



VAPORSAVER

Vaporsaver 1

Installation Manual - UL



ATTENTION:

READ AND UNDERSTAND THIS IMPORTANT SAFETY INFORMATION BEFORE BEGINNING WORK

This product is to be installed and operated near the highly combustible environment of a gasoline storage tank. It is essential for your safety and the safety of others that you carefully read, understand, and follow the warnings and instructions in this manual. Failure to do so could result in danger to life and property including death, serious injury, explosion, fire or electric shock.

Failure to install this product in accordance with the instructions and warnings in this manual as well as failure to follow the requirements of the National Electric Code, federal, state, and local codes will result in voiding warranties of this product.

Only OPW trained and Certified technicians are to install and start-up the system. An OPW trained and Certified technician shall start-up the system only after careful inspection of the installation. The start-up form shall be completed and returned to OPW Technical Support.

Installation, start-up, system maintenance and troubleshooting must be performed by qualified, certified service technicians. Certified technicians must be able to provide proof of certification at any time. Certification number is required for any start-up form to be completed or accepted by OPW as well for warranty purposes. Technicians requesting technical support on the Vaporsaver that do not have the necessary proof of certification will be referred to a certified service technician.

It is your responsibility to install this product in accordance with the instructions and warnings in this manual.

OPW Customer Service: 1-800-422-2525.
www.opw-fc.com

Safety Symbols

The following safety symbols may be used throughout this manual to alert you to important precautions and safety hazards that may arise during the installation and operation of this product.

| | | | |
|---|--|---|--|
|  | ELECTRICITY A potential shock hazard exists. High voltage is supplied to and exists in this device. |  | TURN POWER OFF Turn power off to the device and its accessories when installing and servicing the unit. Live power creates a potential spark hazard. |
|  | EXPLOSIVE Gasoline and its vapor are extremely explosive if ignited. |  | NO POWER TOOLS Sparks from electric power tools can ignite gasoline and its vapors. |
|  | FLAMMABLE Gasoline and its vapors are extremely flammable. |  | NO PEOPLE IN THE AREA Unauthorized people in the work area during installation and service of the device create a potential for personal injury. |
|  | NO SMOKING Gasoline and its vapors can be ignited by sparks and embers of burning cigarettes. |  | READ ALL RELATED MANUALS Read, understand and follow all instructions, warnings and requirements before you begin work. |
|  | NO OPEN FLAMES Open flames from sources like lighters, matches, etc. can ignite gasoline and its vapors. |  | USE SAFETY BARRICADES Unauthorized people or vehicles in the work area create a potential for injury and danger to property. Always isolate your work area by using safety cones, barricades, etc. |
|  | PINCH RISK Stay clear. Keep hands and tools away from rotating machinery and moving parts. |  | ROTATING MACHINERY Stay clear. Keep hands and tools away from rotating machinery. |

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Vaporsaver Interconnect Wiring Diagram

1.0 Introduction



WARNING: Only OPW trained and Certified technicians are to install and/or start-up the system. An OPW Certified technician shall start-up the system only after careful inspection of the installation, and completion of the start-up checklist.

Do not power up the system unless a complete start-up inspection is completed by an OPW Certified technician.

1.1 Control System Description

The OPW Vaporsaver reduces hydrocarbon emissions from a gasoline refueling facility by controlling the storage tank pressure. Tank pressure management is achieved by releasing air from the storage tanks, while recycling the gasoline vapor. The recycling that takes place accomplishes three benefits. First, by returning vapor to the storage tank in a supersaturated form, evaporative emissions are greatly reduced. Second, during the recycling process, liquid gasoline is created and returned to the storage tank. Third, by releasing the air (and saving the gasoline), the pressure in the storage tank is reduced, and vapor emissions to the atmosphere due to venting or fugitive emissions become insignificant.

Pressure in the storage tank will rise due to thermal and pressure affects of the day, by the introduction of air from filling vehicles (larger pressurization occurs with ORVR equipped vehicles), or from Stage I deliveries.

Without the OPW Tank Pressure Management System:

- Ingested air from ORVR vehicles can evaporate the liquid product, and cause an increase in UST pressure.
- Increased pressure from all sources will be released from the UST's to the atmosphere through leaks in the vapor piping, components, and P/V vents.

1.2 Normal Operating Conditions

1. The Control System turns on when the UST pressure increases to a preset pressure slightly above atmospheric pressure.
2. It turns off in the following conditions
 - a. When UST pressure is reduced to a preset pressure slightly below atmospheric pressure.
 - b. The Control System is also designed to only operate 10 minutes continuously. After a 10 minute run, the Control System shuts down for 2 minutes, and will start again if tank pressure requires it. This allows the separator to drain returning liquid product to the storage tank. As well as not allowing the Control System to run excessively if the vapor space has significant leaks.
3. The Residue is the fresh air being released from the Control System. It is continuously monitored for the presence of hydrocarbons to ensure it is below the allowable limit.
4. The Vaporsaver, when installed and operated as designed, is approved by TUV (minimum 97% efficiency); it also will allow any Stage II Vapor Recovery System to meet both the ORVR compatibility and the CARB emission requirement with the nominal A/L = 1.00 (Maximum A/L = 1.10).
5. The Permeate being returned to the UST after vapor/air separation will consist of super saturated vapor and some condensed gasoline liquid.

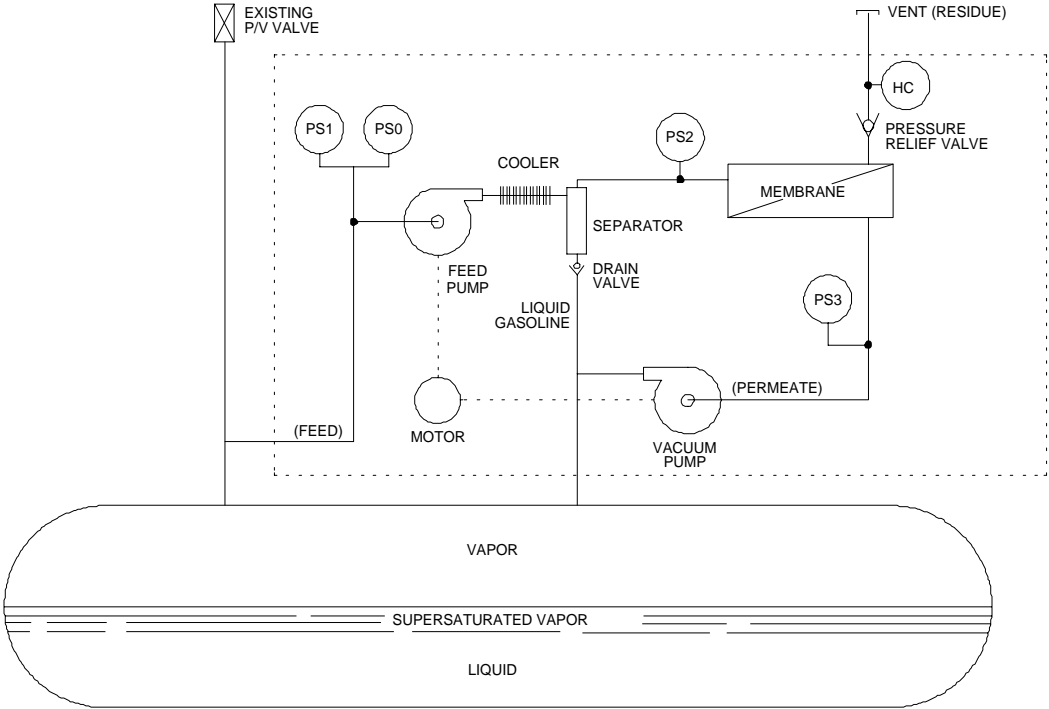
6. There are many variables that influence how long the Vaporsaver will operate per day at any given site. These variables would include:
 - a. station dispensing volume
 - b. number and duration of drops
 - c. fuel vapor pressure
 - d. fuel temperature
 - e. barometric pressure and temperature
 - f. vapor tightness of the Stage I and Stage II Systems
 - g. storage tank ullage
7. The amount of operating time per day can vary from station to station, as well as from day to day at the same station. A seemingly significant variation from day to day should not be a concern. The Vaporsaver is self-monitoring; if a fault arises, an alarm will sound.

2.0 Operation

As pressure in the storage tank rises, the pressure sensor monitoring the tanks will start the Vaporsaver Control System.

1. The feed pump draws the vapor/air (saturated vapor) mixture from the storage tank.
2. The vapor/air flow is pressurized.
3. The feed vapor stream temperature rises.
4. The heated vapor stream passes through a cooler.
5. The cooler reduces the vapor stream to ambient temperature.
6. The cooling process causes liquid gasoline to condense.
7. The vapor/air mixture and liquid gasoline go to a separator.
8. The liquid gasoline is separated, removed from the vapor/air mixture, and stored for return to the storage tank.
9. The remaining vapor/air flow proceeds to the membrane.
10. The membrane material has two sides, a pressure (feed) side, and a vacuum (permeate) side.
11. As hydrocarbon molecules pass along the membrane pressure side, they are attracted and absorb into the membrane material.
12. Air molecules are not absorbed by the membrane surface on the pressure side, and are released from the Control System as clean air (residue).
13. The pressure differential between the pressure side and the vacuum side cause the hydrocarbon molecules to be drawn through the membrane material.
14. The vacuum pump returns the supersaturated gasoline vapor (permeate) to the storage tank where some of it will condense into liquid gasoline.
15. When the pressure in the storage tank is reduced a preset level, the Control System is shut down and put into stand-by mode waiting for the pressure to rise again.
16. The separator valve is then opened, and the stored gasoline liquid in the separator is returned to the UST.

VAPORSAVER 1 CONTROL SYSTEM
OPERATION SCHEMATIC



NOTE: ONLY VAPOR LINES SHOWN

MD-VR020

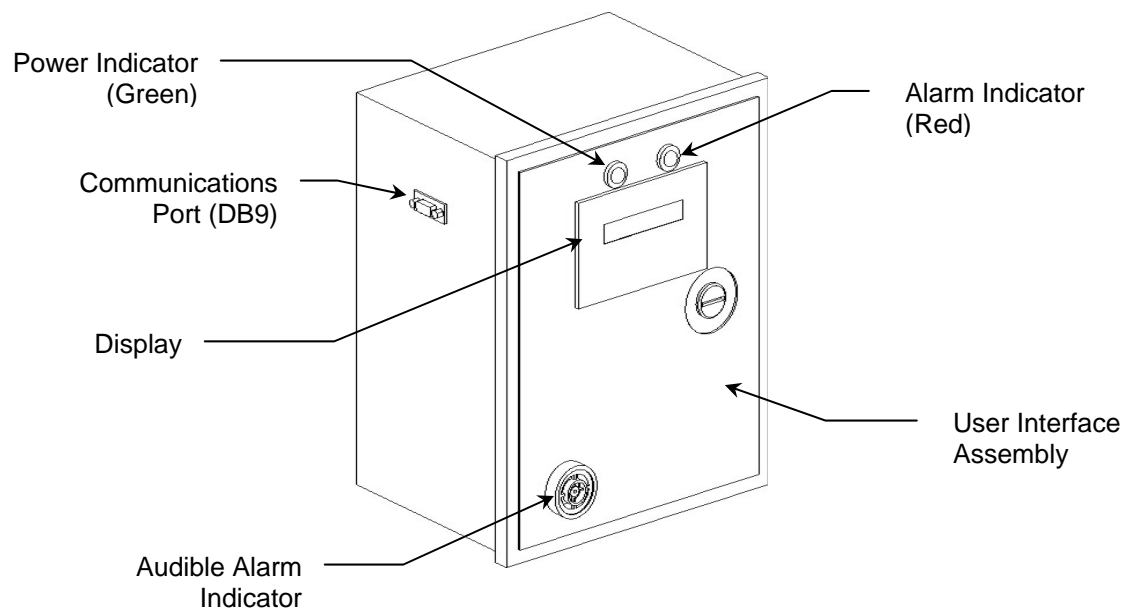
3.0 Component Identification

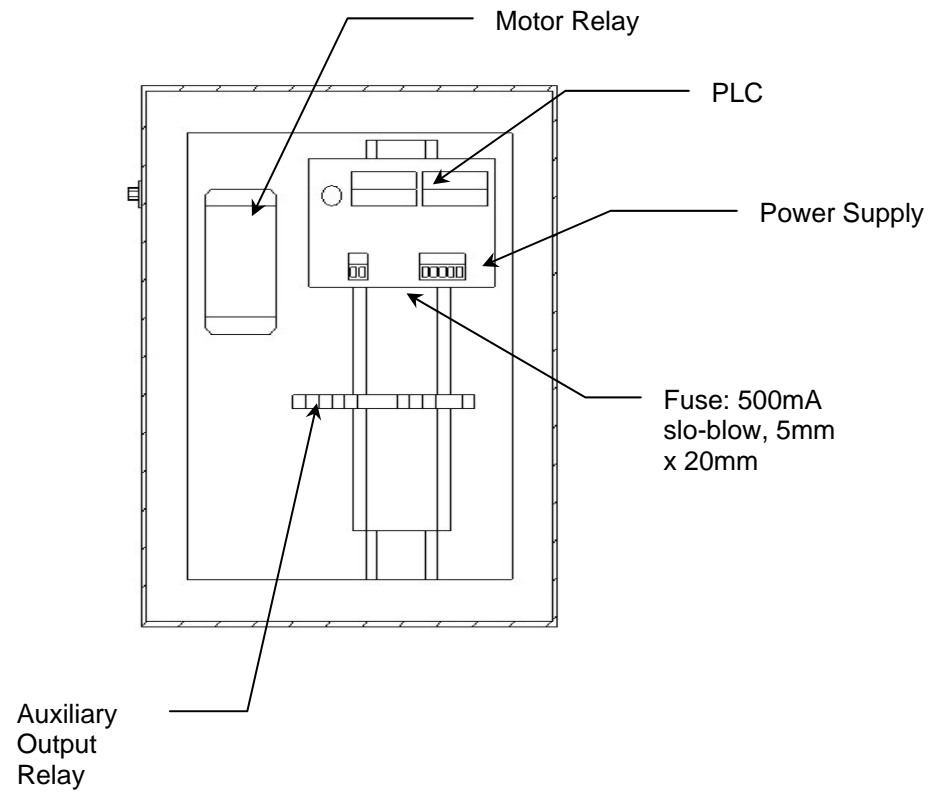
The Vaporsaver 1 consists of two major components: The User Interface and the Control System. The User Interface is the logic center of the system. It allows for interaction with the system for monitoring system status information, setting initial site configuration, and accessing recorded history. The Control System is the active tank pressure management component which houses the pumps, motor, monitoring sensors and the membrane.

