Vaporsaver 1

Installation Manual

ATTENTION:

READ AND UNDERSTAND THIS IMPORTANT SAFTEY 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 to 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.

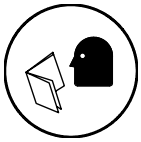
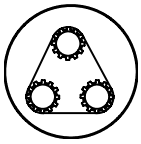
Installation, start-up, system maintenance and troubleshooting must be performed by qualified, certified service technicians. Certified technicians must be able to provide proof of certification at any time. Certification number is required for any start-up form to be completed or accepted by OPW as 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.

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 check list.

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 equipped with ORVR, or from Stage I bulk 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 +0.1 inches of water column pressure.
2. It turns off in the following conditions
    a. When UST pressure is reduced to approximately -0.5 inches of water column vacuum.
    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, can allow any dispenser based Stage II Vacuum Assist 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:

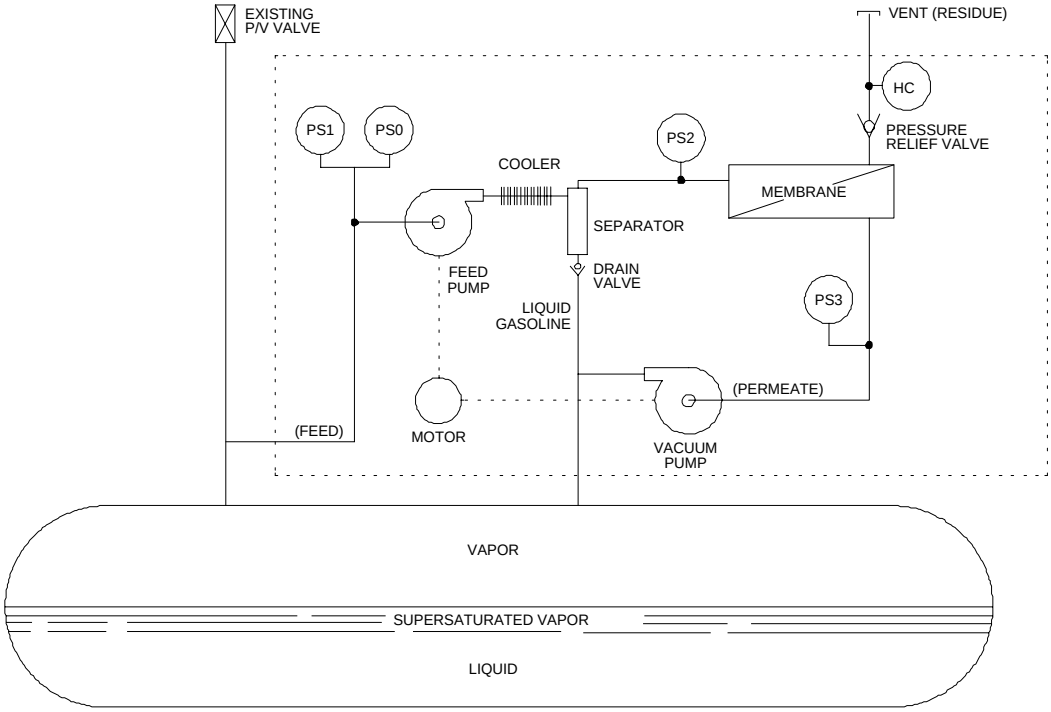
   a. station dispensing volume
   b. number and duration of drops
   c. fuel vapor pressure
   d. fuel temperature
   e. barometric pressure and temperature
   f. vapor tightness of the Stage I and Stage II Systems
   g. storage tank ullage
7. The amount of operating time per day can vary from station 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. Increasing pressure within the same volume causes the vapor stream temperature to rise.
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 later removal and 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 bond to the membrane material.
12. Air molecules are repelled by the membrane surface on the pressure side, and continue on until 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 released to the UST.

VAPORSAVER 1 CONTROL SYSTEM OPERATION SCHEMATIC



NOTE: ONLY VAPOR LINES SHOWN

MD-VR020

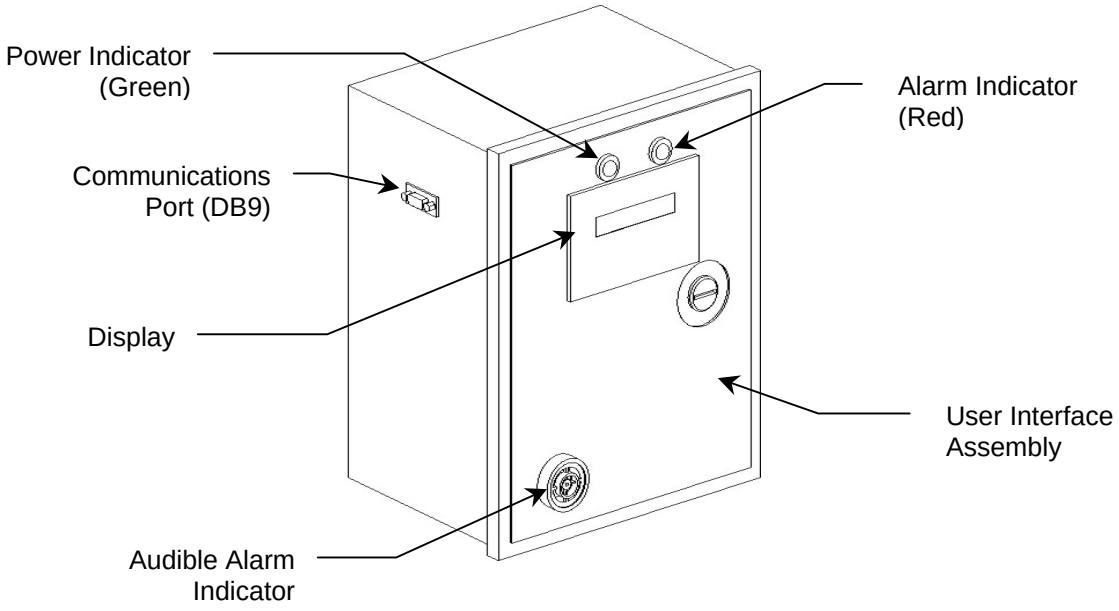
3.0 Component Identification

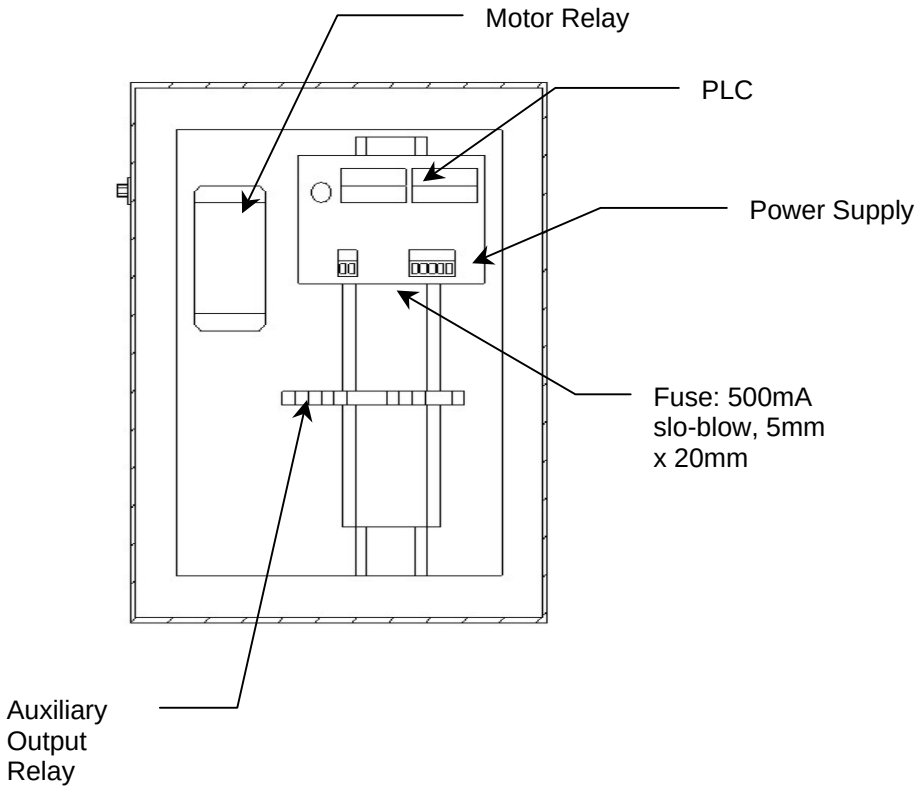
The Vaporsaver 1 consists of two major components: The User Interface and the Control System. The User Interface is the logic center of the system. It allows for interaction with the system for monitoring system status information, setting initial site configuration, and accessing recorded system history. 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:

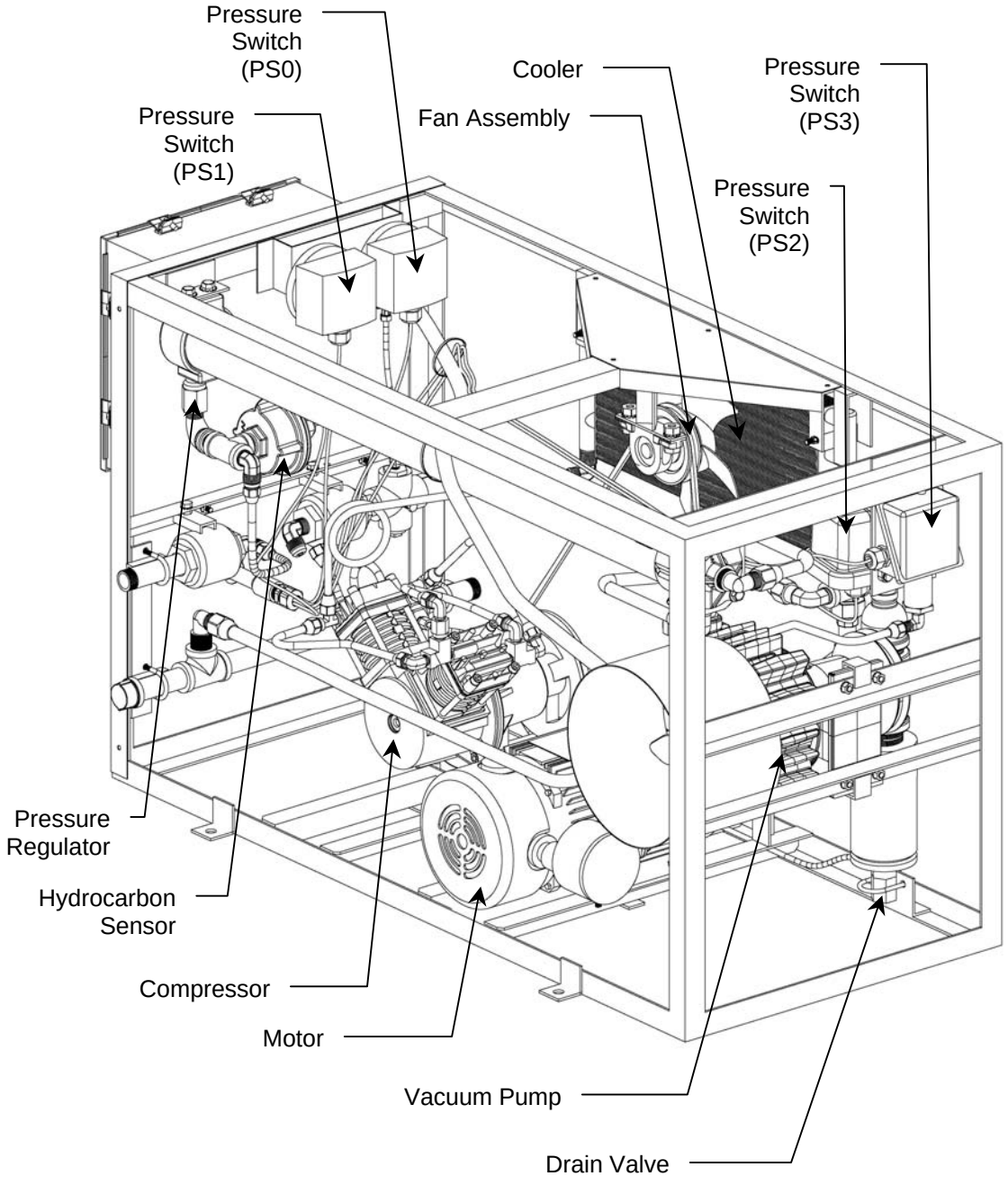
- Indicator lamps (Green - Power, Red – Alarm / Warning)
- Liquid crystal display (2 lines x 16 characters per line)
- A four button key pad
- Audible alarm indicator
- Auxiliary output alarm relay
- Port for serial communications (DB9, local or remote access)
- Operating temperature range: 32° F to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




Motor Relay
PLC
Power Supply
Fuse: 500mA
slo-blow, 5mm
x 20mm
Auxiliary
Output
Relay

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).**

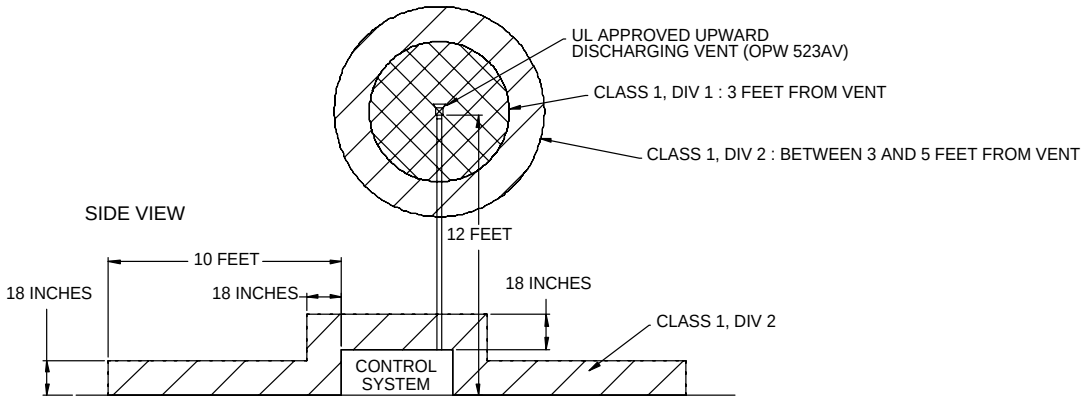
1. User Interface electrical enclosure must be installed indoors and protected from the weather.
2. The enclosure must be installed so station personnel can hear the audible alarm.
3. There must be clear access to the enclosure so station personnel can interact with it.
4. All conduit connections must 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.

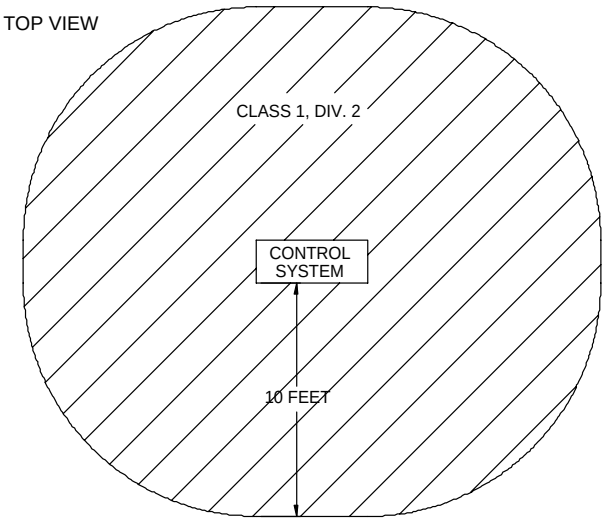
4.2 Control System Location

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. Class 1, Group D, Division 2 within 18 inches in all directions of the equipment extending to grade level. 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 POMECO/OPW pipe guards (POMECO SPG, 6PGU, or 6PGR series guards).

Classified/Hazardous Areas





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.

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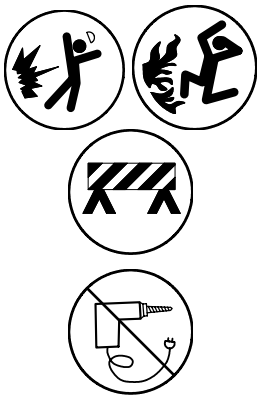
4.3 Control System Mounting

WARNING



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.

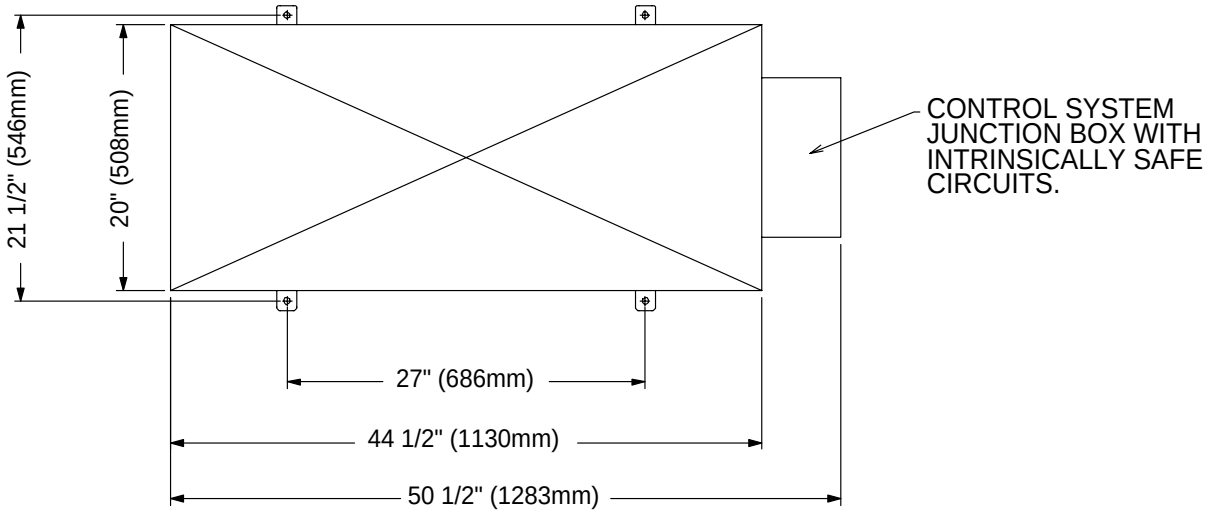
You are working in an area where vehicle traffic may occur. Always block off the work area during installation and service to protect yourself and others.

Do not use power tools that can generate sparks if there is a risk of flammable or explosive vapors or liquids being present.

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 POMECO/OPW island-form (p/n 6013-SFR6W3L6 or 6013-SFR6W3L5).

Control System Foot Print and Mounting

TOP VIEW



APPROXIMATE UNIT WEIGHT: 300 LB (135 kg)

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

IM-VR099

5.0 Control System Piping

WARNING

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.

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.

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.

5.1 General Piping Guidelines

1. The main guide for piping is that the Control System should pull from and return to different parts of the vapor system.
2. All aboveground piping must be schedule 40 galvanized; only use pipe that is internally and externally corrosion protected.

5.2 Inlet Piping

1. With vapor manifold tanks the Control System inlet is typically connected to the high-grade gasoline storage tank or the Stage II piping between the dispensers and the tanks.
2. Inlet piping must slope away from Control System and have slope to drain towards storage tanks. Slope minimum 1/4" per foot between the Vaporsaver and the vents.
3. Piping should remain a minimum of 2" ID from the Control System inlet connection pipe to the connection to the storage tank (or storage tank vents).

5.3 Clean Air Vent Piping

1. The clean air vent (residue) must be piped so the discharge opening is 12 feet minimum above adjacent grade.
2. The clean air vent must have an NFPA and UL approved upward discharging vent (Use OPW 523AV).
3. The clean air vent piping should remain a minimum of 1-1/2" ID.
4. The vent creates a hazardous location as per NFPA 30A.
    a. Class 1, Group D, Division 1 within 3 feet in all directions of the vent opening.
    b. Class 1, Group D, Division 2 between 3 feet and 5 feet in all directions of the vent opening.
    c. Follow all applicable codes.

