



Vapor Systems Technologies, Inc.

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News and Notes for  
the Fuel Dispensing  
Industry Professional

# The ! Voice

Chapter 1

Back to the Basics

01/15/15

## SPECIAL EDITION

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### In This Issue

- Chapter 1:  
Back to the Basics

Hello!

VST has been listening to the discussions happening in the vapor recovery industry in California. Perhaps the discussion with the most intensity is UST (Underground Storage Tank) over-pressurizations happening around the state.

We are hearing a number of myths about Balance Systems, and we suspect that much of it has to do with a general lack of familiarity with the differences between Balance Systems and Vacuum Assist Systems. We feel it's important to take the time to overview the systems and to show the cost benefits of Balance Systems so that station owners can take advantage of those benefits. We would also like to address the distinct advantages of a VST Engineered Balance System versus a hanging hardware assembly made up of different manufacturer's products.

Over the next several months, VST will relay the physics behind the operation of both EVR Balance Systems and EVR Assist Systems and the differences between them. The goal will be to educate everyone involved about the inner workings of the two different types of vapor recovery systems, after which it will be easy to understand why the VST EVR balance system will be the predominate system of choice, with the benefits of much fewer alarms and over-pressurization issues, lower operating cost, and better durability.

We will be discussing the following topics in each of the "Chapters" of the Special Edition of the Voice:

1. Overview of the Systems: Back to the Basics
2. Cost Benefits of using Balance versus Assist
3. Why use VST Engineered Solutions versus component suppliers
4. Causes for some Alarms – Over-Pressurization, Backflow

Until next time,

Susie McLaughlin  
Editor, The VST Voice

## OVERVIEW OF THE SYSTEMS:

BY RODGER GRANTHAM: VICE PRESIDENT, RESEARCH & DEVELOPMENT

### CHAPTER 1: BACK TO THE BASICS

This month's overview will cover the basic operating principles of each system, which may be very simple to some of you, but these need to be understood first before we delve into some of the more complex issues we will cover later, such as the causes for the UST over-pressurization issues.

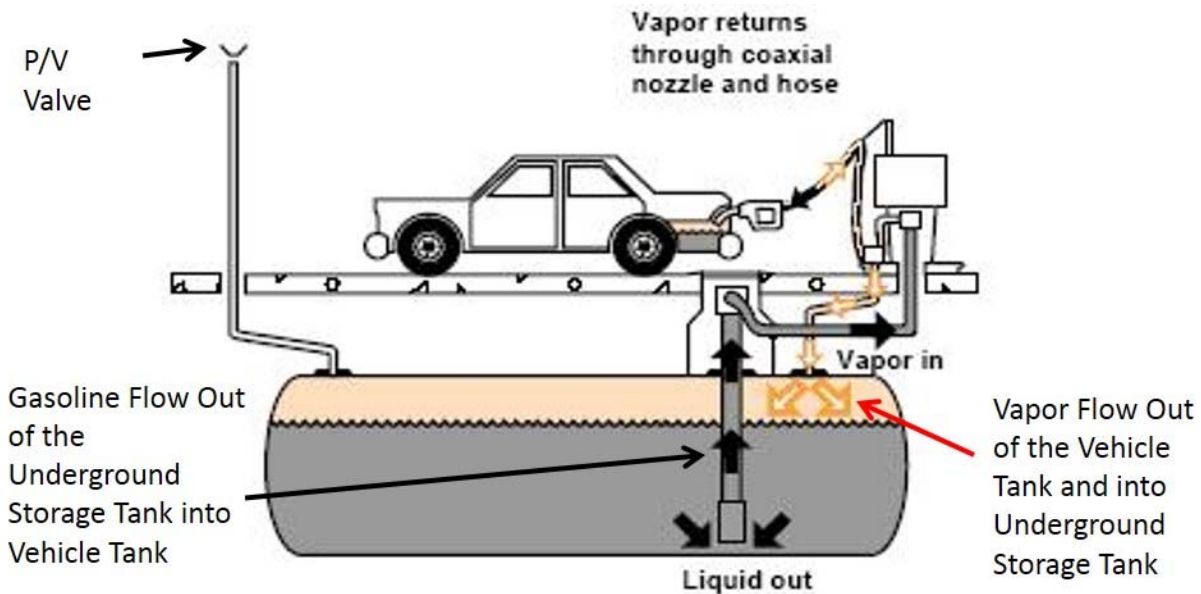


Figure 1: Phase II EVR

Figure 1 shows the basic operation of a Phase II vapor recovery system, which captures any gasoline vapors leaving the vehicle's gas tank during refueling, and sends them into the UST.

## BALANCE VERSUS ASSIST SYSTEMS

- Balance Vapor Recovery is generally categorized by the “boot” on the nozzle that allows it to capture vapors during vehicle refueling. The hose used is a coaxial hose specially designed to allow gasoline to flow through an inner hose surrounded by a larger hose that allows the vapors to be returned down to the storage tank. As gasoline flows from the dispenser into the vehicle fuel tank, the movement of the vapors from the vehicle to the storage tank is done without the use of a pump. Rather the vapors are displaced out of the vehicle fuel tank by the incoming gasoline filling the tank. Simultaneously, vapor is pulled into the underground storage tank (UST) as the liquid gasoline is pulled out of the UST. This is called a “Balance System.”
- Vapor-Assist systems use some type of pump to actively pull vapors from the vehicle into the UST when refueling. Again a coaxial hose is used, with the vapor in the inner hose, and the gasoline in the outer hose.

