SUBARU.

QUALITY DRIVEN® SERVICE

SERVICE BULLETIN

APPLICABILITY: 2013MY to Current Legacy and Outback 2.5L Models 2012MY to Current Impreza 2.0L Models 2013MY to Current XV Crosstrek 2011MY to Current Forester 2.5L Models 2014MY to Current Forester 2.0L DIT Models 2015MY to Current WRX 2013MY to Current BRZ 2019MY Ascent	**NUMBER:** 02-163-16R **DATE:** 08/12/16 **REVISED:** 03/08/19

SUBJECT: Inspection and Repair Procedures for AVCS-Related DTCs

INTRODUCTION:

This Service Information bulletin provides new inspection and repair procedures for AVCS (Active Valve Control System) -related DTCs on the FA and FB engine equipped models listed above. The applicable Service Manuals will be revised with this new information in the near future.

CHAPTER 1: DTCs and their Descriptions which will be covered in this bulletin:

DTC	DESCRIPTION
P000A	"A" CAMSHAFT POSITION SLOW RESPONSE BANK1
P000B	"B" CAMSHAFT POSITION SLOW RESPONSE BANK1
P000C	"A" CAMSHAFT POSITION SLOW RESPONSE BANK2
P000D	"B" CAMSHAFT POSITION SLOW RESPONSE BANK2
P0011	"A" CAMSHAFT POSITION-TIMING OVER ADVANCED OR SYSTEM PERFORMANCE BANK1
P0014	"B" CAMSHAFT POSITION-TIMING OVER ADVANCED OR SYSTEM PERFORMANCE BANK1
P0021	"A" CAMSHAFT POSITION-TIMING OVER ADVANCED OR SYSTEM PERFORMANCE BANK2
P0024	"B" CAMSHAFT POSITION-TIMING OVER ADVANCED OR SYSTEM PERFORMANCE BANK2
P0016	CRANKSHAFT POSITION-CAMSHAFT POSITION CORRELATION BANK1, SENSOR A
P0017	CRANKSHAFT POSITION-CAMSHAFT POSITION CORRELATION BANK1, SENSOR B
P0018	CRANKSHAFT POSITION-CAMSHAFT POSITION CORRELATION BANK2, SENSOR A
P0019	CRANKSHAFT POSITION-CAMSHAFT POSITION CORRELATION BANK2, SENSOR B

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CHAPTER 2: Inspection and Repair Procedures:

The actual Troubleshooting Charts (CHAPTER 3) referenced in Tables 2-1 and 2-2 below begin on **Page 3.**

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Table 2-1: For DTCs P000A, P000B, P000C, P000D, P0011, P0014, P0021, P0024:

Model	Engine	MY	Use Troubleshooting Chart Number:
LEGACY/ OUTBACK	2.5L NA	13MY and after	
IMPREZA	2.0L NA	12MY and after	
XV	2.0L NA	13MY and after	
FORESTER	2.5L NA	11MY and after	(1). P000A, P0011
	2.0L DIT	14MY and after	
WRX	2.0L DIT	15MY and after	
BRZ	2.0L DI NA	13MY and after	

Table 2-2: For DTCsP0016, P0017, P0018 and P0019:

Model	Engine	MY	VVT Initial Position Learning Value		VVT Adv. Angle Amount	Use Troubleshooting Chart Number:
			Readability?	Method	Standard Angle Data	
LEGACY/ OUTBACK	2.5L NA	13MY to current	Yes	SSM Data Monitor	0 deg.	(2)-1. P0016 General
IMPREZA	2.0L NA	14MY to current	Yes	SSM Data Monitor	0 deg.	(2)-1. P0016 General
		12MY and 13MY	No	None	0 deg.	(2)-4. P0016 for No Learning Value
XV	2.0L NA	14MY to current	Yes	SSM Data Monitor	0 deg.	(2)-1. P0016 General
		13MY	No	None	0 deg.	(2)-4. P0016 for No Learning Value
FORESTER	2.5L NA	14MY to current	Yes	SSM Data Monitor	0 deg.	(2)-1. P0016 General
		2011, 12 and 13MY	No	None	0 deg.	(2)-4. P0016 for No Learning Value
	2.0L DIT	16MY to current	Yes	SSM Data Monitor	0 deg.	(2)-1. P0016 General
		14MY and 15MY	Yes	SSM Data Monitor	27 deg.	(2)-2. P0016 for 27deg
WRX	2.0L DIT	15MY to current	Yes	SSM Data Monitor	0 deg.	(2)-1. P0016 General
BRZ	2.0L NA	13MY to current	Yes	SSM Work Support	0 deg.	(2)-3. P0016 for Work Support

