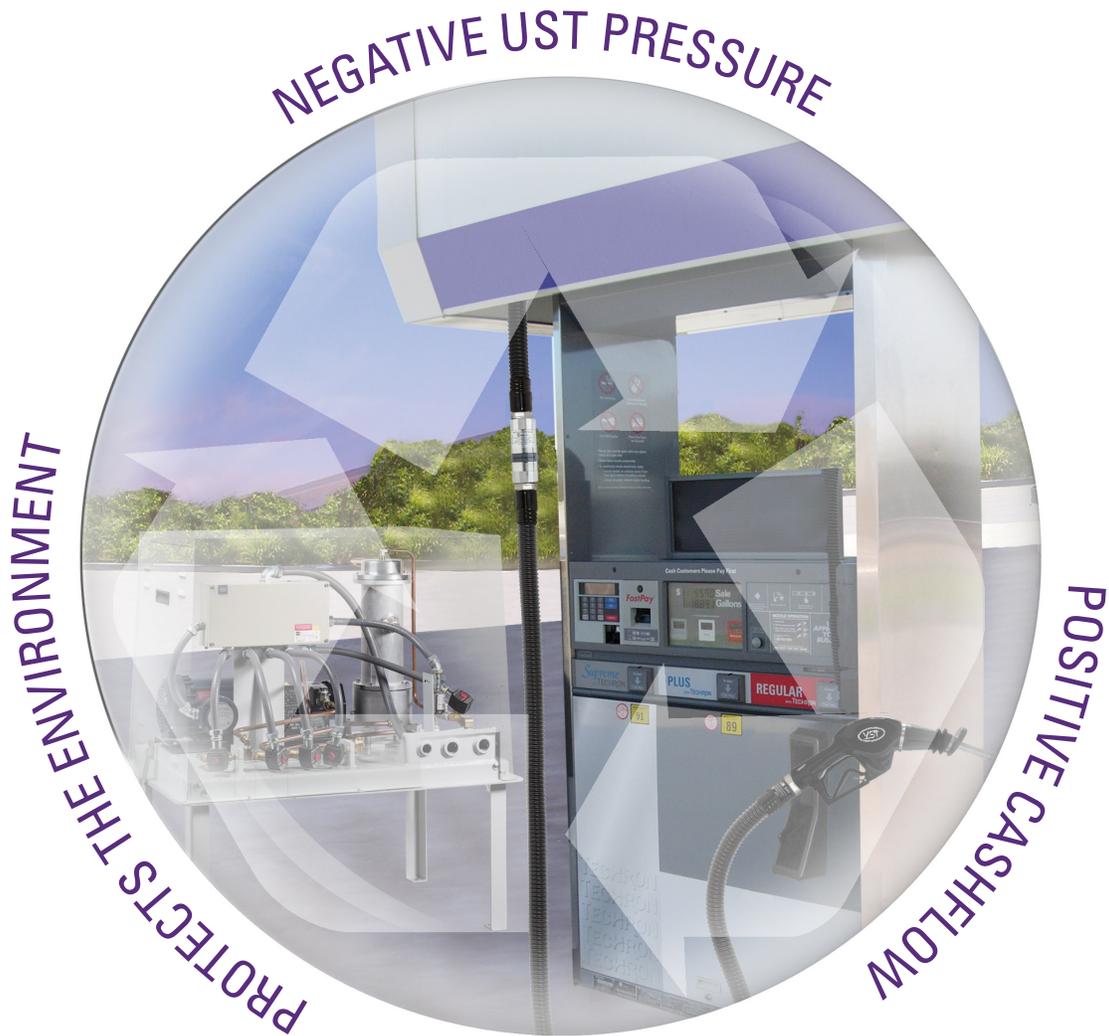


Vapor Systems Technologies, Inc.

ENVIRO-LOC™

Total System Solution



Vapor Systems Technologies, Inc.
One Company – Integrated Solutions
www.vsthose.com

Vapor Systems Technologies, Inc.



VST began in 1989 with the vision of **One Company – Integrated Solutions**.

Today, that philosophy is still in place and getting stronger. Recognizing that a healthier environment is a need and not an option, VST has dedicated its undivided attention to the ever changing, stringent regulations that govern fugitive vapors at gasoline dispensing facilities (GDF). To this challenge, VST is committed to a continual R&D campaign of developing the most current, technologically advanced solutions to service not only the United States, but also the world.

