Certification Reports

Results of Performance Evaluation Conducted According to the E.P.A. Test Procedures

Pressurized Line Leak Detection System and Wireless Pressurized Line Leak Detection System

Manual Number 576013-308, Revision D

Contents:

- Monthly Test: Pressurized Line Leak Detector (Fiberglass Pipeline) Series 8484 (PLLD)
- Hourly Test: Pressurized Line Leak Detector (Flexible Pipeline) Series 8484 (PLLD)
- Line Tightness Test: Pressurized Line Leak Detector (Flexible Pipeline) Series 8484 (PLLD)
- Hourly Test: Pressurized Line Leak Detector (Fiberglass and Steel Pipeline) Series 8484 (PLLD)
- Line Tightness Test: Pressurized Line Leak Detector (Fiberglass and Steel Pipeline) Series 8484 (PLLD)
- Hourly Test: Pressurized Line Leak Detector (Fiberglass and Steel Pipeline) Series 8494 (WPLLD)
- Monthly Monitoring Test: Pressurized Line Leak Detector (Fiberglass and Steel Pipeline) Series 8494 (WPLLD)
- Line Tightness Test: Pressurized Line Leak Detector (Fiberglass and Steel Pipeline) Series 8494 (WPLLD)
Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as a
Monthly Monitoring Test

This form summarizes the results of an evaluation to determine whether the pipeline leak
detection system named below and described in Attachment 1 complies with federal regulations for
conducting a line tightness test. The evaluation was conducted according to the United States
Environmental Protection Agency’s (EPA’s) evaluation procedure, specified in Standard Test
Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems. This full
evaluation report includes eight attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file
to show compliance with the federal regulations. Tank system owners should check with state and
local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: Veeder-Root Pressurized Line Leak Detector

Version of System: Series 8484

Manufacturer Name: Veeder-Root

125 Powder Forest Drive, Post Office 2003
(street address)

Simsbury, CT 06070-2003
(city, state, zip code)

(203) 651-2700
(telephone number)

Evaluation Results

1. The performance of this system
(X) meets or exceeds
( ) does not meet
the federal standards established by the EPA regulation for monthly monitoring tests.

The EPA regulation for a monthly monitoring test requires that the system be capable of
detecting a leak as small as 0.2 gal/h with a probability of detection (P_D) of 95% and a
probability of false alarm (P_FA) of 5%.

2. The estimated P_FA in this evaluation is ___ % and the estimated P_D against a leak rate of 0.2
gal/h defined at a pipeline pressure of ___ psi (the normal operating pressure) in this
evaluation is ___ %. The system was actually tested at an average calibrated leak rate of
0.195 gph (at ___ psi) and it detected ___ % of induced leaks.
Criterion for Declaring a Leak

3. This system
   (X) uses a preset threshold
   () measures and reports the output quantity and compares it to a predetermined threshold to
determine whether the pipeline is leaking.

4. This system
   (X) uses a single test (1 test after accounting for effects of thermals, if any)
   () uses a multiple-test sequence consisting of _____ tests (specify number of tests
required) separated by _____ hours (specify the time interval between tests) to determine
whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of
   0.17 (specify flow rate in gal/h) in _____ out of _____ tests (specify, for example, 1 out of 2,
   2 out of 3). Please give additional details, if necessary, in the space provided.

Evaluation Approach

6. There are five options for collecting the data used in evaluating the performance of this
   system. This system was evaluated
   (X) at a special test facility (Option 1)
   () at one or more instrumented operational tank facilities (Option 2)
   () at five or more operational storage tank facilities verified to be tight (Option 3)
   () at 10 or more operational storage tank facilities (Option 4)
   () with an experimentally validated computer simulation (Option 5).

7. A total of _____ tests was conducted on nonleaking pipeline(s) between 9/23/96 (date) and
   9/27/96 (date). A description of the pipeline configuration used in the evaluation is given
in Attachment 3. (These tests supplemented a full set of 53 tests conducted earlier on the
related Series 8494 system. See Attachment 8 for further testing details.)

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8. The pipeline used in the evaluation was ______ in. in diameter, _____ ft long and
   constructed of fiberglass, fiberglass, steel or other).

9. A mechanical line leak detector
   () was
   (X) was not
   present in the pipeline system. System has a 3 gal/h test mode, whose function
   replaces that of a mechanical leak detector.

Answer questions 10 and 11 if Option 3 or 4 was used.

10. The evaluation was conducted on ______ (how many) pipeline systems ranging in diameter
from ______ in. to ______ in., ranging in length from ______ ft to ______ ft, and
constructed of ______ (specify materials).
11. A mechanical line leak detector
( ) was
( ) was not
present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the data collection:
( ) 0 to 6 h
( ) 6 to 12 h  (Not applicable)
( ) 12 to 24 h
( ) 24 h or more.

Temperature Conditions

This system was evaluated under the range of temperature conditions specified in Table 1. The difference between the temperature of the product circulated through the pipeline for 1 h or more and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is summarized in Table 1. If Option 1, 2, or 3 was used, a more detailed summary of the product temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4 was used, no artificial temperature conditions were generated.

Table 1. Summary of Temperature Conditions Used in the Evaluation

<table>
<thead>
<tr>
<th>Minimum Number of Conditions Required</th>
<th>Number of Conditions Used(^a)</th>
<th>Range of (\Delta T) (°F)(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>(\Delta T &lt; -25)</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>(-25 \leq \Delta T &lt; -15)</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>(-15 \leq \Delta T &lt; -5)</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>(-5 \leq \Delta T &lt; +5)</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>(+5 \leq \Delta T &lt; +15)</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>(\Delta T &gt; +25)</td>
</tr>
</tbody>
</table>

\(^a\) This column should be filled out only if Option 1, 2, or 3 was used. Also, see Attachment 8.
\(^b\) \(\Delta T\) is the difference between the temperature of the product dispensed through the pipeline for over an hour prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

Data Used to Make Performance Estimates

13. The induced leak rate and the test results used to estimate the performance of this system are summarized in Attachment 5. Were any tests removed from the data set?

( ) no
( ) yes

If yes, please specify the reason and include with Attachment 5. (If more than one test was removed, specify each reason separately.)
Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.)*
   () According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at **38** psi with **100** ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

Table 2. Summary of the Results of Trapped Vapor Tests

<table>
<thead>
<tr>
<th>Test No.</th>
<th>ΔT (°F)</th>
<th>Induced Leak Rate (gal/h)</th>
<th>Measured Leak Rate (gal/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>12.0</td>
<td>0.000</td>
<td>Pass</td>
</tr>
<tr>
<td>10</td>
<td>12.0</td>
<td>0.196 at 30 psi</td>
<td>Fail</td>
</tr>
<tr>
<td>13</td>
<td>0.3</td>
<td>0.000</td>
<td>Pass</td>
</tr>
</tbody>
</table>

Performance Characteristics of the Instrumentation

16. State below the performance characteristic of the primary measurement system(s) used to collect the data. *(Please specify the units, for example, gallons, inches.)*

<table>
<thead>
<tr>
<th>Quantity Measured:</th>
<th>Pressure (psi)</th>
<th>Volume (ml)</th>
<th>Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>0.1</td>
<td>0.5</td>
<td>0.01</td>
</tr>
<tr>
<td>Precision:</td>
<td>0.1</td>
<td>0.5</td>
<td>0.05</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>0.3</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Minimum Detectable Quantity:</td>
<td>0.1</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Response Time:</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Threshold is exceeded when the flow rate due to a leak exceeds **0.17** gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

- the system that was evaluated has not been substantially changed by subsequent modifications
- the manufacturer's instructions for using the system are followed
- a mechanical line leak detector
  () is present
  (X) has been removed from the pipeline *(Check both if appropriate.)*
the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is _NA_ h

the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is _0.75-1.0_ h

the total data collection time for the test is _0.53, 0.80_ h (for pass or fail, respectively)

the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

please give any other limitations specified by the vendor or determined during the evaluation:

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Disclaimer: This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.

