OPW
FUEL MANAGEMENT SYSTEMS

EECO System®

LLD-*Plus* Standalone Option

Operation Manual

 Manual 340237 Rev. C

OPW Fuel Management Systems -
System and Replacement Parts Warranty Statement

Effective September 1, 2002

System and Replacement Parts Warranty

OPW Fuel Management Systems warrants that all OPW Tank Gauge and Petro Vend Fuel Control systems supplied by OPW Fuel Management Systems to the Original Purchaser will be free from defects in material and/or workmanship under normal use and service for a period of 12 months from the date of installation or 15 months from the date of shipment. Additionally, OPW Fuel Management Systems warrants that all upgrades and replacement parts (new and remanufactured) supplied by OPW Fuel Management Systems will be free from defects in material and workmanship under normal use and service for a period of 90 days from the date of installation or for the remainder of the system's original warranty, whichever is greater, as set forth in the first sentence of this statement. The foregoing warranties will not extend to goods subjected to misuse, neglect, accident, or improper installation or maintenance or which have been altered or repaired by anyone other than OPW Fuel Management Systems or its authorized representative.

The buyer's acceptance of delivery of the goods constitutes acceptance of the foregoing warranties and remedies, and all conditions and limitations thereof.

If a claim is made within the warranted time period that any equipment and/or remanufactured part is defective in material or workmanship under normal use and service, such equipment and/or remanufactured part shall be returned to OPW Fuel Management Systems, freight prepaid. If such equipment or remanufactured part is found by OPW Fuel Management Systems in its sole judgment, to be defective in material or workmanship under normal use and service, OPW Fuel Management Systems, shall, at its sole option, repair or replace such equipment and/or remanufactured part (excluding, in all instances, fuses, ink cartridges, batteries, other consumable items, etc.)

The warranties, as set forth above, are made expressly in lieu of all other warranties, either expressed or implied, including, without limitation, warranties of merchantability and fitness for any particular purpose and of all other obligations or liabilities on OPW Fuel Management Systems part. Further, OPW Fuel Management Systems neither assumes, nor authorizes any other person to assume for it, any other liability in connection with the sale of the systems, or any new/replacement part that has been subject to any damage from any act of nature or any *force majeure*.

The term "Original Purchaser" as used in these warranties shall be deemed to mean the authorized OPW Fuel Management Systems distributor to which the system or any new/replacement part was originally sold. These warranties may be assigned by the original purchaser to any of its customers who purchase any OPW Fuel Management Systems systems or new/replacement parts.

The sole liability of OPW Fuel Management Systems, for any breach of warranty, shall be as set forth above. OPW Fuel Management Systems does not warrant against damage caused by accident, abuse, faulty or improper installation or operation. In no event shall manufacturer's liability on any claim for damages arising out of the manufacture, sale, delivery or use of the goods exceed the original purchase price of the goods. In no event shall OPW Fuel Management Systems be liable for any direct, indirect, incidental or consequential damage or loss of product.

TABLE OF CONTENTS

1. Introduction

The Operating Instructions for the EECO SYSTEM® LLD-*Plus Stand-Alone* line leak detector systems explain the following:

- When to perform tests. This appears in Section 1.
- How to conduct line leak tests for compliance reasons. See Section 2.
- How to respond to alarms. See Section 3.
- How to calibrate the line leak detector system. See Section 4.
- How to interpret test results and take action. See Section 5.

Any inquiries regarding installation of the system or these instructions should be directed to:

Emco Electronics
114-300 Mackenan Drive
Cary, NC 27511 USA
Attention: Technical Support Services Mgr.
(800) 342-6125 (Toll Free)
(919) 460-6000
(919) 460-7595 (Fax)

Important safety messages are located throughout this manual. Be alert to the possibility of personal injury. Carefully read the messages that are identified by the following notations:

DANGER **Imminent Hazard Exists** for serious personal injury or death!

WARNING **Potential Hazard** Exists for serious personal injury or death!

CAUTION **Potential** Hazard Exists for personal injury/unsafe practice!

NOTICE **Helps** to make the task easier or more understandable!

1.1 WHEN TO PERFORM LINE LEAK TESTS

Operators are required by law to perform certain leak detection testing, interpret results, prepare compliance reports and call for line service, when warranted. The LLD-*Plus* system conducts several tests automatically and also allows operators to choose when to perform those required by law. Operators **must** follow local or state regulations concerning required tests.

1.2 3 GPH LEAK TEST

1.2.1 Automatic Monitoring

The LLD-*Plus* system automatically performs a catastrophic 3 gallons per hour (GPH) test. This test series is initiated every 45 minutes and consists of three consecutive 5-minute test intervals with either pass or fail results. If all three tests fail, the system will log the last result and alarms will occur. If all three tests pass, the system will log the last result and no alarms will occur. If some tests pass while others fail, testing will continue until three consecutive tests pass or fail. Tests are initiated and performed until the line is determined to be out of service after 3 hours of no dispensing.

If, while testing, product dispensing occurs, the test will be terminated. It will be restarted from the beginning as soon as dispensing is complete. The 3 GPH test is performed from the pumping pressure down to 7.5 PSI.

1.2.2 Manually initiated

A manual test may be conducted at an operator's command. Refer to the latest regulations governing compliance testing in your locality to determine a schedule. Instructions are presented in Section 2 describing how tests are to be conducted at operator command.

1.3 0.2 GPH LEAK TEST

1.3.1 Automatic Monitoring

As soon as a line is declared out of service (3 hours with no dispensing activity), the 0.2 GPH test is performed automatically by the LLD-*Plus* system. The 0.2 GPH tests are conducted until a test passes. Passing a test is logged by flashing the TEST lamp once every 4 seconds. Following three failed tests, a failure is logged by flashing the ALARM lamp once every 4 seconds. Thereafter, each subsequent test is logged until the line is returned to service.

1.3.2 Manually Initiated

Operators are called upon to comply with monthly leak test requirements. Instructions are presented in Section 2 explaining how to perform the tests by manual means.

