracer chemical may be tested after consultation with the manufacturer.

Tank Capacity: Not limited by capacity.

Waiting Time: Ranges from 7 to 30 days (normally 2 weeks) after tracer is added to tank.

Tracer Dosage: Tracer is added to tank manually at tank fill or automatically using a metered injection pump at pipeline flowing into tank.
Manual dosage of tracer is based on tank size, product volume in tank, and frequency and volume of tank refills according to manufacturer's recommendations.
Automated dosage at pipeline flowing into tank is based on pipeline size and flow rate.
All tanks and piping downstream of the injection point are dosed with tracer compound.

Permeability: Soil permeability must readily allow tracer movement through the tank excavation backfill (greater than 1 Darcy).

Probe: Radius of influence of each tracer sampling probe is maximum 10 feet.
All tank surfaces must be within the zone of influence of a sampling probe.
Probes must be installed per Manufacturer's guidelines.

Groundwater: Depth to groundwater in tank excavation backfill must be determined. For test method to detect a release of tracer chemical below groundwater, the hydrostatic pressure of product in the tank must exceed the hydrostatic pressure of groundwater during test. To accomplish this, product level must be maintained at least 6 inches above groundwater for a minimum of 17 hours during the first three days following addition of tracer to the tank.
At the discretion of the regulatory agency, water ingress measuring devices may be used to supplement test method in high groundwater conditions.

Comments: Frozen or saturated soil above bottom of tank may limit effectiveness of this test method.
Groundwater above bottom of tank may limit effectiveness of test method (e.g. when applied to tanks containing water-miscible products or products whose specific gravity is greater than 1).
Test method may not be effective in some tank excavation backfill (such as clay) because it may plug holes in tank and retard tracer movement through the soil.
Third party evaluation of the ALD 2000 System tested the device's ability to collect a sample, transport sample through 2700 feet of 3/32 inch tubing, and analyze sample.
Sample collection, analysis, data storage, and alarm activation is controlled by system's computer.
Prior evaluations tested P_D, P_{FA}, leak threshold, dose, tracer movement through soil, and waiting times.

Tracer Research Corp.
3755 N. Business Center Dr.
Tucson, AZ 85705
Tel: (800) 394-9929

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 10/04/90, 06/19/99
Evaluator: Control Strategies Engineering
Tel: (602) 682-8726
Date of Evaluation: 05/92

Tracer Research Corp.

Tracer ALD 2000 Automated Line Tightness Test

LARGE DIAMETER PIPELINE LEAK DETECTION METHOD

Certification: Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: A pipeline system should not be declared tight when tracer chemical or hydrocarbon greater than the background level is detected outside of the pipeline system.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, waste oil.
Other fluids which are compatible and soluble with an acceptable tracer chemical may be tested after consultation with the manufacturer.

Pipeline Capacity: Not limited by capacity.

Waiting Time: Ranges from 1 week to 4 weeks (normally 2 weeks) after tracer is added to tank.
For very large pipeline systems, several days or weeks may be required to circulate tracer-labeled product through all parts of the pipeline.
Waiting time begins after tracer has reached all portions of the pipeline being tested.

Tracer Dosage: Tracer is added to tank manually or automatically using a metered injection pump at tank fill or tank discharge pipeline.
Tracer-labeled product must be circulated through pipeline before test period begins.
Pressurized pipeline must be brought up to operating pressure or operated on a daily basis.
Manual dosage of tracer is based on tank size, product volume in tank, and frequency and volume of tank refills according to manufacturer's recommendations.
Automated pipeline injection uses metered injection pumps to automatically inject tracer every time product flows through pipeline. Dosage is based on pipeline size and flow rate.

Permeability: Soil permeability must readily allow tracer movement through the tank excavation backfill (greater than 1 Darcy).

Probe: Radius of influence of each tracer sampling probe is maximum 10 feet.
Pipeline must be accurately located to ensure that all pipeline surfaces are within the zone of influence of a sampling probe.
Probes must be installed per manufacturer's guidelines.

Comments: Frozen or saturated soil surrounding pipeline may limit effectiveness of this test method.
Groundwater surrounding pipeline may limit effectiveness of test method (e.g. when applied to pipelines containing water-miscible products or products whose specific gravity is greater than 1).
Test method may not be effective in some tank excavation backfill (such as clay) because it may plug holes in pipeline and retard tracer movement through the soil.
Third party evaluation of the ALD 2000 System tested the device's ability to collect a sample, transport sample through 2700 feet of 3/32 inch tubing, and analyze sample.
Sample collection, analysis, data storage, and alarm activation is controlled by system's computer.
Prior evaluations tested P_D, P_{FA}, leak threshold, dose, tracer movement through soil, and waiting times.

Tracer Research Corp.
3755 N. Business Center Dr.
Tucson, AZ 85705
Tel: (800) 394-9929

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 10/04/91, 06/19/99
Evaluator: Control Strategies Engineering
Tel: (602) 682-8726
Date of Evaluation: 05/92

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%.
Leak rate of 0.005 gph with P_D = 97% and P_{FA} = 2.9%.

Leak Threshold: A pipeline system should not be declared tight when tracer chemical is detected outside of the pipeline.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, waste oil.
Other fluids which are compatible and soluble with an acceptable tracer chemical may be tested after consultation with the manufacturer.

Pipeline Capacity: Not limited by capacity.

Waiting Time: Ranges from 1 week to 4 weeks (normally 2 weeks) after tracer is added to tank.
For very large pipeline systems, several days or weeks may be required to circulate tracer-labeled product through all parts of the pipeline.
Waiting time begins after tracer has reached all portions of the pipeline being tested.

Tracer Dosage: Dosage of tracer is based on tank size, product volume in tank, and frequency and volume of tank refills according to manufacturer's recommendations.
Tracer-labeled product must 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 readily allow tracer movement through the tank excavation backfill (greater than 1 Darcy).

Probe: Radius of influence of each tracer sampling probe is maximum 10 feet.
Pipeline must be accurately located to ensure that all pipeline surfaces are within the zone of influence of a sampling probe.
Probes must be installed per Manufacturer's guidelines.

Comments: Frozen and saturated soil surrounding pipeline may limit effectiveness of this test method.
Groundwater surrounding pipeline may limit effectiveness of test method (e.g. when applied to pipelines containing water-miscible products or products whose specific gravity is greater than 1).

Tracer Research Corp.
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Tel: (800) 394-9929

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 10/04/91
Evaluator: Control Strategies Engineering
Tel: (602) 682-8726
Date of Evaluation: 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 rate of 0.005 gph with P_D = 97% and P_{FA} = 2.9%.

Leak Threshold: A tank system should not be declared tight when tracer chemical is detected outside of the tank system.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, waste oil.
Other fluids which are compatible and soluble with an acceptable tracer chemical may be tested after consultation with the manufacturer.

Tank Capacity: Not limited by capacity.

Waiting Time: Ranges from 7 to 30 days (normally 2 weeks) after tracer is added to tank.

Tracer Dosage: Dosage of tracer is based on tank size, product volume in tank, and frequency and volume of tank refills according to manufacturer's recommendations.

Permeability: Soil permeability must readily allow tracer movement through the tank excavation backfill (greater than 1 Darcy).

Probe: Radius of influence of each tracer sampling probe is maximum 10 feet.
All tank surfaces must be within the zone of influence of a sampling probe.
Probes must be installed per Manufacturer's guidelines.

Groundwater: Depth to groundwater in tank excavation backfill must be determined. For test method to detect a release of tracer chemical below groundwater, the hydrostatic pressure of product in the tank must exceed the hydrostatic pressure of groundwater during test. To accomplish this, product level must be maintained at least 6 inches above groundwater for a minimum 17 hours during the first three days following addition of tracer to the tank. At the discretion of the regulatory agency, water ingress measuring devices may be used to supplement test method in high groundwater conditions.

Comments: Frozen and saturated soil above bottom of tank may limit effectiveness of this test method.
Groundwater above bottom of tank may 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) 394-9929

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 10/04/90
Evaluator: Control Strategies Engineering
Tel: (602) 682-8726
Date of Evaluation: 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)	xylene	benzene	2-methylbutane	unleaded gasoline	chemical tracers
Accuracy (%)	<20	<20	<20	<20	N/R*
Bias (%)	0	0	0	0	N/R
Detection time (sec)	<1	<1	<1	<1	N/R
Fall time (sec)	<1	<1	<1	<1	N/R
Lower detection limit (ppm)	20	20	20	20	N/R
Tracer Detector					
Accuracy (%)	N/R	N/R	N/R	N/R	<20
Bias (%)	N/R	N/R	N/R	N/R	0
Detection time (sec)	N/R	N/R	N/R	N/R	<1
Fall time (sec)	N/R	N/R	N/R	N/R	<1
Lower detection limit (ppm)	N/R	N/R	N/R	N/R	10^{-5}

* See glossary.

Manufacturer's specifications:
Soil permeability at the site must exceed 1 Darcy.

Comments:
System 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) 394-9929

Evaluator: Control Strategies Engineering
Tel: (602) 682-8726
Date of Evaluation: 05/05/92

Training and Services Corp.

AcuRite
(for Fiberglass, Steel and Flexible Pipelines)

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 0.01 gph. A pipeline 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.

Specification: System tests fiberglass, steel and flexible 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 150 gallons.

Waiting Time: Minimum of 6 hours between delivery and testing.
Minimum of 30 minutes between dispensing and testing.

