Troubleshooting and Replacement Manual

Green Machine™ - California

Revision 1.5

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This Document

- The purpose of this Troubleshooting Guide is to explain what actions to take when the *Green Machine* is not functioning properly.

- This Guide will cover in detail:
  1. An order in which to begin to troubleshoot the *Green Machine* and VST Control Panel
  2. When to replace which components
  3. How to replace the necessary components
  4. The replacement parts required

Green Machine Replacements Parts Table

Part #	Description
GM-001	Aluminum Cover
GM-002	1-2 Hour Rated Fire-Resistant Enclosure (OPTIONAL)
GM-003	Model 2 Vacuum Pump/Single-Phase Motor Assembly
GM-004	Rubber Flange Sleeve
GM-006	UL Control Valves – Core Rebuild Kit
GM-033	Vapor Filtration Cartridge Assembly – 1
GM-022	Model 2 Vacuum Pump (only)
GM-027	Vacuum Pump Motor (only), 120VAC, 1-Phase
VST *Green Machine* Control Panel	
Part #	**Description**
GM-008	*Green Machine* Controller
GM-029	*Green Machine* Control Panel

VST Control Panel Replacement Parts List

Item	Qty	Part Number	Description	Manufacturer
1	1	PS3X-C24AFC	24 VDC POWER SUPPLY, 1.1 A	IDEC
2	4	PIR6W-1P-24VDC	TERMINAL RELAY, 24V AC/DC, SPDT	SPRECHER+SCHUH
3	1	KTA7-25S-20A	20A MOTOR CIRCUIT CONTROLLER	SPRECHER+SCHUH
4	1	KT7-PA1-20	SIDE-MOUNT AUX CONTACT 2 N.O.	SPRECHER+SCHUH
5	1	KT7-UA-120V	UNDERVOLTAGE TRIP MODULE, 120V, CONTROL	SPRECHER+SCHUH
6	1	KT7-HTRY	DOOR COUPLING HANDLE, RED/YEL	SPRECHER+SCHUH
7	2	KT7-25-TE1	TERMINAL ADAPTER	SPRECHER+SCHUH
8	1	70S2-04-C-12-S	SOLID STATE RELAY, 12A, 24VDC COIL	MAGNECRAFT
9	1	L9-10/1/D	MINI CIRCUIT BREAKER, 10A, UL489	SPRECHER+SCHUH
10	4	V7-H6	FUSE HOLDER	SPRECHER+SCHUH
11	3	MDL-5	5A GLASS FUSE	BUSSMAN
12	1	MDL-4	4A GLASS FUSE	BUSSMAN
13	1	GM-032	TLS INSPECTOR PORT COMMUNICATIONS KIT	VST
14	1	KT7-HT	250 MM EXTENSION SHAFT	SPRECHER & SCHUH
15	1	H721LC	ANALOG CURRENT TRANSDUCER	VERIS INDUSTRIES

Troubleshooting Flow Chart

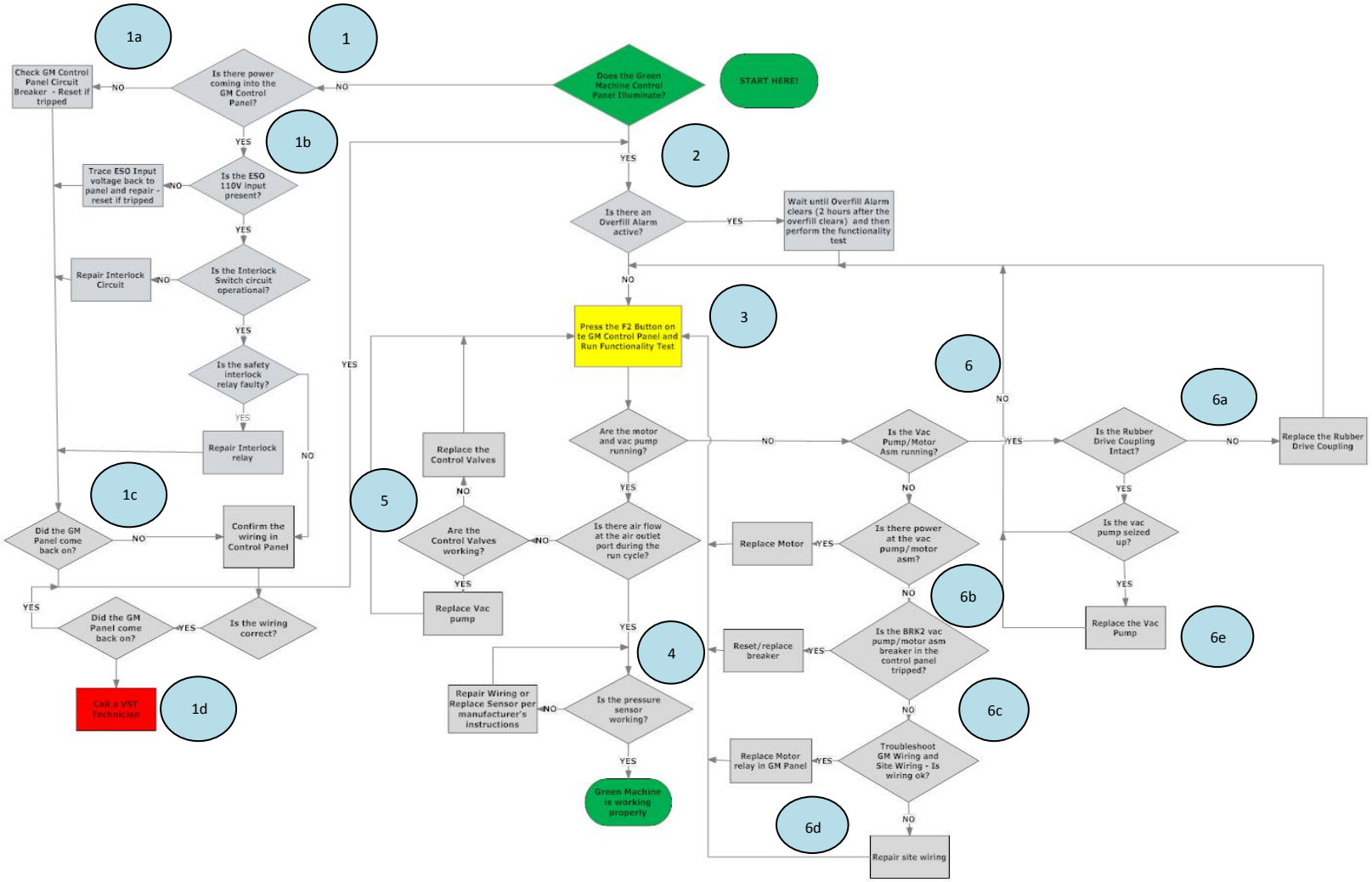


Figure 1: Troubleshooting Flow Chart

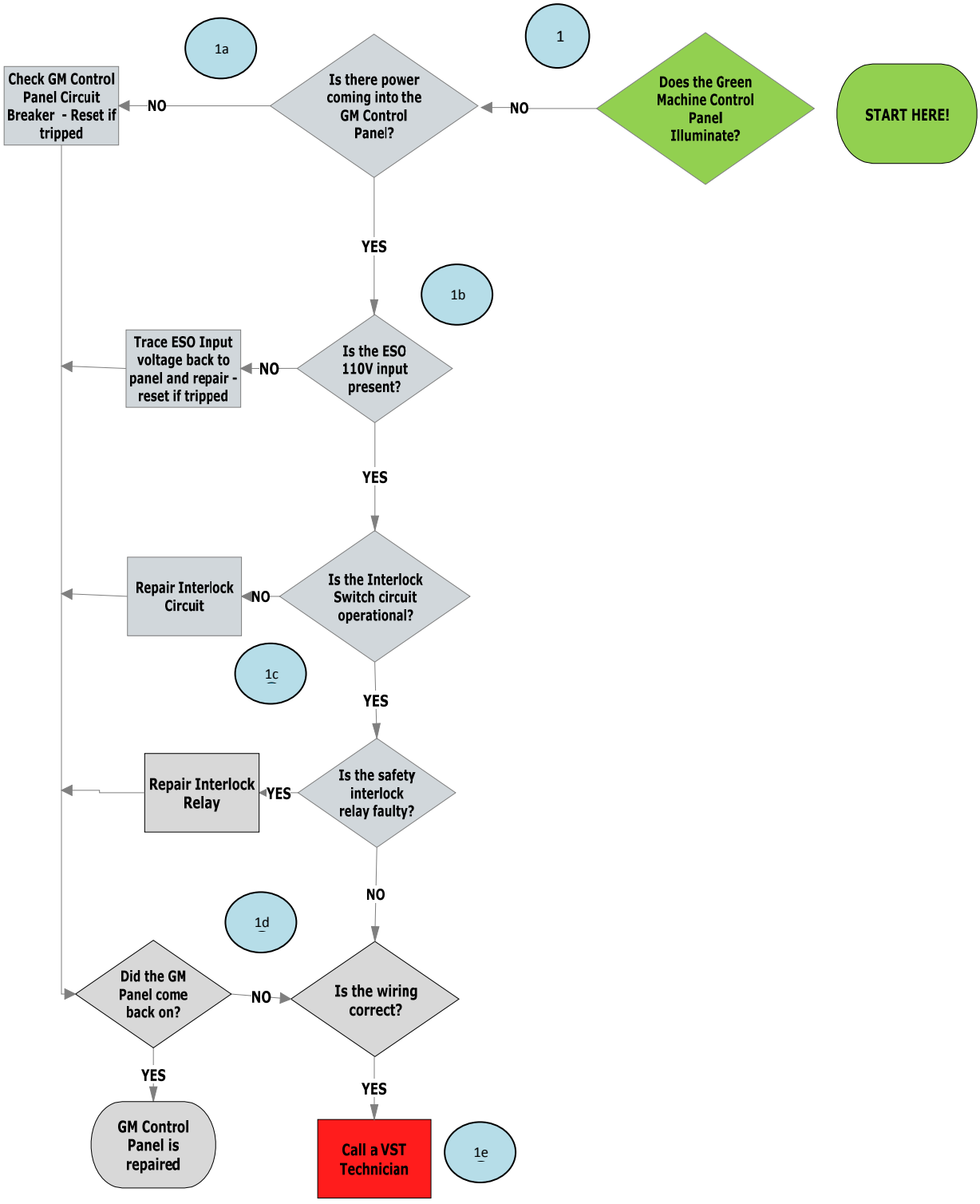


Figure 2: VST Control Panel troubleshooting (section 1)

1 No Power to the VST Control Panel

The VST Control Panels are pre-wired and tested prior to leaving the factory. There may be a chance that a wire connection came loose during shipment. There is also a chance that the wire connections may not be tight during the field installation or the electrical equipment is not properly configured after the installation wiring is complete. The VST Control Panel is MET Listed to comply with UL Standard 508A, and CSA C22.2 No.14. If an electrical component has malfunctioned inside the VST Control Panel, all the electrical components MUST BE ordered from the Replacement Parts List in this manual.

a. Verify that the breaker for the VST Control Panel in the main power distribution panel is closed. If not, close it.
    - Verify that the disconnect switch on the front of the VST Control Panel is ON.

b. The Emergency Shut Off (ESO) must supply 115 VAC power to the VST Control Panel for the *Green Machine* Controller to have 24 VDC power and for the *Green Machine* to operate.
    a. Verify the ESO is not engaged, if the ESO is engaged the *Green Machine* will not operate.
    b. Verify the GDF Emergency Shut-Off (ESO) is connected to the VST Control Panel
    c. Verify all the wire connections are tight
    d. Verify the ESO circuit is supplying 115 VAC power to the VST Control Panel across terminals 02023 and 02032 in the field connections section of the VST Control Panel**.** **See Figure 4**.

c. The Safety Disconnect Interlock must be connected to the VST Control Panel for the *Green Machine* to operate.
    a. Check that the Safety Disconnect Switch output voltage is 115VAC.
    b. Verify the wires to the safety disconnect switch interlock are properly connected to the VST Control Panel and all the wire connections are correct and tight.
    c. If a safety disconnect was not installed, a wire jumper must be installed in the VST Control Panel from: 02023 and 02032, **See Figure 4.** The interlock wiring **or** jumper wire must be installed for the *Green Machine* to operate.

d. Verify the VST Control Panel fuses and wiring to the power supply are correct:
    a. With power OFF to the VST Control Panel, check to see if the FU 3 fuse is functioning. The 4 amp fuse may be blown, if so replace fuse. **See Figure 9**.
    b. Verify there is 24 VDC power out of the 24 VDC power supply. On the 24 VDC power supply, check the OUTPUT terminals marked –V and +V. The voltage should be 24 ± 5 VDC. The 24 VDC power supply may be damaged, if so replace.
    c. Check the 24 VDC wire connections to the *Green Machine* Controller. At the *Green Machine* Controller, check to make sure there is 24 VDC power. The *Green Machine* Controller may be damaged, if so, replace. **See Figure 9.**

e. If the Control Panel worked <u>prior to this issue</u> and after checking items a-d, the Control Panel still does not have power, call a VST Technician.

f. If the VST Control Panel does not work <u>on initial install</u> and items a-d have been checked, call a VST Technician.

