



# Vapor Recovery Inspections

At Gasoline Dispensing Facilities  
(GDFs)

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## Stage I Vapor Recovery

A system designed to capture displaced vapors that emerge from inside a storage tank when a load of gasoline is delivered into the tank. During the filling process, the rising liquid displaces the vapors present in the upper portion (ullage) of the tank. These displaced vapors have to escape to enable the product transfer to the tank. If there is not a tight connection (tight fill) between the delivery hose and the fill port, some vapors flow out around the hose while additional vapors escape through the tank's vent pipe. The Stage I VRS is designed to capture said vapors that result from the gasoline transfer from the delivery truck to the storage tank.

### Stage I VRS: Single Point and Dual Point.

**Single Point** systems utilize a co-axial drop tube which consists of a "pipe within a pipe". Again, this device is in the drop tube located at the tank's fill port. Typically, there is a poppet valve in the co-axial drop tube which is normally closed which prevents the escape of vapors from the storage tank when the toggle cap is opened. The product enters the tank through the center (inner) pipe and the tank vapors are returned to the tanker through the outer pipe. Since only one fill/vapor recovery port is present, this type of system is called a "one point or single point". The delivery is through one fill unit which has two hoses connected to it. One hose conducts the fuel from the tanker truck to the tank; the second hose returns the displaced vapors to the truck's compartments.

**Dual Point** systems utilize two separate tank ports for delivery and vapor recovery; hence the name Dual Point. The first port is the fill port drop tube. The delivery unit is attached to the drop tube and a hose from the tanker transfers fuel to the storage tank. The vapor recovery port is called a "Dry Break" (commonly painted orange) and it consists of a riser and a spring loaded poppet valve which is normally closed. During a fuel delivery, a vapor recovery device is attached to the dry break which automatically opens the poppet valve. The vapor return hose routes the vapors from the tank through the dry break and back to the tanker.

## Stage II Vapor Recovery

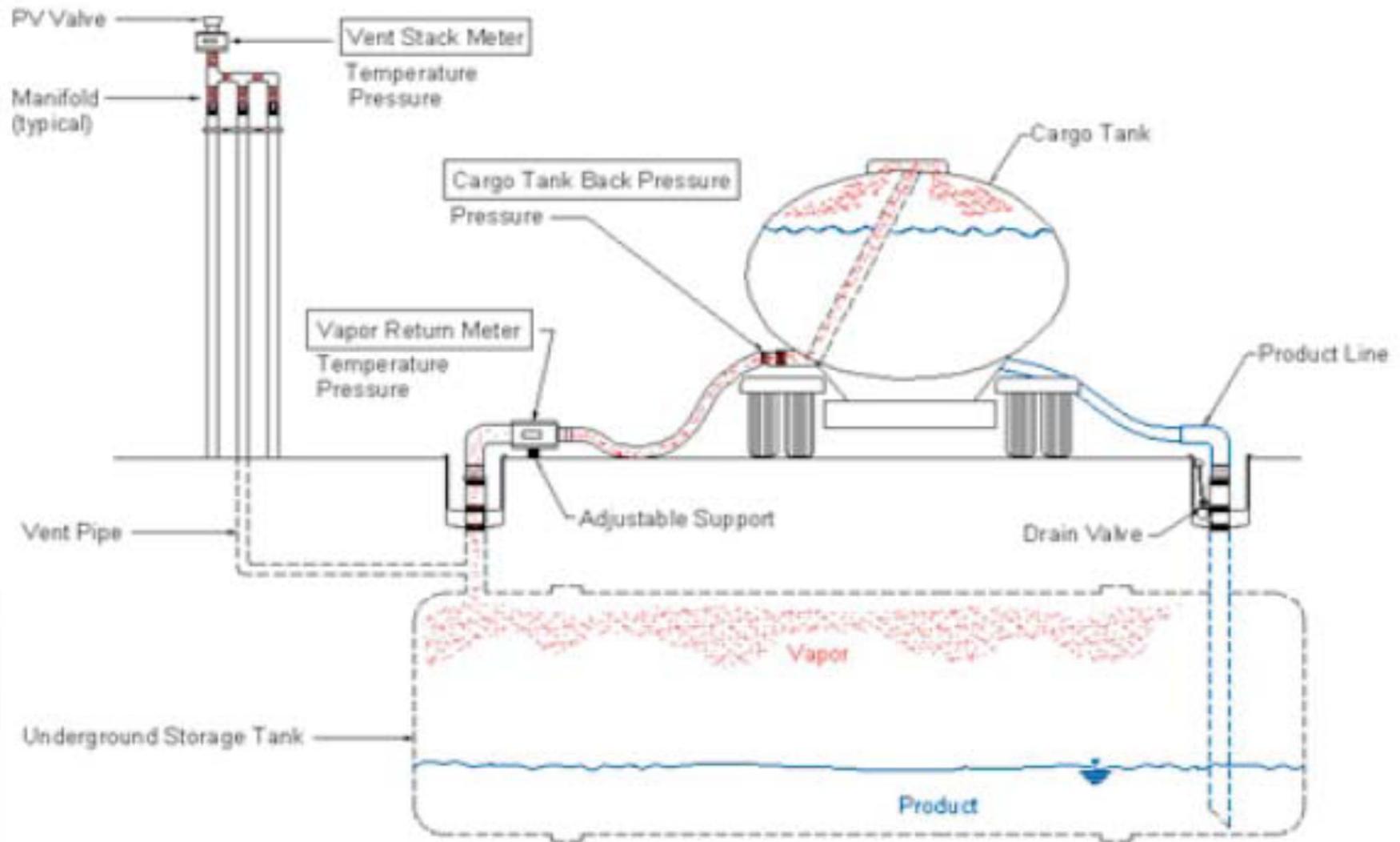
The Stage II system is designed to capture displaced vapors that emerge from inside a motor vehicle fuel tank, when gasoline is dispensed into the tank. Gasoline vapors accumulate in automobile and truck tanks, above the liquid level. When the vehicle tanks are filled, the rising liquid forces these vapors to seek an escape route, typically to the atmosphere. When a conventional nozzle is used (no Stage II provisions), the displaced vapors flow out around the nozzle and into the air.

