Automatic Tank Gauging

Standardized Inspection Manual
Technical Chapter 3.2

Tennessee Department of Environment & Conservation | Division of Underground Storage Tanks | October 2015

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STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF UNDERGROUND STORAGE TANKS

TECHNICAL CHAPTER 3.2
AUTOMATIC TANK GAUGING

EFFECTIVE DATE: October 1, 2015

PURPOSE

The purpose of this technical chapter is to assist Division of Underground Storage Tanks (Division) staff in understanding the regulatory requirements for the operation, features, release detection, and record keeping requirements for underground storage tank (UST) systems which utilize Automatic Tank Gauging (ATG) for leak detection.

This technical chapter contains the current policy of the Division based on the statute and regulations governing the Tennessee Petroleum Underground Storage Tank program.

AUTHORITY

All rules referred to in this technical chapter are contained in Chapter 0400-18-01 and are available on the Division of Underground Storage Tanks website at
http://www.state.tn.us/sos/rules/0400/0400-18/0400-18-01.20130121.pdf

APPLICABILITY

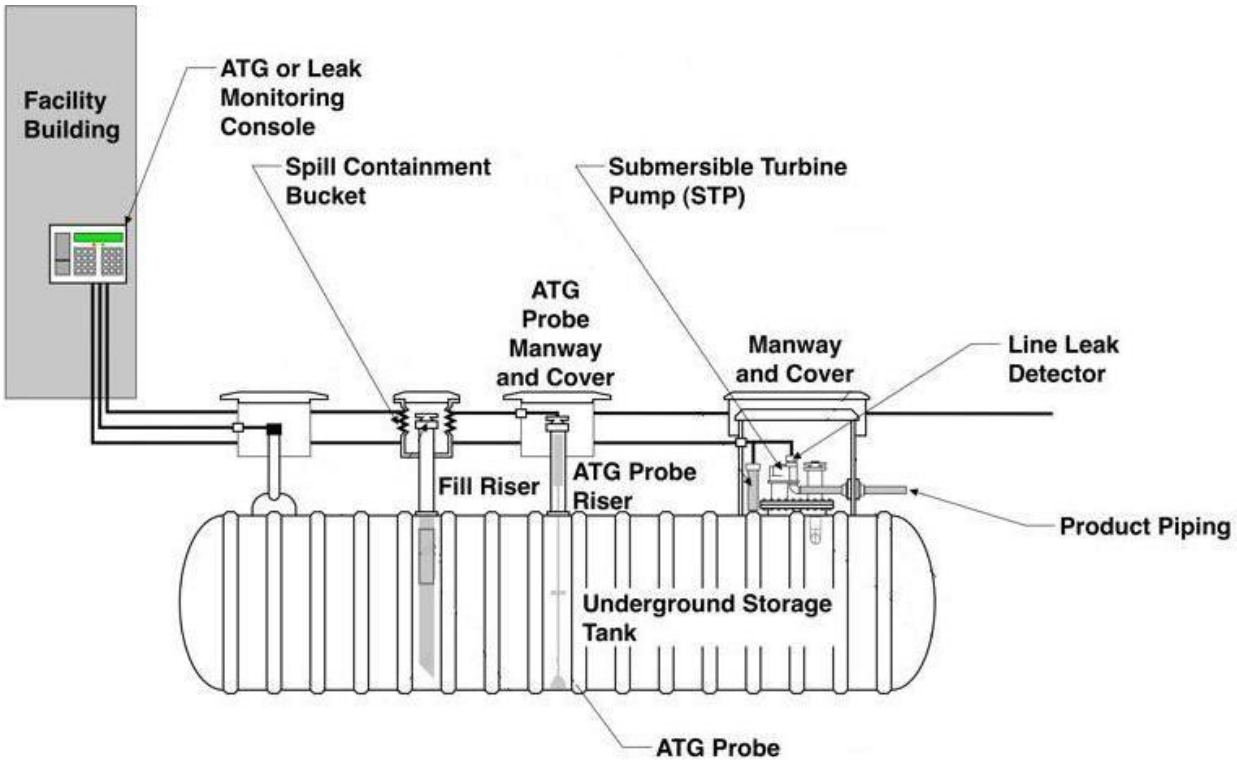
This document provides technical and specific industry knowledge regarding the operation, maintenance, and release detection requirements for UST systems equipped with ATG systems. The document also provides recommended practices for inspection, discussion of common problems associated with ATG systems, and a discussion of the most common types of ATG systems utilized at UST facilities.

Each ATG system must be evaluated by a third party and subsequently listed by the National Work Group on Leak Detection Evaluations (NWGLDE). All ATG systems must be third party certified to test for leaks at 0.2 gph on a monthly basis, with a 95% probability of detection, with no more than a 5% probability of false alarm as required by rule .04(1)(a)3. The NWGLDE evaluations list may be accessed at www.nwglde.org

INTRODUCTION

ATG systems were originally developed by petroleum tank system manufacturers as a method of determining the amount of fuel in a tank without the use of a tank gauging stick. The earliest versions of ATGs were essentially gauging sticks which a facility operator could use to determine how much fuel was present in a UST system. These readings were used to conduct monthly inventory control and no additional leak testing was conducted. As technology advanced, additional features were incorporated into the device. Water level measurements, product temperature, leak alarms, and eventually in-tank leak detection was developed and included by the Environmental Protection Agency (EPA) for use as a leak detection method.

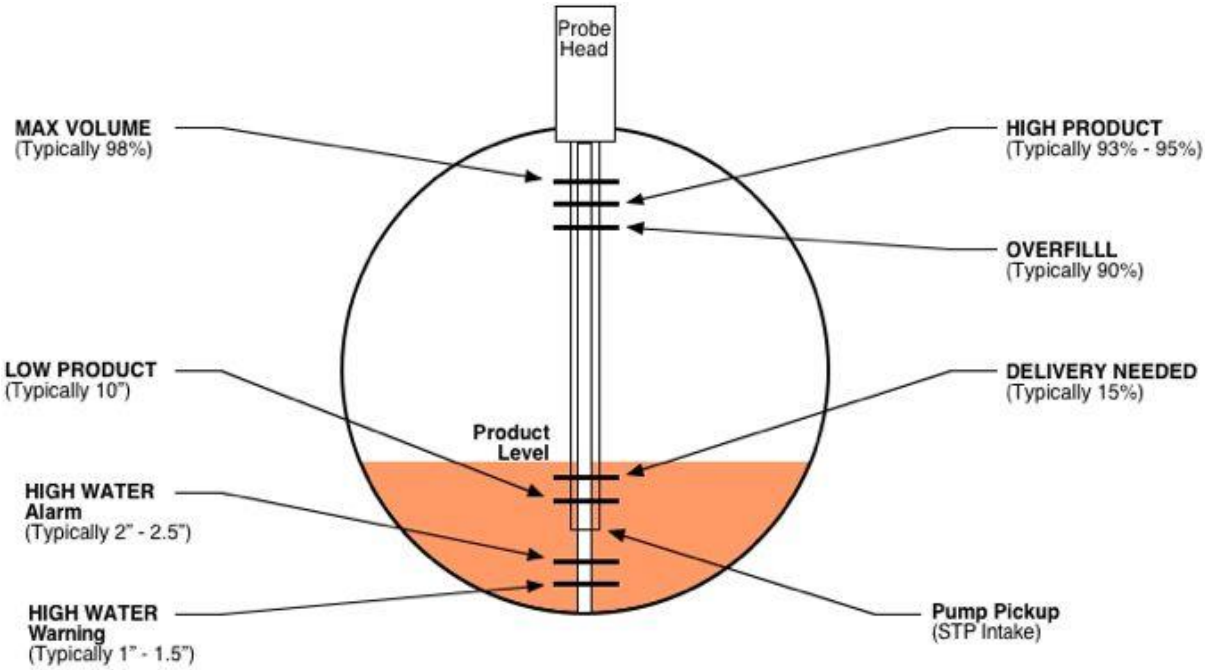
Today there are numerous manufacturers which produce ATG systems, each with its own features and benefits. As technology in the petroleum industry has advanced, most modern UST facilities are now equipped with an ATG which can measure liquid levels within an accuracy of 1/1000th of an inch.



ATG systems consist of a tank probe mechanism installed in the tank that records information such as product level and temperature and a control panel inside the facility. The control panel is essentially a computer that communicates with the probes in one or multiple tank(s) as well as any sensors connected to it. The ATG console collects, interprets, and analyzes the information from the probes. Information from the ATG console is communicated to the operator via on-site or remote printer, audible/visual alarms, or a display monitor. Most ATG systems are capable of measuring the following:

- **Gross volume**- the volume of product in the tank based on the product depth and the tank's depth to volume conversion factor.
- **Product temperature**- the average temperature of product in the tank.
- **Net volume**- temperature-compensated volume of product (calculated at 60 degrees Fahrenheit).
- **Water level**- the amount of water in the tank in inches/gallons.
- **Product level**- amount of the product in the tank in inches/gallons.
- **Ullage**- the capacity of the tank minus the gross volume of product, or empty space above the product level (usually expressed in gallons).
- **Net delivered product volume**- an automatic calculation of delivery volume based on before and after product level and temperature measurements. This volume is temperature compensated to 60 degrees F of product delivered.
- **Leak test result**- the results of the most recent as well as past leak tests. The result of a leak test may be PASS, FAIL, INVALID, INCREASE, or TEST ABORTED, etc. Some ATG systems may include the term SLOPE which is equivalent to the calculated leak rate.

ATG systems can be programmed to send audible/visual alarms when various conditions exist. Most models include the following alarms:



It is important to mention that the figure above showing a high water warning at 1"-1.5" is for fuels with no alcohol content. According to the Tennessee Kerosene and Motor Fuel Quality Regulations *"…no water phase greater than 6 millimeters (1/4 in) as determined by an appropriate detection paste, is allowed to accumulate in any tank utilized in the storage of gasoline-alcohol blend, biodiesel, biodiesel blends, ethanol-flex fuel, aviation gasoline, and aviation turbine fuel."* Rule 0800-12-05-.04 (1)

DEFINITIONS:

Continuous In-Tank Leak Detection System (CITLDS): acronym used by Warren Rogers Associates for CITLDS, which is a third party approved leak detection method utilizing an ATG to collect multiple points of data for in-tank leak detection at high throughput facilities. The advantage of using CITLDS is that tank systems do not have to be taken out of service each month to conduct a static test.
Please see Technical Chapter 3.3 Statistical Inventory Reconciliation for more detailed information on this method.

Continuous Statistical Leak Detection (CSLD): another term also used to refer to continuous ATG systems.

Leak Rate: a positive number expressed in gallons per hour (gph), measured by the test device that indicates the amount of product that may be leaking out of the tank system. A negative number may indicate that something was being added to the tank (delivery) or may be caused by a thermal effect due to product expansion.

Leak Threshold: the measured leak rate at which an ATG system determines the tank to be leaking. The leak threshold will always be less than or equal to the leak rate requirement for the ATG system. For typical ATG systems, the leak rate is set at 0.2 gph and the leak threshold is set at the leak threshold value determined in the third party evaluation.

Quiet Time: amount of time between dispensing when continuous leak test data is collected.

Statistical Continuous Automatic Leak Detection (SCALD): another term used for continuous ATG systems used by Franklin Fueling (INCON).

Tank Capacity: the volume of product a tank will hold in gallons. Tank capacities are reported as "nominal" capacities which means the true capacity may be smaller or larger due to allowable tolerances in manufacturers' processes.

Test Period: the length of the leak test as determined by the third party evaluation. This is only applicable to static testing.

Ullage: the portion of unfilled space above the liquid level in an underground storage tank, usually expressed in gallons.