3.1 User Interface

The User Interface incorporates the following features:

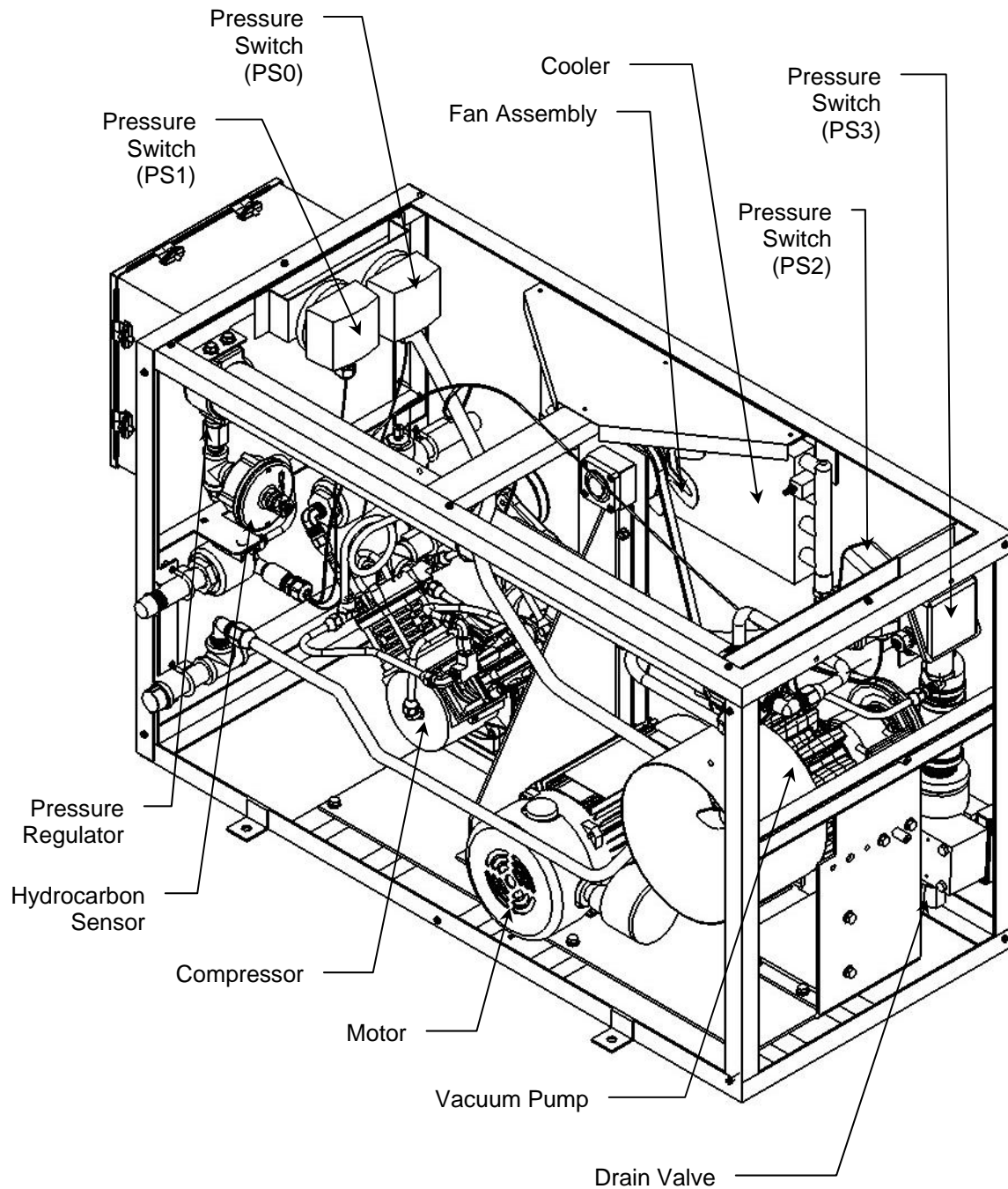
- Indicator lamps (Green - Power, Red – Alarm / Warning)
- Liquid crystal display (2 lines x 16 characters per line)
- A four button key pad
- Audible alarm indicator
- Auxiliary output alarm relay
- Port for serial communications (DB9, local or remote access)
- Operating temperature range: 32° F to 104°F (0°C to 40°C)






3.2 Control System




Nominal operating temperature range: -4° F to 120°F (-20°C to 50°C). Occasional and short-term excursions beyond this nominal range are acceptable, and will not cause damage to the unit.



4.0 Component Location

4.1 User Interface Location

| | |
|---|---|
|  | WARNING: Installation of this product must comply with the National Electric Code, federal, state and local codes, as well as other applicable safety codes. |
|---|---|

|  WARNING | |
|--|---|
|  | The User Interface enclosure must be installed in a non-Hazardous location. Explosion or fire resulting in serious injury or death, or property loss or damage could occur if the User Interface is installed in a Hazardous location. |
|  | Do not install User Interface enclosure in a combustible or explosive atmosphere (Class 1, Division 1 or Division 2; Class IIA, Zone 0, Zone 1, or Zone 2). |

1. User Interface electrical enclosure must be installed indoors and protected from the weather.
2. The enclosure must be installed so station personnel can hear the audible alarm.
3. There must be clear access to the enclosure so station personnel can interact with it.
4. All conduit connections must be made through the factory provided knockouts in the bottom of the enclosure. All unused knockouts must be plugged. Follow NEC for approved conduit types.
5. There is a serial port on the side of the enclosure for downloading data to a computer locally or via modem.
6. There are no end user serviceable parts within the User Interface enclosure.
7. The User Interface enclosure is 10" high, 8" wide, and 6" deep.

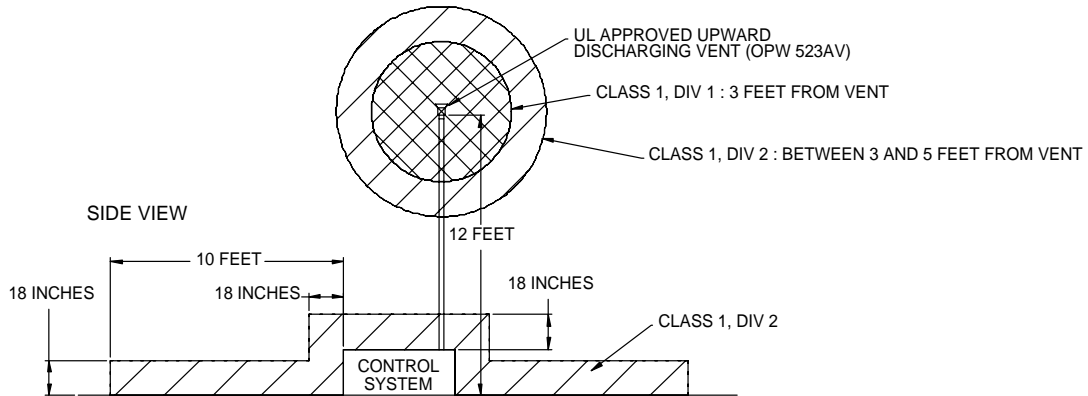
4.2 Control System Location



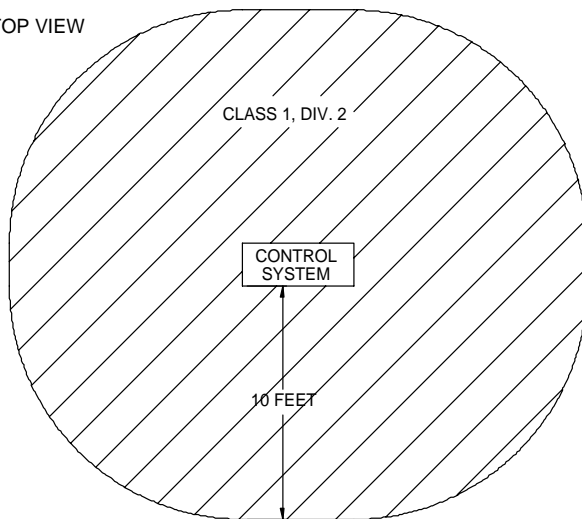
WARNING: Installation of this product must comply with the National Electric Code, federal, state and local codes, as well as other applicable safety codes.

1. Reference: NFPA 30A (2000) Chapter 10, Section 10.1 Vapor Processing Control Systems.
2. A hazardous location is created by the Vapor Processing Control System as per NFPA 30A (Table 8.3.1).
3. Hazardous Location Class 1, Group D, Division 2 extends within 18 inches in all directions of the equipment extending to grade level, and up to 18 inches above grade level within 10 feet horizontally of the vapor processing equipment.
4. The classified area shall not extend beyond a solid floor, wall, roof, or other partition that has no communicating openings.
5. Vapor Processing Equipment shall be installed at least 10 feet from adjacent property lines that can be built upon (NFPA 10.1.6). Local authorities may grant reduced distance depending on specific circumstance (e.g. a property line with a cinderblock wall and no communicating openings).
6. Vapor Processing Equipment shall be installed at least 20 feet from dispensing devices (NFPA 10.1.6).
7. The Vaporsaver Control System **cannot** be installed within a Class I, Division 1 area created by another device or location.
8. The Vaporsaver Control System can be installed in a Class I, Division 2 area created by another device or location, but the extent of both Classified Areas continue to be in affect.
 - a. If this is done, be sure that all existing electrical seal-offs continue to meet NEC and NFPA requirements after the installation of the Vaporsaver.
 - b. Always obtain approval from the local authority having jurisdiction.
9. If the Control System is located where vehicle or pedestrian traffic has access, measures must be taken to protect the Control System and exposed piping from damage or vandalism.
10. Installation of vehicle bumper posts or fenced enclosures may be necessary.
11. Use POMEKO/OPW pipe guards (POMEKO SPG, 6PGU, or 6PGR series guards).

Classified/Hazardous Areas



TOP VIEW



AUTHORITY SITED:

NFPA 30A - AUTOMOTIVE AND MARINE
SERVICE STATION CODE


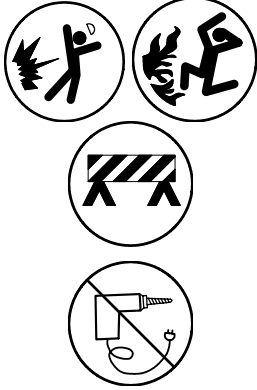
NFPA 70 - NATIONAL ELECTRICAL CODE

ALL DEVICES INSTALLED WITHIN THESE
HAZARDOUS LOCATIONS MUST COMPLY
WITH ALL APPLICABLE CODES
FOR SPECIFIC HAZARDOUS LOCATION.

