TECH TIPS

Subaru Service and Technical Support Line Newsletter

SPECIAL EDITION

2012-Current Model Subaru Evaporative Diagnostics & Smoke Testing

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When faced with an Evaporative Emissions DTC (P0441-P0459, P2404 etc.), the first thing most Technicians do is reach for the smoke machine to check for leaks.

This should no longer be a Technicians first step for diagnosis.

Never put pressure into the ELCM or use smoke as residual oil in the smoke can contaminate the ELCM and cause internal components to malfunction.

Instead, the first step for diagnosis should be a forced self-test of the evaporative emission system, recording the test results, then graphing the test to determine where the problem is.

Late model Subaru vehicles are equipped with an Electronic Leak Check Module (ELCM) in their evaporative system. The ELCM is a very sensitive and delicate piece of electronic equipment that has the capability of performing self-tests to inspect the systems integrity for leaks and operation. These systems operate on vacuum, *not pressure*, when performing their self-test.

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Follow the outlined directions in this document for performing the ELCM forced self-test, then use the diagnosis procedure found in STIS to identify where the problem is. Technicians can graph the recorded self test and compare it to the diagnosis chart. This chart is in the General Description tab or located at the bottom of most Evap DTC Trouble Trees in STIS. This article also includes a reference chart, along with examples of completed graphs with a set DTC. The Subaru smoke machine tool kit comes with the correct quick disconnect plugs to be able to block off the disconnected lines. Below are step-by-step directions for performing the ELCM force test, saving that test data and using it to diagnose the concern.

NOTE: ***For diagnosing Evaporative codes on 2011-2014 models, the following testing may not apply. Please see TechTIPS from 3/17 and / or 10/19 for performing this testing.***

NOTE: *This testing does not work on STI models. Always follow the testing methods outlined in the Service Manual for STI models.*

2013MY to Current Legacy and Outback
2012MY to Current Impreza
2013MY to Current XV Crosstrek
2014MY to Current Forester
2013MY-2014MY Tribeca
2015MY to Current WRX
2013MY to Current BRZ
2019MY to Current Ascent

OVERVIEW OF EVAPORATIVE SYSTEM

- The ELCM is a device installed in the evaporative system to detect leaks and blockages.
- According to legal regulations, leaks of 0.02 inch or more need to be detectable.

The main components in the EVAP system:

CPC valve (purge control solenoid)

ELCM

Canister

Fuel tank

Drain filter

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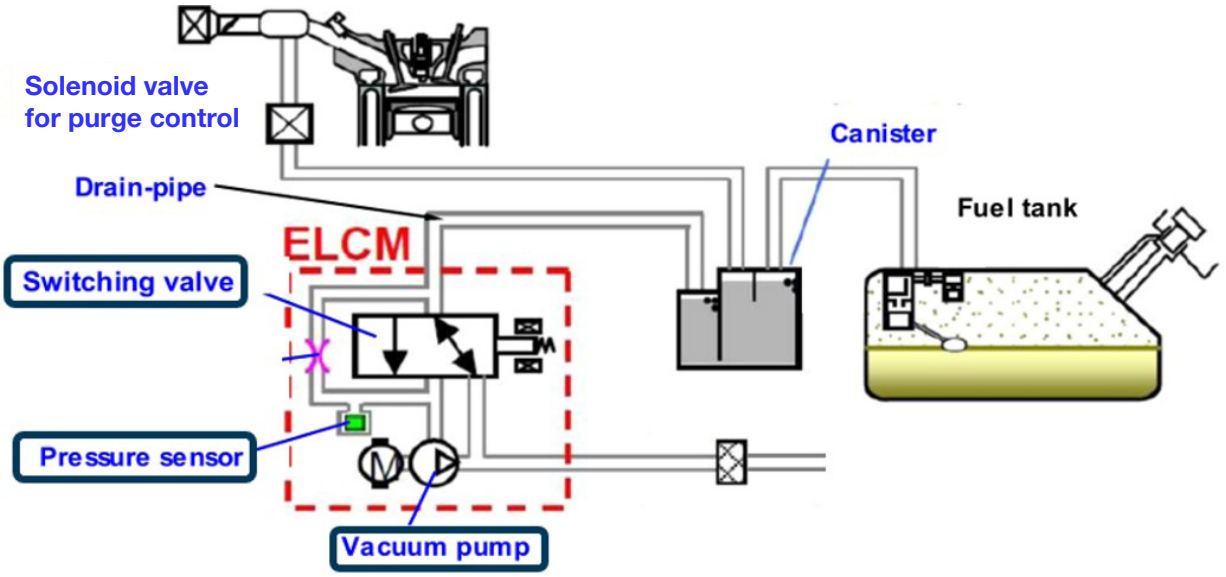
OVERVIEW OF EVAPORATIVE SYSTEM (CONTINUED)



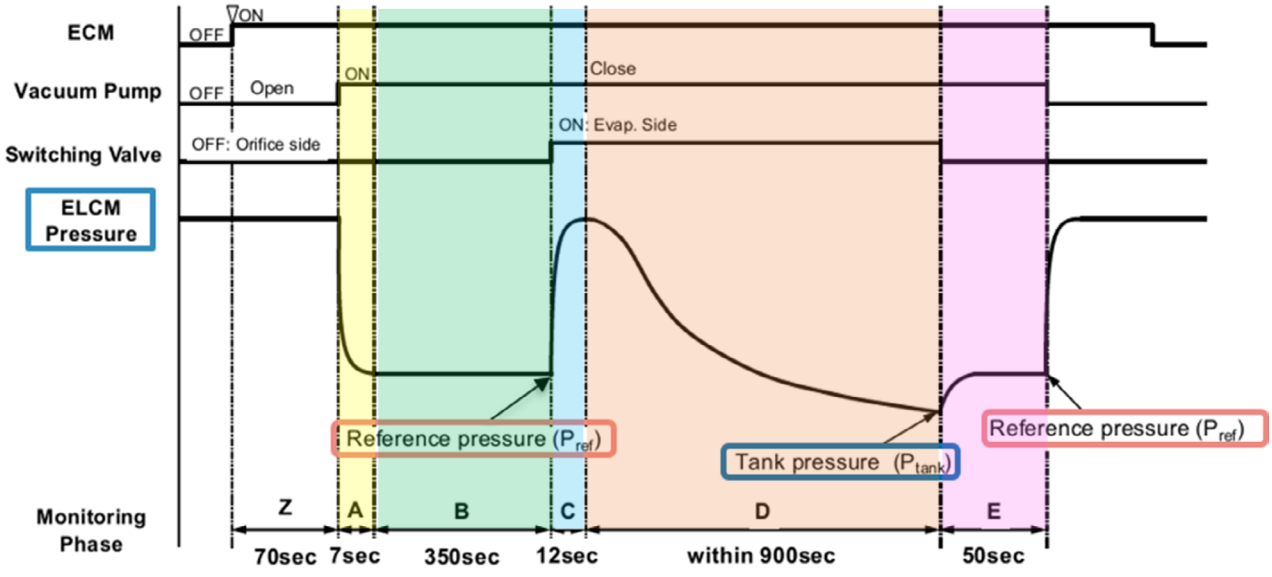
SUMMARY OF EVAP LEAK DIAGNOSIS

- EVAP Leak diagnosis is conducted during soak (5~7h after engine stop).
- The ELCM draws a vacuum in the Evaporative line and determines the leak by the **level of negative pressure.**

To find a 0.02-inch leak, the ELCM measures two types of pressure:

1) **Reference pressure**: pressure at the occurrence of a 0.02-inch leak
2) **Tank pressure:** pressure in the EVAP line

While measuring pressures 1) and 2), a P code is established according to the location of the abnormality.