Attachments

Attachment 1 - Description of the System Evaluated
Attachment 2 - Summary of the Performance of the System Evaluated
Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation
Attachment 4 - Data Sheet Summarizing Product Temperature Conditions in the Evaluation
Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation
Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests
Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise
Attachment 8 - Justification for Abbreviated Test Matrix

Certification of Results

I certify that the pipeline leak detection system was operated according to the vendor's instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

William D. Glauz
(name of person performing evaluation)

Midwest Research Institute
(organization performing evaluation)

425 Volker Boulevard
(address)

Kansas City, MO 64110
(city, state, zip)

November 13, 1996
(date)

(816) 753-7600
(telephone number)
Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as an
Hourly Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a line tightness test. The evaluation was conducted according to the United States Environmental Protection Agency’s (EPA’s) evaluation procedure, specified in Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems. The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: Veeder-Root Pressurized Line Leak Detector

Version of System: Series 8484

Manufacturer Name: Veeder-Root

125 Powder Forest Drive, Post Office Box 2003
(street address)

Simsbury, CT 06070-2003
(city, state, zip code)

(203) 651-2700
(telephone number)

Evaluation Results

1. The performance of this system
   (X) meets or exceeds
   () does not meet
   the federal standards established by the EPA regulation for line tightness tests.

   The EPA regulation for a line tightness test requires that the system be capable of detecting a leak as small as 3.0 gal/h with a probability of detection (P_D) of 95% and a probability of false alarm (P_FA) of 5%.

2. The estimated P_FA in this evaluation is _0__ % and the estimated P_D against a leak rate of 3.0 gal/h defined at a pipeline pressure of _10_ psi in this evaluation is _100__ %. The system was actually tested at an average calibrated leak rate of _2.67_ gph (at 10 psi) and it detected _100___ % of induced leaks.
Criterion for Declaring a Leak

3. This system
(X) uses a preset threshold
( ) measures and reports the output quantity and compares it to a predetermined threshold to determine whether the pipeline is leaking.

4. This system
(X) uses a single test  *(1 test after accounting for effects of thermals, if any)*
( ) uses a multiple-test sequence consisting of _______ tests (specify number of tests required) separated by _______ hours (specify the time interval between tests) to determine whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of \( I.5 \) (specify flow rate in gal/h) in \( _{1} \) out of \( _{1} \) tests (specify, for example, 1 out of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.

Evaluation Approach

6. There are five options for collecting the data used in evaluating the performance of this system. This system was evaluated
(X) at a special test facility (Option 1)
( ) at one or more instrumented operational tank facilities (Option 2)
( ) at five or more operational storage tank facilities verified to be tight (Option 3)
( ) at 10 or more operational storage tank facilities (Option 4)
( ) with an experimentally validated computer simulation (Option 5).

7. A total of \( _{53} \) tests was conducted on nonleaking pipeline(s) between \( 5/4/95 \) (date) and \( 5/23/95 \) (date). A description of the pipeline configuration used in the evaluation is given in Attachment 3.

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8. The pipeline used in the evaluation was \( _{1.5} \) in. in diameter, \( _{220} \) ft long and constructed of \( _{other} \) (fiberglass, steel or other). *(flexible piping of low bulk modulus)*

9. A mechanical line leak detector
( ) was
(X) was not present in the pipeline system. System has a 3 gal/h test mode, whose function replaces that of a mechanical leak detector.

Answer questions 10 and 11 if Option 3 or 4 was used.

10. The evaluation was conducted on \( _{_____} \) (how many) pipeline systems ranging in diameter from \( _{_____} \) in. to \( _{_____} \) in., ranging in length from \( _{_____} \) ft to \( _{_____} \) ft, and constructed of \( _{_____} \) (specify materials).
11. A mechanical line leak detector
( ) was
( ) was not
present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the data collection:
( ) 0 to 6 h
( ) 6 to 12 h (Not applicable)
( ) 12 to 24 h
( ) 24 h or more.

Temperature Conditions

This system was evaluated under the range of temperature conditions specified in Table 1. The difference between the temperature of the product circulated through the pipeline for 1 h or more and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is summarized in Table 1. If Option 1, 2, or 5 was used, a more detailed summary of the product temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4 was used, no artificial temperature conditions were generated.

Table 1. Summary of Temperature Conditions Used in the Evaluation

<table>
<thead>
<tr>
<th>Minimum Number of Conditions Required</th>
<th>Number of Conditions Used&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Range of $\Delta T$ ($^\circ$F)&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &lt; -25$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$-25 \leq \Delta T &lt; -15$</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>$-15 \leq \Delta T &lt; -5$</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>$-5 \leq \Delta T &lt; +5$</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>$+5 \leq \Delta T &lt; +15$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$+15 \leq \Delta T &lt; +25$</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &gt; +25$</td>
</tr>
</tbody>
</table>

<sup>a</sup> This column should be filled out only if Option 1, 2, or 5 was used.

<sup>b</sup> $\Delta T$ is the difference between the temperature of the product dispensed through the pipeline for over an hour prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

Data Used to Make Performance Estimates

13. The induced leak rate and the test results used to estimate the performance of this system are summarized in Attachment 5. Were any tests removed from the data set?
( ) no
( ) yes
If yes, please specify the reason and include with Attachment 5. (If more than one test was removed, specify each reason separately.)
Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.)*

( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at 30 psi with 100 ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>$\Delta T$ (<em>°F</em>)</th>
<th>Induced Leak Rate (gal/h)</th>
<th>Measured Leak Rate (gal/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-10.0</td>
<td>2.66</td>
<td>Fail</td>
</tr>
<tr>
<td>2</td>
<td>-10.0</td>
<td>0.00</td>
<td>Pass</td>
</tr>
<tr>
<td>3</td>
<td>-0.3</td>
<td>2.66</td>
<td>Fail</td>
</tr>
</tbody>
</table>

Performance Characteristics of the Instrumentation

16. State below the performance characteristic of the primary measurement system(s) used to collect the data. *(Please specify the units, for example, gallons, inches.)*

<table>
<thead>
<tr>
<th>Quantity Measured:</th>
<th>Pressure (psi)</th>
<th>Volume (ml)</th>
<th>Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>0.1</td>
<td>0.5</td>
<td>0.01</td>
</tr>
<tr>
<td>Precision:</td>
<td>0.1</td>
<td>0.5</td>
<td>0.05</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>0.3</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Minimum Detectable Quantity:</td>
<td>0.1</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Response Time:</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
</tbody>
</table>

Threshold is exceeded when the flow rate due to a leak exceeds _1.5_ gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

- the system that was evaluated has not been substantially changed by subsequent modifications
- the manufacturer's instructions for using the system are followed
- a mechanical line leak detector
  ( ) is present
  (X) has been removed from the pipeline *(Check both if appropriate.)*
• the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is **NA** h

• the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is **0.21** h

• the total data collection time for the test is **0.07, 0.1** h (for pass or fail, respectively)

• the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

• please give any other limitations specified by the vendor or determined during the evaluation: **SEE SPECIAL ATTACHMENT 8**

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**Disclaimer:** This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.

