Chapter 7: Maintenance Procedures

7 Maintenance Overview

- VST recommends conducting Maintenance on the GREEN MACHINE annually to make sure all the components are in good working order. If the annual maintenance is not conducted, there is a possibility the GREEN MACHINE may not be operating properly.

- The Vacuum Pump and Control Valves are the only components with moving parts in the GREEN MACHINE; therefore, it requires very little maintenance.

- All replacement parts must be from VST's recommended replacement parts list located in Chapter 9: Replacement Procedures Section.

- If the GREEN MACHINE is not functioning properly consult Chapter 8: Troubleshooting Section to determine which component may need to be repaired or replaced.

- Sections that will be covered in this Chapter:

7.1 Maintenance Procedures

1. At the VST Control Panel Main Screen, check to make sure there are no alarms. **See Figure 7-1**.
   If there are alarms, repair the item causing the alarm (See Chapter 8: Troubleshooting) before proceeding.
2. VST has recommended spare parts that might be needed when conducting Maintenance. **See Section 7.2.**
3. Conduct a Functionality Test: **See Section 7.3.**
   The Functionality Test will verify the GREEN MACHINE is operating properly.
   - If the Functionality Test Passes, go to Step 3.
   - If the Functionality Test does not Pass (See Chapter 8: Troubleshooting Procedures)
4. The Pressure Sensor Verification Test Procedure: **See Section 7.4.**
   - This procedure will verify that the Pressure Sensor is operating properly and within specifications.

Maintenance Procedures, continued…

5. Rubber Flange Sleeve Replacement Procedure: **See Section 7.5.**
   To keep the GREEN MACHINE operational, replace the rubber flange sleeve yearly.
6. Cleaning the Control Valves: **See Section 7.6.**
   Cleaning the control valves will reduce valve noise. Check the valve components for wear and damage and keep the valves operational for a longer period of time.
7. Check the Air Outlet for Liquid Condensate: **See Section 7.7.**
   Check annually for liquid condensate in the air outlet pipe.
8. Separator Check Procedure: **See Section 7.8.**
   - Check annually for excessive accumulation of debris.

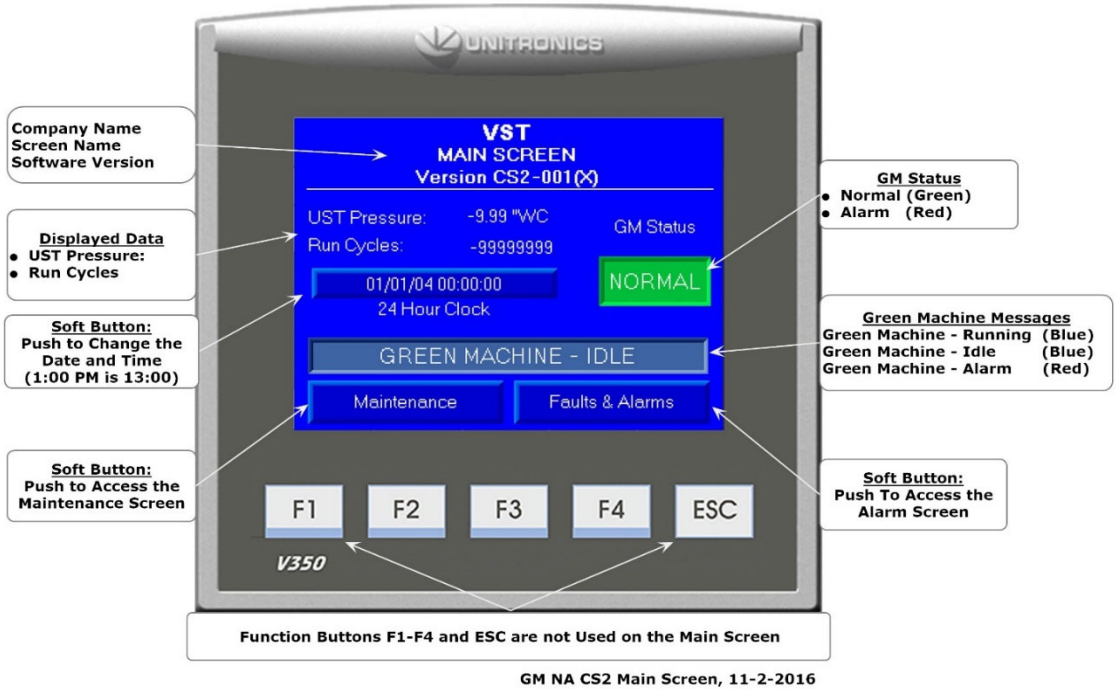

Figure 7-1: VST PLC Main Screen w/no Alarms

7.2 Recommended Replacement Parts

VST recommends the ASC bring the parts shown in the table below for replacement parts. The entire list of GREEN MACHINE replacement parts can be found in Chapter 9: Replacement Procedures.
See Figure 7-2.

Ref. #	Description	Part No.	Quantity	Manuf.
1	VACUUM PUMP MOTOR (ONLY), 115VAC, SINGLE-PHASE	GM-027	1	VST
2	MODEL 2 VACUUM PUMP (ONLY)	GM-022	1	
3	RUBBER FLANGE SLEEVE	GM-004	1	
4	CONTROL VALVES – CORE REBUILD KIT	GM-006	5	
5	PRESSURE SENSOR	GM-043	1	
6	SEPARATOR	GM-049	1	

