UST Manifolds - Siphon Systems

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Oil Control Program

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A manifoldeo UST system is like a box of chocolates...
What's the Difference?

Both STPs have a copper line connected to the functional element...Is there a difference?
Associated with a Siphon Manifold
Associated with Stage II Vapor Recovery Theft Port
Stage II Vapor Recovery Theft Port

FIGURE 5-5. A liquid-collection point must be installed in the vapor return piping when there is not enough difference in elevation between the dispenser(s) and the tank field to provide uniform slope of the vapor piping. Liquid collects in the bottom of the liquid-collection point where it will not interfere with the flow of vapors toward the tank. Small diameter copper tubing connected to the siphon port of the submersible pump is used to remove the liquid that collects in the bottom of the liquid-collection point.
• Newer systems are not typically installed with manifolds.

• Newer systems are now required to be double-walled.

• Less piping=
  – Less chance of a leak
  – Less chance of complications to obtain passing release detection results.
Types of Facilities that Have Manifolds

- Increase the product volume.

- A UST System that was temporarily out of use back into service.

- What type of a facility would have a manifold system?
Gas Stations... eh, no big deal.
Bulk Oil Facilities... a little more challenging.
Truck Stops... Help Me!!!
How many tanks can be manifolded?

Limitations will be based on Release Detection Methods.
- Vapor Monitoring
- Ground Water Monitoring
- Interstitial Monitoring
- Automatic Tank Gauge
- Statistical Inventory Reconciliation

**Reference NWGLDE for limitations.**

Siphon Manifold AND the Functional Element

I’m A Functional Element...I’m very Important!!!
# Automatic Tank Gauging - Static

**Veeder-Root**


## Automatic Tank Gauging Method

### Certification
- Leak rate of 0.1 gph with PD = 99.8% and PFA = 1.6% for 2 hour test.
- Leak rate of 0.1 gph with PD = 96.0% and PFA = 3.4% for 5 hour test.
- Leak rate of 0.1 gph with PD = 91.2% and PFA = 6.8% for 4 hour test.
- Leak rate of 0.1 gph with PD = 95.4% and PFA = 4.6% for 3 hour test.
- Leak rate of 0.1 gph with PD = 97.3% and PFA = 2.5% for 2 hour test.

### Leak Threshold
0.126 gph for leak rate of 0.2 gph.
0.071 gph for leak rate of 0.1 gph.
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

### Applicability
Gasoline, diesel, aviation fuel, biodiesel blends B6-B20 meeting ASTM D7467, biodiesel B100 meeting ASTM D6751.

### Tank Capacity
- Maximum of 20,000 gallons.
- Tanks less than 59% full may be tested. Minimum product level required is based on tank diameter as follows:
  - 48" dia/min 18'':
    - 96" dia/min 24'':
    - 112" dia/min 39'':
    - 132" dia/min 59'':
  - For other tank diameters, see evaluation report.

### Waiting Time
- Minimum of 8 hours between delivery and testing for 2 hour test and leak rate of 0.2 gph.
- Minimum of 8 hours between delivery and testing for 5 hour test and leak rate of 0.1 gph.
- Minimum of 9 hours between delivery and testing for 4 hour test and leak rate of 0.1 gph.
- Minimum of 11 hours between delivery and testing for 3 hour test and leak rate of 0.1 gph.
- Minimum of 12 hours between delivery and testing for 2 hour test and leak rate of 0.1 gph.
- Minimum of 30 minutes between dispensing and testing.
- There must be no delivery during waiting time.

### Test Period
- Minimum of 2 hours.
- Test data are acquired and recorded by system's computer.
- Leak rate is calculated from the difference between the first and last data collected.
- There must be no dispensing or delivery during test.

### Temperature
- Average for product is determined by probe which contains 5 thermistors.
- At least two thermistors must be submerged in product during test.

### Water Sensor
- Must be used to detect water ingress.
- Minimum detectable water level in the tank is 0.66 inch for model 8463 and 0493 probe.
- Minimum detectable water level in the tank is 0.75 inch for model 8493 probe.