Waiting Time: minimum amount of time after fuel deliveries before a leak test can begin.

90% Ullage: tank specific fuel level that the ATG system uses as a target threshold to ensure that tank overfills do not occur. This level is set at 90% of the entire tank capacity.

COMPONENTS OF AUTOMATIC TANK GAUGING SYSTEMS

1) Console- see photos on page 9.
2) Probe Types

For these types of ATG systems to operate properly, all leak tests must be performed during a period when no fuel is added to or removed from the tank.

a. Magnetostrictive

A magnetostrictive probe works on the principle that sound maintains a constant velocity despite temperature differences that may occur along its route of travel. When this principle is employed in an ATG system, a vertical pipe is installed in the tank. A wire runs down the center of the full length of the pipe. Around the outside of the pipe is a doughnut-shaped float that contains a strong magnet. Magnetic flux from this floating magnet impinges on the wire at the liquid level in the tank. For measurement of this level, a sound wave is injected into the top end of the wire and when the sound wave reaches the level of the magnetic float, the vibration of the wire causes electricity to be generated in the wire. With repeated calculation of the time between the start of the sound pulse and the start of the subsequent electrical pulse, the precise level of the float can be determined.

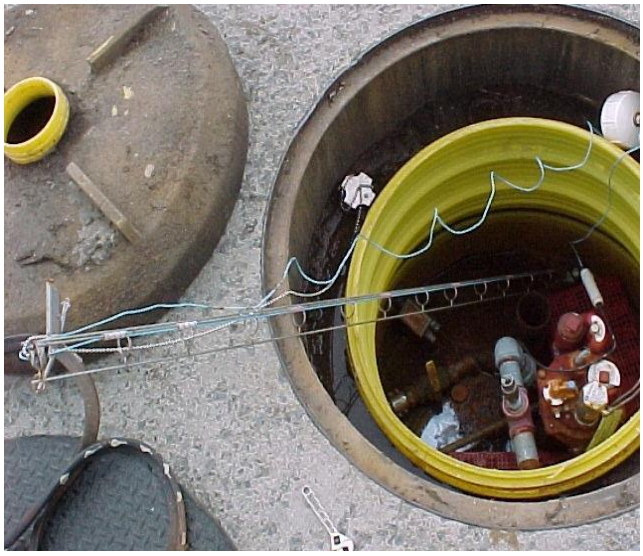
b. Capacitance

Certain ATG systems utilize capacitance type liquid measurement as a means of detecting changes in the depth of liquid in a storage tank. A hollow metal tube, with a smaller electronic tube running down its center, is installed vertically in an underground storage tank. The outside surface of the inside tube and the inside surface of the outside tube form the two plates of a capacitor. The space between them is then converted to a measurement of the liquid level in the tank which is translated on a gauging instrument.

Capacitance probes do not work with ethanol blended fuels.

c. Ultrasonic

A sensor detects sound wave echoes reflected from an interface of water/fuel or fuel/air to calculate the liquid level based on the speed of sound in the media.



Ultrasonic Probe

d. Mass measurement

Mass buoyancy probes operate on the Archimedes Principle, and measure the weight of a probe or load cell suspended in the fuel during the test period. Any changes in the weight of the suspended object can be converted to a volume change and the amount of fuel (in gallons/inches) in the tank can be determined. Mass buoyancy ATG measurements are not affected by changes in product temperature. However, they require a test period when nothing is added to or removed from the tank.

TYPES OF MONITORING METHODS FOR AUTOMATIC TANK GAUGING SYSTEMS

1) Static

This method is typically done by taking the tank out of service and putting the ATG into test mode on a monthly basis at a minimum. ATGs can be programmed to run static tests at any time. If a static test is being conducted and a consumer attempts to purchase fuel, it will invalidate the test result. The ATG might interpret this as a sudden loss. If a test has not been conducted at the end of the month, a tank owner has no monthly record for their release detection. See rule .04(3)(d)2. (See Appendix 1 for ATG reference guide)

2) Continuous

These systems may use different techniques; however, they share the characteristic of monitoring tank data continuously for days, weeks, or months, and then providing leak detection capabilities on demand once the initial data requirements are met. They may use many data items, including product height, product temperature, presence or depth of water, the tank chart or geometry, meter readings, delivery records, etc., collected continually. The advantage of using continuous systems is that tank systems using this method do not have to be taken out of service each month to conduct a static test. See rule .04(3)(d)3. Continuous systems use an ATG to collect product level measurements and employ three different techniques to generate results.

Three techniques are described in the *Evaluation Protocol for Continuous In-Tank Leak Detection Systems Revision 1* dated January 7, 2000.

a. Continuous Automatic Tank Gauging

These systems use an ATG probe to collect data continually and combine this with software to identify time intervals when there is no activity in the tank and the data are stable enough for analysis. An algorithm then combines data from a number of such periods until there is enough evidence to make a determination about the leak status of the tank. This type of system functions like an ATG except that it does not require that the tank be taken out of service for a set period of several hours whenever a test is to be done. Instead, it uses data from shorter stable time periods and combines the results to estimate a leak rate and perform a test. The system may default to a standard or shut down ATG test (requiring the tank to be out of service

for a few hours) at the end of the month if sufficient good quality data have not been obtained over the month.

Continuous ATG systems may use the same probe in a tank as a similar ATG to collect temperature and level measurements and report them to a console. However, whereas an ATG requires a specified waiting time after a delivery and a further period of no dispensing or delivery operations while it conducts a leak test (a shut down period), the Continuous ATG system is designed to avoid such specified shut downs of normal tank operation. It does this by collecting data continuously. The software identifies segments of stable data, stores these data, and combines numerous such segments to produce a leak rate estimate that is used to determine whether the tank is tight or not. For high throughput tanks, a period of several days or weeks may be needed for the system to acquire sufficient data to make its determination. Once an adequate data base is obtained, a test can be conducted at any time by operator request. The test is based on the most recent data available. As new data are accumulated, older data are eliminated, so that the leak rate estimate and test are based on the most current data. The total duration of the test period and the amount of data actually used in calculations will vary with the tank use pattern, the type of test being run (e.g., monthly or annual), and the quality of the current data.

b. Continuous In-Tank Leak Detection Systems (Continual Reconciliation)

These systems combine continuous product level and temperature monitoring from the tank with data from dispensing meters. Data from delivery records may also be included. In addition, these systems may address leaks or unexplained losses of product from the tank vessel, the pressurized lines, or a combination to monitor the tank and line system. These systems allow a combination of monitoring data from a static tank and inventory data from a dynamic tank to be combined in monitoring the system for a leak.

Continual reconciliation systems are related to statistical inventory reconciliation (SIR) systems. However, while SIR uses daily inventory records in the statistical analysis, the continual reconciliation systems use much more frequent inventory data. In addition, the continual reconciliation system may use initial data to develop a meter map, identifying meters with the tanks they draw product from. Furthermore, the continual reconciliation system may use data from the first month or so to do a tank calibration for each specific tank, providing a more accurate analysis of the data. Thus, the continual reconciliation systems differ from SIR systems in collecting and using more data from the tank records and in using much more frequent reconciliations as well as collecting some of the data automatically while also allowing for manual input.

REQUIREMENTS

An owner/operator is required to maintain documentation that the ATG system has performed at least one 0.2 gph leak test per month (i.e., every 30 days) for the previous 12 months (if the test period is not complete for the current month, the record for that month is not required to be included). See rule .04(3)(d)2. and 3. Also, during an inspection performed by Division personnel, the ATG console must be accessible and an authorized representative who is familiar with operation of the ATG system must be present to generate inventory and setup reports every six years or if a problem is identified onsite (i.e. product level below test threshold). This may require a follow-up inspection with setup provided if the console could not be reprogrammed during the initial inspection as required by rule .03(2).

The Division recommends that all UST inspectors obtain a copy of the EPA document "Automatic Tank Gauging Systems for Release Detection: Reference Manual for Underground Storage Tank Inspectors". This document has been provided to every tank owner by the Division on the Annual Compliance Tool Box CD under Helpful Information, EPA Publications, Automatic Tank Gauge Systems. The manual is also available from EPA at http://www.epa.gov/swerust1/pubs/automati.htm

Examples of Automatic Tank Gauging Consoles

	
Veeder Root TLS-350	Veeder Root TLS-450

	
Incon Tank Sentinel (TS-1001)	Incon Tank Sentinel (TS-5000, TS-5)

	
Omntec OEM 4000	OPW EECO 1500

	
Red Jacket ST 1400	Pneumercator TMS 3000

COMMON PROBLEMS ASSOCIATED WITH ATG SYSTEMS

1) 24-Hour UST Systems

High throughput or unmanned facilities frequently dispense fuel 24 hours a day and may not be capable of completing a 0.2 gph test. A common problem is that the ATG needs a minimum amount of "quiet time" where no fuel is delivered or dispensed in order to run a valid test. It may not be possible to get a valid test at a UST system open 24 hours a day. If there is adequate quiet time in a 30 day monitoring period, then this should allow the ATG system to perform a valid leak test.

2) Alarms Not Properly Investigated

Owners and operators must address any alarms from the ATG system. During a UST Operations Inspection, Division staff should visually inspect the ATG console to verify there are no active alarms that have not been investigated. If any leak detection records are missing or incomplete, then the inspector must request a copy of the ATG system in-tank alarm history report to confirm there are no ongoing problems which require investigation. See rule .03(2). Examples of alarm history reports from various ATG consoles are shown in later sections of this technical document. Failure to properly investigate leak alarms and report suspected releases to the Division within 72 hours is a violation of rule .03(2)(a)2. and .05(1)(a)3.

3) Monthly Leak Test Reports Not Maintained

Even if a facility is equipped with an ATG, it does not guarantee compliance. Some tank owners rely on the ATG console's internal memory to store these records, and generate them upon request with a Leak History report. Leak history reports are acceptable, under rules .03(2)(b)4. and .04(5)(b), but electronic component failure due to electrical shortage, storms, or hardware problems frequently allow electronically stored records to be permanently lost. Therefore, it is the Division's recommendation that owners/operators not rely on the ATG leak history for maintaining monthly release detection records. A release could go undetected if monthly records are not reviewed. An owner/operator may be unaware if the ATG fails to produce a passing monthly record.

In addition, the Division recommends that ATG leak test reports be reviewed when they are printed on a monthly basis. If the leak report indicates a leak (i.e., failing test, etc.), then, in accordance with rules .03(2)(b)4., .04(3)(d)1.(ii), .04(3)(d)2.(ii), .04(3)(d)3.(ii), and .05(1)(a)3. the owner/operator shall report a suspected release to the Division within 72 hours.

4) Tank Owner/ Operator Unfamiliar with ATG Operation

If the facility operator is not familiar with the ATG functions, then a release may go undetected. Report any monthly failed leak test results as required by rules .03(2)(b)4., .04(3)(d)1.(ii), .04(3)(d)2.(ii), .04(3)(d)3.(ii), and .05(1)(a)3. Failure to do so may result in a civil penalty and jeopardize fund coverage for a release. The owner's ATG manual should be available at the facility. Many ATG manuals may be downloaded from the manufacturers' websites.

5) Tank Fuel Volume Too Low for Valid Leak Test

All ATG probes are required to have a minimum product level in the tank in order to conduct a valid test in static test mode. It is possible for some ATG systems to produce passing results when the product level in the tank is below the minimum product level for a valid test. The Division does not consider tests conducted at insufficient product levels to be acceptable because rule .04(1)(a)2. requires methods of release detection to be "installed, calibrated, operated and maintained in accordance with the manufacturer's instructions, including routine maintenance and service checks for operability or running condition". The minimum product levels are specified in the NWGLDE list and the EPA ATG Reference Manual. These product levels may change based on reevaluations.