There are two basic types of Stage II VRS:

The **Balance System**, the most commonly encountered type, transfers vapors from the vehicle tank to the station's lowest octane grade storage tank (typically, Regular Unleaded) without the assistance of an external force, such as a vacuum pump (venturi or electric). The key feature in the balance system is a hose nozzle that makes a tight connection with the fill pipe on the vehicle gasoline tank. The nozzle spout is fitted with an accordion-like bellows that presses snugly against the fill pipe opening. Balance systems are designed with controls that prevent fuel from flowing into the vehicle unless there is a tight connection between the bellows and the vehicle fill pipe. When fuel delivery begins, gasoline flows from the dispenser into the vehicle fuel tank. Vapors displaced by the rising liquid seek an escape route through an open port in the nozzle bellows. From this port, the vapors flow through the coaxial dispenser hose to the vapor-return piping of the gasoline tank. This recovery of the vapors is accomplished without the employment of external force. The withdrawal of vapors from the vehicle tank is balanced by the simultaneous addition of the vapors to the underground tank from which the gasoline is being dispensed—hence the name, *balance* system.

The **Vacuum Assist System** utilizes a mechanical device to establish a vacuum to pull the vapors back to the underground tank. The vacuum can be generated by either an electric vane pump or a venturi device such as the Healy Mini-Jet that uses pressurized gasoline to produce a vacuum. Vacuum assist most commonly use the electric vane pumps, typically painted blue, and located in the dispenser housing. They operate during a fuel delivery to a vehicle and pull the gasoline vapors from the tank and through piping route the vapors to the underground tank. The vacuum assist dispenser hose is smooth on the outside, not corrugated like the balance system hose. There are several holes in the nozzle end, while balance systems use only a single hole.

