PRODUCT DESCRIPTION

LT-100

Leak Detection System for Pipelines

Leak detection has become an important consideration in pipeline operation and management. Financial, environmental, and regulatory compliance issues are placing increasing demands on owners and operators to seek efficient means of assuring the integrity of their pipelines.

The Vista LT-100 is a self-contained leak detection system for the underground piping typical of truck and railcar loading-rack facilities. It comprises both hardware (a physical apparatus connected to the pipeline) and software (the computer program that runs a test). When the volume of fuel is less than 3400 gallons—roughly 1300 feet of 8-inch-diameter pipe—the LT-100 can reliably detect leaks as small as 0.1 gallon per hour. When the volume is greater than 3400 gallons it can detect a leak equivalent in size to 0.0021% of the total volume *per hour*. Most importantly, through its algorithm for temperature compensation, the LT-100 overcomes some of the major deficiencies of conventional pressure tests.

The LT-100 is independently certified and is listed by the NWGLDE as complying with all EPA protocols.

Benefits

Several attributes set the LT-100 apart from other leak detection systems in its class.

Short Tests. The LT-100 conducts a pipeline test in 2 hours. Because it compensates for thermal expansion and contraction of the liquid in the line *during* a test, it eliminates the need for the long pre-test waiting periods that are typically used to assure thermal stabilization (as recommended by API standard RP 1110 on hydrostatic pressure tests).

Fully Automated. The LT-100 is a fully automated system that is easily installed and operated. Once a test is initiated, a programmable logic controller governs the system operations.

On-the-Spot Results. Easy-to-interpret results are available immediately after the completion of the test. The LT-100 provides a direct measure of the leak rate in gallons per hour at the test pressure (that is, the normal operating pressure of the pipeline).

Accurate and Reliable. Each test includes a self-check on the "goodness" of the test result—a built-in safeguard that establishes the credibility of the result and minimizes the chance of a false alarm or missed detection. This safeguard takes the form of a calculation called the "test error," which is a direct estimate of the accuracy of the temperature compensation achieved during the test. The LT-100 calculates a test error and uses it to determine the validity of the result of *every test*.

Owner/Operator Control. The LT-100 test can be run, and its results easily interpreted, by the owner of the pipeline. Tests can be conducted with any desired frequency.

Certified Performance. The LT-100 has been certified by an independent third party (Ken Wilcox Associates, Inc.); this evaluation is listed by the

National Work Group on Leak Detection Evaluations as complying with all established EPA protocols.

Testing Large Pipelines

The diameter of the piping plays an important role in how successfully a leak detection system can do its job. Lines at retail service stations are generally small—2 to 3 inches in diameter—and various methods of leak detection are used on them successfully. The typical line at a bulk storage or truck fueling facility is much larger—8 to 12 inches in diameter. Because of the much greater volumes of product found in such lines, they present a challenging technical problem. Leak detection systems that are used successfully on small-diameter lines may detect large leaks in these bigger pipelines but not small ones. And the hydrostatic pressure test, which is the conventional method used on larger lines, is not only subject to thermally induced errors but has operational drawbacks as well.

The LT-100's unique, patented algorithm compensates for thermal expansion and contraction.

Description

The LT-100 is a computer-controlled, fully automatic system. All data are acquired and processed electronically. As shown in the schematic diagram at right, the LT-100 sensor unit consists of (1) a measurement cylinder (Tank 1); (2) a storage cylinder (Tank 2); (3) a differential pressure sensor to measure level changes in the measurement cylinder electronically; (4) a pump for transferring fuel from the measurement cylinder or storage cylinder to the line in order to increase line pressure to a specified level; and (5) two pressure relief valves and a bypass valve for removing fuel from the line and adding it to the measurement cylinder or storage cylinder in order to decrease the pressure in the line to a specified level. When combined, the pump and the pressure relief valves can be used to maintain a constant pressure in the line at a specified level. The size of the cylinders is determined by the capacity of the largest pipeline segment that will be tested at a given site.

The storage cylinder is normally used to set or change the overall pressure in the line. (Pressure can also be set or changed with the pressure management system used to operate the line or by adding or removing fuel from a nearby tank, tanker truck, or pipeline.) The measurement cylinder is normally used to maintain constant pressure during a test and to make the volume measurements required during the test. A test can be conducted with the measurement cylinder alone if there is no need for the extra storage capacity that Tank 2 provides. The pump and pressure-relief-valve system are used to adjust and maintain a constant pressure in the line. As shown by the valves on the "ladder," the system can be operated at three pressures: a high pressure, a low pressure, and atmospheric pressure (by means of the bypass valve). The high- and low-pressure relief valves can be set to operate at any desired pressure. Finally, a pressure relief valve and an overfill alarm in each cylinder ensure safe operation of the system.