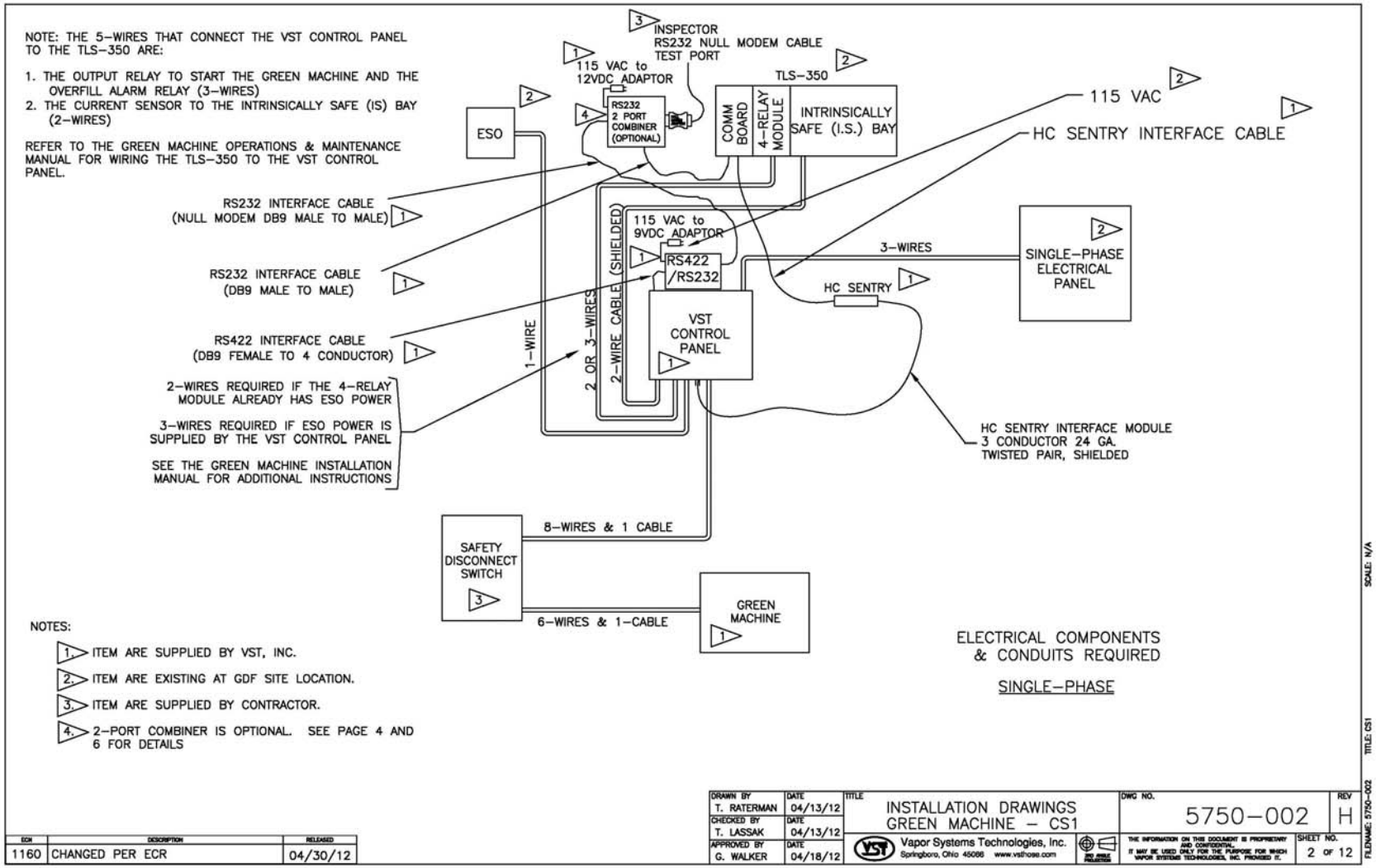


Figure 3: Electrical Overview Installation Diagram

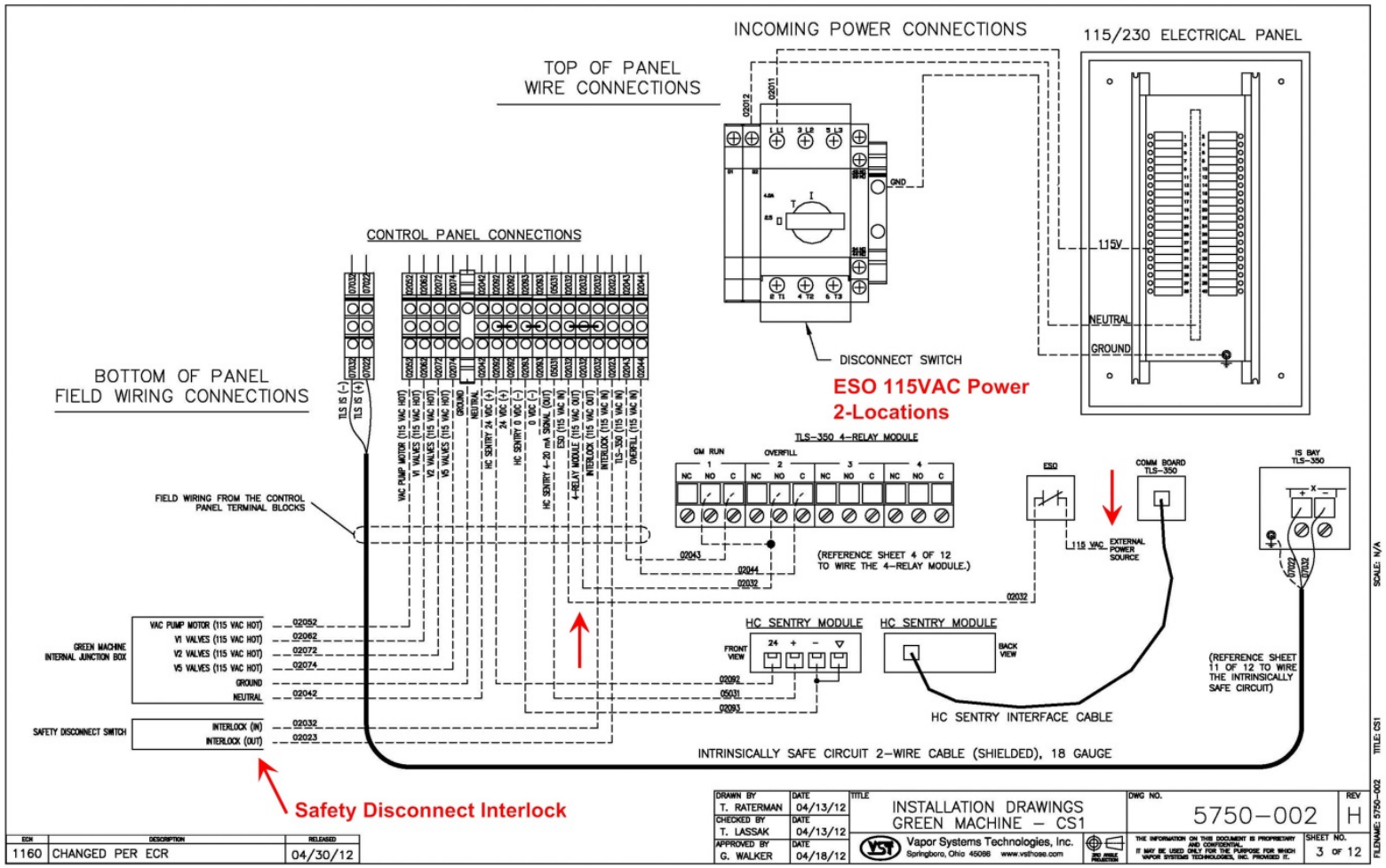


Figure 4: Electrical Field Wiring Diagram - Option 1

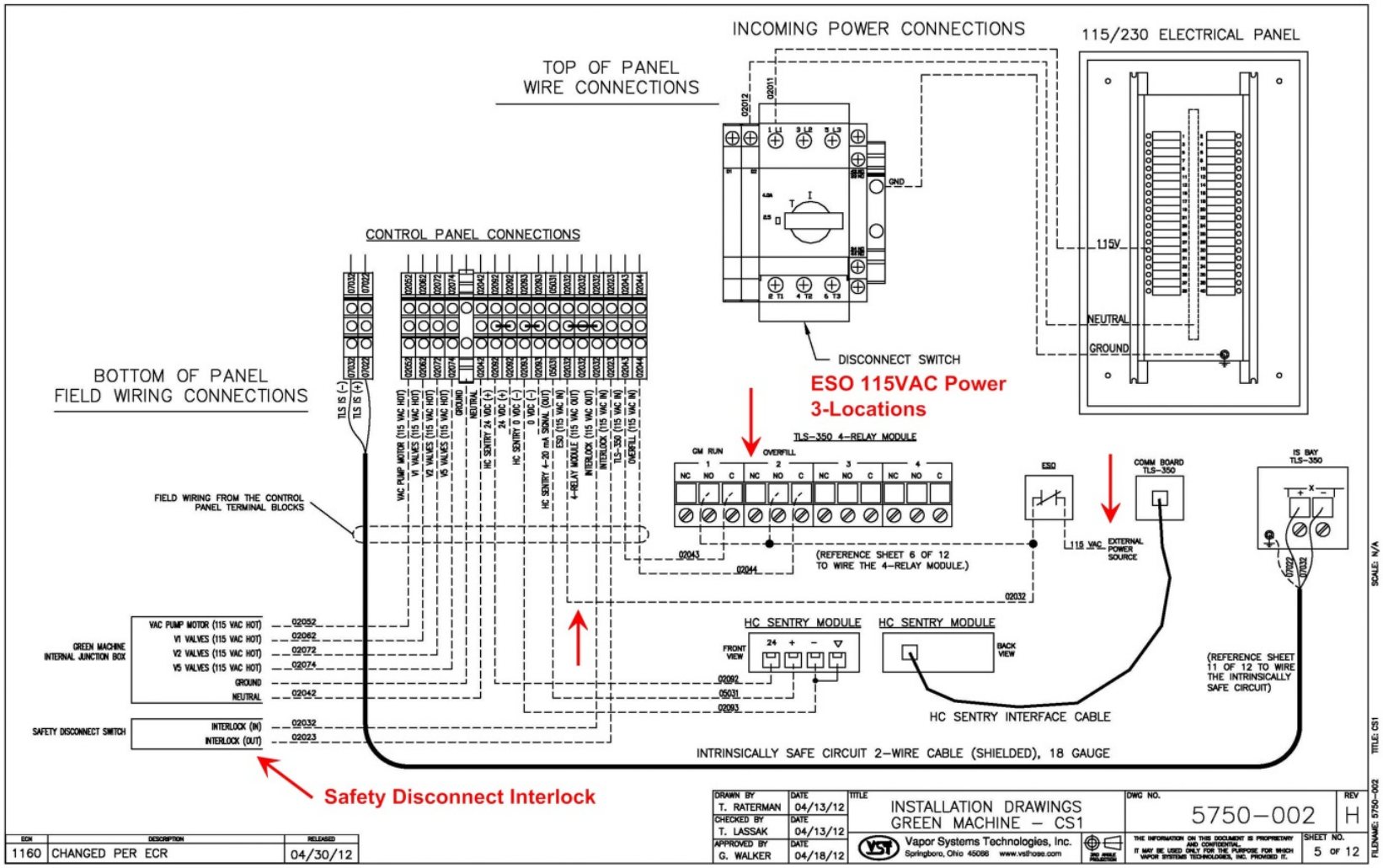


Figure 5: Electrical Wiring Diagram - Option 2

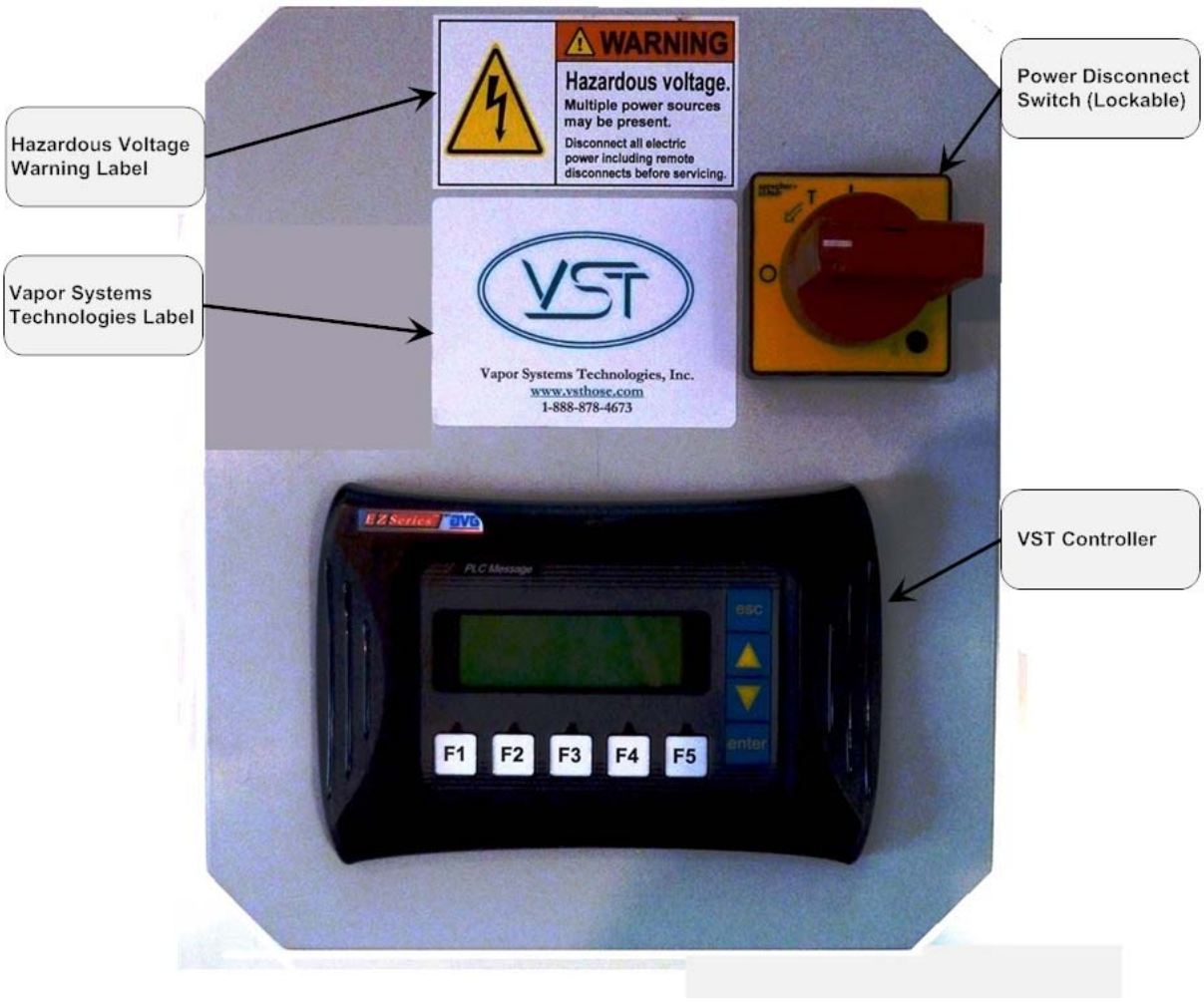


Figure 6: VST Control Panel Front Cover

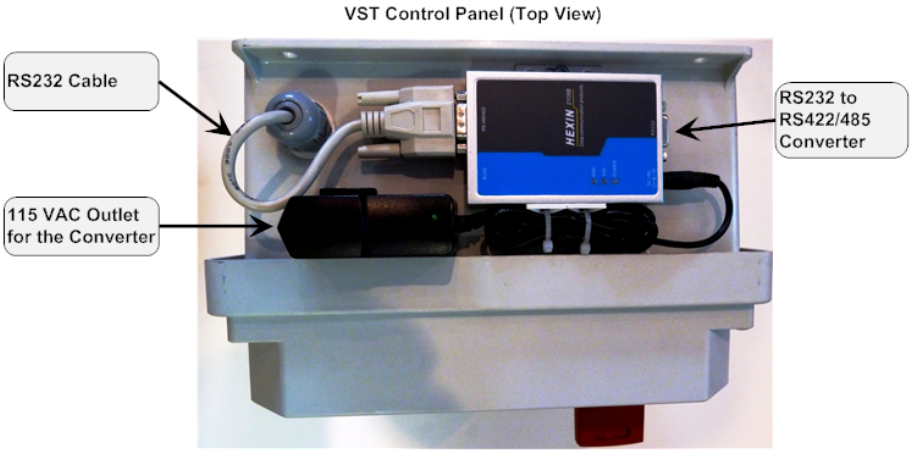


Figure 7: VST Control Panel Top

Figure 8: VST Control Panel Inside Front Cover

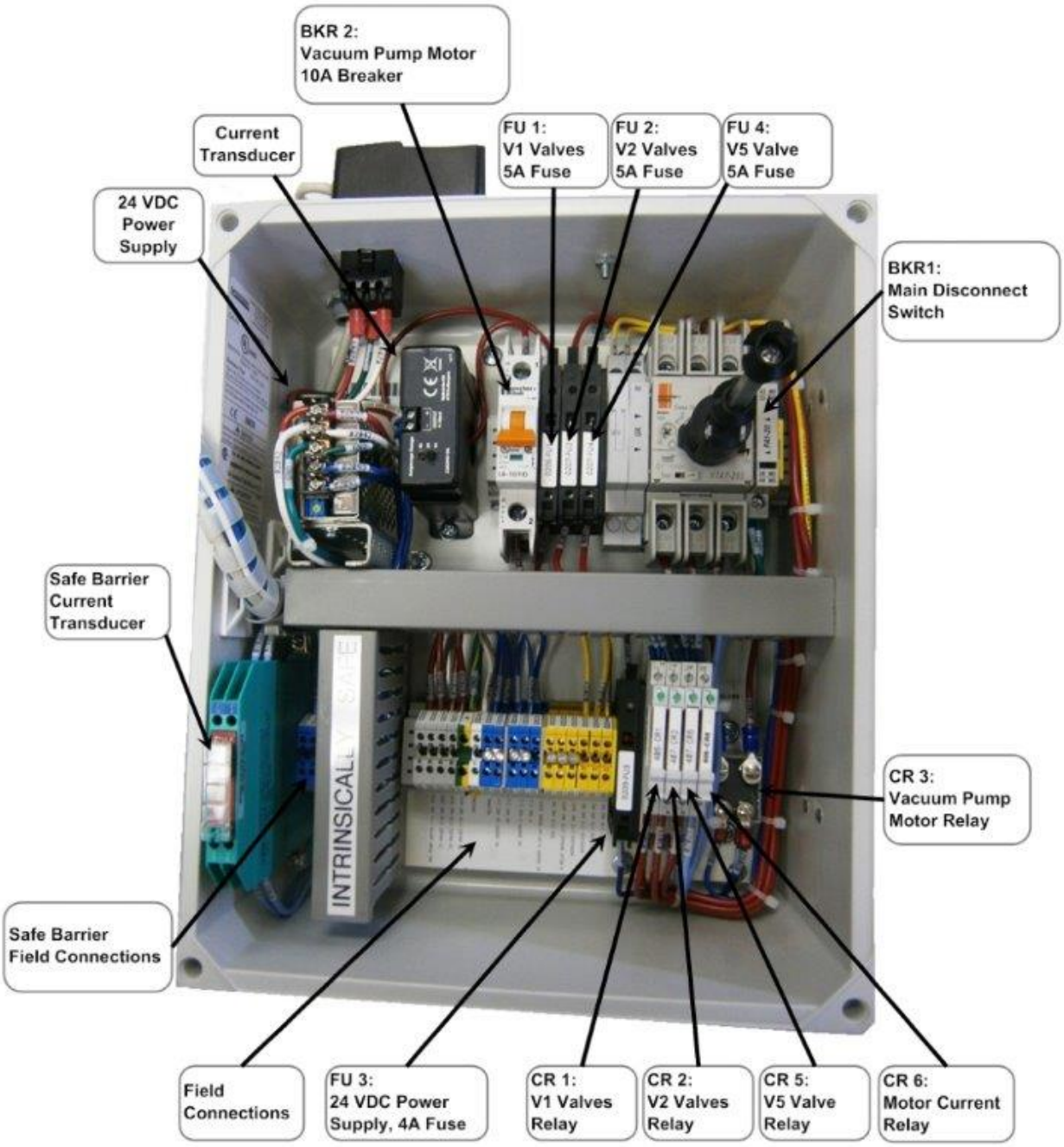


Figure 9: VST Control Panel Components

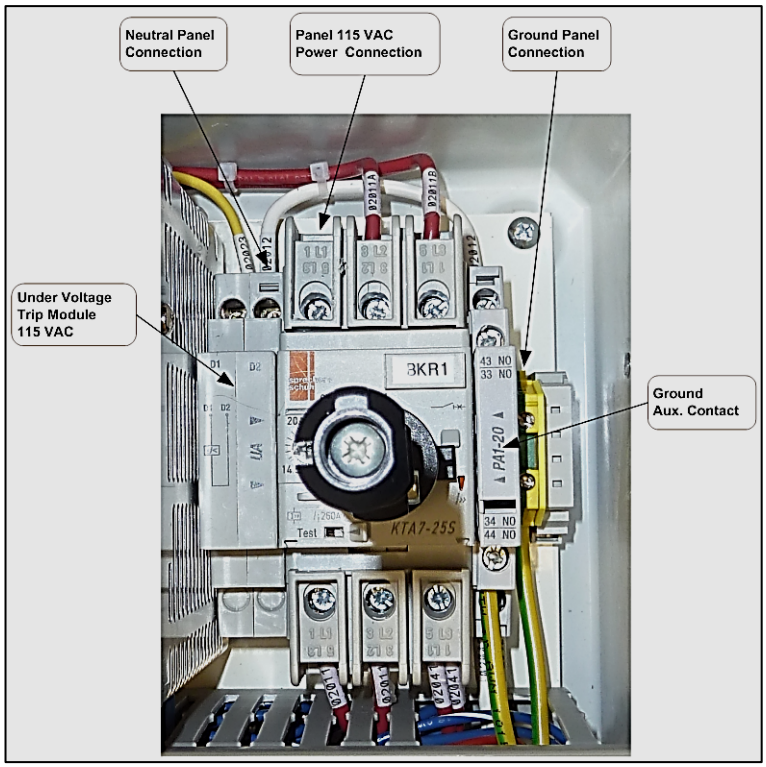


Figure 10: VST Control Panel Disconnect Switch Main Breaker (BRK1) and 115 VAC Power Connections