VST specializes in the development, engineering, manufacturing and sale of products that are sold into the GDF segment of the petroleum industry. The VST focus provides our customers and users with exceptional products, services, and innovative solutions for improving the fueling station experience as well as the world's air quality.

VST's product offering includes; curb pump and vapor recovery hoses, safety breakaways, nozzles, and underground storage tank pressure management processors. The ENVIRO-LOC™ vapor recovery product offering represents the most innovative concept in the industry for trapping fugitive vapors from the front end (vehicle refueling) to the back end (vent stacks) of a GDF site.



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The VST ENVIRO-LOC™ Total System (A Comprehensive Phase II Solution)

ENVIRO-LOC™ Total System

VST's comprehensive guideline recommendation is the industry's most effective and efficient Phase II solution for managing fugitive vapors and spillage from the front end (vehicle refueling) to the back end (vent stack releases), during normal refuelings at a Gasoline Dispensing Facility (GDF) site. This system recommendation is the result of years of extensive field-testing, certification approvals, and product development derived to exceed the most stringent regulations currently published for Phase II equipment anywhere in the world. The front end hanging hardware performance data includes a 98%-plus collection efficiency of vapors and a 99%-plus efficiency rating for liquid spillage during vehicle refueling. In addition, the VST GREEN MACHINE™ controls Underground Storage Tank (UST) fugitive emissions by managing UST system pressure at or below atmospheric pressure. Fugitive emissions cannot escape a system that is operating in a negative pressure mode.

The VST **ENVIRO-LOC™ Total System** guideline recommendation is applicable to vapor recovery systems installed at a GDF for controlling gasoline vapors emitted during the fueling of storage tanks (Phase I) and the refueling of vehicle fuel tanks (Phase II). Vapor recovery systems are complete systems and shall include all associated dispensers, piping, nozzles, couplers, processing units, underground tanks and any other equipment or components necessary for the control of gasoline vapors during Phase I or Phase II refueling operations. The **ENVIRO-LOC™ Total System** recommendation includes: equipment specifications and performance criteria, vapor-piping specifications for any Stage II dispenser and UST and system test procedures.

The combination of VST's ENVIRO-LOC™ hanging hardware and GREEN MACHINE™ processor equals the **ENVIRO-LOC™ Total System**.

ENVIRO-LOC™ TOTAL SYSTEM SOLUTION

- Exceeds CARB EVR requirements
- Phase I and Phase II Compatible
- GREEN MACHINE™ & Hanging Hardware
- Dripless/Spitless Stage II Nozzles
- Customer Friendly



**The VST ENVIRO-LOC™ Total System
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VST Required System Specifications

Hanging Hardware

The VST recommended Phase II hanging hardware set (whip hose, safety breakaway, primary fueling hose, and nozzle) consist of products that have been field tested as a system over a six-year time period at 3,000 stations and 30,000 fueling positions. The targeted performance standards are based on the most stringent Phase II requirements established by the California Air Resource Board (CARB) under the Enhanced Vapor Recovery protocol. Effective and efficient vapor collection as well as dramatically reduced liquid spillage during vehicle refueling has been achieved.

- **Vapor Collection & Control of Transfer Emissions**

Transfer emissions or efficiency of the vapor recovery system is the sum of all vapor losses accumulated during vehicle refueling, added to the fugitive emissions associated with UST over pressurization. The most stringent test parameters do not allow for more than 0.38 pounds loss per 1000 gallons dispensed or 95% system efficiency. VST testing demonstrated 99%-plus vapor collection efficiency at the nozzle via multiple, monitored 200-car tests. Total system efficiency, including fugitive emissions associated with UST over pressurization and the use of the VST *GREEN MACHINE™*, exceeded 98%.

- **Control of Liquid Losses Accumulated during Vehicle Refueling**

The industry's most comprehensive standards for controlling liquid losses during vehicle refueling have been established in CARB's EVR requirements – reference CARB test procedures TP-201.2C, D, and E. VST has designed our **ENVIRO-LOC™** nozzle to exceed these EVR standards by more than 90%. Field test performance results indicated below:

Nozzle Category	CARB EVR Requirement	VST Test Results
A. Liquid Retention	≤ 100 ml. per 1,000 gal. dispensed	Zero
B. Spillage	≤ 0.24 lbs. per 1,000 gal. dispensed	≤ 0.003 lbs. per 1,000 gal. dispensed
C. Spitting	≤ 1.0 ml. per refueling	Zero
D. Drops/refueling	** ≤ 3 drops per refueling ** (included in spillage totals)	** ≤ 0.375 drops per refueling ** (included in spillage totals)
Total Liquid Losses	Approx: 0.60 lbs per 1,000 gal.	Approx: 0.003 lbs. per 1,000 gal.