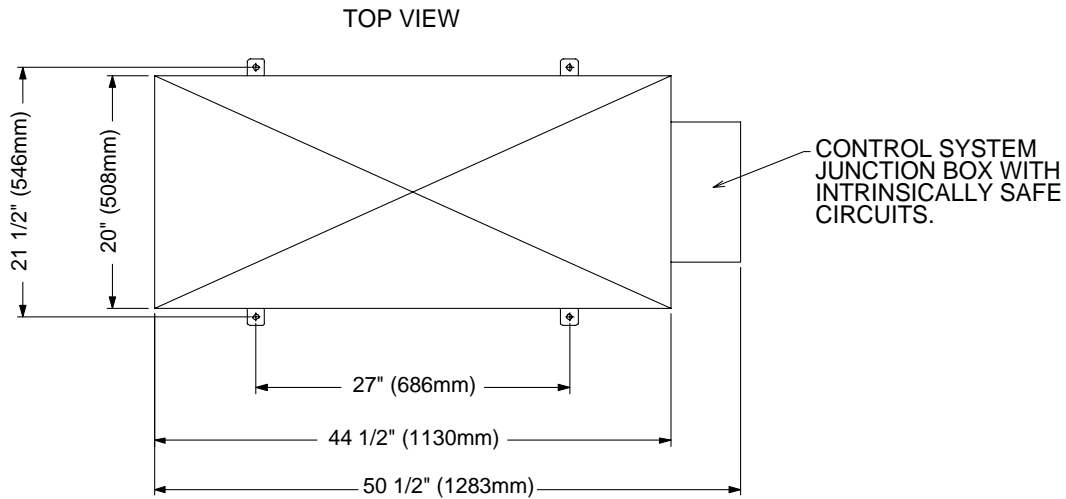
OBTAIN APPROVAL FROM THE LOCAL
AUTHORITY HAVING JURISDICTION.

IM-VR100

4.3 Control System Mounting

|  WARNING | |
|--|--|
|  | <p>The Control System is to be installed near locations where highly flammable and explosive vapors and liquids may be present. Risk of fire, explosion, serious injury or death.</p> <p>You are working in an area where vehicle traffic may occur. Always block off the work area during installation and service to protect yourself and others.</p> <p>Do not use power tools that can generate sparks if there is a risk of flammable or explosive vapors or liquids being present.</p> |

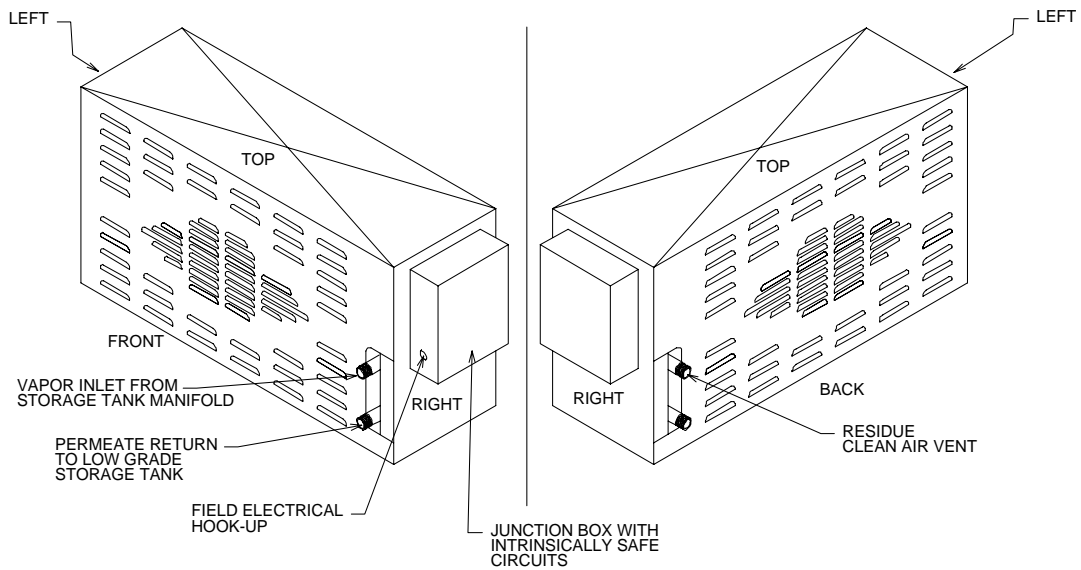
1. The Control System can be installed directly on grade.
2. It must be permanently anchored to concrete or another solid base, and must be installed level.
3. Minimum clearances for service access (more clearance always makes service easier).
 - a. Back: 12 inches
 - b. Top: 12 inches
 - c. Front: 12 inches
 - d. Left: 48 inches
 - e. Right: 12 inches
4. Do not install Control System where snow will accumulate or be placed when clearing lots. The above minimum clearances should be maintained at all times during operations.
5. Do not install where irrigation or sprinkler systems can spray water up through the louver vents.
6. If it is necessary to install a concrete pad, a 3 foot by 6 foot (or 3 foot by 5 foot) pad is adequate; minimum 4" thickness. To ease and speed installation, use a POMEKO/OPW island-form (p/n 6013-SFR6W3L6 or 6013-SFR6W3L5).



APPROXIMATE UNIT WEIGHT: 360 LB (165 kg)

USE 3/8" OR 1/2" (M10 OR M12)
MOUNTING HARDWARE
TO RIGID PLATFORM

IM-VR099





MINIMUM CLEARANCE REQUIREMENTS:
FRONT: 12 INCHES
BACK: 12 INCHES
TOP: 12 INCHES
RIGHT: 12 INCHES
LEFT: 48 INCHES
UNIT TO BE MOUNTED TO CONCRETE PAD
DIRECTLY ON GRADE, OR TO RIGID
MOUNTING PLATFORM.

ACCESS:
RIGHT: JUNCTION BOX AND I.S. CIRCUITS
LEFT: MEMBRANE MODULE
FRONT/TOP: ALL OTHER COMPONENTS

IM-VR097

5.0 Control System Piping

|  WARNING | |
|--|---|
|  | <p>The Control System is to be installed near locations where highly flammable and explosive vapors and liquids may be present. Risk of Fire, Injury and Death.</p> <p>You are working in an area where vehicle traffic may occur. Always block off the work area during installation and service to protect yourself and others.</p> <p>Do not use power tools that can generate sparks if there is a risk of flammable or explosive vapors or liquids being present. Open piping to the gasoline storage tank will be emitting dangerous, flammable and potentially explosive vapors. Do not smoke or have open flames in areas near open piping.</p> |

5.1 General Piping Guidelines

1. When planning the installation of a Vaporsaver, the main rule for piping is that the Control System should pull from and return to different locations of the vapor system.
2. It is important that return piping connections are separated from the inlet piping connections, so the permeate return vapors cannot be drawn directly back into the inlet piping. This will maximize the vapor and fuel recovered.
3. All aboveground piping must be schedule 40 galvanized; only use pipe that is internally and externally corrosion protected.
4. Follow local requirements for underground vapor piping with regard to secondary containment.
5. All pipes must have slope away from the Vaporsaver Control System directed to the storage tanks. Minimum slope: 1/8" per foot (0.5°, 10 mm/1 meter)
Recommended slope: 1/4" per foot (1°, 20 mm/1 meter)

5.2 Inlet Piping

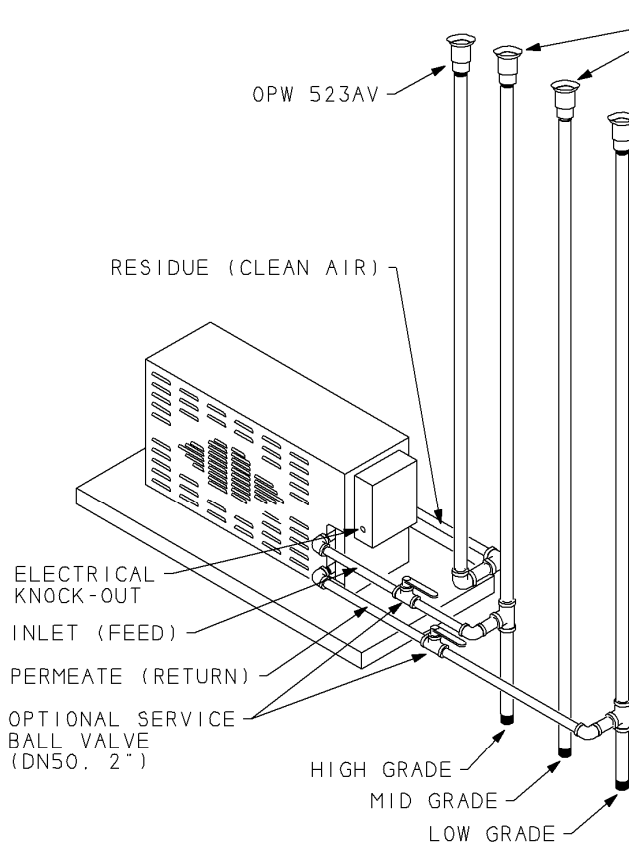
1. The Control System inlet is typically connected to the high-grade gasoline storage tank.
2. Piping should remain a minimum of 2" NPT (DN50) from the Control System inlet connection to the connection to the storage tank (or storage tank vents).
3. For maintenance purposes, it may be desired to install a 2" (DN50) ball valve. Ensure that the valve has a 2" (50mm) flow opening and is approved for gasoline use. **NEVER OPERATE THE VAPORSAVER WITH THE SERVICE VALVES CLOSED;** damage to the Vaporsaver will occur. It is highly recommended that the valve handle is removed to avoid tampering.

5.3 Clean Air Vent Piping

1. The clean air vent (residue) must be piped so the discharge opening is 5 meters minimum above adjacent grade.
2. Use OPW 523AV for the clean air vent.
3. The clean air vent piping should remain a minimum of 1-1/2" NPT (DN40).
4. The vent creates a Hazardous Location.
 - a. Class 1, Division 1 within 3 feet in all directions of the vent opening.
 - b. Class 1, Division 2 between 3 feet and 5 feet in all directions of the vent opening
 - c. Follow all applicable codes.

5.4 Hydrocarbon Return Piping

1. The Control System hydrocarbon return (permeate) should be connected to the low-grade gasoline storage tank.
2. It is important that return piping connections are separated from the inlet piping connections, so the permeate return vapors cannot be drawn directly back into the inlet piping.
3. The hydrocarbon return piping must slope away from Control System. This pipe will be carrying liquid condensation from the separator, and supersaturated vapor.
Minimum slope: 1/8" per foot (0.5°, 10 mm/1 meter)
Recommended slope: 1/4" per foot (1°, 20 mm/1 meter)
4. The hydrocarbon return piping should remain 1-1/2" NPT (DN40) minimum until it returns to the storage tank. Some special installation may allow smaller pipe to be used as long as the internal diameter is not less than 3/4 inch (DN20) and the length does not exceed 10 feet (3 meters); for longer pipe runs of 3/4 inch (DN20) consult OPW Technical Support for installation review.
5. For maintenance purposes, it may be desired to install a 1-1/2" (DN40) or 2" (DN50) ball valve. Ensure that the valve has a 1-1/2" (40mm) diameter flow opening and is approved for gasoline use. NEVER OPERATE THE VAPORSAVER WITH THE SERVICE VALVES CLOSED; damage to the Vaporsaver will occur. It is highly recommended that the valve handle is removed to avoid tampering.



NOTES:

PERMEATE AND RESIDUE VAPOR PIPING TO BE MINIMUM DN40 (1-1/2").

FEED VAPOR PIPING TO BE MINIMUM DN50 (2").

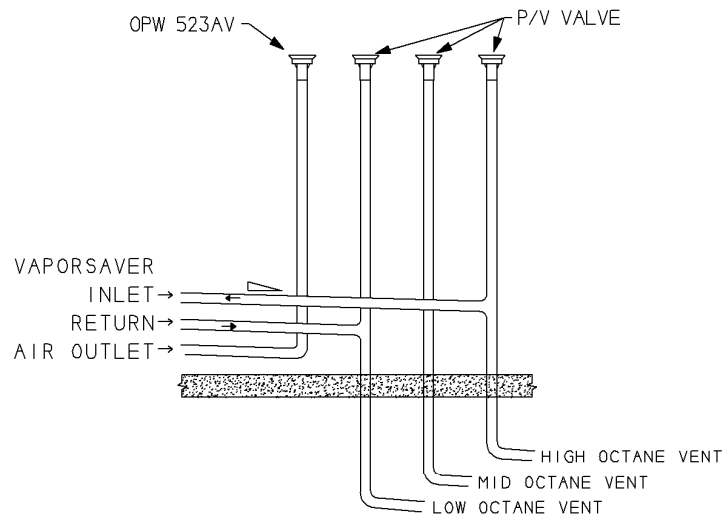
ALL VAPOR PIPING CONNECTING VAPORSAVER TO VENTS MUST SLOPE DOWN TOWARD VENTS AT MINIMUM 10mm/1m (0.5° , 1/8"/FOOT).

PIPING CONNECTIONS SHOWN ARE FOR USE WITH UNDERGROUND VAPOR MANIFOLD.

IMPORTANT WARNING!:
IF SERVICE BALL VALVES ARE INSTALLED, IT IS IMPERATIVE THAT THE VAPORSAVER IS NEVER OPERATED WITH THE BALL VALVES CLOSED. DAMAGE TO THE UNIT WILL OCCUR. IT IS HIGHLY RECOMMENDED THAT THE VALVE HANDLES ARE REMOVED TO AVOID TAMPERING.