1.4 0.1 GPH LEAK TEST

1.4.1 Automatic Monitoring

When the 0.2 GPH test has passed and the line has been out of service for more than 6 hours, the 0.1 GPH test is performed. The 0.1 GPH tests are conducted until a test passes. Passing a test is logged by double flashing the TEST lamp. If three failures occur, the failure is logged by double flashing the ALARM lamp. Thereafter each subsequent test is logged until the line is returned to service. Once the 0.1 GPH test passes no further 0.1 GPH line testing will automatically occur.

1.4.2 Manually Initiated

Operators are called upon to comply with annual leak test requirements. Instructions are presented in Section 2 explaining how to perform the tests by manual means.

1.5 FAIL TO CATCH PRESSURE

1.5.1 Automatic Monitoring

A catch pressure check is performed each time the submersible turbine pump (STP) operates, whether by test or dispensing. A fail to catch pressure condition occurs when the line cannot maintain at least 10 PSI within 2 seconds after the pump is turned off. If this occurs, an alarm is sounded immediately and the line is shut down. A line break or a faulty check valve in the pump can cause this condition.

1.5.2 Manually Initiated

No manually initiated tests can be performed.

1.6 PRESSURE-UP CHECK

1.6.1 Automatic Monitoring

A pressure-up check is performed each time the pump operates, whether by test or dispensing. The pressure-up check tests for a gross leak such as a broken line or piping component. The line pressure must reach at least 12 PSI within 3 seconds to pass the pressure-up check. If the first check fails, a second check is performed to learn if the line will hold at least 7.5 PSI for 2 seconds following pump turn off. This will help determine if the cause may be broken piping. Should both pressure-up checks fail, an alarm is sounded immediately and the line is shut down. A line break, pump failure, or low product level can cause this condition.

1.6.2 Manually Initiated

No manually initiated tests can be performed.

2. Performing Manual Leak Tests

Operators using the LLD-*Plus* system may conduct manual tests at chosen times. These tests can be used to evaluate line integrity for compliance reporting as well as to verify system self-testing capabilities.

2.1 CLEARING PRIOR TEST RESULTS

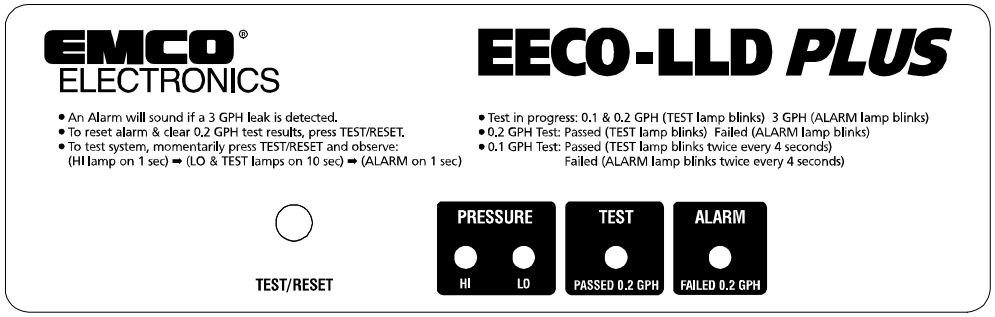

Figure 1 - LLD-Plus Display

Pressing the TEST/RESET button a single time clears the lamp displays and alarm. Upon release of the button, the lamps will cycle from the HI lamp on to the LO and TEST lamps on followed by the ALARM lamp on.

2.2 MANUAL 3.0 GPH TEST

Conduct a 3 GPH test by pressing the channel's TEST / RESET button. Then press the button a second time when the TEST lamp (green) comes on. Refer to Figure 2 and observe the console light pattern as self-testing proceeds in the leak detection mode from A to I to indicate passing the 3.0 GPH test.

2.3 MANUAL 0.2 GPH TEST

Conduct a 0.2 GPH test by pressing the channel's TEST / RESET button. Then press the button twice (2-times) when the TEST lamp (green) comes on after each time the button is pressed. Refer to Figure 2 and observe the console light pattern as self-testing proceeds in the leak detection mode from B to F to indicate passing the 0.2 GPH test. The console's light display will revert to patterns H or I revealing the outcome of the last test performed.

2.4 MANUAL 0.1 GPH TEST

Conduct a 0.1 GPH test by pressing the channel's TEST / RESET button. Then press the button three (3) more times when the TEST lamp (green) comes on after each time the button is pressed. Refer to Figure 2 and observe the console light pattern as self-testing proceeds in the leak detection mode from B to F to indicate passing the 0.1 GPH test. The console's light display will revert to patterns H or I revealing the outcome of the last test performed.

2.5 TEST LOGS

For stand-alone units, duplicate the LEAK DETECTOR TEST LOG sheets for record-keeping purposes as part of the fuel system compliance requirements at the location. A blank form is at the end of this manual. Complete and maintain the logs in accordance with all local and state compliance and reporting regulations.

