Maryland
Department of
the Environment

UST Manifolds- Siphon Systems

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Oil Control Program

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410-537-3487


A manifolded 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

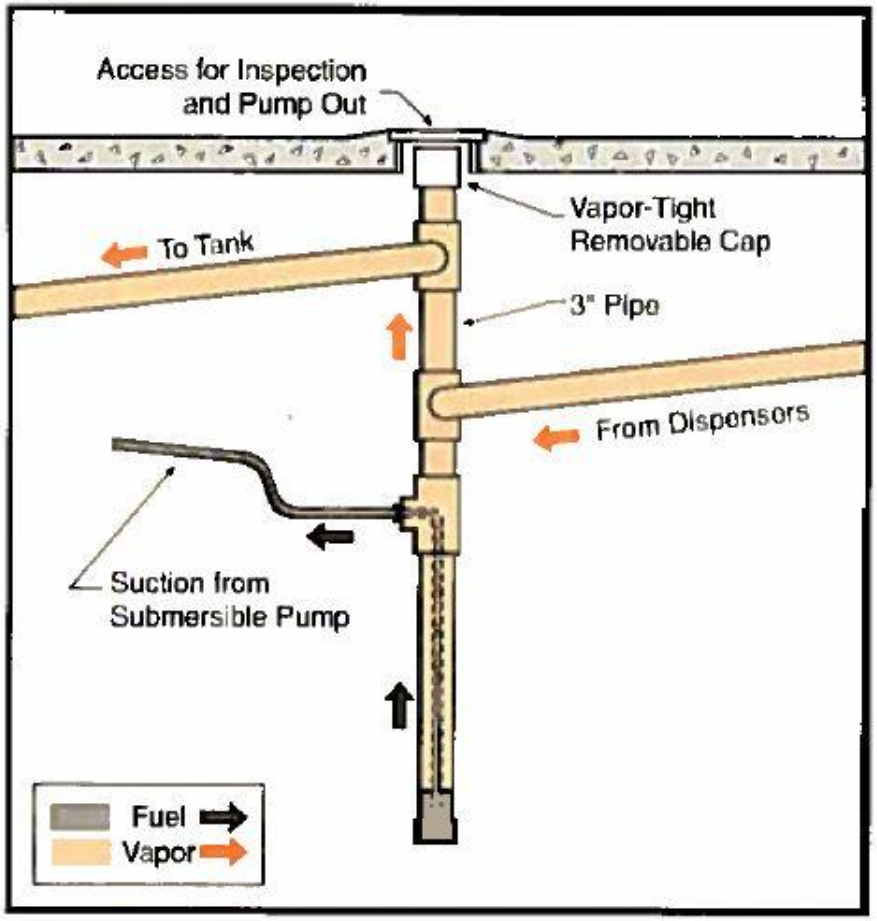


FIGURE 5-5. *A liquid-collection point must be installed in the vapor return piping when there is not enough difference in elevation between the dispenser(s) and the tank field to provide uniform slope of the vapor piping. Liquid collects in the bottom of the liquid-collection point where it will not 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.*

PEI/RP 300-04, Section 5.14, Figure 5.5, pg 17

Thing of the past…

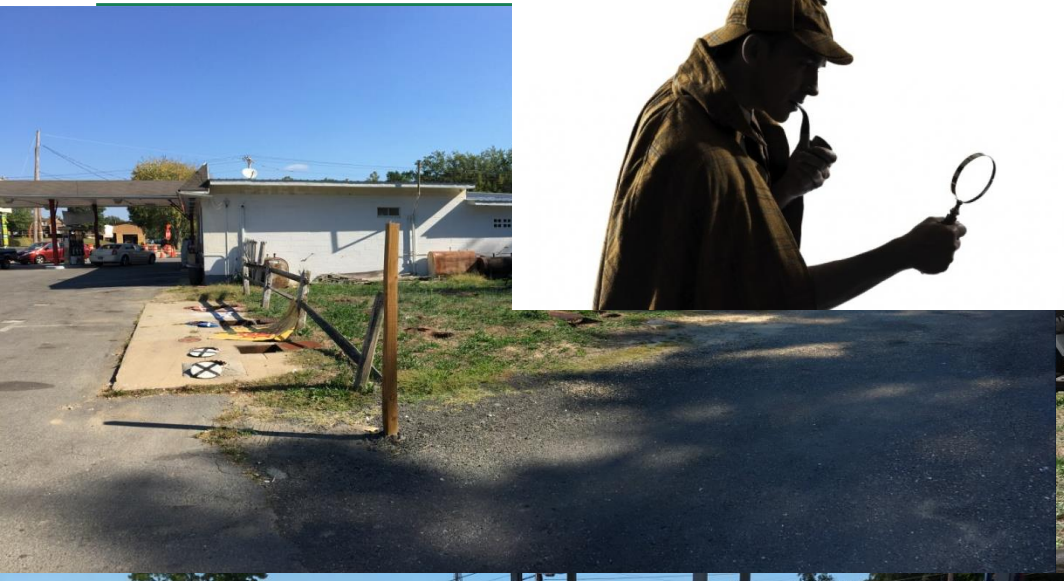
- Newer systems are not typically installed with manifolds.
- Newer systems are now required to be double-walled.
- Less piping=
  - Less chance of a leak
  - Less chance of complications to obtain passing release detection results.