IM-VR113

VAPORSAVER CONNECTIONS WITH UNDERGROUND VAPOR MANIFOLD



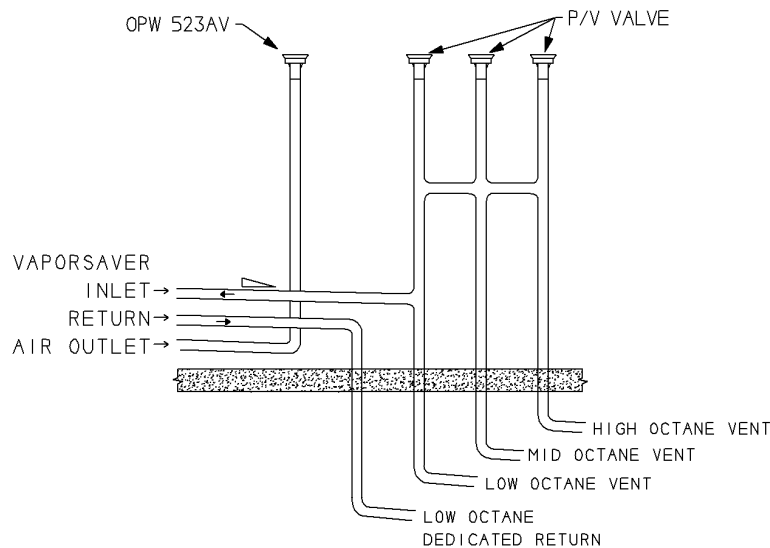
IMPORTANT INSTALLATION NOTES:

FOR BEST PERFORMANCE, AVOID A VAPOR MANIFOLD NEAR THE VAPORSAVER THAT MAY RECIRCULATE THE RETURNED VAPOR DIRECTLY BACK TO THE VAPORSAVER INLET.

IF THE ONLY VAPOR MANIFOLD IS LOCATED AT THE P/V VALVES, THE VAPORSAVER RETURN PIPE SHOULD NOT CONNECT TO THE VENT STACKS, BUT SHOULD HAVE A DIRECT DEDICATED CONNECTION TO THE LOW GRADE TANK.

IM-VR182

VAPORSAVER CONNECTIONS WITHOUT UNDERGROUND VAPOR MANIFOLD



IMPORTANT INSTALLATION NOTES:

FOR BEST PERFORMANCE, AVOID A VAPOR MANIFOLD NEAR THE VAPORSAVER THAT MAY RECIRCULATE THE RETURNED VAPOR DIRECTLY BACK TO THE VAPORSAVER INLET.

IF THE ONLY VAPOR MANIFOLD IS LOCATED AT THE VENT STACKS, THE VAPORSAVER RETURN PIPE SHOULD NOT CONNECT TO THE VENT STACKS, BUT SHOULD HAVE A DIRECT DEDICATED CONNECTION TO THE LOW GRADE TANK.

IM-VR190

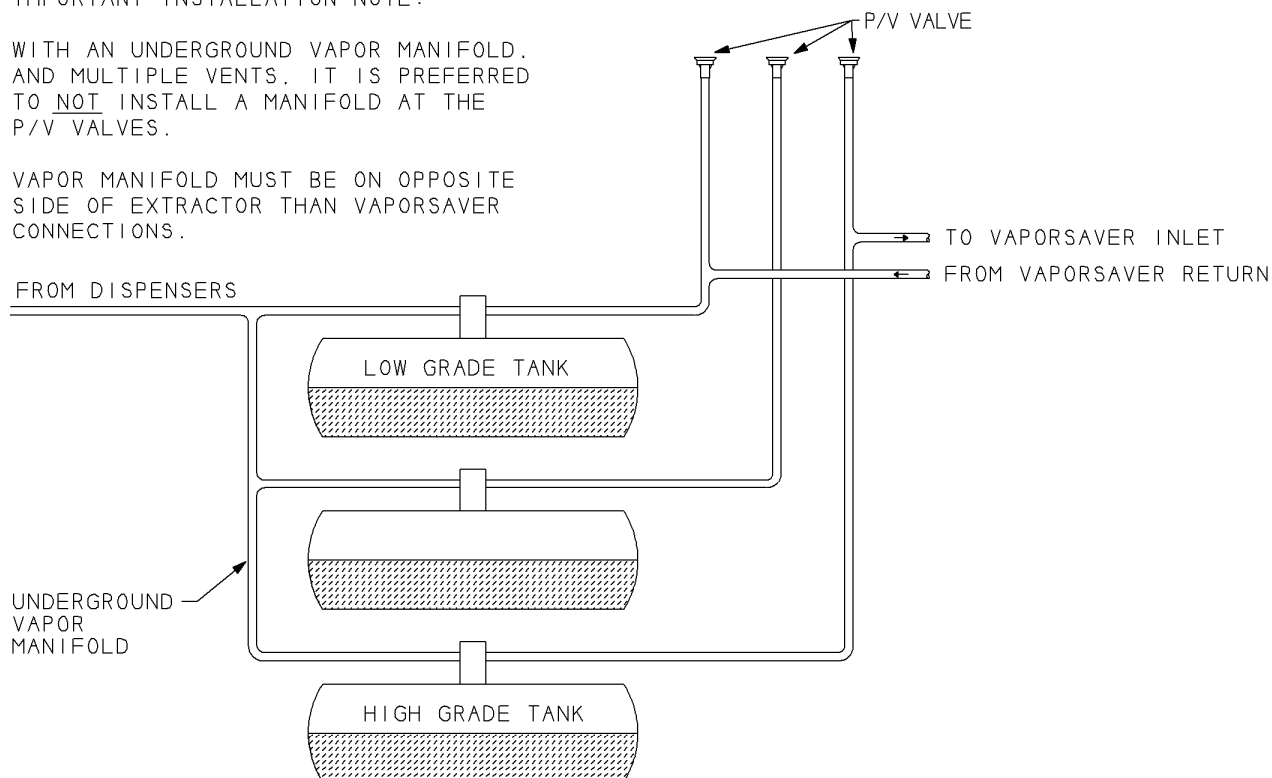
5.5 Storage Tank Vapor Manifolds

1. Storage tanks must be vapor manifolded. The location of the vapor manifold will have an impact on how the Vaporsaver feed and return can be piped.
2. A manifold too close to the Control System may cause recirculation of the permeate return back to the Vaporsaver inlet. Therefore, if the only vapor manifold is an above ground manifold near the Vaporsaver, the permeate should not connect to the vent stacks, but instead should have a dedicated return to the low grade tank.
3. Some local authorities require manifolding in one location or the other; check with the local authority having jurisdiction.
4. Above ground manifolding should be minimum 12 feet (4 meters) above adjacent grade; if it is not, sufficient overfill prevention must be fitted to ensure that liquid cannot cross contaminate tanks nor enter the Vaporsaver.
5. Vent openings must be greater than 12 feet (4 meters) above adjacent grade and have an approved pressure/vacuum valve.
6. All above ground vapor piping must be schedule 40 galvanized steel, and painted to minimize solar heat gain.
5. The vent creates a Hazardous Location.
 - a. Class 1, Division 1 within 3 feet in all directions of the vent opening.
 - b. Class 1, Division 2 between 3 feet and 5 feet in all directions of the vent opening
 - c. Follow all applicable codes.

IMPORTANT INSTALLATION NOTE:

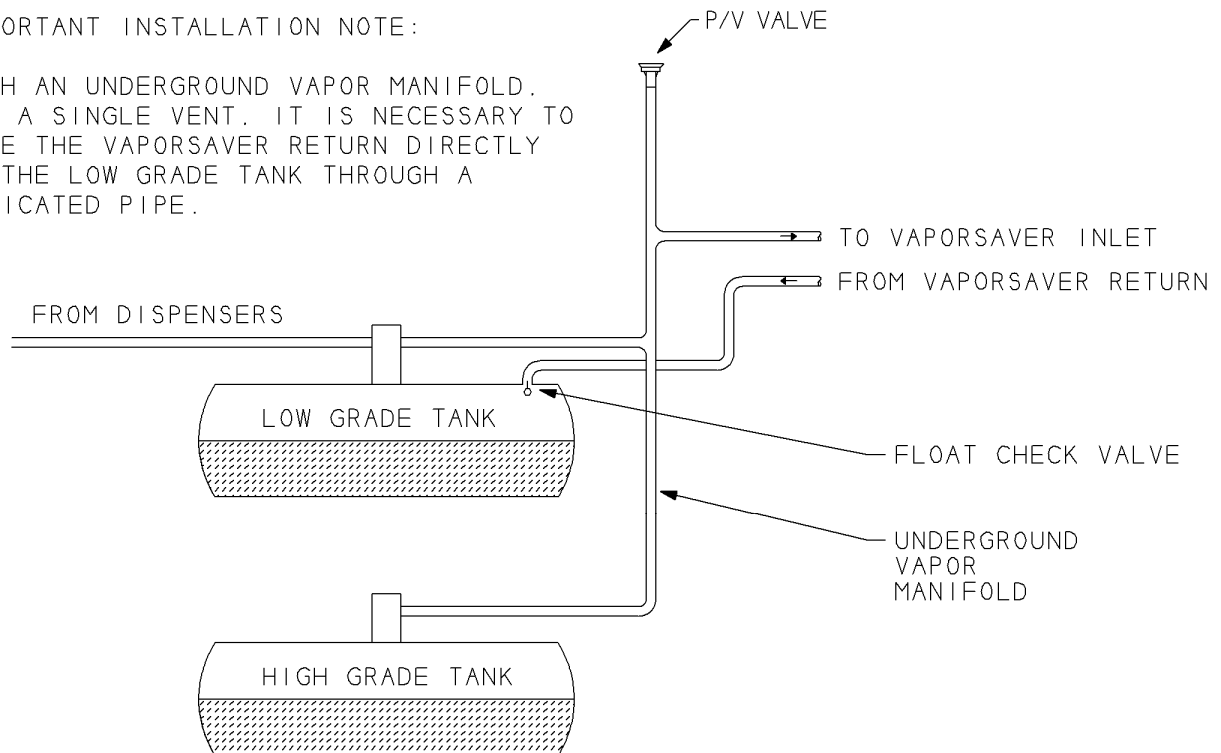
WITH AN UNDERGROUND VAPOR MANIFOLD, AND MULTIPLE VENTS, IT IS PREFERRED TO NOT INSTALL A MANIFOLD AT THE P/V VALVES.

VAPOR MANIFOLD MUST BE ON OPPOSITE SIDE OF EXTRACTOR THAN VAPORSAVER CONNECTIONS.



IMPORTANT INSTALLATION NOTE:

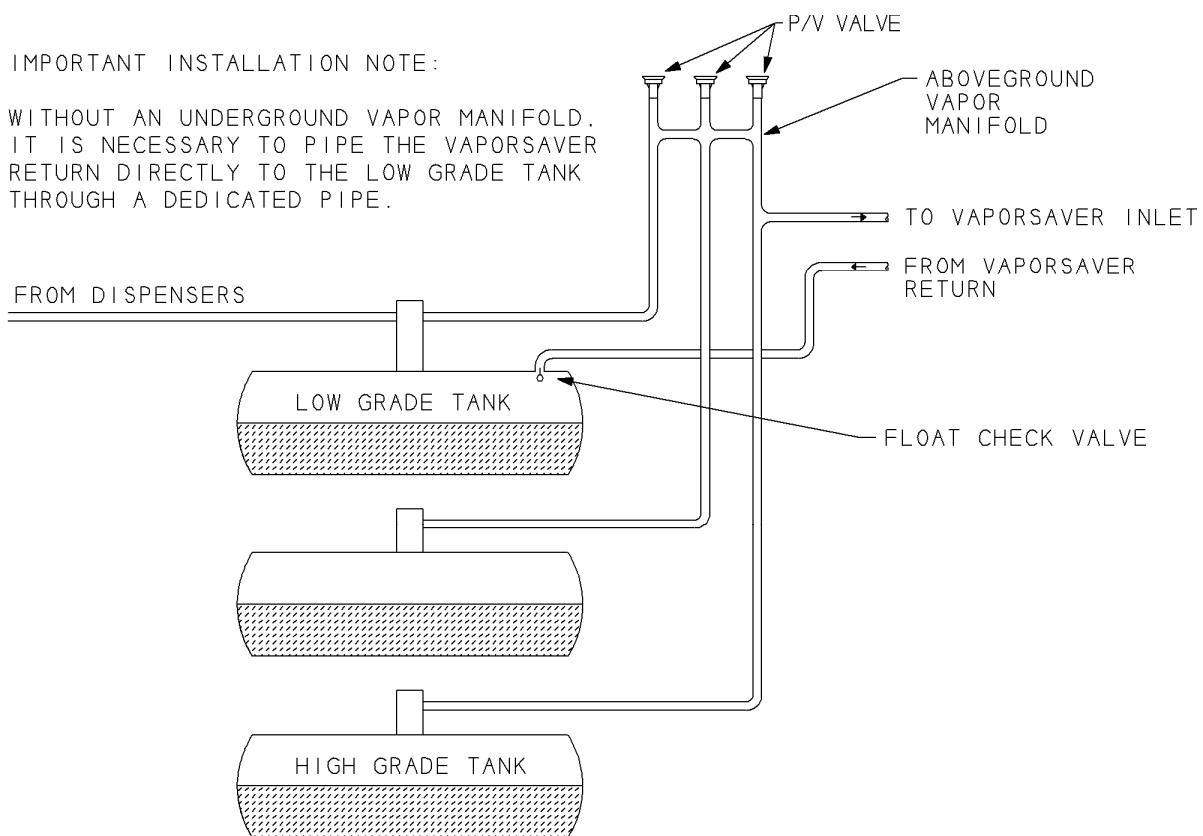
WITH AN UNDERGROUND VAPOR MANIFOLD, AND A SINGLE VENT, IT IS NECESSARY TO PIPE THE VAPORSAVER RETURN DIRECTLY TO THE LOW GRADE TANK THROUGH A DEDICATED PIPE.