# Stage I Vapor Recovery



# Stage I Vapor Recovery

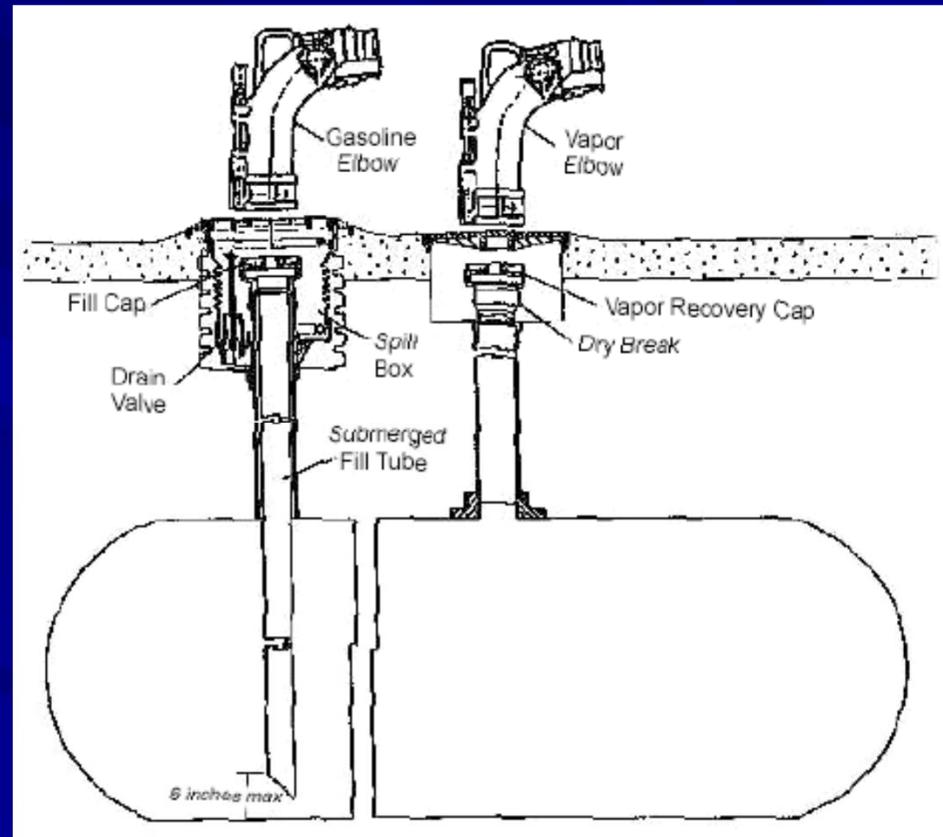
NJAC 7:27-16.3(c)&(d)

- Required for gasoline tanks 2,000 gallons or greater in capacity
- Delivery MUST be made through a submerged fill pipe (within 6" of the tank bottom)
- Storage Tank MUST be equipped with one of the following emission controls:
  - A Pressure/Vacuum relief valve must be installed on the vent *and*
  - System must reduce the total VOC emissions into the outdoor atmosphere by no less than 98%
  - OR
  - A floating roof

# Two-Point Delivery



This is your typical delivery at a facility that has dry breaks. If you witness a delivery, make sure the hose has a tight seal with the dry break to prevent a vapor discharge.



Some GDFs have manifolded vapor recovery, or ONE dry break for multiple tanks. That is the only case where one vapor connection is acceptable for multiple tanks!

# Dry Break

aka "Poppet Valve"



Here is a typical dry break. Make sure this valve is in the closed position. Also, try to depress the valve, as it should spring back up when you release it. If this is frozen in the open OR closed position, it's a violation and the tank should not take deliveries until it is repaired/replaced according to 7:27-16.3(d)

# Dry Break Problem?



**Before**



**After**

Both are violations, the one on the right is just comical.

