AUTOMATIC TANK MONITORING & LINE LEAK DETECTION

REFERENCE MANUAL

Author: Bjorn Brinkman, Environmental Engineer
EPA, Region 7, 913-551-7761
TLS-250

Automatic Tank Gauging System

VEEDER-ROOT
125 Powder Forest Dr.
Simsbury, CT 06070
Tel: (203) 651-2700

Evaluator: MRI - 05/14/93

System Description: The TLS-250 is capable of sensing product loss as small as 0.2 gph. The leak detect routine is conducted while no fueling is taking place and no bulk deliveries are being made. The leak detection mode can be operated manually or set automatically for times when the facility is closed. It can be set to test a single tank or all tanks in a system. The TLS also checks itself and the fuel prior to and during a test for nine separate conditions including low inventory, recent bulk delivery and equipment problems which could cause a false test failure. The TLS system is capable of handling 8 probes. The TLS-250 Plus! uses different probes and can detect a leak of 0.1 gph. The TLS-250i uses sensors to monitor interstitial areas.

Certification: 0.2 gph with PD = 99% and PFA = 0.1%
0.1 gph with Plus! system

Tank Capacity: Max. 15,000 gal

Test Period: Min. 2 hrs with tank 50 - 95% full
Min. 3 hrs with Plus! system

Limitations: - No dispensing or delivery during test
- Not evaluated using manifold tanks
- Not capable of continuous monitoring
- Not equipped to monitor product lines
SAMPLE REPORTS
TLS-250

1. Display Inventory Information (NORMAL MODE)
   a. Depress FUNCTION until desired function
   b. Depress TANK until desired tank

2. Print Inventory Information (NORMAL MODE)
   a. Depress PRINT; information for all tanks in system.

3. Leak or Sensor Monitor Report (NORMAL MODE)
   a. Depress FUNCTION until “Leak Rate (gal/hr)”
   b. Depress PRINT; information for all tanks in system
4. **Alarm History Report (DIAGNOSTIC MODE)**

   a. Depress FUNCTION until diagnostic code “8”
   b. Depress PRINT, shows the last three occurrences of each type of alarm for this tank

5. **Inventory Increase Report (NORMAL MODE)**

   a. Depress FUNCTION until “Delivery Volume”
   b. Depress PRINT; shows last delivery

```
TANK 1
PREMIUM UNLEADED
INVENTORY INCREASE

FEB 6, 1987
3:38 PM
709 GALLONS FUEL
56.7 DEGREES F

FEB 6, 1987
3:59 PM
5685 GALLONS FUEL
60.4 DEGREES F

4976 NET INCREASE

ALARM HISTORY REPORT
-- EXT. INPUT ON ---
MAR 13, 1987
9:09 PM
MAR 9, 1987
4:25 PM
MAR 6, 1987
10:25 AM
-- EXT. INPUT OFF --
MAR 13, 1987
9:09 PM
MAR 9, 1987
4:25 PM
MAR 6, 1987
10:35 AM
TANK 5
PRODUCT 5
------- LEAK -------
MAR 13, 1987
1:10 AM
MAR 3, 1987
2:15 AM
MAR 1, 1987
4:15 AM
------- HIGH WATER ------
MAR 13, 1987
9:06 PM
------- OVERFILL ------
FEB 23, 1987
4:07 PM
------- LOW LIMIT ------
FEB 23, 1987
9:04 AM
------- THEFT ---------
FEB 10, 1987
12:11 AM
```
**System Description:** The **TLS-350** and the **TLS-350R** (business inventory reconciliation) are monitoring systems that can be upgraded to provide continuous statistical leak detection (**CSLD**) and line leak detection if the appropriate options are added to the console. The **CSLD** option provides continuous tank leak detection without operational shutdown. The system can also operate on various software, depending on the UST system. The **TLS-350R** is able to automatically gather inventory information and reconcile totals at the end of each shift, day and period. Without the **CSLD** option, the TLS-350 can detect a leak of 0.1 gph; however, the UST system must be idle during the test. With the **CSLD** option, it is certified at 0.2 gph and can be used to test manifolded systems. Three line leak detection options are available:

- **Volumetric Line Leak Detection (VLLD)**
- **Pressurized Line Leak Detection (PLLD)**
- **Wireless Pressurized Line Leak Detection (WPLLD)**

all can detect 3, 0.2 and 0.1 gph. The **TLS-350** is also capable of monitoring groundwater and vapor sensors. The console features a built-in beeper and warning lights for alarm conditions and can be programmed to shut down pumps. **You can verify which options are included in the system by scrolling thru the functions listed on the console display.**
TLS-350
(CONT)

Certification:  

**TANK GAUGING**  
0.1 gph with PD = 99% and PFA = 1%  
*With CSLD*  
0.2 gph with PD = 100% and PFA = 0%  

**LINE TEST**  
3, 0.2 & 0.1 gph with PD = 100% and PFA = 0%

Tank Capacity:  
Max. 15,000 gal  
Max. 38,170 gal for all manifolded tanks with CSLD

Test Period:  

**TANK GAUGING**  
Min. 3 hrs with tank 95% full for 0.1 gph test  
Min. 2 hrs with tank 50 - 95% full for 0.2 gph test  
*With CSLD*  
No down time

**LINE TEST**  
(Depends on probe series)  
3.0 gph - 14 sec to 1 min  
0.2 gph - 6 to 45 min  
0.1 gph - 14 to 45 min

Limitations:  

**W/O CSLD option**  
- No dispensing or delivery during test  
- Not evaluated using manifolded tanks  

**W/O LLD option**  
- Not equipped to monitor product lines
SAMPLE REPORTS
TLS-350

Console Keypad

1. View Inventory Information
   a. Press FUNCTION until “In-Tank Inventory”
   b. Press STEP to view inventory in first tank
   c. Continue to press STEP for all other inventory information
   d. Press TANK for inventory in next tank

2. Print Inventory Information
   a. Find “All Functions Normal” on display
   b. Press PRINT; information for all tanks in system.

3. Delivery Increase Amount
   a. Press FUNCTION until “In-Tank Inventory”
   b. Press STEP until “Delivery=”
   c. Press TANK for inventory in next tank
   d. Press PRINT for delivery in tank
4. **Tank Leak Test Results**

   a. Press `FUNCTION` until “In-Tank Test Results”
   b. Press `PRINT` for all tank leak tests

5. **CSLD Test Results**

   a. Press `FUNCTION` until “CSLD Test Results”
   b. Press `PRINT` for CSLD results in all tanks

6. **Pressurized Line Leak Detection Tests (PLLD)**

   a. Press `FUNCTION` until “Pressure Line Results”
   b. Press `PRINT` for results in all lines
7. PLLD History Reports

a. Press FUNCTION until “Pressure Line Results”
b. Press STEP until “Press Print for History”
c. Press PRINT for history; last 3 gph, first 0.2 gph & first 0.1 gph results for each month

8. Wireless Pressurized Line Leak Detection Tests (WPLLD)

a. Press FUNCTION until “WPLLD Line Results”
b. Press PRINT for results of all lines

9. WPLLD History Reports

a. Press FUNCTION until “WPLLD Line Results”
b. Press STEP until “Press Print for History Report”
c. Press PRINT for history; last 3 gph, first 0.2 gph & first 0.1 gph results for each month
10. Volumetric Line Leak Detection Tests (VLLD)  
   (TLS-350R Only)  
   a. Press FUNCTION until “Line Leak Detect Results”  
   b. Press PRINT for history results of all lines  

11. Liquid Status Reports  
   a. Press FUNCTION until “Liquid Status”  
   b. Press PRINT for report for up to 64 sensors  
   c. Press TANK/SENSOR for other sensors in system  
   d. Press PRINT for report of sensor status  

12. Vapor Status Reports  
   a. Press FUNCTION until “Vapor Status”  
   b. Press PRINT for report for up to 40 sensors  
   c. Press TANK/SENSOR for other sensors in system  
   d. Press PRINT for report of sensor status  

13. Groundwater Sensor Status  
   a. Press FUNCTION until “Groundwater Status”  
   b. Press PRINT for report for up to 40 sensors  
   c. Press TANK/SENSOR for other sensors in system  
   d. Press PRINT for report of sensor status  

14. Alarm History Report  
   a. Press MODE until “Diagnostic”  
   b. Press FUNCTION until “Alarm History Report”  
   c. Press STEP until desired report  
   d. Press PRINT for tank/sensor displayed  
   e. Press TANK/SENSOR to access other tanks/sensors  