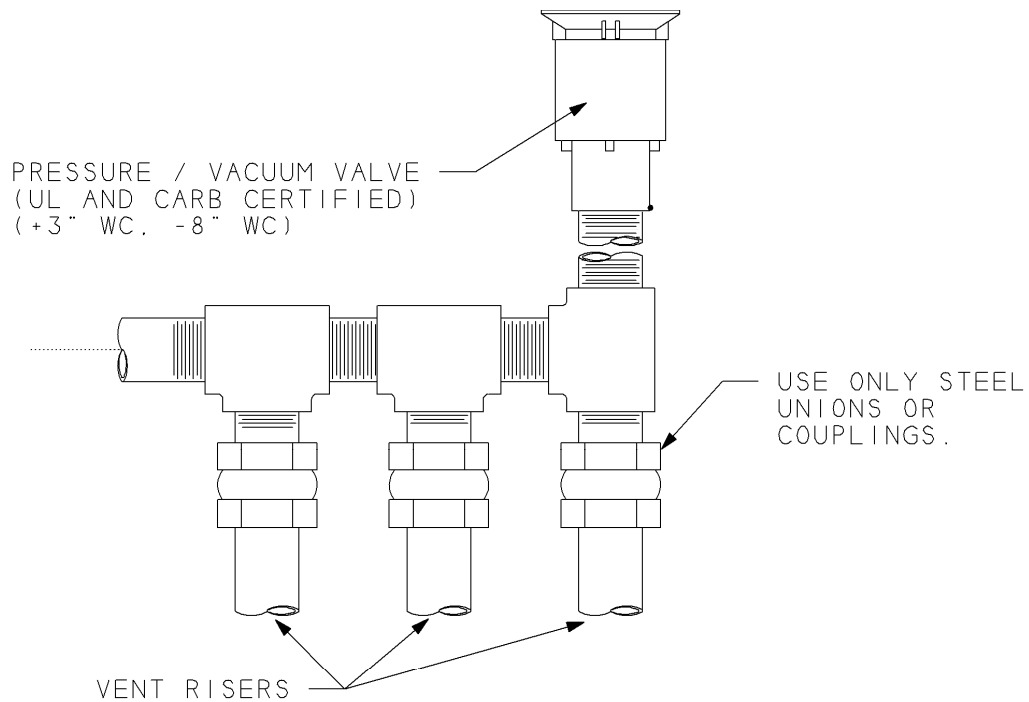
IM-VR185

IMPORTANT INSTALLATION NOTE:

WITHOUT AN UNDERGROUND VAPOR MANIFOLD, IT IS NECESSARY TO PIPE THE VAPORSAVER RETURN DIRECTLY TO THE LOW GRADE TANK THROUGH A DEDICATED PIPE.



IM-VR188



IM-VR009

Alternate pressure/vacuum vent valve settings must be preapproved by OPW to ensure that the Vaporsaver's safety and performance are not compromised. Always follow the local authority regulations and approvals.

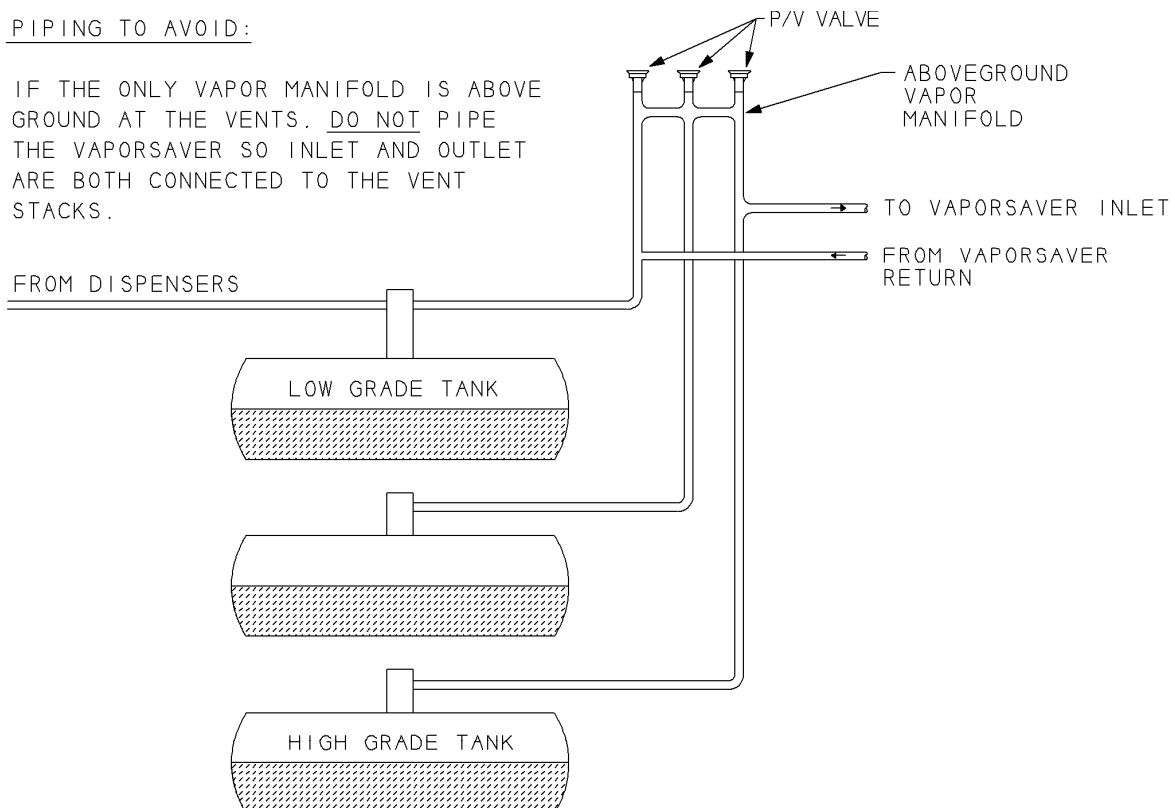
5.6 Piping To Avoid

1. To obtain the maximum product recovery, best performance, and longest life of the Vaporsaver, there are several piping configurations that should be avoided.
2. Remember, the main rule for piping is that the Control System should pull from and return to different locations of the vapor system.
3. It is important that return piping connections are separated from the inlet piping connections, so the permeate return vapors cannot be drawn directly back into the inlet piping.
4. Piping must be configured so that permeate return will reach the storage tank before it is recirculated back to the Vaporsaver inlet.

The following drawings show the wrong way to install a Vaporsaver.

PIPING TO AVOID:

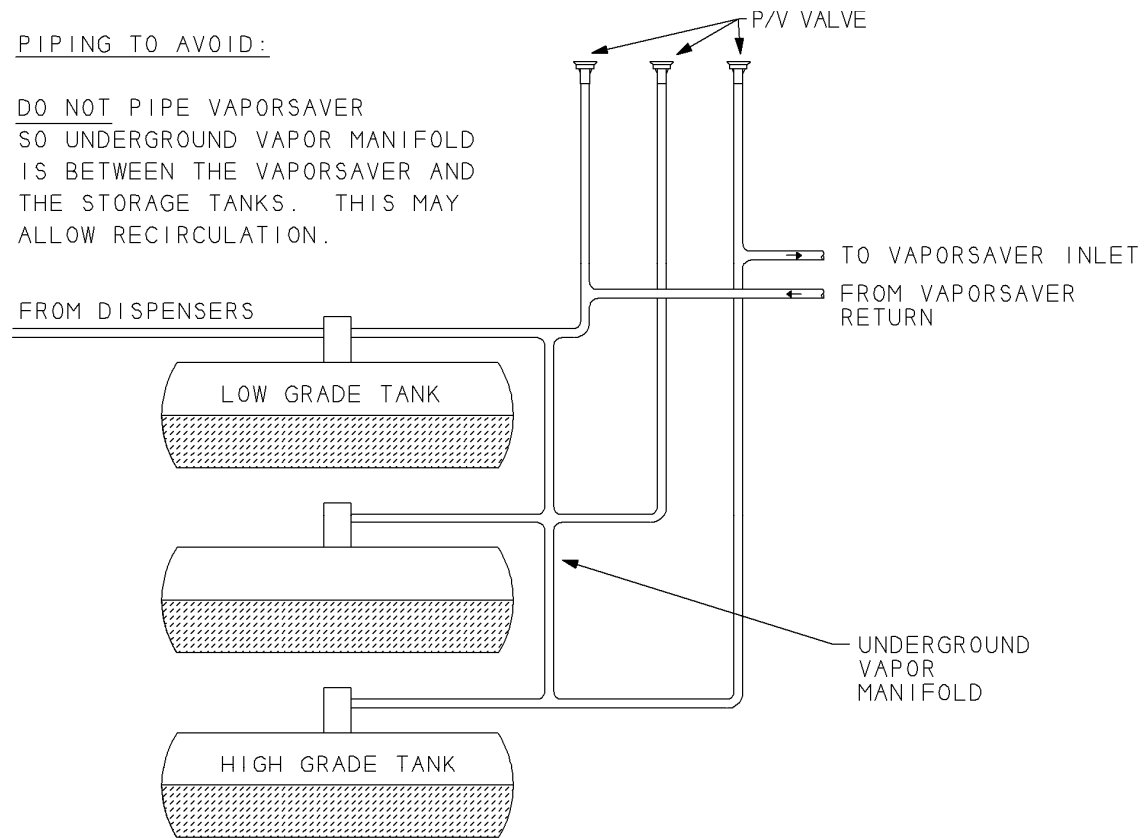
IF THE ONLY VAPOR MANIFOLD IS ABOVE GROUND AT THE VENTS. DO NOT PIPE THE VAPORSAVER SO INLET AND OUTLET ARE BOTH CONNECTED TO THE VENT STACKS.



IM-VR186

PIPING TO AVOID:

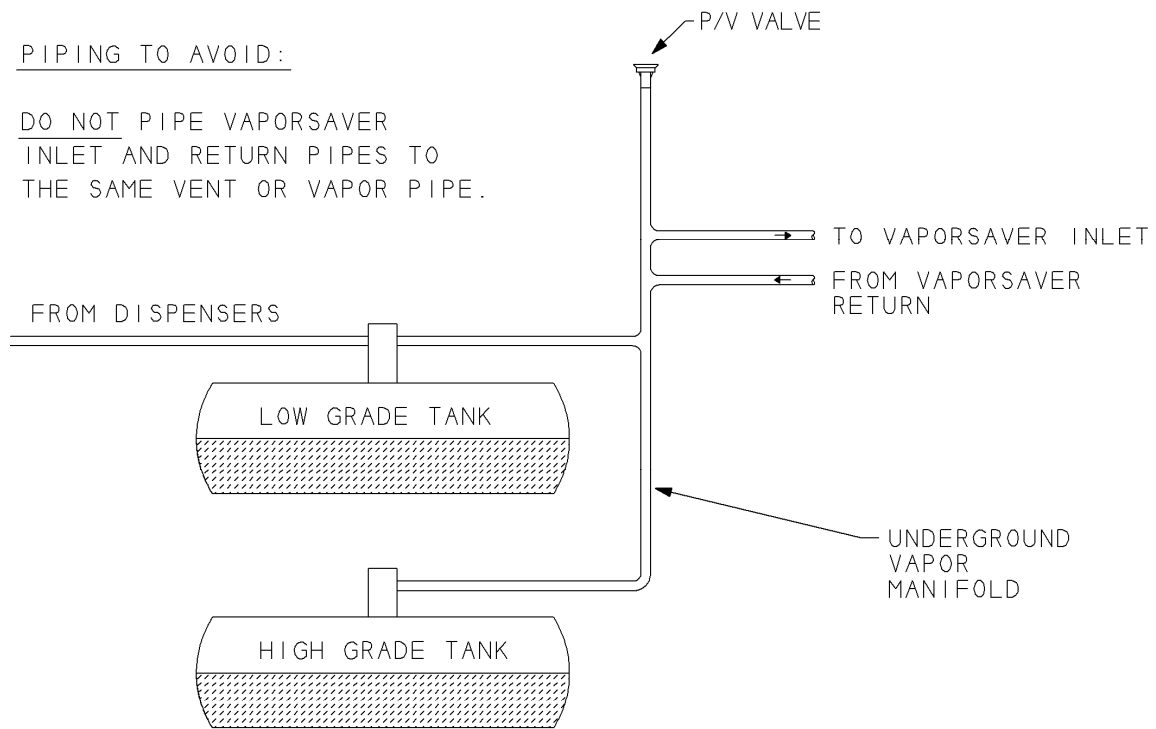
DO NOT PIPE VAPORSAVER
SO UNDERGROUND VAPOR MANIFOLD
IS BETWEEN THE VAPORSAVER AND
THE STORAGE TANKS. THIS MAY
ALLOW RECIRCULATION.