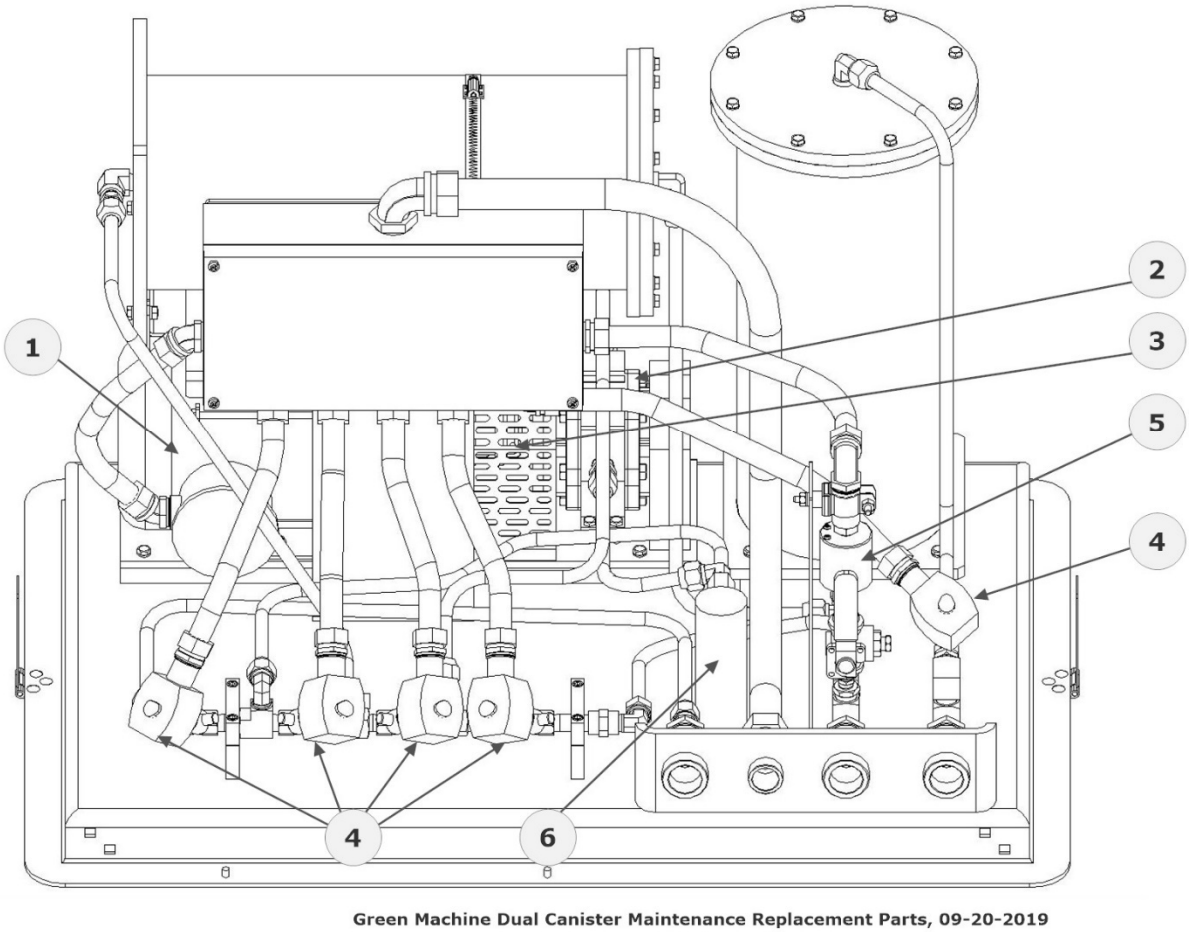

Figure 7-2: Maintenance Replacement Parts

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7.3 Functionality Test

7.3.1 The Purpose of the Functionality Test

The purpose of the Functionality Test is to verify that the Control Panel, Vacuum Pump, and the Control Valves are working properly.

7.3.2 Preparation for the Functionality Test

1. At the VST Control Panel, make sure the Maintenance Screen is showing on the PLC. **See Figure 7-3**. (The GREEN MACHINE is now in the Manual OFF mode and will not operate.)

   If the PLC is not in the Maintenance Screen: At the Main Screen, push the Maintenance Screen button to access the Password Screen, then enter the password to access the Maintenance Screen: Password is 878.

2. At the GREEN MACHINE, make sure the locks from the three ball valves have been removed, all three valves are closed, and the caps from the three tees have been removed. **See Figure 7-4**.

3. Unlock the hasp and remove the cover from the GREEN MACHINE.

4. Close the 3-way valve below the Pressure Sensor so the handle is turned HORIZONTAL (OFF or Closed). Leaving the valve ON or Open during this test may damage the Pressure Sensor.