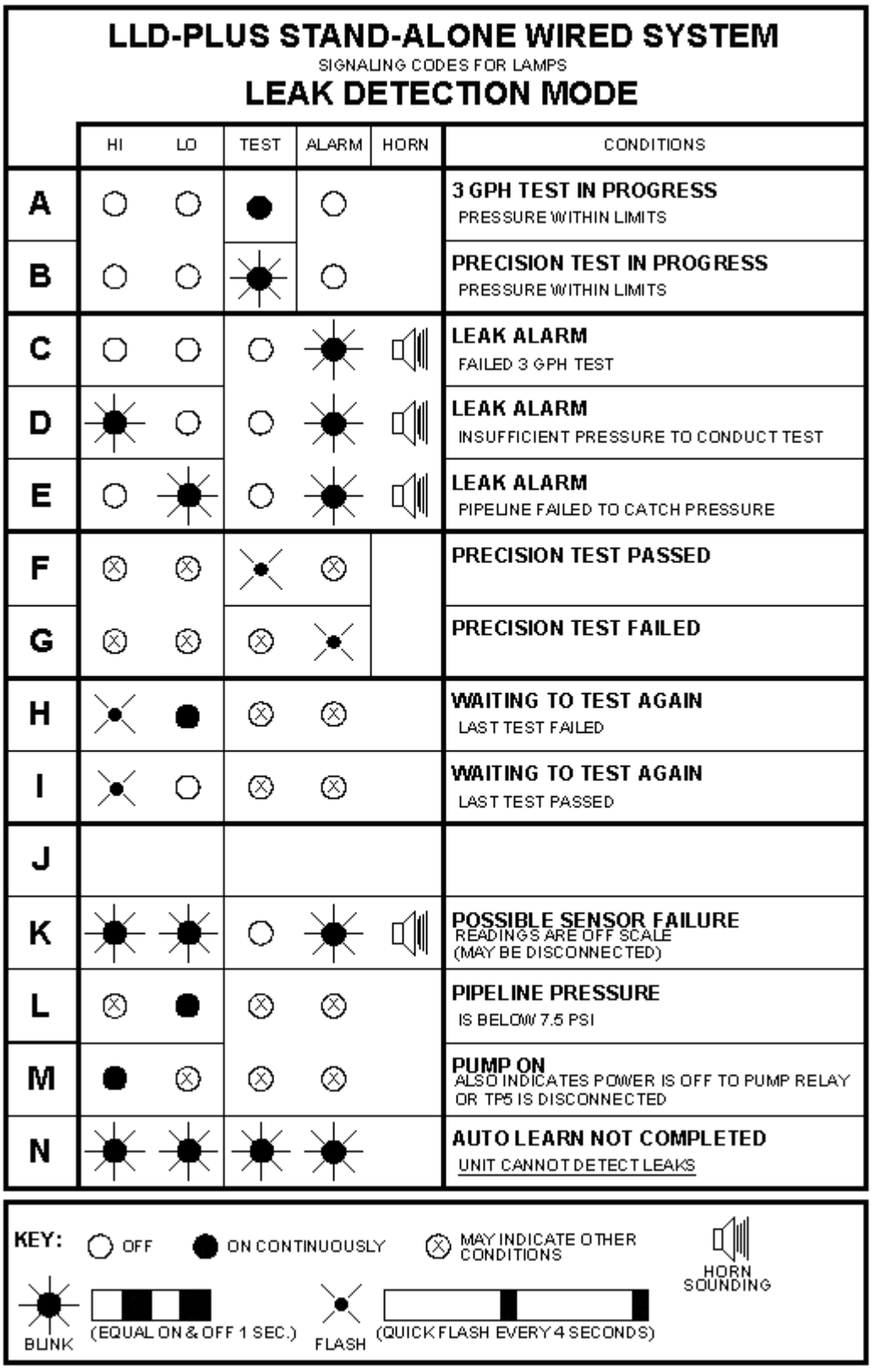

Figure 2 - Indicator Lamp Definitions (Leak Detect Mode)

3 Responding to Alarms

3.1 WHAT TO DO WHEN A LEAK ALARM OCCURS

The following troubleshooting guides may be used to isolate a fault in either the line or the LLD-*Plus* leak detection system.

If the LLD-*Plus* system indicates a line leak, call a qualified service agent for line inspection without delay.

3.2 FAULT DIAGNOSIS – DETECT MODE

The diagnostic chart outlines system faults, possible causes, and provides suggested action steps.

During calibration refer to the calibration section of this manual for fault diagnosis, possible causes, and suggested action steps for the LLD-Plus systems.

Symptom	Possible Cause	Action
No lights are on.	• The LLD-Plus system is between tests and the line pressure is above 7.5 PSI. The system is idle. • The power to the system is off.	• Press RESET/TEST button and observe self-test cycle. • Check circuit breaker.
System indicates leak alarm with the HI and ALARM lamps blinking. (Insufficient pressure)	• The system sensor did not detect the pressure reach 12-PSI in 3 seconds following pump turn on. • A catastrophic leak in piping • Pressure sensor damage • STP motor did not run.	• Check STP breaker. • Check sensor for output and supply voltages as shown in the Sensor Chart below. • Check piping for leaks • Check STP motor and starting capacitor.
System indicates leak alarm with the LO and ALARM lamps blinking. (Failed to achieve catch pressure)	• Gross leak in piping. • The check valve has stuck open.	• Inspect piping. • Inspect STP's functional element. • Check for bad valve in dispenser.

Alarm with the HI, LO, and ALARM lamps blinking.	• The pressure sensor is out of range. • Connection to the pressure sensor has been broken • Fuse blown in barrier (Intrinsically safe versions) • Channel is disabled	• Check sensor for output and supply voltages as shown in the Sensor Chart below. • Check sensor wiring for breaks. • Check I.S. barrier for continuity • Check the channel enable switch on the processor board
The HI, LO, and ALARM lamps randomly flicker on and then go off.	• The sensor communications are intermittently lost. • Calibration of the line is required (no piping data saved, learn process terminated before completion)	• Check sensor wiring for poor connections. (Pump vibration can cause poor connections to become intermittent). • Recalibrate line
All the lamps are blinking.	• Piping characteristics have not been learned. (No piping data saved so learn process terminated before complete).	• Recalibrate line
The system ran fine for a week or so, and then 3.0 GPH leak alarms started to occur.	• When the piping characteristics were learned, the modulus was lower because air was entrapped. (Most likely to happen with new stations).	• Recalibrate line.
The system ran fine and now the 0.1 GPH and 0.2 GPH tests are not passing.	• The line is starting to develop a leak • The pump's functional element is starting to show wear. (Most likely to appear in cold weather). • When the piping characteristics were learned, the modulus was lower because air was entrapped. (Most likely to happen with new stations).	• Inspect and replace, as required, the STP's check and relief valves. (The flexible seals deteriorate with age.) • Perform independent precision test to verify that pipe is not leaking. • Recalibrate line.
Performed a precision test on piping, but still fail the 0.1 GPH and 0.2 GPH tests.	• The leak is not in the underground piping. It may be in a dispenser or the STP. (During a manual precision test, all the dispensers and the pump are blocked off).	• Inspect inside the dispensers; especially the filters, which are the most common leak source. • Inspect the STP's functional element • Check for internal dispenser leak through the valves.