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**Attachments**

Attachment 1 - Description of the System Evaluated  
Attachment 2 - Summary of the Performance of the System Evaluated  
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Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise

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**Certification of Results**

I certify that the pipeline leak detection system was operated according to the vendor's instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

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**William D. Glaz**  
(name of person performing evaluation)

**Midwest Research Institute**  
(organization performing evaluation)

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**425 Volker Boulevard**  
(street address)

**Kansas City, MO 64110**  
(city, state, zip)

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**(816) 753-7600**  
(telephone number)

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Pipeline Leak Detection System - Results Form (Hourly Test)  
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Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as a
Line Tightness Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a line tightness test. The evaluation was conducted according to the United States Environmental Protection Agency’s (EPA’s) evaluation procedure, specified in Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems. The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: Veeder-Root Pressurized Line Leak Detector

Version of System: Series 8484

Manufacturer Name: Veeder-Root

125 Powder Forest Drive, Post Office Box 2003
(street address)

Simsbury, CT 06070-2003
(city, state, zip code)

(203) 651-2700
(telephone number)

Evaluation Results

1. The performance of this system
   (X) meets or exceeds
   ( ) does not meet
   the federal standards established by the EPA regulation for line tightness tests.

   The EPA regulation for a line tightness test requires that the system be capable of detecting a leak as small as 0.1 gal/h with a probability of detection \( P_D \) of 95% and a probability of false alarm \( P_{FA} \) of 5%.

2. The estimated \( P_{FA} \) in this evaluation is _0_ % and the estimated \( P_D \) against a leak rate of 0.1 gal/h defined at a pipeline pressure of _45_ psi (1.5 times the normal operating pressure) in this evaluation is _100_ %. The system was actually tested at an average calibrated leak rate of _0.092_ gph (at 45 psi) and it detected _100_ % of induced leaks.
Criterion for Declaring a Leak

3. This system
   (X) uses a preset threshold
   () measures and reports the output quantity and compares it to a predetermined threshold to
determine whether the pipeline is leaking.

4. This system
   (X) uses a single test  *(1 test after accounting for effects of thermals, if any)*
   () uses a multiple-test sequence consisting of _______ tests (specify number of tests
required) separated by _______ hours (specify the time interval between tests) to determine
whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of
   **0.05** (specify flow rate in gal/h) in ______ out of ______ tests (specify, for example, 1 out
   of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.

Evaluation Approach

6. There are five options for collecting the data used in evaluating the performance of this
   system. This system was evaluated
   (X) at a special test facility (Option 1)
   () at one or more instrumented operational tank facilities (Option 2)
   () at five or more operational storage tank facilities verified to be tight (Option 3)
   () at 10 or more operational storage tank facilities (Option 4)
   () with an experimentally validated computer simulation (Option 5).

7. A total of **53** tests was conducted on nonleaking pipeline(s) between **5/4/95** (date) and
   **5/23/95** (date). A description of the pipeline configuration used in the evaluation is given in
   Attachment 3.

*Answer questions 8 and 9 if Option 1, 2, or 5 was used.*

8. The pipeline used in the evaluation was **1.5** in. in diameter, **220** ft long and
   constructed of *other* (fiberglass, steel or other). *(flexible piping of low bulk modulus)*

9. A mechanical line leak detector
   () was
   (X) was not
   present in the pipeline system. **System has a 3 gal/h test mode, whose function
   replaces that of a mechanical leak detector.**

*Answer questions 10 and 11 if Option 3 or 4 was used.*

10. The evaluation was conducted on _______ (how many) pipeline systems ranging in diameter
    from _______ in. to _______ in., ranging in length from _______ ft to _______ ft, and
    constructed of __________________________ (specify materials).
11. A mechanical line leak detector
   ( ) was
   ( ) was not
   present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the
data collection:
   ( ) 0 to 6 h
   ( ) 6 to 12 h (Not applicable)
   ( ) 12 to 24 h
   ( ) 24 h or more.

**Temperature Conditions**

This system was evaluated under the range of temperature conditions specified in Table 1. The
difference between the temperature of the product circulated through the pipeline for 1 h or more
and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is
summarized in Table 1. If Option 1, 2, or 5 was used, a more detailed summary of the product
temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4
was used, no artificial temperature conditions were generated.

**Table 1. Summary of Temperature Conditions Used in the Evaluation**

<table>
<thead>
<tr>
<th>Minimum Number of Conditions Required</th>
<th>Number of Conditions Used*</th>
<th>Range of $\Delta T (^\circ F)$b</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &lt; -25$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$-25 \leq \Delta T &lt; 15$</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>$-15 \leq \Delta T &lt; -5$</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>$-5 \leq \Delta T &lt; +5$</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>$+5 \leq \Delta T &lt; +15$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$+15 \leq \Delta T &lt; +25$</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &gt; +25$</td>
</tr>
</tbody>
</table>

* This column should be filled out only if Option 1, 2, or 5 was used.
b $\Delta T$ is the difference between the temperature of the product dispensed through the pipeline for over an hour
   prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

**Data Used to Make Performance Estimates**

13. The induced leak rate and the test results used to estimate the performance of this system are
    summarized in Attachment 5. Were any tests removed from the data set?
    (X) no
    ( ) yes
    If yes, please specify the reason and include with Attachment 5. (If more than one test was
    removed, specify each reason separately.)
Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.)*

   () According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at **30** psi with **100** ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

Table 2. Summary of the Results of Trapped Vapor Tests

<table>
<thead>
<tr>
<th>Test No.</th>
<th>ΔT (°F)</th>
<th>Induced Leak Rate (gal/h)</th>
<th>Measured Leak Rate (gal/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-10.0</td>
<td>0.0910 @ 45 psi</td>
<td>Fail</td>
</tr>
<tr>
<td>2</td>
<td>-10.0</td>
<td>0.0</td>
<td>Pass</td>
</tr>
<tr>
<td>3</td>
<td>-0.3</td>
<td>0.0</td>
<td>Pass</td>
</tr>
</tbody>
</table>

Performance Characteristics of the Instrumentation

16. State below the performance characteristic of the primary measurement system(s) used to collect the data. (Please specify the units, for example, gallons, inches.)

   Quantity Measured: __________________________ Pressure (psi)  Volume (ml)  Time (sec)

   Resolution: __________  0.1  0.5  0.01
   Precision: __________  0.1  0.5  0.05
   Accuracy: __________  0.3  1.0  0.01
   Minimum Detectable Quantity: __________  0.1  1.0  0.01
   Response Time: __________  ____  ____  ____

   Threshold is exceeded when the flow rate due to a leak exceeds **0.05** gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

   • the system that was evaluated has not been substantially changed by subsequent modifications

   • the manufacturer’s instructions for using the system are followed

   • a mechanical line leak detector

   ( ) is present

   (X) has been removed from the pipeline (Check both if appropriate.)
the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is **NA** h

the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is **1.7** h

the total data collection time for the test is **75, 1.25** h (for pass or fail, respectively)

the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

please give any other limitations specified by the vendor or determined during the evaluation: **SEE SPECIAL ATTACHMENT 8**

___Disclaimer___: This test procedure only addresses the issue of the system’s ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.

**Attachments**

Attachment 1 - Description of the System Evaluated  
Attachment 2 - Summary of the Performance of the System Evaluated  
Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation  
Attachment 4 - Data Sheet Summarizing Product Temperature Conditions in the Evaluation  
Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation  
Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests  
Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise

**Certification of Results**

I certify that the pipeline leak detection system was operated according to the vendor’s instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

______________________________  _______________________________

**William D. Glauz**  
(name of person performing evaluation)  

______________________________  _______________________________

**Midwest Research Institute**  
(organization performing evaluation)  

______________________________  _______________________________

**425 Volker Boulevard**  
(street address)  

______________________________  _______________________________

**Kansas City, MO 64110**  
(city, state, zip)  

______________________________  _______________________________

October 6, 1995  
(date)  

______________________________  _______________________________

**(816) 753-7600**  
(telephone number)
Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as an Hourly Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting an hourly test. The evaluation was conducted according to the United States Environmental Protection Agency's (EPA's) evaluation procedure, specified in Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems. The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: TLS Pressurized Line Leak Detector, Series 8484

Version of System: ----

Manufacturer Name: Veeder-Root

125 Powder Forest Drive, P.O. Box 2003

(Simsbury, CT 06070-2003)

(203) 651-2700

Evaluation Results

1. The performance of this system (X) meets or exceeds ( ) does not meet the federal standards established by the EPA regulation for hourly tests.