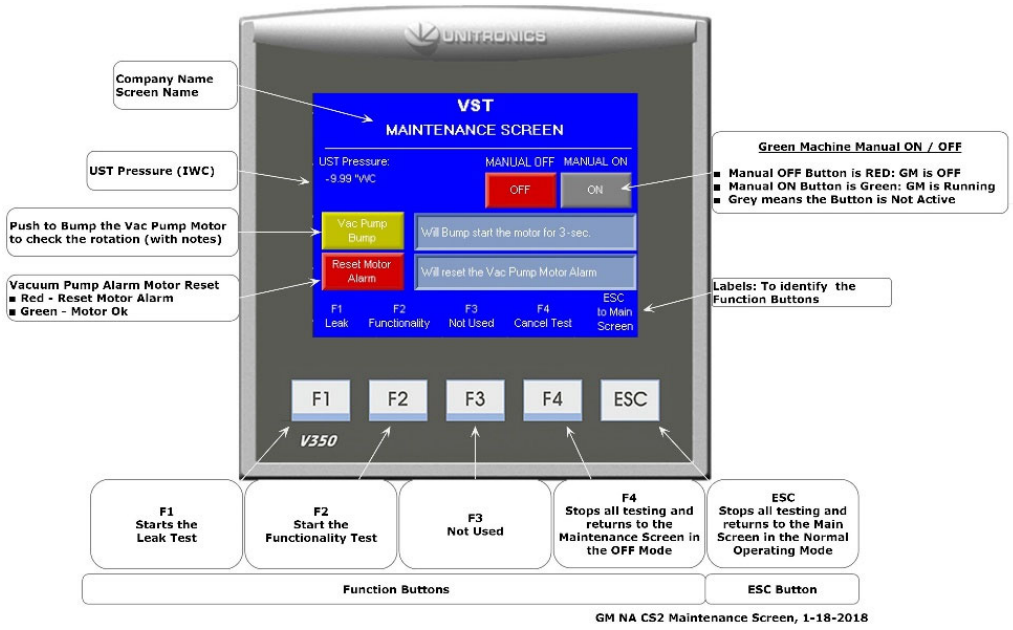

Figure 7-3: Maintenance Screen

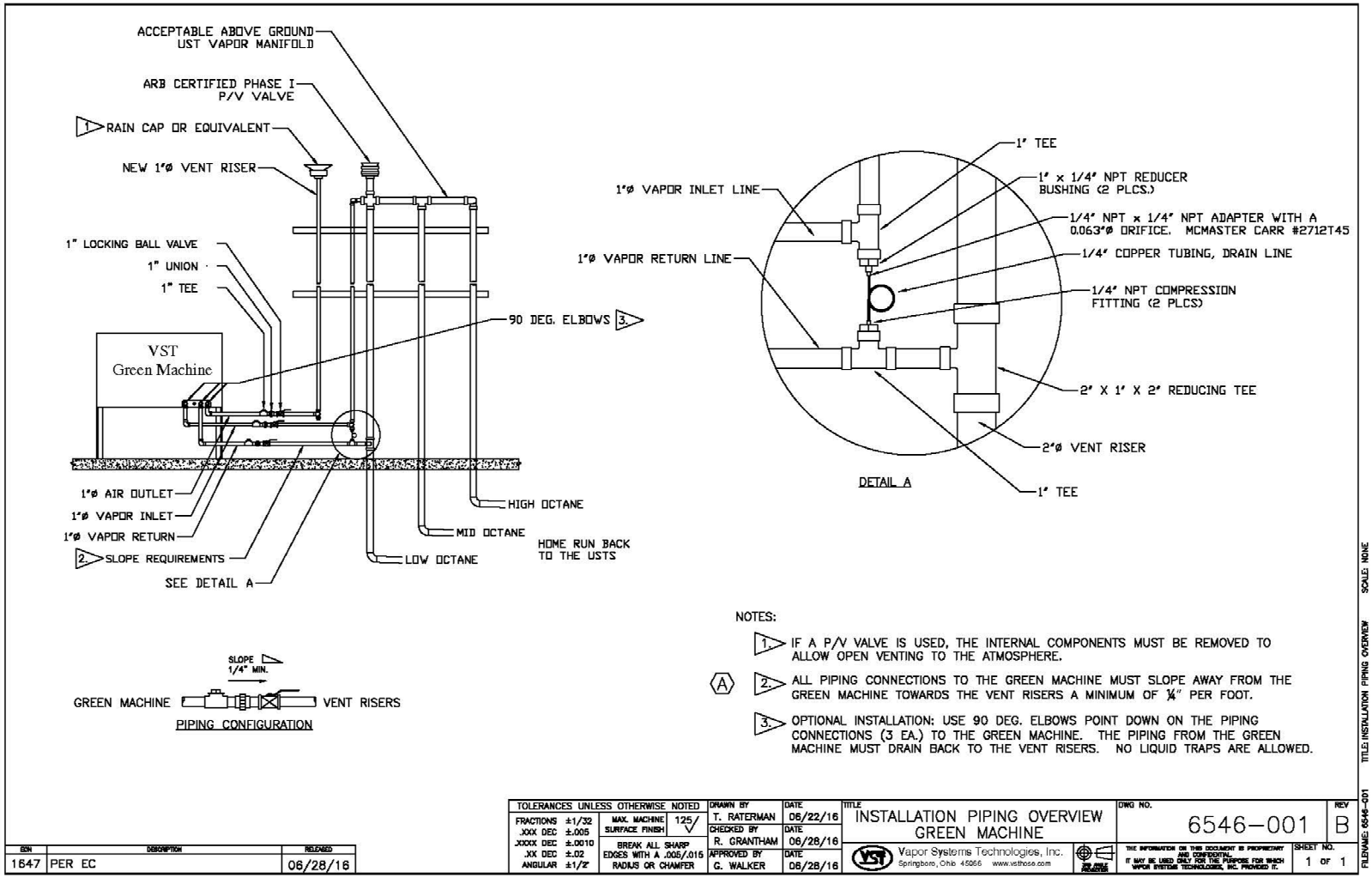

Figure 7-4: GREEN MACHINE Vapor Piping Layout

7.3.3 Functionality Test Procedures

1. Push the F2 button to access the Functionality Test Screen. **See Figure 7-5**.
2. To start the Functionality Test, push the Start Button.
3. Push the Confirm Functionality Test Button to confirm you would like to start the Functionality Test.
   See Figure 7-6.
4. The GREEN MACHINE will run for 60-seconds then purge for 60-seconds (this is one cycle).
5. The GREEN MACHINE will continue to cycle 5 times or until the F4 button is pushed to end the test.
   - There are 5 cycles to provide enough time to conduct the test.
   - Pushing the F4 button will return the system to the Maintenance Screen and the GREEN MACHINE will be in the OFF mode.
6. When the test has ended, the VST Control Panel PLC will display GREEN MACHINE OFF.
7. During the 60-second Run Cycle: **See Figure 7-7**.
   - Place your hand over the tee opening at the Vapor Inlet and feel for suction.
   - Next, place you hand over the tee opening at the Vapor Return and feel for zero airflow.
   - Next, place your hand over the tee opening at the Air Outlet and feel for air blowing.
8. During the Run Cycle:
   1. Suction at the Vapor inlet: NORMAL
   2. Air blowing out the Air Outlet: NORMAL
   3. No air blowing/suction at the Vapor Return: NORMAL
   4. All other blowing or suction conditions at each location, check the following items:
      - Make sure the Vacuum Pump is not in alarm. If so, see Chapter 8: Troubleshooting, Section 8.6.
      - Check the Control Valves to make sure they are all operational.
        See Chapter 8: Troubleshooting, Section 8.6.1, Step 5:
      - Make sure there is no debris in the valve seat.
        Clean the valves as shown in Section 7.5: Cleaning the Control Valves.
      - Make sure the flare nuts are tight. Check each 45-deg. flare nut to make sure they are snug but not over tightened.
9. During the 60-second Purge Cycle: **See Figure 7-7**.
   - After the Purge Cycle has begun, place your hand over the tee opening at the Vapor Return and feel for air blowing. The blowing air will reduce to zero flow soon after the Purge Cycle begins.
   - Next, place your hand over the tee opening at the Vapor Inlet and feel for zero airflow.
   - Next, place your hand over the tee opening at the Air Outlet and feel for zero airflow.

Functionality Test, continued…

10. During the Purge Cycle:
    1. No air blowing/suction at the Vapor Inlet: NORMAL
    2. No air blowing/suction at the Air Outlet: NORMAL
    3. Momentary blowing at the Vapor Return: NORMAL
    4. All other blowing or suction conditions at each location:
        - Make sure the Vacuum Pump is not in alarm. If so, see Chapter 8: Troubleshooting, Section 8.6.
        - Check the Control Valves to make sure they are all operational. See Chapter 8: Troubleshooting, Section 8.6.1, Step 5:
        - Make sure there is no debris in the valve seat. Clean the valves as shown in Section 7.5: Cleaning the Control Valves.
        - Make sure the flare nuts are tight. Check each 45-deg. flare nut to make sure they are snug but not over tightened.
11. After the Functionality Test has ended:
    - The PLC will automatically go back to the Maintenance Screen and will remain in the OFF mode.
    - Lock open the three ball valves between the GREEN MACHINE and the Vent Risers, and replace the caps on the three tees.
    - **CAUTION: Make sure the 3-way valve below the Pressure Sensor is turned VERTICAL (ON or Open). Leaving the valve turned OFF at the Pressure Sensor will not allow the GREEN MACHINE to operate in the Normal Operating Mode.**
    - At the PLC, push the ESC button to return to the Main Screen.

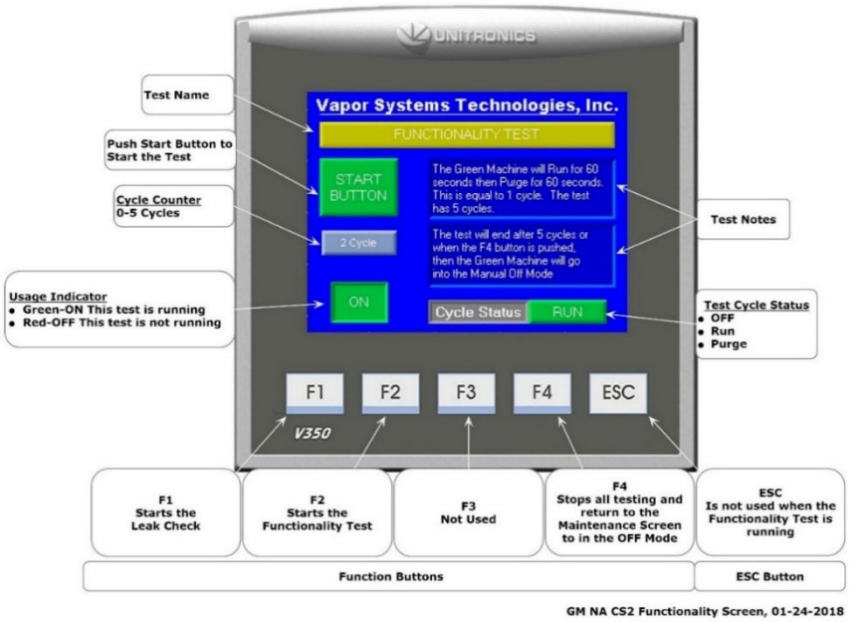

Figure 7-5: Functionality Test Screen

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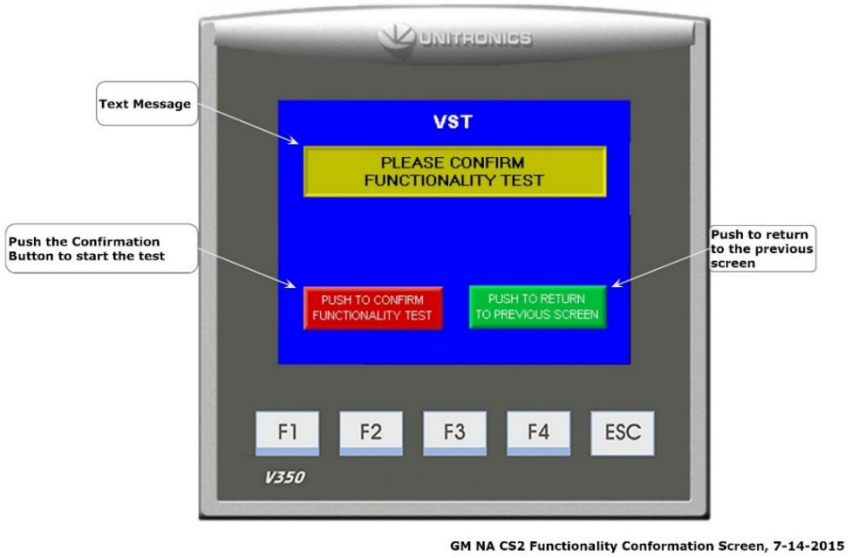