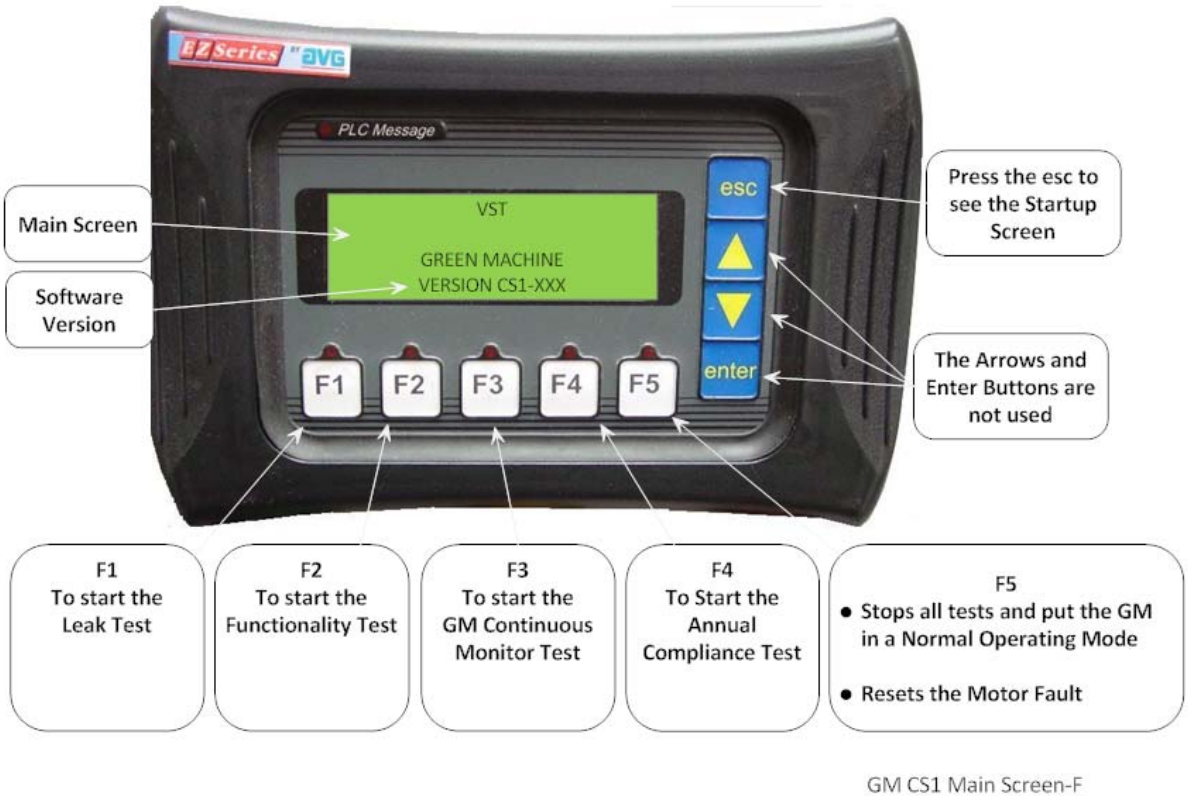


Figure 11: VST Control Panel *Green Machine* Controller Screen

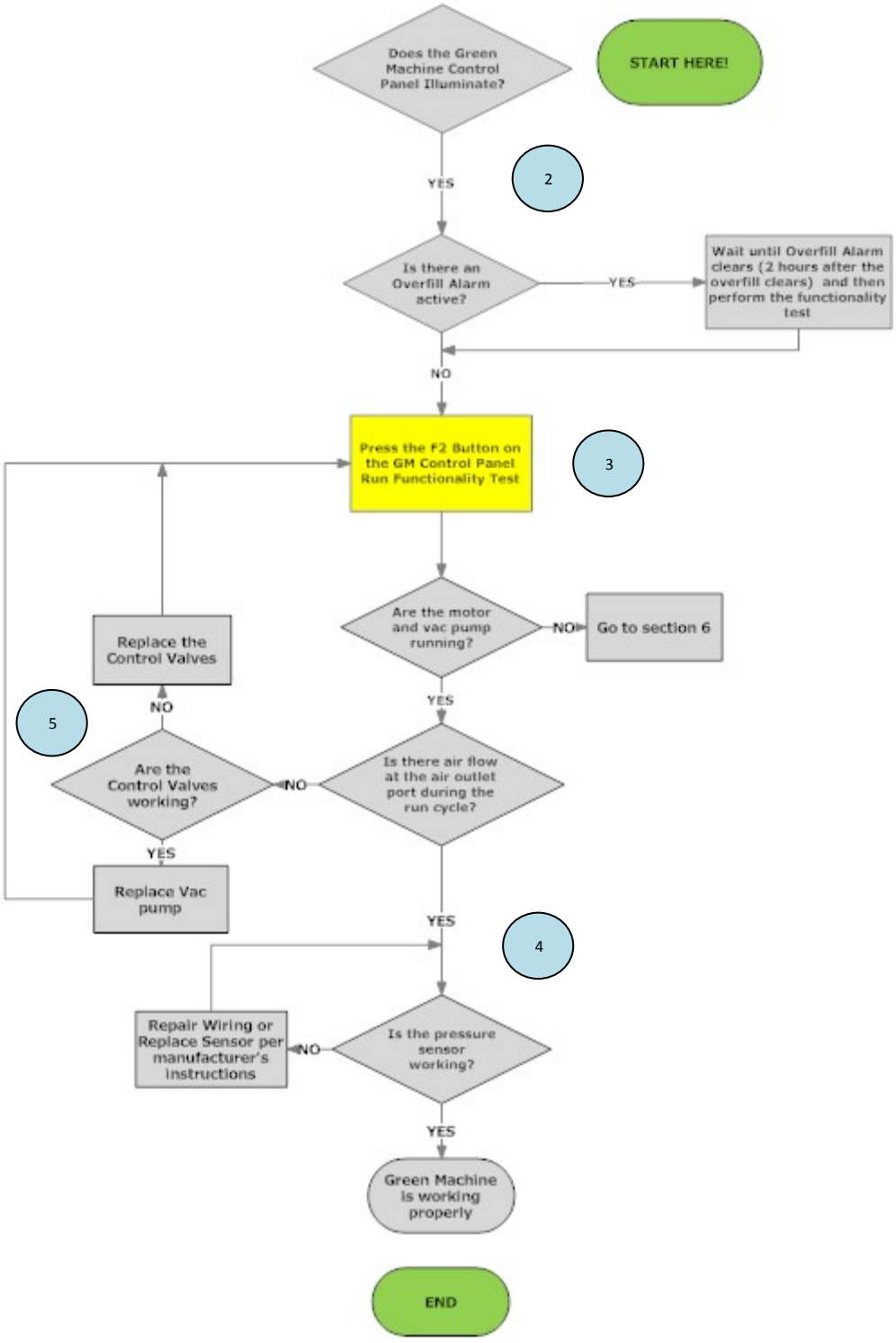


Figure 12: Sections 2-5 of Troubleshooting

2 Overfill Alarm

Figure 13: *Green Machine* Controller Overfill Alarm Screen

- After confirming that the Control Panel is working properly, determine if there is input to the Overfill Alarm circuit. If an Overfill Alarm is displayed on the VST controller, then terminal 02044 either has or had +115VDC supplied to it via an external Overfill Alarm relay.
    - Customer supplied 115 VDC power when the "Fuel Management" Overfill Alarm is active.
    - Terminal 02044 does not have 115 VDC power after the "Fuel Management" Overfill Alarm clears.

- Check to see if the +110VDC is present at the terminal 02044. The Overfill Alarm display will clear 2 hours after the +110VDC signal is removed from the terminal 02044.

- See the Electrical Installation section of IOM 18 *Green Machine* Installation Manual in the latest version of the EO VR 203 or 204 for a description of the wiring of the Overfill Alarm and the Overfill Alarm Screen section for a description of the operation of the Overfill Alarm with the *Green Machine*.

- Once the overfill alarm clears, run a Functionality Test to determine that the *Green Machine* is functioning normally.

3 Functionality Test

Run a Functionality Test to verify that the vacuum pump and valves are working properly.

Preparation

1. Put the *Green Machine* in the Manual OFF mode at the TLS-350.
2. Push the F5 button to make sure no other tests are running.
3. The *Green Machine* is now OFF and will not operate.
4. Make sure power is **ON** to the VST Control Panel.
5. Close the two valves between the *Green Machine* and the Vent Risers, and remove the caps from both of the tees.

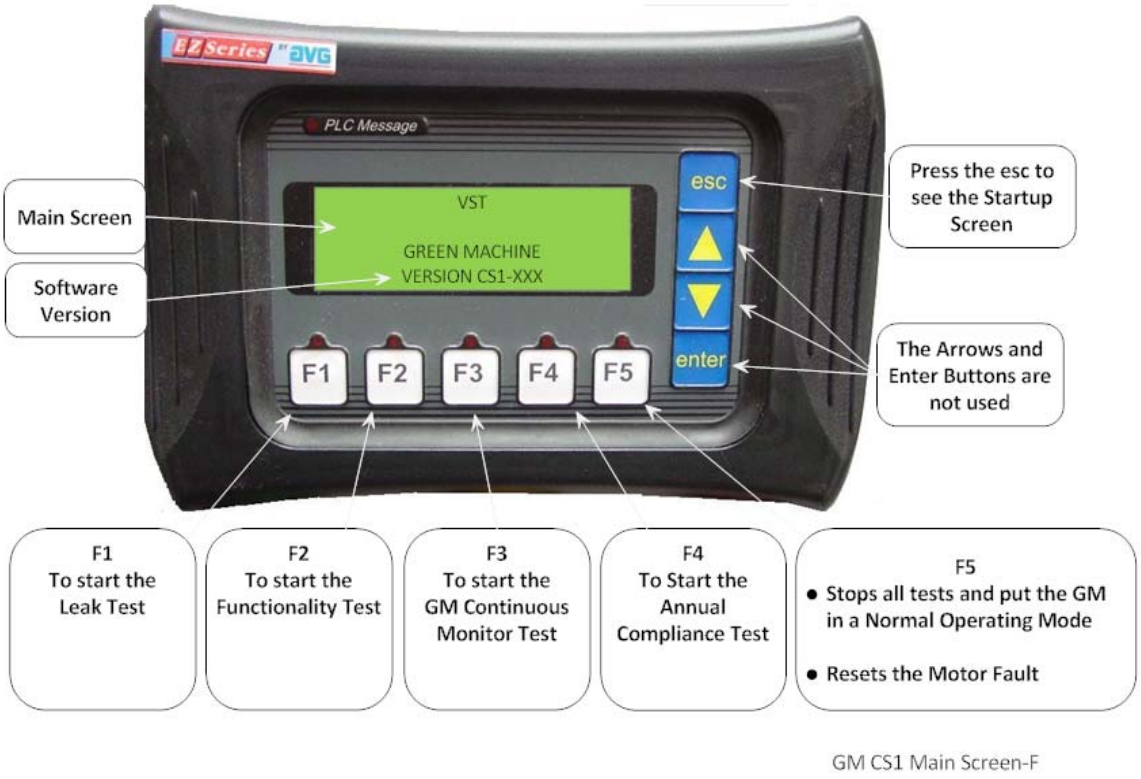


Figure 14: Functionality Test Run Screen

Testing Procedures

1. Push the F2 button to start the Functionality Test, **see Figure 14.**
   - The *Green Machine* will RUN for 60-seconds then PURGE for 60-seconds, (this is one cycle).
   - The *Green Machine* will continue to cycle 5-times or until the F5 button is pushed to end the test.
   - There are 5-cycles to provide enough time to conduct the test.
   - Pushing the F5 button will cancel the test and the screen will show *Green Machine* OFF.
2. During the 60-second RUN mode: **see Figure 15**.
   - Place your hand over the tee opening at the vapor inlet and feel for suction
   - Next, place your hand over the tee opening at the air outlet and feel for air blowing
3. During the 60-second PURGE cycle: **see Figure 15**.
   - After the PURGE cycle has begun, place your hand over the tee opening at the vapor inlet 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 air outlet and feel for zero airflow.
4. If all the conditions hold true for the above test, the valves and the Vacuum Pump are working as expected.

5. Continuous airflow during the PURGE cycle would indicate a leak in the *Green Machine* internal system:
    - Push the F5 button to end the Functionality Test and the screen will show *Green Machine* OFF.
    - Conduct a Leak Test to find where the leak is occurring.
6. After 5-cycles are complete, the Functionality Test has ended:
    - The *Green Machine* Controller will automatically go back to the *Green Machine* OFF screen.
    - Open the two ball valves between the *Green Machine* and the vent risers, and replace the caps on the two tees.
    - Put the *Green Machine* in the AUTOMATIC mode at the TLS-350.

    CAUTION: DO NOT PUT THE *GREEN MACHINE* IN THE AUTOMATIC MODE AT THE TLS-350 UNTIL THE VALVES BETWEEN THE *GREEN MACHINE* AND THE VENT RISERS ARE OPENED. PUTTING THE *GREEN MACHINE* IN THE MANUAL ON MODE, WHEN THE VALVES ARE CLOSED , WILL NOT ALLOW THE *GREEN MACHINE* TO OPERATE PROPERLY AND MAY CAUSE DAMAGE TO INTERNAL COMPONENTS.

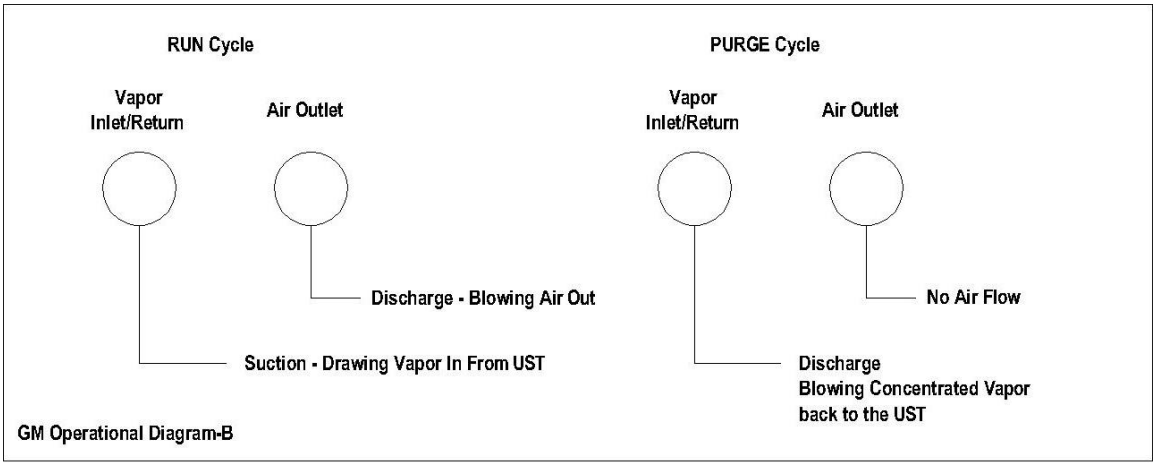


Figure 15: *Green Machine* Operation Diagram

3.1 Leak Test

Purpose and Applicability

- The purpose of the Leak Test is to insure that all of the tubing fittings and tubes located inside the VST *Green Machine* are leak free.
- The leak test will be required only at installation, during certain troubleshooting, and any time after the *Green Machine* plumbing, fittings, or connections have been loosened or adjusted.

Principle and Summary of Test Procedure

- The *Green Machine* is configured in the MANUAL OFF operating mode and the solenoid valves are set such that all internal *Green Machine* piping and connections can be pressurized with nitrogen. Once pressurized, all piping and connections are checked by applying a soapy solution. Any nitrogen escaping from leaks will cause the soapy solution to bubble. The absence of bubbles indicates that the piping and connections are free of leaks.

Equipment and Supplies

- Cylinder of compressed nitrogen gas with regulator capable of establishing an outlet flow of less than 20 psi.
- VST Leak Test Fixture (**See Figure 17**).
- Soapy solution that will produce visible bubbles when exposed to nitrogen gas leaking from piping and connections.

Pre-Test Requirements

- Close the manual inlet and outlet valves at the *Green Machine,* and remove a cap from one of the tees (**See Figure 18**). Only one open tee is required for this test.
- Install the Leak Test Fixture in the empty 1" pipe tee on the *Green Machine* as shown in **Figure 18**.
- Ensure that the shut-off valve on the VST Leak Test Fixture is closed, and then connect the nitrogen source. Set the nitrogen regulator to approximately 5 psi outlet pressure, making sure that it does not exceed a maximum of 20 psi outlet pressure.

Test Procedure

1. Manually turn off the VST *Green Machine* as follows:
    - On the TLS Console front panel, use the 'mode key' to scroll to 'DIAG MODE' and then use the function and step keys to view the 'VAPOR PROCESSOR MODE' menu.

2. From the 'VAPOR PROCESSOR MODE' menu, change the vapor processor mode of operation from automatic to manual mode. From the 'VAPOR PROCESSOR STATE' menu, verify the VP STATE is in the "off" mode. The processor shall be in the off mode for the duration of the test.

CAUTION:
If by chance the TLS is in the Auto Mode during the Leak Check Test, the PLC, after the F1 button is pushed, will control the *Green Machine* as indicated in Step 1 above. After the F5 button is pushed or the 30-minute timer times out, the PLC will convert back to a Normal Operating Mode and the *Green Machine* will start automatically if the UST pressure is above + 0.2"WC. Since this test is conducted with either the *Green Machine* inlet and outlet valve closed, starting the *Green Machine* automatically will NOT ALLOW THE GREEN MACHINE TO OPERATE PROPERLY AND MAY CAUSE DAMAGE TO INTERNAL EQUIPMENT.

3. Make sure power is ON to the VST Control Panel.

4. At the VST Control Panel (**See Figure 19**), press the F1 button to disable running the vacuum pump and to open all of the control valves. The vacuum pump will remain off until one of the following conditions is met:
    - The F5 button is pushed OR
    - The PLC internal timer times out at 30 minutes
    - If additional time is needed to conduct the Leak Test, push the F1 button again to re-start the 30 minute timer.

5. Slowly and carefully pressurize the *Green Machine* to between 1.0 and 2.0 psi as follows:
    - Make sure the shut-off valve on the Leak Test Fixture is fully closed.
    - Make sure the Leak Test Fixture pressure regulator is fully closed.
    - Slowly open the valve on the test fixture to pressurize the *Green Machine* at 1.0 to 2.0 PSI nitrogen.

CAUTION:
PRESSURIZING THE *Green Machine* OVER A MAXIMUM OF 5.0 PSI MAY CAUSE DAMAGE TO THE *Green Machine* O-RINGS AND/OR PUMP SEALS, WHICH WILL VOID ALL WARRANTIES OF THE *Green Machine*.

6. With the *Green Machine* pressurized between 1.0 to 2.0 PSI nitrogen, spray a soapy solution on each fitting to check for bubbles:
    - If bubbles do not appear, the connection is tight.
    - If bubbles do appear, tighten the leaking fitting 1/8" turn (maximum) and re-check for leaks.
    - If the fitting cannot be tightened so that the connection is leak free, replace the 45° flare tube assembly that is leaking with a new tube assembly.

7. Continue this process until all the internal tube fittings have been checked and found leak free.

8. Once this test is complete and all the piping fittings are leak free, remove the compressed nitrogen connection to the Leak Test Fixture.

9. Remove the Leak Test Fixture and Re-install the 1” pipe plug.

10. Open the manual inlet and outlet valves at the *Green Machine*.

11. After the testing is completed, push the F5 button on the VST Control Panel to put the PLC back to normal operating mode. If the F5 button is not pushed, the PLC will convert back to normal operating mode 30 minutes after the F1 button was pushed.