- 6 -
15. Leak History Report

a. Press **MODE** until “Diagnostic”

b. Press **FUNCTION** until “In-Tank Leak Result”

c. Press **STEP** until “Print Leak History”

d. Press **PRINT**

```
TANK LEAK TEST HISTORY
T 1:Unleaded

LAST GROSS TEST PASSED:
NOV 4, 1996 12:01 AM
STARTING VOLUME= 17559
PERCENT VOLUME = 89.1
TEST TYPE = STANDARD

LAST ANNUAL TEST PASSED:
NO TEST PASSED

FULLEST ANNUAL TEST PASS
NO TEST PASSED

LAST PERIODIC TEST PASS:
SEP 29, 1998 2:54 AM
TEST LENGTH 17 HOURS
STARTING VOLUME= 11434
PERCENT VOLUME = 58.0
TEST TYPE = CSLD

FULLEST PERIODIC TEST PASSED EACH MONTH:

JAN 31, 1998 3:19 AM
TEST LENGTH 18 HOURS
STARTING VOLUME= 12276
PERCENT VOLUME = 82.3
TEST TYPE = CSLD

FEB 28, 1998 4:29 AM
TEST LENGTH 19 HOURS
STARTING VOLUME= 14183
PERCENT VOLUME = 73.0
TEST TYPE = CSLD

MAR 31, 1998 3:37 AM
TEST LENGTH 19 HOURS
STARTING VOLUME= 14977
PERCENT VOLUME = 73.0
TEST TYPE = CSLD

APR 30, 1998 4:05 AM
TEST LENGTH 19 HOURS
STARTING VOLUME= 13792
PERCENT VOLUME = 70.0
TEST TYPE = CSLD

MAY 31, 1998 4:00 AM
TEST LENGTH 20 HOURS
STARTING VOLUME= 11188
PERCENT VOLUME = 56.8
TEST TYPE = CSLD

JUN 29, 1998 4:10 AM
TEST LENGTH 21 HOURS
STARTING VOLUME= 10282
PERCENT VOLUME = 52.2
TEST TYPE = CSLD

JUL 31, 1998 4:50 AM
TEST LENGTH 19 HOURS
STARTING VOLUME= 16397
PERCENT VOLUME = 83.2
TEST TYPE = CSLD

AUG 30, 1998 4:42 AM
TEST LENGTH 21 HOURS
STARTING VOLUME= 11794
PERCENT VOLUME = 59.9
TEST TYPE = CSLD

SEP 29, 1998 2:54 AM
TEST LENGTH 17 HOURS
STARTING VOLUME= 11434
PERCENT VOLUME = 58.0
TEST TYPE = CSLD

OCT 31, 1997 4:39 AM
TEST LENGTH 18 HOURS
STARTING VOLUME= 11434
PERCENT VOLUME = 58.0
TEST TYPE = CSLD

NOV 4, 1996 12:01 AM
TEST LENGTH 2 HOURS
STARTING VOLUME= 17559
PERCENT VOLUME = 89.1
TEST TYPE = STANDARD

DEC 1, 1996 11:56 AM
TEST LENGTH 128 HOURS
STARTING VOLUME= 17743
PERCENT VOLUME = 89.0
TEST TYPE = CSLD
```
**EMC ENVIRONMENTAL MANAGEMENT CONSOLE**

Automatic Tank Gauging & Electronic Line Leak Detection System

**GILBARCO**
7300 West Friendly
Greensboro, NC 27420
Tel: (910) 547-5000

**Evaluator:** MRI - 05/14/93

**System Description:** The EMC is manufactured by the same company that manufactures the TLS-350. It operates and looks similar to the TLS-350. Refer to the TLS-350 information sheets for system description and instructions for obtaining reports.

**Certification:**

- **TANK GAUGING**
  
  0.1 gph with PD = 99% and PFA = 1%
  
  With CSLD
  
  0.2 gph with PD = 100% and PFA = 0%

- **LINE TEST**
  
  3, 0.2 & 0.1 gph with PD = 100% and PFA = 0%

**Tank Capacity:**

- Max. 15,000 gal
- Max. 38,170 gal for all manifolded tanks with CSLD

**Test Period:**

- **TANK GAUGING**
  
  Min. 3 hrs with tank 95% full for 0.1 gph test
  Min. 2 hrs with tank 50 - 95% full for 0.2 gph test

  With CSLD
  
  No down time
WILCO

Fuel Management and

Compliance Service

SIMMONS

106 East Main Street
Richardson, TX 75081
Tel: (800) 848-8378

Keypad/Display Unit

Evaluator: S.S.G.

System Description: The Wilco system employs radio and modem communications technology to connect on-site monitoring equipment to the Simmons Central Monitoring Center. Technicians collect and process data, monitor and respond to alarms and generate compliance reports. The Wilco ATG probe uses micro-impulse radar technology to measure tank levels and then transmits data via radio signal to a remote receiver linked to the Wilco Control Panel. The Wilco control panel with user keypad and display unit then sends data between the business and Simmons central monitoring center via existing telephone lines. Inventory, sales and delivery data are then used to produce SIR results. Sales and deliveries must be entered manually thru the keypad. Options include leak detection sensor and overfill alarms.

Certification: SIR 5.7 L.M. version; 0.2 & 0.1 GPH with PD = 99% & PFA = 1%

Tank Capacity: 45,000 gal.; 2, 3 or 4 tank manifolde systems

Test Period: Min. 26 days

Limitations: Data collection only
**WILCO**

**Keypad Operation**

**Keypad/Display Unit**

**Flowchart of Wilco Menu**

1. **Tank Inventory**
   
   a. Press “Menu” until Tank Data
   b. Press “Next” for Volume, Level, Water or Ullage
   c. Press “Tank/Hose” for different tanks in system

2. **Alarm List**
   
   a. Press “Menu” until Alarm List
   b. Press “Next” for each alarm
      i. alarm description will flash on and off to indicate alarm has not been acknowledged
      ii. if alarm status is still present, second line will indicate “ACTIVE”
      iii. if alarm status is not present, second line will indicate “CLEARED”

3. **Self-Test (system functioning properly)**
   
   a. Press “Menu” until Self-Test
   b. Press “Next”; enter passcode (1234)
      i. Display will show SELFTEST OK if functioning properly
      ii. Display will show SELFTEST FAIL or PRESS SERVICE if not functioning properly

4. **Overfill Alarm Check**
   
   a. Initiate Self-Test, alarm should sound; if not, no overfill alarm
   b. Press “Cancel” to silence alarm
**TS-1000 & 2000**

Automatic Tank Gauging & Electronic Line Leak Detection System

**INCON**  
P.O.Box 638  
Saco, ME 04072  
Tel: (207) 283-0156

Evaluator: Ken Wilcox Associates - 08/05/92

**System Description:** The **TS-1000/2000** is a monitoring system that can test and gauge 2 or 4 tank systems. In addition, the **TS-1000/2000** can be optionally equipped with up to 8 leak detection sensors to support interstitial, sump, vapor and groundwater monitoring. Alarms can be setup to sound audibly or control relay contacts for high product levels, high water levels and tank leaks. An optional relay output **BriteBox** accessory unit may be configured to shut-off product dispenser pumps or to turn on/off other devices. The system can also be equipped with optional **TS-LLD** line leak detection software. Reports are obtained in the same manner as the **RLM 5000**.

**Certification:**  
**TANK GAUGING**  
0.2 gph with PD = 99.9% and PFA = 0.1%

**LINE TEST**  
3, 0.2 & 0.1 gph with PD = 100% and PFA = 0%

**Tank Capacity:** Max. 15,000 gal

**Test Period:**  
Min. 5 hrs with tank 50 - 95% full (**TS-1000**)  
Min. 3 hrs with tank 50 - 95% full (**TS-2000**)  

**Limitations:**  
- No dispensing or delivery during test  
- Not evaluated using manifolded tanks
SAMPLE REPORTS
TS-1000

Reports Available
1. Inventory 2. Reconciliation
3. Delivery 4. Delivery History
5. Leak Test 6. Leak Time Estimate
7. Alarm 8. Alarm History
9. Line Test 10. Line Test History
11. Alarm Status and Configuration
12. System Configuration
13. Tank Configuration

Console Keypad

1. To Print Desired Report
   a. Press REPORT key
   b. Press UP or DOWN until desired report
   c. Press ENTER
   d. If prompted, enter tank number or 0 for all tanks
   e. Press ENTER to print report

Inventory Report

Leak Test Report
SAMPLE REPORTS
TS-1000
(cont)