6) ATG Not Programmed Properly

Specific information that may not be programmed correctly includes, but may not be limited to, tank diameter and volume, tank material of construction, product type, minimum product test level, leak detection threshold, high/low product level alarms and high water alarms. A qualified technician must reprogram these parameters if they are incorrect. Consult Technical Chapter 3.5 Requirements for Pressurized Piping for piping parameters if an electronic line leak detector is being used.

Rule .04(1)(a)2. requires release detection equipment to be "installed, calibrated, operated and maintained in accordance with the manufacturer's instructions, including routine maintenance and service checks for operability or running condition".

7) Third Party Evaluation for Large Capacity or Manifolded Tank Systems

Several ATG systems have not been third party evaluated for manifolded tank systems. Each tank in a manifolded tank system is required to have a separate ATG probe unless the ATG system is also using a continuous statistical leak detection system (CSLD or SCALD). The Division will not accept leak test reports from ATG systems that are not third party certified for the tank size the ATG system is monitoring as required by rules .04(1)(a)3., .04(3)(d)2.(ii), and .04(3)(d)3.(ii).

8) ATG System Not Routinely Inspected

Manufacturers recommend routine inspection and maintenance of equipment to ensure proper operation and detect deterioration of the probes, wiring or floats. And, ATG systems must be "maintained in accordance with the manufacturer's instructions" as required by rule .04(1)(a)2. However, we recommend but do not require verification of routine periodic maintenance.

9) ATG Static Leak Threshold Set Incorrectly

The leak threshold must be set at or less than the leak threshold value determined in the third party evaluation. Typically this value is 0.10 gph, but may vary depending on the equipment. Any passing test result with a leak threshold greater than the published value is an invalid test result and a qualified technician must reprogram the leak threshold to the correct value.

10) ATG used for Tank Tightness Testing

ATGs may not be used for tank tightness testing because they do not consider groundwater levels as required by rule .04(3)(c)2., and are not capable of testing the ullage space.

11) Probes with Ethanol-blended Fuels

Traditional water floats used on ATGs will not reliably detect water incursion into a tank containing ethanol-blended fuels. This is problematic in that it does not provide any warning to the tank owner about increasing water content in the fuel. Although not required, tank owners are encouraged to monitor the tank at least monthly with a gauging stick and water finding paste designed for use with ethanol-blended fuels. Some floats are available that will detect the phase separation layer.

12) Submittal of Inaccurate Records

Ensure records are for the correct facility. The ATG console must be accessible during the inspection and an authorized representative who is familiar with operation of the ATG system must be present to generate inventory and setup reports every six years or if a problem is identified onsite (i.e. testing at product level below third party certification, improper tank size for test) This may require a follow-up inspection with setup provided if the console could not be reprogrammed during the initial inspection as required by rule .03(2).

If only the tank leak test history (not monthly leak tests) was provided in records submittal, then the tank leak test history should be again printed off during the onsite inspection.

REASONS WHY TANK LEAK TESTS FAIL

1) An actual leak has occurred.

2) Temperature instability after product delivery

Temperature variations of the product within the tank after a fuel delivery are the most common source of interference and failed leak tests/false alarms (a false positive or failure to detect an actual leak). Look at the hourly temperature data on the leak test report and retest if the variation in temperature is more than a few tenths of a degree. If leak test is being performed in static test mode, then do not begin the leak test until a sufficient period of time has passed since a fuel delivery has occurred. This period is called “waiting time” and is found in the NWGLDE listing for each ATG system.

3) Large changes in product temperature from the beginning to the end of the test.

This could be reported as an invalid test or as a failed leak test result.

4) Water level changes from the beginning to the end of the test.

5) Tank Deformation

The tank changes shape after a large product delivery.

6) Tank Cross-Talk

The fuel level changes in one tank causes a level change in an adjacent tank or compartment in manifolded tanks or compartments.

7) Product is being dispensed during a leak test.

8) Equipment malfunction

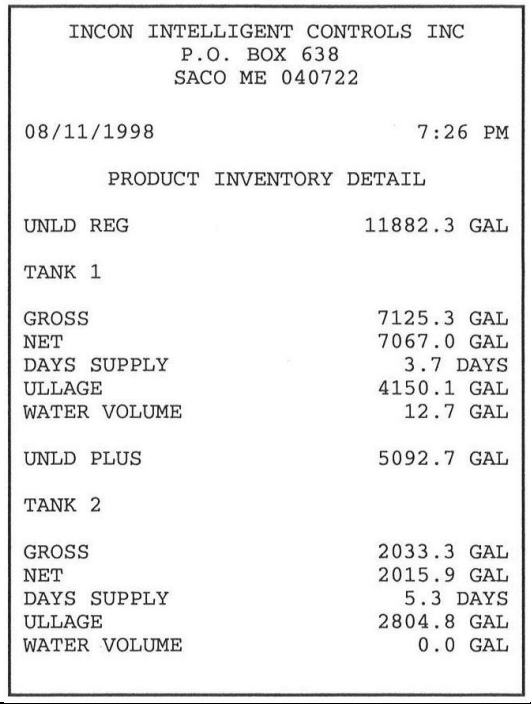
RECORDKEEPING

Rules .03(2)(b)4. And .04(5)(b) require that the previous 12 months of monthly 0.2 gph leak test results for each tank be properly maintained and be available for Division review. The Division also requires under rule .03(2), that someone who is familiar with the operation of the ATG system be present during an inspection and be able to generate the following information for review to ensure the ATG system is operational:

TYPES OF REPORTS

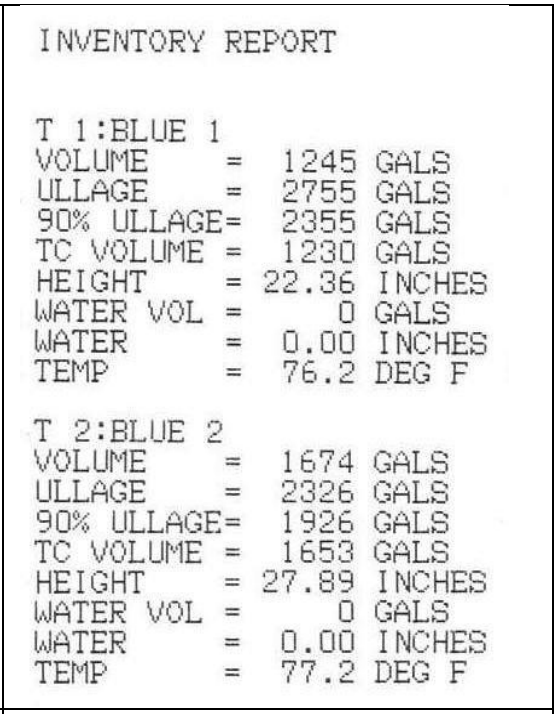
The following are examples of reports that may be generated.

1) In-Tank Inventory



```
INCON INTELLIGENT CONTROLS INC
P.O. BOX 638
SACO ME 040722

08/11/1998                    7:26 PM

PRODUCT INVENTORY DETAIL

UNLD REG                  11882.3 GAL

TANK 1

GROSS                      7125.3 GAL
NET                        7067.0 GAL
DAYS SUPPLY                   3.7 DAYS
ULLAGE                     4150.1 GAL
WATER VOLUME                 12.7 GAL

UNLD PLUS                  5092.7 GAL

TANK 2

GROSS                      2033.3 GAL
NET                        2015.9 GAL
DAYS SUPPLY                   5.3 DAYS
ULLAGE                     2804.8 GAL
WATER VOLUME                  0.0 GAL
```

Incon TS-1000 Inventory Report



```
INVENTORY REPORT

T 1:BLUE 1
VOLUME     =  1245 GALS
ULLAGE     =  2755 GALS
90% ULLAGE=  2355 GALS
TC VOLUME  =  1230 GALS
HEIGHT     = 22.36 INCHES
WATER VOL  =     0 GALS
WATER      =  0.00 INCHES
TEMP       =  76.2 DEG F

T 2:BLUE 2
VOLUME     =  1674 GALS
ULLAGE     =  2326 GALS
90% ULLAGE=  1926 GALS
TC VOLUME  =  1653 GALS
HEIGHT     = 27.89 INCHES
WATER VOL  =     0 GALS
WATER      =  0.00 INCHES
TEMP       =  77.2 DEG F
```

Veeder Root TLS-350 Inventory Report

A current inventory report for each tank should be reviewed during UST inspections to determine the presence of water in the tank and to properly identify each tank probe by name and product type.

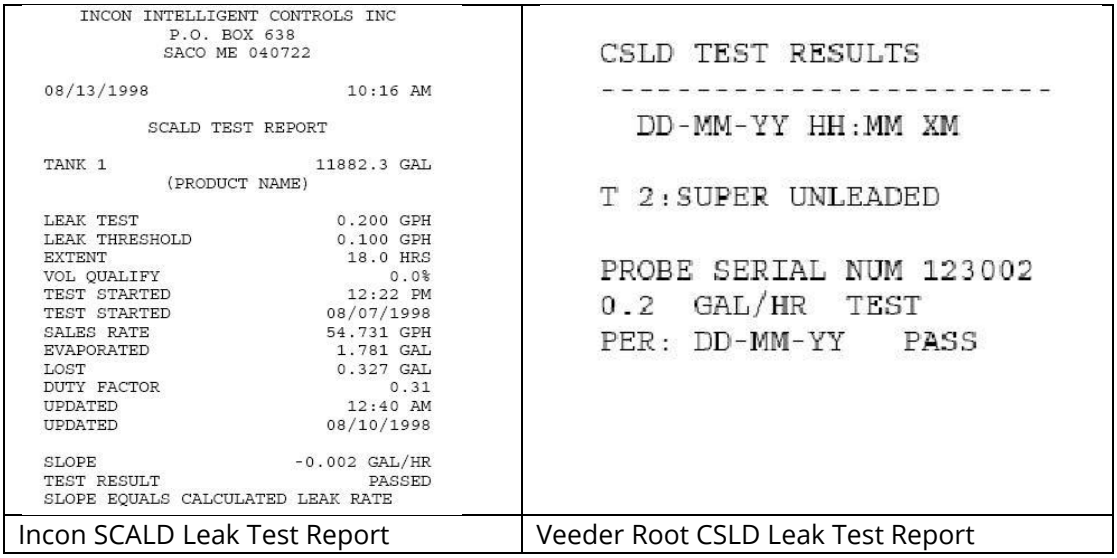
2) Static Leak Test (0.2 or 0.1 gph)

```
          INCON
 INTELLIGENT CONTROLS INC
      P. O. BOX 638
      SACO ME 04072
      1-800-984-6266

10/18/1997          02:42

    LEAK TEST REPORT

PLUS 2          5014.3 GAL
          PLUS

LEAK TEST       0.100 G/H
LEAK THRESHOLD  0.050 G/H
CONFIDENCE LEVEL    99.0%
TEST STARTED        21:45
TEST STARTED  10/17/1997
GROSS CAPACITY      56.12%
BEGIN GROSS    2814.2 GAL
BEGIN NET      2808.8 GAL
BEGIN LEVEL     52.630 IN
BEGIN TEMP      62.720 F
BEGIN WATER       0.4 GAL
BEGIN WATER     0.130 IN
END TIME            2:39
END DATE       10/18/1997
END GROSS      2814.3 GAL
END NET        2808.6 GAL
END LEVEL       52.632 IN
END TEMP        62.870 F
END WATER         0.4 GAL
END WATER       0.131 IN

      HOURLY DATA

TIME      DEG F   GAL
22:44    62.721  2809.23
23:44    62.751  2808.78
 0:44    62.885  2809.07
 1:44    62.883  2809.09

SLOPE          -0.04 GAL/HR
SLOPE LOW      -0.04 GAL/HR
SLOPE HIGH     -0.04 GAL/HR
TEST RESULTS       PASSED
SLOPE EQUALS CALCULATED
LEAK RATE
```

```
MMM DD, YYYY HH:MM XM

LEAK TEST REPORT

T 1: REGULAR UNLEADED
PROBE SERIAL NUM 105792

TEST STARTING TIME:
MM DD, YYYY HH:MM XM

TEST LENGTH = 4.3 HRS
STRT VOLUME = 3725 GALS

LEAK TEST RESULTS
0.2 GAL/HR TEST PASS
```