12. Use the TLS-350 to put the *Green Machine* back into the **Automatic** mode.

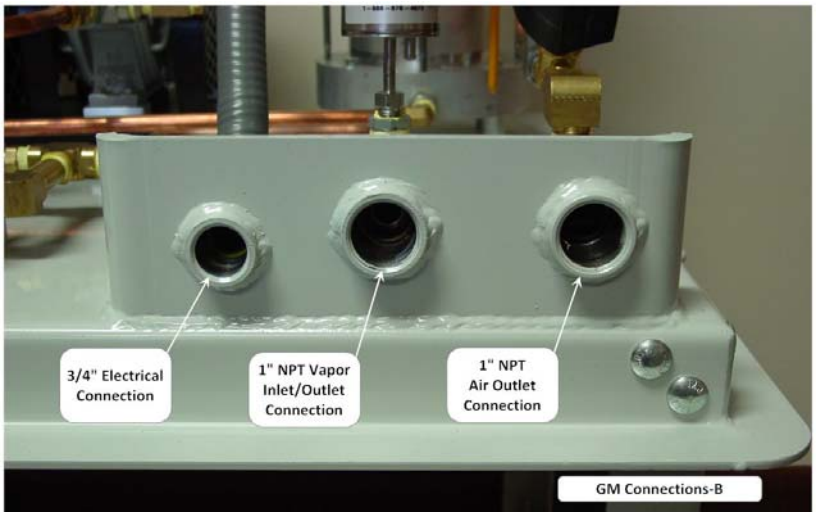


Figure 16: *Green Machine* Vapor Inlet/Return & Air Outlet Connections

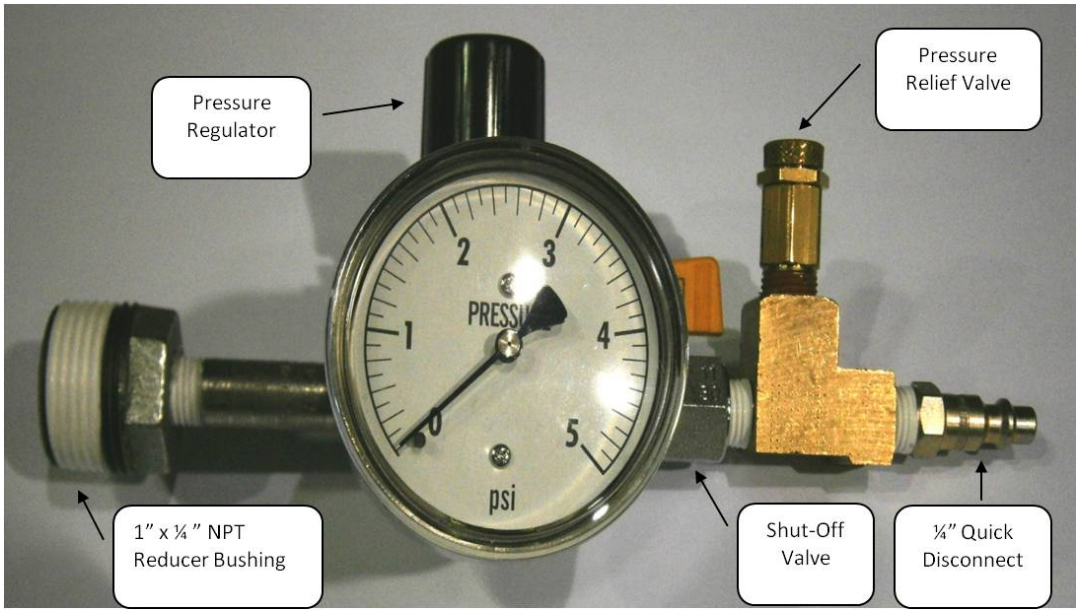
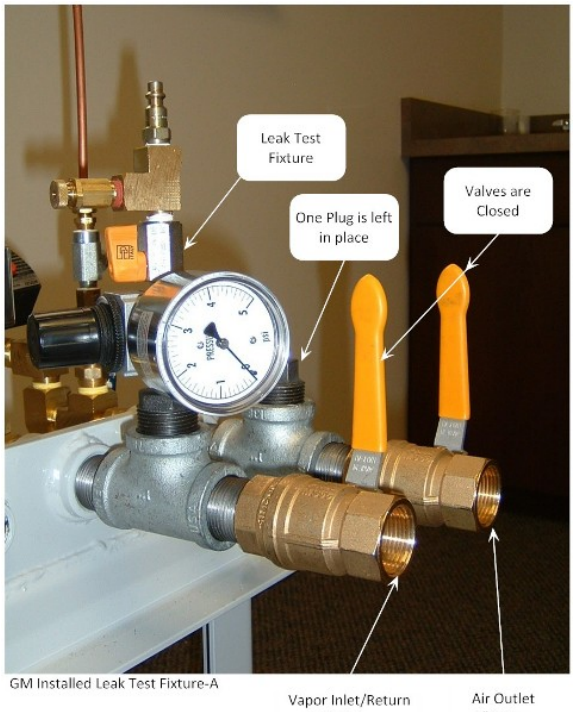


Figure 17: Leak Check Fixture



Note:
This picture shows an example of the valves (2) closed and the Leak Check Fixture attached to the open tee.

Figure 18: *Green Machine* Inlet and Outlet

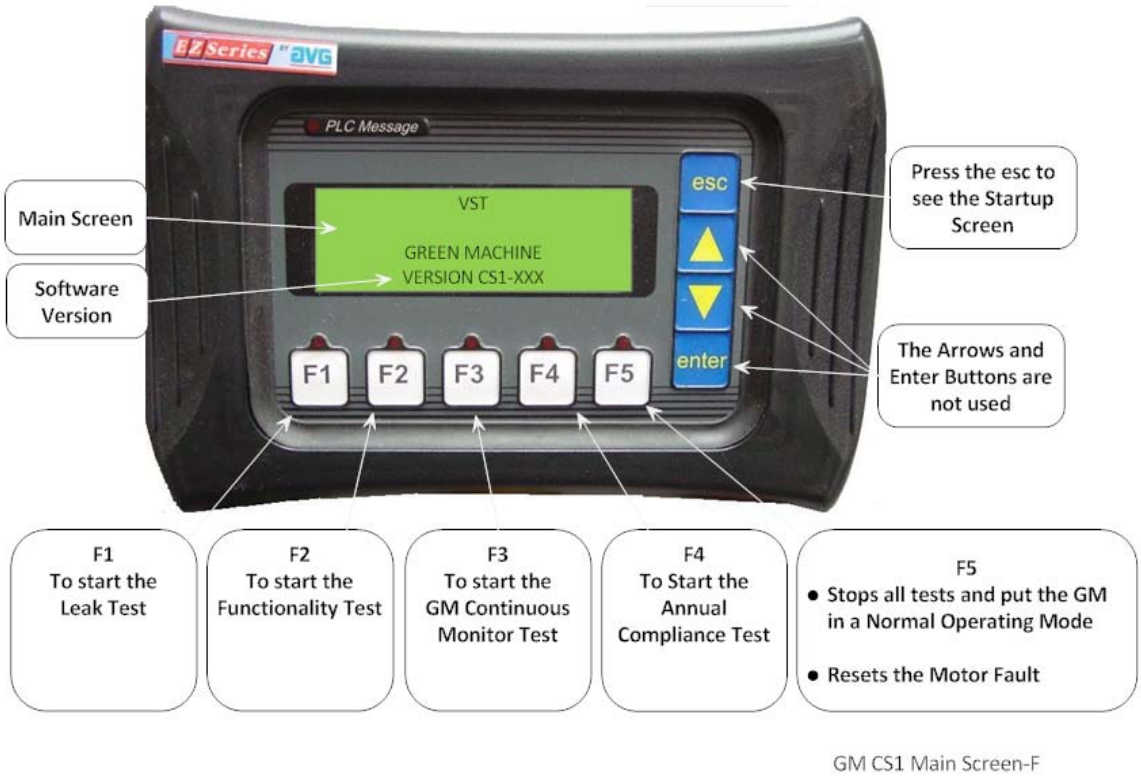


Figure 19: Leak Test Screen

4 Pressure Sensor

If the *Green Machine* is not turning on and steps 1-3 have been verified to be functioning properly, check the accuracy of the pressure sensor with the *Green Machine* Controller to make sure that the Pressure Sensor is working properly.

4.1 Testing Procedures

1. Connect the device that will be used to measure the pressure to the UST at the Vapor Poppet or other suitable location (*Green Machine* inlet tee or the dispenser vapor piping).
2. Check the TLS-350 and confirm that the reading on the measuring device and the TLS-350 are comparable.
3. If readings are close, the pressure sensor is working. If not, replace the pressure sensor per the Veeder Root replacement procedures.

5 Control Valves

5.1 Control Valves Troubleshooting

1. Check for a magnetic field at the red cap in the center of the valve during a Functionality Test.
    a. Take a small non-magnetized screwdriver that will be drawn to the magnetic field, if one is present, and see if the screwdriver is drawn to the general location of the red cap.
    b. The valves will alternate as the Green Machine switches between Run and Purge cycles. During the Run cycle, control valves A, C and E will be ON and B and D will be OFF.
    c. During the Purge cycle, control valves B and D will be ON and A, C and E will be OFF. **See Figure 20.**
        1. If while running the Functionality Test during the **RUN Cycle** there is NO suction on the vapor inlet/return opening OR air is NOT blowing out of the air outlet opening:
            a. And there is 115 VAC to FU1 then, replace the solenoids on valves A and C.
            b. And if there is 115 VAC to FU4, then replace the solenoid on valve E.
2. If there is no magnetic field, check the wiring for voltage.
    a. If voltage is present, replace solenoid.
    b. If no voltage is present, troubleshoot wiring back to the *Green Machine* Control Panel.

NOTE: Follow Lockout Tagout procedures if replacing the solenoid.

3. If the magnetic fields are present, listen for any of the valves making a chattering sound. If chattering is heard, replace the valve assembly with VST P/N GM-006. **See Figures 21 and 22.**

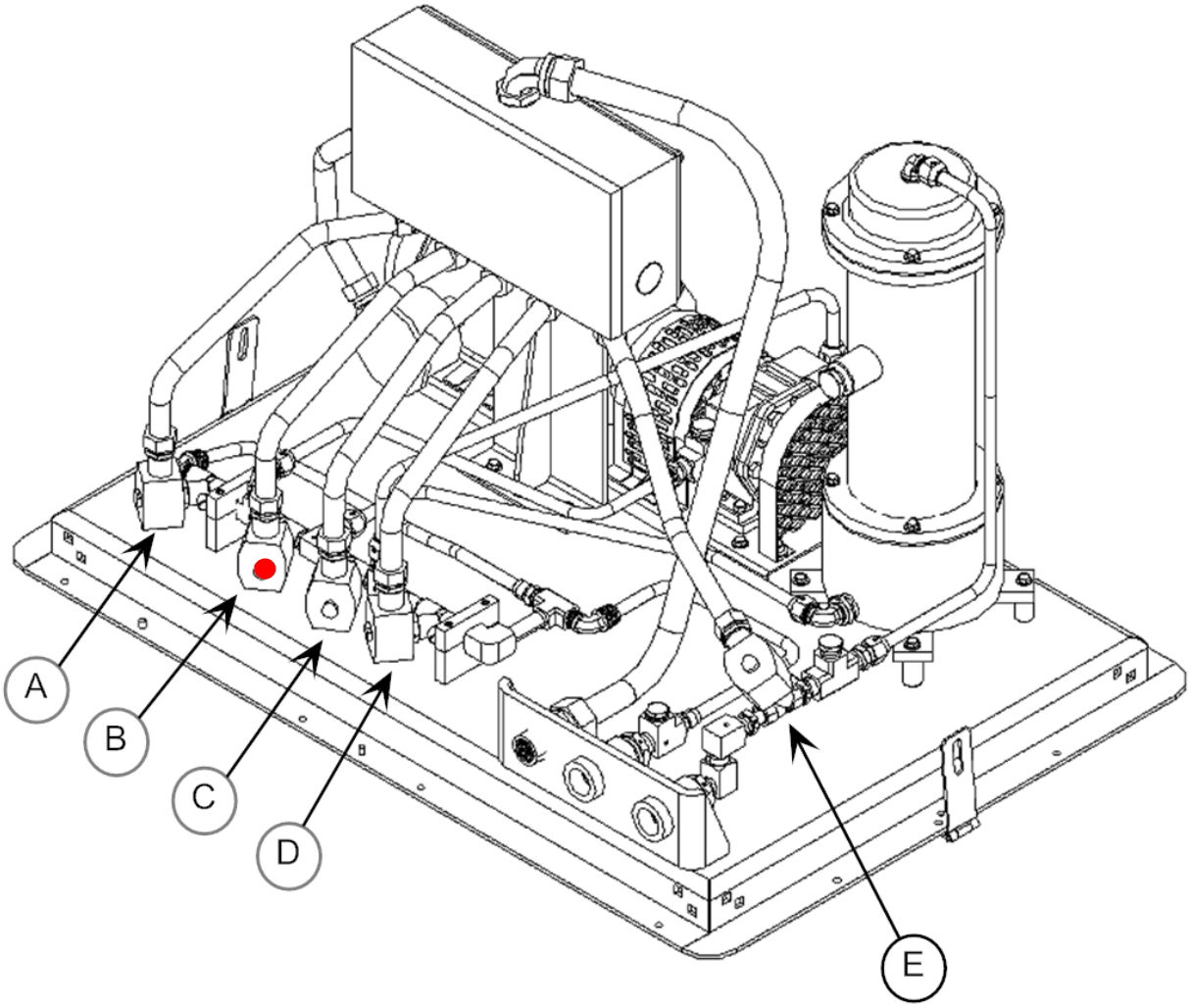


Figure 20: Green Machine Control Valve Layout and Identification

5.2 Valve Core Replacement or Solenoid Replacement

5.2.1 Removing the Valve Solenoid and Core Assembly

See Figure 21

1. Disconnect power to the VST Control Panel. (The power, ground, and neutral will be completely disconnected from the *Green Machine*.)

2. Follow lockout & tagout procedures

3. Unlock the hasps and remove the cover from the *Green Machine*.

4. Un-lock and close the ball valves between the *Green Machine* and the vent risers

NOTE: The Liquid Tight conduit or fitting does not have to be removed from the solenoid

5. Remove the red cap from the solenoid.

6. Remove the nameplate by pushing the solenoid down towards the valve body, then lift and slide the nameplate off.

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, and discard.

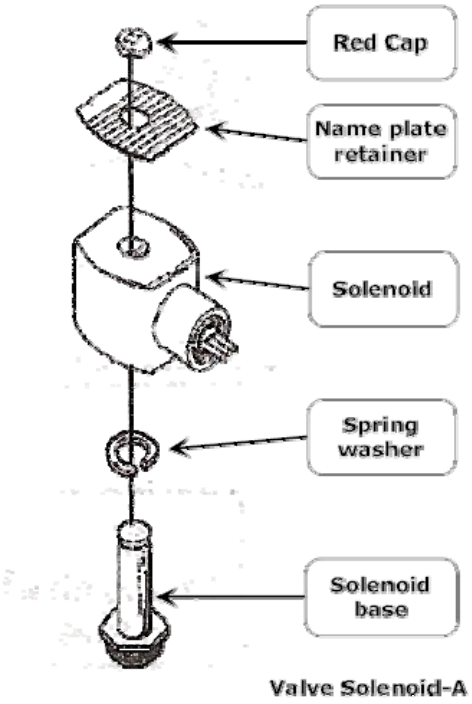


Figure 21: Valve Solenoid Assembly

5.2.2 Replacing the Valve Solenoid and Core Assembly

See Figure 22

1. Install a new Core Assembly which includes:
    - Solenoid base
    - Core assembly with core spring
    - Body gasket
2. Screw the solenoid base assembly onto the valve body 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.
6. Open the ball valves between the *Green Machine* and the vent risers and lock in the OPEN position.
7. **CAUTION: BOTH 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

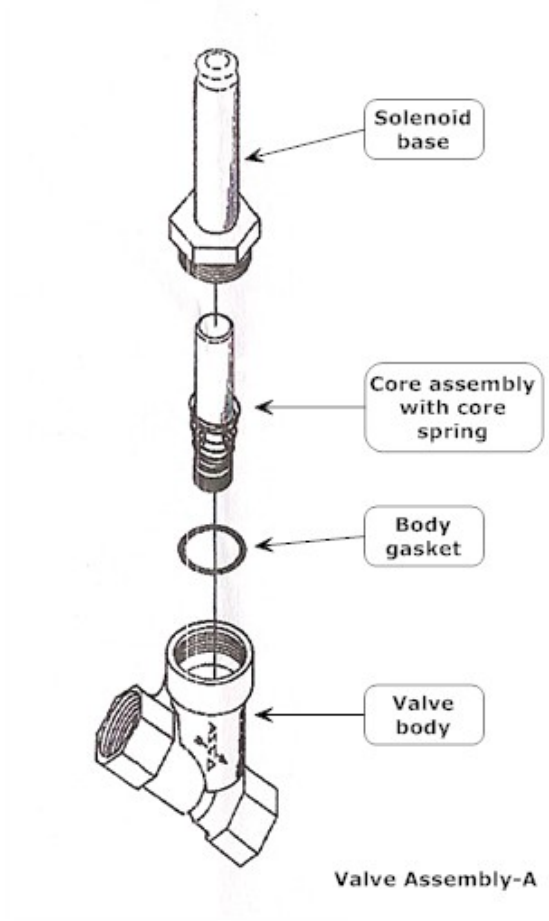


Figure 22: Valve Assembly

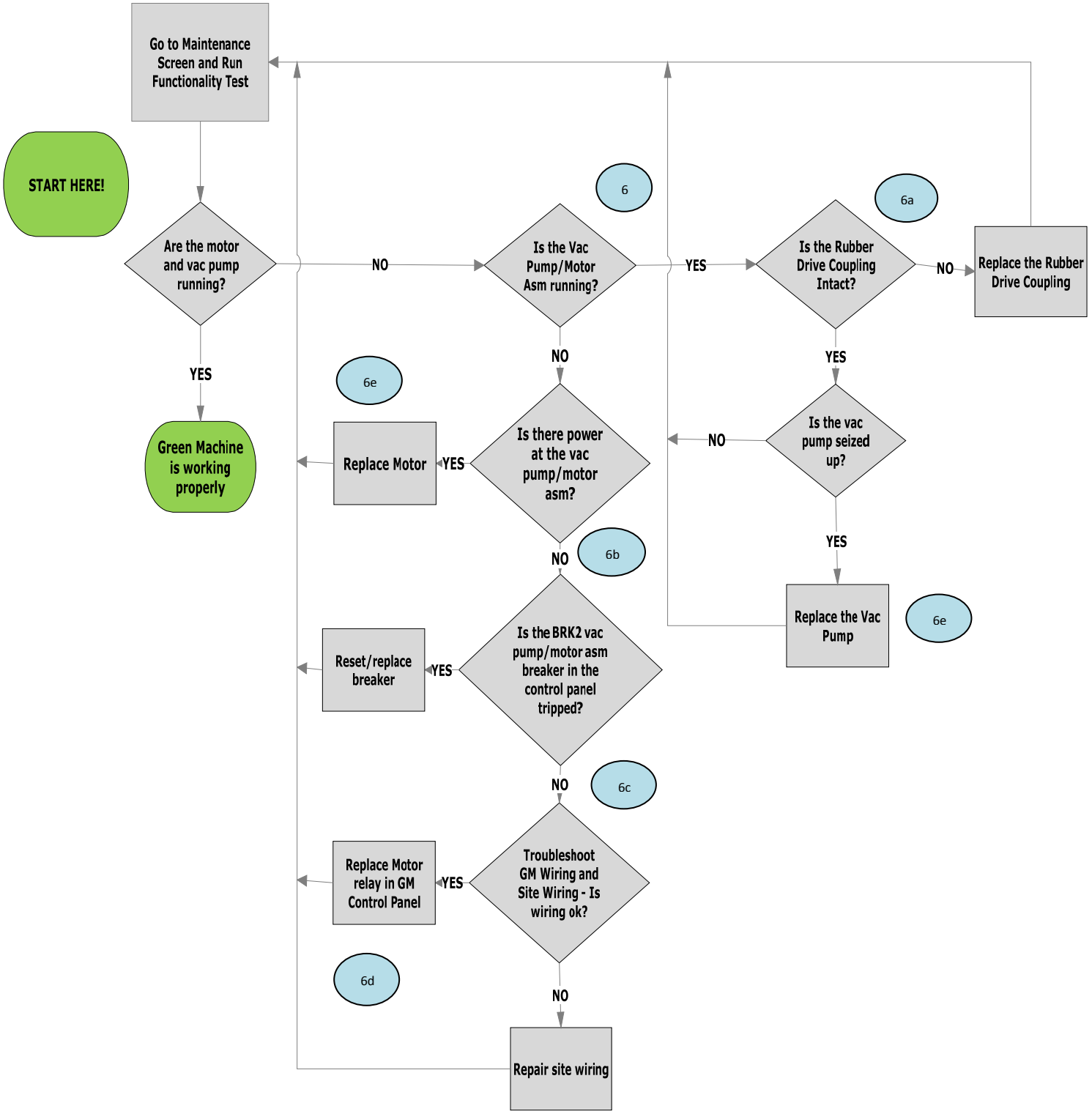


Figure 23: Vacuum Pump/Motor Assembly troubleshooting (Section 6)

6 Vacuum Pump/Motor Assembly Troubleshooting

a. Verify that vacuum pump/motor assembly rotates freely. Visually inspect the Rubber Flange Sleeve if not intact, replace. Run Functionality Test again.

b. If the Functionality Test fails again, verify the vacuum pump breaker BKR2 inside the VST Control Panel is not tripped. **See Figure 9**.
   - If the Control Panel is tripped, reset the breaker and check to see if the Vacuum Pump/Motor is working by running a Functionality Test.

c. Verify the wiring of the vacuum pump/motor assembly is not damaged.

d. Verify the vacuum pump/motor wiring is tight and correct, even at the motor junction box.

e. If the vacuum pump/motor assembly rotates freely and steps 1-4 have been verified to be functioning properly, replace the vacuum pump/motor assembly as outlined in the replacement section.