Alarm Report

JOHNS GAS STOP
111 OAK ST.
BIDDEFORD, ME 04005
SITE # 001

7/24/1998 04:39 AM
ALARM REPORT

7/24/1998 04:38 AM
THEFT
TANK NO. 1

7/25/1998 02:18 PM
DELIVERY REPORT
TANK NO. 1 08000 GAL
UNLEADED REG

Alarm History Report

JOHNS GAS STOP
111 OAK ST.
BIDDEFORD, ME 04005
SITE # 001

7/25/1998 02:12 PM
ALARM HISTORY REPORT

7/11/1998 05:40 PM
POWER UP

7/11/1998 05:40 PM
OVERFILL
TANK NO. 1

7/23/1998 03:30 PM
POWER UP

7/23/1998 06:17 PM
LOW LIMIT
TANK NO. 1

7/25/1998 05:51 AM
THEFT
TANK NO. 1

Delivery Report

Delivery History Report

JOHNS GAS STOP
111 OAK ST.
BIDDEFORD, ME 04005
SITE # 001

7/25/1998 09:14 PM
DELIVERY HISTORY REPORT
TANK NO. 1 08000 GAL
UNLEADED REG

Begin Time 6:15 AM
Begin Date 07/24/1998
Begin Gross 799.3 GAL
Begin Net 796.7 GAL
Begin Level 15.865 IN
Begin Water 8.571 IN
Begin Water 6.2 GAL
Begin Temp 64.481 F
End Time 6:13 AM
End Date 07/24/1998
End Gross 6722.8 GAL
End Net 6676.5 GAL
End Level 75.866 IN
End Water 8.581 IN
End Water 6.4 GAL
End Temp 69.780 F
Gross Del 3923.5 GAL
Net Del 3879.8 GAL

Begin Time 6:13 AM
Begin Date 07/23/1998
Begin Gross 1657.8 GAL
Begin Net 1652.0 GAL
Begin Level 24.952 IN
Begin Water 8.954 IN
Begin Water 8.8 GAL
Begin Temp 66.731 F
End Time 6:21 AM
End Date 07/23/1998
End Gross 3198.3 GAL
End Net 3171.5 GAL
End Level 46.417 F
End Water 8.698 IN
End Water 8.0 GAL
End Temp 68.417 F
Gross Del 1522.4 GAL
Net Del 1521.5 GAL
**TS-1001**

Automatic Tank Gauging & Electronic Line Leak Detection System

**Evaluator:** Ken Wilcox Associates - 09/05/97

**System Description:** The TS-1001 can monitor product in up to 4 tanks and also monitor up to 12 leak detection sensors internally. In addition, the TS-1001 can be optionally equipped with 1 or 2 external sensor expansion modules for an additional 8 or 16 sensor inputs capable of monitoring double walled tanks, containment sumps, dispenser pans, and vapor or groundwater monitoring wells. Alarms can be setup to sound audibly or control relay contacts for high product levels, high water levels and tank leaks. The console may also be configured to shut-off product dispenser pumps or to turn on/off other devices. **Optional** equipment includes overfill alarms, interface with line leak detection (TS-LLD) and SCALD (Statistical and Continuous Automatic Leak Detection; **not 3rd party certified**) software. *(See TS-2001 for sample reports)*

**Certification:** TANK GAUGING

- 0.2 & 0.1 gph with PD = 99.9% and PFA = 0.1%
- 0.2 gph with (LL2 probe)

**Tank Capacity:** Max. 15,000 gal (30,000 gal with LL2 probe)

**Test Period:** Min. 5 hrs (average time to collect quality data)

**Limitations:**
- No dispensing or delivery during test
- Not evaluated using manifolded tanks
System Description: The TS-2001 can monitor product in up to 8 tanks and also monitor up to 24 leak detection sensors internally. In addition, the TS-2001 can be optionally equipped with 1 or 2 external sensor expansion modules for an additional 8 or 16 sensor inputs capable of monitoring double walled tanks, containment sumps, dispenser pans, and vapor or groundwater monitoring wells. Alarms can be setup to sound audibly or control relay contacts for high product levels, high water levels and tank leaks. The console may also be configured to shut-off product dispenser pumps or to turn on/off other devices. Optional equipment includes overfill alarms, interface with line leak detection (TS-LLD) and SCALD (Statistical and Continuous Automatic Leak Detection; not 3rd party certified) software.

Certification: TANK GAUGING
0.2 & 0.1 gph with PD = 99.9% and PFA = 0.1%
0.2 gph with (LL2 probe)

Tank Capacity: Max. 15,000 gal (30,000 gal with LL2 probe)

Test Period: Min. 5 hrs (average time to collect quality data)
Can be tested at less than 50% capacity

Limitations: - No dispensing or delivery during test
- Not evaluated using manifoldsed tanks
SAMPLE REPORTS
TS-1001/2001

1. To Print Desired Report
   a. Press REPORT key
   b. Press DOWN/SPACE for more options
   c. Press menu keys (M1 - M4) to make selection
   d. Press enter to print

2. To Print Inventory Report
   a. Press REPORT key
   b. Press M 1
   c. Press M 4
   d. Press enter to print

3. To Print Inventory Summary Report
   a. Press REPORT key
   b. Press M 1
   c. Press M 2
   d. Press enter to print
SAMPLE REPORTS
TS-1001/2001
(cont)

4. To Print Leak Test Report

a. Press REPORT key
b. Press M 4
c. Press M 2
d. Press M 2 (M 3 for history report)
e. Press M 1

5. To Print SCALD Test Report

a. Press REPORT key
b. Press M 4
c. Press M 3
d. Press desired M

---

**Leak Test Report**

<table>
<thead>
<tr>
<th>Time</th>
<th>Value</th>
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<tbody>
<tr>
<td>10/18/1997 02:42</td>
<td>LEAK TEST REPORT</td>
</tr>
<tr>
<td>PLUS 2</td>
<td>5014.3 GAL PLUS</td>
</tr>
<tr>
<td>LEAK TEST</td>
<td>0.100 GPH</td>
</tr>
<tr>
<td>LEAK THRESHOLD</td>
<td>0.050 GPH</td>
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<tr>
<td>CONFIDENCE LEVEL</td>
<td>99.6%</td>
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<td>TEST STARTED</td>
<td>21:45</td>
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<tr>
<td>TEST STARTED</td>
<td>10/17/1997</td>
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<tr>
<td>GROSS CAPACITY</td>
<td>56.12</td>
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<tr>
<td>BEGIN GROSS</td>
<td>2814.2 GAL</td>
</tr>
<tr>
<td>BEGIN NET</td>
<td>2808.0 GAL</td>
</tr>
<tr>
<td>BEGIN LEVEL</td>
<td>52.630 IM</td>
</tr>
<tr>
<td>BEGIN TEMP</td>
<td>62.720 F</td>
</tr>
<tr>
<td>BEGIN WATER</td>
<td>0.4 GAL</td>
</tr>
<tr>
<td>BEGIN WATER</td>
<td>0.130 IM</td>
</tr>
<tr>
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<td>2:39</td>
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<td>END DATE</td>
<td>10/18/1997</td>
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<tr>
<td>END GROSS</td>
<td>2814.3 GAL</td>
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**Hourly Data**

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<td>22:44</td>
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<tr>
<td>23:44</td>
<td>62.751 2808.78</td>
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<td>0:44</td>
<td>62.885 2809.07</td>
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<tr>
<td>1:44</td>
<td>62.883 2809.09</td>
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**Slope**

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<th>Unit</th>
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<td>-0.04</td>
<td>GAL/HR</td>
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**SCALD Test Report**

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<tr>
<td>08/13/1998 9:56 AM</td>
<td>SCALD TEST REPORT</td>
</tr>
<tr>
<td>TANK 1</td>
<td>11882.3 GAL</td>
</tr>
<tr>
<td>UMLD REG</td>
<td>—</td>
</tr>
<tr>
<td>LEAK TEST</td>
<td>0.200 GPH</td>
</tr>
<tr>
<td>LEAK THRESHOLD</td>
<td>0.100 GPH</td>
</tr>
<tr>
<td>EXTENT</td>
<td>10.0 HRS</td>
</tr>
<tr>
<td>VOL QUALIFY</td>
<td>0.8%</td>
</tr>
<tr>
<td>TEST STARTED</td>
<td>12:22 PM</td>
</tr>
<tr>
<td>TEST STARTED</td>
<td>08/07/1998</td>
</tr>
<tr>
<td>SALES RATE</td>
<td>54.731 GPH</td>
</tr>
<tr>
<td>EVAPORATED</td>
<td>1.781 GAL</td>
</tr>
<tr>
<td>LOST</td>
<td>0.327 GAL</td>
</tr>
<tr>
<td>DUTY FACTOR</td>
<td>0.31</td>
</tr>
<tr>
<td>UPDATED</td>
<td>12:40 AM</td>
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<td>UPDATED</td>
<td>08/10/1998</td>
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**Slope**