# More Dry Break Issues...

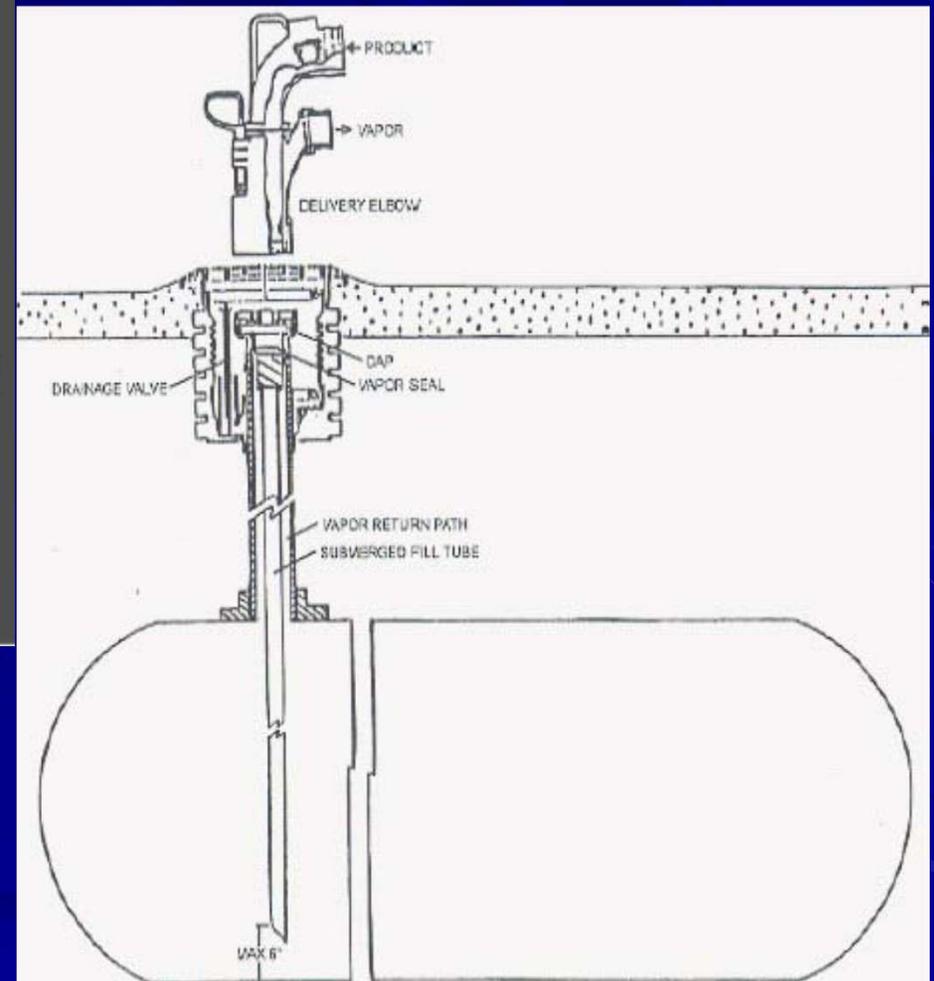


This is a very common and illegal practice. In order to make their delivery faster, some tanker operators do not hook up their stage I hose to the dry break, and instead prop it open with something, usually a screwdriver, pebble, or even the dust cap. If you come across this in the field, stop the delivery until the operator hooks up his hose to the dry break.

# One-Point (Coaxial) Deliveries



## One Point Coaxial



Delivery is made with a double-hose through one connection. Product is on top then through the middle of the connection, vapor is on bottom then around the outside of the connection.

# Poppeted Coaxial



# Pressure/Vacuum Valves

Three vent lines manifolded into one.



Three unmanifolded vent lines with three P/V Valves.



These valves are installed on top of the vents to prevent vapors from being released into the atmosphere. Current regulations require a CARB approved P/V valve to crack at 3" H<sub>2</sub>O of positive pressure and 8" H<sub>2</sub>O of vacuum (+ or - 1/2"). **NOTE: Federal regs as of 2009 require pressures of 2-6" positive and 6-10" negative**