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?

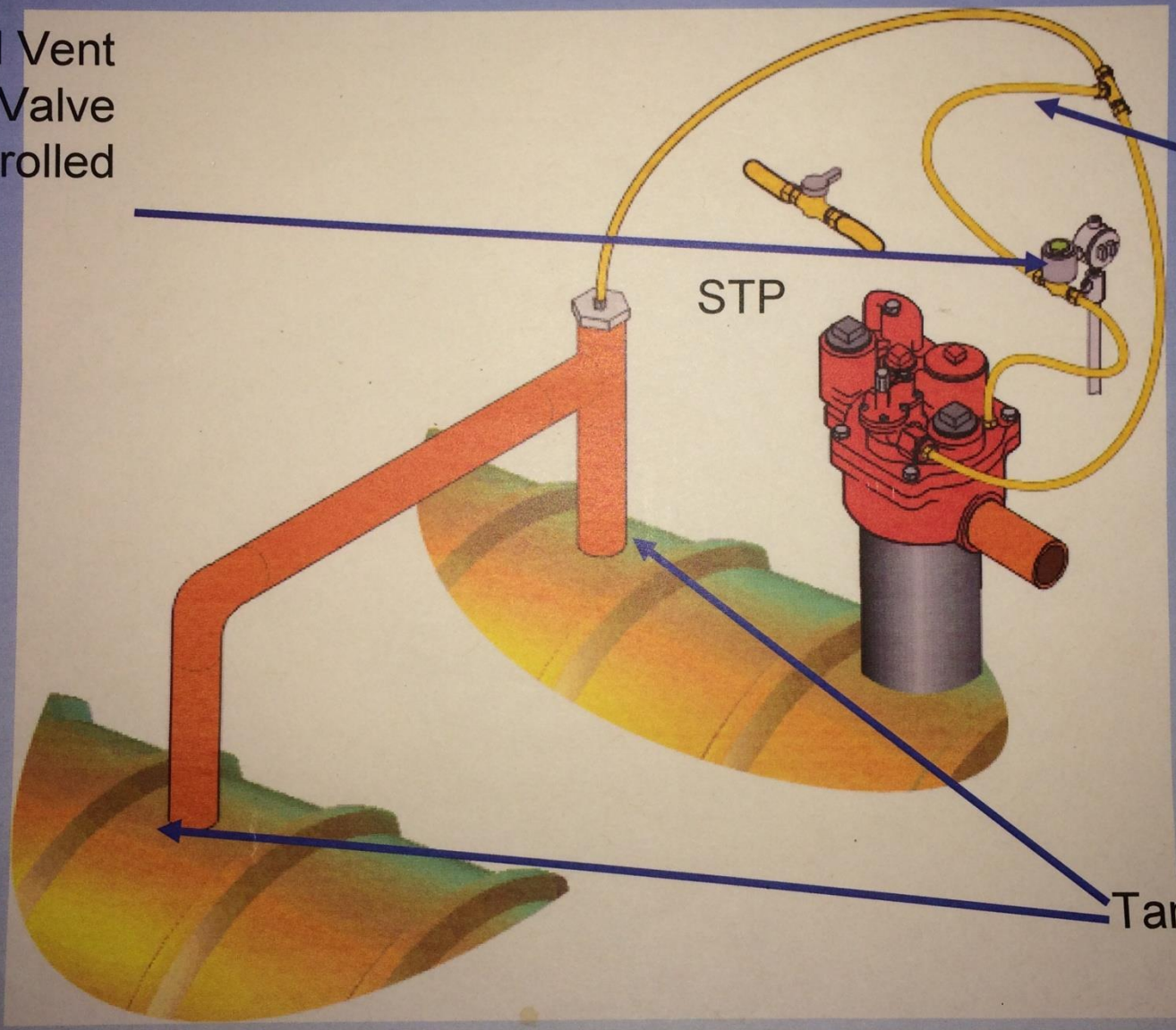
Gas Stations… eh, no big deal.



Bulk Oil Facilities… a little more challenging.

Truck Stops… Help Me!!!