The EPA regulation for an hourly test requires that the system be capable of detecting a leak as small as 3.0 gal/h with a probability of detection ($P_D$) of 95% and a probability of false alarm ($P_{FA}$) of 5%.

2. The estimated $P_{FA}$ in this evaluation is _____%, and the estimated $P_D$ against a leak rate of 3.0 gal/h defined at a pipeline pressure of 20 psi in this evaluation is ____100__%.
Criterion for Declaring a Leak

3. This system
   ( ) uses a preset threshold
   ( ) measures and reports the output quantity and compares it to a predetermined threshold
to determine whether the pipeline is leaking.

4. This system
   ( ) uses a single test
   ( ) uses a multiple-test sequence consisting of _____ tests (specify number of tests
      required) separated by _____ hours (specify the time interval between tests)
to determine whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of
   1.88 gal/hr. (specify flow rate in gal/h) in __ out of __ tests (specify, for example, 1 out
   of 2, 2 out of 3). If more detail is required, please specify in the space provided.

Evaluation Approach

6. There are five options for collecting the data used in evaluating the performance of this
   system. This system was evaluated
   ( ) at a special test facility (Option 1)
   ( ) at one or more instrumented operational storage tank facilities (Option 2)
   ( ) at five or more operational storage tank facilities verified to be tight (Option 3)
   ( ) at 10 or more operational storage tank facilities (Option 4)
   ( ) with an experimentally validated computer simulation (Option 5)

7. A total of _____ tests were conducted on nonleaking pipeline sections between __/__/1991 (date)
    and __/__/1991 (date). A description of the pipeline configuration used in the evaluation is
    summarized in Attachment 3.

   Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8. The pipeline used in the evaluation was ____ in. in diameter, ____ ft long and
   constructed of ____________ (fiberglass, steel, or other).

9. A mechanical line leak detector
   ( ) was
   ( ) was not
   present in the pipeline system.

   Answer questions 10 and 11 if Option 3 or 4 was used. VA

10. The evaluation was conducted on ___________ (how many) pipeline systems ranging in
diameter from _____ in. to ______ in., ranging in length from ________ ft to ________
    ft, and constructed of ___________________________ (specify materials).
11. A mechanical line leak detector
( ) was NA
( ) was not present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the data collection: NA
( ) 0 to 6 h
( ) 6 to 12 h
( ) 12 to 24 h
( ) 24 h or more

**Temperature Conditions**

This system was evaluated under the range of temperature conditions specified in Table 1. The difference between the temperature of the product circulated through the pipeline for 1 h or more and the average temperature of the backfill and soil between 2 and 12 in. from the pipeline is summarized in Table 1. If Option 1, 2 or 5 was used, a more detailed summary of the product temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4 was used, no artificial temperature conditions were generated.

**Table 1. Summary of Temperature Conditions Used in the Evaluation**

<table>
<thead>
<tr>
<th>Minimum Number of Conditions Required</th>
<th>Number of Conditions Used</th>
<th>Range of $\Delta T$ ($^\circ$F)$^{**}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &lt; -25$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$-25 \leq \Delta T &lt; -15$</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>$-15 \leq \Delta T &lt; -5$</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>$-5 \leq \Delta T &lt; +5$</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>$+5 \leq \Delta T &lt; +15$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$+15 \leq \Delta T &lt; +25$</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &gt; 25$</td>
</tr>
</tbody>
</table>

$^*$This column should be filled out only if Option 1, 2, or 5 was used.

$^{**}$ $\Delta T$ is the difference between the temperature of the product dispensed through the pipeline for over an hour prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

**Data Used to Make Performance Estimates**

13. The induced leak rate and the test results used to estimate the performance of this system are summarized in Attachment 5. Were any test runs removed from the data set?
( ) no
( ) yes

If yes, please specify the reason and include with Attachment 5. (If more than one test was removed, specify each reason separately.)
Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. (If not excessive.)

   ( ) According to the vendor, this system should not be used if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at 28 psi with 100 ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>ΔT (°F)</th>
<th>Induced Leak Rate (gal/h)</th>
<th>Measured Leak Rate (gal/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+9.99</td>
<td>2.94 gal/hr @ 10 psi</td>
<td>Fail</td>
</tr>
<tr>
<td>2</td>
<td>+6.23</td>
<td>2.91 gal/hr @ 10 psi</td>
<td>Fail</td>
</tr>
<tr>
<td>3</td>
<td>-6.07</td>
<td>2.8 gal/hr @ 10 psi</td>
<td>Fail</td>
</tr>
</tbody>
</table>

Performance Characteristics of the Instrumentation

16. State below the performance characteristics of the primary measurement system used to collect the data. (Please specify the units, for example, gallons, inches.)

<table>
<thead>
<tr>
<th>Quantity Measured:</th>
<th>Pressure (psi)</th>
<th>Volume (ml)</th>
<th>Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>0.1</td>
<td>0.5</td>
<td>0.01</td>
</tr>
<tr>
<td>Precision:</td>
<td>0.1</td>
<td>0.5</td>
<td>0.05</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>0.3</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Minimum Detectable Quantity:</td>
<td>0.1</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Response Time:</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Threshold is exceeded when the flow rate due to a leak exceeds 1.88 gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities, that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 150 ft or less in length. The performance estimates are valid when:

   - the system that was evaluated has not been substantially changed by subsequent modifications
   - the manufacturer’s instructions for using the system are followed
   - the mechanical line leak detector (X) is present in
   - the pipeline (check both if appropriate)

A mechanical line leak detector is no longer needed because the CEI system performs a 3.0 gph test every time dispensing stops.
- the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is NA h

- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is 0.27 h

- the total data collection time for the test is .008 h

- the volume of the product in the pipeline is less than twice the volume of the product in the pipeline system used in the evaluation, unless separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8

- please give any other limitations specified by the vendor or determined during the evaluation:

Disclaimer: This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability or maintainability of the equipment.

Attachments

Attachment 1 - Description of the System Evaluated

Attachment 2 - Summary of the Performance of the System Evaluated

Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation

Attachment 4 - Data Sheet Summarizing Product Temperature Conditions Used in the Evaluation

Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation

Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests

Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining the Signal and Noise

Certification of Results

I certify that the pipeline leak detection system was operated according to the vendor’s instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

William D. Glauz
(name of person performing evaluation)

8/07/91
(signature)

(816) 753-7600
(telephone number)

Midwest Research Institute
(organization performing evaluation)

425 Volker Boulevard
(street address)

Kansas City, MO 64110
(city, state, zip)
Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as a
Line Tightness Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a line tightness test. The evaluation was conducted according to the United States Environmental Protection Agency’s (EPA’s) evaluation procedure, specified in Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems. The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

<table>
<thead>
<tr>
<th>System Name:</th>
<th>TLS Pressurized Line Leak Detector, Series 8484</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version of System:</td>
<td>----</td>
</tr>
<tr>
<td>Manufacturer Name:</td>
<td>Veeder-Root</td>
</tr>
<tr>
<td>(street address)</td>
<td>125 Powder Forest Drive, P.O. Box 2003</td>
</tr>
<tr>
<td>(city, state, zip code)</td>
<td>Simsbury, CT 06070-2003</td>
</tr>
<tr>
<td>(telephone number)</td>
<td>(203) 651-2700</td>
</tr>
</tbody>
</table>

Evaluation Results

1. The performance of this system
   (X) meets or exceeds
   ( ) does not meet
   the federal standards established by the EPA regulation for line tightness tests.