Figure 7-6: Functionality Test Confirmation Button

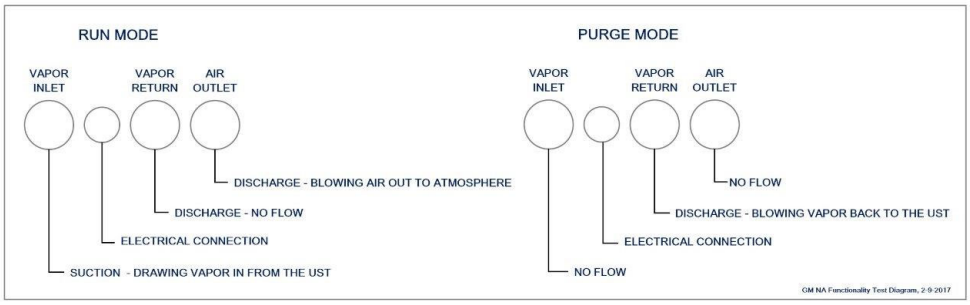

Figure 7-7: GREEN MACHINE Operation Diagram

7.4 Pressure Sensor Verification Test

This procedure was written to verify the Pressure Sensor is operating properly and within specifications: The Pressure Sensor reading on the VST Control Panel PLC Main Screen is checked against atmospheric pressure at the Pressure Sensor.

7.4.1 Safety:

Use lockout-tagout procedures prior to starting work.

7.4.2 Procedure:

1. Turn OFF power to the VST Control Panel at the Power Switch located on the front of the VST Control Panel.
   - This will allow 24 VDC power to the PLC and the Pressure Sensor but will disconnect 115 VAC power to the GREEN MACHINE. Power to the PLC and Pressure Sensor will remain ON.
2. Follow lockout & tagout procedures prior to starting work.
3. Unlock the hasps and remove the cover from the GREEN MACHINE.
4. Turn the handle on the 3-way ball valve located below the Pressure Sensor to horizontal (Closed) so the Pressure Sensor will read atmospheric pressure. **See Figure 7-8**
   - With the 3-way valve handle turned horizontal (Closed), the valve will not be open to gasoline vapor.
5. Remove the ¼" NPT Hex Plug from the side of the 3-way ball valve. **See Figure 7-9.**
6. Wait at least 2-minutes for the pressure to equalize before reading the pressure on the PLC Main Screen.
7. At the VST Control Panel PLC Main Screen, make sure the Pressure reading is 0.0 +/- 0.10 IWC. **See Figure 7-10.**

   The Pressure Sensor Specification at atmospheric Pressure is 0.0 +/- 0.10 IWC.
   - If the pressure reading is within specifications, the Pressure Sensor is reading correctly.
   - If the pressure reading is outside the specification, replace the Pressure Sensor. In the IOMT Manual, See Chapter 9, Section 9.4 for replacement procedures.
8. After testing is complete: Reinstall the ¼" NPT Hex Plug on the 3-way valve. Use gasoline resistant PTFE tape on the ¼" NPT Hex Plug pipe threads prior to installation.
9. Turn the handle on the 3-way ball valve located below the Pressure Sensor to vertical (Open) so the Pressure Sensor will read UST pressure. **See Figure 7-8.**

   (CAUTION: IF THE 3-WAY VALVE HANDLE IS NOT VERTICAL AS SHOWN IN FIGURE 1, THE GREEN MACHINE WILL NOT OPERATE PROPERLY AND MAY CAUSE DAMAGE TO THE VACUUM PUMP.)
10. Put the cover on the GREEN MACHINE and lock the hasps.
11. Turn ON power to the VST Control Panel at the Power Switch located on the front of the VST Control Panel. The GREEN MACHINE is now operational and will operate if the UST pressure is greater than or equal to 0.20 IWC.
12. Check the VST Control Panel to make sure the Main Screen is showing and there are no alarms.

Figure 7-8: Pressure Sensor & 3-Way Valve, NORMAL Operation

Figure 7-9: Pressure Sensor & 3-Way Valve, TEST Position

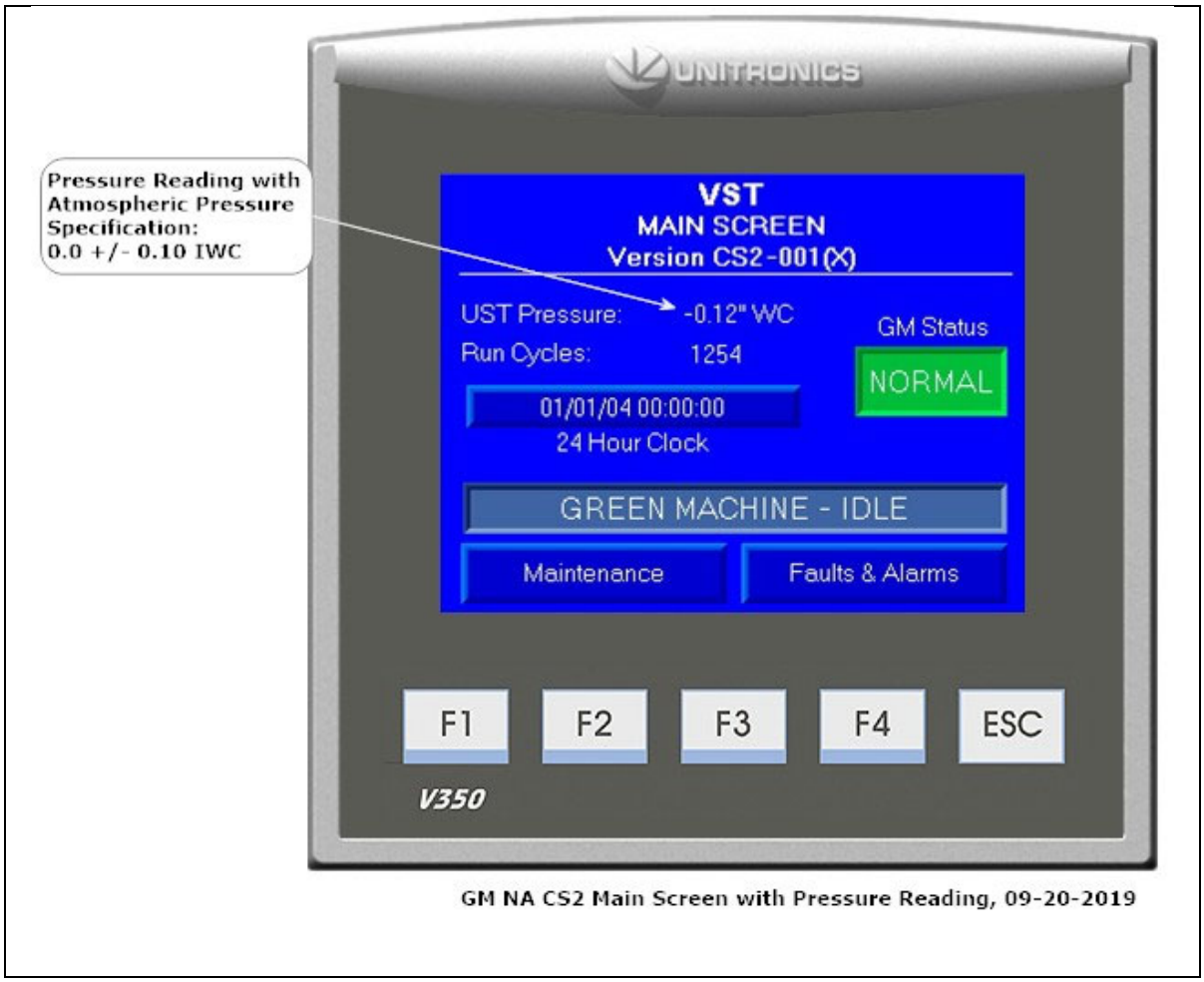

Figure 7-10: Main Screen w/Pressure Reading

7.5 Rubber Flange Sleeve Replacement

Safety

Use lockout / tagout procedures prior to starting work.