6.1 Rubber Flange Sleeve Replacement

NOTE: The Rubber Flange Sleeve replacement is done with the motor still attached to the *Green Machine* base.

Safety

Use lockout / tagout procedures prior to starting work.

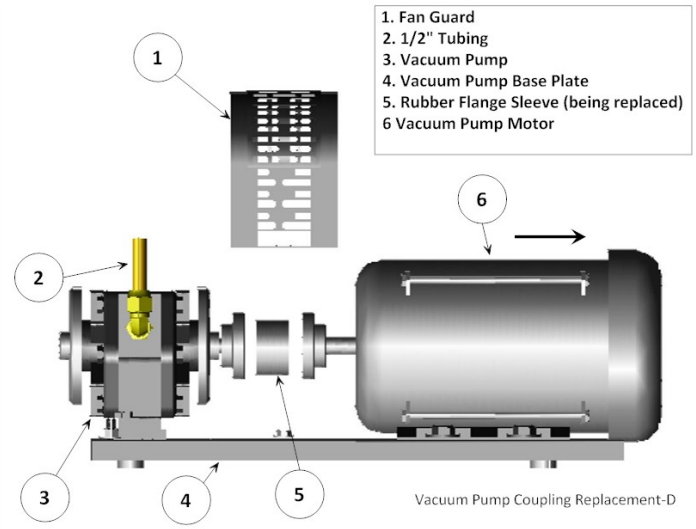


Figure 24: Vacuum Pump Coupling Replacement

6.1.1 Removing the Rubber Flange Sleeve

See Figure 24

1. Disconnect power to the VST Control Panel. (The power, ground, and neutral will be completely disconnected from the *Green Machine*).

2. Follow lockout & tagout procedures.

3. Unlock the hasps and remove the cover from the *Green Machine*
   NOTE: The Vacuum Pump and tubing will not be affected by moving the vacuum pump motor.

4. Remove the Fan Guard over the Coupling Flanges.

5. Remove 4 vacuum pump motor mounting bolts from the base plate.

6. Without removing the electrical service from the vacuum pump motor, slide the vacuum pump motor away from the Vacuum Pump so the Rubber Flange Sleeve can be removed.

6.1.2 Replacing the Rubber Flange Sleeve

See Figure 24

1. Insert a new coupling sleeve and slide the vacuum pump motor towards the Vacuum Pump so the sleeve is tight between the coupling flanges.

2. Re-install and tighten the 4 vacuum pump motor mounting bolts to the base plate.

3. Re-install the fan guard over the coupling flanges.

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.

6. At the *Green Machine*, check to make sure the Vacuum Pump and vacuum pump motor are running without excessive vibration or noise.

7. Put the cover on the *Green Machine* and lock the hasps.

6.1.3 Vacuum Pump & Motor Assembly Replacement

Safety

Use lockout / tagout procedures prior to starting work.

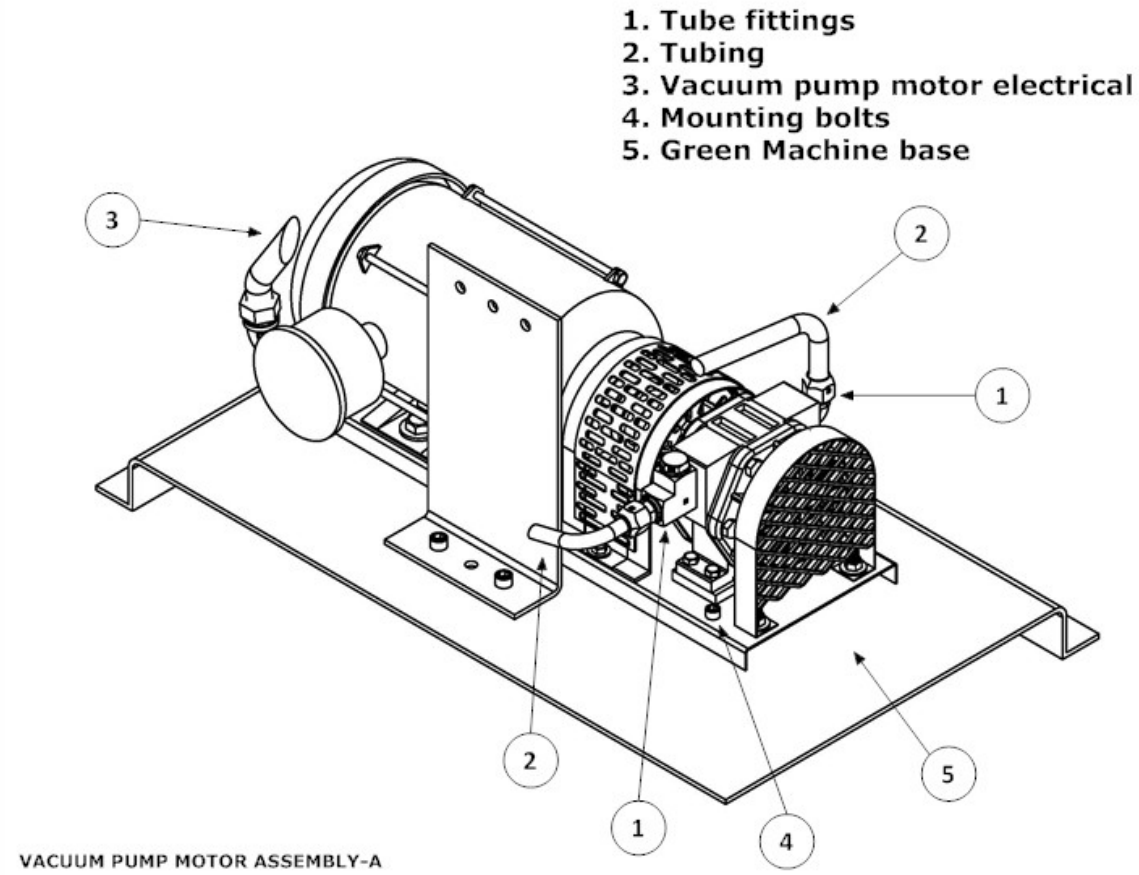


Figure 25: Vacuum Pump Replacement

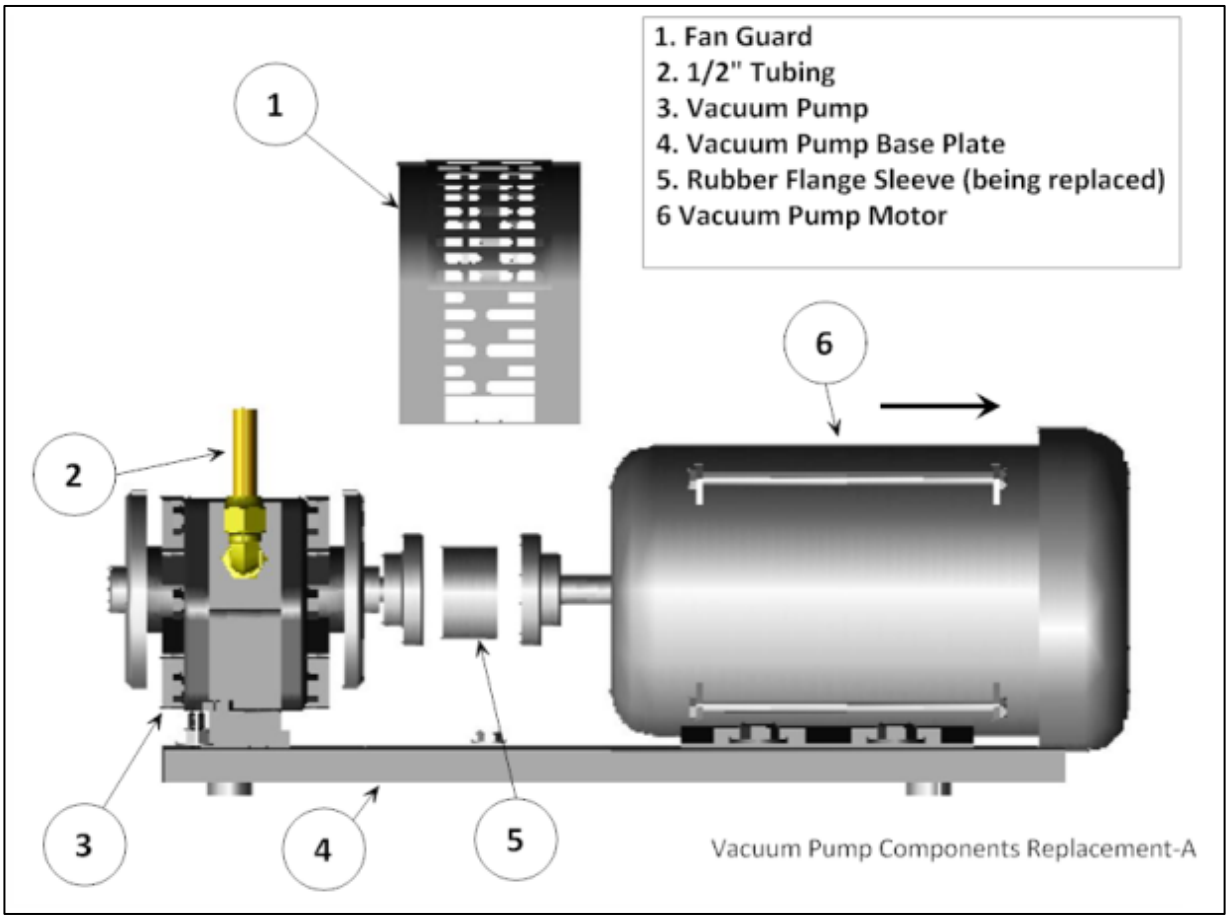


Figure 26: Vacuum Pump Components Replacement

6.1.3.1 Removing the Vacuum Pump Assembly

See Figures 25-28

1. Disconnect power to the VST Control Panel. (The power, ground, and neutral will be completely disconnected from the *Green Machine*).

2. Follow lockout & tagout procedures.

3. Unlock the hasps and remove the cover from the *Green Machine.*

4. Remove the Vacuum Pump ½" inlet 45º flare tubing and all pipe fittings connected to the vacuum pump.

CAUTION: The tube ends are a Parker 45º flare; use caution not to damage the flared ends on the tubing or the threads on the nuts after removal.

5. Disconnect and remove the Vacuum Pump Motor electrical inside the Internal Junction Box.
    - **See Figures 28**

6. Remove the 4 mounting bolts holding the Vacuum Pump and Motor Assembly to the *Green Machine* base plate. The Vacuum Pump and Motor Assembly will stay connected to the base plate. Keep the 4 bolts for reuse.

7. Remove the Vacuum Pump and Motor Assembly.

6.1.4 Replacing the Vacuum Pump Assembly

See Figures 25 - 28

1. Place the new Vacuum Pump on the *Green Machine* base and align the mounting holes.
2. Re-install the (4) ¼" x 1-½" Vacuum Pump Assembly mounting bolts.
3. Tighten the mounting bolts so that the bottom of the Vacuum Pump Base is ⅛" from the *Green Machine* base.
4. Re-install the ½" inlet/outlet 45º flare tubing and all pipe fittings connected to the Vacuum Pump
    - Do not use any thread sealing compound when assembling the 45 º 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. Reconnect the Vacuum Pump Motor electrical power wires inside the Internal Junction Box. **See Figure 28.**
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.
8. Perform a Leak Test to make sure all the tube fittings are leak tight.
9. When performing the Leak Test, check to make sure the Vacuum Pump and Motor are running without excessive vibration or noise.
10. Put the cover on the *Green Machine* and lock the hasps.

6.1.5 Removing the Vacuum Pump

See Figures 25 - 28

1. Disconnect power to the VST Control Panel. (The power, ground, and neutral will be completely disconnected from the *Green Machine*).
2. Follow lockout & tagout procedures.
3. Unlock the hasps and remove the cover from the *Green Machine*
   NOTE: The Motor will not be affected during the removal and replacement of the Vacuum Pump.
4. Remove the Vacuum Pump ½" 45º flare tubing and all pipe fittings connected to the Vacuum Pump and save for reuse.

CAUTION: The tube ends are a Parker 45º flare, use caution not to damage the flared ends on the tubing or the threads on the nuts after removal.

5. Remove both the fan guards for access to the coupling flanges and removal of the Vacuum Pump.
6. Remove the 4 mounting bolts from the Vacuum Pump Base and keep for reuse.
7. Slide the Vacuum Pump away from the Motor and remove.

CAUTION: There may be metal shims under the Vacuum Pump. They must be marked for location and saved for reuse.

8. The Rubber Coupling between the Vacuum Pump and the Motor may, at the discretion of the contractor, be replaced if worn.
9. Remove the Vacuum Pump Drive-Coupling Flange from the Vacuum Pump Shaft and keep for reuse. The flange is attached to the shaft with 2 set screws.

6.1.6 Replacing the Vacuum Pump

See Figures 25 - 28

1. Re-install the Drive-Coupling Flange on the Vacuum Pump shaft but do not tighten the set screws.
2. Place the new Vacuum Pump on the base and align the mounting holes. Remember to re-install the shims under the Vacuum Pump.
3. Install the rubber insert between the Motor Flange and the Pump Flange.
4. Reinstall and tighten the 4 Vacuum Pump mounting bolts.
5. Slide the drive-coupling flange over the rubber insert so both halves of the coupling are tight against the rubber insert and tighten the set screws.
6. Re-install the ½" inlet/outlet 45° flare tubing and all pipe fittings connected to the Vacuum Pump.

CAUTION: Do not use any thread sealing compound when assembling the 45 º 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.

7. Re-install both the fan guards.
8. Remove the lock(s) and tags from the lockout & tagout.
9. After the work is completed, turn ON power to the VST Control Panel. The *Green Machine* is now operational.
10. Perform a Leak Test to make sure all the tube fittings are leak tight.
11. When performing the Leak Test, check to make sure the Vacuum Pump and motor are running without excessive vibration or noise.
12. Put the cover on the *Green Machine* and lock the hasps.

6.2 Vacuum Pump Motor Replacement

6.2.1 Removing the Vacuum Pump Motor

See Figures 25 - 28

1. Disconnect power to the VST Control Panel. (The power, ground, and neutral will be completely disconnected from the *Green Machine*).
2. Follow lockout & tagout procedures.
3. Unlock the hasps and remove the cover from the *Green Machine*
   - **NOTE**: The Vacuum Pump and tubing will not be affected by removing the motor.
4. Remove the fan guard over the Drive-Coupling Flanges.
5. Disconnect the motor wires inside the Motor Junction Box.
   See Figure 28: Green Machine Vacuum Pump Motor Wiring Diagram
6. Remove the flexible conduit and 90° Liquid Tight fitting from the vacuum pump motor junction box and keep for reuse.
7. Remove 4 vacuum pump motor mounting bolts from the Motor Base and keep for re-use.
8. Slide the vacuum pump motor away from the Vacuum Pump and remove.
9. The rubber sleeve between the Vacuum Pump and vacuum pump motor Flanges may, at the discretion of the contractor, be replaced if worn.
10. Remove the vacuum pump motor drive-coupling Flange from the motor shaft and keep for reuse. The coupling is attached to the shaft with a setscrew and has a shaft key.

6.2.2 Replacing the Vacuum Pump Motor

See Figures 25 - 28

1. Re-install the Drive-Coupling Flange on the Motor Shaft but do not tighten the set screw and do not install the shaft key.
2. Place the vacuum pump motor on the base, install the rubber sleeve between the two Coupling Flanges, and align the mounting holes.
3. Re-install and tighten the 4 vacuum pump motor mounting bolts.
4. Slide the Drive-Coupling Flange over the rubber insert so both halves of the coupling are tight against the rubber insert.
5. Install the shaft key, and tighten the set screw.
6. Install the 90° Liquid Tight fitting and flexible conduit on the Motor Junction Box.
7. Re-connect the vacuum pump motor wires inside the Motor Junction Box
   See Figure 28: Green Machine Vacuum Pump Motor Wiring Diagram
8. Re-install the fan guard.
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.
11. At the *Green Machine*, check to make sure the Vacuum Pump and vacuum pump Motor are running without excessive vibration or noise.
12. Put the cover on the *Green Machine* and lock the hasps.