### Comments
Not evaluated using manifolded tank systems. Therefore, this certification is only applicable when there is a probe used in each tank and the siphon is broken during testing.
- Tests only portion of tank containing product.
- As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure).
- Consistent testing at low levels could allow a leak to remain undetected.
- EPA leak detection regulations require testing of the portion of the tank which routinely contains product.
### Static Testing Without Siphon Break

**MANIFOLDED TANKS**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1:</td>
<td>DIESEL</td>
</tr>
</tbody>
</table>

**MANIFOLDED TEST RESULTS:**

- **MANIFOLDED RATE:** 32.17 GALLONS/HR
- **MANIFOLDED TANKS:** #1, #2
- **0.20 GAL/HR FLAGS:** LOW LEVEL TEST ERROR

**LEAK TEST REPORT**

- **PROBE SERIAL NUM:** 374551
- **LAST TEST STARTING TIME:** SEP 14, 2009 12:00 AM
- **TEST LENGTH:** 9.0 HRS
- **STRT VOLUME:** 1790.0 GAL

**TANK TEST SIPHON BREAK:** OFF

**DELIVERY DELAY:** 5 MIN
Mechanical Siphon Break

Solenoid Valve
Static Testing With Siphon Break

2013 ATG Printout

T 2: REGULAR UNLEADED 2
LAST CROSSED TEST PASSED: AUG 13, 2013 3:00 AM
STARTING VOLUME = 1241
PERCENT VOLUME = 105.3
TEST TYPE = STANDARD

LAST ANNUAL TEST PASSED:
NO TEST PASSED

FULLST ANNUAL TEST PASS:
NO TEST PASSED

LAST PERIODIC TEST PASS:
JUL 23, 2013 3:00 AM
TEST LENGTH = 2 HOURS
STARTING VOLUME = 3925
PERCENT VOLUME = 32.6
TEST TYPE = STANDARD

FULLST PERIODIC TEST PASSED EACH MONTH:
JAN 1, 2013 3:00 AM
TEST LENGTH = 2 HOURS
STARTING VOLUME = 4139
PERCENT VOLUME = 34.4
TEST TYPE = STANDARD

FEB 12, 2013 3:00 AM
TEST LENGTH = 2 HOURS
STARTING VOLUME = 4240
PERCENT VOLUME = 35.2
TEST TYPE = STANDARD

2016 ATG Printout

T 1: REGULAR UNLEADED 1
LAST CROSSED TEST PASSED: AUG 13, 2013 3:00 AM
STARTING VOLUME = 1467
PERCENT VOLUME = 97.7
TEST TYPE = STANDARD

LAST ANNUAL TEST PASSED:
NO TEST PASSED

FULLST ANNUAL TEST PASS:
NO TEST PASSED

LAST PERIODIC TEST PASS:
JUL 23, 2013 3:00 AM
TEST LENGTH = 2 HOURS
STARTING VOLUME = 4732
PERCENT VOLUME = 31.2
TEST TYPE = STANDARD

FULLST PERIODIC TEST PASSED EACH MONTH:
JAN 1, 2013 3:00 AM
TEST LENGTH = 2 HOURS
STARTING VOLUME = 4924
PERCENT VOLUME = 32.4
TEST TYPE = STANDARD

FEB 12, 2013 3:00 AM
TEST LENGTH = 2 HOURS
STARTING VOLUME = 5066
PERCENT VOLUME = 33.4
TEST TYPE = STANDARD

AUG 23, 2016 5:00 AM
LEAK TEST REPORT
T 2: REGULAR UNLEADED 2
PROBE SERIAL NUM 566498

TEST STARTING TIME:
AUG 23, 2016 3:00 AM

TEST LENGTH = 2.0 HRS
STRT VOLUME = 5665.9 GAL
STRT VOLUME = 5614.8 GAL

LEAK TEST RESULTS
0.20 GAL/HR TEST PASS
LEAK TEST RESULTS
0.20 GAL/HR TEST PASS
Automatic Tank Gauging—Continual Testing