# Pressure/Vacuum Valves?



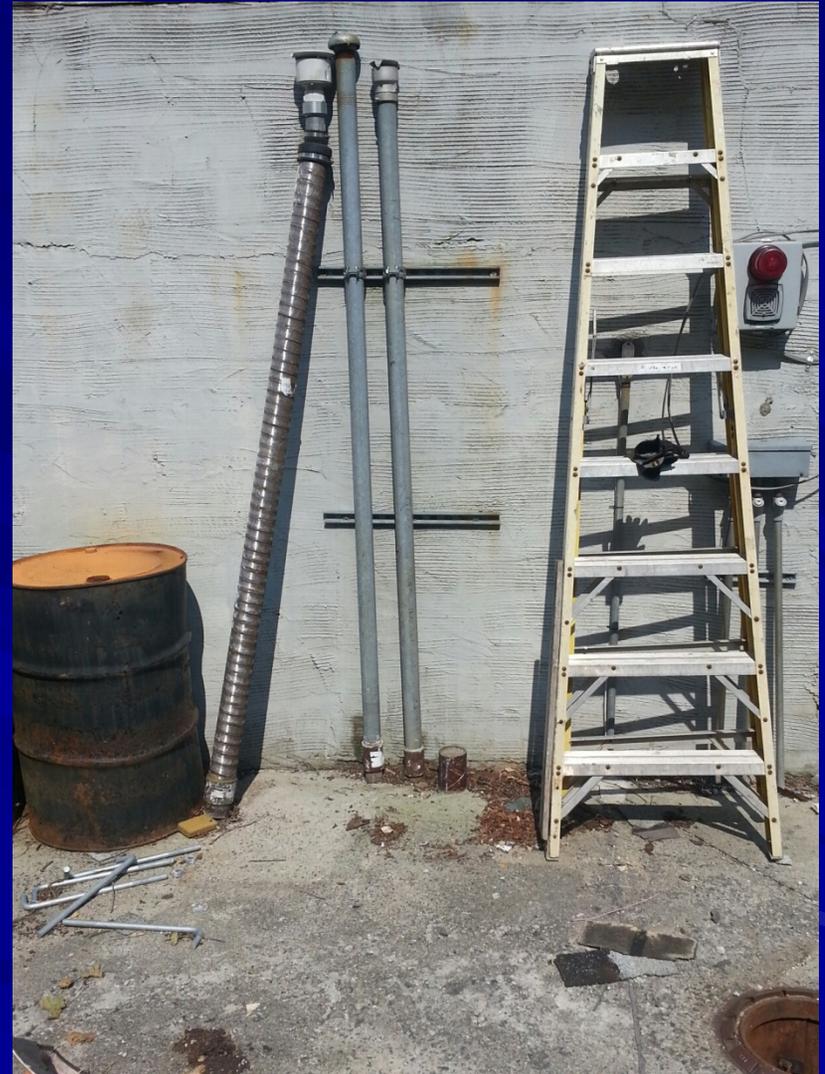
This is a homemade P/V valve, it has a much lower cracking pressure than the CARB approved ones. Systems like this are obviously not permitted.

# Pressure/Vacuum Valves?



Once again, just when you thought you've seen everything, you find a joker like this. Somehow, these gloves are not in compliance with the required cracking pressure of a real P/V valve. According to NJAC 7:27-16.3(d), a delivery can not be made to these tanks. The weather cap on the diesel vent is fine.

# Wait For It....



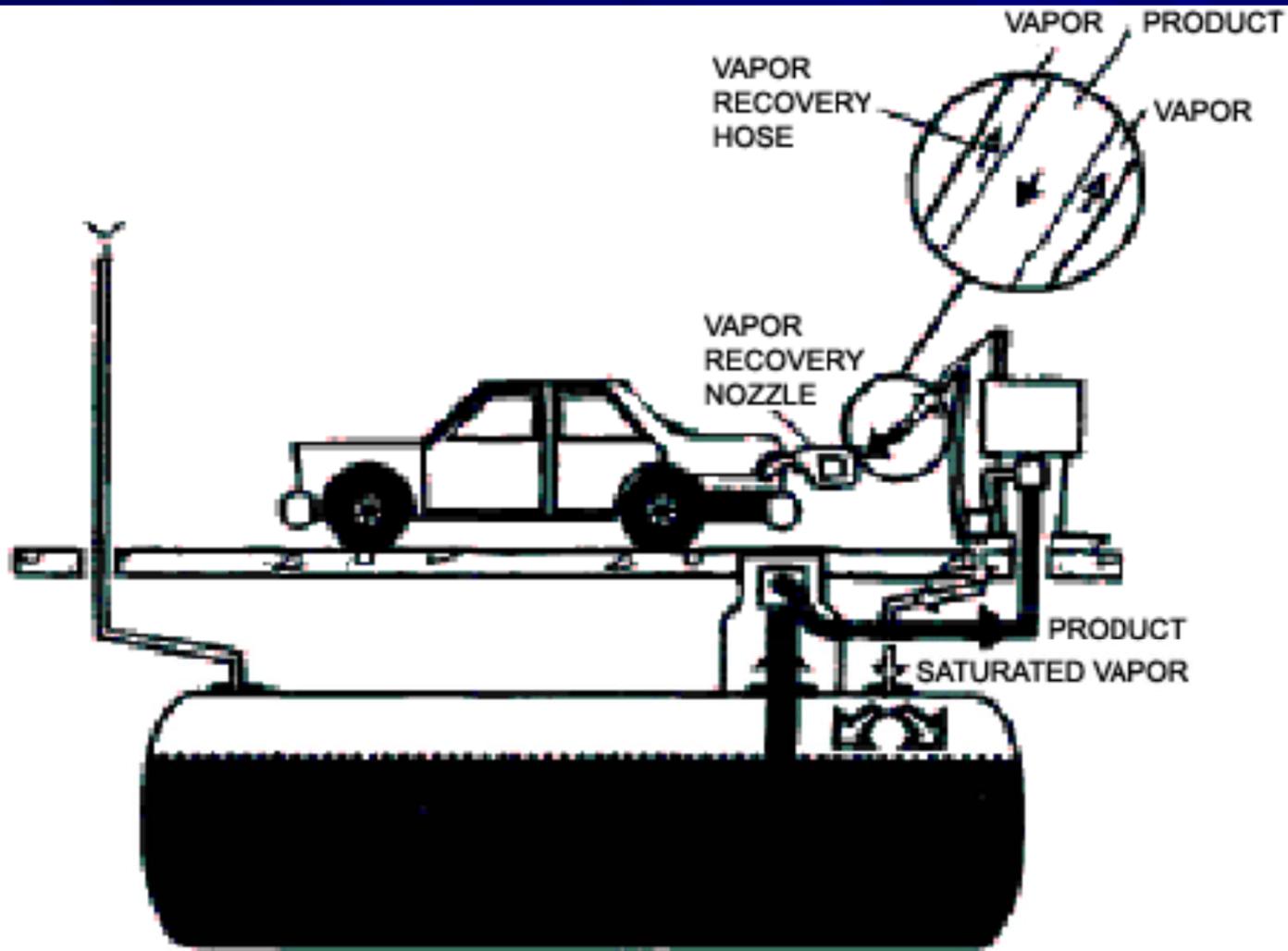
# There it is!