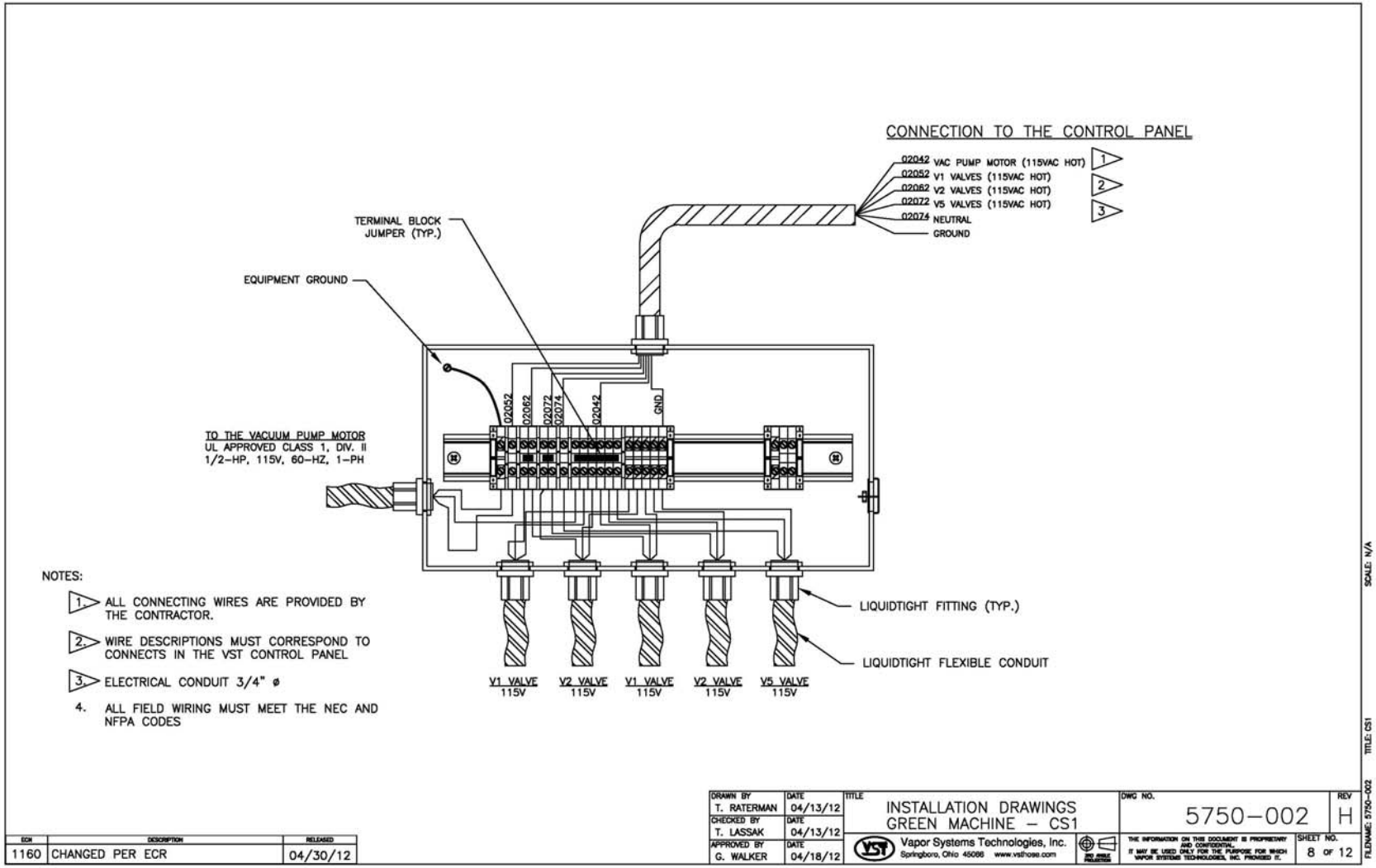


Figure 27: Green Machine Junction Box Wiring Diagram

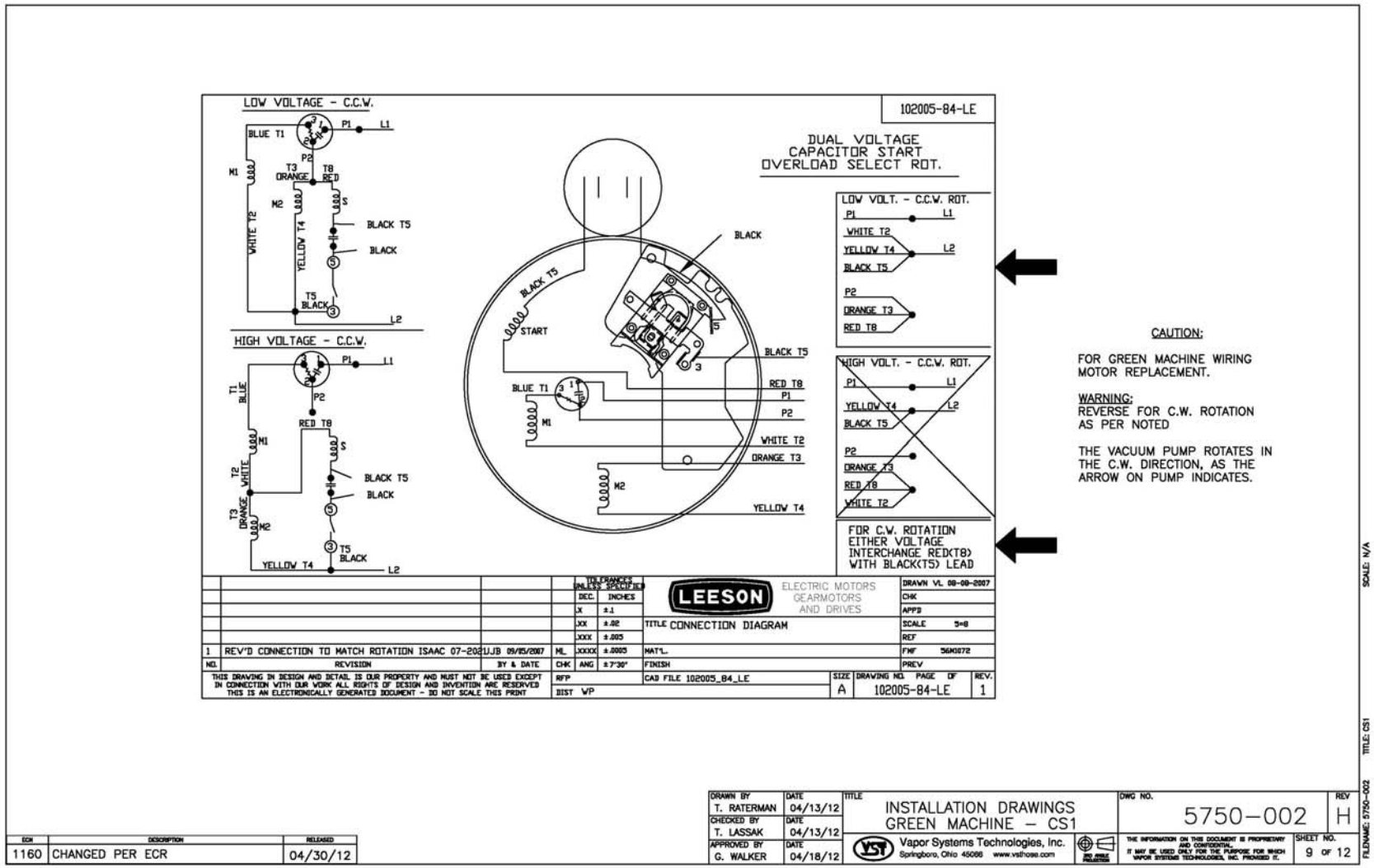


Figure 28: Vacuum Pump Motor Wiring Diagram

7 Introduction to Alarms

- Sites will use either PMC software or ISD software.

- Reference materials required are:
  - A copy of the Executive Order VR-203/204 (with all the Exhibits and IOM manuals)

7.1 Alarm Overview

The front panel of the TLS-350 has three lights:

1. Red = Failure Alarm
2. Yellow = Warning Alarm
3. Green = Power

- The TLS console is continuously monitoring the vapor-recovery system for alarm conditions.
  - During normal operation when the EVR system is functioning properly and no alarm conditions exist, the "**ALL FUNCTIONS NORMAL**" message will appear in the system status line of the console display, and the green power light will be the only light **ON**.

- If an alarm condition occurs, the system displays the condition type and its location. Warning and Failure alarm postings cause the TLS console to activate a warning or a failure indicator light, an audible alarm, and an automatic printout that documents the warning or alarm.
  - If more than one condition exists, the display will continuously cycle through the appropriate alarm messages.
  - Historical reports of warning and alarm events are available for up to one year with ISD only.
  - The system automatically prints an alarm report showing the alarm type, its location, and the date and time the alarm condition occurred.

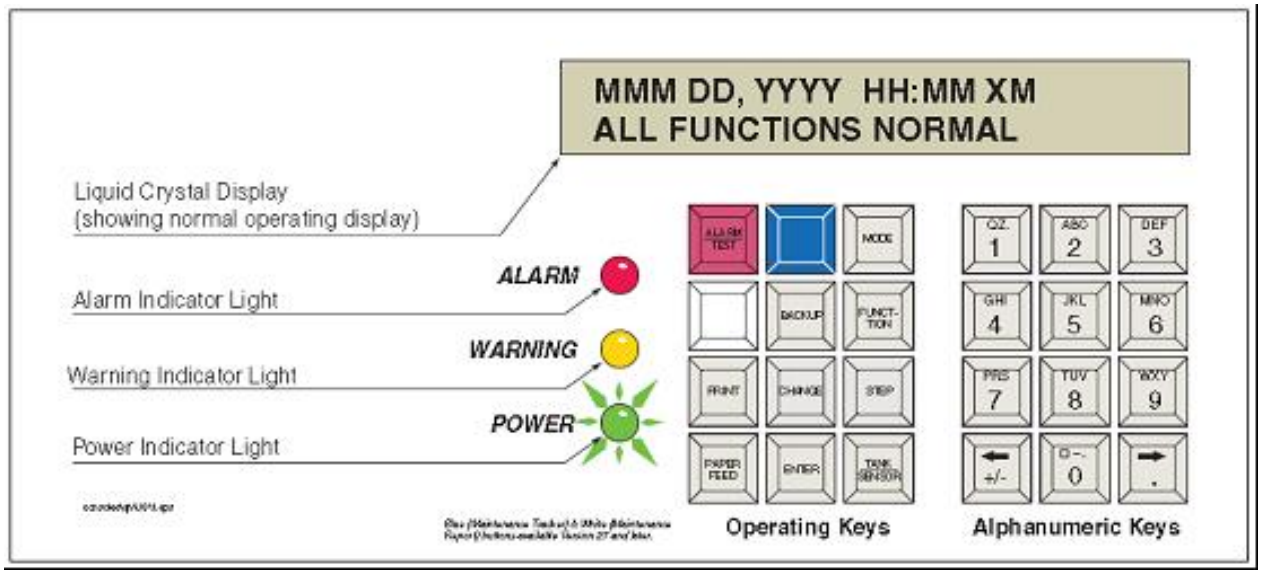


Figure 29: TLS-350 Console

8 ISD Alarms Overview

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard.	• Exhibit 4 • TP-201.3 (or equivalent test procedure)
ISD VAPOR LEAKAGE FAIL[2]	Containment	Red	8th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95th percentile of 7-days' ullage pressure exceeds 1.3 IWC.	• Verify Pressure Sensor is working first with Exhibit 10 - if working, proceed with, • Exhibit 9 to determine if the Green Machine turns ON as required • If Exhibit 9 does not pass, refer to Flow Chart in the VST *Green Machine* Troubleshooting Manual
ISD GROSS PRESSURE FAIL[2]	Containment	Red	8th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75th percentile of 30-days' ullage pressure exceeds 0.3 IWC.	
ISD DEGRD PRESSURE FAIL[2]	Containment	Red	31st Consecutive Failure of Degradation Pressure Test	
FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%.	• Exhibit 5 (Liquid Removal) • Exhibit 6 (Back Pressure) • Exhibit 17 (Flow Meter Operability) • TP-201.4 (or equivalent test procedure)
FLOW COLLECT FAIL[2]	Collection	Red	2nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	
VP EMISSION WARN[3,4]	Processor	Yellow	Mass emission exceeded the certified threshold.	• TSP 1-4 • Exhibit 9 • Exhibit 10 • Refer to Flow Chart in the VST *Green Machine* Troubleshooting Manual
VP EMISSION FAIL[3,4]	Processor	Red	2nd Consecutive Mass emission test failure.	

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	• Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	• Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL[2]	Self-Test	Red	8th Consecutive Failure of Setup Test	

Note: The alarms listed in above table will also activate an audible alarm

[1]See ISD Troubleshooting Manual P/N 577013-819 found at http://www.veeder.com/object/577013-819.html and the VST ISD Troubleshooting Manual found at http://www.vsthose.com/pdf/Troubleshooting_Manual_Green Machine.pdf

[2]ISD Shut Down Alarms – see Figure 48 of IOM Section 12

[3]This warning will result in an ISD VP Status Warn

[4]This failure will result in an ISD VP Status Fail

9 Troubleshooting Procedures

The following Troubleshooting Procedures are used for both PMC and ISD alarms:

Troubleshooting Procedure	Description
TSP-001	HC Sentry Loop Light
TSP-002	HC Sentry RX & TX Lights
TSP-003	E.O. VR -203 & 204 Section 12, PMC Diagnostics – Display 100% HC
TSP-004	E.O. VR - 203 & 204 Section 12, PMC Setup – HC Sensor set to MODBUS
TSP-005	PMC Setup Parameters
TSP-006	GM Manual ON Pressure Test

9.1 TSP-001: HC Sentry Loop Light

TSP-001: HC Sentry Loop Light	
Purpose:	The LOOP light led provides a simple visual indication of loop current on the 4-20 mA loop circuit between the VST controller and the HC Sentry and can be used as a means of field debugging a broken loop.
Note:	The HC Sentry acts as an interface between the TLS-350 and the *Green Machine* Controller. Conditions for the LOOP light to be ON: 1. *The HC Sentry power switch must be ON.* 2. *The HC Sentry must have 24 VDC power supplied from the VST control panel.* 3. *A 4-20 mA signal must supplied from the VST control panel to the HC Sentry.*
Steps:	Check to make sure the LOOP light is ON
1.	If the LOOP light is not ON: **See Figure 32** a. Make sure the HC Sentry power switch is turned ON b. IF the power switch is ON, go to Step 2 c. IF the power switch is OFF, switch on the power ON. d. CLEAR TEST AFTER REPAIR (only if there is an alarm)

2.	Check to see if the HC Sentry has 24 VDC power: **See Figure 33**
	
	a. Using a multimeter with 24 VDC selected:
	b. Place the positive probe on the 24 connections
	c. Place the negative probe on the – connection
	d. The voltage should read 24 +/- 2 VDC
	e. IF there is 24 VDC at the HC Sentry, GO TO STEP 3
	
	f. If the HC Sentry does not have 24 VDC power:
	  a. Check the field wires connecting the VST control panel to the HC Sentry: See Figure 34
	  b. Make sure the VST control panel has 110 VDC power and the disconnect switch on the panel is turned ON
	  c. Check that the 24 VDC power supply inside the VST control panel has power (a green LED will be ON)
	g. IF STEPS 1-3 are okay and the HC Sentry still does not have 24 VDC power, GO TO STEP 4

3.	Make sure there is a milliamp signal from the VST control panel to the HC Sentry: See Figure 32 a. Using a multi-meter with mA amperage selected: Amperage must be tested in series. b. Disconnect the Wire connected to the + terminal on the Sentry c. Connect the positive probe to the (-) terminal d. Connect the negative probe to the wire to complete the circuit. e. The milliamp reading should be approximately 4 mA f. IF milliamp reading is 4 mA and the LOOP light is still OFF, GO TO STEP 4 g. IF there is no signal at the HC sentry: **1.** Make sure the Input/Output modules on the back of the controller are pushed all the way in. **See Figure 34** h. IF the HC Sentry still does not have 24 VDC power, GO TO STEP 5
4.	Replace the HC Sentry module
5.	Call a VST technician

9.2 TSP-002: HC Sentry RX and TX Lights

TSP-002: HC Sentry RX and TX Light	
Purpose:	RX and TX flashes to indicate data transfer to and from the TLS-350. The RX LED flashes to indicates that the TLS queried the HC Sentry for Hydrocarbon data via the RS485 HC Sentry Interface Cable. The TX LED flashes to indicate that the HC Sentry is sending the Hydrocarbon data to the TLS.
Note:	The HC Sentry acts as an interface between the TLS-350 and the *Green Machine* Controller 1. The HC Sentry must be properly connected to the TLS Comm Board using the HC Sentry Interface cable 2. The Vapor Processor must be selected in the PMC Setup (203) or the EVR/ISD Setup (204) *3.* The Hydrocarbon Select must be selected in the PMC Setup (203) or the EVR/ISD Setup (204) and set to Modbus
1.	IF the RX and TX LED lights are not flashing: **See Figure 38** a. Make sure the HC Sentry Interface Cable is properly connected to the HC Sentry module and the TLS-350 Comm Board: **See Figure 39** b. Check for continuity and correct pin-out and re-crimp/replace RJ-45 connector. c. IF the cable is properly connected to the HC Sentry and the Comm Board, GO TO STEP 2 d. IF the cable is not properly connected, make the proper connections e. Check to see if the RX and TX lights are flashing f. IF the lights are now flashing g. Check that the HC SENSOR in the PMC Diagnostic (or in the IV8100 report) is reading either 0% or 20% HC h. CLEAR TEST AFTER REPAIR (only if in alarm)
2.	Check to make sure the TLS-350 is setup for the Green Machine in PMC Setup (203) or the EVR/ISD Setup (204) a. IF the Green Machine is selected, GO TO STEP 3 b. IF the Green Machine is not selected, make the selection c. Check to see if the RX and TX lights are flashing d. IF the lights are now flashing e. Check that the HC SENSOR in the PMC Diagnostic (or in the IV8100 report) is reading either 0% or 20% HC f. CLEAR TEST AFTER REPAIR

TSP-002: HC Sentry RX and TX Light	
3.	Make sure the HYDROCARBON SELECT is set to MODBUS in the PMC Setup (203) or the EVR/ISD Setup (204) a. IF the MODBUS is selected, GO TO STEP 4 b. IF the MODBUS is not selected, change to MODBUS c. Check to see if the RX and TX lights are flashing d. IF the lights are now flashing e. Check that the HC SENSOR in the PMC Diagnostic (or in the IV8100 report) is reading either 0% or 20% HC f. CLEAR TEST AFTER REPAIR
4.	Confirm MODBUS card is listed in communication settings. Confirm communication settings are programmed for 9600 bps, 8 data bits, 1 stop bit and NO parity. If settings are correct proceed to step 5.
5.	Call a VST technician

9.3 TSP-003: PMC Diagnosis-Display 100%

TSP-003: PMC Diagnosis-Display 100%	
	100% HC is being displayed in the TLS PMC Diagnostic Menu or in the IV8100 ISD Report.
Purpose:	A 100% HC reading in the PMC Diagnostic Menu or in the IV8100 ISD report indicates the TLS PMC Setup (203) or the EVR/ISD Setup (204) is not correct, the TLS is not setup for HYDROCARBON SELECT MODBUS protocol in the PMC Setup (203) or the EVR/ISD Setup, or the signal to the TLS is less than 4.0 mA.
Note:	In TSP-001, we verified: 1. The LOOP light is ON, which means the 4-20 mA LOOP circuit is complete between the VST controller and the HC Sentry module. In TSP-002, we verified: 1. The RX and TX lights are flashing to indicate data transfer to and from the TLS-350. 2. TheTLS PMC Setup (203) or the EVR/ISD Setup (204) is set for the Green Machine. 3. The TLS is setup for HYDROCARBON SELECT MODBUS protocol in the PMC Setup (203) or the EVR/ISD Setup (204).
1.	Check to see if the mA input to the HC Sentry is less than 4.0 mA. This would indicate a fault condition with the VST controller or I/0 module #2 Check the milliamp signal input to the HC Sentry: **See Figure 32** a. Using a multi-meter with mA amperage selected: Amperage must be tested in series. b. Disconnect the Wire connected to the + terminal on the Sentry c. Connect the positive probe to the (-) terminal d. Connect the negative probe to the wire to complete the circuit. e. The milliamp reading should be approximately 4.0 mA f. IF milliamp reading is between is less than 4.0 mA, GO TO STEP 2 g. IF the milliamp reading is 4.0 mA, GO TO STEP 3
2.	The only reason the mA signal output from the VST controller to be less than 4.0 mA is: a. The VST controller has malfunctioned and is sending the wrong milliamp value b. The I/O Module #2 has malfunctioned c. Call a VST technician
3.	If the mA reading is 4.0 in Step 1., there must be a problem within the TLS. Call a Veeder-Root technician

9.4 TSP-004: PMC Diagnostics - PMC Set-Up - HC Sensor to MODBUS

TSP-004: PMC Diagnosis-HC Sensor to MODBUS	
	Is The HYDROCARBON SELECT set to MODBUS in the PMC Setup (203) or the EVR/ISD Setup (204)
Purpose:	The HYDROCARBON SELECT must be set to MODBUS for the TLS to receive the hydrocarbon MODBUS signal from the HC Sentry module.
Note:	Some Multi-Port cards look almost identical to the MODBUS card. Confirm the correct card is installed by checking the Communication settings on the TLS and confirm the card is listed as MODBUS, NOT RS-485 or S-SAT
1.	Make sure the HYDROCARBON SELECT is set to MODBUS in the PMC Setup (203) or the EVR/ISD Setup (204) a. See **Figure 30** for PMC b. See **Figure 31** for EVR/ISD c. IF the MODBUS is not selected, change to MODBUS d. Check that the HC SENSOR in the PMC Diagnostic (or in the IV8100 report) is reading either 0% or 20% HC e. CLEAR TEST AFTER REPAIR (only if in alarm)