4 System Calibration

Read these instructions completely before attempting to calibrate the LLD-Plus system. If you are not completely comfortable with the instructions, contact the factory for help before proceeding.

Calibration of the line leak detector system is required prior to operation for the first time and periodically as required by local codes or when equipment modifications are made to the piping system. The ***AUTO-LEARN***® system for calibration is a pressure decay system that removes the disadvantages often associated with configuring a line leak detector system. The piping characteristics are measured automatically using a process that can be performed by a trained service technician in about 45 minutes.

It is important to remove any air from the piping system prior to calibration. If the piping has been recently serviced, causing air to enter the system, flush enough fuel through the line to remove as much of the air as possible.

⚠ WARNING

- This system is installed and operated near the highly combustible environment of an underground fuel storage tank and lines. It is essential to read carefully and follow the warnings and instructions in this manual to protect yourself and others from serious injury, explosion, or electrical shock.
- Leaking underground tanks can create serious environmental and health hazards.
- During operation and maintenance of this product, you must comply with the National Electrical Code, federal, state, and local codes, and other applicable safety codes. Failure to comply with these warnings could result in serious personal injury, property loss, and equipment damage.
- The calibration process involves removing product from the line through a calibrated orifice. Care must be taken to make sure no dispensing activity occurs during the calibration process and that an approved container is used to collect the product that is removed. A 5-gallon or larger container will be required for collecting the fuel.
- Take precautions to ensure that vehicles ***cannot*** enter the work area during service of this system.
- Use appropriate lock-out / tag-out procedures to prevent dispenser or pump operation during service activity.
- The LLD-Plus system has the ability to activate power to the pumping system automatically. Always turn the system power off when servicing the dispenser, pump, or piping system.
- This system has been designed such that it does not:
  - give rise to physical injury or other harm due to contact
  - produce excessive surface temperature, infra-red, electromagnetic, ionizing radiation

4.1 INSTALLATION OF LEAK GENERATOR

The calibrated leak generator kit (#439678) includes the following components: an orifice designed for creating a 3-gph leak at 10psi pressure, a filter, a length of nylon tubing, and a 1/8" fitting for connection to the tee at the pressure sensor, which may be installed in the dispenser shear valve or at the submersible pump test port. Prior to installing the kit in the line inspect all components and connections to make certain they are not damaged, loose, or clogged.

If periodic testing of the system is planned, it is advisable to install a ball valve in the piping system to simplify future testing. Be certain that the selected valve is designed for petroleum applications. The valve will allow the leak to be controlled more accurately and will reduce spillage. If a permanent installation is desired, replace the nylon tubing with a copper tube and connect it to a return port on the submersible pump. The valve can be used to activate the leak when necessary for testing.

Be sure power to the LLD-Plus line leak detection system is off prior to installing the calibrated leak generator.

Turn power to the submersible pump off.

Relieve line pressure by activating the dispenser and opening the hose nozzle while directing the pressurized fuel into an approved container until flow ceases. Then shut off the dispenser.

With spill containment materials at hand, remove and retain the 1/8" plug from the tee at the pressure sensor. Collect any residual fuel that may flow from the plug port using approved methods, absorbent materials, and containers for proper disposal.

Securely connect the fitting on the end of the calibrated leak device hose to the 1/8 " port.

Insert the free end of the leak generator into an approved fuel collection container of at least 5-gallon capacity.

4.2 LEARNING PIPING CHARACTERISTICS

The piping characteristics are learned by introducing a controlled leak on the piping system and allowing the pressure to bleed to zero. The system will automatically cycle through a sequence of steps once the learning process is initiated. The first step of the learning process is to learn the pressure sensor offset characteristics. This must be done with zero pressure on the piping system, otherwise the residual pressure will be added to the transducer offset and all subsequent readings will be in error. Next the pump is activated and the maximum pumping pressure is learned. In the event that the line fails to pressurize to 17.5 PSI, the process will end in error. The final step is to learn the piping pressure decay curve. If the pressure fails to decay the process ends in error.

Make certain that the leak generator kit is properly installed, the end of the orifice is in an approved container for collecting fuel of at least 5-gallons capacity, and the orifice is not clogged or submerged.

Turn the submersible pump power on and activate the STP momentarily for a few seconds to allow the piping to pressurize.

Turn off the STP. Verify that the fuel flows freely and that the pressure will bleed to zero. **Do not allow the orifice to be submerged during the calibration process.** Before

proceeding with the calibration process allow the line pressure to fall to zero pressure. This is important for accurate calibration.

Enable the channel to be set up by switching ON the associated channel switch (S1 – S4) located on the power supply board of the LLD-Plus console (Figure 5).

Set the mode select switch for the channel to be calibrated to the “LEARN” position (Figure 6).

Press the TEST / RESET button to enter the learn mode. Observe the HI, LO, and TEST lamps all blinking, indicating the system is ready to learn.

Press the TEST/RESET button for one second and release. This will begin the learning process.

Observe the system during the learning process. The submersible pump must activate when the HI lamp starts blinking.

The Console alarm will sound twice and the HI, LO, and TEST lamps will all be steadily illuminated when the process is complete.

Check for learning errors indicated by the ALARM lamp. If errors are indicated, allow the product line to bleed to zero and then repeat the learning cycle by pressing the TEST / RESET button. Refer to the diagnostic table in Section 4.3 for possible solutions if the line does not calibrate successfully.

Set the mode select switch to “DETECT” and then press the TEST/RESET button to return the system to the leak detection mode.

Verify the calibration by forcing the unit to conduct a 3-GPH leak test. Press the TEST/RESET button, and when the TEST lamp (green) illuminates, press the TEST/RESET button again. Allow the system to operate until the test completes. This should indicate failure since the leak generator device is still attached. If the leak is not detected, check the calibrated leak generator and repeat the calibration process.

Remove the calibrated leak generator by first turning off the STP power and power to the LLD-*Plus* Console. Observe the orifice until flow into an approved container ceases. This indicates all line pressure has been relieved. Disconnect the leak generator and collect any residual fuel that may flow from the plug port using approved methods, absorbent materials, and containers for proper disposal. Return the 1/8" plug to the test port and secure it after first applying an approved thread compound.