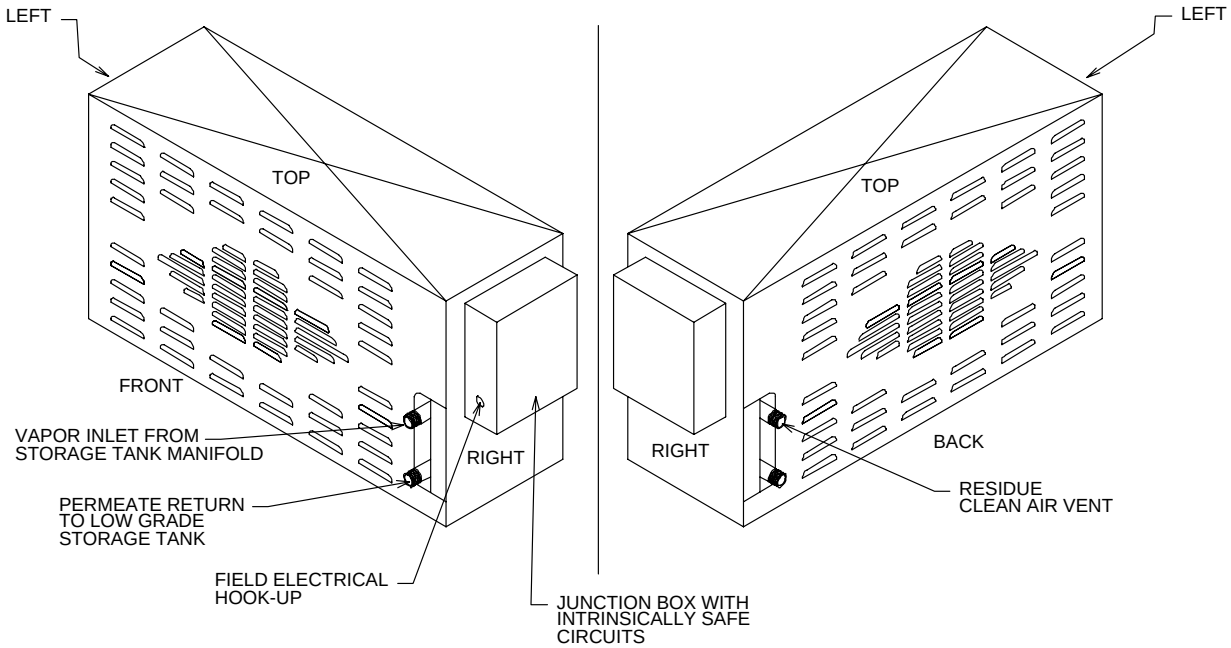
5.4 Hydrocarbon Return Piping

1. With vapor manifold tanks, the Control System hydrocarbon return (permeate) should be connected to the low-grade gasoline storage tank.
2. The hydrocarbon return piping has an extra exit – if the using the outlet on the front of the Control System causes installation problems, use the outlet on the back of the unit. The unused outlet pipe opening must be capped.
3. The hydrocarbon return piping must slope away from Control System. This pipe will be carrying liquid condensation from the separator, and supersaturated vapor. Slope minimum 1/4" per foot between the Vaporsaver and the vent.
4. The hydrocarbon return piping must remain 1-1/2" ID minimum until it returns to the storage tank.

5.5 Underground Piping

1. If the Control System is to be installed at a distance from the vents, underground piping can be installed to connect the Control System to the vent piping.
2. Minimum slope: 1/8” per foot (1/4” per foot recommended)
3. For underground piping, all of the above size and slope requirements must be met as well as all standard requirements for underground vapor piping. Never use flexible vapor piping.
4. Follow local requirements for underground vapor piping with regard to secondary containment.

Control System Piping Connections and Access



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

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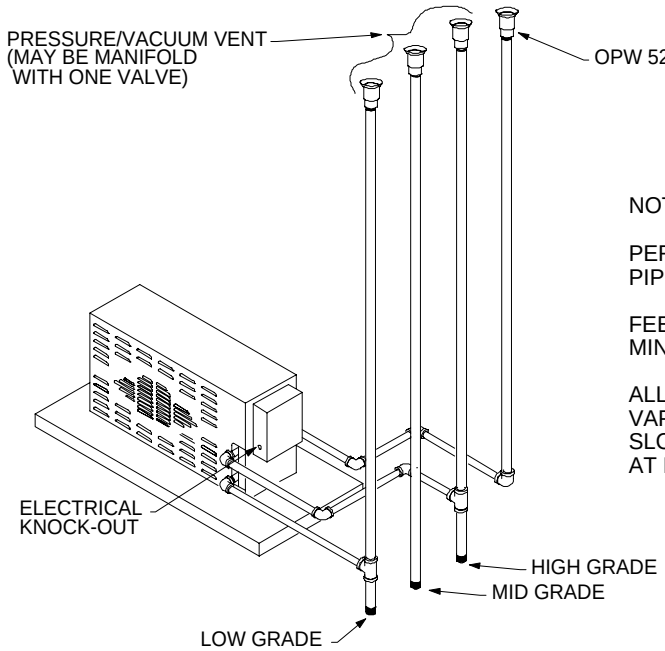
Control System Typical Piping



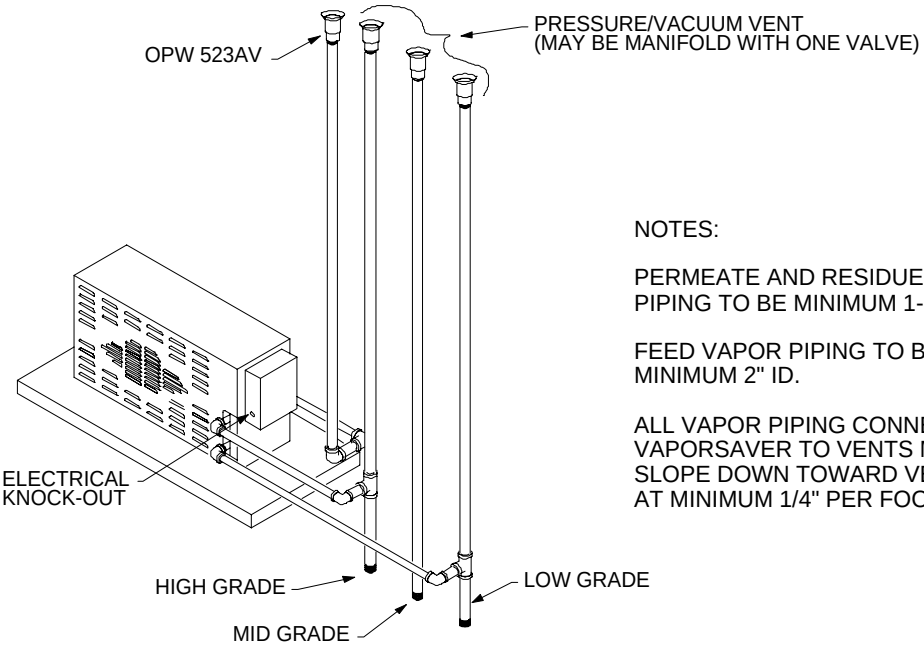
NOTES:

PERMEATE AND RESIDUE VAPOR PIPING TO BE MINIMUM 1-1/2" ID.

FEED VAPOR PIPING TO BE MINIMUM 2" ID.

ALL VAPOR PIPING CONNECTING VAPORSAVER TO VENTS MUST SLOPE DOWN TOWARD VENTS AT MINIMUM 1/4" PER FOOT

IM-VR112



NOTES:

PERMEATE AND RESIDUE VAPOR PIPING TO BE MINIMUM 1-1/2" ID.

FEED VAPOR PIPING TO BE MINIMUM 2" ID.

ALL VAPOR PIPING CONNECTING VAPORSAVER TO VENTS MUST SLOPE DOWN TOWARD VENTS AT MINIMUM 1/4" PER FOOT

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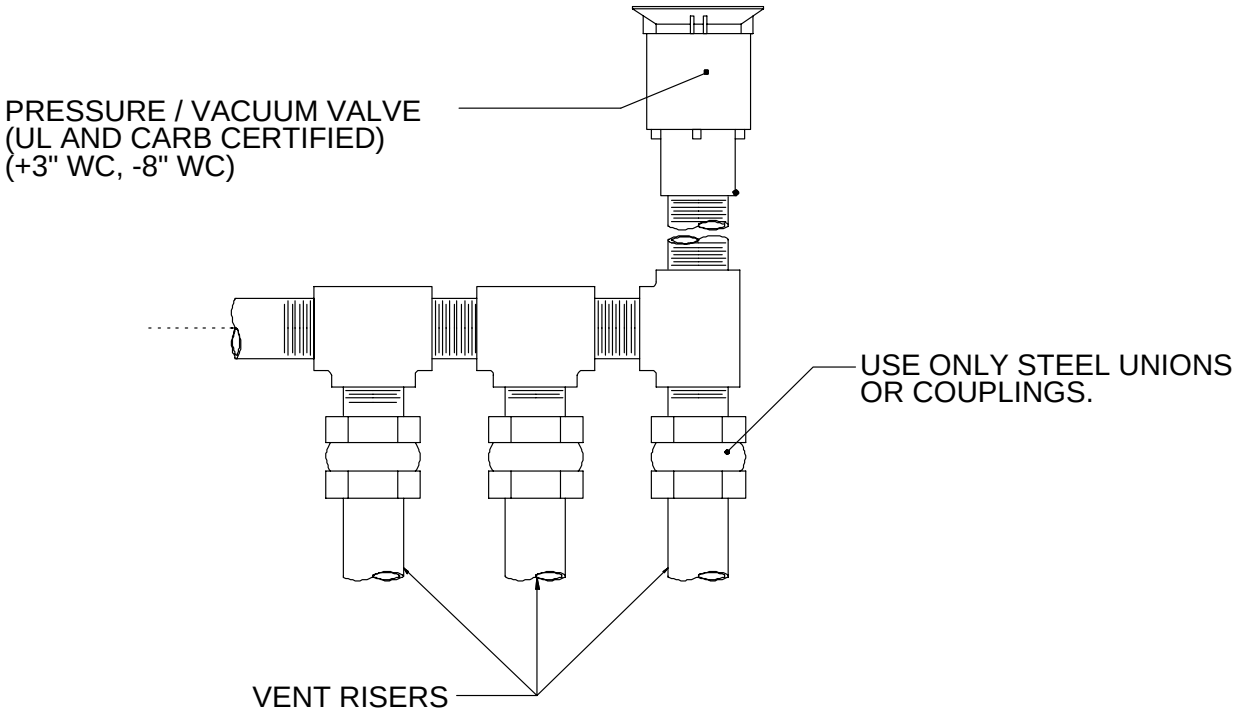
5.6 Storage Tank Vapor Manifolds