   The EPA regulation for a line tightness test requires that the system be capable of detecting a leak as small as 0.1 gal/h with a probability of detection ($P_D$) of 95% and a probability of false alarm ($P_{FA}$) of 5%.

2. The estimated $P_{FA}$ in this evaluation is ___0___ % and the estimated $P_D$ against a leak rate of 0.1 gal/h defined at a pipeline pressure of 20 psi in this evaluation is ___100___ %.
Criterion for Declaring a Leak

3. This system
   (x) uses a preset threshold
   ( ) measures and reports the output quantity and compares it to
       a predetermined threshold
   to determine whether the pipeline is leaking.

4. This system
   (x) uses a single test
   ( ) uses a multiple-test sequence consisting of _____ tests (specify number of tests
       required) separated by _____ hours (specify the time interval between tests)
   to determine whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of
   0.05 (specify flow rate in gal/h) in _____ out of _____ tests (specify, for example, 1
   out of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.
   After accounting for effects of thermals, if any.

Evaluation Approach

6. There are five options for collecting the data used in evaluating the performance of this
   system. This system was evaluated
   (x) at a special test facility (Option 1)
   ( ) at one or more instrumented operational storage tank facilities (Option 2)
   ( ) at five or more operational storage tank facilities verified to be tight (Option 3)
   ( ) at 10 or more operational storage tank facilities (Option 4)
   ( ) with an experimentally validated computer simulation (Option 5)

7. A total of _____ tests were conducted on nonleaking tanks) between _____ (date)
    and _____ (date). A description of the pipeline configuration used in the evaluation is
    given in Attachment 3.

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8. The pipeline used in the evaluation was _____ in. in diameter, _____ ft long and
    constructed of ________ (fiberglass, steel, or other).

9. A mechanical line leak detector
   ( ) was
   (x) was not present in the pipeline system.

Answer questions 10 and 11 if Option 3 or 4 was used.   NA

10. The evaluation was conducted on _______ (how many) pipeline systems ranging in
     diameter from _____ in. to _____ in., ranging in length from _____ ft to
         _____ ft, and constructed of ____________________________ (specify materials).
11. A mechanical line leak detector
( ) was
( ) was not
present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the data collection:
( ) 0 to 6 h
( ) 6 to 12 h
( ) 12 to 24 h
( ) 24 h or more

Temperature Conditions

This system was evaluated under the range of temperature conditions specified in Table 1. The difference between the temperature of the product circulated through the pipeline for 1 h or more and the average temperature of the backfill and soil between 2 and 12 in. from the pipeline is summarized in Table 1. If Option 1, 2 or 5 was used a more detailed summary of the product temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4 was used, no artificial temperature conditions were generated.

Table 1. Summary of Temperature Conditions Used in the Evaluation

<table>
<thead>
<tr>
<th>Minimum Number of Conditions Required</th>
<th>Number of Conditions Used</th>
<th>Range of $\Delta T$ (°F) $^\text{**}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &lt; -25$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$-25 \leq \Delta T &lt; -15$</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>$-15 \leq \Delta T &lt; -5$</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>$-5 \leq \Delta T &lt; +5$</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>$+5 \leq \Delta T &lt; +15$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$+15 \leq \Delta T &lt; +25$</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &gt; 25$</td>
</tr>
</tbody>
</table>

$^\text{*This column should be filled out only if Option 1, 2, or 5 was used.}$

$^\text{**} \Delta T$ is the difference between the temperature of the product dispensed through the pipeline for over an hour prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

Data Used to Make Performance Estimates

13. The induced leak rate and the test results used to estimate the performance of this system are summarized in Attachment 5. Were any test runs removed from the data set?
( ) no
( x ) yes

If yes, please specify the reason and include with Attachment 5. (If more than one test was removed, specify each reason separately.)
Sensitivity to Trapped Vapor

14. (x) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. (If not excessive)
   ( ) According to the vendor, this system should not be used if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at *psi with 100 ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

Table 2. Summary of the Results of Trapped Vapor Tests *(approximately 1.5 times operating pressure)*

<table>
<thead>
<tr>
<th>Test No.</th>
<th>$\Delta T$ (°F)</th>
<th>Induced Leak Rate (gal/hr)</th>
<th>Measured Leak Rate (gal/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+8.56</td>
<td>0.0 gal/hr</td>
<td>PASS</td>
</tr>
<tr>
<td>2</td>
<td>+6.23</td>
<td>0.097 gph @ 40 psi</td>
<td>FAIL</td>
</tr>
<tr>
<td>3</td>
<td>-10.18</td>
<td>0.099 gph @ 40 psi</td>
<td>FAIL</td>
</tr>
</tbody>
</table>

Performance Characteristics of the Instrumentation

16. State below the performance characteristics of the primary measurement system(s) used to collect the data. (Please specify the units, for example, gallons, inches.)

<table>
<thead>
<tr>
<th>Quantity Measured:</th>
<th>Pressure (psi)</th>
<th>Volume (ml)</th>
<th>Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>0.1</td>
<td>0.5</td>
<td>0.01</td>
</tr>
<tr>
<td>Precision:</td>
<td>0.1</td>
<td>0.5</td>
<td>0.05</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>0.3</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Minimum Detectable Quantity:</td>
<td>0.1</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Response Time:</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Threshold is exceeded when the flow rate due to a leak exceeds 0.05 gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities, that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

- the system that was evaluated has not been substantially changed by subsequent modifications
- the manufacturer's instructions for using the system are followed
- a mechanical line leak detector ( ) is present in
- (x) has been removed from the pipeline (check both if appropriate)

System has a 3 gph test mode, whose function replaces that of a mechanical line leak detector.
• the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is _NA_ h
• the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is _2.5_ h
• the total data collection time for the test is _0.3_ h
• the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8
• please give any other limitations specified by the vendor or determined during the evaluation:

Disclaimer: This test procedure only addresses the issue of the system’s ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability or maintainability of the equipment.

Attachments
Attachment 1 - Description of the System Evaluated
Attachment 2 - Summary of the Performance of the System Evaluated
Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation
Attachment 4 - Data Sheet Summarizing Product Temperature Conditions Used in the Evaluation
Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation
Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests
Attachment 7 -- Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining the Signal and Noise

Certification of Results
I certify that the pipeline leak detection system was operated according to the vendor’s instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

William D. Glaуз
(name of person performing evaluation)
August 7, 1991
(date)
(816) 753-7600
(telephone number)

Midwest Research Institute
(organization performing evaluation)
425 Volker Boulevard
(street address)
Kansas City, MO 64110
(city, state, zip)
Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as an
Hourly Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a line tightness test. The evaluation was conducted according to the United States Environmental Protection Agency’s (EPA’s) evaluation procedure, specified in Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems. The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: Veeder-Root Pressurized Line Leak Detector

Version of System: Series 8494 Line Leak Detector for TLS-350/350R and LLD-300

Manufacturer Name: Veeder-Root

125 Powder Forest Drive, Post Office Box 2003
(street address)

Simsbury, CT 06070-2003
(city, state, zip code)

(203) 651-2700
(telephone number)

Evaluation Results

1. The performance of this system
   (X) meets or exceeds
   ( ) does not meet
   the federal standards established by the EPA regulation for line tightness tests.

   The EPA regulation for an hourly line tightness test requires that the system be capable of
   detecting a leak as small as 3.0 gal/h with a probability of detection (P_D) of 95% and a
   probability of false alarm (P_FA) of 5%.