Repeat the 3-GPH leak test with the device removed to confirm that the system will pass a leak test.

LLD-PLUS STAND-ALONE WIRED SYSTEM

SIGNALING CODES FOR LAMPS

AUTO LEARN MODE

	HI	LO	TEST	ALARM	HORN	CONDITIONS
A	✳	✳	✳	○		**IN AUTO LEARN MODE** READY TO BEGIN (DEPRESS BUTTON 1 SEC.)
B	○	✳	○	○		**LEARNING SENSOR ZERO PSI** FIRST STEP IN LEARNING PROCESS
C	✳	○	○	○		**LEARNING PUMP PRESSURE** SECOND STEP IN LEARNING PROCESS
D	○	○	✳	○		**LEARNING TEST PARAMETERS** LAST STEP IN LEARNING PROCESS
E						
F	●	⊗	⊗	○		**AUTO LEARN COMPLETED** READY TO RETURN TO LEAK DETECTION MODE
G	●	●	●	○		**PIPING MODULUS IN RANGE** FOR BOTH 0.2 GPH & 0.1 GPH TESTS
H	●	✳	✳	○		**PIPING MODULUS OUT OF RANGE** FOR BOTH 0.2 GPH & 0.1 GPH TESTS
I	●	●	✳	○		**PIPING MODULUS OUT OF RANGE** FOR 0.1 GPH TEST ONLY
J	●	⊗	○	○		**INSUFFICIENT PRESSURE FOR 0.1 GPH** LESS THAN 22.5PSI, WILL NOT RUN 0.1 GPH TESTS
K	✳	○	○	✳		**INSUFFICIENT PRESSURE** PRESSURE LESS THAN 17.5 PSI
L	○	○	✳	✳		**NO PRESSURE LOSS DETECTED** CALIBRATED LEAK NOT CONNECTED TO LINE
M	⊗	⊗	⊗	●		**MEMORY ERROR** MEMORY FAILED TO WRITE
N	✳	✳	○	✳	🔊	**TRANSDUCER FAILED / CHANNEL NOT ENABLED** PSI READINGS ARE OFF SCALE (MAYBE DISCONNECTED)

KEY: ○ OFF ● ON CONTINUOUSLY ⊗ MAY INDICATE OTHER CONDITIONS 🔊 SHORT BEEP

✳ BLINK (EQUAL ON & OFF 1 SEC.)

✳ FLASH (QUICK FLASH EVERY 4 SECONDS)

Figure 3 - Indicator Lamp Definitions(Learn Mode)

4.3 FAULT DIAGNOSIS – LEARN MODE

Symptom	Possible Cause	Action
Line does not retain the pumping pressure following STP shutdown.	• The relief valve is set too low. Pressure trapped must be at least 24PSI (> 23.5 PSI) to perform 0.2 GPH tests.	• Replace springs in the STP functional element or change to adjustable type. If the Red Jacket® adjustable functional element is used in vapor recovery or manifold tank systems, maintain a minimum 5 PSI differential between operating and seating pressures of the STP. Verify with a gauge.
During piping checkout, the pressure gain or loss is greater than 5 PSI in 5 minutes.	• The piping temperature is not stable.	• Wait for the temperature to stabilize. (This may take several hours).
After waiting for the temperature to stabilize, the pressure loss is still greater than 5 PSI in 5 minutes.	• Leak in STP, dispensers or piping. • The check valve or relief valve is leaking fuel back into the tank.	• Inspect all dispensers, the STP, and piping. • Inspect STP's functional element and all O - rings.
No lights are on.	• The power to the system is off. • The system is idle.	• Check circuit breaker. • Press RESET/TEST button and observe self-test cycle.
System indicates learn error, HI and ALARM lamps blinking. (Insufficient pressure – line pressure did not reach 17.5 PSI).	• STP did not turn on for that product. • Line was not at zero (0) PSI at start of the learning step. • Pressure sensor wired incorrectly. • The product level is below the intake of the STP.	• Check STP breaker. • Check STP motor and starting capacitor. • Check that the sensor is connected to the correct pipe. • Verify that fuel pressure is reduced to zero (0) PSI prior to starting learning process. • Check that the correct pump is being turned on then observe the HI lamp blinks during the learn step. • Check sensor for output and supply voltages as shown in the Sensor Chart in Section 4.4. • Check the product level in the tank.

Alarm with the HI, LO and ALARM lamps blinking.	• The sensor is out of range.	• Check dispenser circuit breaker. • Check sensor for output and supply voltages as shown in the Sensor Chart in Section 4.4. • Check sensor for wiring breaks. • Check relay chip on Power Supply / Relay board.
The HI, LO, and ALARM lamps randomly flicker on, then go off.	• The sensor is intermittently going out of range.	• Check sensor wiring for poor connections.
Learning is taking too long and the ALARM lamp is on.	• The line pressure has not dropped 2.5 PSI in 9 minutes.	• Connect the calibrated leak device to the pipe (observing all proper lock out and tag out measures and fuel pressure relief steps including spill cleanup). Check for proper flow. • Verify that the calibrated leak device is not submerged or clogged.
The learning process ends with the HI lamp on and both the LO and TEST lamps blinking	• The return volume is too large (modulus too low) for the system to perform both the 0.1 and 0.2 GPH tests to specifications.	• Check the piping system for air entrapment (unused runs of pipe). • If at a new station, run fuel through each dispenser until air is purged. • Determine if the piping type and size are out of the operational parameters of the LLD-*Plus* (large, flexible systems may not allow 0.2 GPH testing).
The learning process ends with both the HI and LO lamps on and the TEST lamp blinking.	• The return volume is too large (modulus too low) for the system to perform the 0.1 GPH test to specification, but 0.2 GPH tests are possible.	• Check for air entrapment. Purge accordingly. • Determine if the piping type and size are out of the operational parameters of the LLD-*Plus* (large flexible systems may not allow 0.1 GPH testing).

4.4 Sensor Diagnostics Chart

Use the following chart when measuring Pressure Sensor output voltage levels to verify pressure readings. The figures below allow a tolerance range of ± 5%. The supply voltage is 12.00 volts dc.