Test Period: Minimum of 30 minutes.
Test data are acquired and recorded manually.
Manual calculations are performed by the operator on site.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Operating instructions include specific procedures for flexible pipelines.
Formerly manufactured by Hasstech

Training and Services Corp.
501 Bains St., Suite 113
Brookshire, TX 77423
Tel: (281) 934-3839

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

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% and P_{FA} = 0%.

Leak Threshold: 0.05 gph. A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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.
2525 W. Burbank Blvd.
Burbank, CA 91505
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 tank 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.
Other liquids may be tested after consultation with the manufacturer.

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 tank excavation 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 in accordance with manufacturer's instructions.

Comments: Manifolded 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 underfill 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 tank excavation 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 tank excavation backfill may help identify presence of this condition.

Triangle Environmental, Inc.
2525 W. Burbank Blvd.
Burbank, CA 91505
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 tank 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).
A tank system should not be declared tight if any water ingress is detected.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, waste oil.

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 when groundwater is below bottom of tank.
When groundwater is above bottom of tank, either of the following water sensors may be used:
TEI System 5000 water sensor
Minimum of 10 minutes (time begins after sensor is set up and calibrated).
Horner EZ-3 conductivity water sensor
Minimum test time must be calculated using Horner EZ-3 operations manual. Calculation is based on tank size, groundwater elevation, and product elevation, but not less than 1 hour.

Test Pressure: Vacuum as directed in operating instructions.
If vacuum cannot be maintained, see manufacturer's instructions.

Temperature: Acoustic signal is independent of product temperature.

Water Sensors: Either Triangle or Horner water sensor must be used to detect water ingress.
TEI System 5000 water sensor
Minimum detectable water level is 0.0532 inch.
Minimum detectable change in water level is 0.00013 inch.
Minimum water level in tank must be adjusted to at least 0.0532 inch at the sensor before starting the test.
Horner EZ-3 conductivity water sensor
Minimum detectable water level is 0.014 inch.
Minimum detectable change in water level is 0.0095 inch.
Minimum water level in tank must be adjusted to at least 0.014 inch at the sensor before starting the test.

Groundwater: Depth to groundwater in tank excavation backfill must be determined. If groundwater is above bottom of tank, either the TEI System 5000 water sensor or the Horner EZY 3 conductivity water sensor must be used and the test time extended to allow sufficient time to ensure water ingress detection during test.

Calibration: Acoustic sensor, and TEI System 5000 water sensor or Horner EZY 3 conductivity water sensor, must be calibrated before each test in accordance with manufacturer's instructions.

Comments: Manifolded 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 air ingress signal.
Noise signals are tape recorded rather that recording the noise levels in decibels.
Vacuum test method may not be effective in some tank excavation 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 tank excavation backfill may help identify presence of this condition.

Triangle Environmental, Inc.
2525 W. Burbank Blvd.
Burbank, CA 91505
Tel: (818) 840-7020

Evaluator: United States Testing Co., Inc.
Tel: (213) 723-7181
Dates of Evaluation: 02/04/93, 01/20/98

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 tank 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 #4.
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 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 system's 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 system's 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 tank excavation 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 in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.
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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 METHOD

Certification: Leak rate of 0.2 gph with P_D = 96.6% and P_{FA} = 3.4%.

Leak Threshold: 0.1 gph. A tank 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 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 minimum 90% full.

Waiting Time: Minimum of 8 hours between delivery and testing.
None 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 microprocessor.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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)

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tanks with PSA of 14,244 ft², leak rate is 1.4 gph with P_D = 97.2% and P_{FA} = 2.8%.
For other tank sizes, leak rate equals [(PSA in ft² ÷ 14,244 ft²) x 1.4 gph].
Example: For a tank with PSA = 20,000 ft²; leak rate = [(20,000 ft² ÷ 14,244 ft²) x 1.4 gph] = 2.0 gph.
Calculated minimum detectable leak rate is 1.18 gph with P_D = 95% and P_{FA} = 5%.
Leak rate may not be scaled below 0.2 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 14,244 ft², leak threshold is 0.7 gph.
For other tank sizes, leak threshold equals [(PSA in ft² ÷ 14,244 ft²) x 0.7 gph].
Example: For a tank with PSA = 20,000 ft²; leak threshold = [(20,000 ft² ÷ 14,244 ft²) x 0.7 gph] = 1.0 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks larger than 50,000 gallons.
Maximum product surface area (PSA) is 35,610 ft² (approximately 213 ft. diameter).
Performance not sensitive to product level.

Waiting Time: Minimum of 3 hours, 42 minutes after delivery. Valve leaks and pump drain-back may mask a leak. Allow sufficient waiting time to minimize these effects.
None between dispensing and testing.

Test Period: Minimum of 49 hours.
There must be no dispensing or delivery during test.

Temperature: Measurement not required by this system.

Water Sensor: None. Water leaks are measured as increase in mass inside tank.

Calibration: Probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: 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.
Evaluated in a nominal 2,000,000 gallon, vertical underground tank with product surface area (PSA) of 14,244 ft².

Universal Sensors and Devices, Inc.
9205 Alabama Ave.
Chatsworth, CA 91311
Tel: (800) 899-7121, (818) 988-7121

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 05/17/96

Universal Sensors and Devices, Inc.

LTC-2000
(Differential Pressure Probe)

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tanks with PSA of 14,244 ft², leak rate is 3.0 gph with P_D = 98.8% and P_{FA} = 1.2%.
For other tank sizes, leak rate equals [(PSA in ft² ÷ 14,244 ft²) x 3.0 gph].
Example: For a tank with PSA = 20,000 ft²; leak rate = [(20,000 ft² ÷ 14,244 ft²) x 3.0 gph] = 4.2 gph.
Calculated minimum detectable leak rate is 2.15 gph with P_D = 95% and P_{FA} = 5%.
Leak rate may not be scaled below 0.2 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 14,244 ft², leak threshold is 0.7 gph.
For other tank sizes, leak threshold equals [(PSA in ft² ÷ 14,244 ft²) x 1.5 gph].
Example: For a tank with PSA = 20,000 ft², leak threshold = [(20,000 ft² ÷ 14,244 ft²) x 1.5 gph] = 2.1 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks larger than 50,000 gallons.
Maximum product surface area (PSA) is 35,610 ft² (approximately 213 ft diameter).
Performance not sensitive to product level.

Waiting Time: Minimum of 3 hours, 30 minutes after delivery. Valve leaks and pump drain-back may mask a leak. Allow sufficient waiting time to minimize these effects.
None between dispensing and testing.

Test Period: Minimum of 48 hours, 18 minutes.
There must be no dispensing or delivery during test.

Temperature: Measurement not required by this system.

Water Sensor: None. Water leaks are measured as increase in mass inside tank.

Calibration: Probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: 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.
Evaluated in a nominal 2,000,000 gallon, vertical underground tank with product surface area (PSA) of 14,244 ft².

Universal Sensors and Devices, Inc.
9205 Alabama Ave.
Chatsworth, CA 91311
Tel: (800) 899-7121, (818) 988-7121

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 with LALS-1Liquid Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:
Output type: qualitative
Sampling frequency: continuous
Operating principle: thermal conductivity

Test Results:

	unleaded gasoline
Response time (min)	1.24
Recovery time (min)	<1
Product activation height (cm)	0.61
Lower detection limit (cm)	0.76

Specificity Results (in addition to above):
Activated: synthetic gasoline, diesel, heating oil #2, water.

Comments:
Sensors are 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 LAV-100, LA-01, LA-02, LA-04, LA-X4, LA-08, CATLAS with
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 gasoline	synthetic gasoline	JP-4jet fuel
Detection time (sec)	31	40	42
Fall time (min:sec)	4:43	4:25	4:30
Lower detection limit (ppm)	100	N/D*	N/D

* See glossary.

Specificity Results (in addition to above):
Activated: n-hexane, toluene, xylene(s).

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

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 tank 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.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 15,000 gallons.

Data Requirement: Minimum of 35 days of product level and flow through data.

Comments: Not evaluated using manifolded 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%.
"If a method meets the requirement for detecting a leak rate of 0.1 gph, it will meet the requirement for 0.2 gph.", according to "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods", EPA/530/UST-90/007, June 1990, Section 7.2.3, page 30.

Leak Threshold: 0.1 gph. A tank 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.
Other more viscous liquids may be tested after consultation with the vendor.

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 manifolded 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 > 99% and P_{FA} < 1.0%.
"If a method meets the requirement for detecting a leak rate of 0.1 gph, it will meet the requirement for 0.2 gph.", according to "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods", EPA/530/UST-90/007, June 1990, Section 7.2.3, page 30.

Leak Threshold: 0.05 gph. A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

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 manifolded 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 Versions 95.2, 95.2A, 95.2B

STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

Certification: Leak rate of 0.1 gph with P_D > 99.2% and P_{FA} < 0.08% (Version 95.2).
Leak rate of 0.2 gph with P_D > 99.9% and P_{FA} < 0.1% (Version 95.2A).
Leak rate of 0.2 gph with P_D > 97.2% and P_{FA} < 0.1% (Version 95.2B).

Leak Threshold: 0.05 for leak rate of 0.1 gph (Version 95.2).
0.1 for leak rate of 0.2 gph (Version 95.2A).
0.16 for leak rate of 0.2 gph (Version 95.2B).
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 60,000 gallons for single tanks.
Maximum of 60,000 gallons cumulative capacity for manifolded tank systems with no more than 4 tanks in system.