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SUMMARY OF EVAP LEAK DIAGNOSIS (CONTINUED)

The conditions needed to perform the test are as follows:

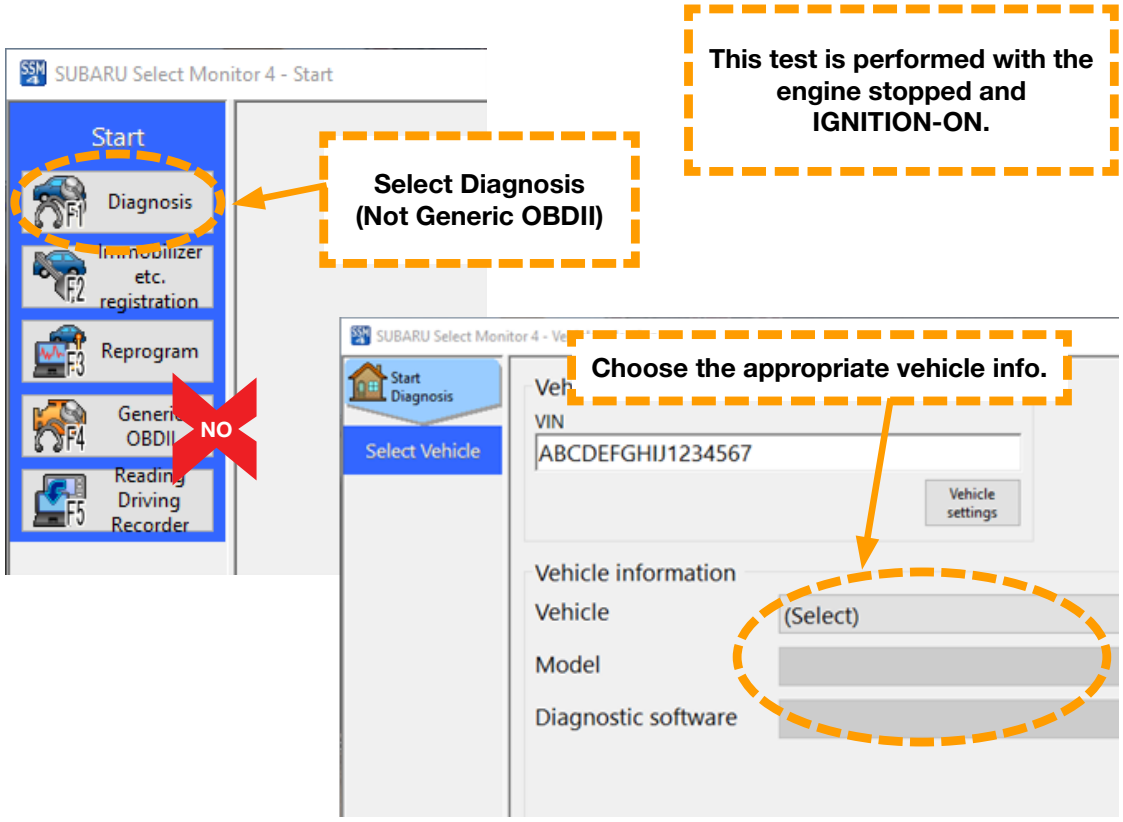
Vehicle	Model Year	Engine Coolant Temperature		Engine Oil Temp	Intake Air Temp	Battery Voltage
		F°	F°	F°	F°	V
Impreza/ Crosstrek	13MY - 22MY	≥ 40	< 113	≥ 40	≥ 40	≥ 10.9
Outback/ Legacy	15MY - 22MY	≥ 40	< 113	≥ 40	≥ 40	≥ 10.9
Forester	14MY - 22MY	≥ 40	< 113	≥ 40	≥ 40	≥ 10.9
Ascent	ALL	≥ 40	< 113	≥ 40	≥ 40	≥ 10.9
WRX	15MY - 22MY	≥ 40	< 113	≥ 40	≥ 40	≥ 10.9
BRZ	13MY - 20MY	≥ 40	< 113	≥ 40	≥ 40	≥ 10.9
	22MY	≥ 40	< 95	≥ 40	≥ 40	≥ 10.9
Tribeca	13MY-14MY	≥ 40	< 113	≥ 40	≥ 40	≥ 10.9

NOTE: There is no fuel level standard for test conditions other than the tank cannot be full.

The IGN must be **ON** with the engine **OFF** when performing the test. The self-test will take 15-30 minutes. Using the DCA-8000 in power supply mode is always recommended.

CAUTION: Test results may be unstable or inaccurate when fuel levels are 100%.

From the SSM4 Menu:



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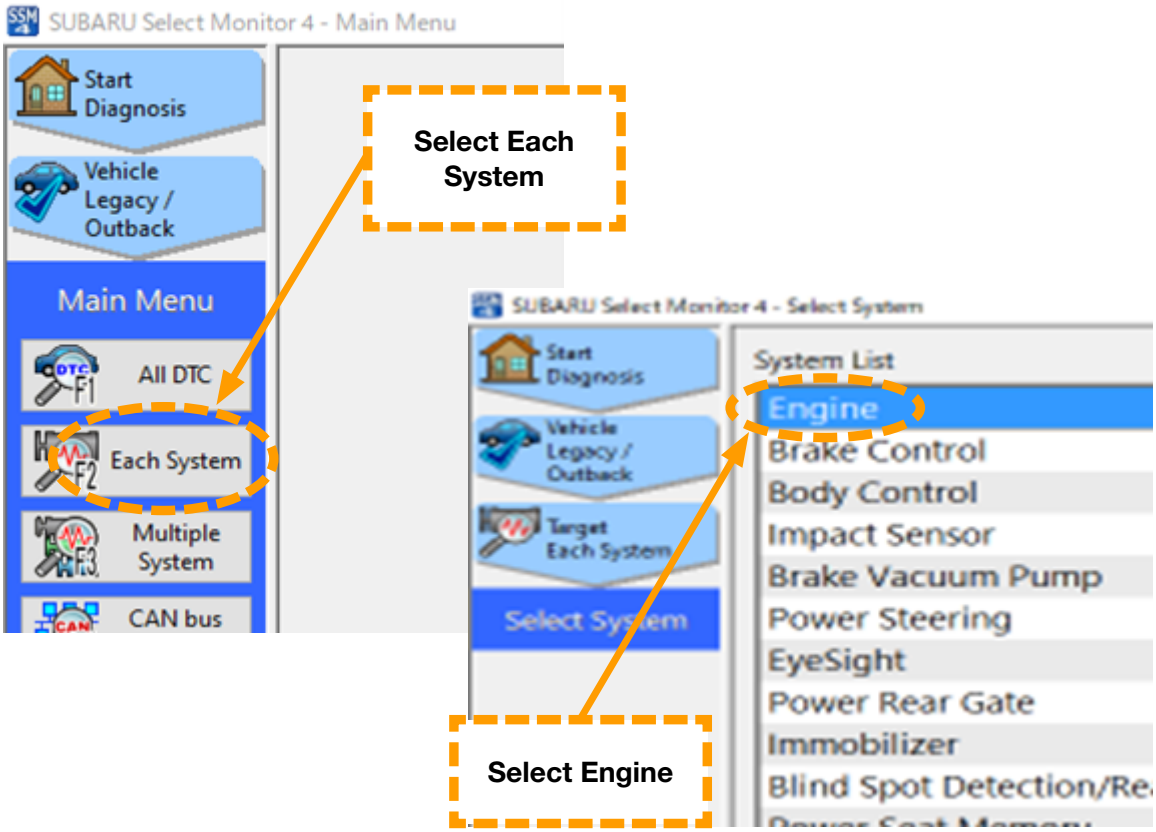