Siphon Break – Vent Valve



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.**

National Work Group on Leak Detection Evaluations- www.nwglde.org

Siphon Manifold AND the Functional Element

Automatic Tank Gauging- Static

Issue Date: August 23, 1999
Revision Date: July 23, 2015

Veeder-Root

TLS-300, 350, 350R, 350Plus, 8600 Series (Consoles TLS-450 and TLS-450PLUS), TLS2, Red Jacket ProMax and ProPlus (Models 8463, 8473, 8493 Magnetostrictive Probes)

AUTOMATIC TANK GAUGING METHOD

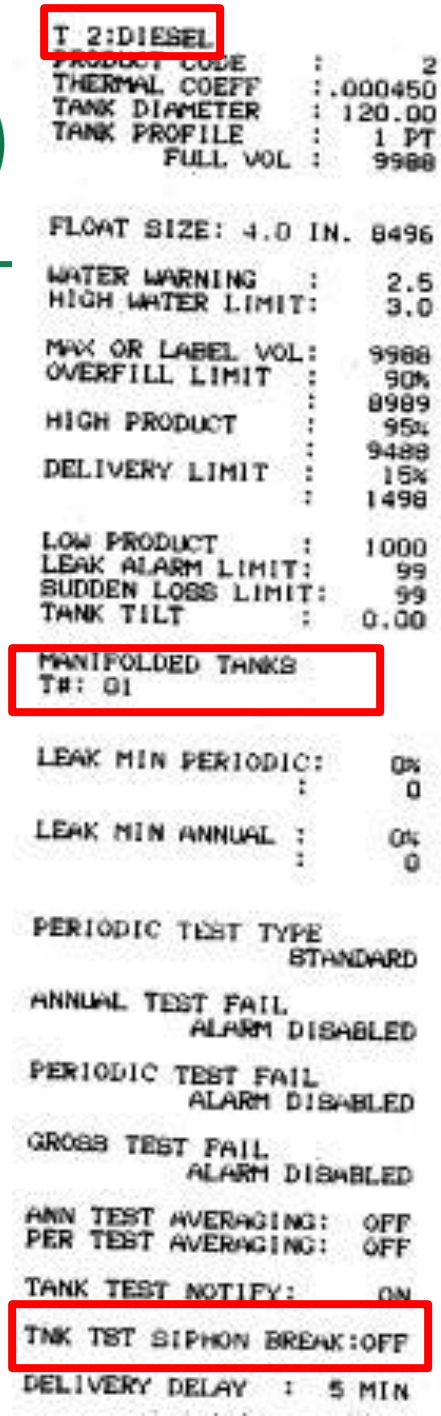
Certification	Leak rate of 0.2 gph with PD = 99.5% and PFA = 1.6% for 2 hour test. Leak rate of 0.1 gph with PD = 96.0% and PFA = 3.4% for 5 hour test. Leak rate of 0.1 gph with PD = 96.2% and PFA = 2.2% for 4 hour test. Leak rate of 0.1 gph with PD = 96.4% and PFA = 1.5% for 3 hour test. Leak rate of 0.1 gph with PD = 97.3% and PFA = 2.3% 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 95% full may be tested. Minimum product level required is based on tank diameter as follows: 48" dia/min 18"; 64" dia/min 21"; 72" dia/min 24"; 96" dia/min 30"; 126" dia/min 39"; 132" dia/min 39". 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 10 hours between delivery and testing for 3 hour test and leak rate of 0.1 gph. Minimum of 11 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 8493 probe. Minimum detectable water level in the tank is 0.75 inch for model 8473 probe.

Siphon Must be Broken During Testing!

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.