Always make voltage measurements at the console. It is dangerous to make measurements within the hazardous area.

Pressure (PSI)	0	10	20	30	40	50	60
Sensor Output (volts)	1.094	1.453	1.832	2.185	2.569	2.931	3.316

To test the pressure sensor, disconnect the white wire of the Pressure Sensor from the cable to the LLD-*Plus* console. Connect the Common lead from a meter to the black wire, and the Voltage lead to the white wire from the pressure sensor. Set the meter to read DC Volts.

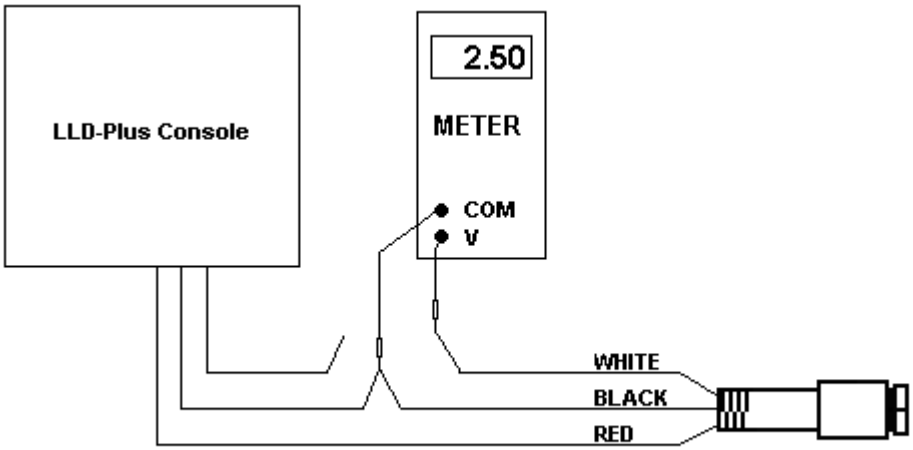

Figure 4 – Pressure Sensor Test Procedure

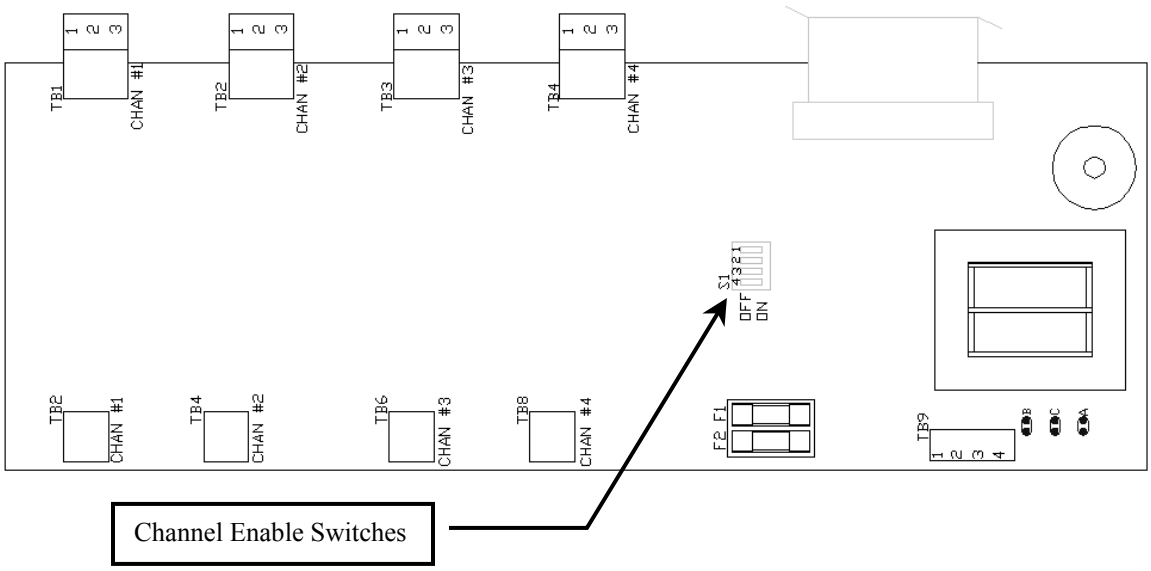

Figure 5 - Power Supply Board

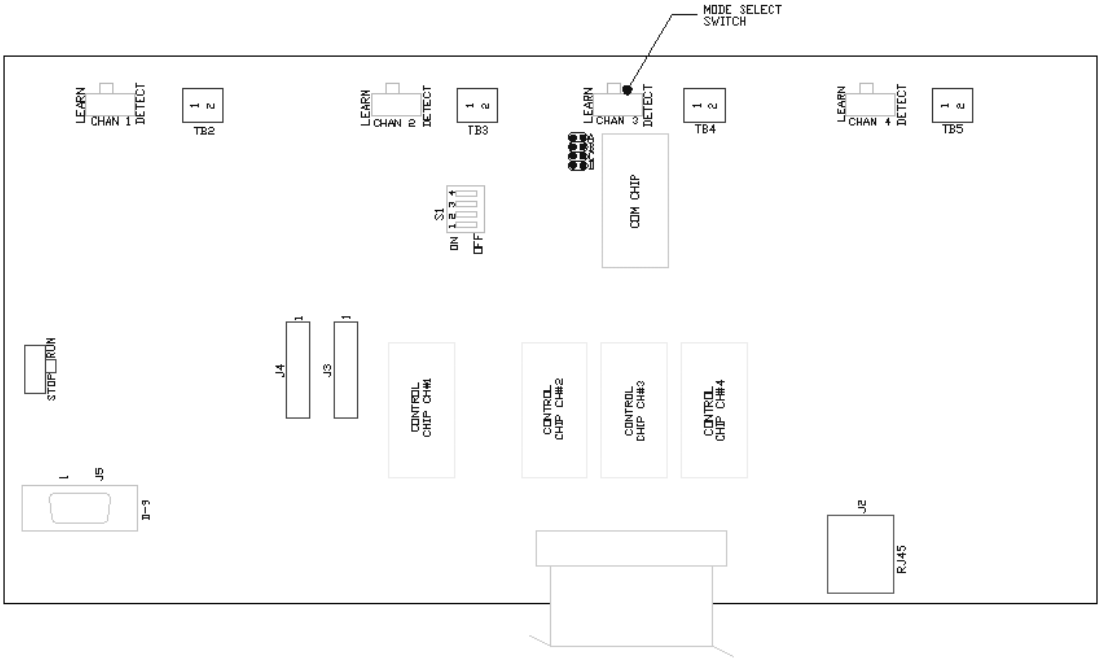

Figure 6 - Controller Board

5 Certification Documents

Evaluation of the Campo/Miller LS300-120 Plus, Auto Learn (A/L), Series Line Leak Detection System