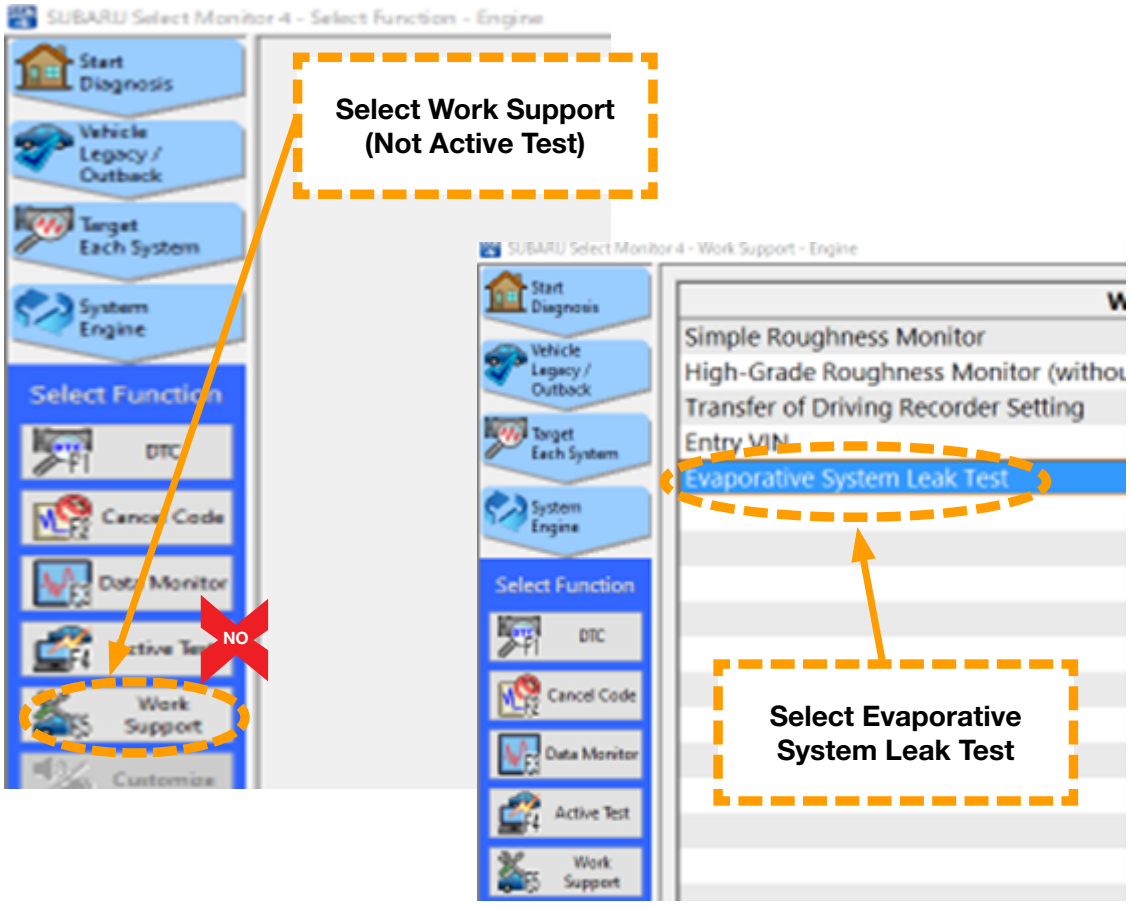

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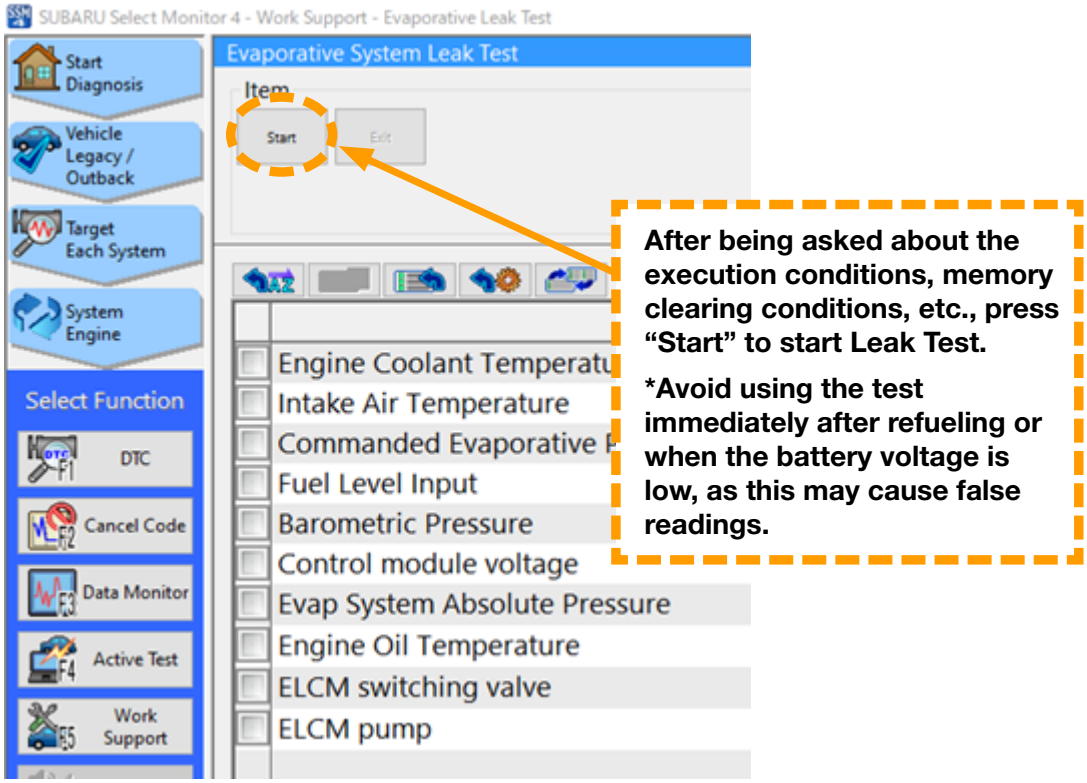