IM-VR187

PIPING TO AVOID:

DO NOT PIPE VAPORSAVER
INLET AND RETURN PIPES TO
THE SAME VENT OR VAPOR PIPE.

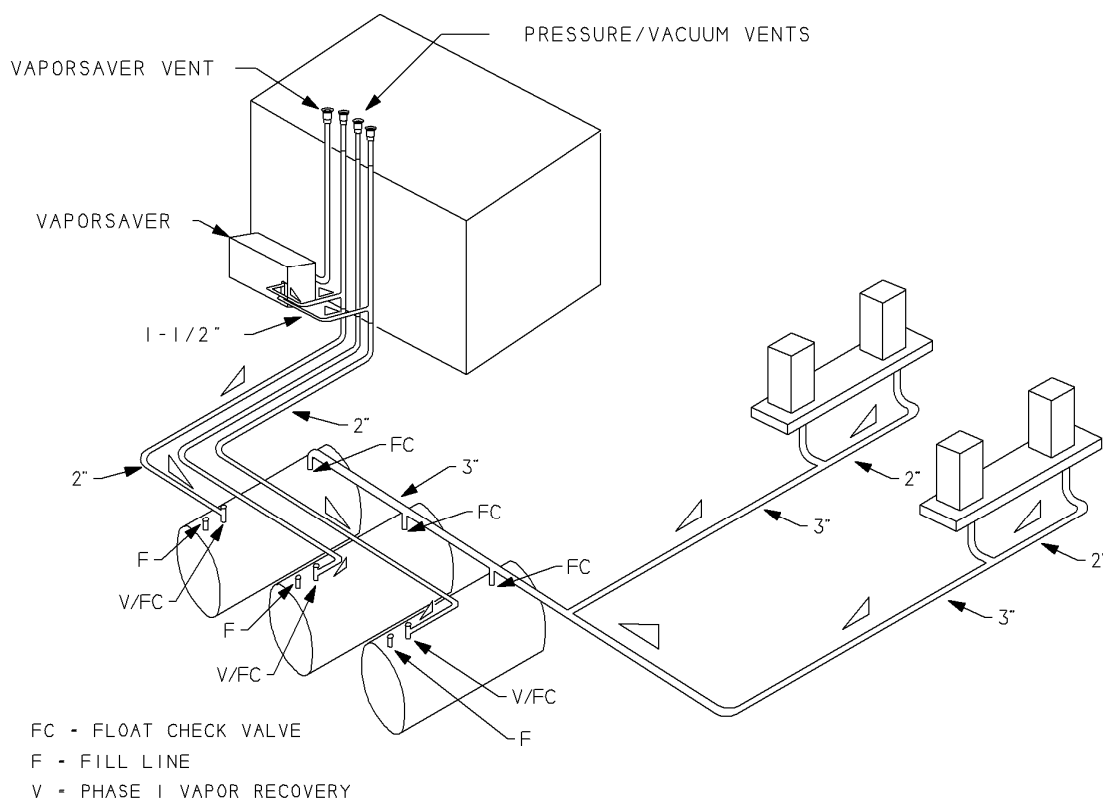


IM-VR189

5.7 Stage 2 Station Underground Piping

1. All underground vapor piping must be a minimum of 2" NPT. Always check with local authorities for applicable requirements; larger pipe size may be required.
2. All vapor piping must have slope for drainage to the underground storage tanks.
3. Slope minimum 1/8" per foot (0.5°, 10 mm/1 meter); recommended 1/4" per foot (1°, 20 mm/1 meter).
4. Always follow the requirements of the local authorities and the manufacturer of the Stage 2 vapor recovery system.

Typical Vapor Piping Layout



NOTE:

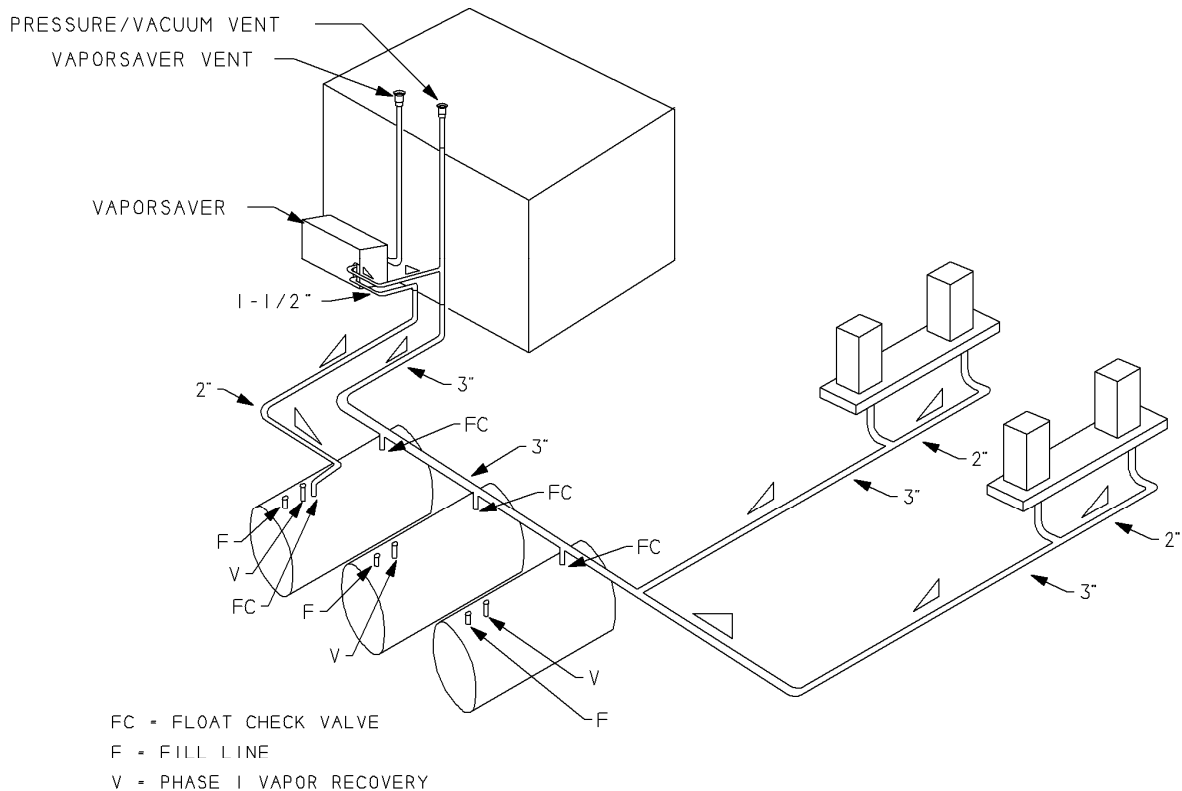
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
1/4" PER FOOT PREFERRED

IM-VR115

Notes:

- Always follow requirements of component and system manufacturers, local, state and national authorities for installation and operation of all equipment.
- Vent piping diameters must comply with applicable codes.
- Feed piping from the Control System to the vents shall be 2" nominal ID (DN50).
- Permeate and Residue piping from the control system to the vents shall be 1-1/2" nominal ID (DN40) minimum.

Typical Vapor Piping Layout



NOTE:

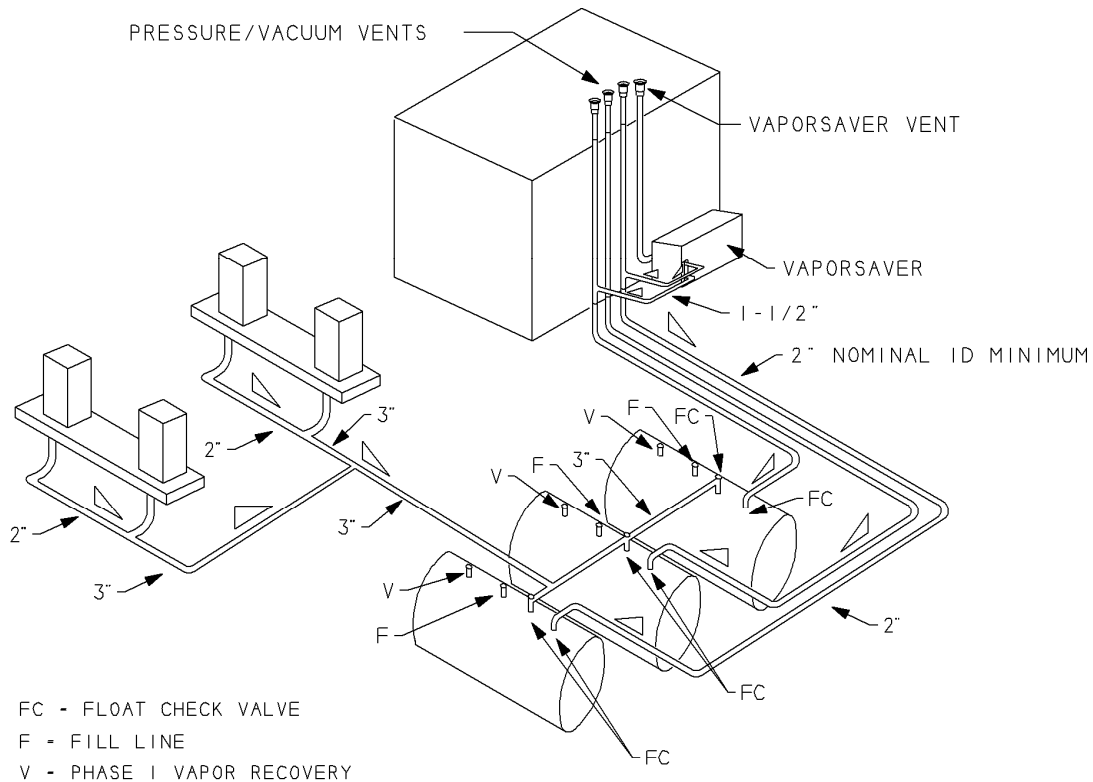
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
1/4" PER FOOT PREFERRED

IM-VR094

Notes:

- Always follow requirements of component and system manufacturers, local, state and national authorities for installation and operation of all equipment.
- Vent piping diameters must comply with applicable codes.
- Feed piping from the Control System to the vents shall be 2" nominal ID (DN50).
- Permeate and Residue piping from the control system to the vents shall be 1-1/2" nominal ID (DN40) minimum.

Typical Vapor Piping Layout



NOTE:

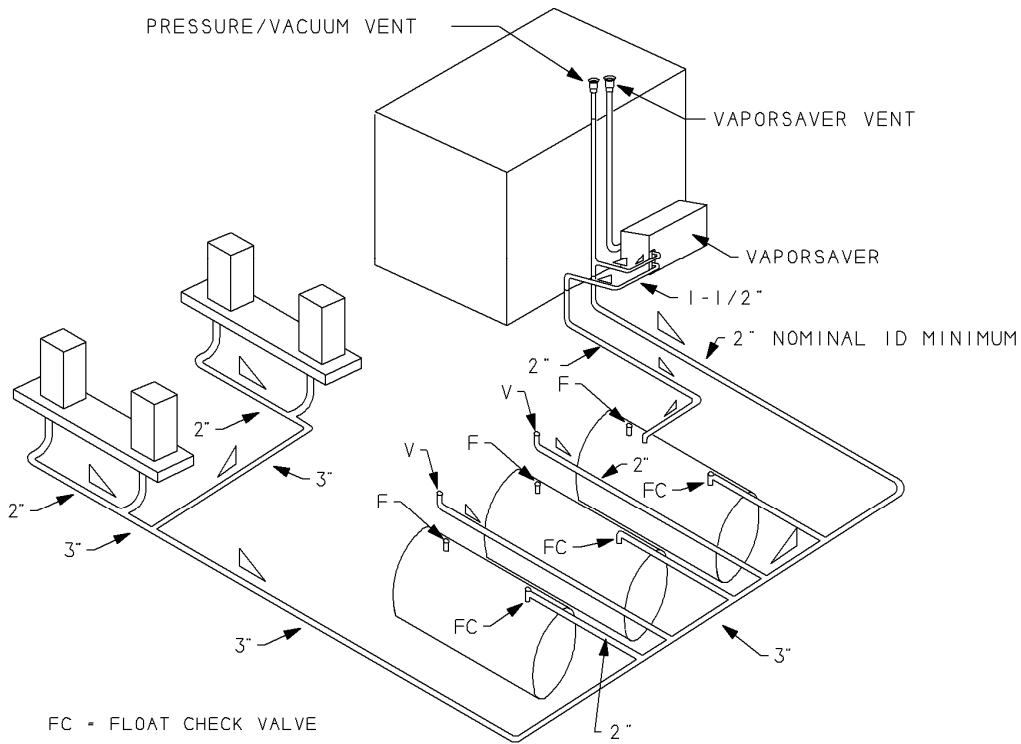
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
 1/4" PER FOOT PREFERRED

IM-VR130

Notes:

- Always follow requirements of component and system manufacturers, local, state and national authorities for installation and operation of all equipment.
- Vent piping diameters must comply with applicable codes.
- Feed piping from the Control System to the vents shall be 2" nominal ID (DN50).
- Permeate and Residue piping from the control system to the vents shall be 1-1/2" nominal ID (DN40) minimum.