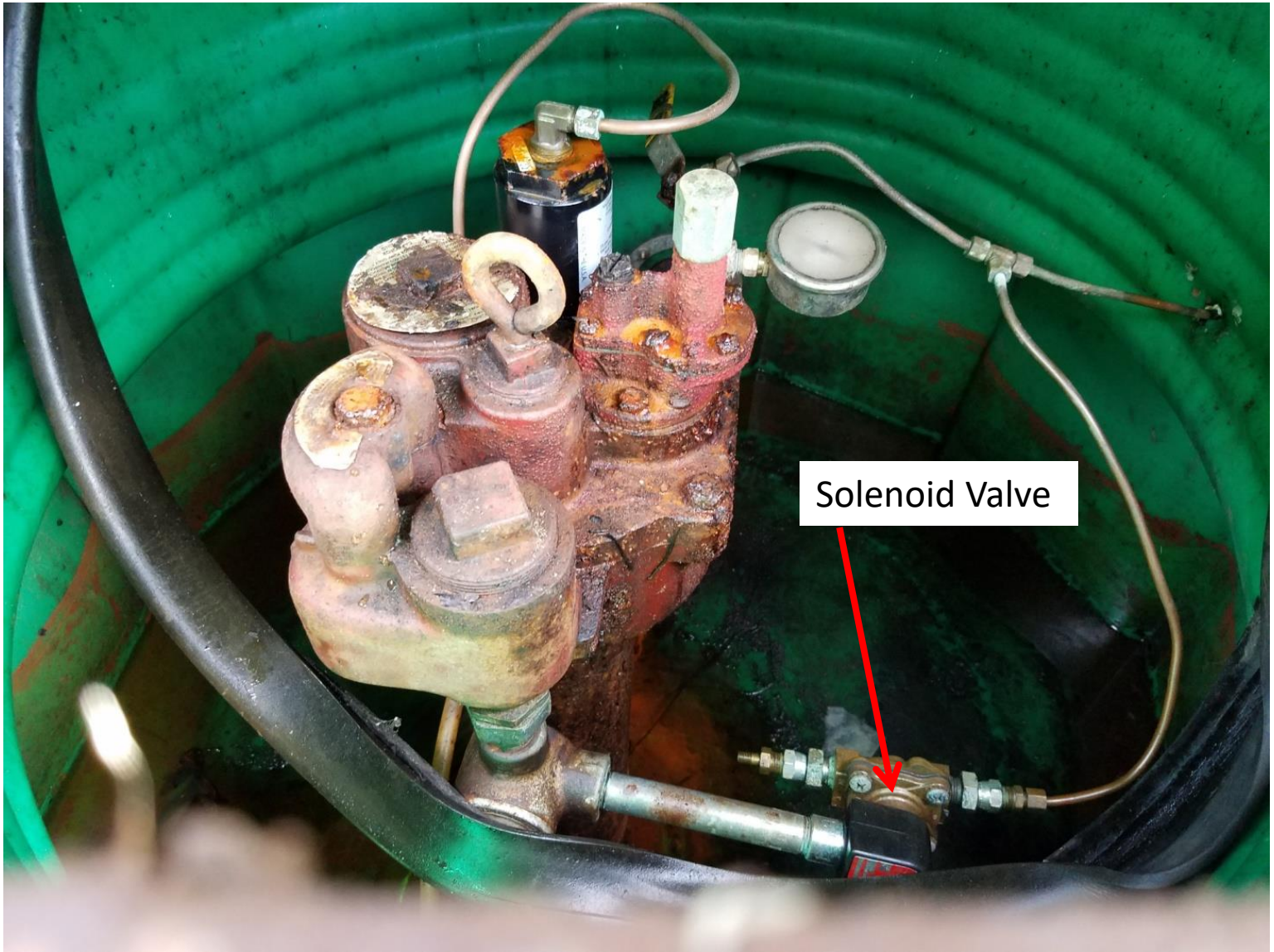
Static Testing Without Siphon Break



```
T 2:DIESEL
PRODUCT CODE      :        2
THERMAL COEFF     :  .000450
TANK DIAMETER     :  120.00
TANK PROFILE      :    1 PT
        FULL VOL  :    9988

FLOAT SIZE: 4.0 IN.  8496

WATER WARNING     :     2.5
HIGH WATER LIMIT  :     3.0

MAX OR LABEL VOL  :    9988
OVERFILL LIMIT    :     90%
                  :    8989
HIGH PRODUCT      :     95%
                  :    9488
DELIVERY LIMIT    :     15%
                  :    1498

LOW PRODUCT       :    1000
LEAK ALARM LIMIT  :      99
SUDDEN LOSS LIMIT :      99
TANK TILT         :    0.00

MANIFOLDED TANKS
T#: 01

LEAK MIN PERIODIC :      0%
                  :       0

LEAK MIN ANNUAL   :      0%
                  :       0

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:      ON

TNK TST SIPHON BREAK:OFF

DELIVERY DELAY    :  5 MIN
```

```
SEP 14, 2009 11:46 AM

LEAK TEST REPORT

T 1:DIESEL
PROBE SERIAL NUM 374551

LAST TEST STARTING TIME

SEP 14, 2009 12:00 AM

TEST LENGTH =    9.0 HRS
STRT VOLUME = 1790.0 GAL

MANIFOLDED TEST RESULTS:

MANIFOLDED RATE
 -32.17 GALLONS/HR
MANIFOLDED TANKS:
 #:1,2


0.20 GAL/HR FLAGS:
LOW LEVEL TEST ERROR
```

Mechanical Siphon Break



Static Testing With Siphon Break

2013 ATG Printout

T 2:REGULAR UNLEADED 2

LAST GROSS TEST PASSED:
AUG 13, 2013 3:00 AM
STARTING VOLUME= 1241
PERCENT VOLUME = 10.3
TEST TYPE = STANDARD

LAST ANNUAL TEST PASSED:

NO TEST PASSED

FULLEST 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

FULLEST 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

T 1:REGULAR UNLEADED 1

LAST GROSS TEST PASSED:
AUG 13, 2013 3:00 AM
STARTING VOLUME= 1467
PERCENT VOLUME = 9.7
TEST TYPE = STANDARD

LAST ANNUAL TEST PASSED:

NO TEST PASSED

FULLEST ANNUAL TEST PASS

NO TEST PASSED

LAST PERIODIC TEST PASS:
JUL 23, 2013 3:00 AM
TEST LENGTH 2 HOURS
STARTING VOLUME= 4733
PERCENT VOLUME = 31.2
TEST TYPE = STANDARD

FULLEST 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

2016 ATG Printout

AUG 23, 2016 5:00 AM

LEAK TEST REPORT

T 1:REGULAR UNLEADED 1
PROBE SERIAL NUM 566498

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

TEST LENGTH = 2.0 HRS
STRT VOLUME = 5965.9 GAL

LEAK TEST RESULTS
0.20 GAL/HR TEST PASS

AUG 23, 2016 5:00 AM

LEAK TEST REPORT

T 2:REGULAR UNLEADED 2
PROBE SERIAL NUM 375168

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

TEST LENGTH = 2.0 HRS
STRT VOLUME = 5614.8 GAL

LEAK TEST RESULTS
0.20 GAL/HR TEST PASS

Automatic Tank Gauging- Continual Testing

Issue Date: February 13, 2015
Revision Date: December 8, 2016

Veeder-Root

8600 Series and 8601 Series Consoles Monitoring Systems with CSLD

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

Certification Leak rate of 0.2 gph with PD = 100% and PFA = 0%.

Leak Threshold

	Threshold	PD	PFA
Single Tank Systems:	0.15	99%	<0.001%
	0.16	96%	<0.001%

Tank Capacity Maximum of 43,722 gallons for single tanks and for up to 3 tanks manifolded together. The minmum 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.
Data sampling frequency is once per minute.
System collects data at naturally occurring product levels without interfering with normal tank operation, and discards data from unstable periods when system performs test.

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.
Minimum detectable water level in the tank is 0.75 inch.
Minimum detectable change in water level is 0.08 inch.

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

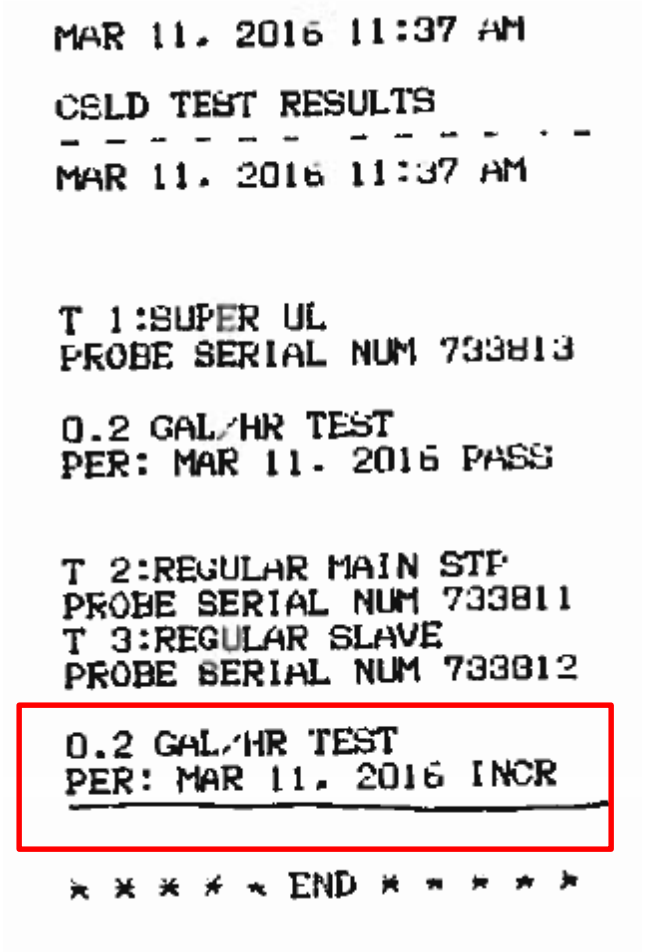
Comments

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.

125 Powder Forest Dr.
Simsbury, CT 06070-2003
Tel: (860) 651-2700
E-mail: info@veeder.com
URL: www.veeder.com

Tel: (816) 443-2494
Dates of Evaluation: 06/29/98 (Rev. 4/17/02) 10/26/07, 02/29/08(water sensor), 10/03/14