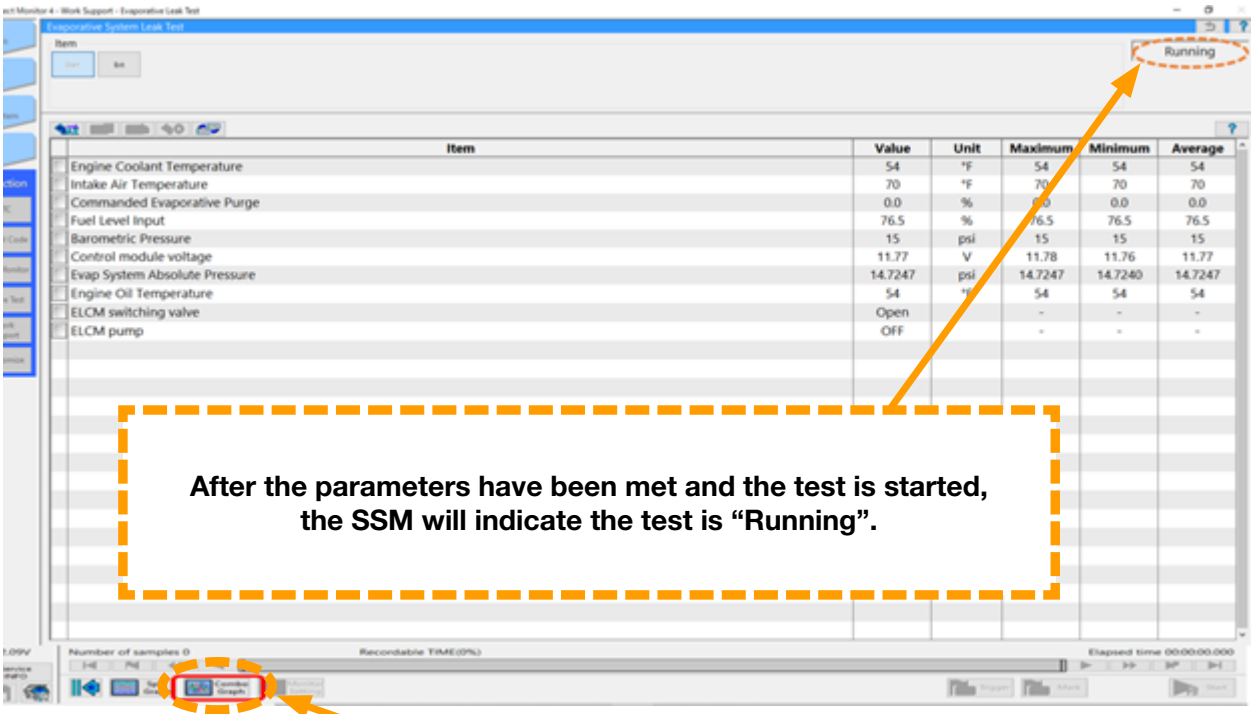

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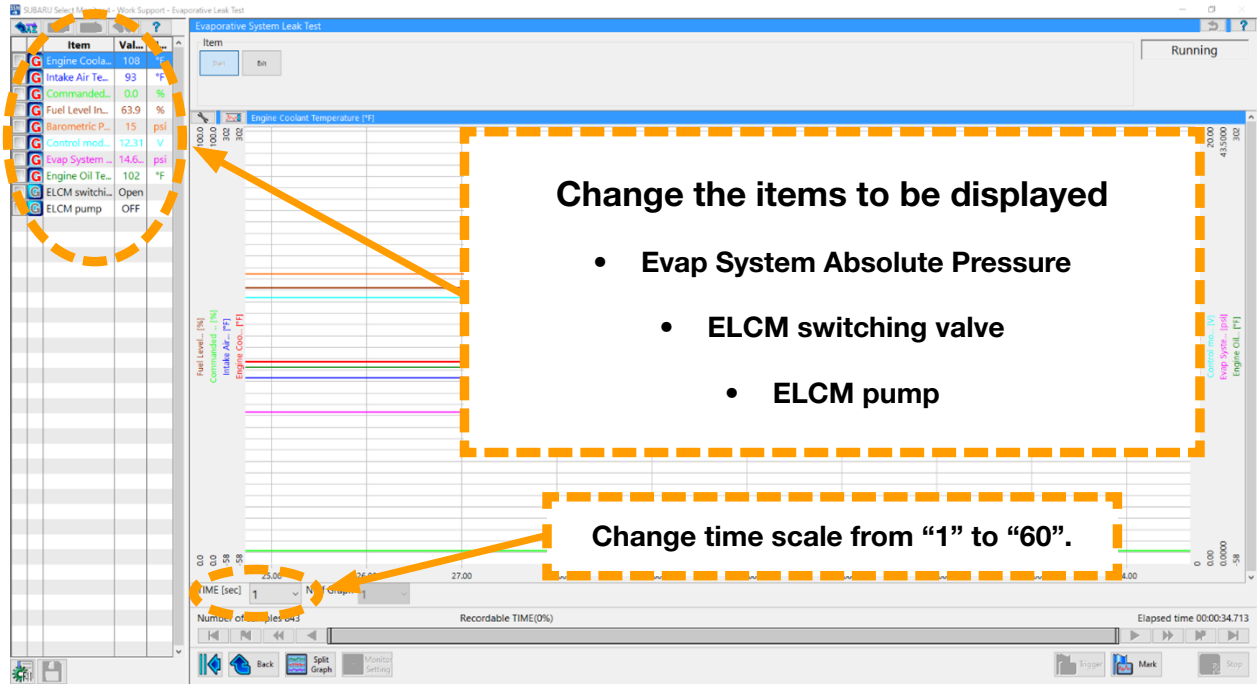

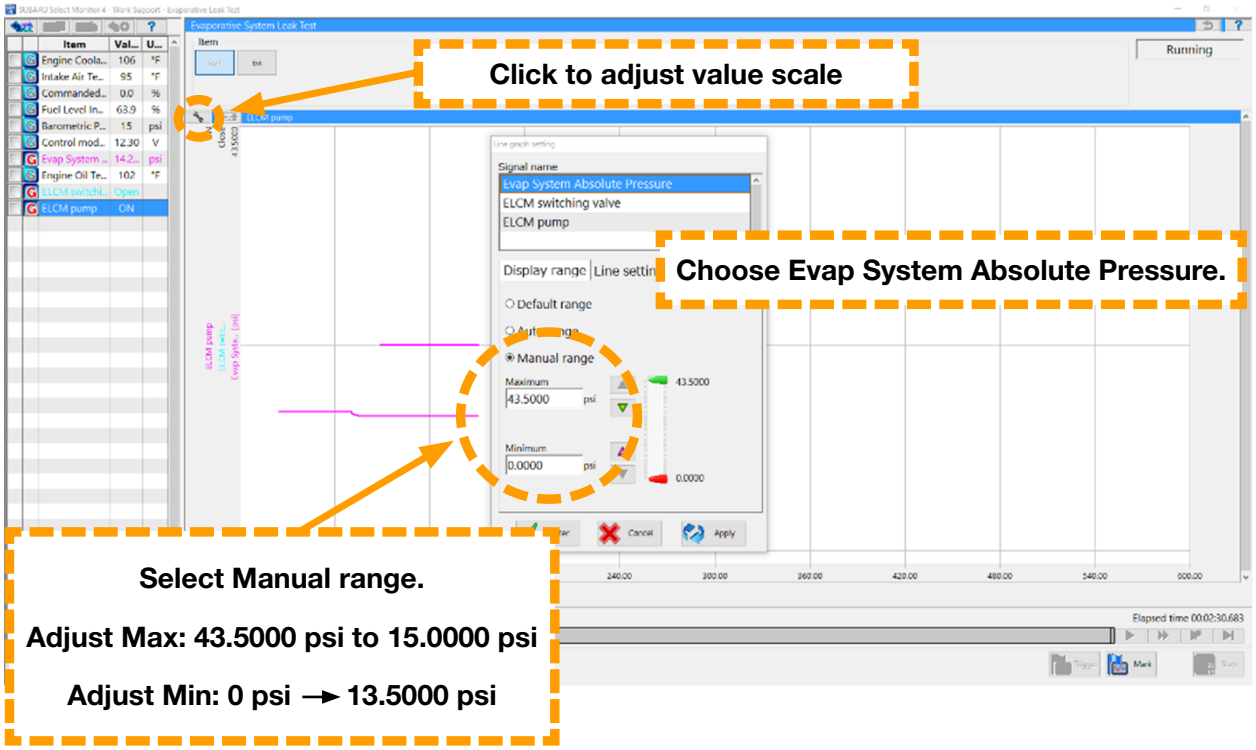

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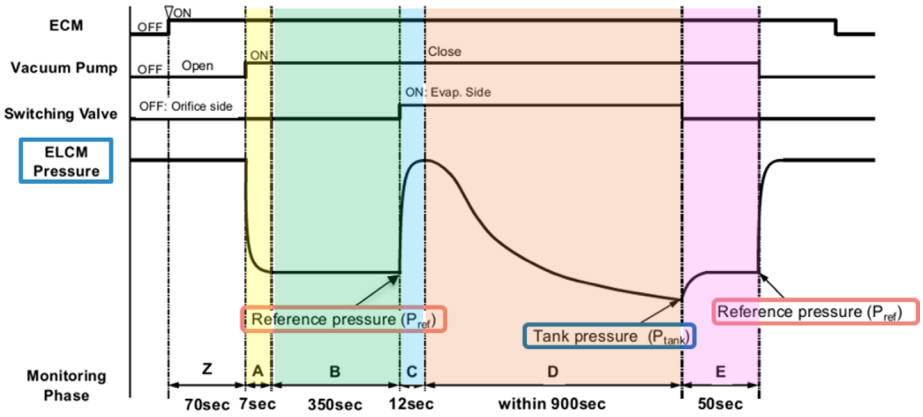
Technicians will now be able to watch the test as it is being performed.

As the test runs, it will perform different phases.

Phase	Explaination of Phase	Diagnosis period
A	Vacuum pump operation confirmation and characteristics stability	7 s or less
B	Measurement of reference pressure for setting the target negative pressure	350 s or less
C	Switching valve operation confirmation	12 s or less
D	0.04 inch leak pressure measurement	900 s or less
	0.02 inch leak pressure measurement	
	Clogging of pipe diagnosis and leak pressure measurement	
E	Reference pressure measurement for judgment	50 s or less



Phase A

The ECM uses this phase to check the operation of the vacuum pump.

The ECM simulates a 0.02 leak by using the reference pressure as the vacuum pump is running.

The switching valve is in the ‘open’ position. This allows ambient air to enter the ELCM.

Phase B

The ECM measures the pressure and calculates the limit of negative pressure based on the reference.

Phase C

The switching valve closes, and ECM measures the evaporative side pressure. The jump in pressure is caused by the movement of the switching valve. This also seals the system from ambient air.

Phase D

With the switching valve closed, the ECM measures the pressure in the EVAP system in relation to the amount of time it takes to reach maximum vacuum.

Phase E

The ECM measures the reference pressure again with the 0.02 simulated leak (ELCM orifice). During this phase, the ECM is determining the size of any leaks. Pressure during this phase is compared to pressure during phase B and should be very similar.