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<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>-0.002</td>
<td>GAL/HR</td>
</tr>
</tbody>
</table>

---

**Tank 2**

<table>
<thead>
<tr>
<th>Time</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/11/1998</td>
<td>5092.7 GAL</td>
</tr>
<tr>
<td>UMLD PLUS</td>
<td>—</td>
</tr>
<tr>
<td>LEAK TEST</td>
<td>0.200 GPH</td>
</tr>
<tr>
<td>LEAK THRESHOLD</td>
<td>0.100 GPH</td>
</tr>
<tr>
<td>EXTENT</td>
<td>10.0 HRS</td>
</tr>
<tr>
<td>VOL QUALIFY</td>
<td>0.8%</td>
</tr>
<tr>
<td>TEST STARTED</td>
<td>9:41 PM</td>
</tr>
<tr>
<td>TEST STARTED</td>
<td>08/09/1998</td>
</tr>
<tr>
<td>SALES RATE</td>
<td>8.896 GPH</td>
</tr>
<tr>
<td>EVAPORATED</td>
<td>0.550 GAL</td>
</tr>
<tr>
<td>LOST</td>
<td>-0.098 GAL</td>
</tr>
<tr>
<td>DUTY FACTOR</td>
<td>0.79</td>
</tr>
<tr>
<td>UPDATED</td>
<td>1:42 AM</td>
</tr>
<tr>
<td>UPDATED</td>
<td>08/11/1998</td>
</tr>
</tbody>
</table>

**Slope**

<table>
<thead>
<tr>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.053</td>
<td>GAL/HR</td>
</tr>
</tbody>
</table>
6. To Print Line Compliance Report

a. Press REPORT key
b. Press M 3
c. Press M 1 (M 3 for history report)
d. Press M 1

7. To Print Alarm/Sensor Reports

a. Press REPORT key
b. Press DOWN/SPACE key
c. Press M 2 (M 1 for sensors)
d. Press desired M key report
System Description: The RLM 5000 operates as the central processing unit and data collection center for leak detection and inventory management. It collects level and temperature data from up to eight magnetostrictive level probes and computes various volumetric quantities, correcting all volumes for temperature. The operator may choose from among various reports as well as generate a complete set of inventory, operation and leak detection reports. These reports may be printed on demand or prescheduled. All alarms generate reports immediately and may be programmed to activate one of the two relay outputs. The RLM 5001 adds the feature of vapor and liquid detection sensors.

Certification: 0.2 gph with PD = 100% and PFA = 0%

Tank Capacity: Max. 15,000 gal

Test Period: Min. 3 hrs with tank 50 - 95% full

Limitations:
- No dispensing or delivery during test
- Not evaluated using manifolded tanks
- Not capable of monitoring product lines
- Not capable of continuous monitoring
1. **Inventory Report (non-temp comp)**
   
a. Press **RPRT** key  
b. Press **UP** or **DN** key till “Inventory”  
c. Press **ENTER** key  
d. Press **1 - 8** for desired tank or **0** for all tanks  
e. Press **ENTER** key

2. **Reconciliation Report (temp comp)**
   
a. Press **RPRT** key  
b. Press **UP** or **DN** key till “Reconcil”  
c. Press **ENTER** key  
d. Press **1 - 8** for desired tank or **0** for all tanks  
e. Press **ENTER** key

3. **Delivery Report**
   
a. Press **RPRT** key  
b. Press **UP** or **DN** key till “Delivery”  
c. Press **ENTER** key  
d. Press **1 - 8** for desired tank or **0** for all tanks  
e. Press **ENTER** key

4. **Delivery History Report (if programmed)**
   
a. Press **RPRT** key  
b. Press **UP** or **DN** key till “Del Hist”  
c. Press **ENTER** key  
d. Press **1 - 8** for desired tank or **0** for all tanks  
e. Press **ENTER** key

5. **Leak Test Report**
   
a. Press **RPRT** key  
b. Press **UP** or **DN** key till “Leak”  
c. Press **ENTER** key  
d. Press **1 - 8** for desired tank or **0** for all tanks  
e. Press **ENTER** key
6. **Leak Estimate Report (length of test)**
   
   a. Press **RPRT** key
   b. Press **UP** or **DN** key till “Leak Est”
   c. Press **ENTER** key
   d. Press 1 - 8 for desired tank or 0 for all tanks
   e. Press **ENTER** key

7. **Alarm History Report**
   
   a. Press **RPRT** key
   b. Press **UP** or **DN** key till “Alarm Hist”
   c. Press **ENTER** key
   d. Press 1 - 8 for desired tank or 0 for all tanks
   e. Press **ENTER** key; last 50 alarms

8. **Alarm Status Report (current alarms)**
   
   a. Press **RPRT** key
   b. Press **UP** or **DN** key till “Alarm Stat”
   c. Press **ENTER** key
   d. Press 1 - 8 for desired tank or 0 for all tanks
   e. Press **ENTER** key

9. **System Setup Report**
   
   a. Press **RPRT** key
   b. Press **UP** or **DN** key till “Setup”
   c. Press **ENTER** key
   d. Press 1 - 8 for desired tank or 0 for all tanks
   e. Press **ENTER** key

10. **Tank Setup Report**
    
    a. Press **RPRT** key
    b. Press **UP** or **DN** key till “Tank set up”
    c. Press **ENTER** key
    d. Press 1 - 8 for desired tank or 0 for all tanks
    e. Press **ENTER** key
**RLM 9000**

Automatic Tank Gauging & Electronic Line Leak Detection System

**Red Jacket**
Marley Pump Co.
9650 Alden Rd.
Lenexa, KS 66215
Tel: 913 541-2985

**Evaluator:** KWA - 04/02/91

**System Description:** The RLM 9000 is a single console unit that incorporates the operational properties of the PPM 4000 and the RLM 5000. Refer to the individual information sheets for additional system description and sample reports.

**Certification:**

- **TANK GAUGING**
  - 0.2 gph with PD = 100% and PFA = 0%

- **LINE TEST**
  - 3, 0.2, 0.1 gph with PD = 100% and PFA = 0%

**Test Period:**

- **TANK GAUGING**
  - Min. 3 hrs with tank 50 - 95% full

- **LINE TEST**
  - 3 gph - 1 min
  - 0.2 gph - 10 min
  - 0.1 gph - 2.5 hrs

**Limitations:** Refer to individual sheets for PPM 4000 & RLM 5000
ST 1400/1800

Automatic Tank Gauging & Electronic Line Leak Detection System

Red Jacket
Marley Pump Co.
9650 Alden Rd.
Lenexa, KS 66215
Tel: 913 541-2985

Evaluator: ADA Technologies, Inc. - 09/30/92

System Description: The ST1400/1800 controllers are electronic tank gauging devices used for leak detection and inventory management. The controllers can collect level and density data from 4 (ST1400) or 8 (ST1800) ultrasonic inventory sensors and compute various volumetric quantities, correcting all volumes for temperature. The systems have programmable alarm thresholds to alert the operator of various alarm conditions. The system is also capable of storing at least the last 33 events of any particular report. The ADD (accumulative data diagnostics) option adds the capability of continuous leak detection (not 3rd partyed). The ST1401/1801 systems add sensor monitoring for interstitial areas, wells and sumps. The ST1400L/1800L add the capability of line leak detection with positive pump shut down.

Certification: TANKS: 0.2 & 0.1 gph  PIPING: 3, 0.2 & 0.1 gph

Capacity: TANKS: Max. 18,000 gal  PIPING: Max. 55.1 gal

Test Period: Min. 2.5 hrs with tank 50 - 95% full (0.2 gph) 
(W/o ADD) 95 - 100% full (0.1 gph)

Limitations: - No dispensing or delivery during test (w/o ADD) 
- Not evaluated using manifolded tanks
CONSOLE DISPLAY

1. **View Display Options** (at SELECT DISPLAY)
   a. Press desired display option keypad #
   b. Press 1 or 1 key to view remaining tanks

2. **View History Reports** (including leak test)
   a. Press 6
   b. Press → to scroll to desired report
   c. Press 1 or 1 key to scroll to “reserved report number”
   d. Press → or → to view info

3. **Print Inventory Report**
   (green ‘OL’ indicator light must be on)
   a. Press P key for all tanks
      i. *For only one feature*, press desired option keypad #
      ii. Press P

4. **Print History Reports**
   (green ‘OL’ indicator light must be on)
   a. Press 6
   b. Press → to scroll to desired report
   c. Press P
   d. Press 1 or 1 key to enter “beginning” date
   e. Press E
   f. Press 1 or 1 key to enter “ending” date
   e. Press E to begin printing
**AUTO\hspace{0.1em}/\hspace{0.1em}STIK II & JR**

Automatic Tank Gauging  
& Electronic Line Leak  
Detection System

**EBW**  
2814 McCracken Ave.  
Muskegon, MI 49441  
Tel: 616 755-1671

**Evaluator:** Ken Wilcox Ass. - 08/20/93

**System Description:** The AUTO/STIK II and JR. series are electronic monitoring devices capable of tracking inventory, detecting leaks and providing alarm warnings. The systems can also be equipped with a continuous 24 hour leak detection option; however this option does not accumulate data during intermittent still times as most systems do, but continually starts a leak test at still times and ends the leak test only after a 30 minute still time. A leak rate for one test period is calculated by combining still period leak tests thru four consecutive days. The AUTO/STIK II can be equipped with the electronic line leak detection option which can monitor 1 to 8 pressurized lines. The AUTO/STIK II is capable of monitoring 1 to 16 tanks for leak detection, 1 to 64 liquid sensors and 1 to 56 relay outputs. The JR series are capable of handling the number of tanks indicated on the model # and are limited to the amount of sensors and relay outputs they provide.