Data Requirement: Minimum of 30 days of product level and flow through data.

Comments: 44% of data sets evaluated were from manifolded 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 15,483 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, 07/21/00

Vaporless Manufacturing

Vaporless LD-2100 or PLC-5000 with 98LD-2000PLC
(for Rigid and Flexible Pipelines)

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.5 gph for leak rate of 3.0 gph.
0.136 gph for leak rate of 0.2 gph.
0.068 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests pressurized flexible, fiberglass and steel pipelines.
Tests are conducted at operating pressure.

Pipeline Capacity: Maximum of 172 gallons for rigid pipelines.
Maximum of 39.5 gallons for flexible pipelines.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Response time is less than 8 minutes for leak rate of 3.0 gph.
Response time is 1 hour, 48 minutes to 10 hours, 54 minutes for leak rates of 0.2 and 0.1 gph.

System Features: Permanent installation on pipeline.
Automatic testing of pipeline.
Preset threshold.
Single test to determine if pipeline is leaking.
LD-2100 is a stand alone system. PLC-5000 must be coupled with the 98LD-2000.
Pump shutdown, message display and alarm activation if leak is declared.

Calibration: System must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Vaporless Manufacturing
8700 East Long Mesa Drive
Prescott Valley, AZ 86314
Tel: (520) 775-0185

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 05/20/98, 11/10/98

Vaporless Manufacturing

Vaporless LD-2000, 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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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, if necessary, calibrated in accordance with manufacturer's instructions.

Vaporless Manufacturing
8700 East Long Mesa Drive
Prescott Valley, AZ 86314
Tel: (520) 775-0185

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 11/19/90

Vaporless Manufacturing

Vaporless LD-2000E, 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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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, if necessary, calibrated 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
8700 East Long Mesa Drive
Prescott Valley, AZ 86314
Tel: (520) 775-0185

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 12/11/92

Vaporless Manufacturing

Vaporless LD-2000T, 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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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, if necessary, calibrated in accordance with manufacturer's instructions.

Vaporless Manufacturing
8700 East Long Mesa Drive
Prescott Valley, AZ 86314
Tel: (520) 775-0185

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 07/13/93

Vaporless Manufacturing

Vaporless 98LD-2000, 99LD-2000, 99LD-2200, LD-2200 Scout
(for Rigid and Flexible Pipelines)

AUTOMATIC MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.5 gph. A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests pressurized flexible, fiberglass, and steel pipelines.
Tests are conducted at operating pressure.

Pipeline Capacity: Maximum of 172 gallons for rigid pipelines.
Maximum of 39.5 gallons for flexible pipelines.

Waiting Time: None between dispensing and testing.
None between delivery and testing.

Test Period: Response time is less than 1 minute without a leak and 1 to 8 minutes with a leak.

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, if necessary, calibrated in accordance with manufacturer's instructions.

Vaporless Manufacturing
8700 East Long Mesa Drive
Prescott Valley, AZ 86314
Tel: (520) 775-0185

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 05/20/98, 11/10/98

Vaporless Manufacturing

Vaporless LD-3000, 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 pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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, if necessary, calibrated in accordance with manufacturer's instructions.

Vaporless Manufacturing
8700 East Long Mesa Drive
Prescott Valley, AZ 86314
Tel: (520) 775-0185

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 08/20/93

Veeder-Root

TLS-350, 350PC, 350R, 350RPC, 350Plus 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 rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.5 gph for leak rate of 3.0 gph.
0.1 gph for leak rate of 0.2 gph.
0.079 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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 system's computer.

Test Period: Response time is 14 seconds for leak rate of 3.0 gph.
Response time is 6 minutes for leak rate of 0.2 gph.
Response time is 14 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated 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
Date of Evaluation: 09/20/91
Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 04/12/93

Veeder-Root

TLS-350, 350PC, 350R, 350RPC, 350Plus 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 rate of 0.2 gph with P_D = 96% and P_{FA} = 4%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.5 gph for leak rate of 3.0 gph.
0.1 gph for leak rate of 0.2 gph.
0.079 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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 system's computer.

Test Period: Response time is 1 minute for leak rate of 3.0 gph.
Response time is 45 minutes to 8 hours, 51 minutes for leak rate of 0.2 gph
Response time is 1 hour, 12 minutes to 12 hours, 54 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated in accordance with manufacturer's instructions.

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-2003
Tel: (860) 651-2700

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 08/04/93

Veeder-Root

TLS 350, 350PC, 350R, 350RPC, 350Plus Line Leak Detector, Series 8484

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.88 gph for leak rate of 3.0 gph.
0.17 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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 for leak rate of 3.0 gph.
Minimum of 45 minutes to 1 hour between dispensing and testing for leak rate of 0.2 gph.
Minimum of 2 hours, 30 minutes between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is 28.8 seconds for leak rate of 3.0 gph.
Response time is 32 to 48 minutes for leak rate of 0.2 gph.
Response time is 18 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated 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
Date of Evaluation: 08/07/91, 12/18/96

Veeder-Root

TLS 350, 350PC, 350R, 350RPC, 350Plus, LLD-300 Line Leak Detector, Series 8484
(for Flexible Pipelines)

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 1.5 gph for leak rate of 3.0 gph.
0.17 gph for leak rate of 0.2 gph.
0.05 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests pressurized flexible pipelines.
Tests are conducted at 10 psi for leak rate of 3.0 gph.
Tests are conducted at 30 psi for leak rate of 0.2 gph.
Tests are conducted at operating pressure equivalent to 45 psi line for leak rate of 0.1 gph.
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 for leak rate of 3.0 gph.
Minimum of 4 minutes to 1 hour, 9 minutes between dispensing and testing for leak rate of 0.2 gph.
Minimum of 1 to 4 hours between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is 1 to 6 minutes for leak rate of 3.0 gph.
Response time is 40 minutes to 1 hour for leak rate of 0.2 gph.
Response time is 45 minutes to 1 hour, 15 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated 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
Date of Evaluation: 10/16/95, 01/31/97

Veeder-Root

TLS 350, 350PC, 350R, 350 RPC, 350Plus, LLD-300 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 rate of 0.2 gph with P_D = 100% and P_{FA} = 0%.
Leak rate of 0.1 gph with P_D = 100% and P_{FA} = 0%.

Leak Threshold: 2.5 gph for leak rate of 3.0 gph.
0.17 gph for leak rate of 0.2 gph.
0.09 gph for leak rate of 0.1 gph.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds this threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

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 for leak rate of 3.0 gph.
Minimum of 45 minutes between dispensing and testing for leak rate of 0.2 gph.
Minimum of 2 hours between dispensing and testing for leak rate of 0.1 gph.

Test Period: Response time is less than 1 minute for leak rate of 3.0 gph.
Response time is 30 to 45 minutes for leak rate of 0.2 gph.
Response time is 32 to 48 minutes for leak rate of 0.1 gph.
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, if necessary, calibrated 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
Date of Evaluation: 05/08/96

Veeder-Root

TLS-200, 200i, 250i, 300, 300C, 300i, 350, 350PC, 350R, 350RPC, 350Plus UST ATGS
(Model 7842 Digital Sensing Capacitance Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99% and P_{FA} = 1%.

Leak Threshold: 0.1 gph. A tank 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 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 8 hours, 18 minutes between delivery and testing.
There must be no dispensing or delivery during waiting time.

Test Period: Minimum of 5 hours.
Test data are acquired and recorded by 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 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 change in water level is 0.040 inch.

Calibration: Temperature averaging probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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, 350Plus UST ATGS (Model 8472 Digital Sensing Capacitance Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99% and P_{FA} = 0.2%.
Leak rate of 0.1 gph with P_D = 99% and P_{FA} = 0.1%.

Leak Threshold: 0.126 gph for leak rate of 0.2 gph.
0.071 gph for leak rate of 0.1 gph.
A tank 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 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 for leak rate of 0.2 gph.
Tank must be minimum 95% full for leak rate of 0.1 gph.

Waiting Time: Minimum of 8 hours, 18 minutes between delivery and testing for leak rate of 0.2 gph.
There must be no dispensing or delivery during waiting time for leak rate of 0.2 gph.
Minimum of 8 hours, 15 minutes between delivery and testing for leak rate of 0.1 gph.
Minimum of 30 minutes between dispensing and testing for leak rate of 0.1 gph.
There must be no delivery during waiting time for leak rate of 0.1 gph.

Test Period: Minimum of 2 hours.
Test data are acquired and recorded by 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 checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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, 350Plus UST ATGS
(Model 8473 Digital Sensing Magnetostrictive Probe)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 99% and P_{FA}= 0.1%.
Leak rate of 0.1 gph with P_D = 99% and P_{FA}= 1%.

Leak Threshold: 0.093 gph for leak rate of 0.2 gph.
0.071 gph for leak rate of 0.1 gph.
A tank 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 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 for leak rate of 0.2 gph.
Tank must be minimum 95% full for leak rate of 0.1 gph.

Waiting Time: Minimum of 8 hours, 18 minutes between delivery and testing for leak rate of 0.2 gph.
Minimum of 8 hours, 15 minutes between delivery and testing for leak rate of 0.1 gph.
Minimum of 30 minutes between dispensing and testing.
There must be no delivery during waiting time.