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

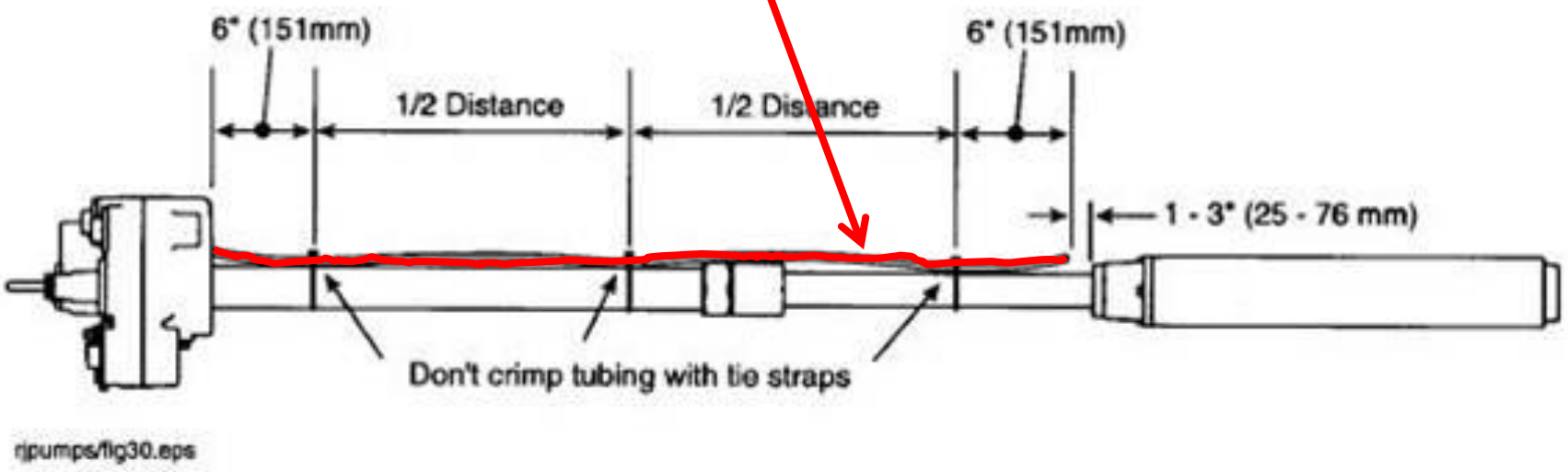
T 2:REGULAR MAIN STP
PROBE SERIAL NUM 733811
T 3:REGULAR SLAVE
PROBE SERIAL NUM 733812

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

Issue Date: November 22, 1995
Revision Date: April 5, 2002

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 manifolded tank systems with no more than 4 tanks in system.

Comments
44% of data sets evaluated were from manifolded 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.

Gilbarco/Veeder Root
Attn: CMS Mailstop F-76
7300 West Friendly Ave.
P.O. Box 22087
Greensboro, NC 27420-2087
Tel: (800) 253-8054

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

Precision Tightness Testing

Issue Date: January 11, 2001
Revision Date: December 31, 2009

Estabrook EZY CHEK Systems
(originally listed as Horner 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%.
Leak Threshold	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 manifolded 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 (96" dia x324" lg) 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 0.0095 inch. Minimum water level
Groundwater	Groundwater level in If groundwater level 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 not be effective 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.

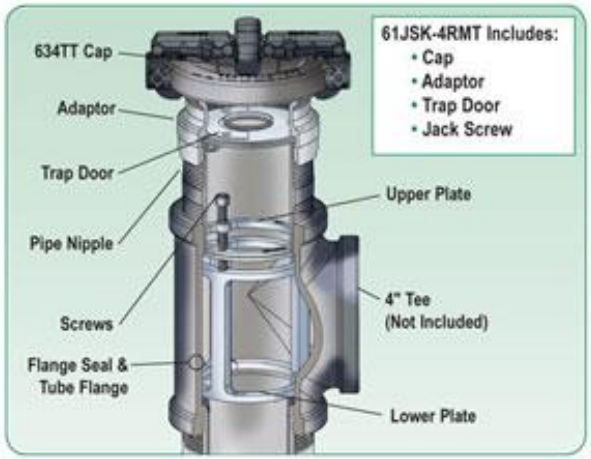
Make sure the manifold is included in the test!!!!

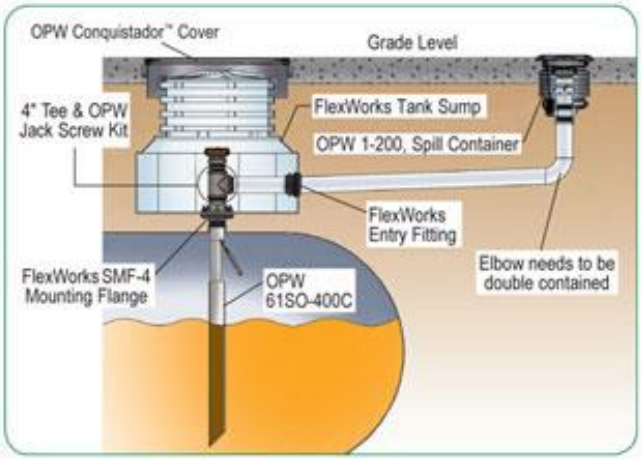
Overfill Protection and Manifold UST Systems