**Certification:** 0.1 gph with PD = 98.3%  and  PFA = 1.7%

**Tank Capacity:** Max. 15,000 gal

**Test Period:** Min. 4 hrs with tank 50 - 95% full

**Limitations:**  
- No dispensing or delivery during test (even w/CLD)  
- Not evaluated using manifolded tanks  
- Not capable of monitoring product lines (JR series)
1. **Printing Reports**

a. Depress **PRINT REPORTS**
b. Depress desired report or **MORE**
c. Continue to press **MORE** until desired report
d. Depress desired report
e. Depress **ALL** or enter desired tank # (01, 02, etc.)
f. Depress **PRINT**

2. **Print Inventory Information (Status Report)**

a. Depress **PRINT REPORTS**
b. Depress **STATUS REPORT**
c. Depress **ALL** or enter desired tank # (01, 02, etc.)
e. Depress **PRINT**

3. **Print Leak Report**

a. Depress **PRINT REPORTS**
b. Depress **MORE**
c. Depress **LEAK REPORT**
d. Depress **ALL** or enter desired tank # (01, 02, etc.)
e. Depress **PRINT**

```
--------- LINE LEAK REPORT ---------
WED MAY 22, 96  5:48:19 PM
STATION NAME:
    GENES SERVICE
    SHERMAN
    MUSKEGON MI
LINE 1

CURRENT STATUS:   NO ERRORS
0.2 GPH MONTHLY PASS:   YES
0.2 GPH TEST HISTORY:
    APR: 
    MAR: 
    FEB: 
    JAN: 
    DEC: 
    NOV: 
LAST 0.2 GPH TEST:   PASS 
    TUE MAY 21, 96  7:01:52 PM
LAST 0.1 GPH TEST:   PASS 
    TUE MAY 21, 96  10:04:07 PM
```

4. **Print Line Leak Report**

a. Depress **PRINT REPORTS**
b. Depress **MORE - MORE - MORE - MORE**
c. Depress **LINE LEAK REPORT**
d. Depress **ALL** or enter desired tank # (01, 02, etc.)
e. Depress **PRINT**
System Description: The EECO 1000 functions in the same manner as the EECO 2000 but does not monitor product lines or external sensors. It is strictly a tank management system designed to monitor up to eight tanks. Tank leak tests will start automatically after deliveries or can programmed to start at a selected time daily, weekly or monthly. A segmented leak detection (SLD) option is available to provide continuous tank leak detection; however, it is not 3rd party certified. 

Refer to the EECO 2000 information sheets for additional system description and instructions to obtain reports.

Certification: 3.0, 0.2 & 0.1 gph

Tank Capacity: Max. 15,000 gal

Test Period: Min. 1 hrs with tank 50 - 95% full

Limitations: - Not evaluated using manifolded tanks
- No dispensing or delivery during test
- Does not monitor product lines
- Does not monitor external sensors
**EECO SYSTEM**

**1500 SERIES**

Automatic Tank Gauging &
Sensor Detection System

**EMCO Electronics**
114-300 Mackenan Dr
Cary, NC  27511
Ph#  919 460-6000

**Evaluator:** Midwest Research Institute - 04/29/94

**System Description:** The EECO 1500 functions in the same manner as the EECO 2000 but does not monitor product lines electronically. The EECO 1500 system is able to monitor product lines by the use of interstitial sensors. Monitoring sensors can also be used for dispenser pans, sumps and liquid/vapor wells. The EECO 1500 management system is designed to monitor two and four tank systems. Tank leak tests will start automatically after deliveries or can programmed to start at a selected time daily, weekly or monthly. A segmented leak detection (SLD) option is available to provide continuous tank leak detection; however, it is **not** 3rd party certified.

Refer to the EECO 2000 information sheets for additional system description and instructions to obtain reports.

**Certification:** 3.0, 0.2 & 0.1 gph

**Tank Capacity:** Max. 15,000 gal

**Test Period:** Min. 1 hrs  with tank 50 - 95% full

**Limitations:**
- Not evaluated using manifoded tanks
- No dispensing or delivery during test
EECO SYSTEM
2000 SERIES

Automatic Tank Gauging &
Electronic Line Leak Detection
System

EMCO Electronics
114-300 Mackenan Dr
Cary, NC 27511
Ph# 919 460-6000

Evaluator: Midwest Research Institute - 04/29/94

System Description: The EECO 2000 is designed to monitor up to eight tanks, 24 EECO Choice sensors and eight pressurized lines. Tank leak tests will start automatically after deliveries or can programmed to start at a selected time daily, weekly or monthly. A segmented leak detection (SLD) option is available to provide continuous tank leak detection; however, it is not 3rd party certified. The sensors are designed to detect fuel and water in secondary containment vessels, sumps, dispenser pans, and monitoring wells. When alarm conditions occur, audible or display lights will be activated. The event is then written into the history log. The Line Leak Detector option provides product line leak detection at 3, 0.2 & 0.1 gph. Leaks exceeding the 'pump shutoff' threshold will disabled submersible pumps. Product line leak tests can occur automatically or manually.

Certification: TANKS: 0.2 & 0.1 gph  PIPING: 3, 0.2 & 0.1 gph

Tank Capacity: Max. 15,000 gal

Test Period: Min. 1 hrs  with tank 50 - 95% full

Limitations: - Not evaluated using manifolded tanks
- No dispensing or delivery during test
- Must have LLD option for product line testing
SAMPLE REPORTS
ECCO 2000

1. View Display Functions
(to print reports; press PRINT prior to the following)

   a. Press DISPLAY
   b. Press STATUS, HISTORY or LEAK TEST
   c. Press ENTER
   d. Press ↓ to scroll thru menu selection
   e. Press ENTER when desired menu
   f. Continue to press ↓ for desired submenu
   g. Press ENTER when desired submenu
   h. Press CANCEL to exit menu level

2. Print Inventory Status
   a. Press [PRINT] [STATUS] [ENTER]

3. Print Event History
   a. Press [PRINT] [HISTORY] [ENTER] [↓] [↑] [ENTER]

4. Print Tank Leak Test History
   a. Press [PRINT] [LEAK TEST] [↓] [ENTER] [↓] [↓] [↓] [ENTER]
PETROSONIC III
Automatic Tank Gauging System

Petro Vend
6900 Santa Fe Drive
Hodkins, IL 60525
Tel: (708) 485-4200

Evaluator: Underwriters Laboratories, Inc. - 11/04/94

System Description: The Petrosonic III is a microprocessor-based system capable of monitoring up to eight probes. The controller interprets probe data, converts the product level measurements into volume measurements and produces reports. The controller records alarms, such as low product, high water, overfill and theft. The controller also functions as a leak indicator by continuously watching for extremely small changes in product level. This is not leak testing, but product variances. The Petrosonic III has alarm inputs you can connect to external devices such as hydrocarbon detectors or alarm bells. The system has three modes of operation; privileged, non-privileged and standby. If the system is in the privileged mode, you must have an access code. Default code is HELLO.