Veeder-Root

8600 Series and 8601 Series Consoles Monitoring Systems with CSLD

CONTINUOUS IN-TANK LEAK DETECTION METHOD
(Continuous Automatic Tank Gauging)

<table>
<thead>
<tr>
<th>Certification</th>
<th>Leak rate of 0.2 gph with PD = 100% and PFA = 0%.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leak Threshold</td>
<td>Threshold  PD  PFA</td>
</tr>
<tr>
<td>Single Tank Systems</td>
<td>0.15  99%  &lt;0.001%</td>
</tr>
<tr>
<td></td>
<td>0.16  99%  &lt;0.001%</td>
</tr>
</tbody>
</table>

Tank Capacity  Maximum of 43,722 gallons for single tanks and for up to 3 tanks manifolded together. The minimum product level required to conduct a test is 15% full.

Throughput  Monthly maximum of 235,000 gallons.

Waiting Time  Minimum of 3 hours stabilization time is allowed between delivery and data collection.

Test Period  Data collection time ranges from 25 to 28 days.

Temperature  Average for product is determined by a probe which contains 5 thermistors. At least two thermistors must be submerged in product during test.

Water Sensor  Must be used to detect water ingress.

Calibration  Thermistors and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.

Comments  System reports a leak rate and a "pass" or "fail" result.

Evaluated using both single and manifolded tank systems with probes in each tank.

For valid monthly testing, a conclusive test report must be produced for each tank every month.

System warns operator if there are no "passing" tests completed during the month.
CSLD Testing Results on a Manifolded UST System

MAR 11, 2016 11:37 AM
CSLD TEST RESULTS
MAR 11, 2016 11:37 AM

T 1: SUPER UL
PROBE SERIAL NUM 733813

0.2 GAL/HR TEST
PER: MAR 11, 2016 PASS

T 2: REGULAR MAIN STE.
PROBE SERIAL NUM 733811
T 3: REGULAR SLAVE
PROBE SERIAL NUM 733812

0.2 GAL/HR TEST
PER: MAR 11, 2016 INCR

* * * * * END * * * * *
Other Potential Issues

- Increase Warning
  - Siphon check valve in the functional element not working
  - Siphon "O" Ring pinched or bad
  - Siphon tube does not exist
Statistical Inventory Reconciliation

Veeder-Root
(originally listed as Ustman Industries, Inc.)

USTMAN SIR Versions 95.2, 95.2A, 95.2B

STATISTICAL INVENTORY RECONCILIATION TEST METHOD (QUANTITATIVE)

Certification
Leak rate of 0.1 gph with PD > 99.2% and PFA < 0.08% (Version 95.2).
Leak rate of 0.2 gph with PD > 99.9% and PFA < 0.1% (Version 95.2A).
Leak rate of 0.2 gph with PD > 97.2% and PFA < 0.1% (Version 95.2B).

Leak Threshold
0.05 for leak rate of 0.1 gph (Version 95.2).
0.1 for leak rate of 0.2 gph (Version 95.2A).
0.16 for leak rate of 0.2 gph (Version 95.2B).
A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.

Applicability
Gasoline, diesel.

Tank Capacity
Maximum of 60,000 gallons for single tanks.
Maximum of 60,000 gallons cumulative capacity for manifolced tank systems with no more than 4 tanks in system.

Comments
44% of data sets evaluated were from manifolced tank systems.
Of 94 data sets submitted for evaluation, all were analyzed with conclusive results.
Results obtained from combined data for USTMAN Version 94.1 and 95.2.
Data used in the evaluation were obtained from manual tank sticking.
Median monthly throughput of tanks evaluated was 15,483 gallons.
Leak rates of 0.05, 0.1, and 0.2 gph were used in evaluation.
Data sets evaluated were supplied by evaluator.