2. The estimated P_FA in this evaluation is 0 % and the estimated P_D against a leak rate of 3.0
   gal/h defined at a pipeline pressure of 10 psi in this evaluation is 100 %. The system
   was actually tested at an average calibrated leak rate of 2.962 gph (at 10 psi) and it detected
   100 % of induced leaks.
Criterion for Declaring a Leak

3. This system (X) uses a preset threshold ( ) measures and reports the output quantity and compares it to a predetermined threshold to determine whether the pipeline is leaking.

4. This system (X) uses a single test ( ) uses a multiple-test sequence consisting of _______ tests (specify number of tests required) separated by _______ hours (specify the time interval between tests) to determine whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of _______ (specify flow rate in gal/h) in _______ out of _______ tests (specify, for example, 1 out of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.

Evaluation Approach

6. There are five options for collecting the data used in evaluating the performance of this system. This system was evaluated (X) at a special test facility (Option 1) ( ) at one or more instrumented operational tank facilities (Option 2) ( ) at five or more operational storage tank facilities verified to be tight (Option 3) ( ) at 10 or more operational storage tank facilities (Option 4) ( ) with an experimentally validated computer simulation (Option 5).

7. A total of _______ tests was conducted on nonleaking pipeline(s) between _______ (date) and _______ (date). A description of the pipeline configuration used in the evaluation is given in Attachment 3.

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8. The pipeline used in the evaluation was _______ in. in diameter, _______ ft long and constructed of _______ (fiberglass, steel or other).

9. A mechanical line leak detector ( ) was (X) was not present in the pipeline system. System's 3 gal/h test mode, being tested, is a function that replaces that of a mechanical leak detector.

Answer questions 10 and 11 if Option 3 or 4 was used.

10. The evaluation was conducted on _______ (how many) pipeline systems ranging in diameter from _______ in. to _______ in., ranging in length from _______ ft to _______ ft, and constructed of _______ (specify materials).
11. A mechanical line leak detector
   ( ) was
   ( ) was not
   present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the data collection:
   ( ) 0 to 6 h
   ( ) 6 to 12 h  \textit{(Not applicable)}
   ( ) 12 to 24 h
   ( ) 24 h or more.

\textbf{Temperature Conditions}

This system was evaluated under the range of temperature conditions specified in Table 1. The difference between the temperature of the product circulated through the pipeline for 1 h or more and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is summarized in Table 1. If Option 1, 2, or 5 was used, a more detailed summary of the product temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4 was used, no artificial temperature conditions were generated.

\textbf{Table 1. Summary of Temperature Conditions Used in the Evaluation}

<table>
<thead>
<tr>
<th>Minimum Number of Conditions Required</th>
<th>Number of Conditions Used$^a$</th>
<th>Range of $\Delta T \ (^\circ F)^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &lt; -25$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$-25 \leq \Delta T &lt; -15$</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>$-15 \leq \Delta T &lt; -5$</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>$-5 \leq \Delta T &lt; +5$</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>$+5 \leq \Delta T &lt; +15$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$+15 \leq \Delta T &lt; +25$</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &gt; +25$</td>
</tr>
</tbody>
</table>

$^a$ This column should be filled out only if Option 1, 2, or 5 was used.

$^b$ $\Delta T$ is the difference between the temperature of the product dispensed through the pipeline for over an hour prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

\textbf{Data Used to Make Performance Estimates}

13. The induced leak rate and the test results used to estimate the performance of this system are summarized in Attachment 5. Were any tests removed from the data set?
   (X) no
   ( ) yes
   If yes, please specify the reason and include with Attachment 5. (If more than one test was removed, specify each reason separately.)
Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.)*
( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at _20-25_ psi with _100_ ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6. Two additional tests were performed with a large amount of vapor accidently placed in the line. Although the system performed correctly, the results are not included in these forms as they were not in accordance with the test protocol.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>$\Delta T$ (°F)</th>
<th>Induced Leak Rate (gal/h)</th>
<th>Measured Leak Rate (gal/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>-10.6</td>
<td>0.00</td>
<td>Pass</td>
</tr>
<tr>
<td>36</td>
<td>-10.6</td>
<td>0.00</td>
<td>Pass</td>
</tr>
<tr>
<td>53</td>
<td>0.0</td>
<td>2.950</td>
<td>Fail</td>
</tr>
</tbody>
</table>

Performance Characteristics of the Instrumentation

16. State below the performance characteristic of the primary measurement system(s) used to collect the data. *(Please specify the units, for example, gallons, inches.)*

<table>
<thead>
<tr>
<th>Quantity Measured</th>
<th>Pressure (psi)</th>
<th>Volume (ml)</th>
<th>Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>0.1</td>
<td>0.5</td>
<td>0.01</td>
</tr>
<tr>
<td>Precision</td>
<td>0.1</td>
<td>0.5</td>
<td>0.05</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.3</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Minimum Detectable Quantity</td>
<td>0.1</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Response Time</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Threshold is exceeded when the flow rate due to a leak exceeds _2.5_ gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

- the system that was evaluated has not been substantially changed by subsequent modifications
- the manufacturer’s instructions for using the system are followed
- a mechanical line leak detector *( ) is present
(X) has been removed from the pipeline *(Check both if appropriate.)*
• the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is **NA** h

• the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is **0.0** h

• the total data collection time for the test is **0.033** h

• the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

• please give any other limitations specified by the vendor or determined during the evaluation:

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Disclaimer: This test procedure only addresses the issue of the system's ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.

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Attachments

Attachment 1 - Description of the System Evaluated
Attachment 2 - Summary of the Performance of the System Evaluated
Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation
Attachment 4 - Data Sheet Summarizing Product Temperature Conditions in the Evaluation
Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation
Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests
Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise

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Certification of Results

I certify that the pipeline leak detection system was operated according to the vendor’s instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

William D. Glauz
(name of person performing evaluation)

William D. Glauz
(signature)

May 8, 1996
(date)

(816) 753-7600
(telephone number)

Midwest Research Institute
(organization performing evaluation)

425 Volker Boulevard
(street address)

Kansas City, MO 64110
(city, state, zip)
Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as a
Monthly Monitoring Test

This form summarizes the results of an evaluation to determine whether the pipeline leak
detection system named below and described in Attachment 1 complies with federal regulations for
conducting a monthly monitoring test. The evaluation was conducted according to the United States
Environmental Protection Agency's (EPA's) evaluation procedure, specified in Standard Test
Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems. The full
evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file
to show compliance with the federal regulations. Tank system owners should check with state and
local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: _Veeder-Root Pressurized Line Leak Detector_

Version of System: _Series 8494 Line Leak Detector for TLS-350/350R and LLD-300_

Manufacturer Name: _Veeder-Root_

125 Powder Forest Drive, Post Office Box 2003
(street address)
Simsbury, CT 06070-2003
(city, state, zip code)
(203) 651-2700
(telephone number)

Evaluation Results

1. The performance of this system
   (X) meets or exceeds
   ( ) does not meet
   the federal standards established by the EPA regulation for line tightness tests.

   The EPA regulation for a monthly monitoring test requires that the system be capable of
detecting a leak as small as 0.2 gal/h with a probability of detection ($P_D$) of 95% and a
probability of false alarm ($P_{FA}$) of 5%.

2. The estimated $P_{FA}$ in this evaluation is _0_ % and the estimated $P_D$ against a leak rate of 0.2
gal/h defined at a pipeline pressure of _31_ psi (the normal operating pressure) in this
evaluation is _100_ %. The system was actually tested at an average calibrated leak rate of
_0.195_ gph (at 31 psi) and it detected _100_ % of induced leaks.
**Criterion for Declaring a Leak**

3. This system
   (X) uses a preset threshold
   () measures and reports the output quantity and compares it to a predetermined threshold to determine whether the pipeline is leaking.