Certification: 0.2 gph with PD = 99.07% and PFA = 0.93%

Tank Capacity: Max. 15,000 gal

Test Period: Min. 4 hrs with tank 50 - 95% full

Limitations:
- No dispensing or delivery during test
- Not evaluated using manifolded tanks
- Not capable of monitoring product lines
- Not capable of continuous monitoring
SAMPLE REPORTS
PETROSONIC III

<table>
<thead>
<tr>
<th>REPORT NAME</th>
<th>FUNCTION #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>1</td>
</tr>
<tr>
<td>Inventory</td>
<td>2</td>
</tr>
<tr>
<td>Deliverys</td>
<td>3</td>
</tr>
<tr>
<td>Variation</td>
<td>4</td>
</tr>
<tr>
<td>Alarms</td>
<td>7</td>
</tr>
<tr>
<td>Tank Info</td>
<td>8</td>
</tr>
<tr>
<td>Tank Leak Test</td>
<td>53</td>
</tr>
</tbody>
</table>

All reports are obtained in the following manner:

1. Printing Reports
   a. Press ACCESS
   b. Press ENTER; console displays ‘non-privileged’ followed by ‘display command > 0’
   c. Enter Access # for desired report (above)
   d. Press PRINT
   e. Press ENTER for report on all tanks

2. Print List of Keypad Commands (Help)
   a. Press ACCESS
   b. Press ENTER
   c. Press PRINT
   d. Press ENTER

3. Abort Command
   a. Press CANCEL
   b. Press ACCESS
### Status Report

* Active Flag (alarm condition)

#### Inventory Report

**PETROSONIC III**  
**TANK GAUGE SYSTEMS.**  
**BY PETRO VEND INC.**

**INVENTORY**

12:24 PM TUE NOV 13, 1990

<table>
<thead>
<tr>
<th>TANK 4 DIESEL</th>
<th>8603.2 GL NET CORRECTED PRODUCT VOLUME.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8605.6 GL NET CORRECTED TANK VOLUME.</td>
</tr>
<tr>
<td></td>
<td>8586.9 GL GROSS MEASURED TANK VOLUME.</td>
</tr>
<tr>
<td></td>
<td>1413.1 GL VOLUME LEFT IN TANK.</td>
</tr>
<tr>
<td></td>
<td>76.90 IN PRODUCT LEVEL.</td>
</tr>
<tr>
<td></td>
<td>56.3 F AVERAGE FUEL LEVEL.</td>
</tr>
<tr>
<td></td>
<td>0.4 IN WATER LEVEL.</td>
</tr>
</tbody>
</table>

#### Delivery Report

**PETROSONIC III**  
**TANK GAUGE SYSTEMS.**  
**BY PETRO VEND INC.**

**MESSAGES**

12:24 PM WED NOV 14, 1990

<table>
<thead>
<tr>
<th>TANK 4 DIESEL</th>
<th>DELIVERY START MEASUREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10:17 AM WED NOV 14, 1990</td>
</tr>
<tr>
<td></td>
<td>5079.3 GL NET CORRECTED PRODUCT VOLUME.</td>
</tr>
<tr>
<td></td>
<td>5093.6 GL NET CORRECTED TANK VOLUME.</td>
</tr>
<tr>
<td></td>
<td>5083.6 GL GROSS MEASURED TANK VOLUME.</td>
</tr>
<tr>
<td></td>
<td>4916.4 GL VOLUME LEFT IN TANK.</td>
</tr>
<tr>
<td></td>
<td>48.63 IN PRODUCT LEVEL.</td>
</tr>
<tr>
<td></td>
<td>56.3 F AVERAGE FUEL TEMPERATURE.</td>
</tr>
<tr>
<td></td>
<td>0.9 IN WATER LEVEL.</td>
</tr>
<tr>
<td></td>
<td>DELIVERY END MEASUREMENT</td>
</tr>
<tr>
<td></td>
<td>10:43 AM WED NOV 14, 1990</td>
</tr>
<tr>
<td></td>
<td>* OVERFLOW *</td>
</tr>
<tr>
<td></td>
<td>* HIGH WATER *</td>
</tr>
<tr>
<td></td>
<td>9946.6 GL NET CORRECTED PRODUCT VOLUME.</td>
</tr>
<tr>
<td></td>
<td>9989.6 GL NET CORRECTED TANK VOLUME.</td>
</tr>
<tr>
<td></td>
<td>9974.3 GL GROSS MEASURED TANK VOLUME.</td>
</tr>
<tr>
<td></td>
<td>23.7 GL VOLUME LEFT IN TANK.</td>
</tr>
<tr>
<td></td>
<td>94.75 IN PRODUCT LEVEL.</td>
</tr>
<tr>
<td></td>
<td>57.1 F AVERAGE FUEL TEMPERATURE.</td>
</tr>
<tr>
<td></td>
<td>1.2 IN WATER LEVEL.</td>
</tr>
<tr>
<td></td>
<td>DELIVERY VOLUME</td>
</tr>
<tr>
<td></td>
<td>4996.9 GL NET CORRECTED TANK VOLUME.</td>
</tr>
<tr>
<td></td>
<td>4980.7 GL GROSS MEASURED TANK VOLUME.</td>
</tr>
<tr>
<td></td>
<td>57.9 F ESTIMATED DELIVERY TEMPERATURE.</td>
</tr>
</tbody>
</table>
SAMPLE REPORTS
PETROSONIC III

Leak Test Report

Leak Test Report is a subset of Messages Report

Alarms Report
**SiteSentinel**  
**Model II**

**Automatic Tank Gauging System**

**PETRO VEND**  
6900 Santa Fe Drive  
Hodgkins, IL 60525  
Ph# 708 485-4200

**Evaluator:** Underwriters Lab., Inc. - 11/04/94

**System Description:** The *SiteSentinel* is a microprocessor-based system capable of monitoring probes and sensors. Each *SiteSentinel* system has one controller to manage operations and can be upgraded with modules to incorporate additional probe and sensor capability. Up to eight modules can be connected for a total of 128 probes and sensors. Inventory and system reports are available anytime and can be scheduled to print automatically. Built-in sound and light alarms can signal any system event. The *SiteSentinel* has three modes of operation: privileged, non-privileged and restricted. If the system is in the privileged mode, you must have the password. The default password is **HELLO**.

**Certification:** 0.1 & 0.2 gph

**Tank Capacity:** Max. 15,000 gal

**Test Period:** Min. 2 hrs (0.2 gph) with tank 50 - 95% full  
Min. 4 hrs (0.1 gph) with tank 90% full

**Limitations:**  
- No dispensing or delivery during test  
- Not evaluated using manifolded tanks  
- Not capable of monitoring product lines  
- Not capable of continuous monitoring
Main Menu Display

1. Go to Main Menu
   a. Press CLEAR/NO till Main Menu
   b. Press CLEAR/NO to scroll sub-menus

2. If password is necessary
   a. Press 1
   b. Enter password with console letter or numbers. (Try HELLO)
   c. Press ENTER

3. Tank Inventory Report
   a. Press 2
   b. Press 0 to print report on all tanks

4. Alarms in Progress
   a. Press 3 then 6
   b. Press 0 to print current alarms

5. Alarm History
   a. Press 3 then 7
   b. Press 0 to print alarm history

6. Leak Test Report
   a. Press 3 then 10 then 8
   b. Press 0 to print
System Description: The Wilco system employs radio and modem communications technology to connect on-site monitoring equipment to the Simmons Central Monitoring Center. Technicians collect and process data, monitor and respond to alarms and generate compliance reports.

The Wilco ATG probe uses micro-impulse radar technology to measure tank levels and then transmits data via radio signal to a remote receiver linked to the Wilco Control Panel. The Wilco control panel with user keypad and display unit then sends data between the business and Simmons central monitoring center via existing telephone lines. Inventory, sales and delivery data are then used to produce SIR results. Sales and deliveries must be entered manually through the keypad. Options include leak detection sensor and overfill alarms.

Certification: SIR 5.7 L.M. version; 0.2 & 0.1 GPH with PD = 99% & PFA = 1%

Tank Capacity: 45,000 gal.; 2, 3 or 4 tank manifolded systems

Test Period: Min. 26 days

Limitations: Data collection only
WILCO
Keypad Operation

Keypad/Display Unit
Flowchart of Wilco Menu

1. Tank Inventory
   a. Press “Menu” until Tank Data
   b. Press “Next” for Volume, Level, Water or Ullage
   c. Press “Tank/Hose” for different tanks in system

2. Alarm List
   a. Press “Menu” until Alarm List
   b. Press “Next” for each alarm
      i. alarm description will flash on and off to indicate alarm has not been acknowledged
      ii. if alarm status is still present, second line will indicate “ACTIVE”
      iii. if alarm status is not present, second line will indicate “CLEARED”

3. Self-Test (system functioning properly)
   a. Press “Menu” until Self-Test
   b. Press “Next”; enter passcode (1234)
      i. Display will show SELFTEST OK if functioning properly
      ii. Display will show SELFTEST FAIL or PRESS SERVICE if not functioning properly

4. Overfill Alarm Check
   a. Initiate Self-Test, alarm should sound; if not, no overfill alarm
   b. Press “Cancel” to silence alarm
Soil Sentry
Liquid 330

Double-Walled UST Monitoring System

Arizona Instrument - A Z I
4114 E. Wood St.
Phoenix, AZ 85040
Tel: 602 731-3434

Evaluator: Ken Wilcox Ass. - 01/08/93

System Description: The Soil Sentry Liquid 330 uses optical sensing technology to monitor double-contained storage tanks and piping. The system utilizes up to 10 optical sensing probes which continuously monitor annular spaces in tanks and piping. Probes can also be installed in the tanks to provide high and low level alarms. The Liquid 330 uses a WET/DRY probe to distinguish between normally DRY or WET conditions. A discriminating probe can be used to determine whether the liquid is water or product. All event conditions (alarms) are stored and can later be recalled. The system is capable of storing 350 lines of information.