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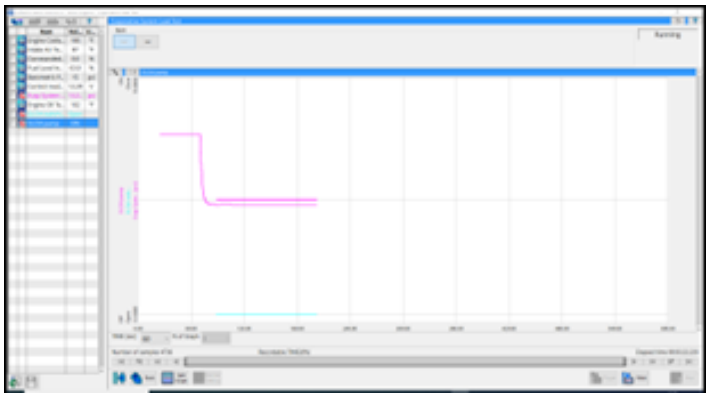
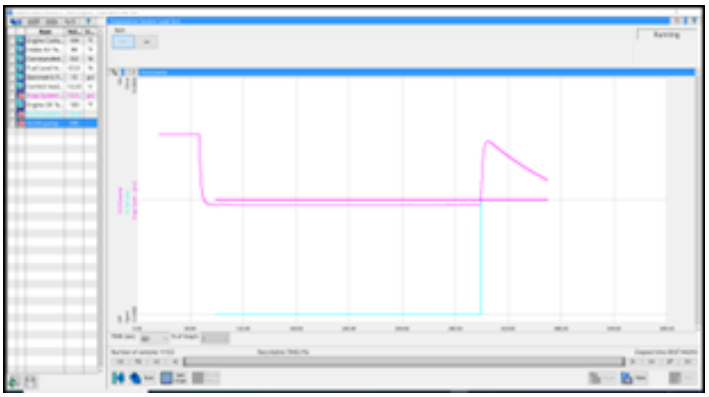
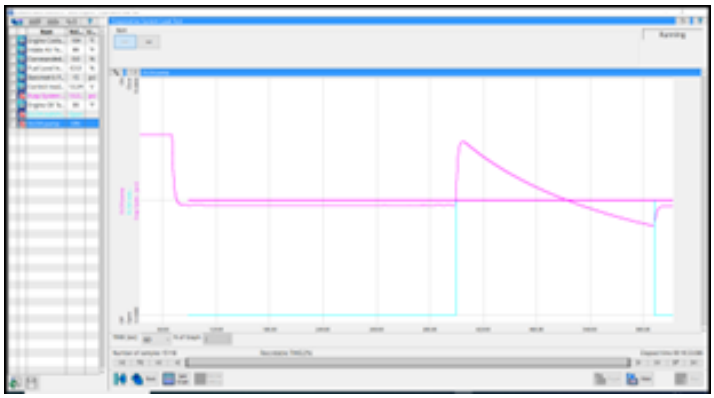
PhaseZ ⟶ PhaseA ⟶ PhaseB



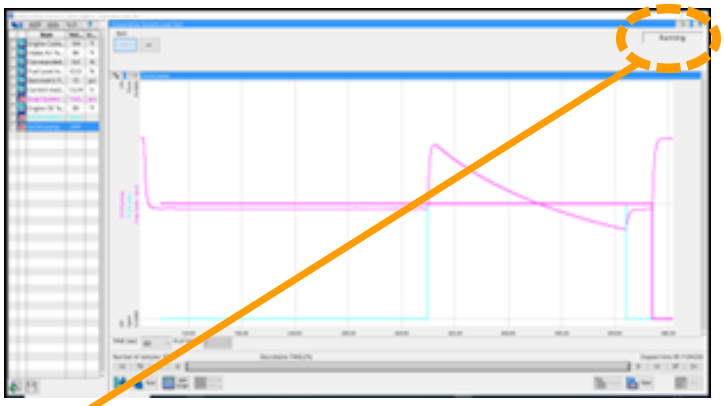
PhaseB ⟶ PhaseC ⟶ PhaseD



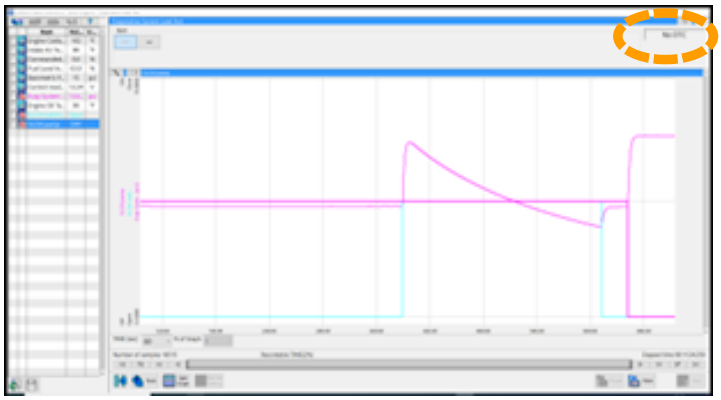
PhaseD ⟶ PhaseE



PhaseE ⟶ PhaseC ⟶ Finish



Judgement



The test can take 15-30 minutes to complete. Once the test has completed, the SSM will show “No DTC” or “DTC” code is entered.

NOTE: ***Turbocharged vehicles will NOT set DTC P04AE after performing the self-test.***

On turbocharged vehicles, after performing the ELCM self-test, without turning the key off, perform an all DTC scan to verify there are no DTC’s set. This is a problem with the SSM4 software that will be corrected with a future software update.

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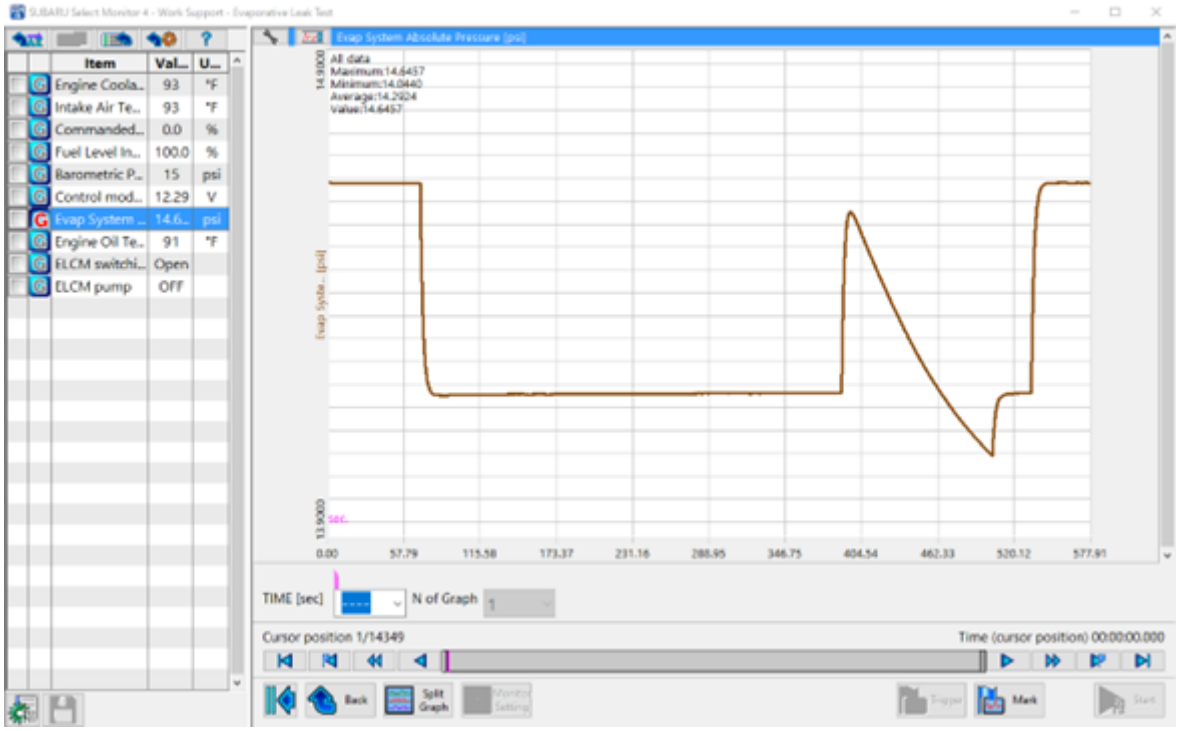
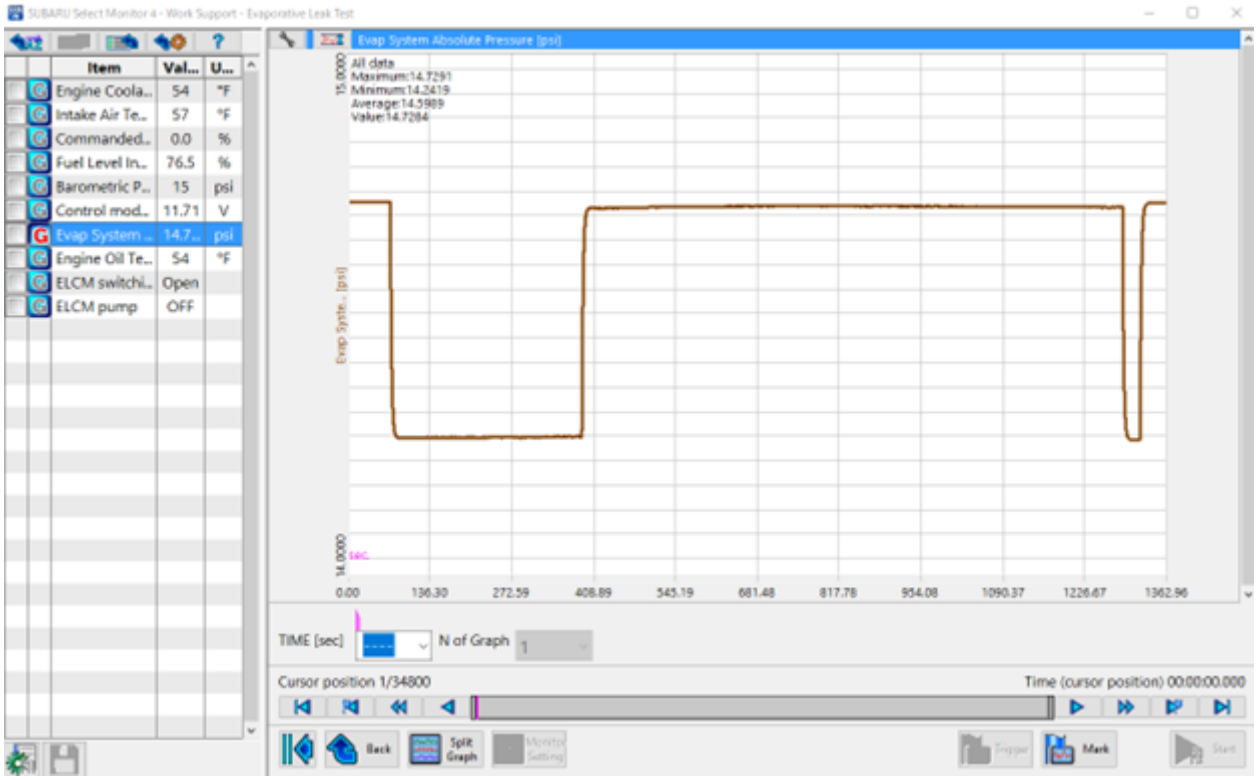
This is an example of a completed self-test, with "**No DTC**" set after being performed:



This is an example of a completed self-test, with "**P0455**" set after being performed:



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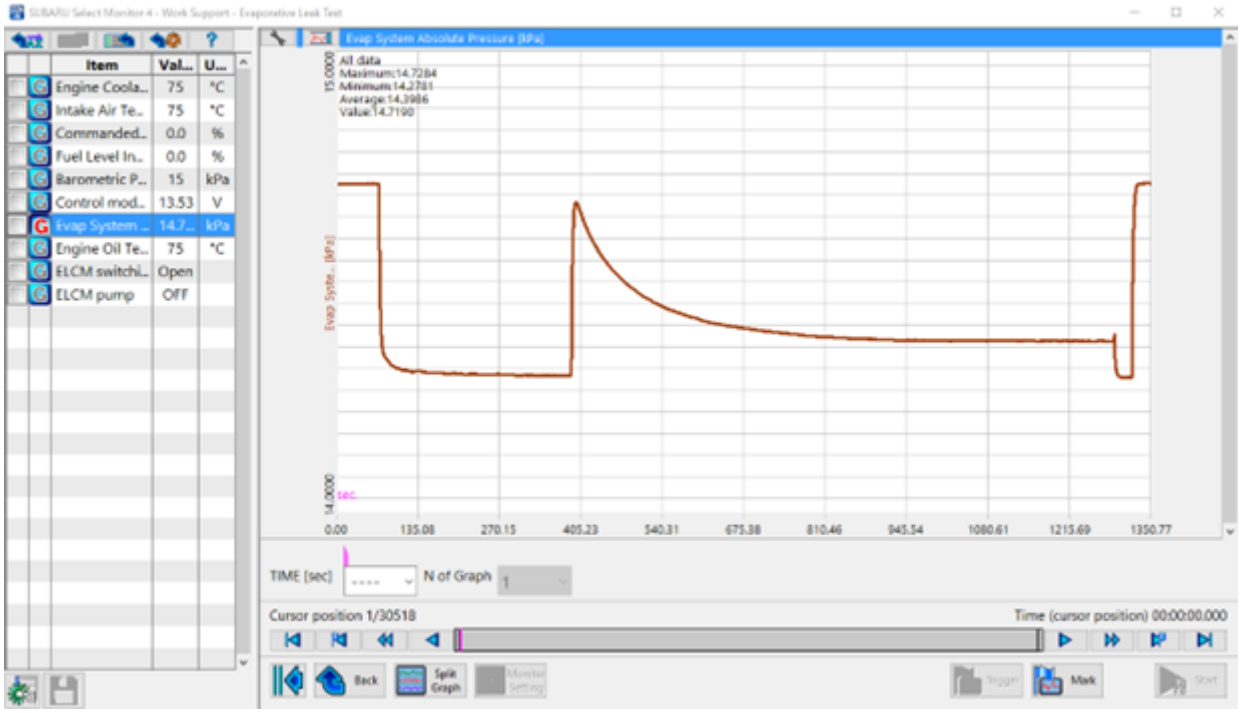
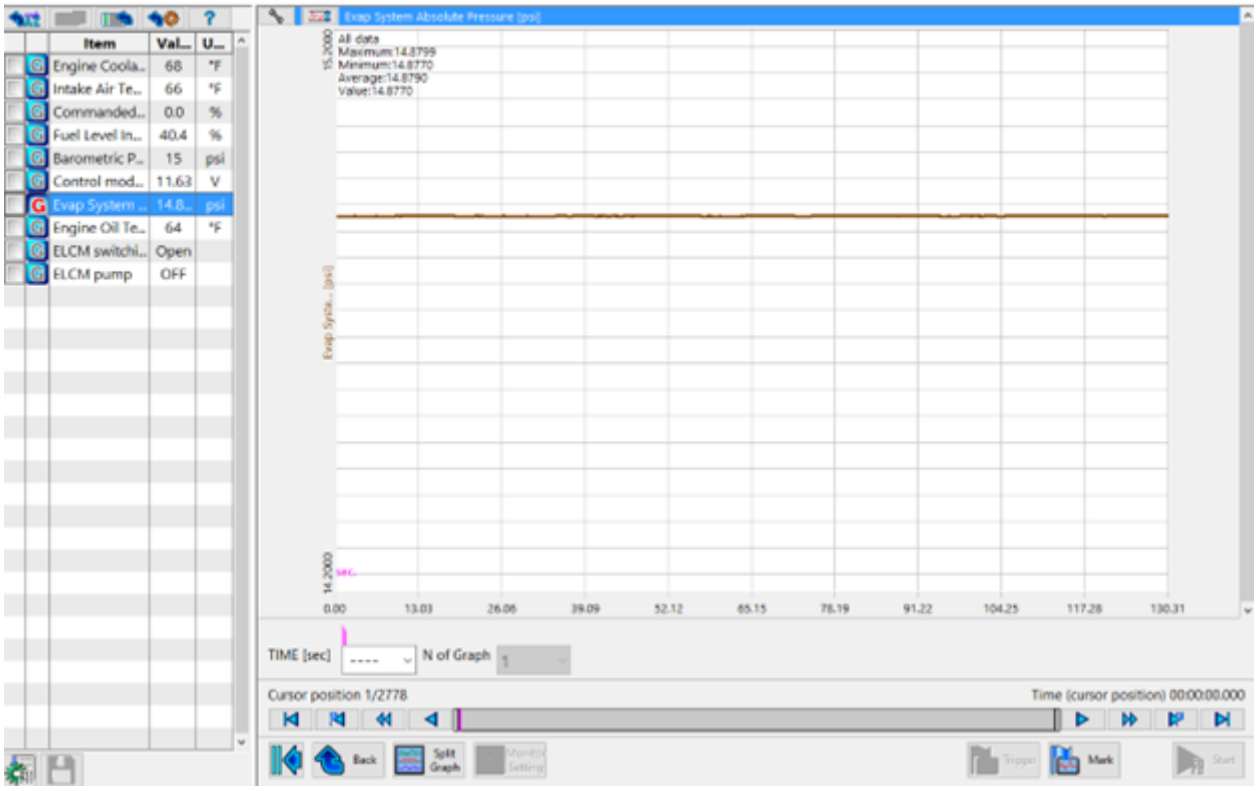
This is an example of a completed self-test, with "**P0456**" set after being performed:



This is an example of a completed self-test, with "**P2404**" set after being performed:
Evap System Absolute Pressure (Phase A) was not changed.