(for Hourly Testing, Monthly Monitoring, and Annual Line Tightness Testing)

Final Report

PREPARED FOR

Campo/Miller

June 23, 1995

Ken Wilcox Associates, Inc. - 19401 E. 40 Hwy, Suite 100
Independence, MO 64055, Voice (816) 795-7997
Fax (816) 795-7998, E-mail kwaleak@ibm.net

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: Campo/Miller Pipeline Leak Detectors

Version of System: (see attached list for models covered by this evaluation)

Manufacturer Name: Campo/Miller

11395 Hwy 65
(street address)

Porterville, CA 93257
(city, state, zip code)

(209) 781-6862
(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 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 %.

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 1.5 gal/hr (specify flow rate in gal/h) in 1 out of 1 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

(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 53 tests were conducted on nonleaking line(s) between 5/1/95 (date) and 6/20/95 (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 pipelines used in the evaluation were 3 inches in diameter, 175 ft in length and were constructed of fiberglass (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.

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:
(X) 0 to 6 h (time after completion of circulation and start of test)
( ) 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

Minimum Number of Conditions Required	Number of Conditions Used*	Range of ΔT(°F)**
1	2	$\Delta T < -25$
4	8	$-25 \leq \Delta T < -15$
5	10	$-15 \leq \Delta T < -5$
5	10	$-5 \leq \Delta T < +5$
5	10	$+5 \leq \Delta T < +15$
4	8	$+15 \leq \Delta T < +25$
1	2	$\Delta T > 25$

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

**ΔT 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?

(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.
( ) 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 pump operating pressure to 0 psi with 110 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

Test No.	ΔT (°F)	Induced Leak Rate (gal/h)	Leak Detected (yes/no)
1	-12.94	3	yes
2	-12.94	0	no
3	-2.67	3	yes

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.)

Quantity Measured: flowrate and temperature
Resolution 0.01 gal/hr and 0.005 deg F
Precision: ±0.02 gal/hr and 0.02 deg F
Accuracy: 0.05 gal/hr and 0.05 deg F
Minimum Detectable Quantity: 2% of total volume collected
Response Time: N/A gal/hr and 5 min for temperature equilibrium
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 rigid pipeline materials, and that typically measure up to 3 inches in diameter and 350 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
( ) is present in
(X) has been removed from the pipeline (check both if appropriate)

- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is 0 h
- the total time required to complete a test is approximately 11 minutes (variable depending on line conditions)
- the volume of the product in the pipeline is less than twice the volume of the product in the pipeline system using 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: Leak detection is performed on a range of piping types. An indication lamp signals that the piping bulk modulus is within limits required for a leak test.

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.

H. Kendall Wilcox, President
(name of person performing evaluation)

H. Kendall Wilcox
(signature)

June 23, 1995
(date)

(816) 795-7997
(telephone number)

Ken Wilcox Associates, Inc.
(organization performing evaluation)

19401 E. 40 Highway
(street address)

Independence, Missouri 64055
(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 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: Campo/Miller Pipeline Leak Detectors

Version of System: (see attached list for models covered by this evaluation)

Manufacturer Name: Campo/Miller

11395 Hwy 65
(street address)

Porterville, CA 93257
(city, state, zip code)

(209) 781-6862
(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 30 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 __0.1 gal/hr__ (specify flow rate in gal/h) in __1__ out of __1__ 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

(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 __53__ tests were conducted on nonleaking line(s) between __5/1/95__ (date) and __6/20/95__ (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 pipelines used in the evaluation were __3__ inches in diameter, __175__ ft in length and were constructed of __fiberglass__ (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.

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:
(X) 0 to 6 h (time after completion of circulation and start of test)
( ) 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

Minimum Number of Conditions Required	Number of Conditions Used*	Range of ΔT(°F)**
1	2	$\Delta T < -25$
4	8	$-25 \leq \Delta T < -15$
5	10	$-15 \leq \Delta T < -5$
5	10	$-5 \leq \Delta T < +5$
5	10	$+5 \leq \Delta T < +15$
4	8	$+15 \leq \Delta T < +25$
1	2	$\Delta T > 25$

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

**ΔT 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?

(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.
( ) 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 pump operating pressure to 0 psi with 110 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

Test No.	ΔT (°F)	Induced Leak Rate (gal/h)	Leak Detected (yes/no)
1	-12.94	0	no
2	-12.94	0	no
3	-2.67	0.20	yes

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.)

Quantity Measured: flowrate and temperature
Resolution 0.01 gal/hr and 0.005 deg F
Precision: ±0.02 gal/hr and 0.02 deg F
Accuracy: 0.05 gal/hr and 0.05 deg F
Minimum Detectable Quantity: 2% of total volume collected
Response Time: N/A gal/hr and 5 min for temperature equilibrium
Threshold is exceeded when the flow rate due to a leak exceeds 0.1 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 rigid pipeline materials, and that typically measure up to 3 inches in diameter and 350 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
( ) is present in
(X) has been removed from the pipeline (check both if appropriate)

- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is 3 h
- the total time required to complete a test is approximately 3.25 to 3.75 hrs including waiting time (variable depending on line conditions)
- the volume of the product in the pipeline is less than twice the volume of the product in the pipeline system using 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: Leak detection is performed on a range of piping types. An indication lamp signals that the piping bulk modulus is within limits required for a leak test.

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.