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

Applicability: Unleaded and synthetic gas, diesel fuel, n-hexane, jet-A fuel, toluene, xylene(s) and water
SAMPLE REPORTS
Liquid 330

Console

1. **View or Print Current Status**
   a. Press **YES** or **NO** until “View Current Status?”
   b. Press 1 or 1 until desired information
   c. Press **YES** to download information
   d. Press **EXIT** to leave routine

2. **View or Print History**
   a. Press **YES** or **NO** until “View Print Options?”
   b. Press 1 or 1 until “Print History?”
   c. Press **YES** to download information
   d. Press **EXIT** to leave routine

Display Options

1. View Menu Options?
2. View Current Status?
3. View Print Options?
4. Make Setup Changes?
5. Diagnostics Options?
Soil Sentry
Twelve - X

Vapor Monitoring System

Arizona Instrument - AZI
4114 E. Wood St.
Phoenix, AZ 85040
Tel: 602 731-3434

Evaluator: Ken Wilcox Ass. - 04/17/91

System Description: The Soil Sentry Twelve-X is an “aspirated vapor” monitoring system. It’s designed to analyze the vapor concentration of Total Organic Hydrocarbons (TOH) found in the soil and backfill around motor fuel tanks. The system searches for leaks by drawing air samples from up to 12 underground locations and electronically analyzing those samples for the vapor of leaking hydrocarbon materials. The system sequentially draws air samples from each active vapor sampling point three times a day. If a vapor level above the adjustable alarm level is identified over three successive sampling cycles, or if a dangerously high vapor level is identified during any one cycle, the site alarm is triggered and a record is made of the day, cycle period, identification of the high vapor sampling point and the measured vapor level.

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

Applicability: Unleaded and synthetic gas, diesel fuel, n-hexane, JP 4 & 5 jet fuel, toluene, xylene(s)
SAMPLE REPORTS
Twelve - X

Display Options

1. View Menu Options?
2. System Status
3. View Site Levels?
4. View Print Options?
5. Operate/Setup Options?
6. Diagnostics Options?

3. View or Print Past Vapor Levels
   a. Press YES or NO until “View Print Options?”
   b. Press ↑ or ↓ until “Past Vapor/Pressure?”
   c. Press YES to download information
   d. Press EXIT to leave routine

Console

1. View Site Levels
   a. Press YES or NO until “View Site Levels?”
   b. Press ↑ or ↓ until desired information
   c. Press EXIT to leave routine

   Arizona Instrument Corp.
   1100 E. University
   Tempe, Arizona 85281

   14-MAR-90 09:00
   Well Vapor(ppm) Press(In.H2O) Alarm
   00 1200 -052 3500 PPM
   01 0010 -050 3500 PPM
   02 0010 -050 3500 PPM
   03 0010 -050 3500 PPM
   04 0010 -050 3500 PPM
   05 0010 -050 3500 PPM
   06 0010 -050 3500 PPM
   07 0010 -050 3500 PPM
   08 0010 -050 3500 PPM
   09 0010 -050 3500 PPM
   10 0010 -050 3500 PPM
   11 0010 -050 3500 PPM
   12 0010 -050 3500 PPM

2. View or Print Alarm History
   a. Press YES or NO until “View Print Options?”
   b. Press ↑ or ↓ until “Past Significant Events?”
   c. Press YES to download information
   d. Press EXIT to leave routine

   Arizona Instrument Corp.
   1100 E. University
   Tempe, Arizona 85281

   09-MAR-90 00:00
   Well Vapor(ppm) Press(In.H2O)
   00 0010 -049
   01 0010 -049
   02 0010 -049
   03 0010 -049
   04 0010 -049
   05 0010 -049
   06 0010 -049
   07 0010 -049
   08 0010 -049
   09 0010 -049
   10 0010 -049
   11 0010 -049
   12 0010 -049

   09-MAR-90 08:00
   Well Vapor(ppm) Press(In.H2O)
   00 0010 -050
   01 0010 -050
   02 0010 -049
   03 0010 -049
   04 0010 -049
   05 0010 -049
   06 0010 -049
   07 0010 -049
   08 0010 -049
   09 0010 -049
   10 0010 -049
   11 0010 -049
   12 0010 -049

   09-MAR-90 16:00
   Well Vapor(ppm) Press(In.H2O)
   00 0010 -050
   01 0010 -050
   02 0010 -049
   03 0010 -049
   04 0010 -049
   05 0010 -049
   06 0010 -049
   07 0010 -049
   08 0010 -049
   09 0010 -049
   10 0010 -049
   11 0010 -049
   12 0010 -049
PPM 4000

Automatic Electronic Line Leak Detector

Red Jacket
Marley Pump Co.
9650 Alden Rd.
Lenexa, KS 66215
Tel: 913 541-2985

Evaluator:  KWA - 04/94

System Description:  The PPM 4000 is a programmable line pressure and probe monitoring system utilizing eight independent channel control functions for use in detecting product discharges from UST’s and supply lines. The line pressure monitoring system is capable of automatically testing at catastrophic (3gph), standard (0.2 gph) and precision (0.1 gph) levels. Tests begin after each operation of the submersible pump and every time the line pressure falls to 10 PSI or upon demand. Alarm and pump shutdown will occur if the system detects a leak of 3 or 0.2 gph. The PPM 4000 is also capable of performing liquid and vapor monitoring. Eight additional channels can be monitored with the installation of the PPM 4100. To check most current information, continue to depress the SCAN key. Date and results of most recent line tests will appear.

Certification:  3, 0.2, 0.1 gph with PD = 100% and PFA = 0%

Pipeline Capacity:  Max. 55.1 gal

Test Period:  3.0 gph - 1 min
              0.2 gph - 10 min
              0.1 gph - 2.5 hrs
System Description: The INCON TS-LLD line leak detector has two major “system” components. The Leak Sensing Unit or LSU is installed into the line leak detector port at the submersible pump housing. The Control Unit or CU is installed above or to the side of the submersible pump relay box or motor starter enclosure. The TS-LLD system will automatically turn on the submersible pump during quiet periods to run pressurized line leak tests. A quiet period is required to complete all line leak tests. A 3.0 gph test will automatically run after every product dispense and takes 3 minutes to complete. The 0.2 gph test also runs automatically after product dispense and takes a minimum of 55 minutes to complete. The 0.1 gph test must be started manually. To conduct a 3.0 gph test, press the control unit reset/test button momentarily. The display should indicate an 88 while the button is held down. Do not hold the button for longer than four seconds or a 0.1 gph test will be started. Turn the dispenser lever on and then off to start 3 gph test. At the control unit, the Line Leak Test indicator will light. The attached page describes alarm and error codes.