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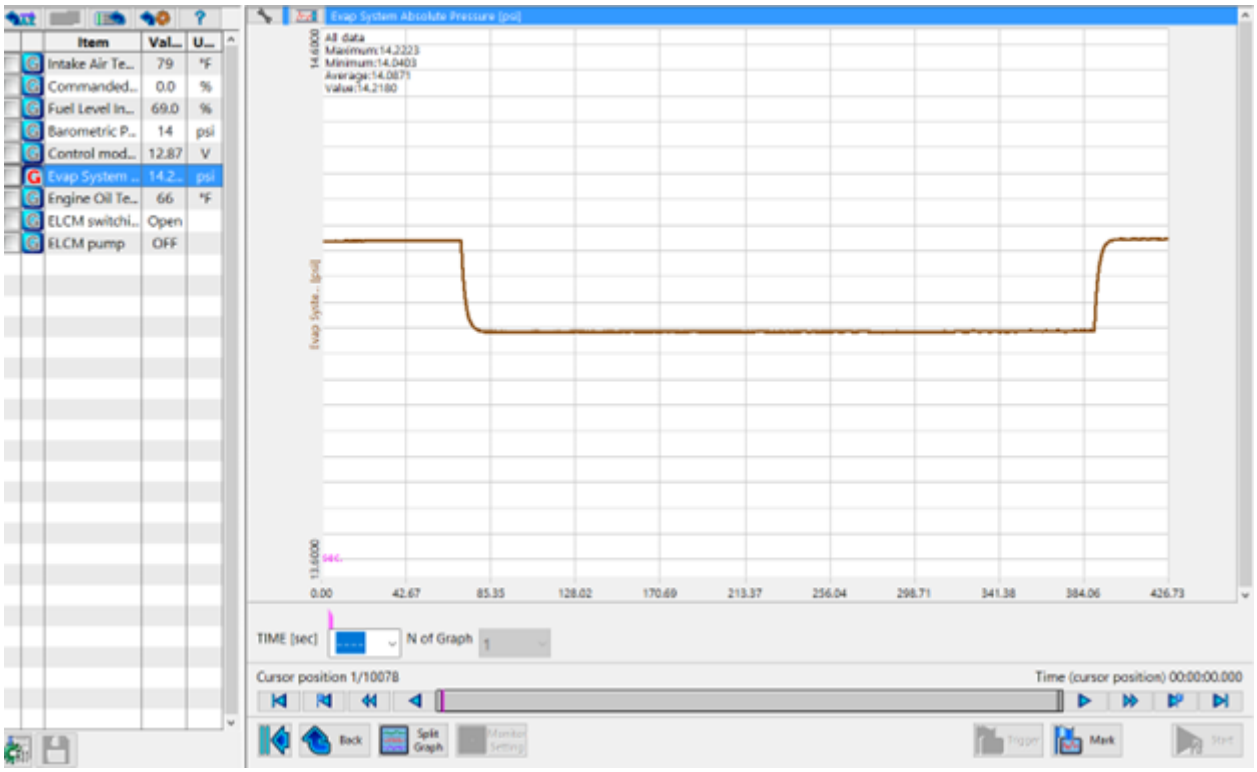
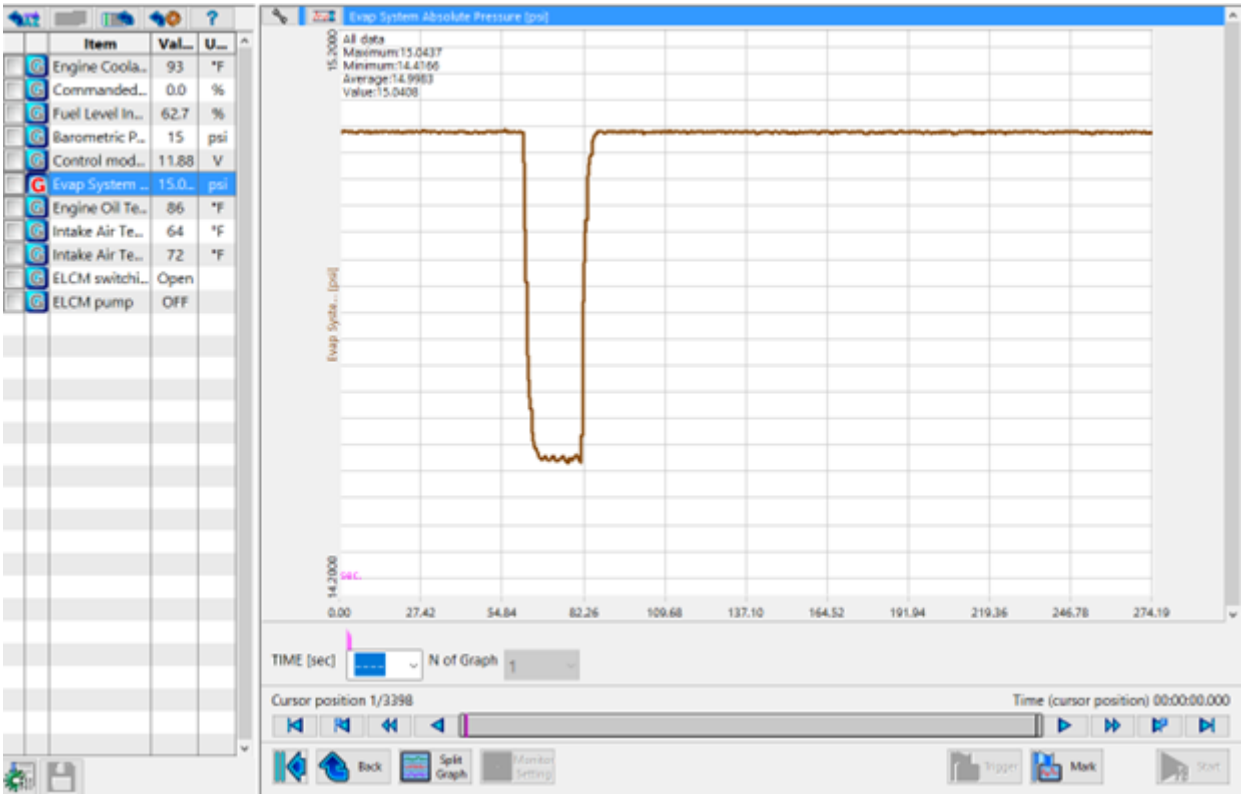
Evap System Absolute Pressure (Phase A) was too high.



Evap System Absolute Pressure (Phase A) was too low.