4. This system
   (X) uses a single test (\textit{I test after accounting for effects of thermals, if any})
   () uses a multiple-test sequence consisting of ________ tests (specify number of tests required) separated by ________ hours (specify the time interval between tests) to determine whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of ________ (specify flow rate in gal/h) in ________ out of ________ tests (specify, for example, 1 out of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.

**Evaluation Approach**

6. There are five options for collecting the data used in evaluating the performance of this system. This system was evaluated
   (X) at a special test facility (Option 1)
   () at one or more instrumented operational tank facilities (Option 2)
   () at five or more operational storage tank facilities verified to be tight (Option 3)
   () at 10 or more operational storage tank facilities (Option 4)
   () with an experimentally validated computer simulation (Option 5).

7. A total of ________ tests was conducted on nonleaking pipeline(s) between ________ (date) and ________ (date). A description of the pipeline configuration used in the evaluation is given in Attachment 3.

   \textbf{Answer questions 8 and 9 if Option 1, 2, or 5 was used.}

8. The pipeline used in the evaluation was ________ in. in diameter, ________ ft long and constructed of \textit{fiberglass} (fiberglass, steel or other).

9. A mechanical line leak detector
   () was
   (X) was not present in the pipeline system. \textit{System has a 3 gal/h test mode, whose function replaces that of a mechanical leak detector.}

   \textbf{Answer questions 10 and 11 if Option 3 or 4 was used.}

10. The evaluation was conducted on ________ (how many) pipeline systems ranging in diameter from ________ in. to ________ in., ranging in length from ________ ft to ________ ft, and constructed of \textit{_________________________} (specify materials).
11. A mechanical line leak detector
   ( ) was
   ( ) was not
   present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the
data collection:
   ( ) 0 to 6 h
   ( ) 6 to 12 h (Not applicable)
   ( ) 12 to 24 h
   ( ) 24 h or more.

**Temperature Conditions**

This system was evaluated under the range of temperature conditions specified in Table 1.
The difference between the temperature of the product circulated through the pipeline for 1 h or more
and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is
summarized in Table 1. If Option 1, 2, or 5 was used, a more detailed summary of the product
temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4
was used, no artificial temperature conditions were generated.

**Table 1. Summary of Temperature Conditions Used in the Evaluation**

<table>
<thead>
<tr>
<th>Minimum Number of Conditions Required</th>
<th>Number of Conditions Used(^a)</th>
<th>Range of (\Delta T (°F))^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>(\Delta T &lt; -25)</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>(-25 \leq \Delta T &lt; -15)</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>(-15 \leq \Delta T &lt; -5)</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>(5 \leq \Delta T &lt; +5)</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>(+5 &lt; \Delta T &lt; +15)</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>(+15 \leq \Delta T &lt; +25)</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>(\Delta T &gt; +25)</td>
</tr>
</tbody>
</table>

\(^a\) This column should be filled out only if Option 1, 2, or 5 was used.

\(^b\) \(\Delta T\) is the difference between the temperature of the product dispensed through the pipeline for over an hour
prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

**Data Used to Make Performance Estimates**

13. The induced leak rate and the test results used to estimate the performance of this system are
summarized in Attachment 5. Were any tests removed from the data set?
   (X) no
   ( ) yes
   If yes, please specify the reason and include with Attachment 5. (If more than one test was
   removed, specify each reason separately.)
Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.)*
   ( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at ___31___ psi with ___100___ ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>ΔT (°F)</th>
<th>Induced Leak Rate (gal/h)</th>
<th>Measured Leak Rate (gal/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>-10.6</td>
<td>0.194 @ 31 psi</td>
<td>Fail</td>
</tr>
<tr>
<td>36</td>
<td>-10.6</td>
<td>0.0</td>
<td>Pass</td>
</tr>
<tr>
<td>53</td>
<td>0.0</td>
<td>0.0</td>
<td>Pass</td>
</tr>
</tbody>
</table>

Performance Characteristics of the Instrumentation

16. State below the performance characteristic of the primary measurement system(s) used to collect the data. (Please specify the units, for example, gallons, inches.)

   Quantity Measured: Pressure (psi)  Volume (ml)  Time (sec)
   Resolution: _______ 0.1  0.5  0.01
   Precision: _______ 0.1  0.5  0.05
   Accuracy: _______ 0.3  1.0  0.01
   Minimum Detectable Quantity: _______ 0.1  1.0  0.01
   Response Time: _______ ---  ---  ---

   Threshold is exceeded when the flow rate due to a leak exceeds ___0.17___ gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

   • the system that was evaluated has not been substantially changed by subsequent modifications

   • the manufacturer’s instructions for using the system are followed

   • a mechanical line leak detector
   ( ) is present
   (X) has been removed from the pipeline (Check both if appropriate.)
• the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is **NA** h

• the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is **0.75** h

• the total data collection time for the test is **0.50, 0.75** h (for pass or fail, respectively)

• the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

• please give any other limitations specified by the vendor or determined during the evaluation: ____________________________________________________________________________________________

_Disclaimer:_ This test procedure only addresses the issue of the system’s ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.

**Attachments**

Attachment 1 - Description of the System Evaluated
Attachment 2 - Summary of the Performance of the System Evaluated
Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation
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Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise

**Certification of Results**

I certify that the pipeline leak detection system was operated according to the vendor’s instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

**Signature:**

**William D. Glauz**

(name of person performing evaluation)

(signature)

**Midwest Research Institute**

(organization performing evaluation)

425 Volker Boulevard

(street address)

Kansas City, MO 64110

(city, state, zip)

May 8, 1996

(date)

(816) 753-7600

(telephone number)
Results of the Performance Evaluation
Conducted According to EPA Test Procedures

Pipeline Leak Detection System
Used as a
Line Tightness Test

This form summarizes the results of an evaluation to determine whether the pipeline leak detection system named below and described in Attachment 1 complies with federal regulations for conducting a monthly monitoring test. The evaluation was conducted according to the United States Environmental Protection Agency’s (EPA’s) evaluation procedure, specified in Standard Test Procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems. The full evaluation report includes seven attachments.

Tank system owners who use this pipeline leak detection system should keep this form on file to show compliance with the federal regulations. Tank system owners should check with state and local agencies to make sure this form satisfies the requirements of these agencies.

System Evaluated

System Name: Veeder-Root Pressurized Line Leak Detector

Version of System: Series 8494 Line Leak Detector for TLS-350/350R and LLD-300

Manufacturer Name: Veeder-Root

125 Powder Forest Drive, Post Office Box 2003
(street address)

Simsbury, CT 06070-2003
(city, state, zip code)

(203) 651-2700
(telephone number)

Evaluation Results

1. The performance of this system
   (X) meets or exceeds
   ( ) does not meet
   the federal standards established by the EPA regulation for line tightness tests.

   The EPA regulation for a line tightness test requires that the system be capable of detecting a
   leak as small as 0.1 gal/h with a probability of detection (P_D) of 95% and a probability of
   false alarm (P_FA) of 5%.

2. The estimated P_FA in this evaluation is ____ % and the estimated P_D against a leak rate of 0.1
gal/h defined at a pipeline pressure of 45 psi (1.5 times the normal operating pressure) in
this evaluation is ____ %. The system was actually tested at an average calibrated leak rate
of 0.096 gph (at 45 psi) and it detected ____ % of the induced leaks.
Criterion for Declaring a Leak

3. This system
   (X) uses a preset threshold
   ( ) measures and reports the output quantity and compares it to a predetermined threshold to
determine whether the pipeline is leaking.