Incon TS-1000 Leak Test Report (static)	Veeder Root TLS-350 Leak Test Report

3) Continuous (CSLD or SCALD) Leak Test

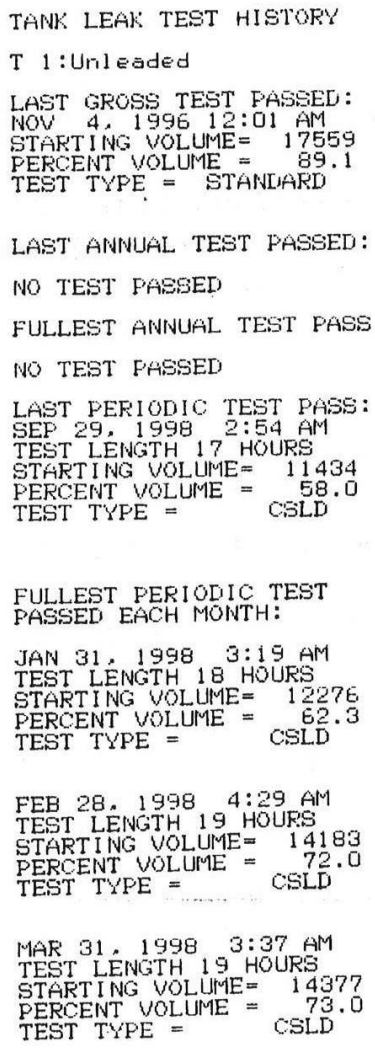


```
     INCON INTELLIGENT CONTROLS INC
              P.O. BOX 638
             SACO ME 040722

08/13/1998                    10:16 AM

           SCALD TEST REPORT

TANK 1                     11882.3 GAL
             (PRODUCT NAME)

LEAK TEST                    0.200 GPH
LEAK THRESHOLD               0.100 GPH
EXTENT                        18.0 HRS
VOL QUALIFY                       0.0%
TEST STARTED                 12:22 PM
TEST STARTED                08/07/1998
SALES RATE                  54.731 GPH
EVAPORATED                   1.781 GAL
LOST                         0.327 GAL
DUTY FACTOR                       0.31
UPDATED                      12:40 AM
UPDATED                     08/10/1998

SLOPE                    -0.002 GAL/HR
TEST RESULT                     PASSED
SLOPE EQUALS CALCULATED LEAK RATE
```

```
CSLD TEST RESULTS
-------------------------
  DD-MM-YY HH:MM XM

T 2:SUPER UNLEADED

PROBE SERIAL NUM 123002
0.2  GAL/HR  TEST
PER: DD-MM-YY   PASS
```

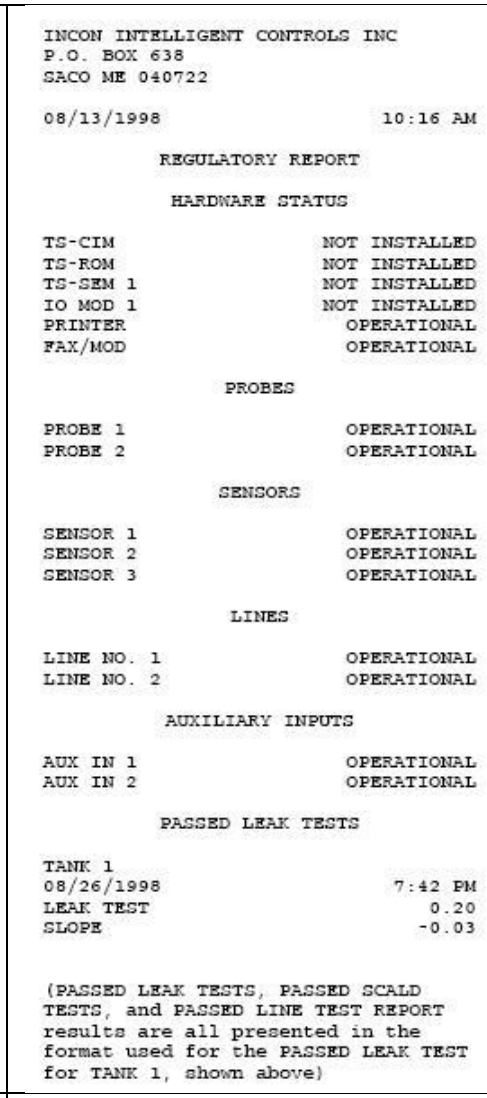
Incon SCALD Leak Test Report	Veeder Root CSLD Leak Test Report

4) Tank Leak Test History



```
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 =    62.3
TEST TYPE =       CSLD


FEB 28, 1998  4:29 AM
TEST LENGTH 19 HOURS
STARTING VOLUME=   14183
PERCENT VOLUME =    72.0
TEST TYPE =       CSLD


MAR 31, 1998  3:37 AM
TEST LENGTH 19 HOURS
STARTING VOLUME=   14377
PERCENT VOLUME =    73.0
TEST TYPE =       CSLD
```

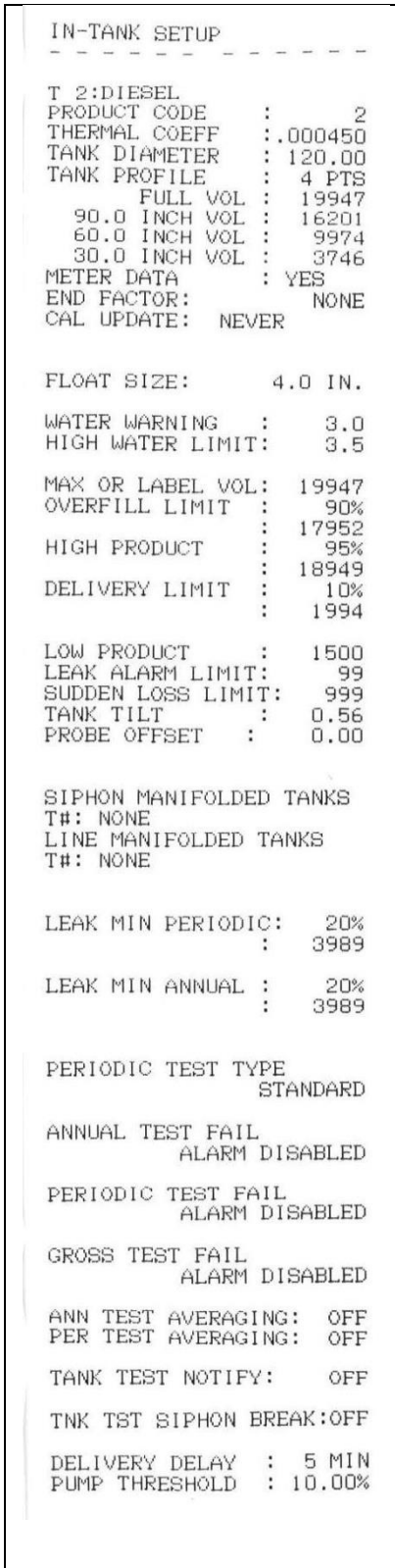
Veeder Root Leak History Report



```
INCON INTELLIGENT CONTROLS INC
P.O. BOX 638
SACO ME 040722

08/13/1998                    10:16 AM

          REGULATORY REPORT

           HARDWARE STATUS

TS-CIM                  NOT INSTALLED
TS-ROM                  NOT INSTALLED
TS-SEM 1                NOT INSTALLED
IO MOD 1                NOT INSTALLED
PRINTER                   OPERATIONAL
FAX/MOD                   OPERATIONAL

               PROBES

PROBE 1                   OPERATIONAL
PROBE 2                   OPERATIONAL

              SENSORS

SENSOR 1                  OPERATIONAL
SENSOR 2                  OPERATIONAL
SENSOR 3                  OPERATIONAL

               LINES

LINE NO. 1                OPERATIONAL
LINE NO. 2                OPERATIONAL

          AUXILIARY INPUTS

AUX IN 1                  OPERATIONAL
AUX IN 2                  OPERATIONAL

          PASSED LEAK TESTS

TANK 1
08/26/1998                    7:42 PM
LEAK TEST                       0.20
SLOPE                          -0.03


(PASSED LEAK TESTS, PASSED SCALD
TESTS, and PASSED LINE TEST REPORT
results are all presented in the
format used for the PASSED LEAK TEST
for TANK 1, shown above)
```