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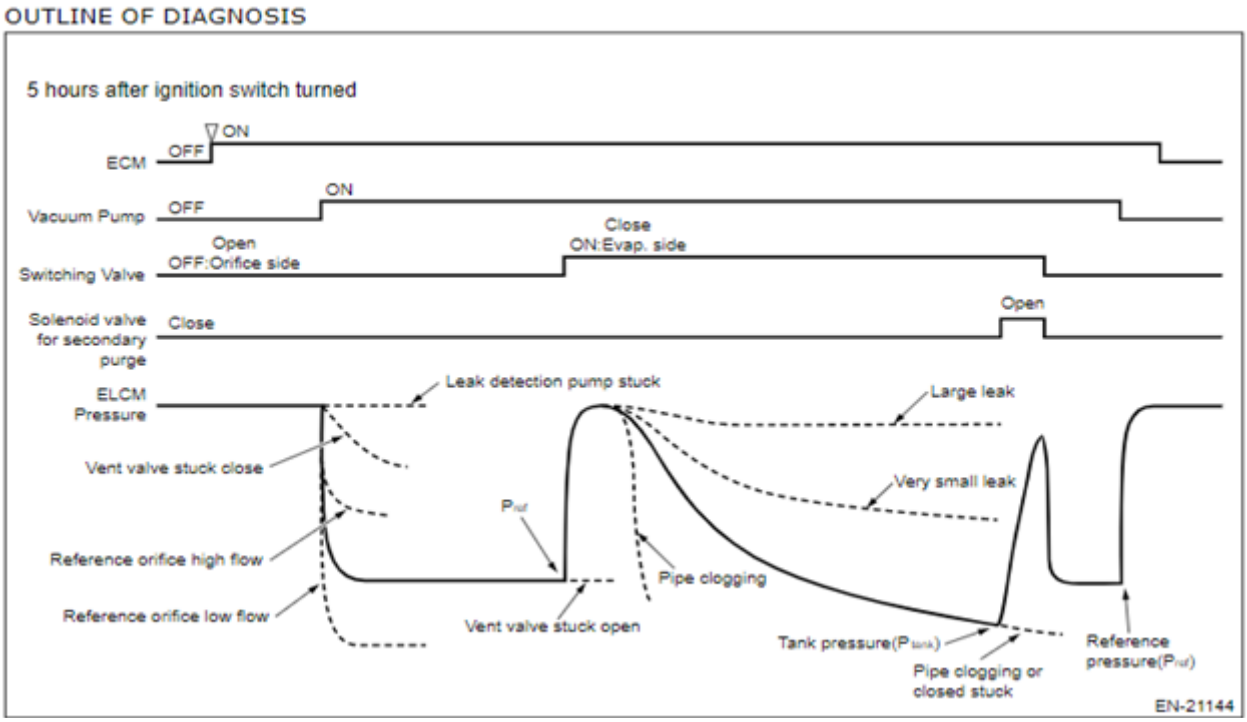
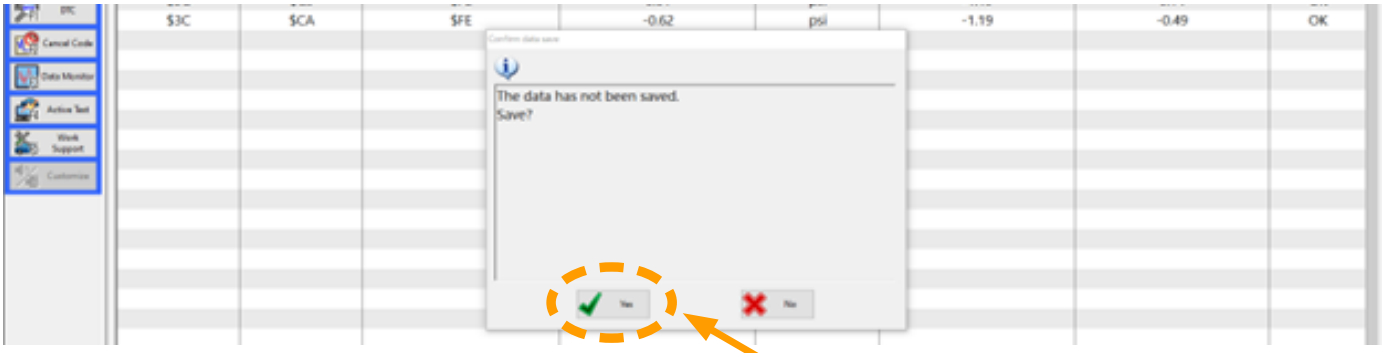
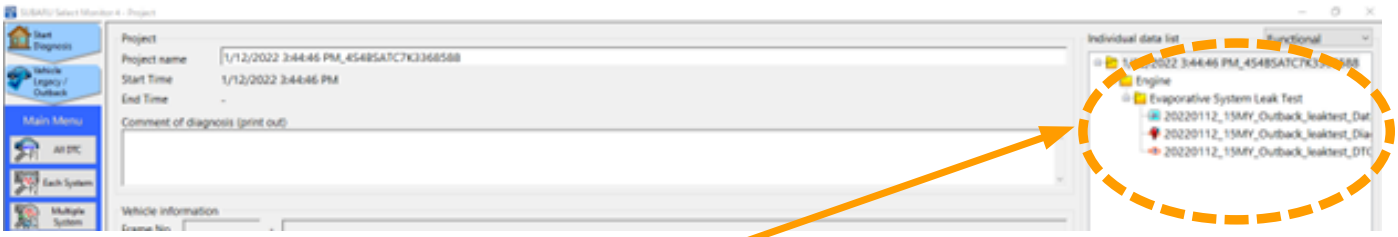


Above is a picture from STIS showing the basic outline for diagnosis in the ELCM force test. This will be useful in a comparison to the data graphed from the force test if a DTC is found.



Be sure to save the file with a name.



The data of the Leak Test will be saved with the name given in the previous step.

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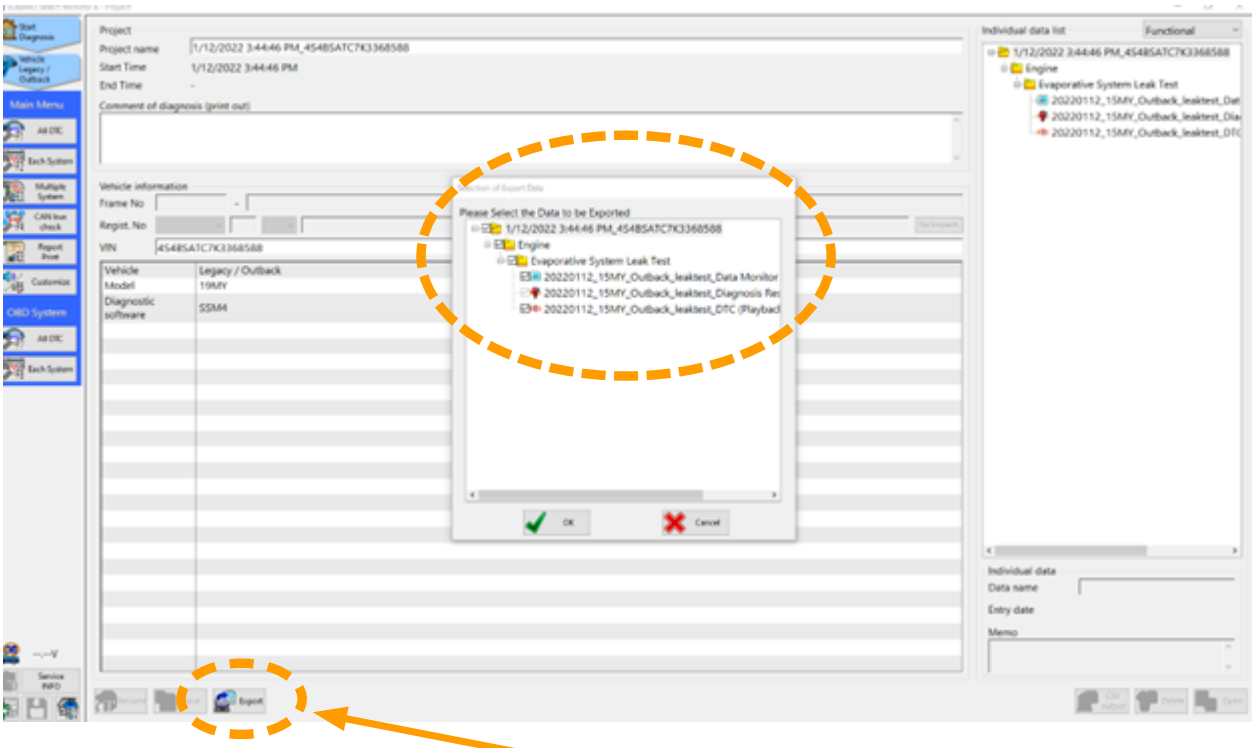
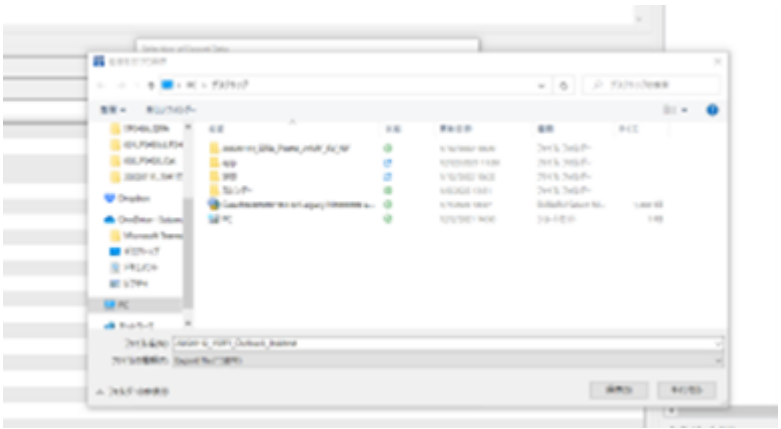
SUMMARY OF EVAP LEAK DIAGNOSIS (CONTINUED)



Press Export, and a pop-up window for saving data will appear. Be sure to check the checkboxes, as the data will be saved if they are checked.

- Data under test (MODE$01)
- Test result (MODE$06)
- DTC code (MODE$02,$03,$07)

are automatically saved in the system.



Save it!