IMPORTANT NOTES AND REMINDERS:

- When directed to replace the engine oil and filter, always use the specified viscosity. **DO NOT** supplement the engine oil with any additives.
- When installing new cam carrier oil filters, use caution to not press them into the cam carriers any deeper than **flush** with the machined cylinder head mating surface.
- The wiring connector chart referenced throughout the Troubleshooting Charts (CHAPTER 8) is found at the end of this TSB.

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CHAPTER 3: Troubleshooting Charts

(1). P000A, P0011

Troubleshooting for P000A, B, C or D / P0011, 14, 21 or 24			LEGACY / OUTBACK 2.5L: 13MY and after IMPREZA: 12MY and after XV: 13MY and after FORESTER 2.5L NA: 11MY and after FORESTER 2.0L DIT: 14MY and after WRX: 15MY and after BRZ: 13MY and after
	Step	**Check**	**YES**	**NO**
1	Check the DTC	Is there any DTC other than P000A, B, C or D / P0011, 14, 21 or 24?	Go to the applicable DTC troubleshooting.	Save the FFD. Go to step 2.
2	Check the engine oil condition.	Does the oil level gauge show out of range? Is the oil excessively dirty? Is the oil clotted due to use of additives? Is undesignated viscosity oil used?	Correct the oil level. Replace the engine oil and oil filter. Go to step 3.	Go to step 3.
3	Is the car is fixed? 1) Replace the oil control valve with a brand new one. 2) Clear the memory using SSM. 3) Perform the drive cycle. (Refer to Chapter 5.) 4) Read the "AVCS diagnostic value" by using SSM. Please refer to Chapter 6 to read out MODE$06.	Is the diagnostic value of applicable AVCS ≧ 1000? If the value is less than 1000, is the value definitely greater than the opposite side AVCS value (more than 1.5 times the opposite side value +100)? SEE **"APPENDIX A"** AT THE END OF CHAPTER 3 If the value is 0, the diagnosis process has not yet completed. Continue to perform a drive cycle without stopping the engine. * The diagnostic value is updated repeatedly, therefore, please watch it while having an assistant test drive the vehicle.	Go to step 4.	Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter. END
4	Check the harness.	Is there a poor contact among the oil control valve, cam angle sensor, crank angle sensor and ECU? -Is there any damage on the connector pin of oil control valve, cam angle sensor, crank angle sensor or ECU? - Are following resistances more than 1Ω: Between the oil control valve and the ECU Between the cam angle sensor and the ECU Between the crank angle sensor and the ECU? (Connector Numbers are found in Chapter 8.)	Repair the problem. Go to step 5.	Go to step 6.
5	Is the car is fixed? 1) Clear the memory by using SSM. 2) Perform the drive cycle. (Refer to Chapter 5) 3) Read the "AVCS diagnostic value" by using SSM. Please refer to Chapter 6 to read out MODE$06.	Is the diagnostic value of applicable AVCS ≧ 1000? If the value is less than 1000, is the value definitely greater than the opposite side AVCS value (more than 1.5 times the opposite side value +100)? SEE **"APPENDIX A"** AT THE END OF CHAPTER 3 If the value is 0, the diagnosis process has not yet completed. Continue to perform a drive cycle without stopping the engine. * The diagnostic value is updated repeatedly, therefore, please watch it while having an assistant test drive the vehicle.	Go to step 6.	END