INCON Regulatory Report

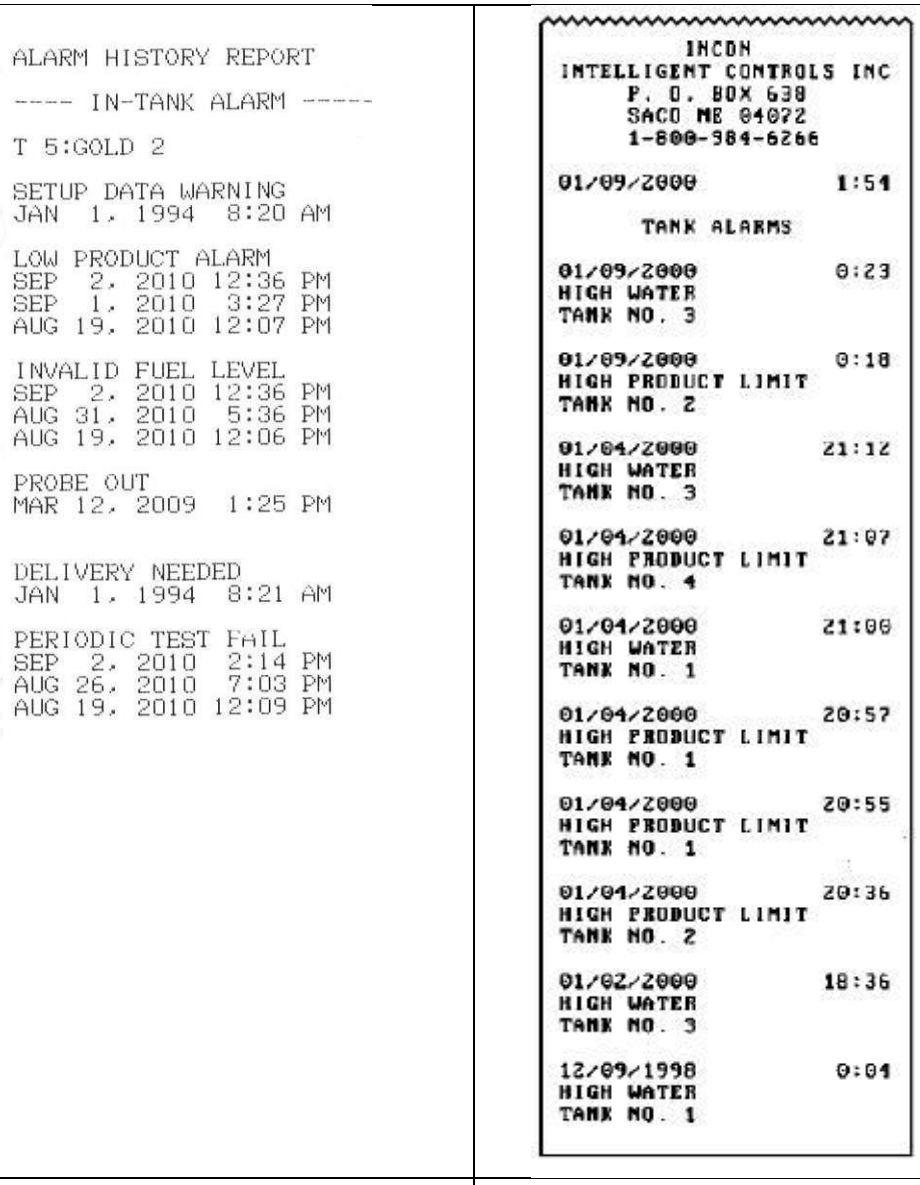
5) In-Tank Setup



```
IN-TANK SETUP
- - - - - - - - - - - -

T 2:DIESEL
PRODUCT CODE     :       2
THERMAL COEFF    :.000450
TANK DIAMETER    : 120.00
TANK PROFILE     :  4 PTS
       FULL VOL  :  19947
  90.0 INCH VOL  :  16201
  60.0 INCH VOL  :   9974
  30.0 INCH VOL  :   3746
METER DATA       : YES
END FACTOR:          NONE
CAL UPDATE:  NEVER


FLOAT SIZE:       4.0 IN.

WATER WARNING    :     3.0
HIGH WATER LIMIT:      3.5

MAX OR LABEL VOL:   19947
OVERFILL LIMIT   :     90%
                 :   17952
HIGH PRODUCT     :     95%
                 :   18949
DELIVERY LIMIT   :     10%
                 :    1994

LOW PRODUCT      :    1500
LEAK ALARM LIMIT:      99
SUDDEN LOSS LIMIT:    999
TANK TILT        :   0.56
PROBE OFFSET     :   0.00


SIPHON MANIFOLDED TANKS
T#: NONE
LINE MANIFOLDED TANKS
T#: NONE


LEAK MIN PERIODIC:    20%
                 :    3989

LEAK MIN ANNUAL  :    20%
                 :    3989


PERIODIC TEST TYPE
                STANDARD

ANNUAL TEST FAIL
          ALARM DISABLED

PERIODIC TEST FAIL
          ALARM DISABLED

GROSS TEST FAIL
          ALARM DISABLED

ANN TEST AVERAGING:  OFF
PER TEST AVERAGING:  OFF

TANK TEST NOTIFY:    OFF

TNK TST SIPHON BREAK:OFF

DELIVERY DELAY   :  5 MIN
PUMP THRESHOLD   : 10.00%
```

TLS-350 In-Tank Setup Report

6) In-Tank Alarm History



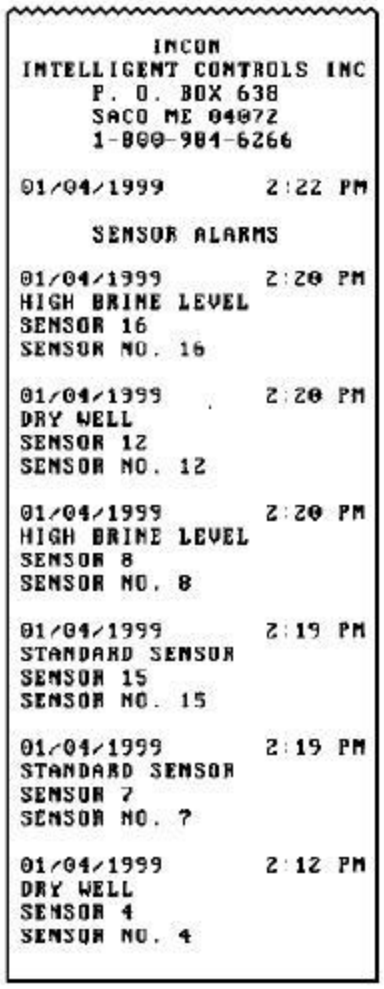
```
ALARM HISTORY REPORT

---- IN-TANK ALARM -----

T 5:GOLD 2

SETUP DATA WARNING
JAN  1, 1994  8:20 AM

LOW PRODUCT ALARM
SEP  2, 2010 12:36 PM
SEP  1, 2010  3:27 PM
AUG 19, 2010 12:07 PM

INVALID FUEL LEVEL
SEP  2, 2010 12:36 PM
AUG 31, 2010  5:36 PM
AUG 19, 2010 12:06 PM

PROBE OUT
MAR 12, 2009  1:25 PM

DELIVERY NEEDED
JAN  1, 1994  8:21 AM

PERIODIC TEST FAIL
SEP  2, 2010  2:14 PM
AUG 26, 2010  7:03 PM
AUG 19, 2010 12:09 PM
```

```
          INCON
INTELLIGENT CONTROLS INC
     P. O. BOX 638
     SACO ME 04072
     1-800-984-6266

01/09/2000            1:51

      TANK ALARMS

01/09/2000            0:23
HIGH WATER
TANK NO. 3

01/09/2000            0:18
HIGH PRODUCT LIMIT
TANK NO. 2

01/04/2000           21:12
HIGH WATER
TANK NO. 3

01/04/2000           21:07
HIGH PRODUCT LIMIT
TANK NO. 4

01/04/2000           21:00
HIGH WATER
TANK NO. 1

01/04/2000           20:57
HIGH PRODUCT LIMIT
TANK NO. 1

01/04/2000           20:55
HIGH PRODUCT LIMIT
TANK NO. 1

01/04/2000           20:36
HIGH PRODUCT LIMIT
TANK NO. 2

01/02/2000           18:36
HIGH WATER
TANK NO. 3

12/09/1998            0:04
HIGH WATER
TANK NO. 1
```

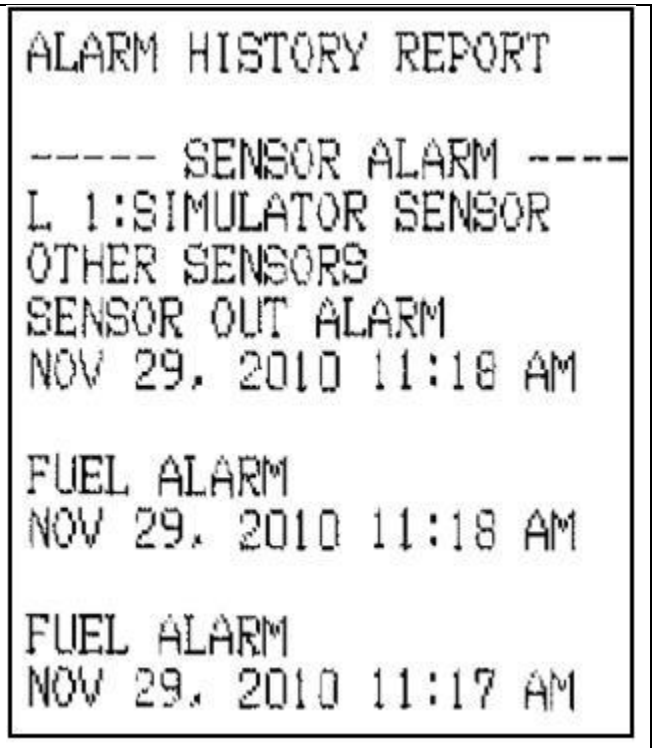
Veeder Root Alarm History Report	INCON In-Tank Alarm History

The in-tank alarm history report will indicate whether any failed test results were recently generated by the ATG. This report must be provided to inspectors onsite when there are missing or incomplete ATG leak test reports.

7) Sensor Alarm History



```
          INCON
INTELLIGENT CONTROLS INC
      P. O. BOX 638
      SACO ME 04072
      1-800-984-6266

01/04/1999          2:22 PM

      SENSOR ALARMS

01/04/1999          2:20 PM
HIGH BRINE LEVEL
SENSOR 16
SENSOR NO. 16

01/04/1999          2:20 PM
DRY WELL
SENSOR 12
SENSOR NO. 12

01/04/1999          2:20 PM
HIGH BRINE LEVEL
SENSOR 8
SENSOR NO. 8

01/04/1999          2:19 PM
STANDARD SENSOR
SENSOR 15
SENSOR NO. 15

01/04/1999          2:19 PM
STANDARD SENSOR
SENSOR 7
SENSOR NO. 7

01/04/1999          2:12 PM
DRY WELL
SENSOR 4
SENSOR NO. 4
```



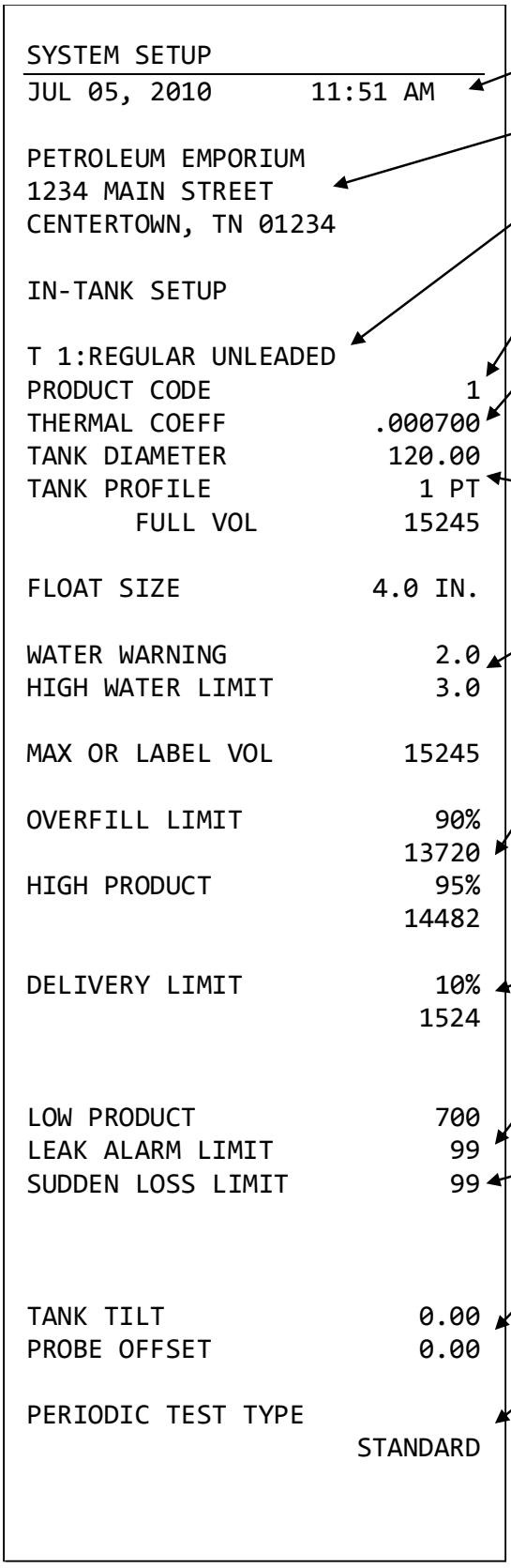
```
ALARM HISTORY REPORT

------ SENSOR ALARM ----
L 1:SIMULATOR SENSOR
OTHER SENSORS
SENSOR OUT ALARM
NOV 29. 2010 11:18 AM

FUEL ALARM
NOV 29. 2010 11:18 AM

FUEL ALARM
NOV 29. 2010 11:17 AM
```

INCON Sensor Alarm History	Veeder Root Sensor Alarm History

INTERPRETATION OF SETUP INFORMATION TO BE REVIEWED ONSITE

Setup information from the ATG will be reviewed during the onsite inspection every six years or if a problem is identified onsite (i.e. product level below test threshold) which will require a follow-up inspection with setup provided thereafter. Below are examples of setup information commonly found for ATGs in Tennessee.