- High Level Alarms
- Drop Tubes with Flapper Valves
- Ball Floats

Overfill Alarms

Overfill Flapper Valves



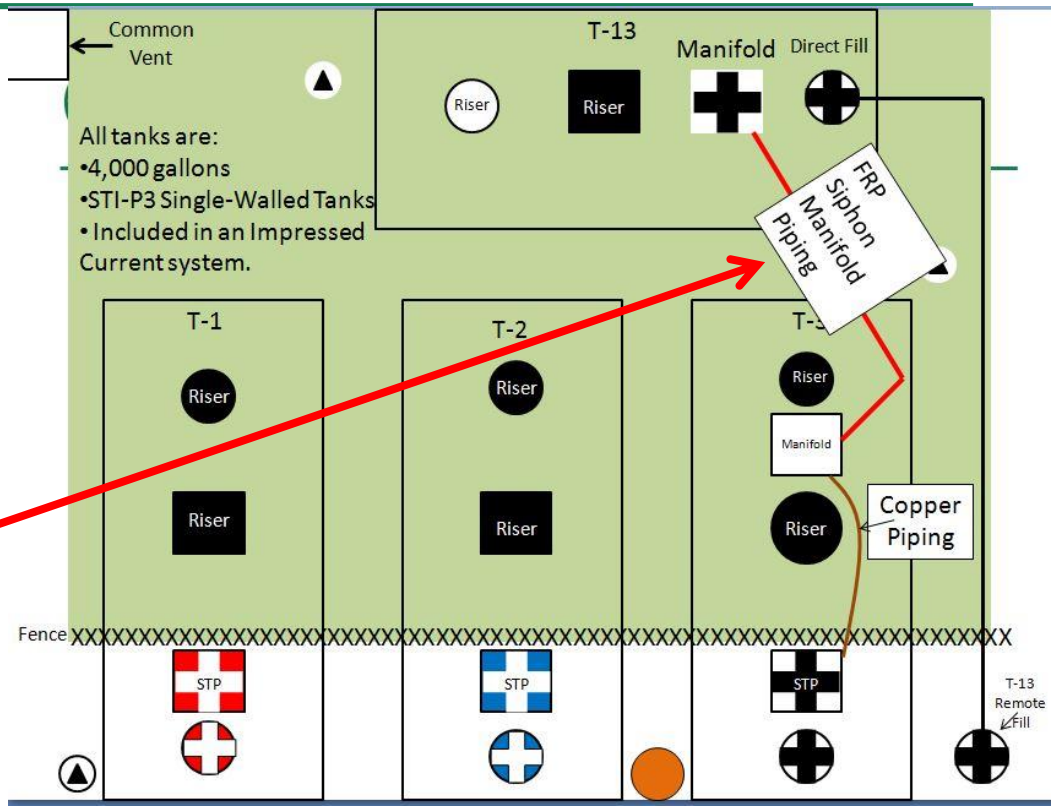


Overfill Ball Floats

Corrosion Protection

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

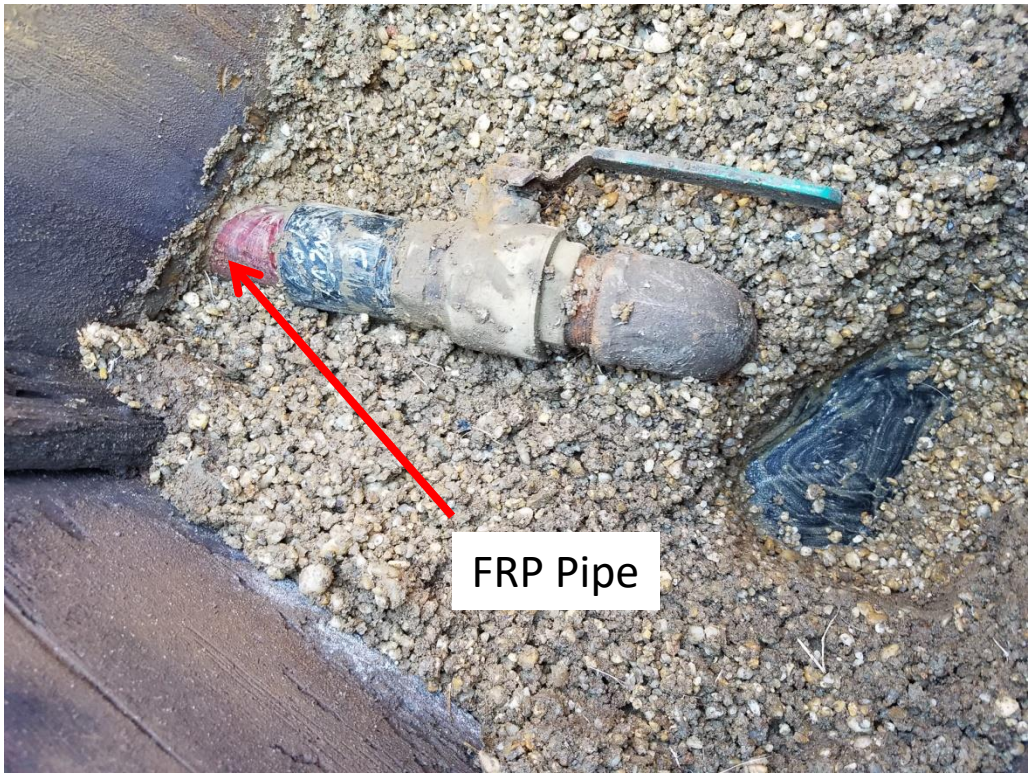
Example Facility



Always Uncover

Before uncovering

After uncovering



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

Tank-nically Speaking
by Marcel Moreau

Marcel Moreau is a nationally recognized petroleum storage specialist whose column, Tank-nically Speaking, is a regular feature of LUSTLine. *As always, we welcome your comments and questions. If there are technical issues that you would like to have Marcel discuss, let him know at* marcel.moreau@juno.com.

Can ATGs Find Leaks in Manifolded Tanks?

I recently received an e-mail from a perplexed regulator who was trying to determine which automatic tank gauges (ATGs) could be used for in-tank leak detection on manifolded tank systems. There has also been a trend lately for petroleum marketers to install blending dispensers to produce the mid-grade product. In some parts of the country, installers are converting three tank/three product storage systems to three tank/two product systems by installing a tank manifold rather than a piping manifold. So this seems like a good time to address the issues surrounding the use of ATGs for leak detection on manifolded tank systems.

Note that newly installed UST systems must use secondary containment and interstitial monitoring for leak detection. This discussion only applies to single-wall UST systems installed before the implementation of the secondary containment requirement.

What Exactly Is a Manifold?

In the UST world, the term "manifold" can be applied to several different aspects of UST systems. Three that come readily to mind are:

- **Tank manifold** – A piping connection between two tanks that allows fuel to freely flow from one tank to another. A tank manifold allows one submersible pump to draw product from two or more tanks, thus increasing the storage capacity for that product (see Figure 1).
- **Piping manifold** – Two submersible pumps provide fuel to a single piping run that supplies fuel to several dispensers. If the two pumps operate together, a piping manifold increases the flow rate through the piping. If the two pumps operate separately, a piping manifold, like a tank manifold, can be used to increase storage capacity.