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6	Check the engine oil pressure.	Is the engine oil pressure lower than specification?	Go to step 7. Replace the chain cover with a new one after the inspection is completed.	Go to step 7.
7	Check the oil passages in the chain cover.	Is there any abnormality of the O-rings for the suction and discharge ports of the oil pump? Is there any abnormality of the O-rings for oil passage to both sides of cylinder heads? Is there any damage or contamination with the oil control valve? Is there any contamination in the oil pump ports? **NOTE:** Do not disassemble the timing chain cover.	Repair the problem. Go to step 8. In case of contamination, replace the chain cover with new one after the inspection is completed.	Go to step 8.
8	Check the camshaft condition.	Remove the timing chain and rotate camshafts. Compare the rotating friction of all 4 camshafts. Is there particular friction in the camshaft which had DTC? Is there any scratch or damage on the surface of the cam journal? Is any additional resistance felt? Compare the intake camshaft with the exhaust camshaft. Is there any scratch or damage on the surface of the cam journal?	Replace cam carrier and camshaft with new one. Go to step 9.	Go to step 9.
9	Check the oil line between the oil pump and the cam sprocket. Replace the oil filter on the cam carrier. (Don't reuse)	Refer to the applicable section of Service Manual to remove cam carrier. Is there any contamination or clog visually in the cam carrier or cylinder head oil line? Is there any contamination or clog visually in the oil line between the sprocket and the camshaft? (Remove the sprocket from the camshaft.) Is there any contamination or clog visually in the sprocket oil line? Is there any contamination or clog visually in the camshaft oil line?	In case of a problem, repair the wrong part and replace cam sprocket with new one. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. *Please do not push in oil filter excessively. The upper end of the oil filter should be flush with the cam carrier. Go to step 10.	*Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. *Please do not push in oil filter excessively. The upper end of the oil filter should be flush with the cam carrier. Go to step 10.

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| 10 | Check the oil strainer. | Is there any debris or contamination in the oil strainer on the oil pan? | In case of a problem, remove the debris and clean it.

Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter.
*Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity.

Go to step 11. | Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter.
*Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity.

Go to step 11. |
| 11 | Is the car is fixed?
1) Clear the memory by using SSM.
2) Perform the drive cycle. (Refer to the Chapter 5)
3) Read the "AVCS diagnostic value" by using SSM. Please refer to Chapter 6 to read out MODE$06. | Is the diagnostic value of applicable AVCS ≧ 1000?

If the value is less than 1000, is the value definitely greater than the opposite side AVCS value (more than 1.5 times the opposite side value +100)?
SEE **"APPENDIX A"** AT THE END OF CHAPTER 3

If the value is 0, the diagnosis process has not yet completed. Continue to perform a drive cycle without stopping the engine.

* The diagnostic value is updated repeatedly, therefore, please watch it while having an assistant test drive the vehicle. | Replace ECU with new one.

END | END |

(2)-1. P0016 General

	Troubleshooting for P0016, 17, 18 or 19 - No.1 General: Models for SSM "Data Monitor" showing "VVT Initial Position Learning Value" Displayed "VVT Adv. Ang. Amount" at the standard angle is "0 deg.".		LEGACY / OUTBACK 2.5L: 13MY and after IMPREZA / XV: 14MY and after FORESTER 2.5L NA: 14MY and after FORESTER 2.0L Turbo: 16MY and after WRX: 15MY and after	
	Step	**Check**	**YES**	**NO**
1	Check the DTC	Is there any DTC other than P0016, 17, 18 or 19?	Go to the concerned DTC troubleshooting.	Save the FFD. Go to step 2.
2	Check the engine oil condition.	Does the oil level gauge show out of range? Is the oil excessively dirty? Is the oil clotted due to use of additives? Is undesignated viscosity oil used?	Correct the oil level. Replace the engine oil and oil filter. Go to step 3.	Go to step 3.