VST recommends replacing the Rubber Flange Sleeve every time Maintenance is performed on the GREEN MACHINE even if the Rubber Flange Sleeve does not look damaged or worn.

7.5.1 Removing the Rubber Flange Sleeve

See Figure 7-11.

1. Turn OFF power to the VST Control Panel at the Power Switch located on the front of the VST Control Panel. (The power, ground, and neutral will be completely disconnected from the GREEN MACHINE).
2. Follow lockout & tagout procedures prior to starting work.
3. Unlock the hasps and remove the cover from the GREEN MACHINE.
   NOTE: The Vacuum Pump and Vacuum Pump tubing will not be affected by moving the Vacuum Pump motor.
4. Remove the fan guard over the drive coupling flanges.
5. Remove the two bolts holding the Internal Junction Box stand to the GREEN MACHINE base. Keep the bolts for reuse.
6. Remove the 4 motor mounting bolts from the motor base plate. Keep the shims from under the motor base and 4-bolts for reuse.
7. Without removing the electrical service from the Vacuum Pump motor, slide the motor away from the Vacuum Pump so the rubber flange sleeve can be removed.
   See Figure 7-12.

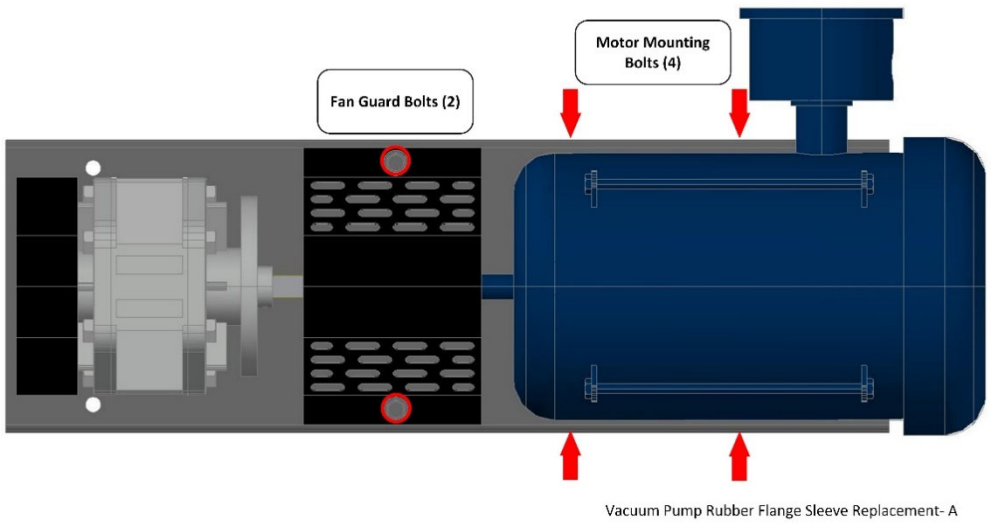

Figure 7-11: Vac Pump Rubber Flange Sleeve Replacement

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7.5.2 Replacing the Rubber Flange Sleeve

See Figure 7-12.

1. Insert a new rubber flange sleeve and slide the motor back to its original position.
   - Make sure the motor-side drive coupling is snug (not tight) against the rubber flange sleeve.
2. Replace any shims that moved while moving the motor.
3. Re-install and tighten the 4 motor mounting bolts to the base plate. Make sure the Motor Shaft and Vacuum Pump shafts are in alignment.
4. Re-install the 2-bolts holding the Internal Junction Box stand to the GREEN MACHINE base.
5. Re-install the fan guard over the coupling flanges.
6. Put the cover on the GREEN MACHINE and lock the hasps.
7. Remove the lock(s) and tags from the lockout & tagout.
8. After the work is completed, turn ON power to the VST Control Panel. The GREEN MACHINE is now operational.

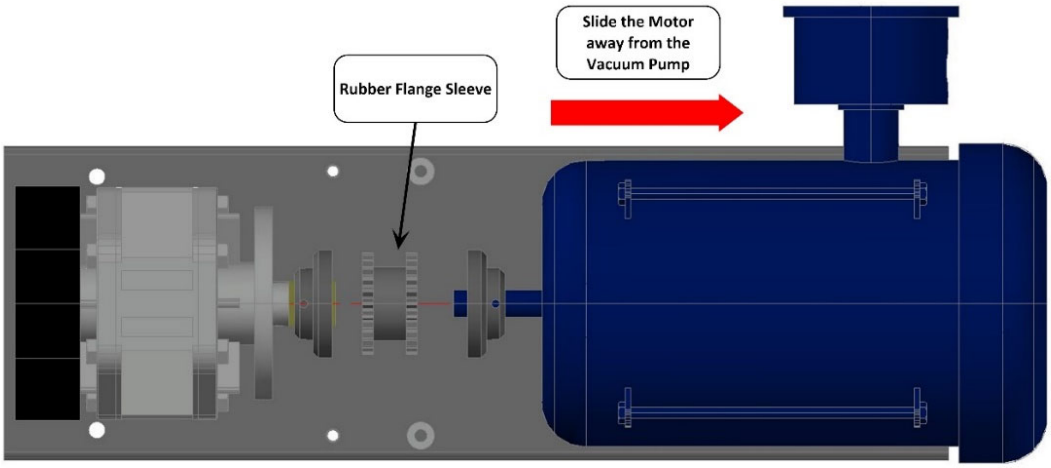

Figure 7-12: Replacing the Rubber Flange Sleeve

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7.6 Cleaning the Control Valves

Safety

Use lockout / tagout procedures prior to starting work.