VEEDER-ROOT TLS-3XX SETUP:



Time/date setup was printed

Facility information

Product Identification

Product Code is related to sales/inventory tracking.

Thermal Coefficient is determined by product; this enables the ATG to take temperature related volume changes into account for leak tests. An incorrect value can cause test failures.

Tank Diameter / Tank Profile – these tank geometry parameters determine the 'tank chart' the ATG will use to convert depths into volumes.

Water Warning / High Water Limit – the ATG alerts the operator of the presence of water as the specified depths.

Overfill Limit / High Product – the ATG alerts the operator to the presence of fuel in excess of these amounts. They differ in that the 'Overfill Limit' is triggered by fuel deliveries, while 'High Product' can be used to recognize slow increases (e.g., in used oil applications)

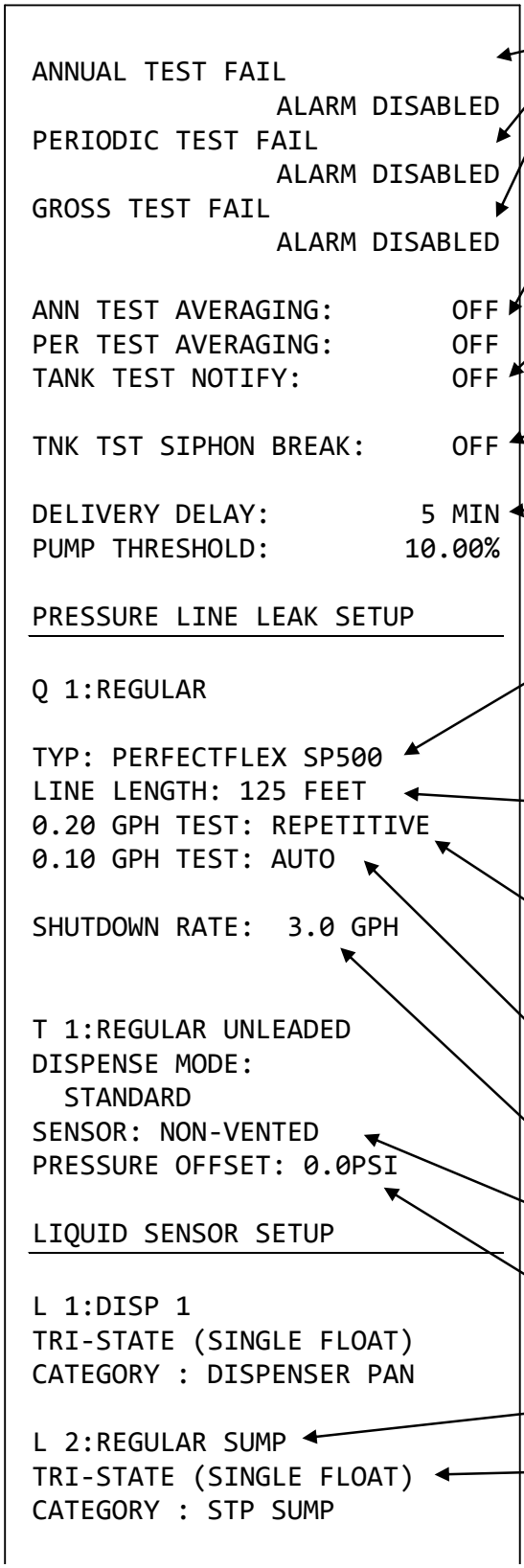
Delivery Limit – typically, the level at which the ATG alerts the operator to order a fuel delivery.

Leak Alarm Limit – warns the operator of a large loss rate (>1 gph) during a leak test

Sudden Loss Limit – warns the operator of a large loss volume loss (>25 gallons) during a leak test

Tank Tilt / Probe Offset – these parameters modify the tank chart for variations in tank and probe positioning.

Possible settings are 'Standard' and 'Quick.' Quick runs a 0.2 gph test in one hour, standard takes two hours.



Alarm settings for different types of tests. The annual test is 0.1 gph, periodic test is 0.2 gph and the gross test is 3 gph.

Annual Test Averaging averages the last ten 0.1 gph tests. Periodic Test Averaging averages the last five 0.2 gph tests.

Test Notify – gives the operator an opportunity to shut off the submersible pump for a test.

Used to perform in-tank leak tests on some manifolded tanks.

This delay allows the tank to "settle out" after a delivery before the system generates a 'Delivery Increase Report.' Can be up to 99 minutes.

Brand/type of piping – there are a number of pre-programmed options. If set as 'User Defined', the bulk modulus of the pipe must be entered manually as a separate parameter.

Total length of piping for the specified product; unrealistically high values will cause an ELLD to miss leaks, particularly with flexible pipe.

'Repetitive' test means that a 0.2 gph line test is run after every dispensing event, immediately after the 3,0 gph test.

'Auto' means that a 0.1 gph test is automatically run every six months.

Leak rate setting for automatic pump shutdown.

LLD type.

Pressure setting adjustment for high geographic elevations.

Sensor location

Sensor type

INCON TANK SENTINEL SETUP:

```
     PETROLEUM EMPORIUM
       1234 MAIN STREET
     CENTERTOWN, TN 01234

  JUL 05, 2010       11:51 AM

      SYSTEM SETUP REPORT

LIMITS
  LEAK LIMIT                2.00
  LEAK LIMIT O/G            NONE
  THEFT LIMIT              10.00
  THEFT LIMIT O/G           NONE


TANK

  NUMBER OF TANKS              2

  TANK 1
    NAME                  REG UNL
    TANK SHAPE         HORIZONTAL
    TANK TYPE           SPECIAL 1
    PROBE                 PROBE 1
    PRODUCT             PRODUCT 1
    MANIFOLD                NONE
    PROD OFFSET            0.000
    WATER OFFSET          -0.816
    DEL THRESHOLD            200
    HIGH HIGH LIM        118.000
    HIGH HIGH O/G           NONE
    HIGH LIMIT           116.000
    HIGH LIMIT O/G          NONE
    LOW LIMIT              500.0
    LOW LIMIT O/G           NONE
    LOW LOW LIMIT          400.0
    LOW LOW O/G             NONE
    WATER LIMIT            3.000
    WATER O/G               NONE
```

Facility information and date of system setup report.

Leak limit is a parameter that checks for fuel loss when the facility is shut down; whereas, theft limit checks for excess fuel being removed while fuel is being dispensed. The O/G or output group parameters tell the tank monitor what action to take (i.e. sound an alarm, send an email, etc.). O/G is typically set at "none" or a letter between A and FF.

Number of tanks at this facility.

Special 1, Probe 1, and Product 1 correspond to various tank, probe and product parameters listed in a different portion of the setup report

Product and/or water offset are used to compensate for product/water reading from tilted tanks

Del Threshold = minimum volume added to tank before delivery is reported on ATG

High Limit and High High Limit represent various degrees of tank fullness with High High representing the fullest level (typically set in inches of product)

High High O/G, High Limit O/G, Low Limit O/G, Low Low O/G and Water O/G represent the actions that the tank monitor takes if any of these conditions exists. For example, the ATG might sound and alarm, email the contact person, do nothing, etc. Value entered is either "none" or a letter between A and FF.

Low Limit and Low Low Limit represent various degrees of tank emptiness with Low Low representing the lowest level of product in a tank (typically set in gallons of product)

Water limit represent the water level (in inches) needed to trigger a high water alarm

```
 SPECIAL TANKS
  SPECIAL 1
   DIAMETER          120.000
   LENGTH            205.700
   CORRECTION POINTS       0




 PROBES
  PROBE 1
   TYPE               STD 125
   GRADIENT           8.99634
   RATIO     1:1 TIP TO HEAD
   FLOATS           2 FLOATS
   FLOAT TYPE       GASOLINE




PRODUCTS

 PRODUCT 1
  NAME                REG UNL
  TYPE           UNLEADED REG


LINES

 NUMBER OF LINES            2

 LINE 1
  NAME                 LINE 1
  TEST FAIL O/G          NONE
  TEST FAULT O/G         NONE
 LINE 2
  NAME                 LINE 2
  TEST FAIL O/G          NONE
  TEST FAULT O/G         NONE
```

Special Tanks contains tank specific dimension and correction factors. Correction points allows the ATG to adjust fuel reading to match data for that tank. For example, you may put 500 gallons of product in a tank, but the tank monitor only reads 450 gallons, so a correction factor would be entered. Numerous correction factors can be entered.

Probe type is selected from a type already programmed into ATG; Gradient is entered from probe label and **is unique to each probe**; ratio corresponds to a correction factor (example, 1:8 would indicate that 1 inch of change indicated by the probe would correspond to 8 inches in the tank; typically used for ASTs; for UST should typically be 1:1); floats are either "2 Floats" or "1 Float" (2 floats corresponds to the product and water float); and float type is either "gasoline" or "oil"

Product = Unleaded Reg, Unleaded Pls, Unleaded Xtr, Unleaded Sup, Diesel, Kerosene, #2 Fuel Oil, Ethanol, or Special (additional information needed if product type is "special")

Number of lines, the line names, and what actions the ATG needs to take in the event of fail (i.e. alarm, etc.) or test fault. Test faults are typically related to computer glitches which cause the test to not run properly.

```
LEAK TEST
 CONFIDENCE                99.0%
 MIN TEST TIME                2
 MAX TEST TIME                8
 LEAK TEST
  TANK 1                    0.20
  TANK 2                    0.20
 TEST SCHEDULES
  TANK 1
   SCHEDULE                DAILY
   TIME                 01:00 AM
  TANK 2
   SCHEDULE                DAILY
   TIME                 01:00 AM
 ALARM ON TEST FAIL          YES


SCALD TESTS


 CONFIDENCE                95.0%
 LEAK TEST                 0.20
 INTERVAL                    18
 VOLUME QUALIFY            0.0%
 VAPOR RECOVERY         DISABLED
 SCALD ENABLED
  TANK 1                 ENABLED
  TANK 2                 ENABLED

ALARM ON TEST FAIL          YES
TEST FAIL O/G
 TANK 1              ALL GROUPS
 TANK 2              ALL GROUPS
```

Leak test contains data on leak rate, frequency, etc. for when the tank monitor is to perform a static leak test. For example, the setup to the left indicates that the 0.2 gph leak test will be performed daily starting at 1:00 AM. Test confidence must be greater than 95%. Min test time refers to the time needed to complete a leak test (set in hours). Ranges from approx. 2 hours for a 4,000 gallon tank to 5 hours for a 10,000 gallon tank to 8 hours for a 20,000 gallon tank. Alarm on test fail represents the action that the ATG will take in the event of a failure.

SCALD = Statistical Continuous Automatic Leak Detection performs volumetric leak tests during the quiet time between dispenses.

Interval is related to temperature compensation during the leak test (default IS 18)

Volume Qualify is the minimum liquid volume for which a leak test can be performed. Refer to the "National Work Group on Leak Detection Evaluations" website for the minimum tank volumes needed to perform a valid leak test. Should never be set at 0!