**The VST ENVIRO-LOC™ Total System
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Dispenser Vapor Piping

The vapor piping inside a dispenser, regardless of manufacturer or model number, must be 1" OD. Dispenser/piping connections are not mandated except the 1-7/8-18 UN threads in the dispenser outlet casting used for the hose attachment. The 1" dispenser vapor piping will insure the dispenser will meet the maximum VST Dynamic Back Pressure requirements of 0.35 inches H₂O as specified by CARB in TP-201.4 and the maximum Pressure Drop requirement of 0.08 inches H₂O as specified by CARB in TP-201.2J procedures.

- **Dynamic Back Pressure**

The Dynamic Back Pressure for the **ENVIRO-LOC™ Total System** is to be established in accordance with CARB Test Standard TP-201.4.

System test:

- A. Should not exceed 0.35 inches H₂O at a flowrate of 60 CFH of Nitrogen from the tip of the nozzle spout to the underground storage tank, with the Phase I vapor poppet open.
- B. Should not to exceed 0.05 inches H₂O at a flowrate of 60 CFH of Nitrogen From the Phase II Riser to UST for the system vapor return line, including the impact valve.

- **Pressure Drop Bench Test Criteria**

VST requires a Pressure Drop Bench Test to be established in accordance with CARB test procedure TP-201.2J. VST has set the following pressure drop criteria for the **ENVIRO-LOC™ Total System** components as:

Back Pressure List	VST Back Pressure Test Results	VST Specifications
Nozzle	< 0.07	< 0.08
Hose (Inc: whip hose & swivel)	< 0.06	< 0.07
Breakaway	< 0.02	< 0.03
Dispenser	< 0.08	< 0.08

Underground Vapor Piping

- A. **Dispenser to UST**

1. Minimum of 2" ID is acceptable unless dispenser vapor lines are manifolded together.
2. Manifolded dispenser vapor lines require 3" ID minimum piping, including the float vent valve if applicable.

- B. **UST to Vent Risers**

1. Stations utilizing only one vent riser require a minimum of 3" ID vapor piping.
2. Stations utilizing multiple vent risers, require a minimum of 2" ID vapor piping.



The VST ENVIRO-LOC™ Total System (A Comprehensive Phase II Solution)

Underground Vapor Piping - continued

C. Slope

VST recommends a minimum slope of the vapor return piping from the dispensers to the UST's and from the vent risers to the UST's to be at least one-fourth (1/4) inch per foot of run. The minimum slope (all other piping), in all cases, shall be at least one-eighth (1/8) inch per foot of run.

D. Material

The vapor return piping shall be constructed of rigid piping, or shall be contained within rigid piping, or shall have an equivalent method to ensure that proper slope is achieved and maintained per local requirements as established by local regulators. Rigidity shall be determined in accordance with CARB Test Procedure TP-201.2G.

Pressure/Vacuum Vent Valves

GDFs are to install, or that have installed pressure/vacuum (P/V) valve(s) on the underground storage tank vent pipe(s), are to comply with the VST ENVIRO-LOC P/V valve requirements set forth below. The CARB test procedure TP-201.1E is to be used to determine these values.

The pressure settings for P/V valves shall be:

- Positive pressure setting of 3.0 ± 0.5 inches H₂O.
- Negative pressure setting of 8.0 ± 2.0 inches H₂O.

The leak rates for P/V valves, including connections, shall be less than or equal to:

- 0.17 CFH at +2.0 inches H₂O.
- 0.21 CFH at -4.0 inches H₂O.

The total additive leak rate valves installed on any vapor recovery system, including connections, should not exceed 0.17 CFH at 2.0 inches H₂O. This may be accomplished by manifolding the tank vent pipes into a single P/V valve or, alternatively, by choosing P/V valves certified to a more restrictive performance specification. VST recommends using the CARB EVR Certified Husky 5885 Pressure Vacuum Vent or the Franklin Fueling Systems PV Zero for the P/V valve.

Vapor Connections and Fittings

All vapor connections and fittings not specifically certified with an allowable leak rate shall not leak. The absence of vapor leaks may be verified by the use of commercial liquid leak detection solution, or by bagging individual component when the vapor containment space of the underground storage tank is subjected to a non-zero gauge pressure. (Note: leak detection solution will detect leaks only when positive gauge pressure exists.) The absence of liquid leaks may be verified by visual inspection for seepage or drips.