Typical Vapor Piping Layout



FC = FLOAT CHECK VALVE
 F = FILL LINE
 V = PHASE I VAPOR RECOVERY

NOTE:

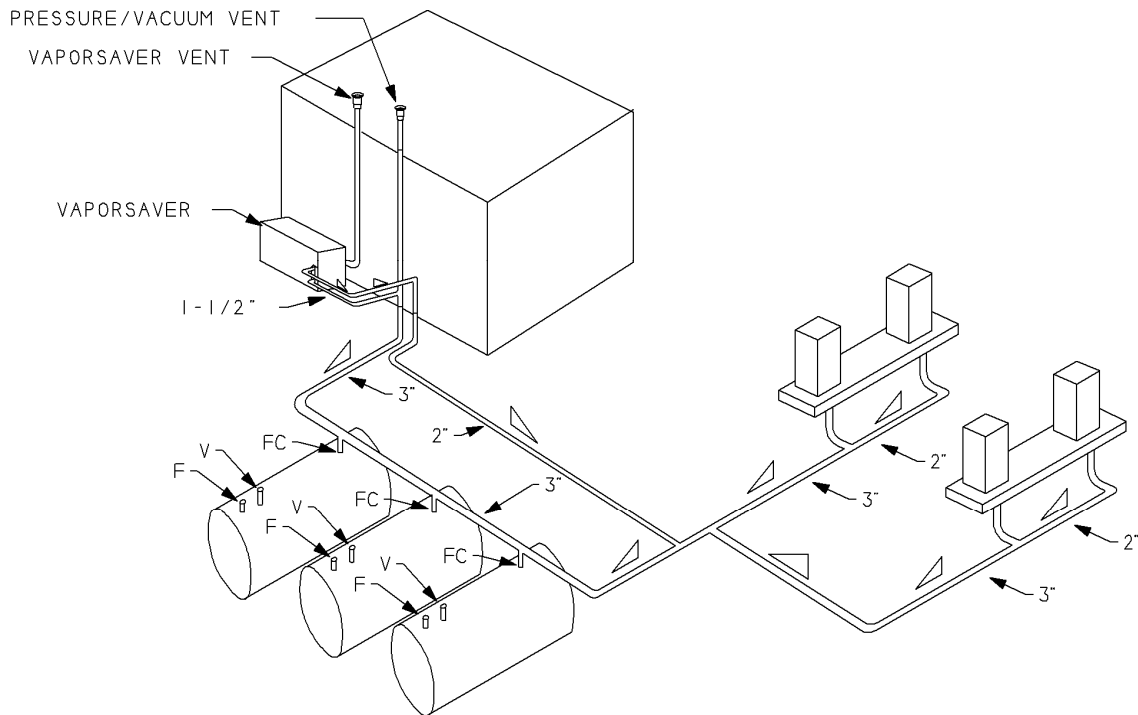
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
 1/4" PER FOOT PREFERRED

IM-VR133

Notes:

- Always follow requirements of component and system manufacturers, local, state and national authorities for installation and operation of all equipment.
- Vent piping diameters must comply with applicable codes.
- Feed piping from the Control System to the vents shall be 2" nominal ID (DN50).
- Permeate and Residue piping from the control system to the vents shall be 1-1/2" nominal ID (DN40) minimum.

Typical Vapor Piping Layout



FC = FLOAT CHECK VALVE
 F = FILL LINE
 V = PHASE I VAPOR RECOVERY

NOTE:

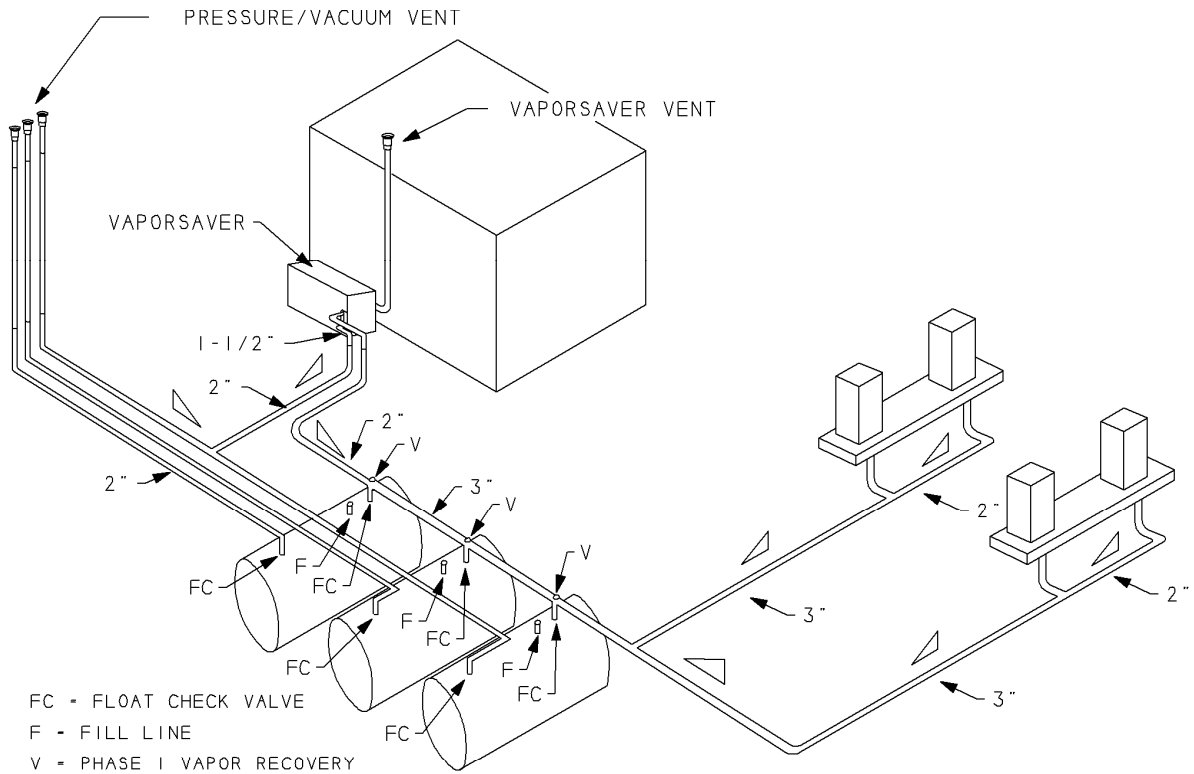
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
 1/4" PER FOOT PREFERRED

IM-VR134

Notes:

- Always follow requirements of component and system manufacturers, local, state and national authorities for installation and operation of all equipment.
- Vent piping diameters must comply with applicable codes.
- Feed piping from the Control System to the vents shall be 2" nominal ID (DN50).
- Permeate and Residue piping from the control system to the vents shall be 1-1/2" nominal ID (DN40) minimum.

Typical Vapor Piping Layout



NOTE:



1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID
MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
1/4" PER FOOT PREFERRED

IM-VR116

Notes:

- Always follow requirements of component and system manufacturers, local, state and national authorities for installation and operation of all equipment.
- Vent piping diameters must comply with applicable codes.
- Feed piping from the Control System to the vents shall be 2" nominal ID (DN50).
- Permeate and Residue piping from the control system to the vents shall be 1-1/2" nominal ID (DN40) minimum.

6.0 Electrical Requirements

|  WARNING | |
|--|--|
|  | <p>This system uses lethal voltages and operates in areas where flammable vapors and liquids may be present.</p> <p>Serious injury or death from electrical shock, fire, or explosion may result if the power is on during installation.</p> <p>Turn power off, lockout and tag power to the unit while installing the system.</p> <p>Read and understand all instructions in this manual and all applicable requirements of the National Electric Code, federal, state and local codes, as well as other applicable safety codes.</p> |

6.1 Power Requirements

1. Vaporsaver System
208-230 VAC, 50/60 Hz, 2.4 Hp plus 1/2 amp, Single Phase
2. A circuit disconnect device is not included with the Vaporsaver System. A readily accessible two pole disconnect device must be incorporated in the installation wiring for the motor.
3. The Vaporsaver system must be grounded in accordance with Article 504 of the NEC.
4. This product shall be installed in accordance with the National Electrical Code (NFPA 70) and the Automotive and Marine Service Station Code (NFPA 30A).
5. The User Interface has internal fuse: 500 mA (slow-blow), 250 V, 5mm x 20mm. The fuse is to only be replaced by qualified and certified technicians.
6. An electrical service (circuit overload breaker) of 20 amp / 240V should be used. Verify required over-current protection ampacity with NEC requirements for load and conductor ampacity ratings and with the local authority having jurisdiction. Note: The motor in the Vaporsaver 1 has full load amperage rating of 12 amps, but the start-up inrush current is higher. Always verify motor ratings on motor nameplate.
7. A lockable circuit breaker shall be supplied in accordance with local, state and national authorities. Some jurisdictions require that the main circuit breaker for the Vaporsaver system be locked in the ON position during normal operation. This is to avoid accidental shut-off of the system. It is also good practice to follow standard lock-out/tag-out procedures when performing service on the unit and may be required by local, state, and national authorities. (For padlock requirement use Square D model: HPAFK; Square D model: QBPA or equivalent for specific breaker).
8. Equipment connected to this device must not use, store or generate more than 250 V rms or dc with respect to ground.
9. The Vaporsaver 1 main power should be controlled by the facility's main Emergency Shut-Off system.

6.2 Control System Electrical Hook Ups

1. System Breaker shall be sized for power load based on NEC requirements.
2. Wiring between the User Interface and the Control System shall be as follows.
 - a. All wiring (208-230 VAC and 24VDC) to be TFFN or THHN with 600 V insulation, gasoline and oil resistant.
 - b. Wiring for the 24 VDC control signals shall be minimum 18 AWG.
 - c. Two ground wires shall be run from the Control System junction box to the load center ground; one is for equipment ground, and the second is for a dedicated Intrinsically Safe Barrier ground. Both ground wires must be minimum 12 AWG (follow all NEC requirements for equipment and Intrinsically Safe Barrier grounding). Proper grounding for the Intrinsically Safe Barrier is crucial for safe operation of the Barriers.
 - d. Both the motor power (208-230 VAC) wiring and the signal wiring (24 VDC) can be routed in the same conduit provided all wiring meet NEC 725-27; use only TFFN and/or THHN, gasoline and oil resistant wiring with 600 V insulation.
 - e. Wiring for 208-230 VAC to power motor shall be minimum 12 AWG; sizing must comply with NEC requirements for motor load and wiring distance. Larger gage wire may be necessary based on conductor length and voltage supplied by load center.
 - i. The following table should be used as a guide to help in correctly sizing motor conductors based on length. Always follow NEC and the requirements of the local authorities.
 - ii. The following table is based on using a conductor ampacity rating of 140% of the motor nameplate rating. Motor nameplate: 12.0 A; 140% of motor nameplate: 16.8A.
 - iii. NEC recommends a maximum conductor voltage drop of 3%, but notes that with a conductor voltage drop of 5%, most devices should operate with acceptable efficiency. It should be noted that with a conductor voltage drop of 5%, motor starting capabilities are reduced, and difficult starting may occur especially if the load center voltage is supplying 208 VAC. So, if the load center is supplying 208 VAC, use 3% voltage drop as the maximum allowable whenever possible. With the load center supplying 230 VAC, most installations should have acceptable operation with a maximum conductor voltage drop of 5%. But, always remember that lower conductor voltage drop is always better for motor starting and operating efficiency; so whenever possible **use the 3% conductor voltage drop**.
 - iv. Running voltage at the motor must never drop below 197 VAC. Motor operation may become significantly affected.

Conductor Length and Size Guide

Maximum conductor length is the total length of the conductor from the load center through the User Interface to the motor.