SCALD Enabled represent which tanks are performing SCALD leak detection (i.e., enable or disabled)

Test fail o/g (output group) represents the action that the ATG will take in the event of a failure. Could be "none", A through FF, or "all groups". All groups indicates that all actions programmed into all relay groups (i.e. A through FF) will occur.

```
LINE TESTS

0.1 GPH TEST SCHEDULES
  LINE 1
    SCHEDULE                DAILY
    TIME                 01:00 AM
  LINE 2
    SCHEDULE                DAILY
    TIME                 01:00 AM

0.2 GPH TEST SCHEDULES

  LINE 1
    SCHEDULE                DAILY
    TIME                 01:00 AM
  LINE 2
    SCHEDULE                DAILY
    TIME                 01:00 AM


SENSORS
  NUMBER OF SENSORS            3
    SENSOR 1                 STD
    RELAY                RELAY 1
    NAME                 1 2 DISP
    STD O/G           ALL GROUPS
    SENSOR 2                 STD
    RELAY                RELAY 1
    NAME                 3 4 DISP
    STD O/G           ALL GROUPS
    SENSOR 3                 STD
    RELAY                RELAY 1
    NAME                 UNL SUMP
    STD O/G           ALL GROUPS
```

Time and frequency that lines are scheduled to be tested at the 0.1 GPH and/or 0.2 GPH leak test levels. Schedule could vary between none, daily, a certain day of the week and/or month.

STD corresponds to a standard sensor type in the ATG setup and STD O/G corresponds to the action that the ATG will take in the event of an alarm.

For Veeder Root and INCON models used for CSLD, the probability of detection can be set at 95% or 99%. Any leak detection method installed after December 22, 1990 must be capable of detecting a leak rate with a probability of detection of ninety-five (95) percent and a probability of false alarm no greater than five (5) percent, in accordance with rule .04(1)(a)3.

Upon transfer of ownership, including, but not limited to, sale of the UST systems, originals and/or copies of all documents required to satisfy the reporting and recordkeeping requirements shall be transferred as required by rules .03(2)(d) and .02(7)(f), to the new owner of the USTs at the time of ownership transfer.

REPORTING

If any of the following conditions are observed, then the Division should be contacted to report a suspected or confirmed release with 72 hours as required by rule .05(1)(a):

- Results of any failed 0.1 gph or 0.2 gph leak tests from the ATG, unless the monitoring device or an associated UST component is found to be defective but not leaking, is immediately repaired, and a follow-up test does not confirm the initial result as required by rule .05(1)(a)3.

- Any in-tank alarm from the ATG which indicates a sudden or unexplained loss of product as required by rule .05(1)(a)2. Documentation of investigation of all in-tank leak alarms should be kept with the ATG leak test reports for review by Division staff.

- Any released petroleum product at the UST site or in the surrounding area (such as the presence of free product, or petroleum vapors in soils, basements, sewer and utility lines and nearby surface water). See rule .05(1)(a)1.

REFERENCES

Automatic Tank Monitoring and Leak Detection Reference Manual, U.S. EPA, Region 7

Automatic Tank Gauging Systems for Release Detection: Reference Manual for Underground Storage Tank Inspectors, August 2000

Getting the Most Out of Your Automatic Tank Gauging System, EPA 510-F-98-011

INCON TS-5 Series Operator's Manual

Kentucky DEP UST Inspector Handbook, May 2006

Petroleum Equipment Institute

Veeder Root TLS-3XX Operators Manual, 576013-610 Rev. AA

Veeder Root TLS-3XX Installation Manual, 576013-498, Rev. B

Veeder Root TLS-3XX System Setup Manual, 576013-623, Rev. V

Veeder Root TLS-3XX Troubleshooting Guide, 576013-818, Rev. AA

Veeder Root TLS Monitoring Systems Contractor's Site Preparation Guide, 577013-578 Rev. E

Wisconsin COMM 10 Material Approval # 20050005, Automatic Tank Gauging, Dec. 2009

Wisconsin COMM 10 Material Approval # 20020011, Incon Series, Dec. 2007

Underground Storage Tanks- The Basics, Iowa Department of Natural Resources, Underground Storage Tank Branch, March 2010

APPENDICES-

1. ATG Leak Detection Quick Reference Table (8-27-2013)

APPENDIX 1
ATG Leak Detection Quick Reference Table
Updated 8-27-2013

Note: Leak detection equipment installed in systems with greater than 10% ethanol should be free of zinc, lead, aluminum, tin or their alloys (brass, terne (lead-tin alloy)).

Manufacturer	Model	Test Type	Minimum Fill	Test Period (see comment)	Threshold	Max. Capacity	Comment
Alert Technologies	SMART STICK I 2000	0.2	50%	1-15 hrs	0.1	15,000	
Andover Controls Corp.	TMU & INFINITY	0.2	50%		0.2	15,000	
		0.1	95%		0.1		
Caldwell Systems Corp.	Tank Manager ATG System	0.2	18 in.	3 hrs. 15 min.		20,000	Ultrasonic probe
		0.1	95%	3 hrs. 15 min.		20,000	Ultrasonic probe
EBW, Inc.	AUTOSTIK II & JR w/ 960/961 Series Probes	0.2	50%	4 hrs	0.1	15,000	Testing can be performed on one tank at a time.
		0.1	95%	4 hrs	0.05	15,000	
	AUTOSTIK II & JR CSLD v31 or v51	0.2	30%		0.07	30,000	<150K Monthly thru-put Testing can be performed on one tank at a time.
	NOTE: EBW 970 & 973 series probes are for inventory measurements only, not for leak detection.						
EBW, Inc.	Autostik (950 series) ONLY	0.2	10%	4 hrs	0.1	15,000	
		0.1	95%	4 hrs	0.05	15,000	
Emco Electronics	EECO TLM 1000, 3000	0.2	14%		0.1	20,000	
		0.1	95%		0.05	20,000	
Engineered Systems	ESI IMAGE	0.2	90%		0.1	15,000	
Franklin Fueling	INCON TS-5, 550, 550evo, 750, 1000, 1001, 2001, 5000, Colibri Probe: TSP-LL2	0.2	See Below	5 1/4 hrs	0.1		Test time is an average; actual times based on pre-set test condition criteria
		0.1	95%	5 3/4 hrs	0.05	15,000	
	INCON TS-5, 550, 550evo, 750, 1000, 1001, 2001, 5000, Colibri Probe: TSP-LL2	0.2 ONLY	See Below	<7 hrs	0.1	30,000	Variable based on quality of test data Maximum 3 Manifolded Tanks
	INCON TS-5, 550, 550evo, 750, 1000, 1001, 2001, 5000, Colibri SCALD	0.2	15%	Continuous	0.1	49,336	Maximum Monthly Throughput of 304,620 gallons Will not test if below minimum fill level.
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Required						
	24" 9" / 72" 15" / 120" 21"						
	36" 10.5" / 76" 15.5" / 126" 21.5"						
	48" 12" / 84" 16.5" / 132" 22"						
	52" 12.5" / 96" 17.5" / 144" 23.5"						
	64" 14" / 108" 19"						2000 Scald
Franklin Fueling	INCON TS-5, 550, 750, 1000, 1001, 2001, 5000, Colibri Probe: TSP-LL2	0.2	See Below	5 1/4 hrs	0.1		Test time is an average; actual times based on pre-set test condition criteria
		0.1	95%	5 3/4 hrs	0.05	15,000	
	INCON TS-5, 550, 750, 1000, 1001, 2001, 5000, Colibri Probe: TSP-LL2	0.2 ONLY	See Below	<7 hrs	0.1	30,000	Variable based on quality of test data Maximum 3 Manifolded Tanks
	TS-5, 550, 750, 1000, 1001, 2001, 5000, Colibri SCALD	0.2	15%	Continuous	0.1	49,336	Maximum Monthly Throughput of 304,620 gallons Will not test if below minimum fill level.
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Required						
	24" 9" / 72" 15" / 120" 21"						
	36" 10.5" / 76" 15.5" / 126" 21.5"						
	48" 12" / 84" 16.5" / 132" 22"						
	52" 12.5" / 96" 17.5" / 144" 23.5"						
	64" 14" / 108" 19"						2000 Scald
Franklin Fueling	INCON TS-5, 550, 750, 1000, 1001, 2001, 5000 Probe: TSP-LL2	0.2	See Below	5 1/4 hrs	0.1		Test time is an average; actual times based on pre-set test condition criteria
		0.1	95%	5 3/4 hrs	0.05	15,000	
	INCON TS-5, 550, 750, 1000, 1001, 2001, 5000 Probe: TSP-LL2	0.2 ONLY	See Below	<7 hrs	0.1	30,000	Maximum 3 Manifolded Tanks
	TS-5, 550, 750, 1000, 1001, 2001, 5000 SCALD	0.2	15%	Continuous	0.1	49,336	Maximum Monthly Throughput of 304,620 gallons Will not test if below minimum.
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Required						
	24" 9" / 72" 15" / 120" 21"						
	36" 10.5" / 76" 15.5" / 126" 21.5"						
	48" 12" / 84" 16.5" / 132" 22"						
	52" 12.5" / 96" 17.5" / 144" 23.5"						
	64" 14" / 108" 19"						2000 Scald

Manufacturer	Model	Test Type	Minimum Fill	Test Period (see comment)	Threshold	Max. Capacity	Comment
GILBARCO, INC.	TM-2, TM-3, EMC Probe PA0238 (Capacitance)	0.2 ONLY	50%	5 hrs	All probes have a preset threshold which cannot be changed. Pass or Fail	15,000	
	TM-2, TM-3, EMC PROBE PA0264 (Capacitance)	0.2 0.1	50% 95%	2 hrs 2 hrs		15,000 15,000	
	TM-2, TM-3 Probes PA0265 & PA0300 (Magnetostrictive)	0.2 0.1	See Below 95%	2 hrs 3 hrs		15,000 15,000	
	EMC Probes PA0265, PA0300 (Magnetostritive)	0.2 0.1	See Below 95%	2 hrs 2-5 hrs		20,000	
	EMC W/CSLD Probes PA0265, PA0300 (Magnetostrictive)	.2 Cont.	5%	na	Will not test below minimum	45K, 37K Manifold Aggregate	Throughput 227,559 single 226,848 Aggregate
	Tank Diameter = Product Required 24'- 26' 9" 27'- 36' 12" 37'- 47' 15" 48'- 58' 18" 59'- 69' 21" Tank Diameter = Product Required 70'- 79' 24" 80'-90' 27" 91'- 101' 30" 102'- 111' 33" 112'- 122' 36" Tank Diameter = Product Required 123'- 133' 39" 134'- 143' 42" 144'- 154' 45" 155'- 165' 48" 166'- 175' 51"						
Intelligent Controls	INCON TS 2000	0.2	50%		0.058	15,000	Magnetostrictive or Digital Level Probes
		0.1	95%		0.058	15,000	No probe numbers available.
	SCALD	0.2	7%			30,000	108K Maximum Monthly Throughput
L&J Environmental	MCG 1100,8100	0.2	50%		0.1	15,000	
		0.1	95%		0.05	15,000	
MagneTek Controls	7021	0.2	10%	6 hrs	0.2	15,000	Probe #7030
		0.1	95%	12 hrs	0.1	15,000	
Mallory Controls	IMAGE	0.2	90%		0.1	15,000	
OMNTEC Mfg.	OEL8000II	0.2	See below	4.5 hrs	0.1	30,000	
	OEL8000II w/CITLOS	0.2	12.70%	Continuous	0.1	18,000	
	Minimum product level based on tank diameter: Tank Diameter = Product Required 0-48" 12" 49-64" 15" 65-72" 18" Tank Diameter = Product Required 73-96" 20" 97-126" 15.5" 127-132" 26" Tank Diameter = Product Required 133 or greater = Contact OMNTEC						
OMNTEC	OEL 8000 Probes are Magnetostrictive	0.2 0.1	50% 95%		VARIABLE VARIABLE	15,000 15,000	Tests are manually initiated. No probe numbers available.
OPW	SiteSentinel iSite--2 or 4 inch float--Probe 924B	0.2	50%	30 Min.	0.1	20,000	System automatically determines minimum time based on test conditions being met. Test times will be longer for larger tanks.
	SiteSentinel iSite---4 inch float---Probe 924B	0.1	95%	1.5 hrs	0.05	20,000	
	SiteSentinel iSite---2 inch float---Probe 924B	0.1	95%	6.0 hrs	0.05	20,000	
	SiteSentinel iSite-4 inch float-Probe Q0400-4XX	0.2	50%	4.0 hrs	0.1	20,000	
	SiteSentinel iSite-SLD	0.2	14.70%	Continuous	0.1	20000.0	Maximum Monthly Throughput of 397,683 gallons Will not test if below minimum fill level
OPW	SITE SENTINEL I,II,III, iTouch Probe 924	0.2	50%			20,000	30 & 60 Minute Test
	SITE SENTINEL I,II,III, iTouch Probe 924	0.2	14%			20,000	2 & 3 Hour Test
	SITE SENTINEL I,II,III VTTT, iTouch Probe 924	0.1	95%			20,000	2 & 3 Hour Test
OPW	PETROSONIC III Probe 613	0.2	59%	2 hrs		15,000	
	SITE SENTINEL Probe 613	0.2	14%	2 hrs		15,000	
	SITE SENTINEL I,II,III, iTouch Probe 924	0.2	50%			20,000	30 & 60 Minute Test
	SITE SENTINEL I,II,III, iTouch Probe 924	0.2	14%			20,000	2 & 3 Hour Test
	SITE SENTINEL I,II,III VTTT Probe 613	0.1	95%			15,000	2 & 3 Hour Test
	SITE SENTINEL I,II,III VTTT, iTouch Probe 924	0.1	95%			20,000	2 & 3 Hour Test