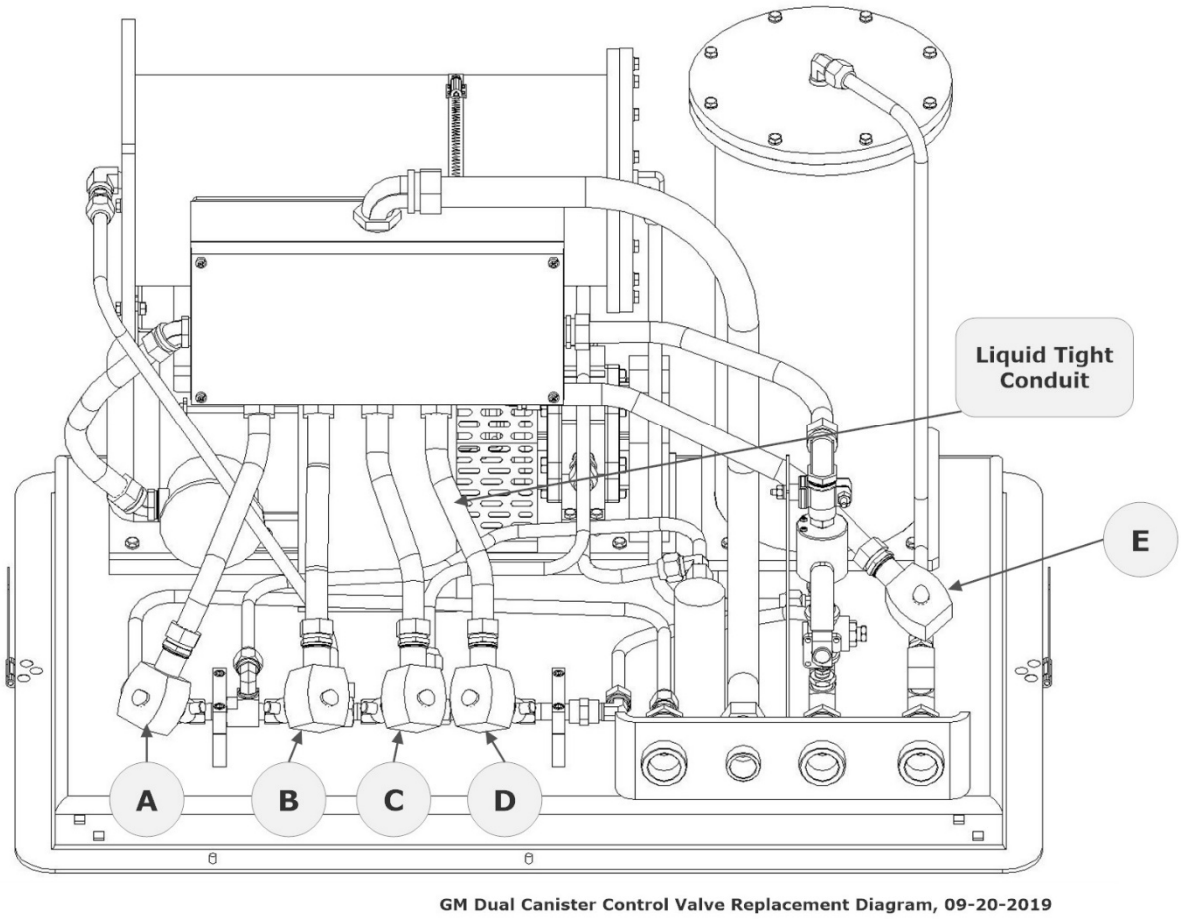

Figure 7-13: GREEN MACHINE Control Valves Identification Tags

7.6.1 Removing the Valve Solenoid and Core Assembly

1. Turn OFF power to the VST Control Panel at the Power Switch located on the front of the VST Control Panel. (The power, ground, and neutral will be completely disconnected from the GREEN MACHINE).
2. Follow lockout & tagout procedures prior to starting work.
3. Unlock the hasps and remove the cover from the GREEN MACHINE.
4. Unlock and close the three ball valves between the GREEN MACHINE and the vent risers.

NOTE: The Liquid Tight conduit or fitting do not have to be removed from the solenoid. **See Figure 7-13.**

See Figure 7-14.

5. Remove the red cap from the solenoid that is not working.
6. Remove the nameplate by pushing the solenoid down towards the valve body, then lift and slide the nameplate off.

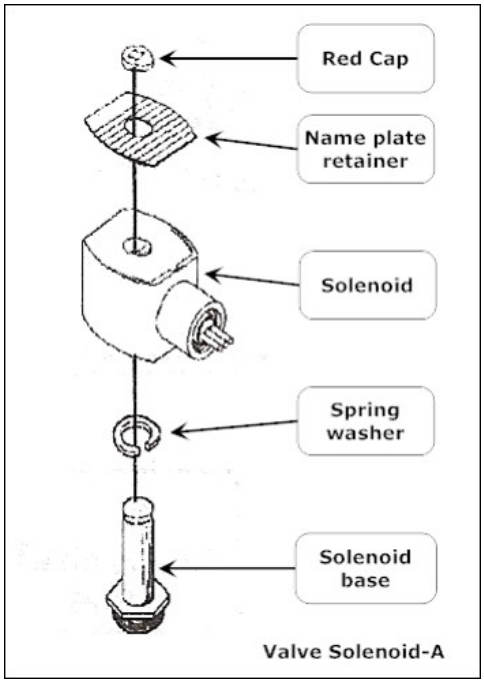

Figure 7-14: Valve Solenoid Assembly

7. Slide the solenoid off the solenoid base. DO NOT lose the spring washer located below the solenoid on the solenoid base.
8. Using a ¾" wrench, remove the solenoid base from the valve body, the core assembly with core spring, and the body gasket.
9. Inspect and clean the following parts with a rag and carburetor cleaner or an equivalent cleaning solution: **Be sure to use eyes and hands protection.**
10. Check to make sure the copper ring in the bottom of the solenoid base is not missing or broken into pieces. **See Figure 7-15.**

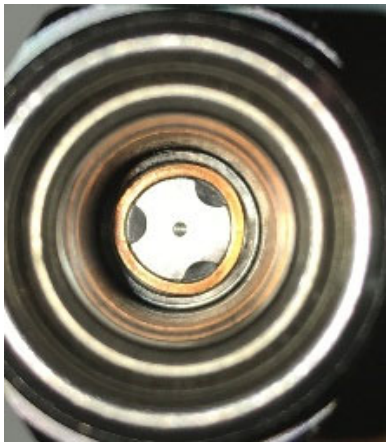

Figure 7-15: Solenoid Base Interior

11. Clean the core assembly, including the metal plunger, the spring, and the rubber seal.
12. Check the rubber seal on the bottom of the core assembly for distortion. Distortion would indicate an indention into the rubber from the valve seat.
13. Check to see if the spring is cracked or broken.
14. Inspect the body gasket in the valve base for damage and wear.
15. If there is any damage, broken parts, or excessive wear on any part of a control valves assembly, VST recommends that all five control valves be replaced.

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7.6.2 Replacing the Valve Solenoid and Core Assembly

See Figure 7-16.

1. Install the clean Core Assembly which includes:
   - Solenoid base
   - Core assembly with core spring
   - Body gasket
2. Screw the solenoid base and tighten with a ¾" wrench until tight. Make sure to install the body gasket with the solenoid base.
3. Place the spring washer on the solenoid base, then slide the solenoid on to the solenoid base.
4. Slide and lock the nameplate on the solenoid.
5. Snap the red cap on the solenoid base.
6. Open the three ball valves between the GREEN MACHINE and the vent risers and lock in the OPEN position.
7. **CAUTION: THREE BALL VALVES BETWEEN THE GREEN MACHINE AND THE VENT RISERS MUST BE OPEN BEFORE APPLYING POWER TO THE VST CONTROL PANEL TO AVOID DAMAGE TO THE GREEN MACHINE INTERNAL EQUIPMENT.**
8. Put the cover on the GREEN MACHINE and lock the hasps.
9. Remove the lock(s) and tags from the lockout & tagout.
10. After the work is completed, turn ON power to the VST Control Panel. The GREEN MACHINE is now operational.