1. Storage tanks must be vapor manifold (above and/or below grade). Follow requirements of the local authority.
2. Some local authorities require manifold in one location or the other; check with the local authority having jurisdiction.
3. Above ground manifold must be minimum 12 feet above adjacent grade.
4. Tank vent openings must be greater than 12 feet above adjacent grade and have UL Listed and CARB Approved Pressure/Vacuum valves (In California, consult Executive Order G-70-204 for acceptable P/V vent valves).
5. All above ground vapor piping must be schedule 40 galvanized steel, and painted to minimize solar heat gain.
6. A hazardous location is created by the vents as per NFPA 30A.
    a. Class 1, Group D, Division 1 within 3 feet in all directions of the vent opening.
    b. Class 1, Group D, Division 2 between 3 and 5 feet in all directions of the vent opening.
    c. The classified area shall not extend beyond a solid floor, wall, roof, or other partition that has no communicating openings.

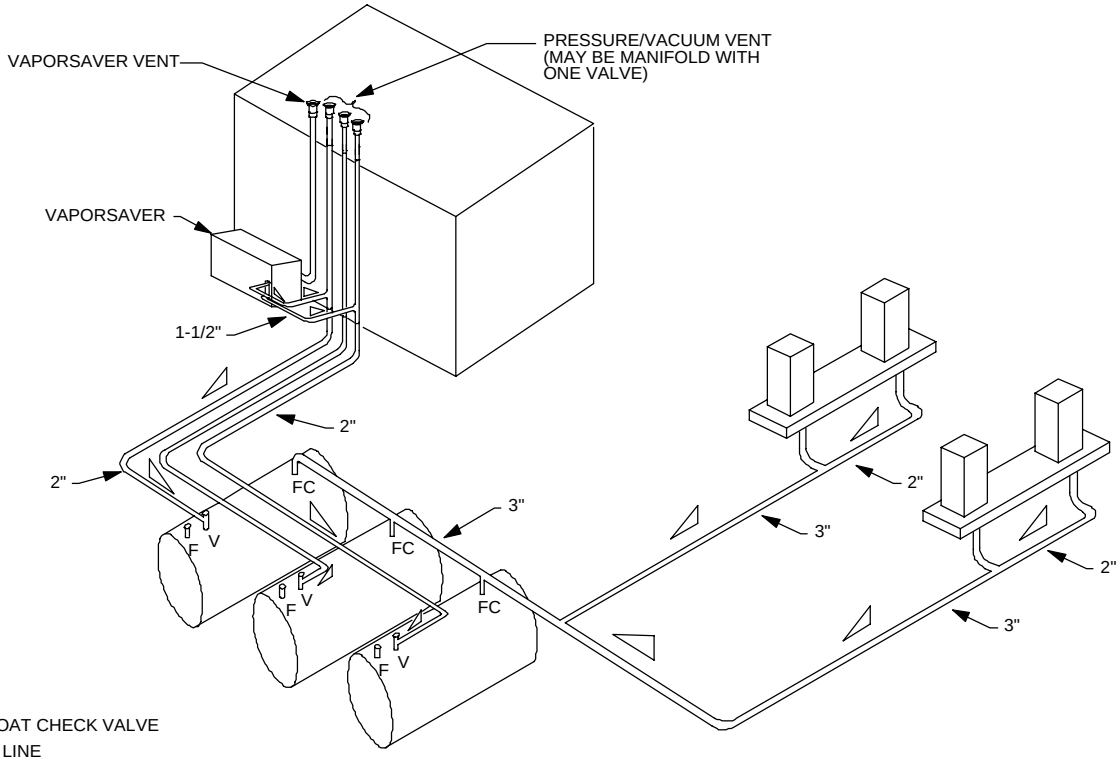
Typical Vent Manifold



5.7 Stage II 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. Minimum slope is 1/8 inch drop per foot run. Recommended wherever possible 1/4 inch drop per foot run.
4. Always follow the requirements of the local authorities and the manufacturer of the Stage II vapor recovery system.

Typical Vapor Piping Layout



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

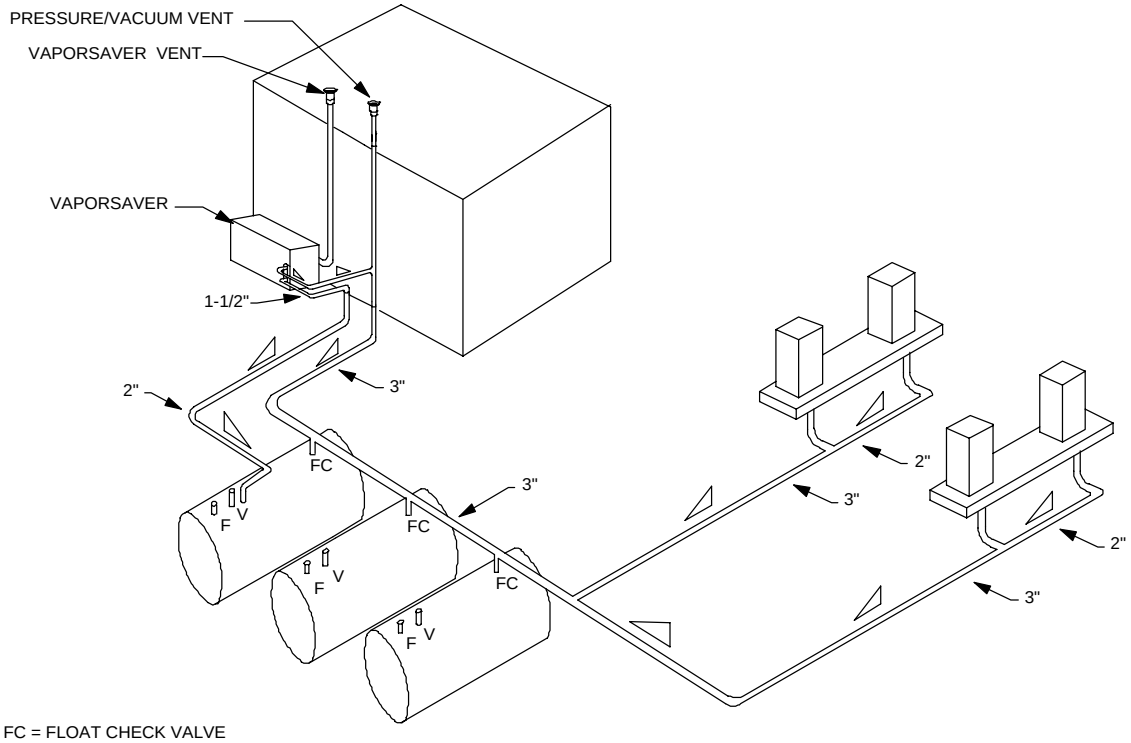
NOTE:
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
1/4" PER FOOT PREFERED

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.
- Permeate and Residue piping from the control system to the vents shall be 1-1/2” nominal ID minimum.

Typical Vapor Piping Layout



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

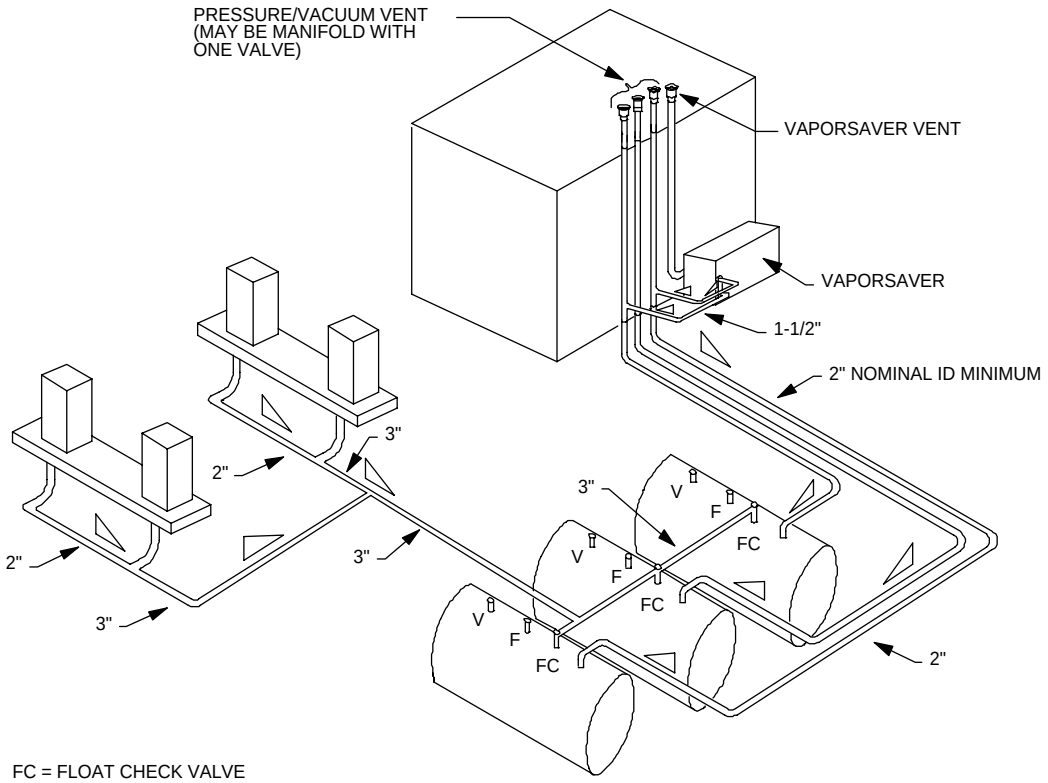
NOTE:
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
1/4" PER FOOT PREFERED