The VST ENVIRO-LOC™ Total System (A Comprehensive Phase II Solution)

Static Pressure Performance

The static pressure performance of VST ENVIRO-LOC Total Solution system, including the associated Phase I system, has been determined in accordance with CARB Test Procedure TP-201.3.

All Phase II vapor recovery systems are to be capable of meeting the performance standard in accordance with Equation 4-1 or 4-2.

For the Phase II VST ENVIRO-LOC Systems, the minimum allowable five-minute final pressure, with an initial pressure of two (2.0) inches H₂O, shall be calculated as follows:

[Equation 4-1]

$$P_f = 2e^{\frac{-760.490}{V}} \quad \text{if } N = 1-6$$

$$P_f = 2e^{\frac{-792.196}{V}} \quad \text{if } N = 7-12$$

$$P_f = 2e^{\frac{-824.023}{V}} \quad \text{if } N = 13-18$$

$$P_f = 2e^{\frac{-855.974}{V}} \quad \text{if } N = 19-24$$

$$P_f = 2e^{\frac{-888.047}{V}} \quad \text{if } N > 24$$

Where:

- N = The number of affected nozzles. For manifolded systems, N equals the total number of nozzles. For dedicated plumbing configurations, N equals the number of nozzles serviced by the tank being tested.
- P_f = The minimum allowable five-minute final pressure, inches H₂O
- V = The total ullage affected by the test, gallons
- e = A dimensionless constant approximately equal to 2.718
- 2 = The initial starting pressure, inches H₂O



The VST ENVIRO-LOC™ Total System (A Comprehensive Phase II Solution)

VST GREEN MACHINE™ Performance Standards

The *GREEN MACHINE™* operates based on UST system pressure. The UST system pressure could fluctuate due to a large number of parameters including: leaks in the underground piping, fuel throughput, fuel vapor growth based on Reid Vapor Pressure, temperature of the fuel during a drop, nozzle seal to gas tank fill pipe, nozzles leaking vapor, outside humidity and temperature, and how efficient the P/V valve is working, etc.

Typically, the VST *GREEN MACHINE™* run time is less than 10% to 20% of the duty cycle. This is the time required to reduce the pressure in the UST to a negative pressure. The “ON” and “OFF” duty cycle is based on how “tight” the station is, and the values of the parameters that are listed above. VST recommends the UST’s system pressure to be set between +0.1” WC to -0.5” WC, but can be adjusted to meet the customer’s requirements.

Summary

The VST **ENVIRO-LOC™ Total System** guideline offers any GDF owner around the world a comprehensive recommendation for the industry’s most effective, environmentally friendly, and cost efficient Phase II solution. The system simultaneously offers:

- Vapor collection during vehicle refueling
- Reduced liquid losses from the nozzle during vehicle refueling
- UST system pressure management – maintained below atmospheric pressure
- No dispenser vapor pumps required.

Benefits

- Reduced fuel odor during refueling
- Reduced fuel drips on hands, shoes, clothing, vehicle and ground
- Managed fugitive vapor releases at the vent stacks and/or UST system piping
- Environmental air and water protection from fugitive vapor releases and liquid drips
- Positive cash payback by containing evaporative emissions – vapor losses equal product losses
- Reduced cost for equipment, installation, maintenance, and energy.
- Existing dispensers can be retrofitted to accept VST’s EVR hanging hardware.

VST ENVIRO-LOC™ Total System Products

- VST ENVIRO-LOC™ Phase II Hoses
- VST ENVIRO-LOC™ Phase II Safety Breakaway
- VST ENVIRO-LOC™ Phase II Dripless Nozzle
- VST *GREEN MACHINE™*



The VST ENVIRO-LOC™ Total System (A Comprehensive Phase II Solution)

CARB Test Procedures as referenced in this document:

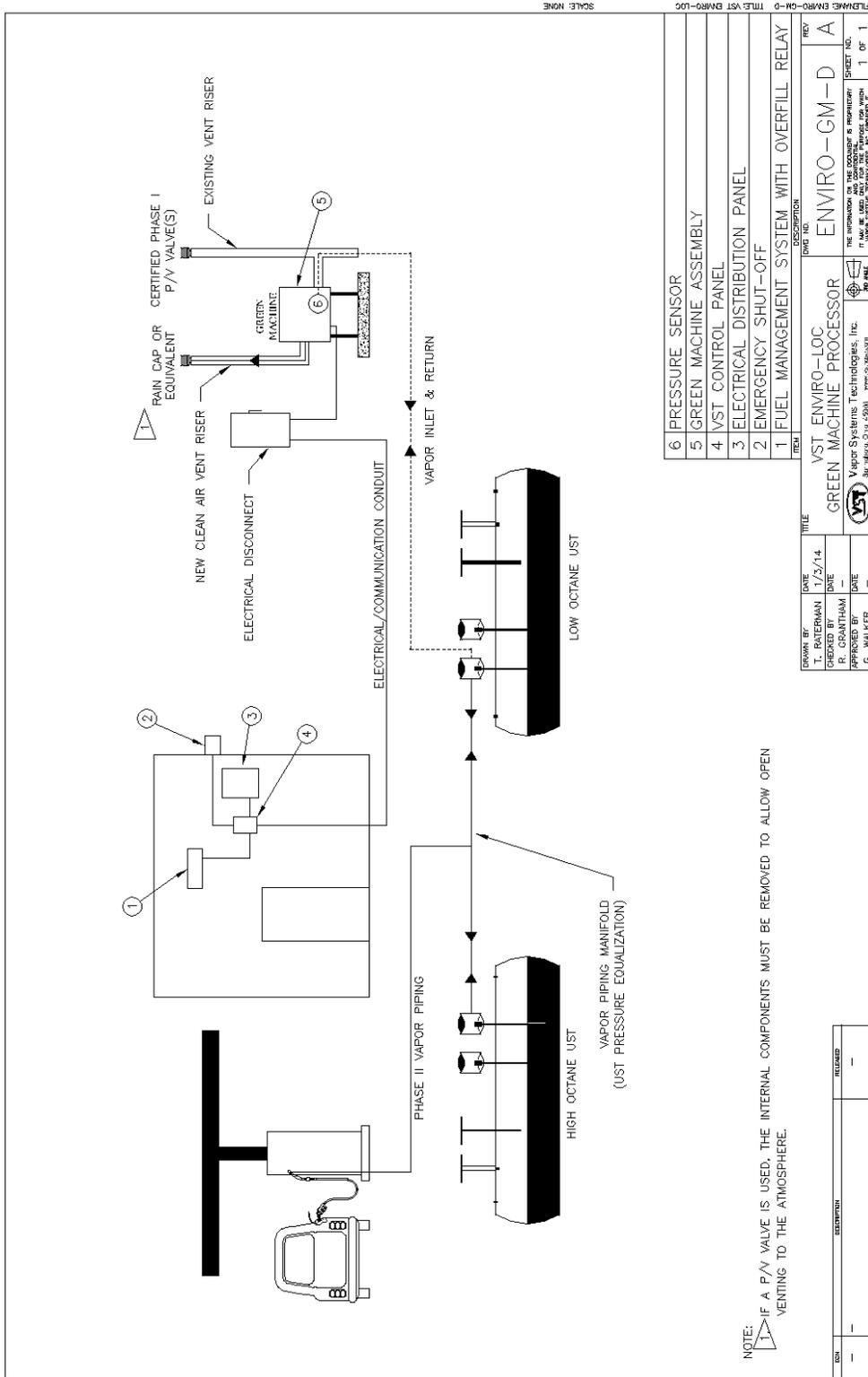
1. CARB Test Procedures TP-201.2C, 2D, 2E
 - a. Spillage from Phase II Systems
 - b. Post-Fueling Drips from Nozzles
 - c. Gasoline Liquid Retention in Nozzles and Hoses
2. CARB Test Procedure TP-201.2J
 - a. Pressure Drop Bench Test
3. CARB Test Procedure TP-201.4
 - a. Dynamic Back Pressure
4. CARB Test Procedure TP-201.2G
 - a. Bend Radius Determination for Underground Storage Tank Vapor Return Piping
5. CARB Test Procedure TP-201.1E
 - a. Leak Rate and Cracking Pressure of Pressure/Vacuum Vent Valves
6. CARB Test Procedure TP-201.3
 - a. Determination of 2 Inch WC Static Pressure Performance of Vapor Recovery Systems of Dispensing Facilities

Drawings

VST <i>GREEN MACHINE</i> ™, Overall Layout	Sheet 1 of 5
VST Dispenser and Front-End Details	Sheet 2 of 5
VST <i>GREEN MACHINE</i> ™ and UST Piping Details	Sheet 3 of 5
VST <i>GREEN MACHINE</i> ™ Process Diagram	Sheet 4 of 5