Test Period: Minimum of 2 hours for leak rate of 0.2 gph.
Minimum of 3 hours for leak rate of 0.1 gph.
Test data are acquired and recorded by 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 0.544 inch.
Minimum detectable change in water level is 0.027 inch.

Calibration: Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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, 03/14/95

Veeder-Root

TLS-250, 250i, 300, 300C, 300i, 300PC, 350, 350PC, 350R, 350RPC, 350Plus UST ATGS (Models 8473, 8493 Magnetostrictive Probes)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 98.9% and P_{FA} = 0.3%.
Leak rate of 0.1 gph with P_D = 95.8% and P_{FA} = 0.9%.

Leak Threshold: 0.126 gph for leak rate of 0.2 gph.
0.071 gph for leak rate of 0.1 gph.
A tank 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 with known coefficients of expansion and density 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 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 tank diameters, see evaluation report.

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 for leak rate of 0.2 gph.
Minimum of 3 hours for leak rate of 0.1 gph.
Test data are acquired and recorded by 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 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-7684
Tel: (860) 651-2700

Evaluator: Midwest Research Institute
Tel: (816) 753-7600
Date of Evaluation: 09/04/97, 07/01/98

Veeder-Root

TLS Series 300, 350, 350R, 350Plus
(Models 8463, 8473, 8493 Magnetostrictive Probes)

AUTOMATIC TANK GAUGING METHOD

Certification:
Leak rate of 0.2 gph with P_D = 99.5% and P_{FA} = 1.6% for 2 hour test.
Leak rate of 0.1 gph with P_D = 96.0% and P_{FA} = 3.4% for 5 hour test.
Leak rate of 0.1 gph with P_D = 96.2% and P_{FA} = 2.2% for 4 hour test.
Leak rate of 0.1 gph with P_D = 96.4% and P_{FA} = 1.5% for 3 hour test.
Leak rate of 0.1 gph with P_D = 97.3% and P_{FA} = 2.3% for 2 hour test.

Leak Threshold:
0.126 gph for leak rate of 0.2 gph.
0.071 gph for leak rate of 0.1 gph.
A tank 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 with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity:
Maximum of 20,000 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";
132" dia/min 39". For other tank diameters, see evaluation report.

Waiting Time:
Minimum of 8 hours between delivery and testing for 2 hour test and leak rate of 0.2 gph
Minimum of 8 hours between delivery and testing for 5 hour test and leak rate of 0.1 gph.
Minimum of 9 hours between delivery and testing for 4 hour test and leak rate of 0.1 gph.
Minimum of 10 hours between delivery and testing for 3 hour test and leak rate of 0.1 gph.
Minimum of 11 hours between delivery and testing for 2 hour test and leak rate of 0.1 gph.
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 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 probe which contains 5 thermistors.
At least two thermistors must be submerged in product during test.

Water Sensor:
Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.66 inch.
System is programmed to report water depth only when it exceeds 0.75 inch.
Minimum detectable change in water level is 0.005 inch for leak rate of 0.2 gph.
Minimum detectable change in water level is 0.027 inch for leak rate of 0.1 gph.

Calibration:
Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments:
Not evaluated using manifolded 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.

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-7684
Tel: (860) 651-2700

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 06/29/98

Veeder-Root

TLS Series 300, 350, 350R, 350Plus
(Models 8463, 8473, 8493 Magnetostrictive Probes)

AUTOMATIC TANK GAUGING METHOD

Certification: Leak rate of 0.2 gph with P_D = 95.6% and P_{FA} = 0.3%.

Leak Threshold: 0.126 gph. A tank 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 with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 30,000 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"; **132"** dia/min 39". For other tank diameters, see evaluation report.

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 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 probe which contains 5 thermistors.
At least two thermistors must be submerged in product during test.

Water Sensor: Must be used to detect water ingress.
Minimum detectable water level in the tank is 0.66 inch.
System is programmed to report water depth only when it exceeds 0.75 inch.
Minimum detectable change in water level is 0.005 inch.

Calibration: Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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.

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-7684
Tel: (860) 651-2700

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 08/14/98

Veeder-Root

TLS-300i, 300J, 350, 350R, 350Plus Monitoring Systems with CSLD (Models 8473, 8493 Magnetostrictive Probes)

CONTINUOUS IN-TANK LEAK DETECTION METHOD

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 manifolded tank systems at 99% operating mode.
A tank 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.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

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 stabilization time is allowed between delivery and data collection.

Test Period: Data collection time ranges from 5 to 28 days.
Data sampling frequency is every 1 to 4 seconds.
System collects data at naturally occurring product levels without interfering with normal tank operation, and discards data from unstable periods when system performs 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 0.54 inch.
Minimum detectable change in water level is 0.027 inch.

Calibration: Thermistors and probe must be checked annually and, if necessary, calibrated 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 manifolded tank systems.
System distinguishes large leak rates (> 1gph) from dispensing activities and reports those as "fail" or as “no idle.”
For valid monthly testing, a conclusive test report must be produced for each tank every month.
System warns 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.
Constant and variable leaks were mathematically induced into tight tank test records which were collected by systems installed at various active tank sites.
The database 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

ILS-250, ILS-350, TLS-250i, 250i Plus, 300, 300C, 300i, 300PC, TLS-350 Series with
Interstitial Liquid Sensor for Fiberglass Tanks 0794390-401, 404, 407, 409,
Interstitial Liquid Sensor for Steel Tanks 0794390-420, 460,
Liquid Sensor for Sumps 0794390-206

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

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

Test Results:

	unleaded gasoline*	synthetic gasoline**
Interstitial Liquid Sensor for Fiberglass Tanks 0794390-401, 404, 407, 409		
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
Interstitial Liquid Sensor for Steel Tanks 0794390-420, 460		
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
Liquid Sensor for Sumps 0794390-206		
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

* ILS-250, TLS-250i, 250i Plus
** ILS-350, TLS-350 Series

Specificity Results (in addition to above):

Activated: diesel, heating oil #2, water.

Comments:

Sensors are 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-350 Series with
Interstitial Liquid Sensor 794380-341,
Dispenser Pan Sensor 794380-320,
Discriminating Containment Sump Sensor 794380-350,
Discriminating Fibretrench Sensor 794380-360, 361, 362

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type:	qualitative
Sampling frequency:	continuous
Operating principle:	capacitance change/ultrasonic (794380-341), electrical conductivity/ultrasonic (794380-320, 350, 360, 361, 362)

Test Results:

Interstitial Liquid Sensor 794380-341	unleaded gasoline	diesel	water
Response time (min)	<1	<1	<1
Recovery time (min)	<1	<1	<1
Product activation height (cm)	<0.125	<0.125	<0.125

Dispenser Pan Sensor 794380-320, Containment Sump Sensor 794380-350, Discriminating Fibertrench Sensor 794380-360, 361, 362		high*	low*
Response time (min)	6.59	5.00	4.60
Recovery time (min)	17.17	<1	<1
Product activation height (cm)	3.40	20.3	2.45

*The "high" and "low" refer to high and low level alarm points of hydrostatic sensors.

Specificity Results (in addition to above for 794380-341):
This sensor will respond to any liquid after its threshold is exceeded.

Specificity Results (in addition to above for 794380-320, 350):
Activated: diesel (at liquid height of 4.75 cm), synthetic fuel (at 2.58 cm), heating oil #2 (at 4.67 cm).

Comments:
Interstitial Liquid Sensor 794380-341 was listed as a discriminating sensor in the 7th edition of this list. However, the vendor has since indicated that the sensor is sometimes unable to determine if the liquid is product or water and the sensor was re-evaluated as a non-discriminating liquid sensor. Therefore, all alarms initiated by any new or existing Interstitial Liquid Sensor 794380-341 should be treated as a liquid alarm indicating product and/or water. This may make it necessary to reprogram previously installed systems.
For Discriminating Fibertrench Sensor 794380-360, lowest water level detection and alarm activation is set at 23 inches high and highest water alarm is set at 25 inches high; for 794380-361, values are 13 inches and 16 inches; for 794380-362, values are 3 inches and 12 inches, (based on manufacturer's specifications).
Sensors are 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: 06/30/93, 05/26/93, 06/30/97
Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 11/01/00

Veeder-Root

TLS-350 Series, TLS-300, 300i with
Discriminating Dispenser Pan Sensor 794380-322,
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:

	polymer strip		float switch water	
Discriminating Containment Sump Sensor 794380-322	unleaded gasoline	diesel	high*	low*
Response time (sec)	~10 min	2-12 hrs	<1	<1
Recovery time (sec)	17.2 min	N/A**	<1	<1
Lower detection limit - height (cm)	N/D**	N/D	31.2	3.48
Lower detection limit - thickness (cm)	0.0127	0.0127	N/A	N/A
Discriminating Dispenser Pan Sensor 794380-352				
Response time (sec)	~10 min	2-12 hrs	<1	<1
Recovery time (sec)	17.2 min	N/A	<1	<1
Lower detection limit - height (cm)	N/D	N/D	19.4	3.43
Lower detection limit - thickness (cm)	0.0127	0.0127	N/A	N/A

*The "high" and "low" refer to high and low level alarm points of float switch sensors.
** See glossary.

Specificity Results (in addition to above):

Activated: synthetic gasoline, jet-A fuel, n-hexane, toluene, xylene(s)
Not activated: water (polymer strip only)

Comments:

Polymer strip must be air dried after exposure to unleaded fuel. Polymer strips must be cleaned with solvent and dried after exposure to diesel.