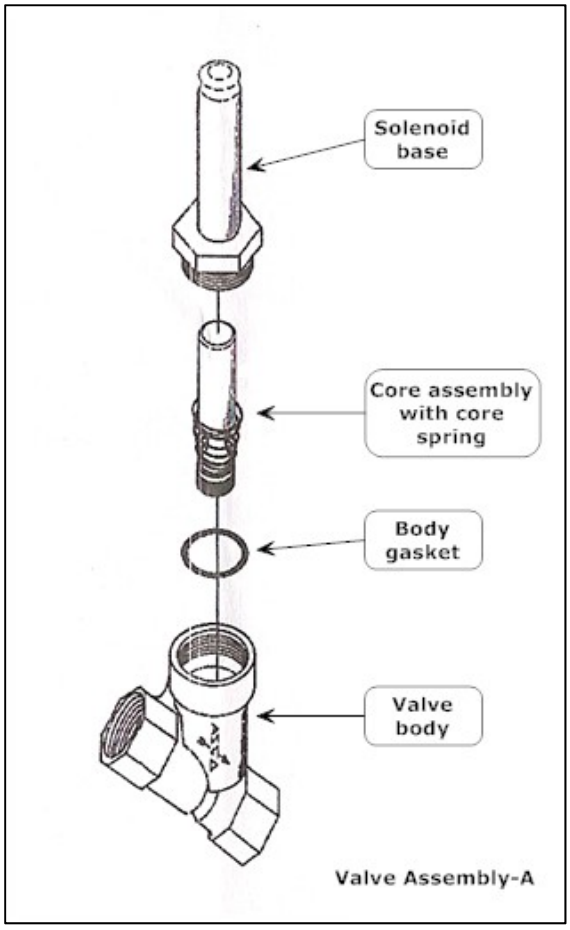

Figure 7-16: Valve Core Assembly

7.7 Check the Air Outlet for Liquid Condensation

7.7.1 Safety

Use lockout / tagout procedures prior to starting work.

7.7.2 Removing the Drain Plug

See Figure 7-17.

1. Turn OFF power to the VST Control Panel at the Power Switch located on the front of the VST Control Panel. (The power, ground, and neutral will be completely disconnected from the GREEN MACHINE*).*
2. Follow lockout & tagout procedures prior to starting work.
3. Place a container below the drain tee at the bottom of the Air Outlet vent riser.
4. Slowly remove the drain plug from the bottom of the Air Outlet vent riser to see if any liquid drains from the line.
5. Keep the drain plug for re-use.

7.7.3 Replacing the Drain Plug

See Figure 7-17 .

1. After all the liquid has drained (if any), put non-hardening pipe-joint compound on the plug threads.
2. Re-install the plug into the drain tee, and tighten.
3. Remove the lock(s) and tags from the lockout & tagout.
4. After the work is completed, turn ON power to the VST Control Panel. The GREEN MACHINE is now operational.

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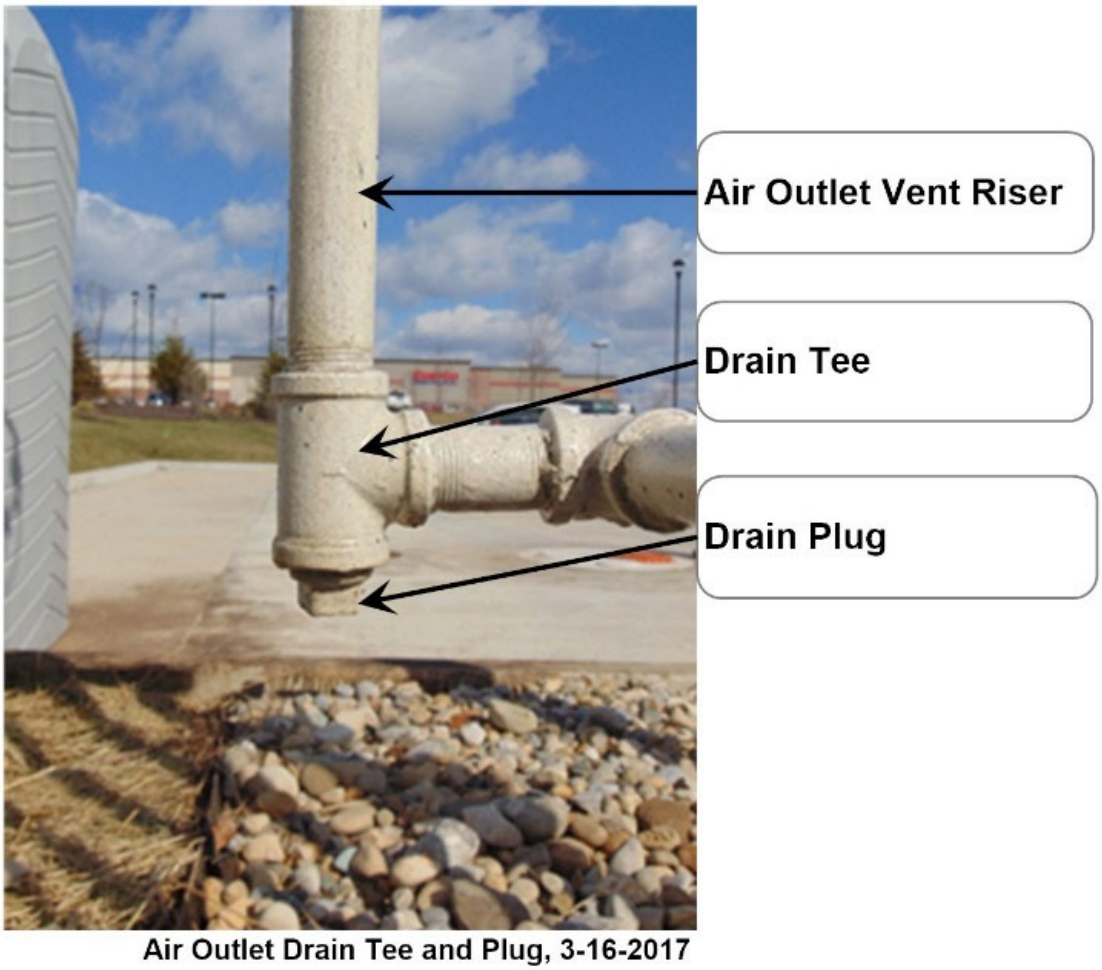

Figure 7-17: Air Outlet, Drain Tee, and Plug

7.8 Separator Check Procedure

7.8.1 Safety

Use lockout / tagout procedures prior to starting work.

7.8.2 7.7.1 Removing and Inspecting the Separator

See Figure 7-18.

1. Turn OFF power to the VST Control Panel at the Power Switch located on the front of the VST Control Panel. (The power, ground, and neutral will be completely disconnected from the GREEN MACHINE*).*
2. Follow lockout-tagout procedures prior to starting work.
3. Unlock the hasps and remove the cover from the GREEN MACHINE.
4. Remove the two 45° flare tubing connections from the separator, being careful not to damage the copper tubing.
5. Remove the separator and while holding it vertically, gently shake it from side to side.
6. If there is clearly excessive debris inside the separator, the separator must be replaced.