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3	Check the chain timing. 1) Clear the memory by using SSM. 2) Disconnect the oil control valve connector. DTC comes on but there is no problem for this check process. 3) Start the engine and check the "VVT Adv. Ang. Amount" at idle within 10 sec. from starting the engine by using SSM. (Refer to 4.1 in Chapter 4)	Does "VVT Adv. Ang. Amount" have more than ± 10deg difference from the reference value (0 deg.)? - Connect the connector after the check. - Record the "VVT Adv. Ang. Amount" because the step below uses the value. *Detailed process 1. Clear the memory by using SSM. 2. Disconnect the applicable AVCS connector which had the DTC. 3. Turn IG on and start monitor the AVCS advance timing value which is the item "VVT Adv. Ang. Amount" in the SSM. 4. Start engine and read out "VVT Adv. Ang. Amount" within 10 sec. (The value changes to "0" after 10 sec) 5. Stop the engine.	Correct the chain timing. Go to step 12.	Go to step 4.
4	Is the car is fixed? 1) Replace the oil control valve with a brand new one. 2) Clear the memory by using SSM. 3) Perform the drive cycle. (Refer to the 6th chapter) 4) Read the "AVCS diagnostic value" by using SSM. Please refer to Chapter 6 to read out MODE$06.	Is the diagnostic value of applicable AVCS ≧ 1000? If the value is less than 1000, is the value definitely greater than the opposite side AVCS value (more than 1.5 times the opposite side value +100)? SEE **"APPENDIX A"** AT THE END OF CHAPTER 3 If the value is 0, the diagnosis process has not yet completed. Continue to perform a drive cycle without stopping the engine. * The diagnostic value is updated repeatedly, therefore, please watch it while having an assistant test drive the vehicle.	Go to step 5.	Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter. Go to step 12.
5	Check the harness.	Is there a poor contact among the oil control valve, cam angle sensor, crank angle sensor and ECU? - Is there any damage on the connector pin of oil control valve, cam angle sensor, crank angle sensor or ECU? - Are the following resistances more than 1Ω? Between the oil control valve and the ECU. Between the cam angle sensor and the ECU. Between the crank angle sensor and the ECU. *Connector Numbers are found in Chapter 8.	Repair the problem. Go to step 6.	Go to step 7.
6	Is the car is fixed? 1) Clear the memory by using SSM. 2) Perform the drive cycle. (Refer to the 6th chapter) 3) Read the "AVCS diagnostic value" by using SSM. Please refer to Chapter 6 to read out MODE$06.	Is the diagnostic value of applicable AVCS ≧ 1000? If the value is less than 1000, is the value definitely greater than the opposite side AVCS value (more than 1.5 times the opposite side value +100)? SEE **"APPENDIX A"** AT THE END OF CHAPTER 3 If the value is 0, the diagnosis process has not yet completed. Continue to perform a drive cycle without stopping the engine. * The diagnostic value is updated repeatedly, therefore, please watch it while having an assistant test drive the vehicle.	Go to step 7.	Go to step 12.
7	Check engine oil pressure.	Is the engine oil pressure lower than specification?	Go to step 8. Replace the chain cover with new one after the inspection is completed.	Go to step 8.

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8	Check the oil passages in the chain cover.	Is there any abnormality of the O-ring for suction port and discharge port of the oil pump? Is there any abnormality of the O-rings for oil passage to both sides of cylinder heads? Is there any damage or contamination with the oil control valve? Is there any contamination in the oil pump ports? **NOTE:** Do not disassemble the timing chain cover.	Repair the problem. Go to step 9. In case of contamination, replace the chain cover with new one after the inspection is completed	Go to step 9.
9	Check the camshaft condition.	Remove the timing chain and rotate camshafts. Compare the rotating friction of all 4 camshafts. Is there particular friction in the camshaft which had DTC? Is there any scratch or damage on the surface of the cam journal? Is any additional resistance felt? Compare the intake camshaft with the exhaust camshaft. Is there any scratch or damage on the surface of the cam journal?	Replace Cam carrier and camshaft with new one. Go to step 10.	Go to step 10.
10	Check the oil line between the oil pump and the cam sprocket. Replace the oil filter on the cam carrier. (Don't reuse)	Refer to the applicable section of Service Manual to remove cam carrier. Is there any contamination or clog visually in the cam carrier or cylinder head oil line? Is there any contamination or clog visually in the oil line between the sprocket and the camshaft? Remove the sprocket from the camshaft. Is there any contamination or clog visually in the sprocket oil line? Is there any contamination or clog visually in the camshaft oil line?	In case of a problem, repair the wrong part and replace cam sprocket with new one. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of service manual and apply correct type of THREE BOND with proper quantity. *Please do not push in oil filter excessively. The upper end of the oil filter should be flush with the cam carrier. Go to step 11.	*Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. *Please do not push in oil filter excessively. The upper end of the oil filter should be flush with the cam carrier. Go to step 11.
11	Check the oil strainer.	Is there any debris or contamination in the oil strainer on the oil pan?	In case of a problem, remove the debris and clean it. Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of service manual and apply correct type of THREE BOND with proper quantity. Go to step 12.	Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. Go to step 12.

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| 12 | Check the learning value.

1) Clear the memory by using SSM.
2) Turn IG on.
3) Read the "VVT Initial Position Learning Value" by using SSM "Data Monitor". (Refer to 4.1 in Chapter 4) | Is the following value out of normal range?

"VVT Initial Position Learning Value" + "VVT Adv. Ang. Amount"

*"VVT Adv. Ang. Amount" is read out in the step3 of this troubleshooting.

*Refer to Chapter 7 which shows a normal range of the learning value. | Replace the ECU with new one.

Drive the test driving cycle.