This lovely work of art was at a facility owned by one of our “favorite” customers. The facility was undergoing renovations, but was still open and in service. If it wasn’t swaying with the breeze, we may never have caught it. Believe it or not, this place had a PASSING pressure decay test. We made them replace this punch line anyway, since a closer look revealed obvious vapor escaping. Proof that you’ve really just NEVER seen it all...



# Stage II Vapor Recovery



# Stage II Vapor Recovery

NJAC 7:27-16.3(e)&(f)

- Facilities with a monthly throughput of 10,000 gallons or greater, and all new facilities constructed after June 29, 2003.
- System must have a collection efficiency of 95%
- System must prevent overfilling and spillage
- Airports and marinas are exempt. Why?
- Systems installed on or after June 29, 2003 must be a unihose dispensing system.
- Nozzles must fit into the dispenser housing properly, with the check valve remaining closed.
- If a facility is exempt from Stage I, they are also exempt from Stage II

# Stage II Components

## Phase II Components



What to look for:

What kind of Stage II system?

Tears/holes in hoses or nozzles

Are all components installed in the correct direction?

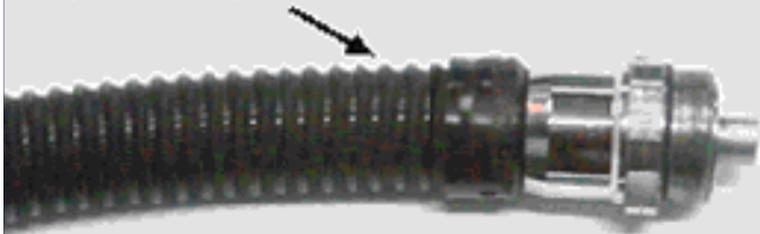
Is any part of the hose laying on the ground?

Does the nozzle fit in the holster?

Is the nozzle check valve functioning?