The VST ENVIRO-LOC™ Total System (A Comprehensive Phase II Solution)



FILENAME: ENVIRO-GM-D TITLE: VST ENVIRO-LOC SCALE: NONE

REV	DESCRIPTION	DATE	BY
6	PRESSURE SENSOR		
5	GREEN MACHINE ASSEMBLY		
4	VST CONTROL PANEL		
3	ELECTRICAL DISTRIBUTION PANEL		
2	EMERGENCY SHUT-OFF		
1	FUEL MANAGEMENT SYSTEM WITH OVERFILL RELAY		

DATE	DATE	DATE	DATE
1/5/14			

DRAWN BY: T. PATERMAN
 CHECKED BY: R. CRANTHAM
 APPROVED BY: G. WALKER

DATE	DATE	DATE	DATE
1/5/14			

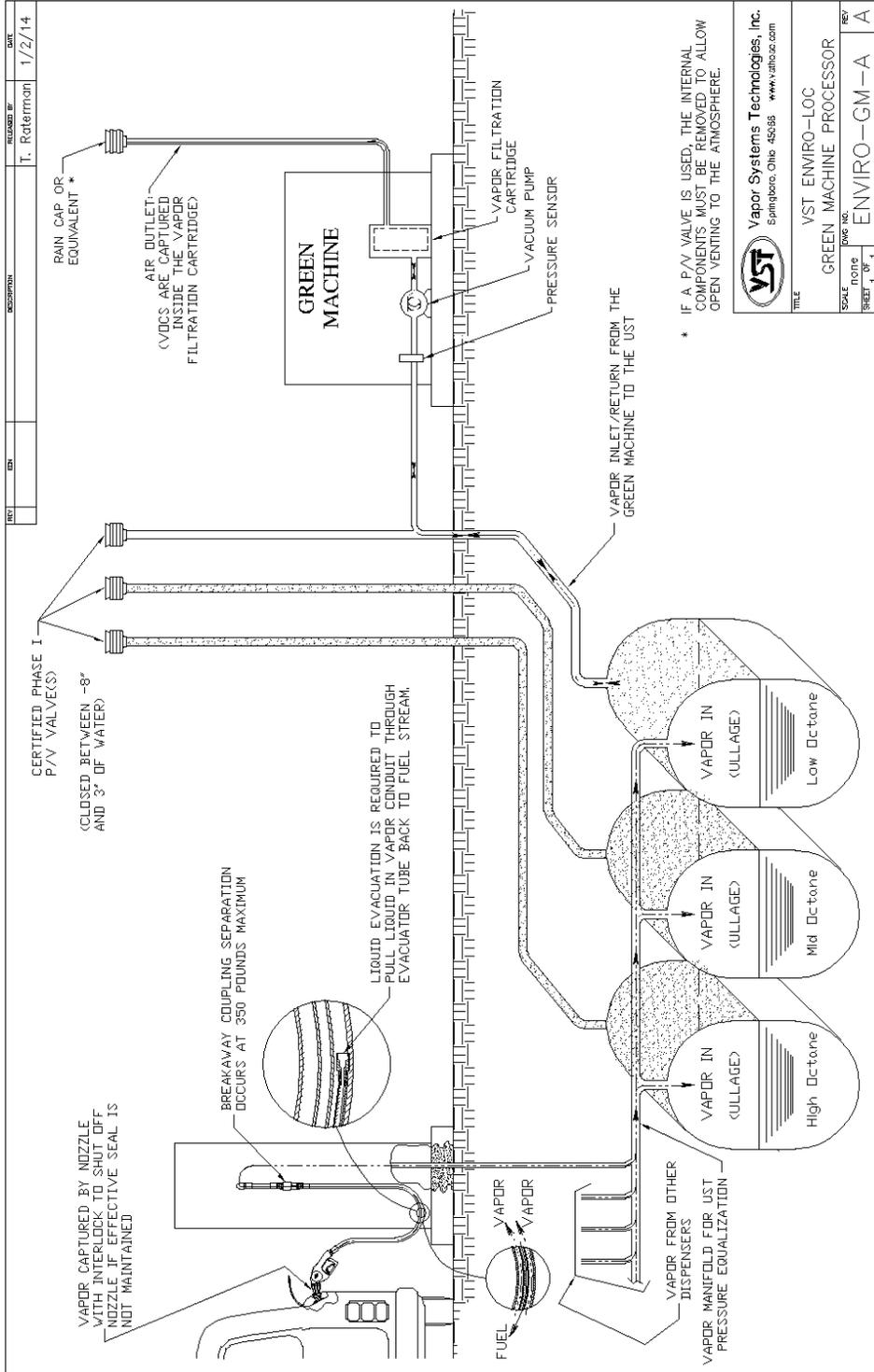
VST ENVIRO-LOC
 GREEN MACHINE PROCESSOR
 Vapor Systems Technologies, Inc.
 3749 S. 13th St. • Tulsa, Oklahoma 74119