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-2003
Tel: (860) 651-2700

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluation: 01/02/95, 06/23/97, 04/20/98

Veeder-Root

Dispenser Pan Sensor 847990-001 and Differentiating Dispenser Pan Sensor 847990-002 with Dispenser Control Interface

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:
Output type: qualitative
Sampling frequency: continuous
Operating principle: product permeable, reed switch/float

Test Results:

	polymer strip		float switch
Dispenser Pan Sensor 847990-001	unleaded gasoline	diesel	water
Detection time (sec)	<1	<1	<1
Minimum product level (in)	1.71	1.66	1.62
Precision (in)	0.006	0.004	0.008
Differentiating Dispenser Pan Sensor 847990-002			
Minimum product thickness (in)	0.06	0.06	N/A*
Minimum product level (in)	0.03	0.06	6.39
Precision (in)	N/A**	N/A**	0.008
Detection time (min:sec)	06:30	19:50	<00:01

*See glossary.
**Tested at discrete levels only.

Specificity Results (in addition to above):
Activated: synthetic gasoline, n-hexane, toluene, xylene(s)
Not activated: water (polymer strip only)

Comments:
Sensors are 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) 443-2494
Dates of Evaluation: 11/15/93, 11/02/98

Veeder-Root

TLS-350 Series, TLS-300, 300I with
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	
	high*	low*	high	low
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

*The "high" and "low" refer to high and low level alarm points of hydrostatic sensors.

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.
Sensors are reusable.

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Evaluator: Carnegie Mellon Research Institute
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Dates of Evaluation: 12/07/92, 03/16/98

Veeder-Root

TLS-300C, 300i, 300PC, 350, 350PC, 350R, 350RPC with
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:

Piping Sump Sensor 794380-208, 209	unleaded gasoline	diesel	water
Minimum product level (cm)	3.51	3.40	3.03
Precision (cm)	0.011	0.011	0.011
Detection time (sec)	<1	<1	<1
Solid-State Pan/Sump Sensor 794380-321, 351			
Minimum product thickness (cm)	2.60	2.50	2.60
Precision (cm)	0.010	0.010	0.010
Detection time (sec)	<1	<1	<1
Micro Sensor 794380-340			
Minimum product thickness (cm)	0.51	0.46	0.48
Precision (cm)	0.011	0.007	0.007
Detection time (sec)	<1	<1	<1

Comments:

Sensors are reusable.
208 and 209 sensors are also compatible with 300 series.

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Date of Evaluation: 10/20/94

Veeder-Root

350 Series UST Monitoring Systems
Models ILS-350, TLS-350, 350R, 350PC, 350RPC with
Groundwater Sensors 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 gasoline	synthetic gasoline
Detection time (min:sec)	8:55	6:18
Fall time (min:sec)	54:50	26:02
Lower detection limit (cm)	0.02	0.02

Specificity Results (in addition to above):
Activated: n-hexane, diesel, jet-A fuel, toluene, xylene(s).

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

Comments:
Sensors are reusable.

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Evaluator: Carnegie Mellon Research Institute
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Dates of Evaluation: 11/20/91, 07/28/92

Veeder-Root

ILS-350, TLS-350 Series with
Adsistor Vapor Probe 794390-700

VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

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

Test Results:

	unleaded gasoline	synthetic gasoline	JP-4 jet fuel
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:
Not Activated: n-hexane, toluene, xylene(s).

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Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Date of Evaluation: 07/24/92

Vista Research, Inc. and Naval Facilities Engineering Service Center

LRDP-24 (V1.0.2, V1.0.3)

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft², leak rate is 2.0 or 3.0 gph with P_D = 95% and P_{FA} < 0.001%. Choose one to determine the scaled leak rate and scaled leak threshold for the tank being monitored.
For other tank sizes, scaled leak rate equals [(PSA in ft² ÷ 6,082 ft²) x (leak rate in gph)].
Example: For a tank with PSA = 10,000 ft², leak rate = 2.0 gph; scaled leak rate = [(10,000 ft² ÷ 6,082 ft²) x 2.0 gph] = 3.29 gph.
Calculated minimum detectable leak rate is 0.446 gph with P_D = 95% and P_{FA} = 5%.
Leak rate may not be scaled below 0.2 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft² and leak rate of 2.0 or 3.0 gph, leak threshold is 1.777 or 2.77gph respectively.
For other tank sizes, scaled leak threshold equals [(PSA in ft² ÷ 6,082 ft²) x (leak rate in gph - 0.223 gph)].
Example: For a tank with PSA = 10,000 ft², leak rate = 2.0 gph; scaled leak threshold = [(10,000 ft² ÷ 6,082 ft²) x (2.0 gph - 0.223 gph)] = 2.92 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks larger than 50,000 gallons.
Maximum product surface area (PSA) is 15,205 ft² (approximately 139 ft diameter).
Performance not sensitive to product level.

Waiting Time: Minimum of 24 hours after delivery or dispensing.
Valve leaks and pump drain-back may mask a leak. Allow sufficient waiting time to minimize these effects.
Waiting times during evaluation ranged from 16.08 to 115.8 hours.

Test Period: Minimum of 24 hours.
There must be no dispensing or delivery during test.

Temperature: Measurement not required by this system.

Water Sensor: None. Water leaks are measured as increase in mass inside tank.

Calibration: Differential pressure sensor must be checked regularly in accordance with manufacturer's instructions.

Comments: 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.
Evaluated in a nominal 600,000 gallon, vertical underground tank with product surface area (PSA) of 6,082 ft².
Not evaluated as a stand alone system.
Significant bias of 0.103 gph was detected during the evaluation. Evaluator believes this bias was the result of product inflow into the tank from valve leaks and product drain back from the pump return line and thus evaluator did not use this bias in calculating above results.
Performance of the system can be improved by combining results of 2 or more tests. If this option is used, it is important to determine the number of tests, their timing and the number of passing results necessary to confirm a tank is tight. The LRDP-24-5 (V1.0) combines the results of 5 tests and is one evaluated option to improve the performance of this system.

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Date of Evaluation: 01/29/99

Vista Research, Inc. and Naval Facilities Engineering Service Center

LRDP-48 (V1.0.2, V1.0.3)

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft², leak rate is 2.0 or 3.0 gph with P_D = 95% and P_{FA} < 0.001%. Choose one to determine the scaled leak rate and scaled leak threshold for the tank being monitored.
For other tank sizes, scaled leak rate equals [(PSA in ft² ÷ 6,082 ft²) x (leak rate in gph)].
Example: For a tank with PSA = 10,000 ft², leak rate = 2.0 gph; scaled leak rate = [(10,000 ft² ÷ 6,082 ft²) x 2.0 gph] = 3.29 gph.
Calculated minimum detectable leak rate is 0.376 gph with P_D = 95% and P_{FA} = 5%.
Leak rate may not be scaled below 0.2 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft² and leak rate of 2.0 or 3.0 gph, leak threshold is 1.812 or 2.812 gph respectively.
For other tank sizes, scaled leak threshold equals [(PSA in ft² ÷ 6,082 ft²) x (leak rate in gph - 0.188 gph)].
Example: For a tank with PSA = 10,000 ft², leak rate = 2.0 gph; scaled leak threshold = [(10,000 ft² ÷ 6,082 ft²) x (2.0 gph - 0.188 gph)] = 2.98 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks larger than 50,000 gallons.
Maximum product surface area (PSA) is 15,205 ft² (approximately 139 ft diameter).
Performance not sensitive to product level.

Waiting Time: Minimum of 24 hours after delivery or dispensing.
Valve leaks and pump drain-back may mask a leak. Allow sufficient waiting time to minimize these effects.
Waiting times during evaluation ranged from 16.08 to 115.8 hours.

Test Period: Minimum of 48 hours.
There must be no dispensing or delivery during test.

Temperature: Measurement not required by this system.

Water Sensor: None. Water leaks are measured as increase in mass inside tank.

Calibration: Differential pressure sensor must be checked regularly in accordance with manufacturer's instructions.

Comments: 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.
Evaluated in a nominal 600,000 gallon, vertical underground tank with product surface area (PSA) of 6,082 ft².
Not evaluated as a stand alone system.
Significant bias of 0.078 gph was detected during the evaluation. Evaluator believes this bias was the result of product inflow into the tank from valve leaks and product drain back from the pump return line and thus evaluator did not use this bias in calculating above results.
Performance of the system can be improved by combining results of 2 or more tests. If this option is used, it is important to determine the number of tests, their timing and the number of passing results necessary to confirm a tank is tight. The LRDP-48-4 (V1.0) combines the results of 4 tests and is one evaluated option to improve the performance of this system.

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Vista Research, Inc. and Naval Facilities Engineering Service Center

LRDP-24 (V1.1)

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft², leak rate is 0.856 gph with P_D = 95% and P_{FA} = 0.017%.
For other tank sizes, leak rate equals [(PSA in ft² ÷ 6,082 ft²) x 0.856 gph].
Example: For a tank with PSA = 10,000 ft²; leak rate = [(10,000 ft² ÷ 6,082 ft²) x 0.856 gph] = 1.407 gph.
Calculated minimum detectable leak rate is 0.446 gph with P_D = 95% and P_{FA} = 5%.
Leak rate may not be scaled below 0.2 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft², leak threshold is 0.632 gph.
For other tank sizes, leak threshold equals [(PSA in ft² ÷ 6,082 ft²) x 0.632 gph].
Example: For a tank with PSA = 10,000 ft²; leak threshold = [(10,000 ft² ÷ 6,082 ft²) x 0.632 gph] = 1.039 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks larger than 50,000 gallons.
Maximum product surface area (PSA) is 15,205 ft² (approximately 139 ft diameter).
Performance not sensitive to product level.