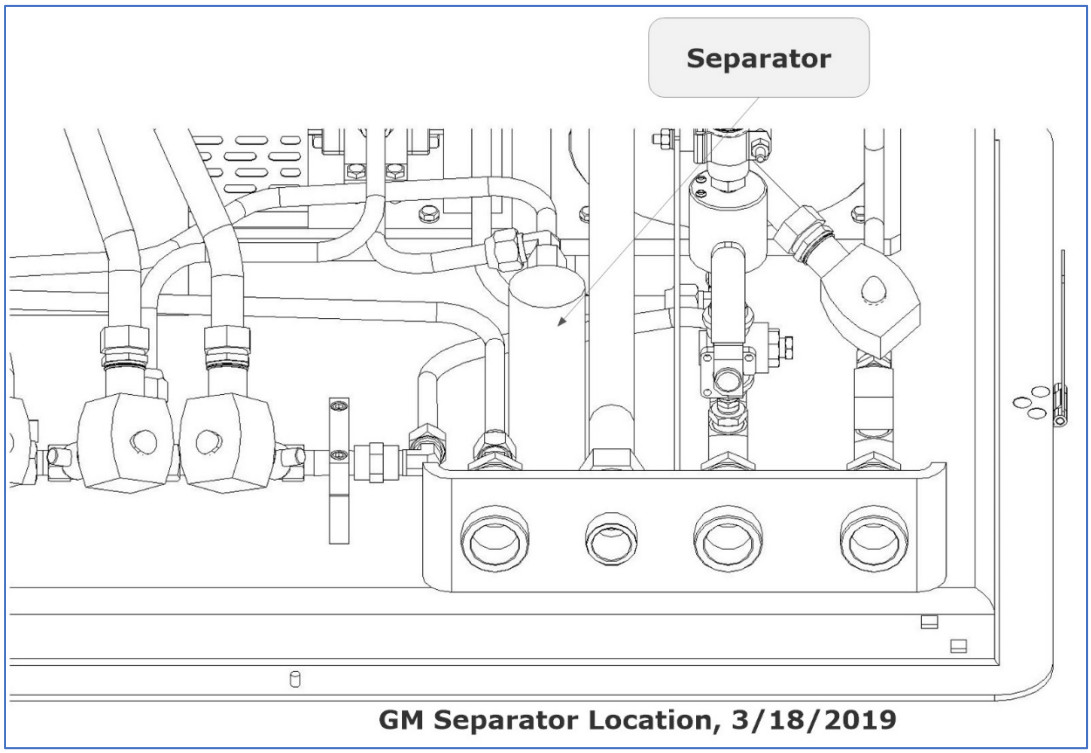

Figure 7-18: Separator Location

7.8.3 7.7.2 Reinstalling the Existing Separator

See Figure 7-18.

1. If the existing separator is still functioning properly, place the separator back into position in the GREEN MACHINE.
2. Re-install two 45° flare tubing connections.
   CAUTION: Do not use any thread sealing compound when assembling the 45° flare nuts.
   CAUTION: When tightening the 45° flare nuts: Clamp the tube flare between nut and nose body of the tube by screwing the nut on finger tight. Tighten with a wrench an additional ¼ turn for a metal-to-metal seal.
3. Put the cover on the GREEN MACHINE and lock the hasps.
4. Remove the lock(s) and tags from the lockout-tagout.
5. After the work is completed, turn ON power to the VST Control Panel. The GREEN MACHINE is now operational.

7.8.4 Installing a New Separator

See Figure 7-19.

1. If the existing separator needs to be replaced, remove the 90° and straight pipe fittings from the existing separator for reuse. The existing separator can be discarded.
2. Wrap the pipe fittings with gasoline resistant PTFE tape, and install the pipe fittings into the new separator.
3. Place the new separator into position in the GREEN MACHINE.
4. Re-install two 45° flare tubing connections.
   CAUTION: Do not use any thread sealing compound when assembling the 45° flare nuts.
   CAUTION: When tightening the 45° flare nuts: Clamp the tube flare between nut and nose body of the tube by screwing the nut on finger tight. Tighten with a wrench an additional ¼ turn for a metal-to-metal seal.
5. Put the cover on the GREEN MACHINE and lock the hasps.
6. Remove the lock(s) and tags from the lockout-tagout.
7. After the work is completed, turn ON power to the VST Control Panel. The GREEN MACHINE is now operational.

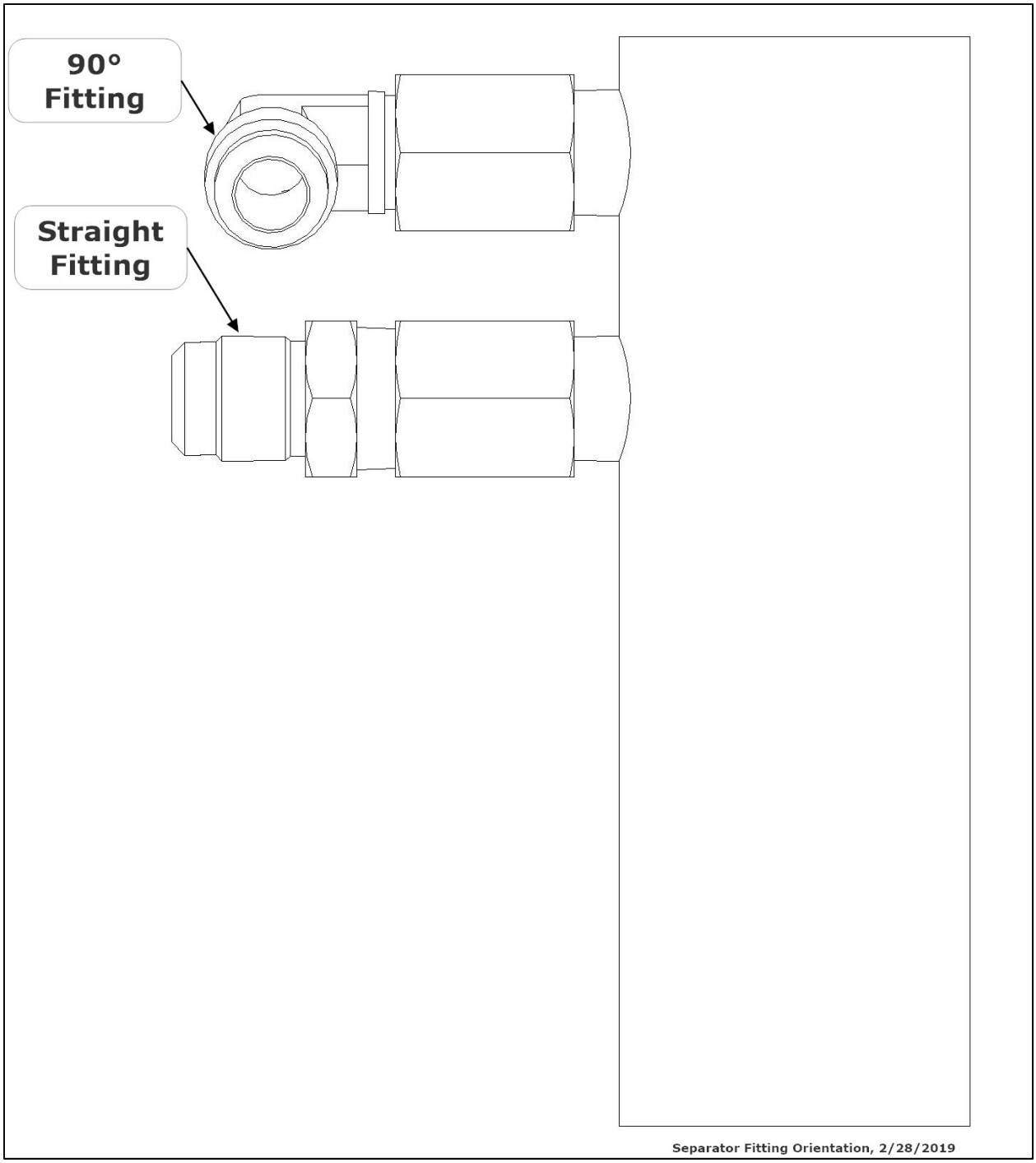

Figure 7-19: Separator Fitting Orientation