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.
- Permeate and Residue piping from the control system to the vents shall be 1-1/2” nominal ID 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 PREFERED

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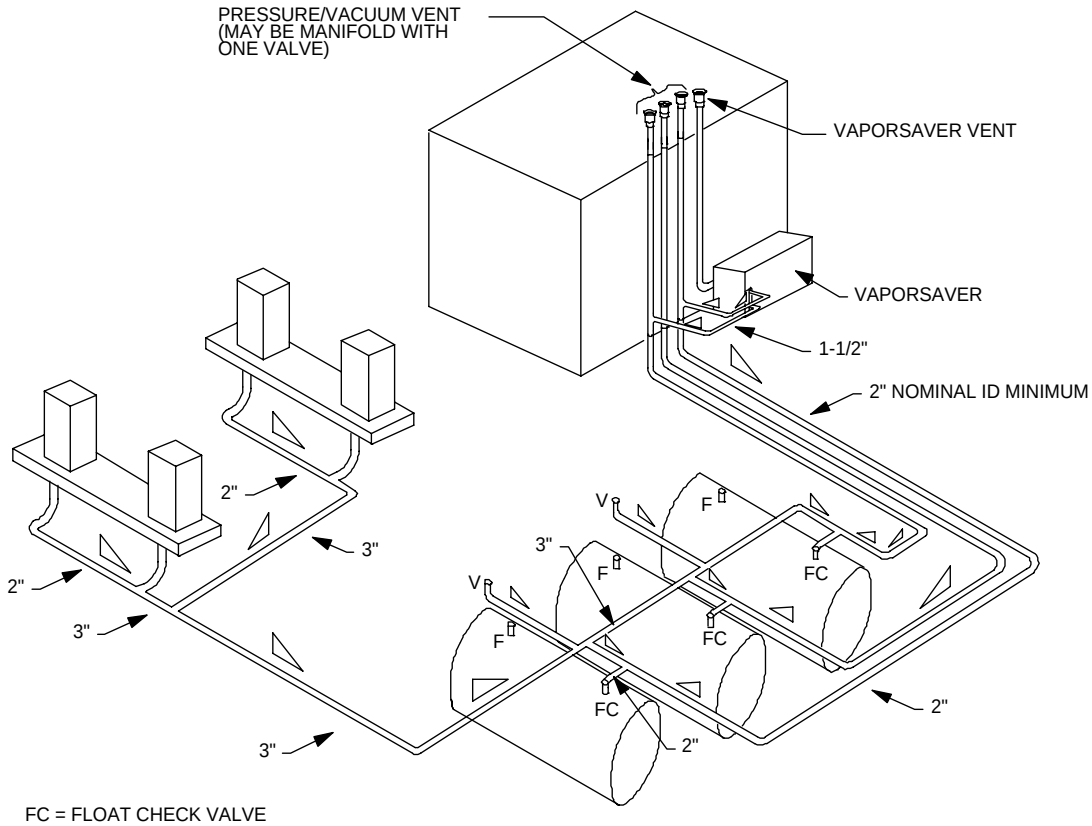
Notes:

- 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.
- Permeate and Residue piping from the control system to the vents shall be 1-1/2” nominal ID minimum.

Typical Vapor Piping Layout



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

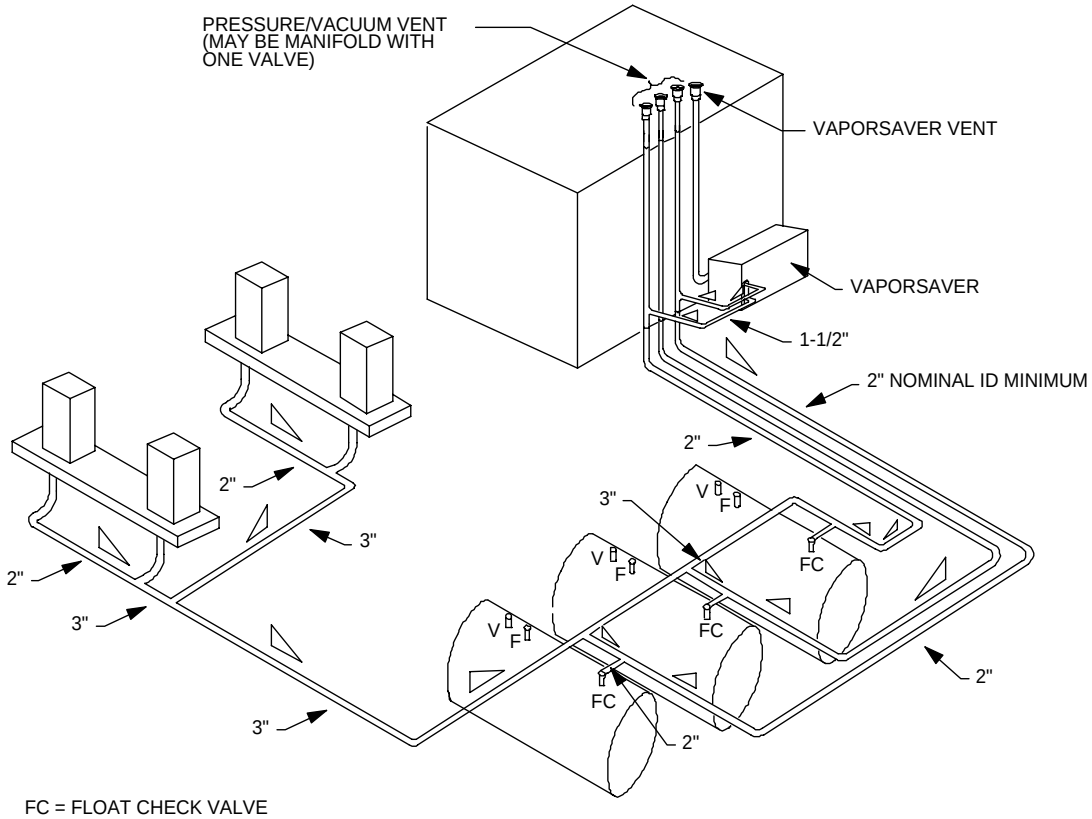
NOTE:
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
1/4" PER FOOT PREFERED

IM-VR131

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.
- Permeate and Residue piping from the control system to the vents shall be 1-1/2” nominal ID minimum.

Typical Vapor Piping Layout



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

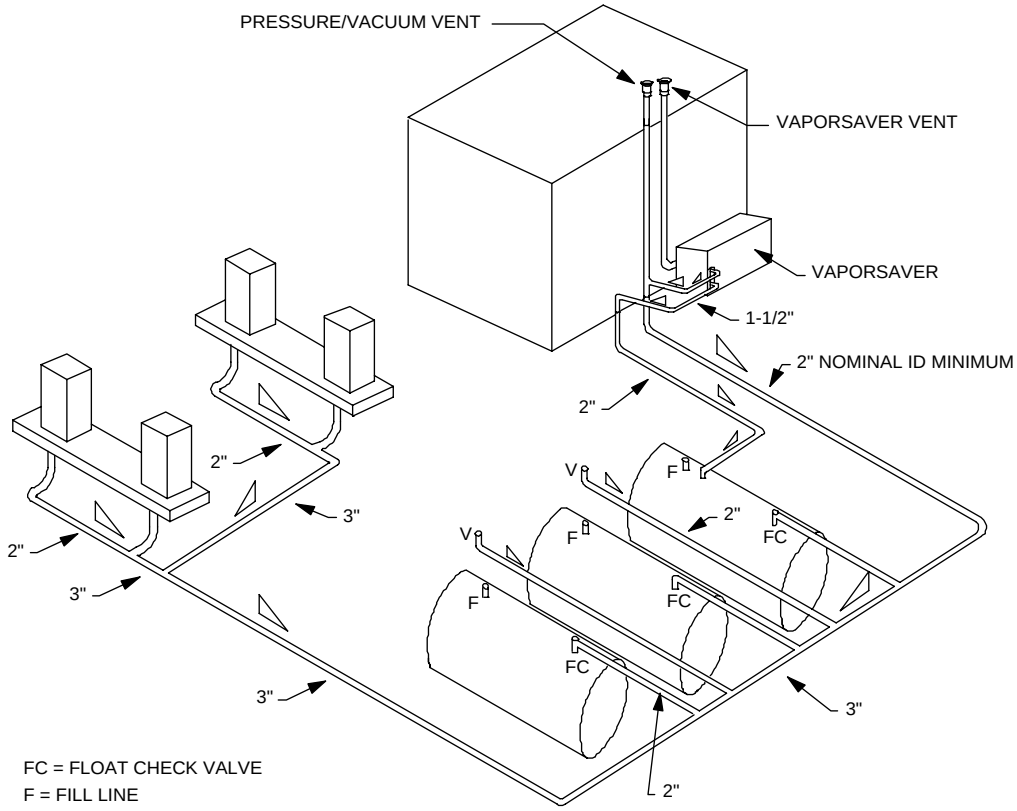
NOTE:
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
1/4" PER FOOT PREFERED

IM-VR132

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.
- Permeate and Residue piping from the control system to the vents shall be 1-1/2” nominal ID minimum.