Waiting Time: Minimum of 24 hours after delivery or dispensing.
Valve leaks and pump drain-back may mask a leak. Allow sufficient waiting time to minimize these effects.
Waiting times during evaluation ranged from 16.08 to 115.8 hours.

Test Period: Minimum of 24 hours.
There must be no dispensing or delivery during test.

Temperature: Measurement not required by this system.

Water Sensor: None. Water leaks are measured as increase in mass inside tank.

Calibration: Differential pressure sensor must be checked regularly in accordance with manufacturer's instructions.

Comments: 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.
Evaluated in a nominal 600,000 gallon, vertical underground tank with product surface area (PSA) of 6,082 ft².
Not evaluated as a stand alone system.
Significant bias of 0.103 gph was detected during the evaluation. Evaluator believes this bias was the result of product inflow into the tank from valve leaks and product drain back from the pump return line and thus evaluator did not use this bias in calculating above results.
Performance of the system can be improved by combining results of 2 or more tests. If this option is used, it is important to determine the number of tests, their timing and the number of passing results necessary to confirm a tank is tight. The LRDP-24-5 (V1.1) combines the results of 5 tests and is one evaluated option to improve the performance of this system.

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Vista Research, Inc. and Naval Facilities Engineering Service Center

LRDP-48 (V1.1)

BULK FIELD-CONSTRUCTED TANK LEAK DETECTION METHOD

Certification: Leak rate is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft², leak rate is 0.749 gph with P_D = 95% and P_{FA} = 0.012%.
For other tank sizes, leak rate equals [(PSA in ft² ÷ 6,082 ft²) x 0.749 gph].
Example: For a tank with PSA = 10,000 ft²; leak rate = [(10,000 ft² ÷ 6,082 ft²) x 0.749 gph] = 1.232 gph.
Calculated minimum detectable leak rate is 0.376 gph with P_D = 95% and P_{FA} = 5%.
Leak rate may not be scaled below 0.2 gph.

Leak Threshold: Leak threshold is proportional to product surface area (PSA).
For tanks with PSA of 6,082 ft², leak threshold is 0.563 gph.
For other tank sizes, leak threshold equals [(PSA in ft² ÷ 6,082 ft²) x 0.563 gph].
Example: For a tank with PSA = 10,000 ft²; leak threshold = [(10,000 ft² ÷ 6,082 ft²) x 0.563 gph] = 0.926 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds the calculated leak threshold.

Applicability: Gasoline, diesel, aviation fuel.
Other liquids may be tested after consultation with the manufacturer.

Tank Capacity: Use limited to single field-constructed vertical tanks larger than 50,000 gallons.
Maximum product surface area (PSA) is 15,205 ft² (approximately 139 ft diameter).
Performance not sensitive to product level.

Waiting Time: Minimum of 24 hours after delivery or dispensing.
Valve leaks and pump drain-back may mask a leak. Allow sufficient waiting time to minimize these effects.
Waiting times during evaluation ranged from 16.08 to 115.8 hours.

Test Period: Minimum of 48 hours.
There must be no dispensing or delivery during test.

Temperature: Measurement not required by this system.

Water Sensor: None. Water leaks are measured as increase in mass inside tank.

Calibration: Differential pressure sensor must be checked regularly in accordance with manufacturer's instructions.

Comments: 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.
Evaluated in a nominal 600,000 gallon, vertical underground tank with product surface area (PSA) of 6,082 ft².
Not evaluated as a stand alone system.
Significant bias of 0.078 gph was detected during the evaluation. Evaluator believes this bias was the result of product inflow into the tank from valve leaks and product drain back from the pump return line and thus evaluator did not use this bias in calculating above results.
Performance of the system can be improved by combining results of 2 or more tests. If this option is used, it is important to determine the number of tests, their timing and the number of passing results necessary to confirm a tank is tight. The LRDP-24-5 (V1.1) combines the results of 5 tests and is one evaluated option to improve the performance of this system.

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Date of Evaluation: 01/29/99

Vista Research, Inc.

Model HT-100 Monitoring Method and Line Tightness Test Method
Version 1.0, Version 1.1

LARGE DIAMETER PIPELINE LEAK DETECTION METHOD

Certification: Leak rate of 0.004% of line capacity in gph with P_D = 95% and P_{FA} = 1.25% for Version 1.0, (smallest leak rate for Version 1.0 evaluation, which was conducted on a 306,477 gallon line at 160 psi, was 12.3 gph).
Leak rate of 0.00209% of line capacity in gph with P_D = 95% and P_{FA} = 5% for Version 1.1, (smallest leak rate for Version 1.1 evaluation, which was conducted on a 306,477 gallon line at 160 psi, was 6.42 gph).

Leak Threshold: 0.00282% of line volume in gph for Version 1.0.
0.000916% of line volume in gph for Version 1.1
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds these thresholds.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests fiberglass or steel piping.
Tests are conducted at operating pressure to a maximum of 200 psi.

Pipeline Capacity: Maximum of 612,954 gallons.
Minimum of 3,000 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Minimum of 3 hours, 10 minutes 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 monitoring, or may be transported and set up to perform line tightness testing.
A single 3-hour 10-minute test is required consisting of a 1-hour 10-minute monitoring period at operating pressure, and a 2-hour monitoring period at atmospheric pressure.
System measures change in volume and reports output quantity in gph, while compensating for thermal effects.
Printed message and alarm activation if leak is declared.

Calibration: System must be calibrated in accordance with manufacturer's instructions.

Comments: System is to be used only on large bulk pipelines and airport hydrant fueling systems.
This evaluation utilized a total of 87 tests, one with induced leak rate of 13.1 gph.

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Date of Evaluation: 11/06/98

Vista Research, Inc.

Model HT-100-n Monitoring Method and Line Tightness Test Method
Version 1.0, Version 1.1

LARGE DIAMETER PIPELINE LEAK DETECTION METHOD

Certification: Leak rate of 0.004% ÷ √(n) of line capacity in gph with P_D = 95% and P_{FA} = 1.25% for Version 1.0, where n is the number of tests averaged together (smallest leak rate for Version 1.0 evaluation, which was conducted on a 306,477 gallon line at 160 psi where n = 3, was 7.08 gph).

Leak rate of 0.00209%÷ √(n) of line capacity in gph with P_D = 95% and P_{FA} = 5% for Version 1.1, where n is the number of tests averaged together (smallest leak rate for Version 1.1 evaluation, which was conducted on a 306,477 gallon line at 160 psi where n = 3, was 3.71 gph).

Leak Threshold: 0.00282% ÷ √(n) of line volume in gph for Version 1.0.

0.000916% ÷ √(n) of line volume in gph for Version 1.1.
A pipeline system should not be declared tight if the test result indicates a loss that equals or exceeds these thresholds.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.
Other liquids may be tested after consultation with the manufacturer.

Specification: System tests fiberglass or steel piping.
Tests are conducted at operating pressure to a maximum of 200 psi.

Pipeline Capacity: Maximum of 612,954 gallons.
Minimum of 3,000 gallons.

Waiting Time: None between delivery and testing.
None between dispensing and testing.

Test Period: Minimum of 3 hours, 10 minutes after setup and after pipeline is fully isolated.
Test data are acquired and recorded by a microprocessor.
Calculations are automatically performed by the microprocessor.
Averaging of individual tests, where tests may be selected over any time frame yet not necessarily consecutive.

System Features: System may be permanently installed on pipeline to perform monitoring, or may be transported and set up to perform line tightness testing.
A single 3-hour 10-minute test is required consisting of a 1-hour 10-minute monitoring period at operating pressure, and a 2-hour monitoring period at atmospheric pressure.
System measures change in volume and reports output quantity in gph, while compensating for thermal effects.
Printed message and alarm activation if leak is declared.

Calibration: System must be calibrated in accordance with manufacturer's instructions.

Comments: System is to be used only on large bulk pipelines and airport hydrant fueling systems.
This evaluation utilized a total of 87 tests, one with an induced leak rate of 13.1 gph.

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Date of Evaluation: 11/24/98

Vista Research, Inc.

Model LT-100 Monthly Monitoring Method and Line Tightness Test Method
Version 1.0 (Manual Method)

LARGE DIAMETER PIPELINE LEAK DETECTION METHOD

Certification: Leak rate of 0.2 gph with P_D = 96% and P_{FA} < 4%.
Leak rate of 0.1 gph with P_D = 96% and P_{FA} = 4%.

Leak Threshold: 0.177 gph for leak rate of 0.2 gph.
0.077 gph for leak rate of 0.1 gph.
A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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.

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Date of Evaluation: 04/15/96

Vista Research, Inc.

Model LT-100 Monthly Monitoring Method and Line Tightness Test Method
Version 1.0 (Primary Method)

LARGE DIAMETER PIPELINE LEAK DETECTION METHOD

Certification: Leak rate of 0.2 gph with P_D = 97% and P_{FA} < 3%.
Leak rate of 0.1 gph with P_D = 97% and P_{FA} = 3%.

Leak Threshold: 0.148 gph for leak rate of 0.2 gph.
0.06 gph for leak rate of 0.1 gph.
A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 lightness 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.