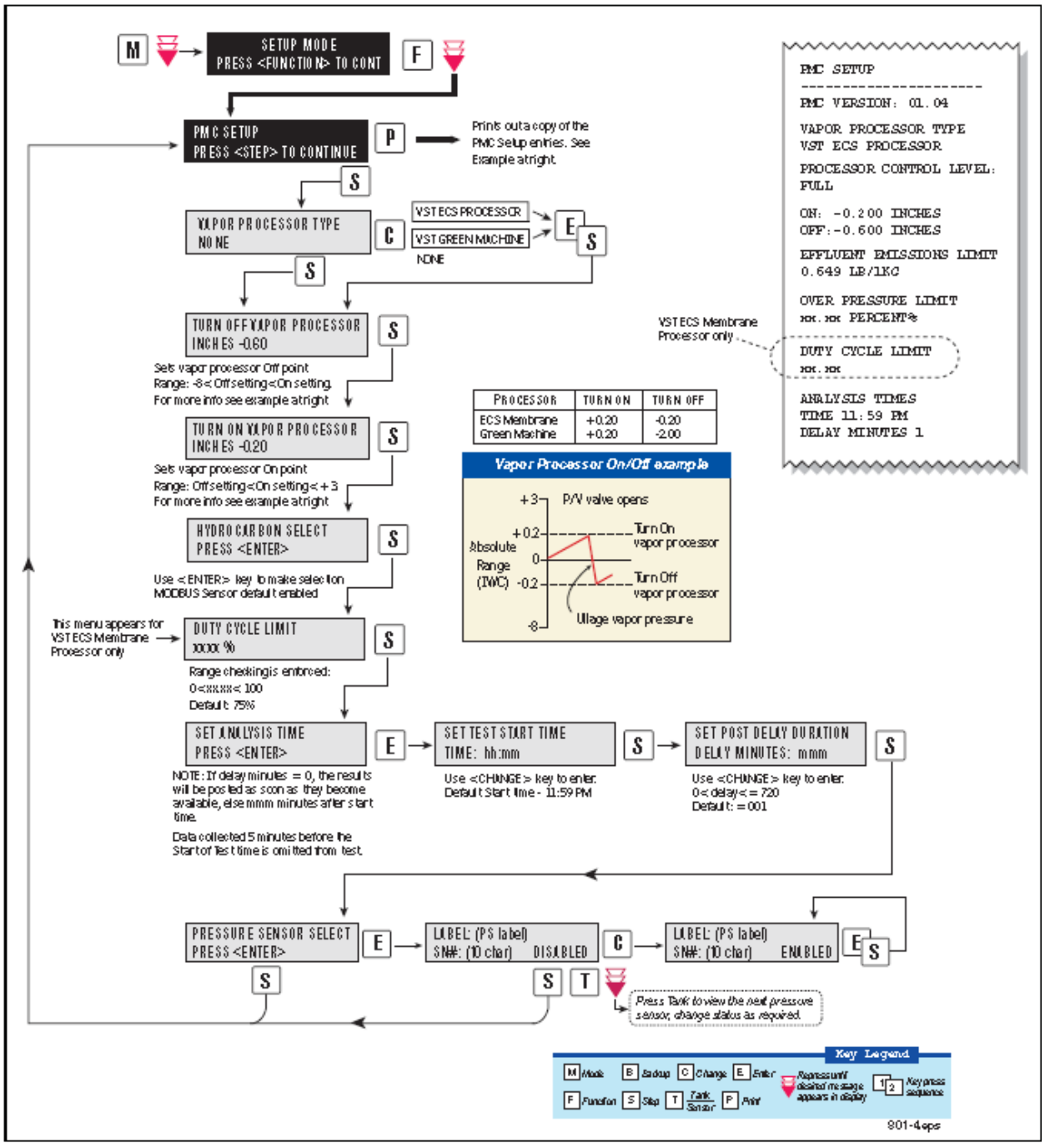


Figure 30: PMC Set-up

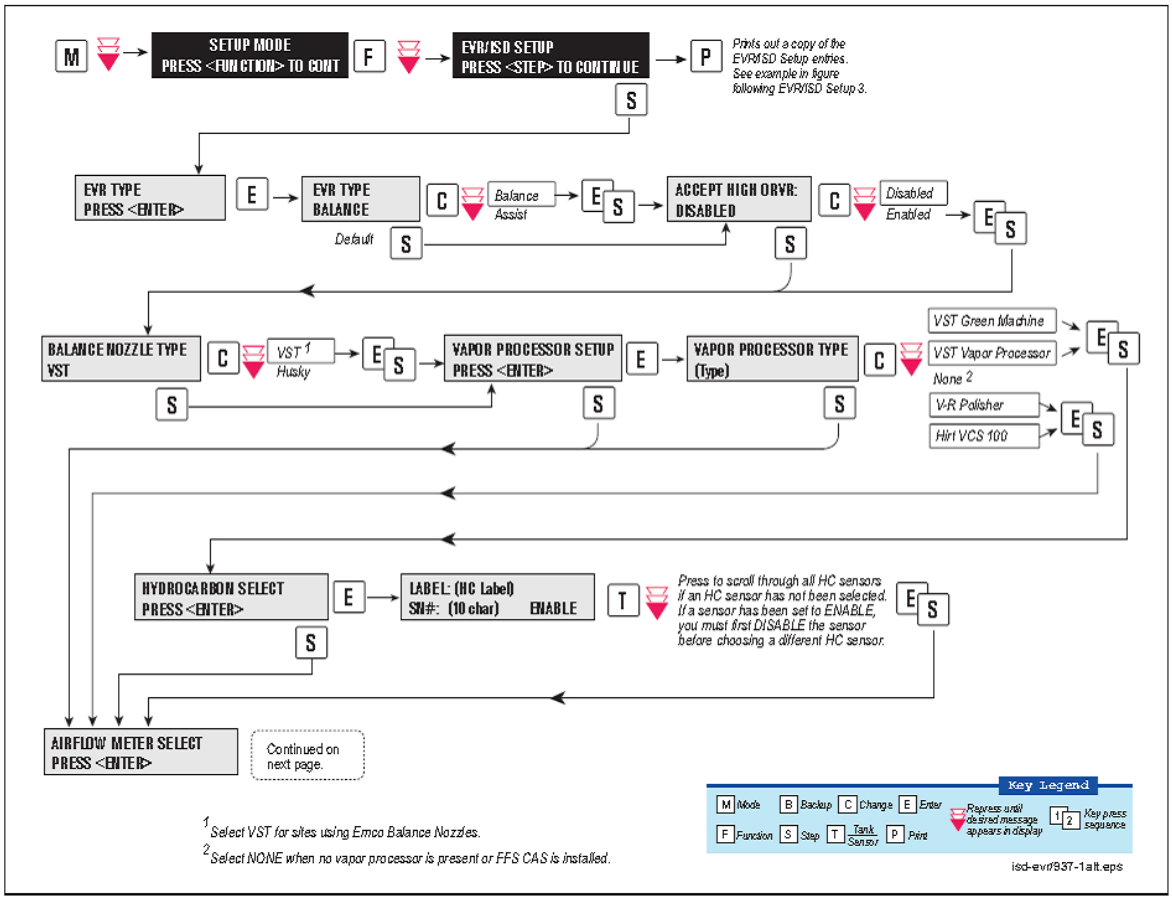


Figure 31: ISD Set-up

9.5 TSP-005: PMC Setup Parameters

TSP-005: PMC Setup Parameters	
Purpose:	Checking the PMC parameters will check that the TLS is setup for the Green Machine.
Note:	Are the PMC Setup (VR-203) parameters set correctly for the Green Machine
1.	Make sure the PMC Setup (VR-203) parameters are set to the Green Machine 1. Are the PMC Setup parameters set correctly for the Green Machine a. VAPOR PROCESSOR: VST Green Machine b. TURN OFF VAPOR PROCESSOR INCHES: -2.00 c. TURN ON VAPOR PROCESSOR INCHES: +0.20 d. HYDROCARBON SELECT: ENTER (Selects MODBUS) e. SET ANALYSIS TIME: ENTER f. SET TEST START TIME: 11:59 PM (USER DEFINED) g. SET POST DELAY DURATION: 001 (DEFAULT) h. PRESSURE SENSOR SELECT: ENTER i. LABEL: (PS label) SN# (10 char) ENABLE 2. IF the PMC Setup parameters are not setup correctly, make the correction CLEAR TEST AFTER REPAIR
2.	Make sure the PMC Setup (VR-204) parameters are set to the Green Machine 3. Are the PMC Setup parameters for the VST Green Machine (VR-204) set correctly for the Green Machine a. TURN ON VAPOR PROCESSOR INCHES: +0.20 a. IF the PMC Setup parameters are not setup correctly, make the correction b. CLEAR TEST AFTER REPAIR

9.6 TSP-006: GM Manual RUN Check

TSP-006: GM Manual RUN Check	
	Conducting a GM Manual RUN Test using the TLS Manual ON mode
Purpose:	Putting the Green Machine in the Manual ON Mode will close a relay at the TLS instructing the Green Machine to RUN regardless of UST pressure. By running the Green Machine in the Manual ON mode, the UST pressure will decrease when the Green Machine is in the RUN mode.
Note:	This procedure will check the: 1. Field wiring connections between the TLS Relay Output and the VST control panel 2. Field wiring between the VST control panel and the Green Machine 3. The VST control panel will also be check for loose wires or for any malfunctioned electrical components.
1.	Put the Green Machine in the Manual ON mode at the TLS a. In the PMC Diagnostic Menu, check to see that the UST pressure is decreasing b. IF the UST pressure is not decreasing, GO TO STEP 2
2.	Check the VST controller a. Check to see if the VST controller display is showing Green Machine ON b. IF the controller is not showing Green Machine ON, GO TO STEP 3 (There are two reasons the controller is not showing Green Machine ON: a. The VST controller is not receiving a signal from the TLS to turn ON b. There is a malfunction with the VST controller
3.	Check connections from the VST control panel to the TLS Output Relay board a. There is one wire labeled TLS-350 (110 VAC HOT) that connects the VST control panel to the TLS RUN Output Relay. The TLS RUN Output Relay is powered from the ESO 110 V HOT circuit. (**See Figure 35**) 1. Check to see that both Output Relay wires are properly connected 2. IF both wires are properly connected, GO TO STEP 4. b. IF the wires are not properly connected 1. Put the Green Machine in the Manual OFF mode at the TLS 2. Make the wiring corrections 3. Put the Green Machine in the Manual ON mode 4. Check to see if the UST pressure is decreasing 5. IF the UST pressure is decreasing 6. CLEAR TEST AFTER REPAIR c. IF the UST pressure is not decreasing, GO TO STEP 4

4.	Check if the Vapor Processor is selected in the RELAY TYPE in the Output Relay Setup a. Follow the instructions in the Veeder Root PMC or ISD Install, Setup, & Operation Manual to check the RELAY CONFIG, RELAY DESIGNATION, RELAY TYPE, and ORIENTATION. b. IF the RELAY is setup correctly, GO TO STEP 5 c. IF the RELAY is not setup correctly, make the correction d. CLEAR TEST AFTER REPAIR
5.	Call a VST Technician