4. This system
   (X) uses a single test  (1 test after accounting for effects of thermals, if any)
   ( ) uses a multiple test sequence consisting of _______ tests (specify number of tests
required) separated by ________ hours (specify the time interval between tests) to determine
whether the pipeline is leaking.

5. This system declares a leak if the output of the measurement system exceeds a threshold of
   0.09_ (specify flow rate in gal/h) in _____ out of _____ tests (specify, for example, 1 out
of 2, 2 out of 3). Please give additional details, if necessary, in the space provided.

Evaluation Approach

6. There are five options for collecting the data used in evaluating the performance of this
system. This system was evaluated
   (X) at a special test facility (Option 1)
   ( ) at one or more instrumented operational tank facilities (Option 2)
   ( ) at five or more operational storage tank facilities verified to be tight (Option 3)
   ( ) at 10 or more operational storage tank facilities (Option 4)
   ( ) with an experimentally validated computer simulation (Option 5).

7. A total of 53__ tests was conducted on nonleaking pipeline(s) between 6/25/96 (date) and
   7/5/96 (date). A description of the pipeline configuration used in the evaluation is given in
   Attachment 3.

Answer questions 8 and 9 if Option 1, 2, or 5 was used.

8. The pipeline used in the evaluation was 2.22_ in. in diameter, 249_ ft long and
constructed of fiberglass (fiberglass, steel or other).

9. A mechanical line leak detector
   ( ) was
   (X) was not System has a 3 gal/h test mode, whose function
present in the pipeline system. replaces that of a mechanical leak detector.

Answer questions 10 and 11 if Option 3 or 4 was used.

10. The evaluation was conducted on _______ (how many) pipeline systems ranging in diameter
    from __________ in. to __________ in., ranging in length from __________ ft to __________ ft, and
    constructed of _________________ (specify materials).
11. A mechanical line leak detector
() was
() was not
present in the majority of the pipeline systems used in the evaluation.

12. Please specify how much time elapsed between the delivery of product and the start of the
data collection:
() 0 to 6 h
() 6 to 12 h (Not applicable)
() 12 to 24 h
() 24 h or more.

**Temperature Conditions**

This system was evaluated under the range of temperature conditions specified in Table 1.
The difference between the temperature of the product circulated through the pipeline for 1 h or more
and the average temperature of the backfill and the soil between 2 and 12 in. from the pipeline is
summarized in Table 1. If Option 1, 2, or 5 was used, a more detailed summary of the product
temperature conditions generated for the evaluation is presented in Attachment 4. If Option 3 or 4
was used, no artificial temperature conditions were generated.

<table>
<thead>
<tr>
<th>Minimum Number of Conditions Required</th>
<th>Number of Conditions Used&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Range of $\Delta T$ ($^\circ$F)&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &lt; -25$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$-25 \leq \Delta T &lt; -15$</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>$-15 \leq \Delta T &lt; -5$</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>$-5 \leq \Delta T &lt; +5$</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>$+5 \leq \Delta T &lt; +15$</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>$+15 \leq \Delta T &lt; +25$</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>$\Delta T &gt; +25$</td>
</tr>
</tbody>
</table>

<sup>a</sup> This column should be filled out only if Option 1, 2, or 5 was used.
<sup>b</sup> $\Delta T$ is the difference between the temperature of the product dispensed through the pipeline for over an hour
prior to the conduct of a test and the average temperature of the backfill and soil surrounding the pipe.

**Data Used to Make Performance Estimates**

13. The induced leak rate and the test results used to estimate the performance of this system are
summarized in Attachment 5. Were any tests removed from the data set?
(X) no
() yes
If yes, please specify the reason and include with Attachment 5. (If more than one test was
removed, specify each reason separately.)
Sensitivity to Trapped Vapor

14. (X) According to the vendor, this system can be used even if trapped vapor is present in the pipeline during a test. *(If not excessive.*)

( ) According to the vendor, this system *should not be used* if trapped vapor is present in the pipeline.

15. The sensitivity of this system to trapped vapor is indicated by the test results summarized in Table 2. These tests were conducted at **38** psi with **100** ml of vapor trapped in the line at a pressure of 0 psi. The data and test conditions are reported in Attachment 6.

### Table 2. Summary of the Results of Trapped Vapor Tests

<table>
<thead>
<tr>
<th>Test No.</th>
<th>$\Delta T$ (°F)</th>
<th>Induced Leak Rate (gal/h)</th>
<th>Measured Leak Rate (gal/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>-11.9</td>
<td>0.095 at 45 psi</td>
<td>Fail</td>
</tr>
<tr>
<td>36</td>
<td>-11.9</td>
<td>0.0</td>
<td>Pass</td>
</tr>
<tr>
<td>53</td>
<td>-0.7</td>
<td>0.095 at 45 psi</td>
<td>Fail</td>
</tr>
</tbody>
</table>

Performance Characteristics of the Instrumentation

16. State below the performance characteristic of the primary measurement system(s) used to collect the data. *(Please specify the units, for example, gallons, inches.)*

<table>
<thead>
<tr>
<th>Quantity Measured:</th>
<th>Pressure (psi)</th>
<th>Volume (ml)</th>
<th>Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution:</td>
<td>0.1</td>
<td>0.5</td>
<td>0.01</td>
</tr>
<tr>
<td>Precision:</td>
<td>0.1</td>
<td>0.5</td>
<td>0.05</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>0.3</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Minimum Detectable Quantity:</td>
<td>0.1</td>
<td>1.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Response Time:</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Threshold is exceeded when the flow rate due to a leak exceeds **0.09** gal/h.

Application of the System

17. This leak detection system is intended to test pipeline systems that are associated with underground storage tank facilities that contain petroleum or other chemical products, that are typically constructed of fiberglass or steel, and that typically measure 2 in. in diameter and 200 ft or less in length. The performance estimates are valid when:

- the system that was evaluated has not been substantially changed by subsequent modifications
- the manufacturer’s instructions for using the system are followed
- a mechanical line leak detector *( ) is present
  *(X) has been removed from the pipeline (Check both if appropriate.)*
• the waiting time between the last delivery of product to the underground storage tank and the start of data collection for the test is \[ \text{NA} \] h

• the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is \[ 2.0 \] h

• the total data collection time for the test is \[ 0.53, 0.80 \] h (for pass or fail, respectively)

• the volume of the product in the pipeline system is less than twice the volume of the product in the pipeline system used in the evaluation, unless a separate written justification for testing larger pipeline systems is presented by the manufacturer, concurred with by the evaluator, and attached to this evaluation as Attachment 8.

• please give any other limitations specified by the vendor or determined during the evaluation: 

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**Disclaimer:** This test procedure only addresses the issue of the system’s ability to detect leaks in pipelines. It does not test the equipment for safety hazards or assess the operational functionality, reliability, or maintainability of the equipment.

**Attachments**

Attachment 1 - Description of the System Evaluated  
Attachment 2 - Summary of the Performance of the System Evaluated  
Attachment 3 - Summary of the Configuration of the Pipeline System(s) Used in the Evaluation  
Attachment 4 - Data Sheet Summarizing Product Temperature Conditions in the Evaluation  
Attachment 5 - Data Sheet Summarizing the Test Results and the Leak Rates Used in the Evaluation  
Attachment 6 - Data Sheet Summarizing the Test Results and the Trapped Vapor Tests  
Attachment 7 - Data Sheet Summarizing the Test Results Used to Check the Relationship Supplied by the Manufacturer for Combining Signal and Noise

**Certification of Results**

I certify that the pipeline leak detection system was operated according to the vendor’s instructions. I also certify that the evaluation was performed according to the procedure specified by the EPA and that the results presented above are those obtained during the evaluation.

---

**William D. Glauz**  
(name of person performing evaluation)

\[ \text{signature} \]

**Midwest Research Institute**  
(organization performing evaluation)

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