Maximum Conductor Length (1-Phase)

| Voltage | | 208 | 208 | 230 | 230 |
|----------------|-----------------|---------------|-----------|----------|-----------|
| % Voltage Drop | | 3% | 5% | 3% | 5% |
| | | | | | |
| AWG | mm ² | Feet (meters) | | | |
| 12 | 3.3 | 91(28) | 151 (46) | 100 (30) | 167 (51) |
| 10 | 5.3 | 144 (44) | 240 (73) | 159 (48) | 265 (81) |
| 8 | 8.4 | 229 (70) | 382 (116) | 254 (77) | 423 (129) |

Notes:

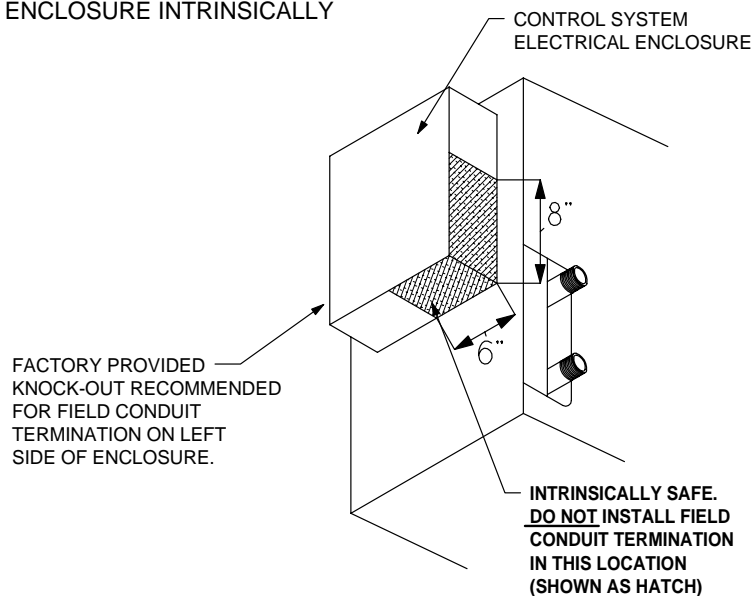
- These tables are based on 140% of nameplate ratings, if national or local authority will allow voltage drop conductor length calculations based on load ampacity rating of 125% of motor nameplate, multiply the maximum length in the table by 1.12 to get the new maximum conductor length.
- THESE TABLES ARE ONLY TO BE USED AS A REFERENCE.
- ALWAYS VERIFY AND FOLLOW NATIONAL AND LOCAL ELECTRICAL REGULATIONS.

7.0 Other Requirements

7.1 Other Electrical Requirements

1. Seal-offs are required as per NPFA 70 (National Electrical Code) for a conduit run leaving a Division 2 location to an unclassified location. Install as required by NEC and local authority having jurisdiction. Other seal-offs may be necessary based on the installation and site specifics.
2. Wiring shall be sized as specified in the NEC for the load and conductor length from the load center to the motor.
3. The Control System is supplied with a knock-out for recommended field conduit termination. This knock-out is supplied with a weather tight plug. If an alternate location to terminate the field conduit in the Control System electrical enclosure is chosen, the following must be followed.
 - a. Do not remove the factory knock-out weather tight plug.
 - b. A field knock-out must never be installed in Control System electrical enclosure into the Intrinsically Safe zone.

DO NOT TERMINATE FIELD CONDUIT
INTO THE CONTROL SYSTEM
ELECTRICAL ENCLOSURE INTRINSICALLY
SAFE ZONE.



IM-VR122

7.2 Storage Tank Overfill Devices

Storage tank over fill prevention devices must be used to ensure that in the event of an overfill liquid gasoline does not enter the Control System. Damage may occur, and may result in a hazardous condition.

7.3 P/V Valve

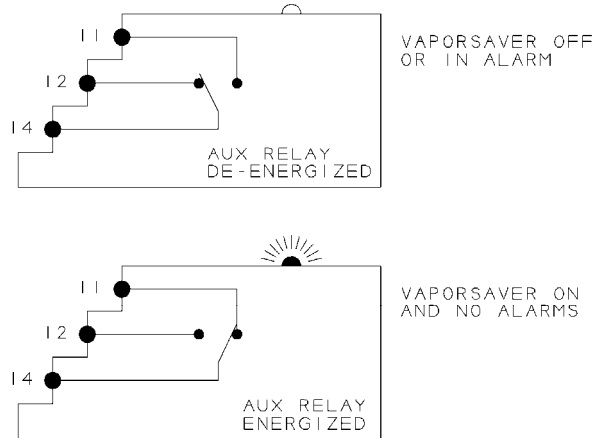
1. Required minimum one per site (always verify requirements of the local authorities).
2. Use CARB and UL approved valve. (In California, consult the latest applicable Executive Order for acceptable P/V vent valves).
3. Typical pressure setting: +3" wc +/- 1/2" wc (verify setting with local authority).
4. Typical vacuum setting: -8" wc +/- 2" wc (verify setting with local authority).

7.4 Other Control System Requirements

1. All tests referenced in this document are to the current revisions of the approved procedures in California. Other states may require the use of alternate approved methods. Always verify with the local authority having jurisdiction the applicability of CARB or other approved test methods.
2. The Vaporsaver should not be used with any flexible vapor or vent piping.
3. During Pressure Decay Test (CARB TP-201.3 and Exhibit 3 of the latest applicable CARB Executive Order), the Vaporsaver must be powered off.
4. During Tie Tank Test (CARB TP-201.3C), the Vaporsaver must be powered off.
5. During Dynamic Back Pressure Test (CARB TP-201.4), the Vaporsaver must be powered off.
6. During Air/Liquid (A/L) ratio testing (Exhibit 5 of the latest applicable CARB Executive Order), the Vaporsaver can be either on or off, as it has no impact on the testing. Typically the Vaporsaver is left powered to help in controlling the vapor growth associated with air ingestion and liquid return during A/L testing.
7. To ensure proper operation of all vapor recovery components and systems (including the Vaporsaver) the entire vapor system (piping, tanks, valves, dispensers...) at a minimum must be able to pass Pressure Decay (CARB TP-201.3 and Exhibit 3 of the latest applicable CARB Executive Order), Tie Tank (TP-201.3C), Dynamic Back Pressure (TP-201.4) and A/L (Exhibit 5 of the latest applicable CARB Executive Order) tests. Always follow local authority requirements.
8. Other testing may be required by the local authority for other vapor system components, systems, or sub-systems:
 - a. During Leak Rate of Drop Tube and Drain Valve Assembly Test (CARB TP-201.1C), the Vaporsaver can be either on or off, as it has no impact on the testing. Typically the Vaporsaver is left powered to continue controlling storage tank pressure.
 - b. During Leak Rate of Drop Tube Overfill Prevention Devices and Spill Container Drain Valves Test (CARB TP-201.1D), the Vaporsaver must be powered off.
 - c. During Leak Rate and Cracking Pressure of Pressure/Vacuum Vent Valves Test (CARB TP-201.1E), since the pressure/vacuum vent valve is removed from the vapor system, the Vaporsaver must be powered off.
 - d. During Static Torque Test (CARB TP-201.1B), the Vaporsaver can be either on or off, as it has not impact on the testing.
 - e. During the Determination of Pressure of the Underground Gasoline Storage Tanks (Exhibit 4 of the latest applicable CARB Executive Order), the Vaporsaver must be powered on.

7.5 Auxiliary Output Relay

1. The User Interface is equipped with an Auxiliary Output Relay for external monitoring of the Vaporsaver system. It is located on the main terminal block.
2. When the Vaporsaver is powered and operating normally, the Aux Relay is energized (green LED on Aux Relay is lit). When the Vaporsaver is either powered off, or is in Alarm, the Aux Relay is de-energized.
3. Aux Relay contact rating: 240V, 6A with 4000V isolation.



8.0 Control System Maintenance

The OPW Vaporsaver is designed to require very little scheduled maintenance. The following table is a general guide of what is required.

8.1 Maintenance

1. Every 36 months, the Hydrocarbon Sensor must be returned to OPW for calibration or replacement. There are no serviceable parts in the Hydrocarbon Sensor. The calibration date of the Sensor can be verified by checking at two locations:
 - a. The Hydrocarbon Sensor has a calibration label showing the calibration due date. Remove the Control System covers to access the Sensor.
 - b. A second calibration label is located on the side of the User Interface enclosure or on the front of the Control System electrical enclosure. Also, when a Sensor is replaced in the field, the replacement sensor is supplied with a new calibration label on the Sensor and a second label is to be placed by the installer next to the original calibration label.
2. Every 12 months, check all belts for wear and proper tension. Only replace belts with same size and type as originally installed. See Section 8.3 for belt tension guidelines.
3. Every 12 months, check Control System operating pressure and vacuum readings.
4. Every 12 months, visually check the Control System for overall wear issues.
5. Every 12 months check total run time (TRT). If approaching or greater than the maximum hours stated in Section 8.4 replace pumps. Verify records to ensure pumps have not already been changed.

8.2 Repair and Maintenance Interval

The OPW Vaporsaver is designed to require very little scheduled maintenance. The following table is a general guide of what is required. Please keep in mind that in most applications a single Vaporsaver manages the tank pressure for the entire site. In some cases the Vaporsaver is the station's vehicle of compliance to ORVR and/or EVR regulations. Repair and maintenance of the Vaporsaver, like all equipment, is inevitable. To ensure end-users can enjoy the benefits of the Vaporsaver's operation, whether in terms of compliance or for the quantifiable savings of fuel due to eliminated vapor emissions, all precautions to minimize down time must be taken. OPW recommends that the Vaporsaver have an allowable repair and maintenance interval not to exceed 72 hours. The allowable interval for your market may vary. OPW products should be used in compliance with applicable federal, state, provincial, and local laws and regulations. The 72-hour interval was arrived at using the following worst-case scenario:

1. Alarm sounds at station, contractor dispatched
2. Contractor arrives at site, Vaporsaver diagnosed, part unavailable locally
3. OPW Cincinnati ships part via Next Day Air on a Saturday
4. Sunday part in route
5. Monday part received by contractor, repair completed

OPW has many parts stocking distributors so the scenario above, though possible, should be the exception and not the rule. It's also important to note that should a Vaporsaver shutdown for any reason the GFD will default back to the PV vent valve managing tank pressures, exactly how many sites throughout the country operate today.

In California, repair and maintenance intervals are subject to the interpretation of local Air Quality Management Districts (AQMD). Please contact your local AQMD for guidance in your specific District.

8.3 General Rules for Belt Tensioning

1. Ideal belt tension is the lowest tension at which the belt will not slip under peak conditions.
2. Over tensioning shortens pump, bearing and belt life.
3. Keep belts free from foreign material that may cause slippage.
4. Never apply belt dressing, as this will damage the belt and cause early failure.
5. Only replace belts with OPW specified belt size and type.
6. Over tensioning belts places extra load on the motor. An overly tight belt can add several amps to the motor loading.
7. The Vaporsaver is supplied with spring-loaded/self-adjusting belt tensioners require minimal or no adjustment.
8. IMPORTANT: After changing or adjusting belts, always measure the motor full load amperage; it must be less than the full load rating of the motor.

8.4 Component Replacement

The User Interface has a totalizer (TRT: total run time since first installed) that is part of the continuous scrolling screens. This totalizer shall be used for the following maintenance/replacement items:

- a. It is recommended that the compressor pump be replaced at approximately 5000 hours of operation, and is required to be replaced before 8,500 hours of operation.
- b. It is recommended that the Vacuum pump be replaced at approximately 10,000 hours of operation, and is required to be replaced before 12,000 hours of operation.
- c. The Membrane Module may need to be replaced at approximately 15,000 hours of operation.

8.5 Spare Parts

14-40010: Drain valve
14-40015: Fan assembly
14-40200: Membrane module replacement assembly (with o-rings)
14-40300: PLC
14-40350: Display
14-40400: Power supply
14-40401: I.S. Barrier (1 channel)
14-40402: I.S. Barrier (2 channel)
14-40406: I.S. Power supply
14-41002: Motor (UL, 60 Hz)
14-41003: Motor (UL, 50 Hz)
14-41121: Pressure switch (PS2)
14-41225: Pressure regulator
14-41240: Compressor (UL)
14-41241: Vacuum Pump (UL)
14-42700: Pressure switch (PS3)
14-44002: Hydrocarbon sensor
14-44300: Belt, compressor
14-44400: Belt, vacuum pump
14-48231: Pressure switch (PS0)
14-48230: Pressure switch (PS1)
14-55000: Membrane module replacement o-ring kit

Contact OPW Fueling Components Customer Service or Technical Support for other available spare parts kits.

9.0 Glossary of Terms

| | |
|-----------------------|---|
| A/L | Air to liquid ratio. With any vapor recovery system A/L relates to the volume of air (or vapor) returned by the vapor recovery system (usually measured in Cubic Ft.) divided by the volume of liquid dispensed (7.481 Gallons U.S. = 1 Cubic Ft.). |
| CARB | California Air Resource Board. |
| Control System | The enclosure that houses the membrane, motor, pumps and associated hardware that mounts to the vapor space of the UST to control tank pressure. |
| Feed | Vapor flow which the Vaporsaver pulls from the storage tank, pressurizes, partially condenses and enters the membrane. |
| NEC | National Electric Code (NFPA 70). |
| ORVR | Onboard Refueling Vapor Recovery refers to vehicles equipped with their own vapor recovery system. |
| Permeate | Supersaturated vapor flow from the Vaporsaver returned to the storage tank. |
| Residue | Clean air exhaust from the Vaporsaver. |
| User Interface | The User Interface is the control panel for the Vaporsaver system. It contains the display and visual and audible indicators that allow personnel to observe the operational information of the Vaporsaver. It also allows end-users to set time/date and acknowledge alarms. |
| UST | Underground Storage Tank |
| Voltage Drop | The amount of voltage lost due to any components specific resistance. All components in an electrical circuit have an inherent voltage loss. (See Section 6.0) |