Evaluator: Ken Wilcox Associates
Tel: (816) 443-2494
Dates of Evaluations: 12/12/95, 07/21/00
Precision Tightness Testing

Estabrook EZY CHEK Systems
(originally listed as Homer EZY CHEK)

EZY 3 Locator Plus

NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD (VACUUM)

Certification
Leak rate of 0.1 gph with PD = 100% and PFA = 1.6%.

A tank system should not be declared tight when the acoustic signal detected is different from the baseline signal before a vacuum is placed on the tank, or when water ingress is detected by the water sensor.

Applicability
Gasoline, diesel, aviation fuel, fuel oil #4, waste oil.

Tank Capacity

Maximum of 30,000 gallons.

Ullage volume must exceed the greater of 1% of tank volume or 50 gallons.

Maximum of 30,000 gallons per tank for manifolder tank systems with microphone, water sensor and pressure monitoring gauges in each tank.

A few minutes to determine background noise and at least 2 minutes to run the test after desired vacuum is reached.

When groundwater level in tank excavation backfill is above bottom of tank or when the groundwater level in the tank excavation backfill has not been determined:

The time it takes for water ingress to increase the water level in the tank to allow the water sensor to detect the "minimum detectable change in water level" (see "Water Sensor" section below).

Test period based on water ingress is dependent on tank size. For example, the test period is 36 minutes for a 10,000 gallon (56' dia x 32' h) tank.

Before starting test, water sensor must be calibrated to "minimum detectable water level" (see "Water Sensor" section below) according to manufacturer's instructions.

There must be no dispensing or delivery during test.

Test Pressure
Pressure differential across tank wall at bottom of tank must be at least 0.5 psig.
Pressure differential across tank wall is equal to the absolute value of vacuum applied to tank, plus pressure of tank excavation backfill on tank, plus groundwater pressure on tank, minus pressure of liquid in tank.

Temperature
Acoustic signal is independent of product temperature.

Water Sensor
Conductivity water sensor must be used to detect water ingress and must be calibrated for every test when groundwater level in tank excavation backfill is above bottom of tank or when the groundwater level in the tank excavation backfill has not been determined.

Minimum detectable water level is 0.014 inch.
Minimum detectable change in water level is 0.0015 inch.
Minimum water level

Groundwater
Groundwater level in tank shall be at least 0.25 feet above top of tank.

Sensor must be used and test time extended to ensure water ingress detection during test.

Comments
Microphone was 25 ft away from leak source during evaluation.
Although not tested on empty tanks, a third party acoustics specialist has certified the device is equally effective when tanks are empty as when tanks contain product.
Test may be inconclusive if there is high background noise.
Vacuum test method may be ineffective in some tank excavation backfill (such as clay) because it may plug holes in tank.
If free product is present in tank excavation backfill, a leak in the free product zone may not be detected by a vacuum test method.
An observation well or soil probe in tank excavation backfill may help determine backfill material, water level in tank excavation backfill, and free product. Manufacturer must certify operator at least every 2 years.

More than 4 psi pressure differential across the tank wall at any location in the tank could damage tank.

Make sure the manifold is included in the test!!!!
Overfill Protection and Manifold UST Systems

- High Level Alarms
- Drop Tubes with Flapper Valves
- Ball Floats
Overfill Alarms
Overfill Flapper Valves
Overfill Ball Floats
Corrosion Protection

• All metallic components associated with a siphon manifold are required to be protected from corrosion.
Example Facility

All tanks are:
- 4,000 gallons
- STI-P3 Single-Walled Tanks
- Included in an Impressed Current system.

FRP Manifold
Copper Piping
T-13 Remote Fill

Fence

T-1
Riser
Riser

T-2
Riser
Riser

T-13
Manifold
Direct Fill

Common Vent

Riser

Riser

Riser
Always Uncover

Before uncovering

After uncovering

FRP Pipe
Always be on your Toes and Keep your head on a Swivel!

Great Article!
Marcel Moreau
L.U.S.T.Line Bulletin 76
December 2014