Manufacturer	Model	Test Type	Minimum Fill	Test Period (see comment)	Threshold	Max. Capacity	Comment
OPW	1500 & 2000 Probe Q0400-4XX (Magnetostrictive)	0.2	9%	3.3 hrs	0.1	20,000	System automatically determines minimum time based on test conditions being met. Test times will be longer for larger tanks.
		0.1	95%	3.5 hrs	0.05	20,000	
	EECO SLD Probe Q0400-4XX (Magnetostrictive)	2 Cont.	9%			2 Tank Max. <=35K	
							SLD 130K Maximum Throughput
OPW	SiteSentinel iSite--2 or 4 inch float--Probe 9248	0.2	50%	30 min	0.1	20,000	System automatically determines minimum time based on test conditions being met. Test times will be longer for larger tanks.
	SiteSentinel iSite---4 inch float---Probe 9248	0.1	95%	1.5 hrs	0.05	20,000	
	SiteSentinel iSite---2 inch float---Probe 9248	0.1	95%	6.0 hrs	0.05	20,000	
	SiteSentinel iSite-4 inch float-Probe Q0400-4XX	0.2	50%	4.0 hrs	0.1	20,000	
P C Interactive	AINLAY TANK MASTER	0.2	50%		0.05	75,000	
	TANK MASTER JR	0.2	20%		0.05	30,000	
Pneumercator Co.,Inc	TMS2000 & TMS3000 <20K Probe 4505 or 7100 (Magnetostrictive) >20K	0.2	20%	2 hrs	0.1	20,000	Pnuemercator probe number 4505 is the same as the Ametek Patriot 7100 probe used in the 3rd-party evaluation
		0.1	95%*	7 hrs	0.05	20,000	
		0.2	50%	8 hrs	0.1	75,000	
Pneumercator Co.,Inc	TMS2000 & TMS3000 <20K Probe 4505 or 7100 (Magnetostrictive) >20K	0.2	20%	2 hrs	0.1	20,000	Pnuemercator probe number 4505 is the same as the Ametek Patriot 7100 probe used in the 3rd-party evaluation
		0.1	95%*	7 hrs	0.05	20,000	
		0.2	50%	8 hrs	0.1	75,000	
Ronan Engineering	API/RONAN	0.2	10%		0.1	15,000	
		0.1	95%		0.05	15,000	
Southwest Environmental Services	US Test Model 2001	0.2	50%	30 min	0.1	15,000	Ultrasonic Probes
		0.1	95%	1 hr	0.05	15,000	
	AUTOSTIK II & JR w/ Magnetostrictive Probe	0.2	See below	5 1/4 hrs	0.1	15,000	Test time is an average; actual times based on pre-set test condition criteria
		0.1	95%	5 3/4 hrs	0.05	15,000	
	AUTOSTIK II & JR w/ TSP-LL2 series probe	0.2	See below	< 7 hrs	0.1	30,000	
	AUTOSTIK II & JR w/ SCALD 2.0	0.2	14%	Continuous	0.1	49,336	Throughput Restrictions/2 max. manifolded
	Minimum product level based on tank diameter:						
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Required						
	26" 9" / 72" 15" / 120" 21"						
	36" 10.5" / 76" 15.5" / 126" 21.5"						
	48" 12" / 84" 16.5" / 132" 22"						
	64" 14" / 108" 19"						
The Marley Pump Co.	RLM5000, RLM5001,RLM9000	0.2	50%	Test time not available	0.058	15,000	All probes are magnetostrictive or ultrasonic. No probe numbers available.
		0.1	95%		0.05	15,000	
	ST1400, ST1401,ST 1401L, ST1600, ST1601, St1601L, Prolink Ultra	0.2	15"		0.09	73,500	
		0.1	95%		0.05	73,500	
	PROLINK	0.2	50%		0.1	18,000	PC Compatible
Tidel Engineering	EMS 3500	0.2	15%		0.1	15,000	
		0.1	95%		0.05	15,000	
	EMS 2000 & EMS3000	0.2	50%		0.05	15,000	
Universal Sensors	TICS 1000	0.2	90%		0.1	15,000	
Veeder-Root Co. Red Jacket Pro Plus & ProMax	Probe 7842 (Capacitance) w/ ProPlus & ProMax	0.2	50%	5 hrs	All probes have a preset threshold which cannot be changed by operator. Pass or Fail Only	15000	
	Probe 8472 (Capacitance) w/ ProPlus & ProMax	0.2	50%	2 hrs			
		0.1	95%	2 hrs			
	Probe 8463 & 8473 (Magnetostrictive)w/ ProPlus	0.2	see below	2 hrs			
		0.1	95%	3 hrs			
	Probe 8463 & 8473 (Magnetostrictive) w/ProMax	0.2	see below	2 hrs		30000	
		0.1	95%	2-5 hrs		20000	
	Probe 8463 & 8473 (Magnetostrictive) w/CSLD	0.2	5%			45000 single	Throughput Restrictions
	Minimum product level based on tank diameter:						
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Required						
	24-26" 9" / 70-79" 24" / 123-133" 39"						
	27-36" 12" / 80-90" 27" / 134-143" 42"						
	37-47" 15" / 91-101" 30" / 144-154" 45"						
	48-58" 18" / 102-111" 33" / 155-165" 48"						
	59-69" 21" / 112-122" 36" / 166-175" 51"						

Manufacturer	Model	Test Type	Minimum Fill	Test Period (see comment)	Threshold	Max. Capacity	Comment
Veeder-Root Co. TLS Series	Probe 7842 (Capacitance) All Models Except TLS2	0.2	50%	5 hrs	All probes have a preset threshold which cannot be changed. Pass or Fail	15,000	Note: Capacitance probes will not function properly when the ethanol content is above 10%.
	Probe 8472 (Capacitance) All Models Except TLS250, TLS250i & TLS2	0.1	95%	2 hrs		15,000	
		0.2	50%	2 hrs			
	Probe 8463 & 8473 (Magnetostrictive) TLS250iPlus,TLS300,TLS300i,TLS300iPlus,TLS300C	0.1	95%	3 hrs		15,000	
		0.2	See Below	2 hrs			
	Probe 8463 & 8473 TLS 350 Series & TLS2	0.1	95%	2-5 hrs		20000	
		0.2	See Below	2 hrs		30000	
	8463 or 8473 W/CSLD TLS300 & TLS350 Series	.2 Cont.	5%			45000 single	28 Days 227,559 thru-put
						37K manifolded	28 Day 226,848 thru-put
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Required						Checks fuel level. Will not test if below minimum requirement.
	24-26" 9" / 70-79" 24" / 123-133" 39"						
	27-36" 12" / 80-90" 27" / 134-143" 42"						
	37-47" 15" / 91-101" 30" / 144-154" 45"						
	48-58" 18" / 102-111" 33" / 155-165" 48"						
	56-69" 21" / 112-122" 36" / 166-175" 51"						
Veeder-Root Co. TLS Series ProPlus, ProMax	Probe 8463 & 8473 (Magnetostrictive) TLS-PC, ProPlus, and ProMax	0.1	95%	3 hrs	Preset which cannot be changed. Pass or Fail	15,000	
		0.2	See Below	2 hrs			
	Probe 8463 & 8473 TLS 300 series, TLS 350 series, TLS 450, TLS-PC, TLS-2	0.1	95%	2-5 hrs		20000	
		0.2	See Below	2 hrs		30000	
	8463 and 8473 W/CSLD TLS300, TLS350, EMC Series, ProPlus, ProMax	.2 Cont.	5%			45000 single	28 Days 227,559 thru-put
						37K manifolded	28 Day 226,848 thru-put
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Required						Checks fuel level. Will not test if below minimum requirement.
	24-26" 9" / 70-79" 24" / 123-133" 39"						
	27-36" 12" / 80-90" 27" / 134-143" 42"						
	37-47" 15" / 91-101" 30" / 144-154" 45"						
	48-58" 18" / 102-111" 33" / 155-165" 48"						
	56-69" 21" / 112-122" 36" / 166-175" 51"						
Veeder-Root Co. TLS, EMC Series Pro Plus, ProMax	Probe 7842 (Capacitance) All Models Except TLS2	0.2	50%	5 hrs	All probes have a preset threshold which cannot be changed. Pass or Fail	15,000	Note: Capacitance probes will not function properly when the ethanol content is above 10%.
	Probe 8472 (Capacitance) All Models Except TLS250, TLS250i & TLS2	0.1	95%	2 hrs		15,000	
		0.2	50%	2 hrs			
	Probe 8463 & 8473 (Magnetostrictive) TLS250iPlus,TLS300,TLS300i,TLS300iPlus	0.1	95%	3 hrs		15,000	
		0.2	See Below	2 hrs			
	Probe 8463 & 8473 TLS 350 Series, TLS2, ProMax, EMC except Basic	0.1	95%	2-5 hrs		20000	
		0.2	See Below	2 hrs		30000	
	8463 and 8473 W/CSLD TLS300, TLS350, EMC Series, ProPlus, ProMax	.2 Cont.	5%			45000 single	28 Days 227,559 thru-put
						37K manifolded	28 Day 226,848 thru-put
	Tank Diameter = Product Required / Tank Diameter = Product Required / Tank Diameter = Product Required						Checks fuel level. Will not test if below minimum requirement.
	24-26" 9" / 70-79" 24" / 123-133" 39"						
	27-36" 12" / 80-90" 27" / 134-143" 42"						
	37-47" 15" / 91-101" 30" / 144-154" 45"						
	48-58" 18" / 102-111" 33" / 155-165" 48"						
	56-69" 21" / 112-122" 36" / 166-175" 51"						
Wm.Wilson's Sons Inc.	GASBOY TMS 500	0.2	50%	3 hrs	0.2	15,000	Unknown probes
		0.1	95%	9 hrs	0.1	15,000	Magnetostrictive Probe