REV	DESCRIPTION	DATE	BY
1			

ENVIRO-GM-D
 SHEET NO. 1 OF 1

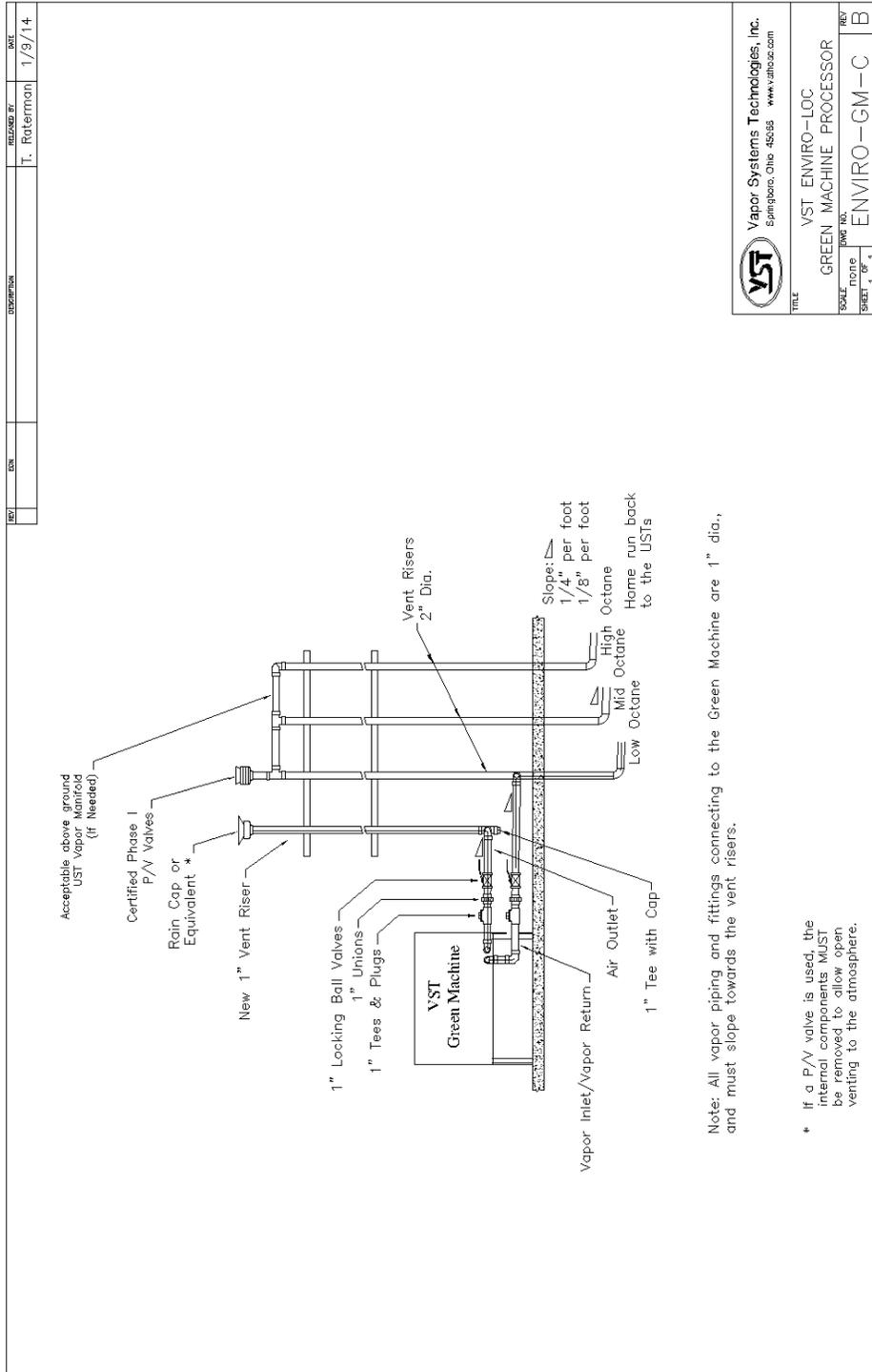


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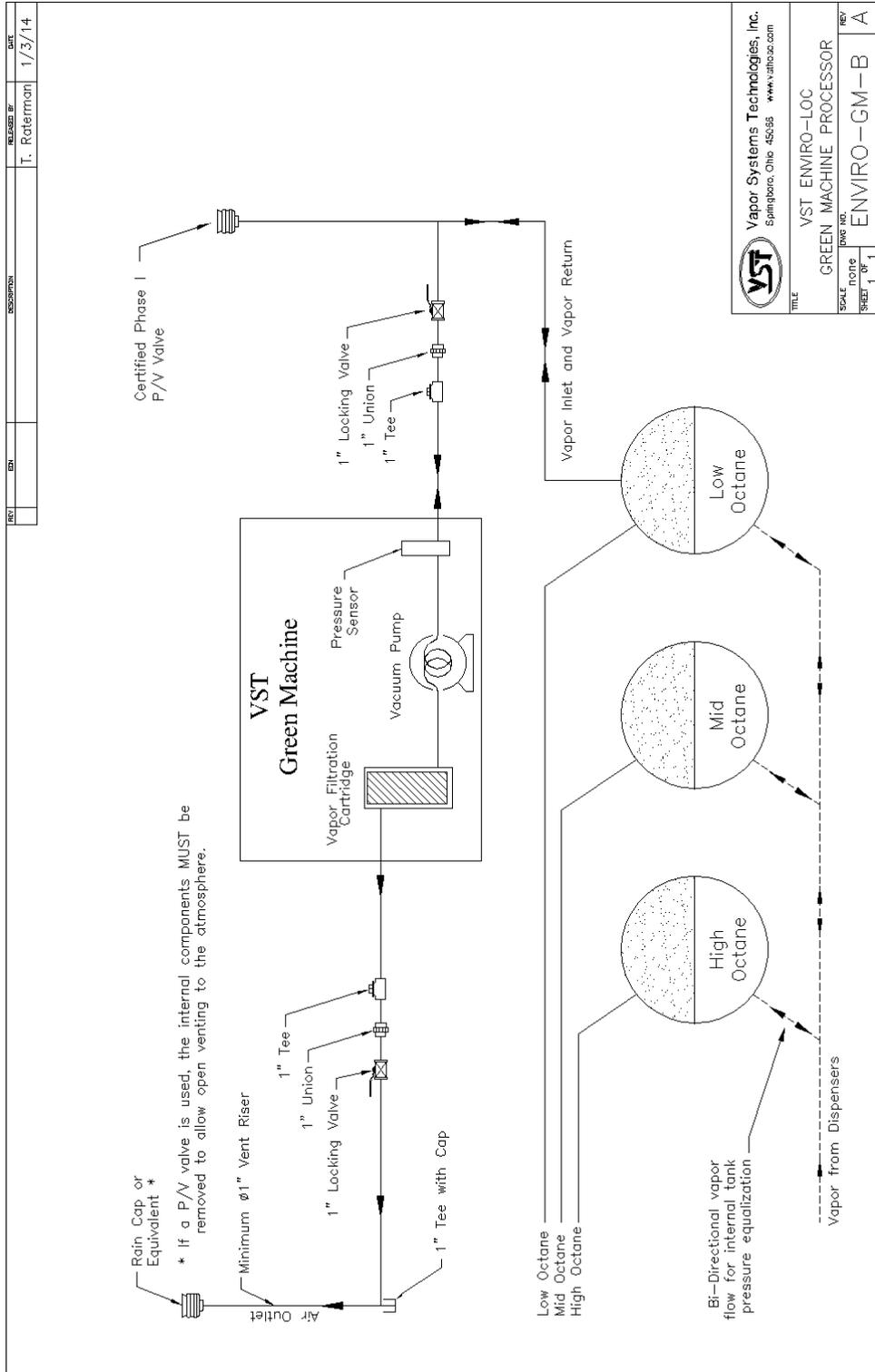
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VST ENVIRO-LOC GREEN MACHINE PROCESSOR			
SCALE	DRAWING NO.	REV	
1" = 1'	ENVIRO-GM-C	B	
SHEET 1 OF 1			



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	Vapor Systems Technologies, Inc. Springfield, Ohio 45595 www.vstinc.com
TITLE VST ENVIRO-LOC GREEN MACHINE PROCESSOR	
SCALE none	DWG NO. ENVIRO-GM-B
SHEET 1 OF 1	REV. A