- **Pump manifold** – A term used to describe the part of the submersible pump located above the top of the tank.

Each of these types of "manifold" brings leak detection issues to mind, but in this article I'd like to focus on tank manifolds and how they affect the ability of ATGs to detect leaks when the ATG is conducting in-tank testing. During an in-tank test, the ATG is monitoring the liquid level in the tank during quiet periods to determine whether a leak is present. This discussion does not apply if the tanks involved are double-walled and the ATG is monitoring interstitial sensors.

How a Tank Manifold Is Set Up

In a typical tank manifold, there are two tanks installed next to one another. Each tank is equipped with its own fill pipe and vent pipe. Ideally, each tank also has the same diameter and the two tanks are installed at exactly the same level in the ground. If an ATG is to conduct testing, each tank will also have a probe to measure the liquid level.

The two tanks are connected together by a piping run that begins near the bottom of one tank, runs out the top of the tank, horizontally over to the adjacent tank and then vertically down to near the bottom of the adjacent tank. This piping run contains no pump mechanism and usually contains no valves. It is often referred to as a "siphon bar." When both tanks have fuel in them and the siphon bar is also full of fuel, the surface level of the fuel in the two tanks will always be exactly equal. If the tank bottoms are at slightly different elevations, the depth of fuel in each of the tanks will be different, but the surface elevation of the fuel will always be exactly the same. Now, if a delivery has just occurred and different volumes of fuel have been delivered into each tank, it may take a while for

■ continued on page 22

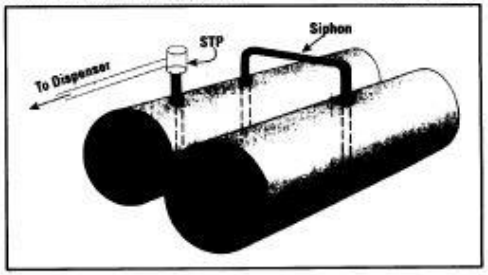


Figure 1. Tank manifold. *A tank manifold connects two tanks so that product can flow freely from one tank to the other. A tank manifold allows one submersible pump to draw product from two tanks, thus increasing the storage capacity for that product.*

Great Article!

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