Typical Vapor Piping Layout



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

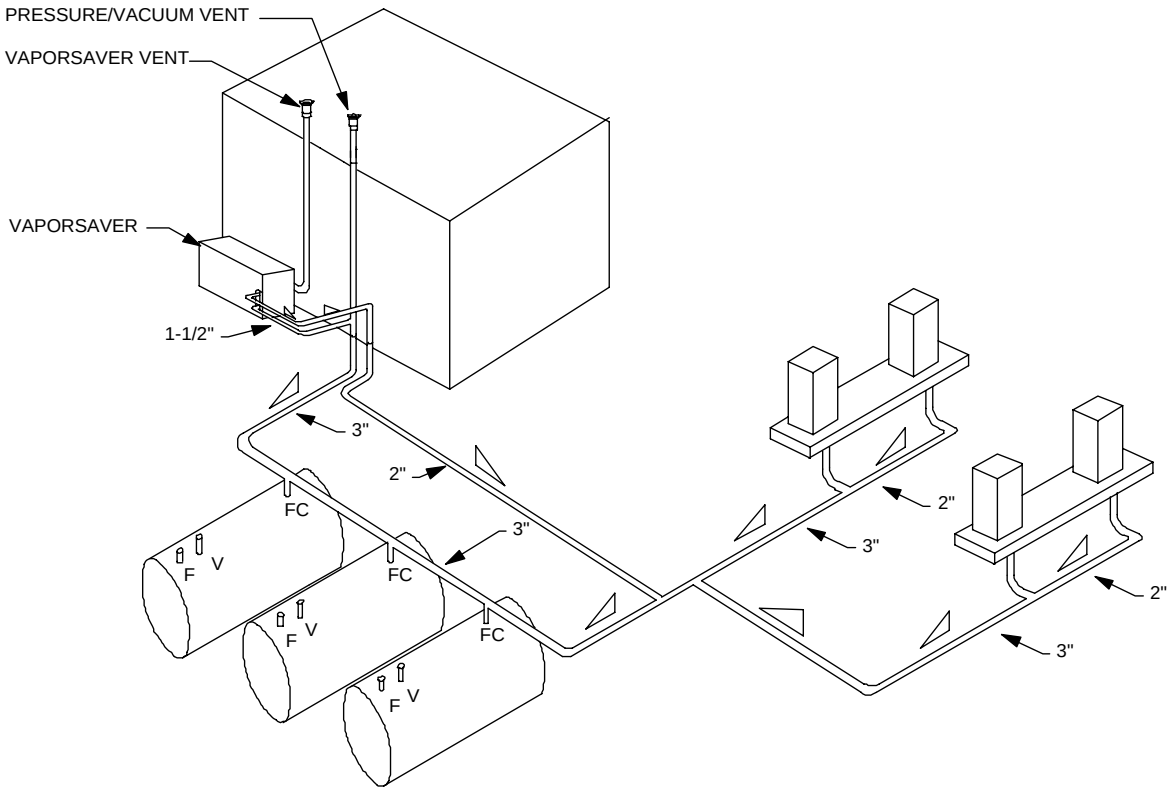
NOTE:
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
1/4" PER FOOT PREFERED

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.
- Permeate and Residue piping from the control system to the vents shall be 1-1/2” nominal ID minimum.

Typical Vapor Piping Layout



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

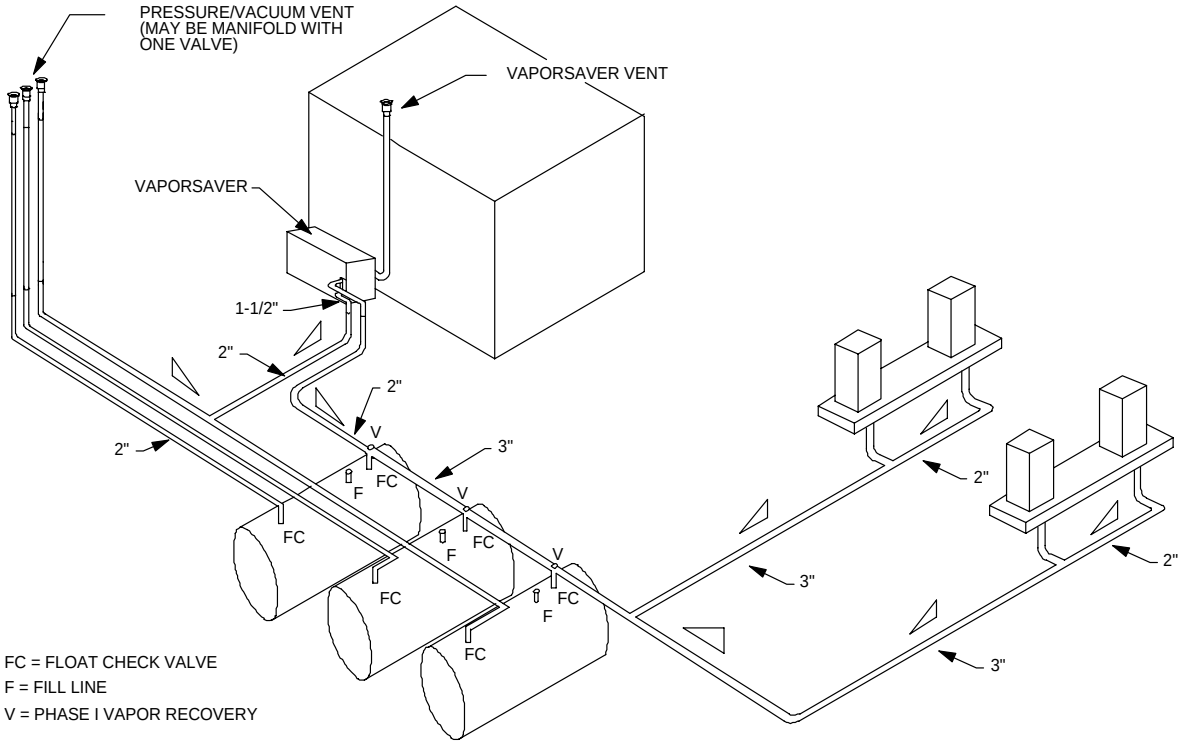
NOTE:
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
1/4" PER FOOT PREFERED

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.
- Permeate and Residue piping from the control system to the vents shall be 1-1/2” nominal ID minimum.

Typical Vapor Piping Layout



NOTE:

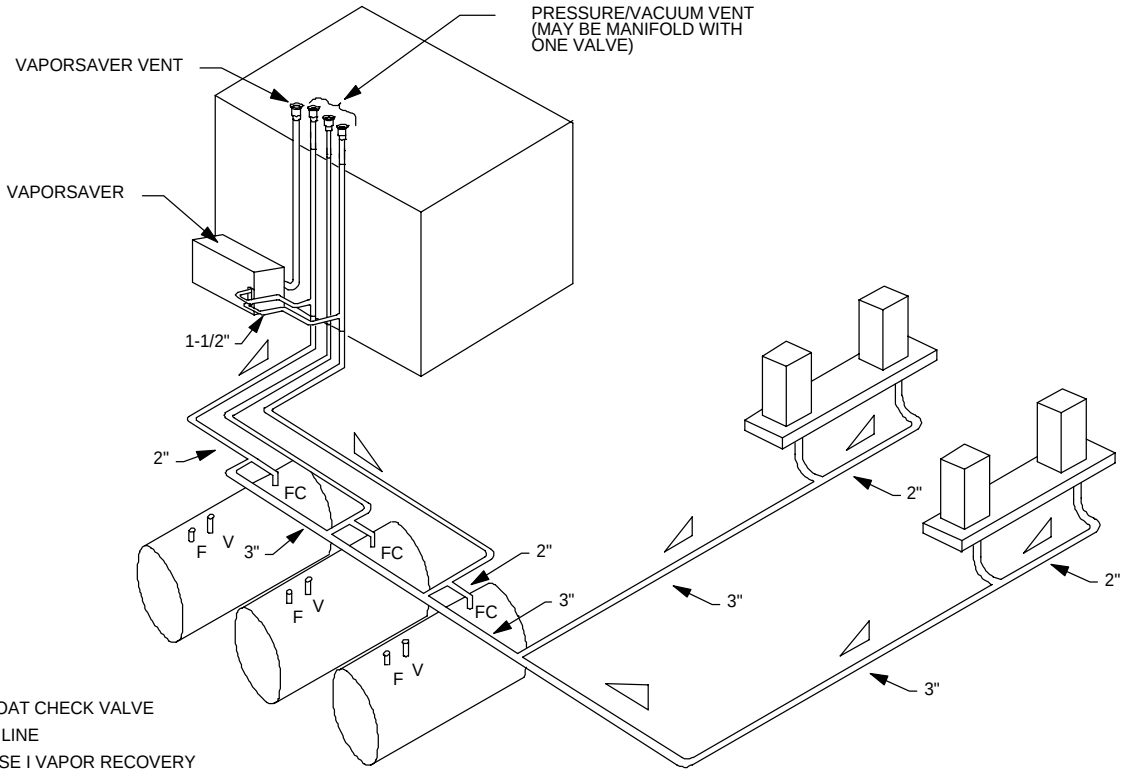
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
   1/4" PER FOOT PREFERED

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.
- Permeate and Residue piping from the control system to the vents shall be 1-1/2” nominal ID minimum.