Installation

The LT-100 sensor unit is attached to the line at a single location, by means of a valve. Any convenient location along the line will do. The fuel remains in the line during a test, but all transfer operations must be suspended. The line must be completely isolated, by means of valves, from any storage tanks connected to it and from other sections of line not being tested. If the valves used to isolate the line do not seal properly, either a double block and bleed valve or valve blinds must be installed.

Test Duration

The LT-100 system offers flexibility in terms of test duration. The standard 2-hour test, which is the one most commonly implemented, can detect a leak of one-tenth of a gallon per hour. There is an option for a 15-minute test, which can detect a leak of 3 gallons per hour.

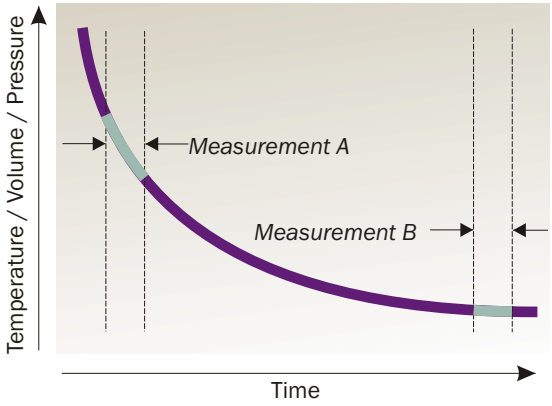
Temperature Compensation

When a section of piping is prepared for testing, the fuel it contains is not necessarily at the same temperature as the surrounding ground. The fuel may have just been pumped in from an AST, from a truck, or from another section of piping. As soon as flow stops, the fuel begins to come into equilibrium with the ground temperature. Then, as the

LT-100

Pressure Gauges
PI-1
PI-2
PT-2 Atmospheric Pressure Sensor
PVRV-1 Pressure/Vacuum Relief Valve
LLS-1 Level-Limit Switch
LLS-2
V-3 Bypass Valve
SV-2 Low-Pressure Valve
BPRV-2 Pressure Relief Valve (5 - 50 psi)
T-2 Tank 2
T-1 Tank 1
SV-1 High-Pressure Valve
TT-1 Temperature Sensor
LT-2
BPRV-1 Pressure Relief Valve (75 - 175 psi)
LT-1 Differential Pressure Sensor (DP Cell)
V-1 Tank 1 Access Valve
V-2 Tank 2 Access Valve
PRV-2 Thermal Pressure Relief Valves
PRV-1
PT-1 Line Pressure Sensor
Pump P-1
Line/Tank Valves
CV-1 Check Valve
V-4 V-5 V-6 V-7
More Line/Tank Valves (optional)
To/from AST (optional)
to Line 3 (optional)
to Line 2 (optional)
Connection to Line 1
To Tank Farm
To Other Section(s) of Pipeline
Pipeline under Test ("Line 1")
Isolation Valves

Valve Open
Valve Closed
Direction of flow
Fuel
Air



The graph shows the rate of change of temperature of the fuel in a pipeline as it tries to come into thermal equilibrium with the surrounding backfill and soil. After many tens of hours, the rate of change becomes small enough to allow an accurate pressure test (in time frame "B"). Because the LT-100 actively compensates for the effects of temperature, it can conduct a test during time frame "A," eliminating the need for a lengthy waiting period.

temperature increases or decreases, so do volume and pressure. This phenomenon, which in the case of pressure tests is the greatest inhibitor of quick, accurate estimates of pipeline integrity, has been taken into account in the design of the LT-100.

The LT-100 compensates for the thermally induced volume changes in the line without using temperature sensors. The compensation removes over 99% of the thermally induced volume changes that would otherwise interfere with the detection of small leaks. There are no waiting periods required for thermal stabilization.

The LT-100 compensates for the thermal expansion and contraction of the fuel within the line by measuring volume changes at two different but constant pressures. The higher of the two pressures is usually the *operating pressure* of the line. The lower one is either atmospheric (zero-gauge) pressure or some pressure above zero that is lower than the test pressure. At each pressure, the LT-100 measures the volume of fuel added to or removed from the line to maintain constant pressure and expresses the volume changes as a flow rate in gallons per hour, the quantity of regulatory interest.