# Balance vs. Vac Assist

Standard Coaxial Hose

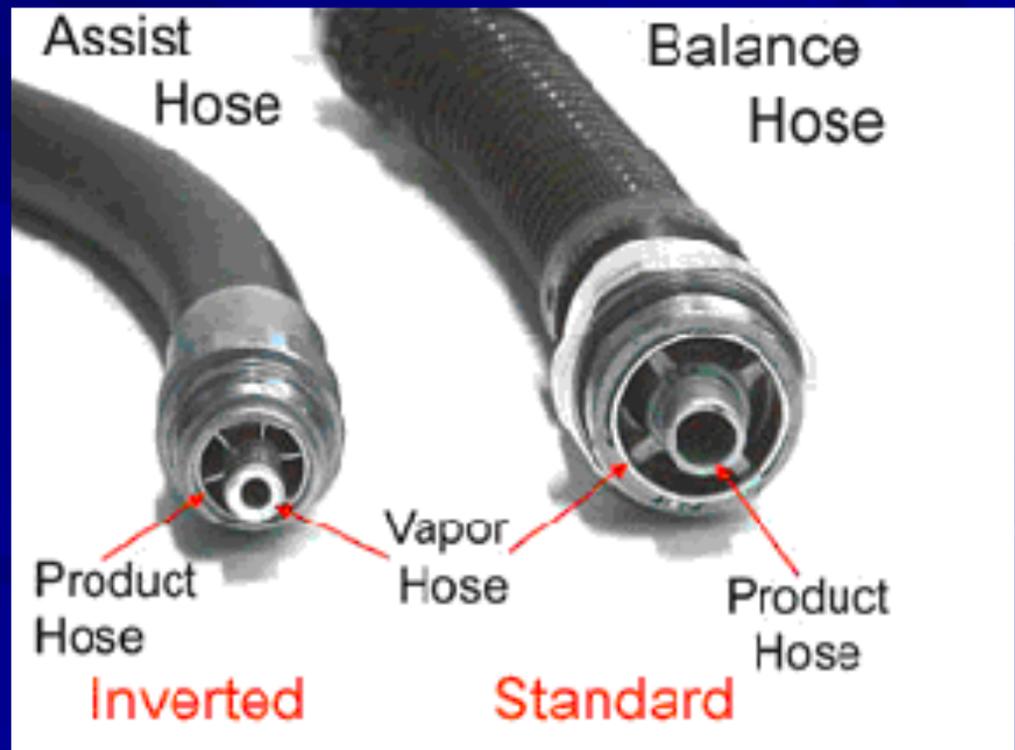


Inverted Coaxial Hose

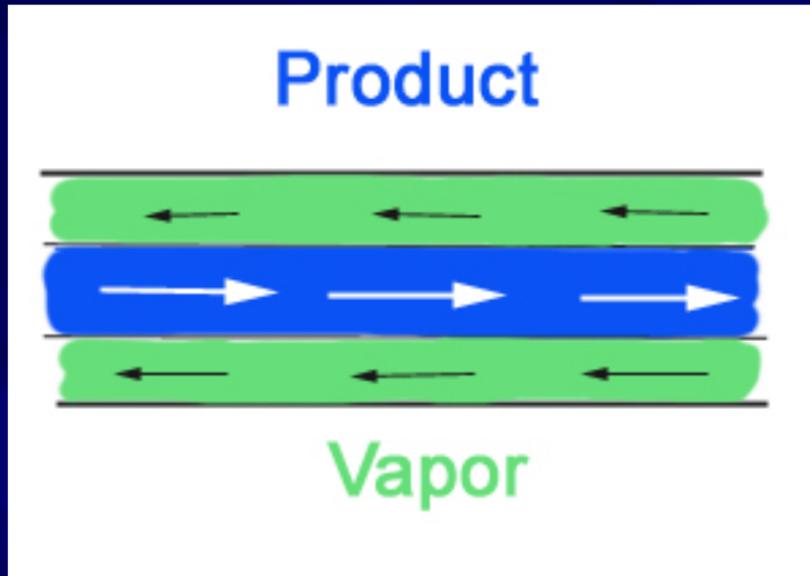


The difference between the two types of system hoses is apparent. The balance hose is thicker and ribbed, while the vac assist hose is smooth and thinner.

The inner workings of the two hoses are inverted. A balance hose has the vapor path on the outside, while the assist hose has the product path on the outside.



# Balance System



A balance system has the product flowing through the middle in one direction, and the vapor along the outside in the opposite direction. This is a passive system that relies on the slight pressurization of the vehicle gas tank gaining product, along with the vacuum created by the UST (or AST) losing product. This system is compatible with any Stage I system.



# Balance Nozzle

Check for tears or holes in the bellows and faceplate. Also test the check valve to make sure it is opening/closing. To test for a liquid blockage, simply hold the nozzle out downward with the hose over your shoulder, point the nozzle into a bucket, and pull open the bellows to open the check valve. If gasoline pours out of the bellows, it's likely the station is topping off.