Typical Vapor Piping Layout



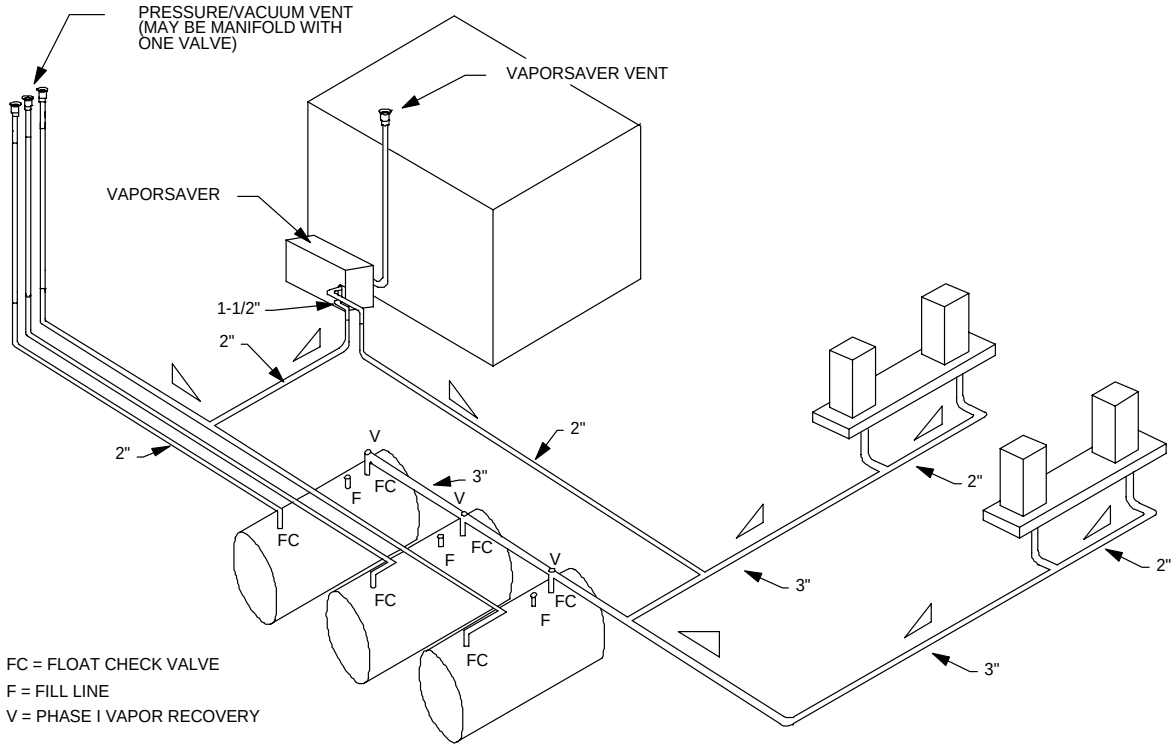
NOTE:
1. ALL VAPOR/VENT LINES ARE 3" NOMINAL ID MINIMUM EXCEPT AS NOTED
2. SLOPE: 1/8" PER FOOT MINIMUM
1/4" PER FOOT PREFERED

IM-VR117

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.
- Permeate and Residue piping from the control system to the vents shall be 1-1/2” nominal ID minimum.

Typical Vapor Piping Layout



IM-VR135

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.
- Permeate and Residue piping from the control system to the vents shall be 1-1/2” nominal ID minimum.

6.0 Electrical Requirements

WARNING

This system uses lethal voltages and operates in areas where flammable vapors and liquids may be present.

Serious injury or death from electrical shock, fire, or explosion may result if the power is on during installation.

Turn power off, lockout and tag power to the unit while installing the system.

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.

6.1 Power Requirements

1. Vaporsaver System
   208-230 VAC
   50/60 Hz
   Single Phase
   2.4 Hp plus 1/2 amp
2. A circuit disconnect devise 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. There are no end user serviceable parts in the Vaporsaver System.
4. 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.
5. An electrical service (breaker) of minimum 20 amp / 240V should be used. A larger breaker may be necessary in some installations; 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.
6. 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).
7. This product shall be installed in accordance with the National Electrical Code (NFPA 70) and the Automotive and Marine Service Station Code (NFPA 30A).
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 (220VAC 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 (220VAC) 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 been 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.

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

Maximum Conductor Length (feet)

Voltage	208	208	230	230
% Voltage Drop	3%	5%	3%	5%
AWG	Feet (maximum)			
12	91	151	100	167
10	144	240	159	265
8	229	382	254	423

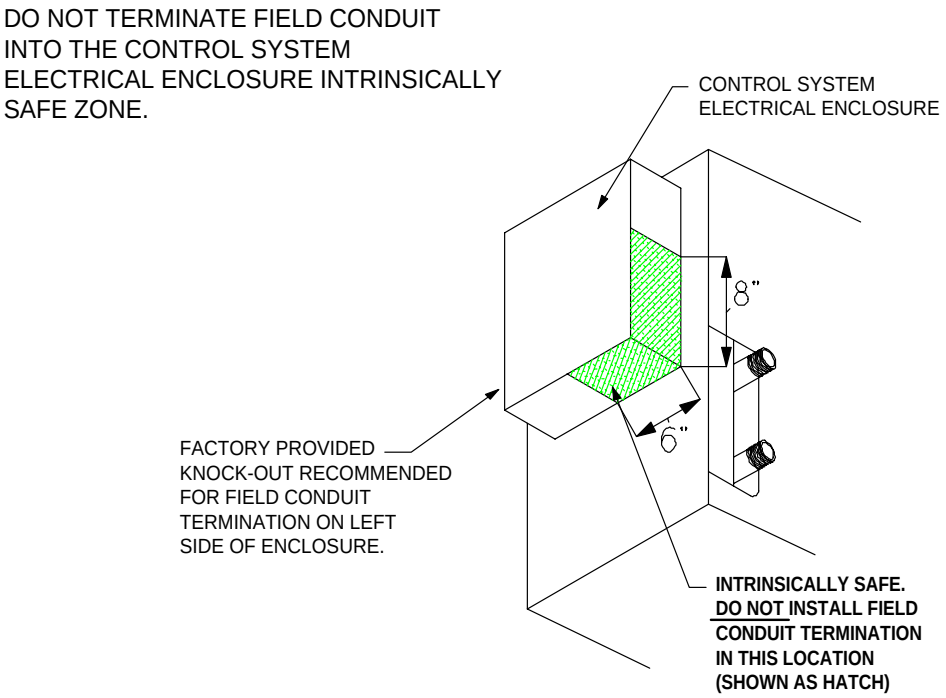
Note: This table is only a guide. Always refer to the requirements of the National Electric Code and of the local authorities.

Note: If local authority will allow conductor ampacity rating of 125% of motor nameplate instead of 140%, multiply the maximum length in the table by 1.12 to get the new maximum conductor length.

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.



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 Executive Order G-70-204 for acceptable P/V vent valves).
3. Pressure setting: +3" wc +/- 1/2” wc.
4. Vacuum setting: -8" wc +/- 2” wc.

7.4 Other Control System Requirements

1. The Vaporsaver should not be used with any flexible vapor or vent piping.
2. During Pressure Decay Test (CARB TP-201.3 and Exhibit 3 of Order G-70-204), the Vaporsaver must be powered off.
3. During Tie Tank Test (CARB TP-201.3C), the Vaporsaver must be powered off.
4. During Dynamic Back Pressure Test (CARB TP-201.4), the Vaporsaver must be powered off.
5. During Air/Liquid (A/L) ratio testing (Exhibit 5 of CARB Executive Order G-70-204), 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.
6. 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 Order G-70-204), Tie Tank (TP-201.3C), Dynamic Back Pressure (TP-201.4) and A/L (Exhibit 5 of Executive Order G-70-204) tests. Always follow local authority requirements.
7. 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 be 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 Executive Order G-70-204), 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. This relay will typically be used when the Vaporsaver is installed with an In-Station Diagnostic system as specified by CARB Enhanced Vapor Recovery Program.
2. When the Vaporsaver is powered and operating normally, the Auxiliary Relay is energized (green LED on Auxiliary Relay is lit); Auxiliary Relay contact position 11 to position 14 is closed and contact position 12 to position 14 is open.
3. When the Vaporsaver is either powered off, or is in Alarm, the Auxiliary Relay is de-energized; Auxiliary Relay contact position 11 to position 14 is open and contact position 12 to position 14 is closed.
4. Auxiliary 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. There are no serviceable parts in the Hydrocarbon Sensor. The calibration of the Sensor can be verified by checking at two locations:
    a. The Hydrocarbon Sensor has a calibration label showing the calibration due date. The Sensor is accessed by removing the Control System covers.
    b. A second calibration label is located on the side of the User Interface enclosure. A label is placed on the User Interface at the factory showing the original equipment Sensor calibration due date. 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 to be placed by the installer on the User Interface enclosure 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 8.2 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 8.3 replace pumps. Verify records to ensure pumps have not already been changed.

8.2 General Rules for Belt Tensioning

1. Ideal belt tension is the lowest tension at which the belt will not slip under peak conditions.
2. Tension the belt when slipping.
3. Over tensioning shortens pump, bearing and belt life.
4. Keep belts free from foreign material that may cause slippage.
5. Never apply belt dressing, as this will damage the belt and cause early failure.
6. Only replace belts with OPW specified belt size and type.
7. Over tensioning belts places extra load on the motor. An overly tight belt can add several amps to the motor loading.
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.

8.3 Component Replacement

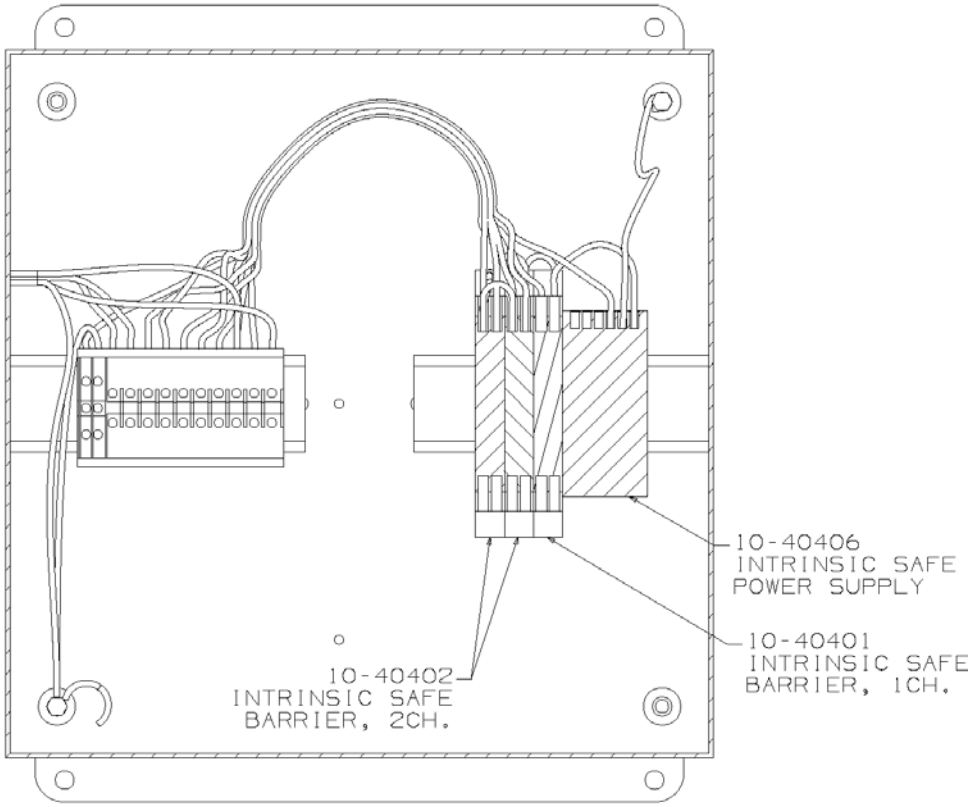
The User Interface has a totalizer (TRT: total run time since first installed) that is part of the continuous scrolling screens. This totalizer shall be used for the following maintenance/replacement items:

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.