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Date of Evaluation: 04/15/96

Vista Research, Inc.

Model LT-100 Monthly Monitoring Method and Line Tightness Test Method
Version 1.0 (Segmented Method)

LARGE DIAMETER PIPELINE LEAK DETECTION METHOD

Certification: Leak rate of 0.2 gph with P_D = 97% and P_{FA} = 3%.
Leak rate of 0.1 gph with P_D = 97% and P_{FA} = 3%.

Leak Threshold: 0.174 gph for leak rate of 0.2 gph.
0.074 gph for leak rate of 0.1 gph.
A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 minut es 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.

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Date of Evaluation: 04/15/96

Vista Research, Inc.

Model LT-100a Monthly Monitoring Method and Line Tightness Test Method
Version 1.0

LARGE DIAMETER PIPELINE LEAK DETECTION METHOD

Certification: Leak rate of 0.2 gph at 50 psi with P_D > 97% and P_{FA} < 3% for Monthly Monitoring Method.
Leak rate of 0.1 gph at 50 psi with P_D = 97% and P_{FA} = 3% for Line Tightness Test Method.

Leak Threshold: 0.148 gph for leak rate of 0.2 gph.
0.06 gph for leak rate of 0.1 gph.
A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 pressure, and a 1-hour monitoring period at atmospheric pressure.
Discrete test method (Monthly Monitoring Method only).
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: (650) 966-1171

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 11/06/98

Vista Research, Inc.

Model LT-100a Monthly Monitoring Method and Line Tightness Test Method
Version 1.0 (Segmented Method)

LARGE DIAMETER PIPELINE LEAK DETECTION METHOD

Certification: Leak rate of 0.2 gph at 50 psi with P_D > 97% and P_{FA} < 3% for Monthly Monitoring Method.
Leak rate of 0.1 gph at 50 psi with P_D = 97% and P_{FA} = 3% for Line Tightness Test Method.

Leak Threshold: 0.174 gph for leak rate of 0.2 gph.
0.074 gph for leak rate of 0.1 gph.
A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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.
Discrete test method (Monthly Monitoring Method only).
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: (650) 966-1171

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 11/06/98

Vista Research, Inc.

Model LT-100a Hourly and Monthly Monitoring Method and Line Tightness Test Method
Version 2.0 (Segmented Method)

LARGE DIAMETER PIPELINE LEAK DETECTION METHOD

Certification: Leak rate of 3.0 gph with P_D = 95% and P_{FA} < 0.1% for Hourly Monitoring Method.
Leak rate of 0.2 gph with P_D = 95% and P_{FA} = 2.9% for Monthly Monitoring Method.

Leak Threshold: 2.936 gph for leak rate of 3.0 gph.
0.136 gph for leak rate of 0.2 gph.
A pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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 15 minutes 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 hourly monitoring or monthly monitoring, or may be transported and set up to perform line tightness testing.
A single 15-minute test is required consisting of two 3-minute monitoring segments at atmospheric pressure spaced 0 minutes apart, and two 3-minute monitoring segments at operating pressure spaced 0 minutes apart.
Discrete test methods.
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: (650) 966-1171

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Date of Evaluation: 11/06/98

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%.
"If a method meets the requirement for detecting a leak rate of 0.1 gph, it will meet the requirement for 0.2 gph.", according to "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods", EPA/530/UST-90/007, June 1990, Section 7.2.3, page 30.

Leak Threshold: 0.05 gph. A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 18,000 gallons.

Data Requirement: Minimum of 30 days of product level and flow through data.

Comments: Not evaluated using manifolded 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%
"If a method meets the requirement for detecting a leak rate of 0.1 gph, it will meet the requirement for 0.2 gph.", according to "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods", EPA/530/UST-90/007, June 1990, Section 7.2.3, page 30.

Leak Threshold: 0.05 gph. A tank system should not be declared tight when there is a statistically significant loss at the 0.01 level of significance.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 36,000 gallons for single tank.
Maximum of 36,000 gallons cumulative capacity for manifolded tank systems with no more than 3 tanks in 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.
Median monthly throughput of separate manifolded tank system evaluation was 14,944 gallons.
Leak rates of 0.05, 0.10, and 0.20 gph were used in evaluation.
All manifolded tank system data sets evaluated were supplied by evaluator.
A portion of the data sets drawn from the WRA Statistical Inventory Analysis Version 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 with
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 gasoline	diesel	water
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.

Comments:

Sensors are reuseable.

Warrick Controls, Inc.
4237 Normandy Court
Royal Oak, MI 48073
Tel: (810) 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 gasoline	diesel	water
Detection time (hr:min:sec)	0:06:50	4:14:40	N/A
Fall time**	N/A*	N/A	N/A
Lower detection limit (cm)	≤2.54	≤2.54	N/A

* See glossary.
**Fall time is not applicable, since sensor must be replaced after activating.

Specificity Results:

Activated: Evaluator claims that this sensor will respond to any material that is capable of dissolving the hydrocarbon-sensitive wax.
Not Activated: Water.

Comments:

Sensor is activated when hydrocarbon-sensitive wax is dissolved, releasing a spring that activates an alarm.
Sensor is not reusable, and must be replaced after contact with hydrocarbons.
Liquid level was set at 1 inch (2.54 cm) during test.

Warrick Controls, Inc.
4237 Normandy Court
Royal Oak, MI 48073
Tel: (810) 549-4900

Evaluator: Ken Wilcox Associates, Inc.
Tel: (816) 443-2494
Date of Evaluation: 11/18/96

Warrick Controls, Inc.

Model 5700 Meter with
PVP-2 Sensor

VAPOR-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:
Output type: quantitative
Sampling frequency: continuous
Operating principle: adsistor

Test Results:

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

Warrick Controls, Inc.
4237 Normandy Court
Royal Oak, MI 48073
Tel: (810) 549-4900

Evaluator: Carnegie Mellon Research Institute
Tel: (412) 268-3495
Date of Evaluation: 09/10/91

Watson Systems, Inc. (formerly EnviroQuest Technologies Limited)

SIRAS Software System Versions 2.0, 2.8.3

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: 0.1 for leak rate of 0.2 gph.
0.05 for leak rate of 0.1 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability: Gasoline, diesel.
Other more viscous liquids may be tested after consultation with the vendor.

Tank Capacity: Maximum of 30,000 gallons.
Size limits using an acceptable protocol for manifolded tank systems have not been determined.

Data Requirement: Minimum of 30 days of usable product level and flow through data.

System Features: Backup technical support for the end user was part of the service feature of these SIR versions and was provided through contract with Watson Systems, Inc. Since these SIR versions are now owned by USTMAN Technologies, Inc., information, assistance, and technical support for these versions are at their discretion.

Comments: Not evaluated for in-house use that is independent of vendor participation.
Not evaluated for manifolded tank systems using an acceptable protocol.
27% of data sets evaluated were from manifolded 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.

Former Owner: Watson Systems, Inc.
Current Owner: USTMAN Technologies, Inc.
12265 W. Bayaud Ave.
Lakewood, CO 80228
Tel: (800) 253-8054

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 pipeline 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.
Other liquids may be tested after consultation with the manufacturer.

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, if necessary, calibrated 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 tank 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.
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 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 system's 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 tank excavation 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, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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)

Certification: Leak rate of 0.1 gph with P_D = 98.9% and P_{FA} = 1.1%.

Leak Threshold: 0.05 gph. A tank 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.
Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.

Tank Capacity: Maximum of 75,000 gallons.
Tank must be minimum 100% full.

Waiting Time: 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.

Test Period: Minimum of 4 hours.
Test data are acquired and recorded by system's computer.
Leak rate is calculated from the last 3 hours of test period data.
There must be no dispensing or delivery during test.

Temperature: Average for product is determined by a minimum of 12 thermistors.

Groundwater: Depth to groundwater in tank excavation 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.
Thermistors must be checked annually and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments: Not evaluated using manifolded 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 Trucheck Hydrostatic Monitoring System

DOUBLE WALLED TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gph with P_D = 99% and P_{FA} = 1%.

Leak Threshold: 0.05 gph. A tank 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 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 tank excavation 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: (952) 887-1890

Evaluator: Robert Plunkett, Ph.D.
Tel: (612) 338-0945
Date of Evaluation: 01/07/93

PART III

LEAK DETECTION EQUIPMENT/SYSTEMS THIRD PARTY EVALUATIONS UNDER REVIEW

ALPHABETICAL BY VENDOR,

THEN BY TEST METHOD,

FINALLY BY EQUIPMENT/SYSTEM MODEL

Test Method	Vendor	Equipment Model	Evaluator/Date of Evaluation
Bulk Field-Constructed Tank Tightness Test Leak Detection Method	**Engineering Design Group, Inc.**	EDG XLD 2000 Plus	Ken Wilcox Associates 12/22/98
Bulk Field-Constructed Tank Tightness Test Leak Detection Method	**Engineering Design Group, Inc.**	EDG XLD 2000 Plus with MTS DDA Probe (2,100,000 gallons)	Ken Wilcox Associates 10/01/01
Bulk Field-Constructed Tank Tightness Test Leak Detection Method	**Engineering Design Group, Inc.**	MCG 8100 ATG	Ken Wilcox Associates 07/10/97
Bulk Field-Constructed Tank Tightness Test Leak Detection Method	**Engineering Design Group, Inc.**	Ronan Engineering X-76 CTM with MTS level Plus Probe (50,000 gallons)	Ken Wilcox Associates 10/01/01
Continuous In-Tank Leak Detection Method	**INCON Intelligent Controls, Inc.**	Tank Sentinel ATG with SCALD Models TS-1000, TS-1001, TS-2000, TS-2001 (TSP-LL2 Probe)	Ken Wilcox Associates 02/23/00
Continuous In-Tank Leak Detection Method	**Marley Pump Co.**	ST Series 1400-1800, FMS, ATG, LLM Series and ProLink	ADA Technologies, Inc. 11/17/98
Non-Volumetric Tank Tightness Test Method	**Mass Tech International, Ltd.**	Mass Tech Remote Spectral Analysis	Ken Wilcox Associates 1/02/01
Non-Volumetric Tank Tightness Test Method	**Mass Tech International, Ltd.**	Mass Tech Analog Acoustic Vacuum Method	Ken Wilcox Associates 1/02/01
Non-Volumetric Tank Tightness Test Method	**Mesa Engineering Co.**	Mesa Model Z-D	Ken Wilcox Associates 7/17/01