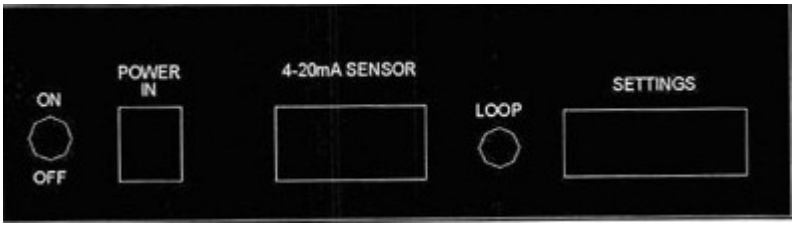


Figure 32: HC Sentry Front View

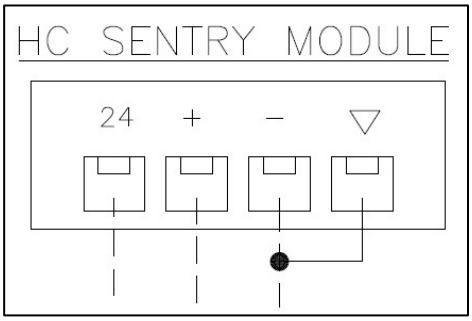


Figure 33: 24 VDC Power and 4-20 mA Signal Connections on the HC Sentry Module

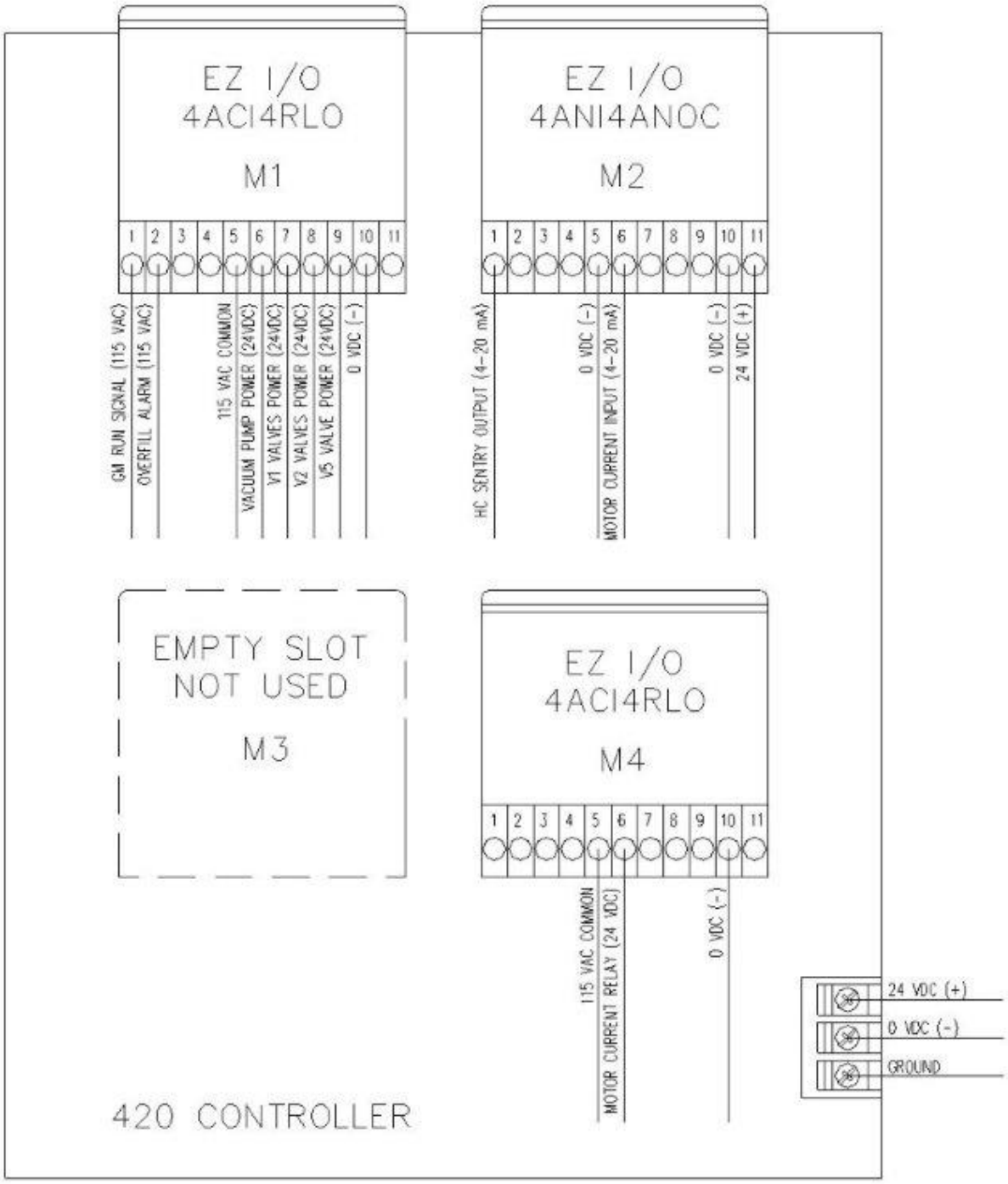


Figure 34: Controller Input / Output Modules Connections

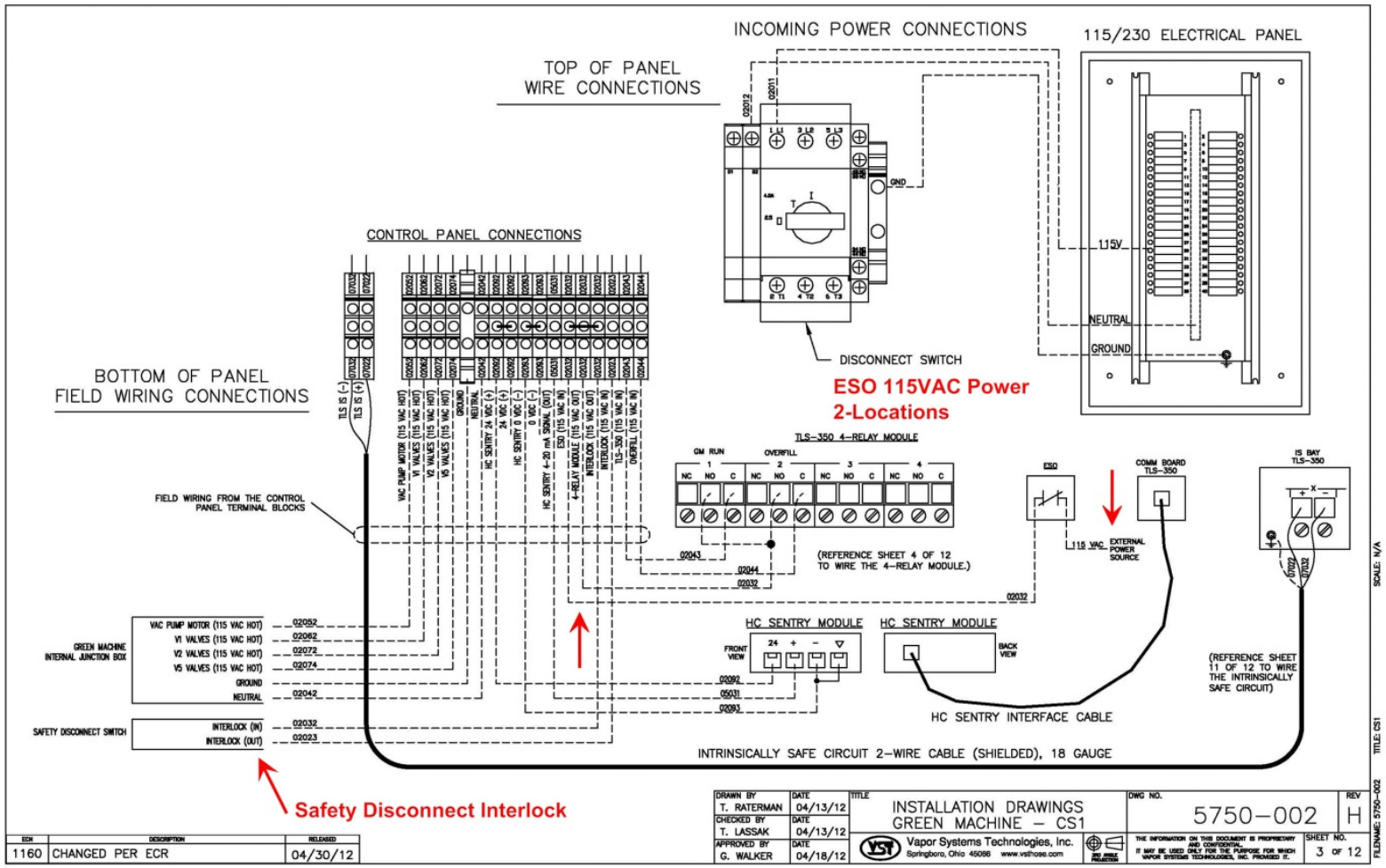


Figure 35: HC Sentry Field Wiring to the VST Control Panel

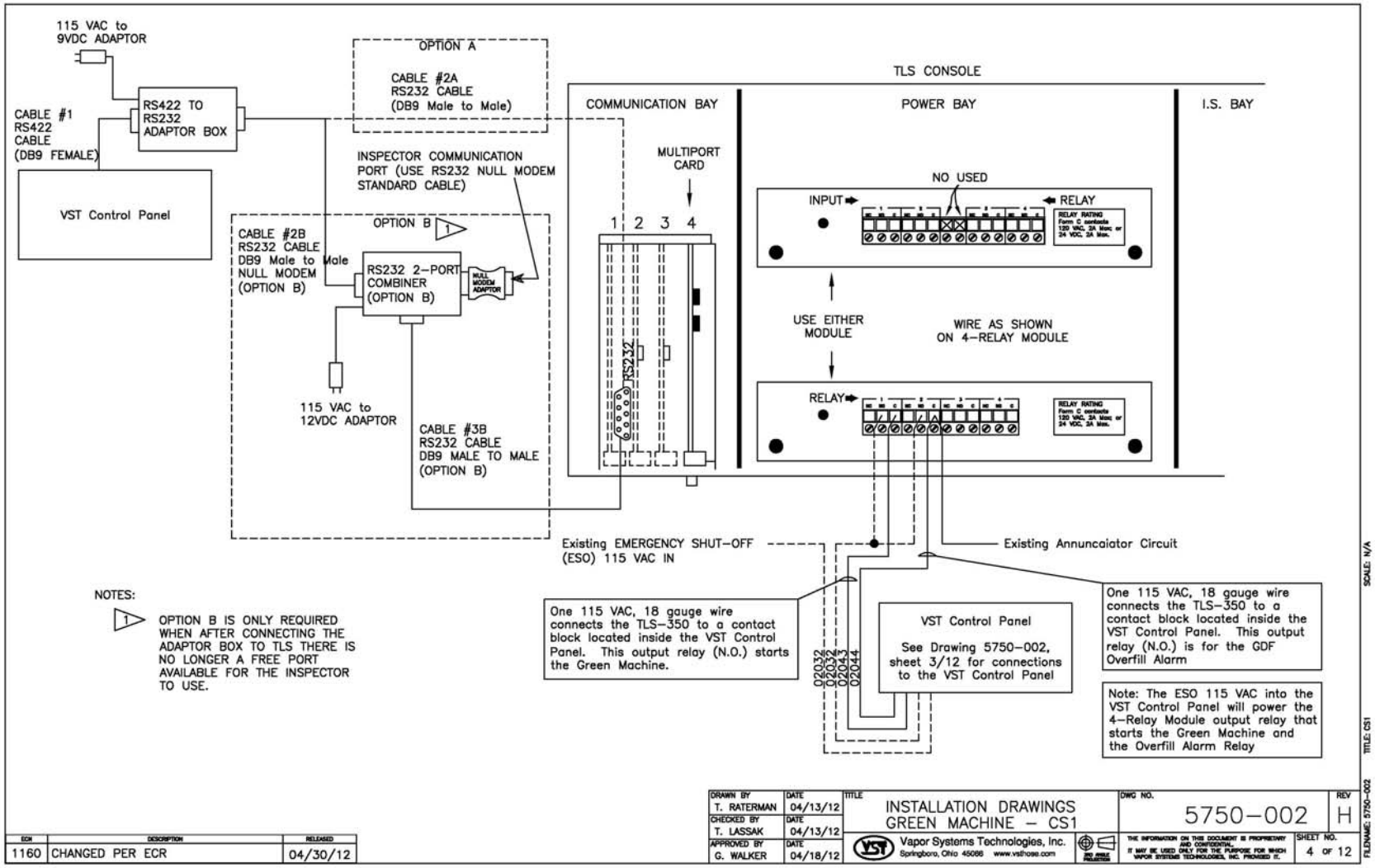


Figure 36: TLS-350 Inspector Port Communications Installation

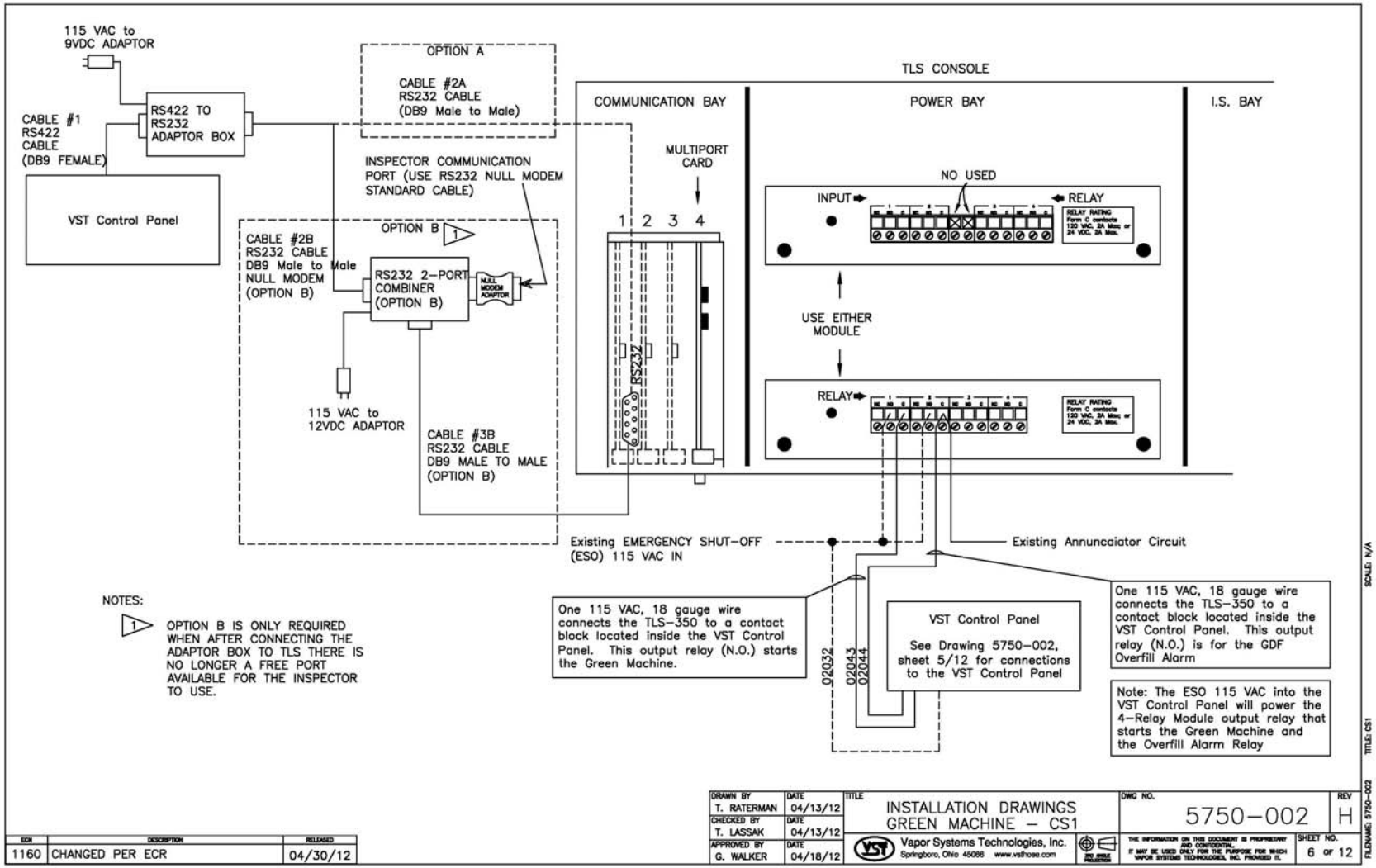


Figure 37: TLS-350 Inspector Port Communications Installation Option B

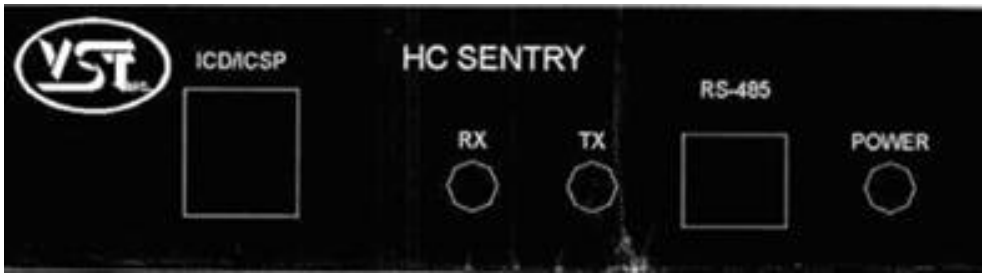


Figure 38: HC Sentry Back View

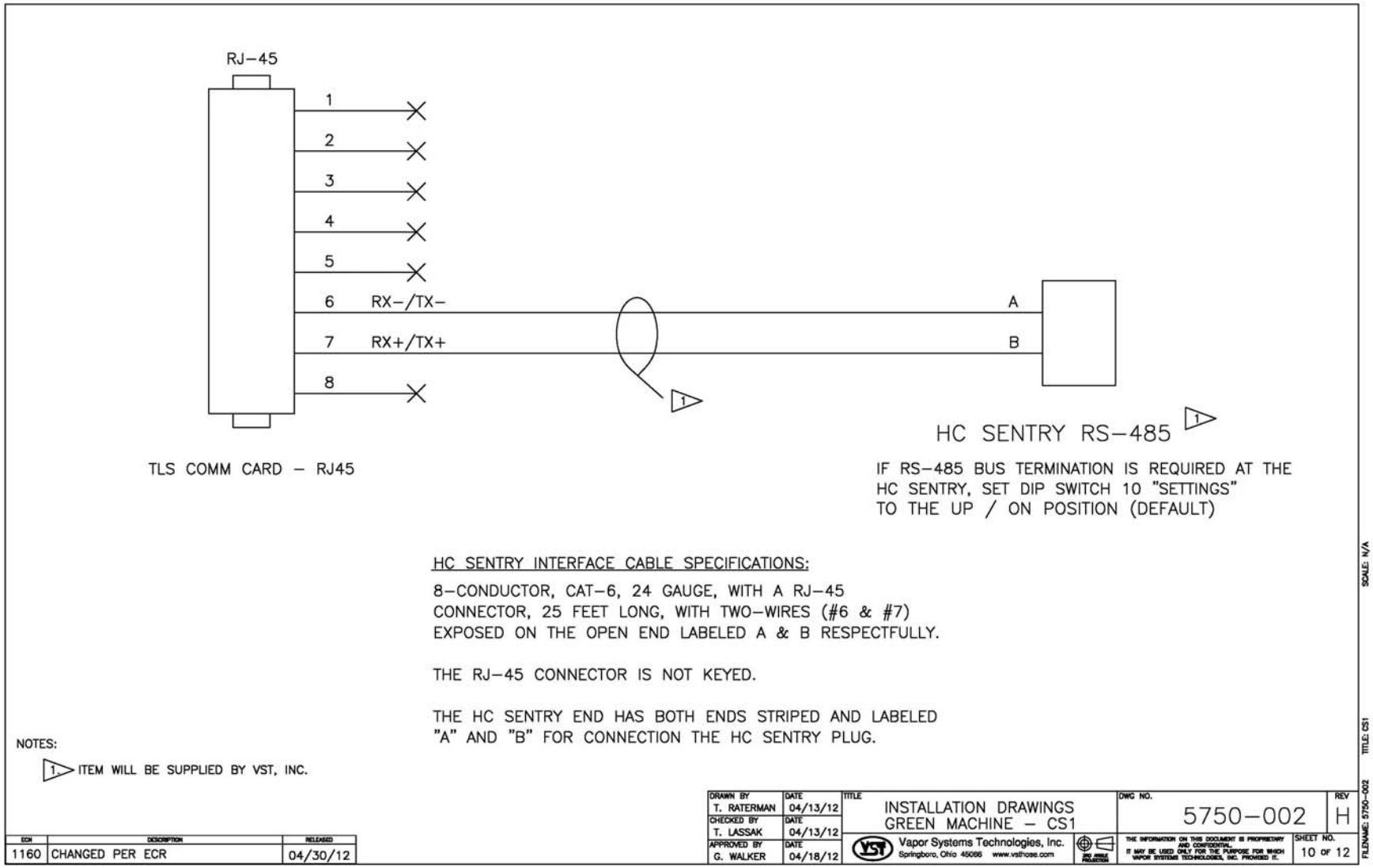


Figure 39: HC Sentry to the TLS Comm Board Cable Connections

10 Vapor Filtration Cartridge

If the *Green Machine* does not pass the Annual Compliance Bag Test, and all other Troubleshooting has shown no failure mode, the Vapor Filtration Cartridge may need to be replaced.

11 Vapor Filtration Cartridge Replacement

Safety

Use lockout / tagout procedures prior to starting work.

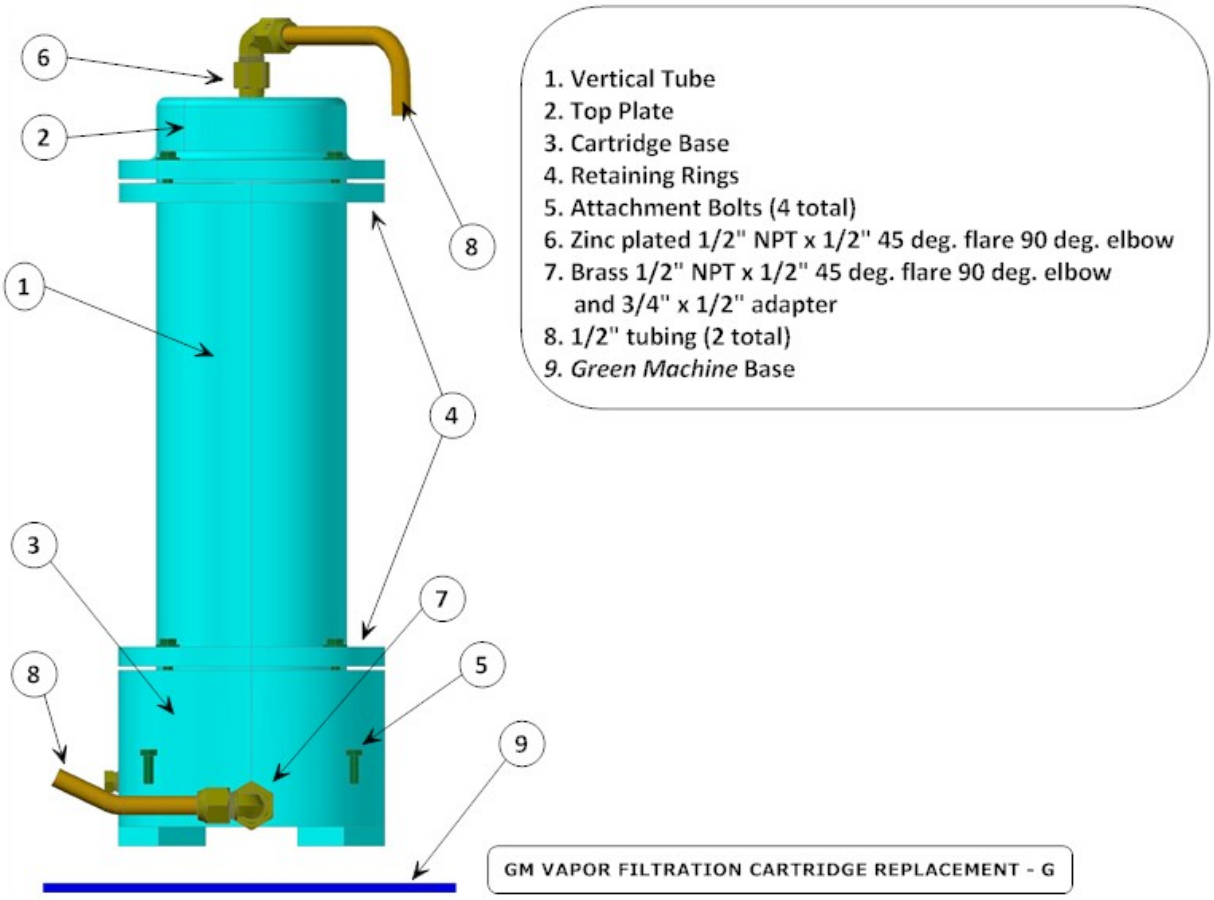


Figure 40: Vapor Filtration Cartridge Replacement

11.1 Removing the Vapor Filtration Cartridge

Figure 40	
7.	Disconnect power to the VST Control Panel. (The power, ground, and neutral will be completely disconnected from the *Green Machine*.)
8.	Follow lockout/tagout procedures
9.	Unlock the hasps and remove the cover from the *Green Machine*
10.	Disconnect and completely remove the two ½" 45° flare tubing from the cartridge base and the top plate of the Vapor Filtration Cartridge housing
11.	Remove the tubing fittings from the top plate and the Cartridge base and keep for re-use when installing the new Cartridge assembly **NOTE:** Use caution to avoid damaging the flared ends on the tubing or the threads on the nuts after removal
12.	Unscrew the 4 bolts that secure the base of the Cartridge to the base of the *:* keep for re-use
13.	Remove the Vapor Filtration Cartridge Assembly from the base of the *Green Machine*
14.	Install plugs in the top plate and Cartridge base, use Teflon tape to seal the threads
15.	Package the used Vapor Filtration Cartridge Assembly in a plastic bag for disposal
CAUTION: FOLLOW RECOMMENDED EPA REQUIREMENTS FOR THE PROPER DISPOSAL OF THE CARTRIDGE	

11.2 Replacing a New Vapor Filtration Cartridge

Figure 40	
16.	Place the NEW Vapor Filtration Cartridge Assembly on the *Green Machine* base
17.	Install and tighten the 4 bolts that secure the Cartridge assembly to the base of the *Green Machine*
18.	Remove the two plugs from the Vapor Filtration Cartridge Assembly
19.	Re-Install the fittings on the top plate and Cartridge base. The zinc plated fitting must be installed on the top plate • On the top plate, use the Zinc plated ½" NPT x ½" 45 deg. flare 90 deg. elbow as shown in **Figure 40**, item # 6 • On the Cartridge base, use the brass ½" NPT x ½" 45 deg. flare 90 deg. elbow and the adapter as shown in **Figure 40**, item # 7
20.	Re-install the ½" 45° flare tubing on the base and the top plate of the Vapor Filtration Cartridge
NOTE: When tightening the 45° flare nuts, clamp the tube flare between the nut and the 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	
21.	Put the cover on the *Green Machine* and lock the hasps
22.	Remove the lock(s) and tags from the lockout/tagout
23.	After the work is completed, turn ON power to the VST Control Panel. The *Green Machine* is now operational