## BALANCE PHASE II SYSTEMS

- Pressure that develops in the vehicle tank during fueling operations, and vacuum in the storage tank created when the fuel is removed, forces displaced vapors out of the vehicle fuel tank and back into the storage tank.
- Phase II vapor recovery systems that operate on this principle, without vacuum pumps or aspirators, are referred to as Balance Systems. Balance Systems utilize a tight seal between the vapor recovery nozzle and the vehicle fill pipe to prevent the escape of vapors.
- Balance vapor recovery nozzles utilize face seals, bellows, and interlocks to ensure a tight seal at the fill pipe.
- A vapor check valve is located in the nozzle to prevent the escape of vapors from the vapor-return path between fueling operations.
- The way the Balance System operates prevents the ingestion of excess air into the storage tank. This prevents the creation of excessive tank pressure with the accompanying emissions at the vent P/V valve.

## VACUUM ASSIST PHASE II SYSTEMS

- Vacuum-Assist Systems employ vacuum pumps, located either at the dispenser or in the piping, which create a vacuum to assist the movement of vapors back into the storage tank.
- Since a vacuum is created by a pump, the amount of vacuum must be adjusted to meet performance requirements. This is referred to as the V/L, or Vapor to Liquid ratio.
- Vacuum-Assist Systems employ specific nozzle designs for use with the equipment that have a pathway for the vapor flow.
- Since most vacuum assist nozzles do not seal on the vehicle fill neck, there can be some excess air drawn in by the vacuum pump and sent to the UST. This excess intake of air will pressurize the UST. In most cases, this excess UST pressure will exceed the P/V valve cracking pressure and vent Volatile Organic Compound (VOC) emissions to atmosphere.

### TYPICAL ASSIST VAPOR RECOVERY SYSTEM IN CALIFORNIA

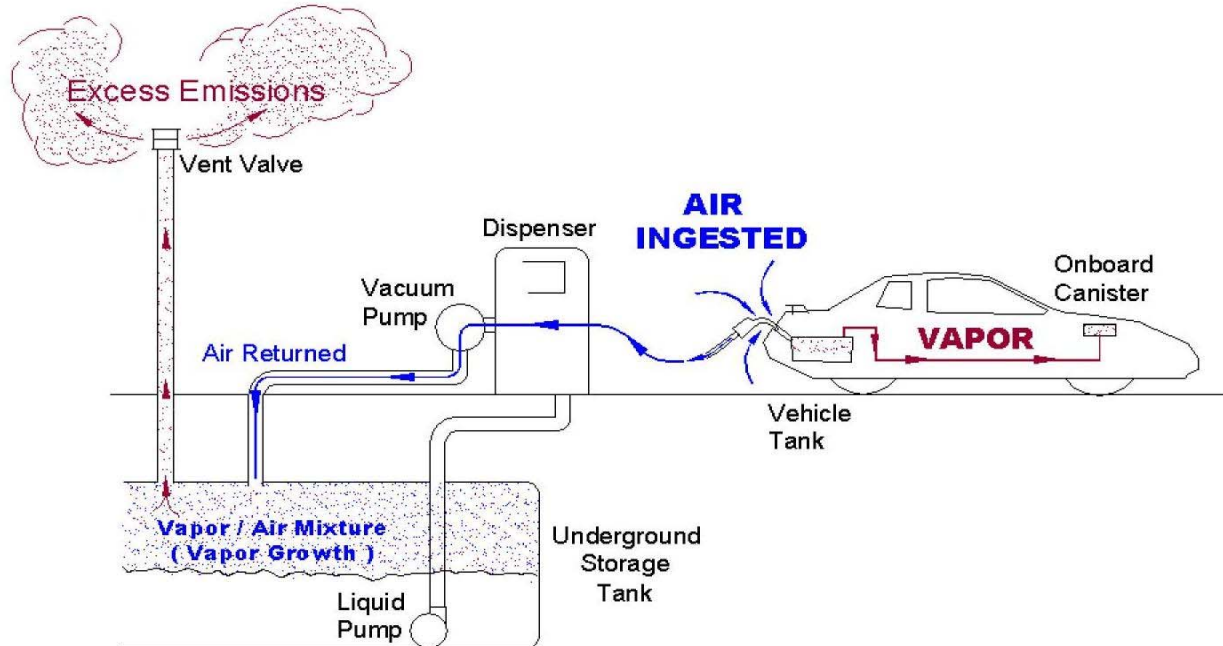


Figure 2: Typical Assist System

## DIFFERENCES BETWEEN BALANCE & ASSIST VAPOR RECOVERY

### Balance

- Uses physics to transfer the vapors from the vehicle to the UST, so no vapor pump is used. This greatly reduces the cost of ownership for the system.
- Uses a tight seal from the nozzle to the vehicle fill neck.
- Balance hoses have the vapor path in the outer coaxial hose.
- The Balance System does not send excessive air back to the UST, preventing the tank from pressurizing and causing excessive vent emissions.
- No additional equipment is needed to be compatible with ORVR vehicles.

### Assist

- Uses vacuum pumps to pull the vapors from the vehicle to the UST increasing the number of components and the operating cost.
- Assist nozzles require adjustment to set the proper vacuum to pull the vapors to the UST.
- Assist Systems have the vapor path through the inner hose. To prevent additional emissions due to permeation, an additional low permeation barrier layer is required for the outer hose.
- Excess air can be drawn in by the vapor pump causing the storage tank to pressurize. This creates excessive vent emissions.
- EVR Assist Systems need to detect if a vehicle has ORVR in order to avoid pulling fresh air back into the UST.
- Assist systems require monitoring to maintain proper V/L.
- To obtain equivalent vapor transfer efficiency to a Balance System, the Assist System must employ a similar boot and also uses an interlock.