Test Method	Vendor	Equipment Model	Evaluator/Date of Evaluation
Liquid-Phase Interstitial Detector	**Mine Safety Appliances**	Tankgard and Tankgard VIII with Universal Reservoir Sensor	Carnegie Mellon Research Institute 10/16/92
Vapor-Phase Out-Of-Tank Product Detector	**Mine Safety Appliances**	Tank-Check	Carnegie Mellon Research Institute 05/31/91
Liquid-Phase Interstitial Detector	**Pneumercator Company, Inc.**	Patriot 7100 Probe using TMS 2000 and TMS 3000	Ken Wilcox Associates 01/30/01
Liquid-Phase Interstitial Detector	**Pneumercator Company, Inc.**	ES 825-200(F) Discriminating and ES 825-100(F) Non-Discriminating Sensors as Liquid Level Sensors	Ken Wilcox Associates 08/04/01
Automatic Tank Gauging Method	**Practical Tank Management**	MTS Level Sensor ATG	Ken Wilcox Associates 3/12/96
Liquid-Phase Interstitial Detector	**S. Bravo Systems, Inc.**	Model B-2000 Shallow Steel Dispenser Containment System	Underwriters Laboratories 11/12/97 National Technical System 02/19/1990 & 08/21/01
Volumetric Tank Tightness Test Method	**Sound Products Manufacturing Inc.**	USTest 2001/P (20,000 gallons)	Ken Wilcox Associates 10/11/01
Non-Volumetric Tank Tightness Test Method (Vacuum)	**Tanknology - NDE**	U3 Vacuum	Ken Wilcox Associates 06/25/96
Liquid-Phase Interstitial Detector	**Veeder-Root**	Discriminating Interstitial Sensor 794380-343	Ken Wilcox Associates 05/10/01
Liquid-Phase Interstitial Detector	**Veeder-Root**	Microsensor 794380-344	Ken Wilcox Associates 05/10/01

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PART IV

ACCEPTABLE TEST PROTOCOLS

ALPHABETICAL BY TEST METHOD,

THEN BY PROTOCOL DATE

Automatic Tank Gauging Method

"Standard Test Procedures for Evaluating Leak Detection Methods: Automatic Tank Gauging **Automatic** Systems", EPA/530/UST-90/006, March 1990

"Test Procedures for Comparison of Different ATG Probes", Ken Wilcox Associates, March 27, 2000

Bulk Field-Constructed Tank Leak Detection Method

"Alternative Test Procedures for Evaluating Leak Detection Methods: Mass-based and Volumetric Leak Detection Systems for Bulk Field-constructed Tanks", Ken Wilcox Associates, November 2000

"Alternative Test Procedures for Evaluating Leak Detection Methods: Evaluation of Bulk Field-constructed Tanks", Ken Wilcox Associates, February 1996 (Evaluations prior to November 2000 only)

"Protocol for Certification of the ASTTest Mass Balance Leak Detection System", ASTTest Systems Inc., May 1997 (Evaluations prior to November 2000 only)

Continuous In-Tank Leak Detection Method

"Evaluation Protocol for Continuous In-Tank Leak Detection Systems", Midwest Research Institute, April 7, 1995

"Evaluation Protocol for Continuous In-Tank Leak Detection Systems", Jairus D. Flora, Jr. Ph.D., January 7, 2000

Large Diameter Pipeline Leak Detector

"Modified Third party Testing Protocol for Large Pipeline Leak Detection", EFA Technologies, Inc., August 1995

"Proposed Protocol for the Performance Evaluation of the MALT and MALTtm Plus", Ken Wilcox Associates, Inc., February 9, 1996

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 Test Method
"Standard Test Procedures for Evaluating Leak Detection Methods: Non-Volumetric Tank Tightness Testing Methods", EPA/530/UST-90/005, March 1990

Line Tightness Test Method
"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 Test Method
"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 Detector
"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 Test Method
"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? [1,2]	Yes	No
Has the accuracy of the level sensor been tested? [3]	Yes	No
Has the accuracy of the water sensor been tested? [4]	Yes	No
Has the appropriateness of the high water level alarm setting been verified? [5]	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)? [1]	Yes	No
Has the battery been tested within the last 3 months?	Yes	No
Has the accuracy of the product sensor been tested? [2]	Yes	No
Has the accuracy of the water sensor been tested? [3]	Yes	No
Has the appropriateness of high-water level alarm setting been verified? [4]	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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LINE LEAK DETECTOR MAINTENANCE CHECKLIST

Minimum procedures to be conducted by a *qualified service technician*

Yes	No	NA	For equipment start-up or annual equipment certification, was a leak simulated to verify LLD performance? (Circle all that apply) Simulated leak rate: 3 gph 0.2 gph 0.1 gph
Yes	No	NA	Is the audible alarm operational?
Yes	No	NA	Is the visible alarm operational?
Yes	No	NA	If alarms are relayed to remote monitoring system, is all communication equipment (e.g. modem) operational?
Yes	No	NA	Was monitoring system set-up reviewed to ensure proper settings?
Yes	No	NA	Was the testing apparatus properly calibrated?
Yes	No	NA	For mechanical LLDs, does the LLD restrict product flow if it detects a leak?
Yes	No	NA	For electronic LLDs, have all accessible wiring connections been visually inspected?
Yes	No	NA	For electronic LLDs, does the turbine shut off if the LLD detects a leak?
Yes	No	NA	For electronic LLDs, does the turbine shut off if any portion of the monitoring system is disabled or disconnected?
Yes	No	NA	For electronic LLDs, does the turbine shut off if any portion of the monitoring system malfunctions or fails a self-test?
Yes	No	NA	Were all items on the equipment manufacturer's maintenance checklist completed?
Yes	No	NA	Were all LLDs confirmed operational and accurate within regulatory requirements?
Comments:			

1. Line leak detectors should be tested in-place, not removed.

2. The functional elements of the mechanical LLD are the piston and the diaphragm. To ensure that these elements are functioning properly, the submersible pump can be started and the time that the piston or diaphragm takes to move into a position to enable full flow of the product noted. The range of allowable opening times is specified by the manufacturer and is available in the equipment manual.

3. Equipment that monitors underground storage tank systems containing hazardous materials must be tested/serviced per regulatory requirements, or on a schedule specified by the manufacturer, whichever is more frequent.

4. **System Set-Up Report -** If the monitoring system or diagnostic equipment used in testing is capable of generating a hard-copy report describing system set-up, you should include a copy of the report with this checklist.

5. **Alarm History Report -** If the monitoring system is capable of generating a hard-copy alarm history report, you must include a copy of the report with this checklist. This report should be printed before you test any LLDs.

6. ***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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APPENDIX

GLOSSARY OF TERMS

Accuracy:
The degree to which the measured leak rate agrees with the induced leak rate on the average. If a system 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 Method (Continuous ATGS):
These systems use an automatic tank gauge 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 automatic tank gauge 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 automatic tank gauge 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 (P_D) and 5% probability of false alarm (P_{FA}). 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 Method (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.
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.

GLOSSARY OF TERMS (Continued)

False Alarm:
Declaring a tank to be leaking when in fact it is tight.

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 system 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 system.

Lower Detection Limit:
The smallest liquid concentration or level that a detector can reliably detect ($P_D > 95\%$, $P_{FA} < 5\%$).

Manifolded 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.

Minimum Detectable Leak Rate:
The leak rate that can be detected with a Probability of Detection (P_D) of 95% and a Probability of False Alarm (P_{FA}) of 5%. The minimum threshold is calculated setting the P_{FA} at 5%. For a P_D of 95%, the leak rate is then equal to twice the threshold that gives a P_{FA} of 5% assuming the bias is not significant.

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 system. A negative number would indicate that something was being added to the tank. The performance of a system 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

GLOSSARY OF TERMS (Continued)

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 system. It is a positive number expressed in gallons per hour (gph).

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.

Product Activation Height:
The minimum height of liquid required to cause sensor activation (this value does not have to meet the $P_D > 95\%$, $P_{FA} < 5\%$ criteria).

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.”

GLOSSARY OF TERMS (Continued)

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.

Statistical Inventory Reconciliation (SIR), In-House System:
Data gathered and input by owner or operator. System does analysis. If analysis presents problems, technical support and analysis are available from vendor or vendor representative.

Statistical Inventory Reconciliation (SIR), Stand Alone System:
No human interface required. Data gathered and analyzed automatically without owner/operator input.

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.