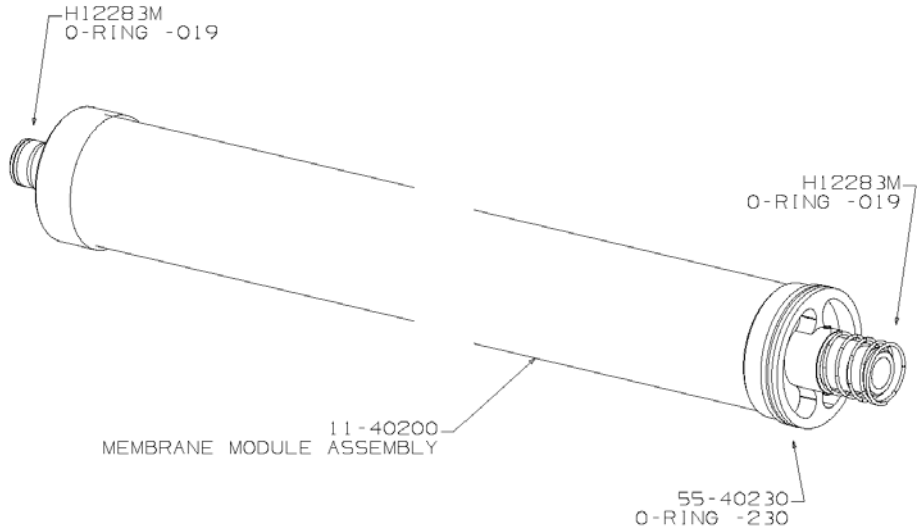
9.0 Glossary of Terms

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. (See Section 3.2)
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. (See Section 3.1)
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)

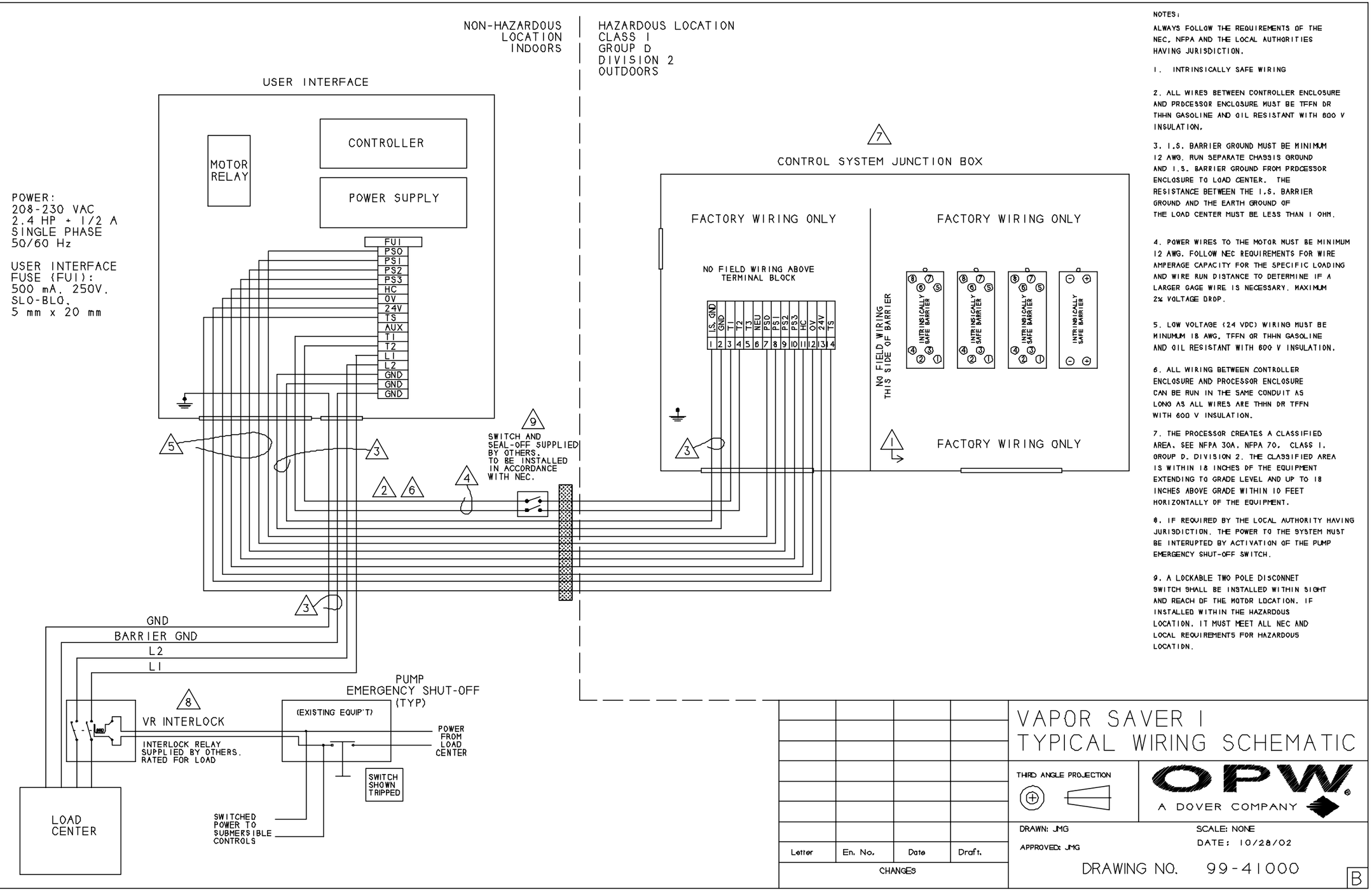
Control System Enclosure (with Intrinsically Safe Area)



Membrane Module



Membrane housing flange o-ring: H12037M



NOTES:

ALWAYS FOLLOW THE REQUIREMENTS OF THE NEC, NFPA AND THE LOCAL AUTHORITIES HAVING JURISDICTION.

1. INTRINSICALLY SAFE WIRING

2. ALL WIRES BETWEEN CONTROLLER ENCLOSURE AND PROCESSOR ENCLOSURE MUST BE TFFN OR THHN GASOLINE AND OIL RESISTANT WITH 600 V INSULATION.

3. I.S. BARRIER GROUND MUST BE MINIMUM 12 AWG. RUN SEPARATE CHASSIS GROUND AND I.S. BARRIER GROUND FROM PROCESSOR ENCLOSURE TO LOAD CENTER. THE RESISTANCE BETWEEN THE I.S. BARRIER GROUND AND THE EARTH GROUND OF THE LOAD CENTER MUST BE LESS THAN 1 OHM.

4. POWER WIRES TO THE MOTOR MUST BE MINIMUM 12 AWG. FOLLOW NEC REQUIREMENTS FOR WIRE AMPERAGE CAPACITY FOR THE SPECIFIC LOADING AND WIRE RUN DISTANCE TO DETERMINE IF A LARGER GAGE WIRE IS NECESSARY. MAXIMUM 2% VOLTAGE DROP.

5. LOW VOLTAGE (24 VDC) WIRING MUST BE MINIMUM 18 AWG, TFFN OR THHN GASOLINE AND OIL RESISTANT WITH 600 V INSULATION.

6. ALL WIRING BETWEEN CONTROLLER ENCLOSURE AND PROCESSOR ENCLOSURE CAN BE RUN IN THE SAME CONDUIT AS LONG AS ALL WIRES ARE THHN OR TFFN WITH 600 V INSULATION.

7. THE PROCESSOR CREATES A CLASSIFIED AREA, SEE NFPA 30A, NFPA 70, CLASS I, GROUP D, DIVISION 2. THE CLASSIFIED AREA IS WITHIN 18 INCHES OF THE EQUIPMENT EXTENDING TO GRADE LEVEL AND UP TO 18 INCHES ABOVE GRADE WITHIN 10 FEET HORIZONTALLY OF THE EQUIPMENT.

8. IF REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION, THE POWER TO THE SYSTEM MUST BE INTERUPTED BY ACTIVATION OF THE PUMP EMERGENCY SHUT-OFF SWITCH.

9. A LOCKABLE TWO POLE DISCONNET SWITCH SHALL BE INSTALLED WITHIN SIGHT AND REACH OF THE MOTOR LOCATION. IF INSTALLED WITHIN THE HAZARDOUS LOCATION, IT MUST MEET ALL NEC AND LOCAL REQUIREMENTS FOR HAZARDOUS LOCATION.

Letter	En. No.	Date	Draft.
CHANGES			

VAPOR SAVER I TYPICAL WIRING SCHEMATIC

THIRD ANGLE PROJECTION

OPW
A DOVER COMPANY

DRAWN: JMG
APPROVED: JMG
SCALE: NONE
DATE: 10/28/02

DRAWING NO. 99-41000

B