H. Kendall Wilcox, President
(name of person performing evaluation)

H. Kendall Wilcox
(signature)

June 23, 1995
(date)

(816) 795-7997
(telephone number)

Ken Wilcox Associates, Inc.
(organization performing evaluation)

19401 E. 40 Highway
(street address)

Independence, Missouri 64055
(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

System Name: Campo/Miller Pipeline Leak Detectors

Version of System: (see attached list for models covered by this evaluation)

Manufacturer Name: Campo/Miller

11395 Hwy 65

(street address)

Porterville, CA 93257

(city, state, zip code)

(209) 781-6862

(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 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 gal/hr (specify flow rate in gal/h) in 1 out of 1 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

(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 53 tests were conducted on nonleaking line(s) between 5/1/95 (date) and 6/20/95 (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 pipelines used in the evaluation were 3 inches in diameter, 175 ft in length and were constructed of fiberglass (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.

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:
(X) 0 to 6 h (time after completion of circulation and start of test)
( ) 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

Minimum Number of Conditions Required	Number of Conditions Used*	Range of ΔT(°F)**
1	2	$\Delta T < -25$
4	8	$-25 \leq \Delta T < -15$
5	10	$-15 \leq \Delta T < -5$
5	10	$-5 \leq \Delta T < +5$
5	10	$+5 \leq \Delta T < +15$
4	8	$+15 \leq \Delta T < +25$
1	2	$\Delta T > 25$

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

**ΔT 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?

(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.
( ) 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 pump operating pressure to 0 psi with 110 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

Test No.	ΔT (°F)	Induced Leak Rate (gal/h)	Leak Detected (yes/no)
1	-12.94	0	no
2	-12.94	0.10	yes
3	-12.94	0.10	yes

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.)

Quantity Measured: flowrate and temperature
Resolution 0.01 gal/hr and 0.005 deg F
Precision: ±0.02 gal/hr and 0.02 deg F
Accuracy: 0.05 gal/hr and 0.05 deg F
Minimum Detectable Quantity: 2% of total volume collected
Response Time: N/A gal/hr and 5 min for temperature equilibrium
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 rigid pipeline materials, and that typically measure up to 3 inches in diameter and 350 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
( ) is present in
(X) has been removed from the pipeline (check both if appropriate)

- the waiting time between the last dispensing of product through the pipeline system and the start of data collection for the test is 6 h
- the total time required to complete a test is approximately 6.5 to 7 hrs including waiting time (variable depending on line condition)
- the volume of the product in the pipeline is less than twice the volume of the product in the pipeline system using 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: Leak detection is performed on a range of piping types. An indication lamp signals that the piping bulk modulus is within limits required for a leak test.

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.

H. Kendall Wilcox, President
(name of person performing evaluation)

H. Kendall Wilcox
(signature)

June 23, 1995
(date)

(816) 795-7997
(telephone number)

Ken Wilcox Associates, Inc.
(organization performing evaluation)

19401 E. 40 Highway
(street address)

Independence, Missouri 64055
(city, state, zip)

Addendum to the June 23, 1995 Evaluation of the Campo/Miller LS300-120 Plus, Auto Learn (A/L), LSI Flex Series Line Leak Detection System

(for Testing on Flexible Pipeline Systems)

Final Report

Prepared For:

Campo/Miller

September 10, 1998

Ken Wilcox Associates, Inc.
1125 Valley Ridge Drive, Grain Valley, MO 64029, USA
Voice (816) 443-2494, Fax (816) 443-2495
E-mail info@kwaleak.com, Web http://www.kwaleak.com

Preface

The data contained in this report was obtained from the Campo/Miller LS300-120 Plus, A/L, LSI Flex Series Line Leak Detection System. This report is to be used in conjunction with the June 23, 1995 evaluation of the Campo/Miller system.[1] The report contains additional test data that was collected in July-August, 1998 on flexible pipelines. Testing was performed in accordance with the EPA Pipeline Leak Detection Test Protocol [2] with the exception of the number of tests performed. The results of this abbreviated testing indicate that Campo/Miller system will successfully perform leak detection on flexible pipeline systems. All testing was conducted at the Fuels Management Research Center (FMRC) operated by Ken Wilcox Associates, Inc.

This report was prepared by Mr. Jeffrey K. Wilcox, Ken Wilcox Associates, Inc. Questions regarding this addendum should be directed to Mr. Ernest Filippi, Campo/Miller, at (209) 781-6862.

KEN WILCOX ASSOCIATES, INC.

Jeffrey K. Wilcox

Jeffrey K. Wilcox
Project Engineer

Approved:

H. Kendall Wilcox

H. Kendall Wilcox, Ph.D.
President

September 10, 1998

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[1] Evaluation of the Campo/Miller LS300-120 Plus, Auto Learn (A/L), Series Line Leak Detection System (for Hourly Testing, Monthly Monitoring, and Annual Line Tightness Testing), Final Report, Prepared for Campo/Miller, June 23, 1995, Ken Wilcox Associates, Inc.

[2] "Standard Test Procedures for Evaluating Leak Detection Methods: Pressurized Pipeline Leak Detection Systems", EPA/530/UST-90/010, September, 1990.

LINE LEAK DETECTOR TEST LOG

DATE: ________________ INSPECTOR: __________________________

STATION LOCATION: ____

PRODUCT IDENTIFICATION			
TEST RESULTS	[ ] PASS	[ ] FAIL	[ ] TROUBLE
COMMENTS:			

PRODUCT IDENTIFICATION			
TEST RESULTS	[ ] PASS	[ ] FAIL	[ ] TROUBLE
COMMENTS:			

PRODUCT IDENTIFICATION			
TEST RESULTS	[ ] PASS	[ ] FAIL	[ ] TROUBLE
COMMENTS:			

PRODUCT IDENTIFICATION			
TEST RESULTS	[ ] PASS	[ ] FAIL	[ ] TROUBLE
COMMENTS:			

PRODUCT IDENTIFICATION			
TEST RESULTS	[ ] PASS	[ ] FAIL	[ ] TROUBLE
COMMENTS:			

OPW Fuel Management Systems
6900 Santa Fe Drive
Hodgkins, IL 60525
708-485-4200