Test Period: 3.0 gph - 3 minutes
0.2 gph - min. 55 minutes to max. 8 hrs
0.1 gph - 8 hrs quite time; 40 minute test

Max. Pipeline Cap: Rigid - 163 gal
Flex - 49.6 gal
### ALARM & ERROR CODES

#### TS-LLD

<table>
<thead>
<tr>
<th>Display Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00 to 28</td>
<td><strong>Not Flashing (No Alarm or Error)</strong> this is a normal display of the number of days since the last monthly line leak test passed.</td>
</tr>
<tr>
<td>88</td>
<td><strong>Not Flashing (System OK)</strong> the control unit electronics and display is working correctly.</td>
</tr>
</tbody>
</table>

#### Flashing Display - Alarm and Error Codes

<table>
<thead>
<tr>
<th>Display Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Failed Annual (0.1) GPH line leak test</td>
</tr>
<tr>
<td>2</td>
<td>Failed Monthly (0.2) GPH line leak test</td>
</tr>
<tr>
<td>3</td>
<td>Failed Hourly (3.0) GPH line leak test</td>
</tr>
<tr>
<td>29 - 32</td>
<td><strong>Alarm - Over 28 days since the last Monthly line leak test passed.</strong> The number that is flashing is the number of days since the last monthly line leak test passed.</td>
</tr>
<tr>
<td>80</td>
<td>Annual leak test aborted.</td>
</tr>
<tr>
<td>81</td>
<td>Leak Sensing Unit is out of operating range.</td>
</tr>
<tr>
<td>82</td>
<td>Leak test aborted -- thermal instability</td>
</tr>
<tr>
<td>83</td>
<td>Leak Sensing Unit is not communicating.</td>
</tr>
<tr>
<td>84</td>
<td>Pressurized line is out of compliance.</td>
</tr>
<tr>
<td>85</td>
<td>Leak Sensing Unit requires cleaning.</td>
</tr>
</tbody>
</table>
Auto-Learn
LS300-120 PLUS A/L, A/S & LSI

Electronic Line Leak Detection System

EBW
2814 McCracken Ave.
Muskegon, MI 49441
Tel: 616 755-1671

Evaluator: Jetronix Engr. Lab. - 06/01/91

System Description: The EBW Automatic Line Leak Detection system consists of a main logic control unit which is interfaced with the Auto Stik ATG console and the model LS-300 pressure transducer located in the pipeline. The system uses a microprocessor with an algorithm based on time and line pressure to determine if a leak is present. Three gph leak tests are conducted every 45 minutes. In the event that a leak is detected by the system, the pump is activated and the line is repressurized. After 3 successive fails, the alarm is activated and the pump is shut down. Leak tests for 0.2 gph are automatically initiated after the pump has been still for 3 hours; 0.1 gph leak tests are initiated after a still time of 6 hours. If the system detects a leak, the same process occurs as in the 3.0 gph tests. Models that do not include the A/L series are only certified at 3 gph. This EBW system was previously owned by Compo Miller. You may still see this brand name.

Certification: 3, 0.2, & 0.1 gph

Pipe Capacity: 163 gal

Test Period: 3.0 gph - 10 minutes
0.2 gph - 25 minutes
0.1 gph - 34 minutes
<table>
<thead>
<tr>
<th>HI</th>
<th>LO</th>
<th>TEST</th>
<th>ALARM</th>
<th>HORN</th>
<th>CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>3 GPH TEST IN PROGRESS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PRESSURE WITHIN LIMITS</td>
</tr>
<tr>
<td>B</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>PRECISION TEST IN PROG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PRESSURE WITHIN LIMITS</td>
</tr>
<tr>
<td>C</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>LEAK ALARM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FAILED 3 GPH TEST</td>
</tr>
<tr>
<td>D</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>LEAK ALARM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PRESSURE WITHIN LIMITS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>INSUFFICIENT PRESSURE TO CONDUCT TEST</td>
</tr>
<tr>
<td>E</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>LEAK ALARM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PIPELINE FAILED TO CATCH PRESSURE</td>
</tr>
<tr>
<td>F</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>0.2 GPH PRECISION TEST PASSED</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.1 GPH TEST PASSED 2 FLASHES)</td>
</tr>
<tr>
<td>G</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>0.2 GPH PRECISION TEST FAILED</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.1 GPH TEST FAILED 2 FLASHES)</td>
</tr>
<tr>
<td>H</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>WAITING TO TEST AGAIN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LAST TEST FAILED</td>
</tr>
<tr>
<td>I</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>WAITING TO TEST AGAIN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LAST TEST PASSED</td>
</tr>
<tr>
<td>J</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>POSSIBLE TRANSDUCER/SENDER FAILURE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SENDER NOT ANSWERING / TRANSDUCER READINGS ARE OFF SCALE (EITHER MAYBE DISCONNECTED)</td>
</tr>
<tr>
<td>K</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>PIPELINE PRESSURE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IS BELOW 7.5 PSI</td>
</tr>
<tr>
<td>L</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>PUMP ON</td>
</tr>
<tr>
<td>M</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>AUTO LEARN NOT COMPLETED</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>UNIT CAN NOT DETECT LEAKS</td>
</tr>
</tbody>
</table>

**Legend:**
- ● OFF
- ○ ON CONTINUOUSLY
- × MAY INDICATE OTHER CONDITIONS
- ⊙ BLINK (EQUAL ON & OFF 1 SEC)
- ★ FLASH (QUICK)
- ☐ FLASH EVERY 4 SECONDS
LINE TITE
PIPELINE MONITOR

Electronic Line Leak Detection System

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

Evaluator: Ken Wilcox Ass. - 04/15/97

System Description: The LineTite CPLD (continuous pressure leak detector) system consists of a single control panel and a remote sensor for each product pipeline. The functions of four remote line monitor sensors can be upgraded with the addition of two LineTite CPLD expansion modules (4 sensors per module) allowing control of up to twelve lines per system. The control panel provides indicators to continuously show the current operating status of the system. The indicators will show a NORMAL, WARNING or ALARM condition. An LCD Display will also continuously indicate the status of the system as well as the exact cause of any system WARNING or ALARM conditions. In the event of a system error or failed test, an internal or optional external buzzer will sound to alert the station operator. System is also capable of dispenser shutdown.

Certification: 3 & 0.1 gph w/ PD = 100% & PFA = 0%

Test Period: 3.0 gph - 1 to 26 minutes (depending on sensor)
0.1 gph - 1.2 to 12.9 hrs

Pipe Capacity: 0.1 gph - 49.6 gal
1. *Print Daily Report*
   a. Press FUNCTION then 06

   ![FUNCTION #06]

   -------------------------------------------
   DAILY REPORT
   07/24/97  14:11
   HASSTECH INC.
   6985 FLANDERS DR
   SAN DIEGO
   CA  92121
   619-457-5880

   CHAN #1  PRODUCT #1
   3GPH TESTS PASSED:  0003
   3GPH TESTS FAILED:   0002
   3GPH TESTS ERRORED:  0001
                      0.1 GPH TEST NOT RUN

   CHAN #2  PRODUCT #2
   3GPH TESTS PASSED:  0003
   3GPH TESTS FAILED:   0002
   3GPH TESTS ERRORED:  0001
                      0.1 GPH TEST NOT RUN

   CHAN #3  PRODUCT #3
   3GPH TESTS PASSED:  0000
   3GPH TESTS FAILED:   0002
   3GPH TESTS ERRORED:  0001
                      0.1 GPH TEST NOT RUN

   CHAN #4  PRODUCT #4
   3GPH TESTS PASSED:  0000
   3GPH TESTS FAILED:   0000
   3GPH TESTS ERRORED:  0000
                      0.1 GPH TEST NOT RUN

   -------------------------------------------

2. *Print History Report*
   a. Press FUNCTION then 16

   ![FUNCTION #16]

   -------------------------------------------
   HISTORY REPORT
   07/24/97  14:11

   LAST 0.1 GPH TEST PASSED:
   07/23/97 CH 1
   07/23/97 CH 2
   07/23/97 CH 3
   07/23/97 CH 4

   LAST 3 GPH TEST PASSED:
   07/23/97 CH 1
   07/23/97 CH 2
   07/23/97 CH 3
   07/23/97 CH 4

   SYSTEM SETUP CHANGED:
   07/24/97

   -------------------------------------------

3. *Audible Alarm Test*
   a. Press FUNCTION then 15
RED JACKET
Mechanical Line Leak Detectors

Diaphragm Leak Detector (DLD)

Piston Leak Detector (PLD) (Not 3rd party certified)

Extended Life Diaphragm (XLD)

Extended Life Piston (XLP)

DLD

XLP
RED JACKET
Mechanical Line Leak Detectors

FX1V
FXV Series
FX2V
FX Model
FX Model
FX2V
FX1V
VAPORLESS
Mechanical Line Leak Detectors

LD-2000

LD-2200/SCOUT

LD-2000-S (electronically assisted pump shut down)

LD-2000-E (for Enviroflex piping)

LD-2000-T (for Tokheim pumps)

LD Accumulator
FE PETRO
Mechanical Line Leak Detector

RJ PUMP w/ FE PETRO MLLD

FE PETRO PUMP & MLLD

RJ PUMP w/ FE PETRO MLLD
ELECTRONIC Line Leak Detectors

INCON TS-LLD (wireless)

EBW (Compo Miller)

EECO-LLD

Hasstech w/RJ Pump
RED JACKET ELECTRONIC
Line Leak Detectors
for PPM4000, RLM9000 & ST1400/1800

(older model)

(new model)

(plumbed)
Veeder Root Electronic
Line Leak Detectors

Wireless LLD

Wireless LLD w/Red Jacket pump

Pressure LLD (wire)

Pressure LLD (field)

Wireless LLD w/FE Petro pump

Wireless LLD