END | END |

(2)-2. P0016 for 27deg.

Troubleshooting for P0016, 17, 18 or 19 - No.2 27 deg.: Models for SSM "Data Monitor" showing "VVT Initial Position Learning Value" Displayed "VVT Adv. Ang. Amount" at the standard angle is "27deg".			FORESTER 2.0L Turbo: 14MY and 15MY	
	Step	**Check**	**YES**	**NO**
1	Check the DTC	Is there any DTC other than P0016, 17, 18 or 19?	Go to the concerned DTC troubleshooting.	Save the FFD. Go to step 2.
2	Check the engine oil condition.	Does the oil level gauge show out of range? Is the oil excessively dirty? Is the oil clotted due to use of additives? Is undesignated viscosity oil used?	Correct the oil level. Replace the engine oil and oil filter. Go to step 3.	Go to step 3.
3	Check the chain timing. 1) Clear the memory by using SSM. 2) Disconnect the oil control valve connector. DTC comes on but there is no problem for this check process. 3) Start the engine and check the "VVT Adv. Ang. Amount" at idle within 10 sec. from starting the engine by using SSM. (Refer to 4.1 in Chapter 4)	Does "[VVT Adv. Ang. Amount] – 27deg." have more than ±10 deg. difference from the reference value (0 deg.)? - Connect the connector after the check. - Record the "VVT Adv. Ang. Amount] -27deg." because the step below uses the value. *Detailed process 1. Clear the memory by using SSM. 2. Disconnect the applicable AVCS connector which had the DTC. 3. Turn IG on and start monitor the AVCS advance timing value which is the item "VVT Adv. Ang. Amount" in the SSM. 4. Start engine and read out "VVT Adv. Ang. Amount" within 10sec. (The value changes to "27" after 10 sec) 5. Stop the engine.	Correct the chain timing. Go to step 12.	Go to step 4.

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4	Is the car is fixed? 1) Replace the oil control valve with a brand new one. 2) Clear the memory by using SSM. 3) Perform the drive cycle. (Refer to Chapter 5) 4) Read the "AVCS diagnostic value" by using SSM. Please refer to Chapter 6 to read out MODE$06.	Is the diagnostic value of applicable AVCS ≧ 1000? If the value is less than 1000, is the value definitely greater than the opposite side AVCS value (more than 1.5 times the opposite side value +100)? SEE **"APPENDIX A"** AT THE END OF CHAPTER 3 If the value is 0, the diagnosis process has not yet completed. Continue to perform a drive cycle without stopping the engine. * The diagnostic value is updated repeatedly, therefore, please watch it while having an assistant test drive the vehicle.	Go to step 5.	Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter. Go to step 12.
5	Check the harness.	Is there a poor contact among the oil control valve, cam angle sensor, crank angle sensor and ECU? - Is there any damage on the connector pin of oil control valve, cam angle sensor, crank angle sensor or ECU? - Are following resistances more than 1Ω? Between the oil control valve and the ECU. Between the cam angle sensor and the ECU. Between the crank angle sensor and the ECU. *Connector Numbers are found in Chapter 8.	Repair the problem. Go to step 6.	Go to step 7.
6	Is the car is fixed? 1) Clear the memory by using SSM. 2) Perform the drive cycle. (Refer to the 6th chapter) 3) Read the "AVCS diagnostic value" by using SSM. Please refer to Chapter 6 to read out MODE$06.	Is the diagnostic value of applicable AVCS ≧ 1000? If the value is less than 1000, is the value definitely greater than the opposite side AVCS value (more than 1.5 times the opposite side value +100)? SEE **"APPENDIX A"** AT THE END OF CHAPTER 3 If the value is 0, the diagnosis process has not yet completed. Continue to perform a drive cycle without stopping the engine. * The diagnostic value is updated repeatedly, therefore, please watch it while having an assistant test drive the vehicle.	Go to step 7.	Go to step 12.
7	Check engine oil pressure.	Is the engine oil pressure lower than specification?	Go to step 8. Replace the chain cover with new one after the inspection is completed.	Go to step 8.
8	Check the oil passage in the chain cover.	Is there any abnormality of the O-ring for suction port and discharge port of the oil pump? Is there any abnormality of the O-rings for oil passage to both sides of cylinder heads? Is there any damage or contamination with the oil control valve? Is there any contamination in the oil pump ports? **NOTE:** Do not disassemble the timing chain cover.	Repair the problem. Go to step 9. In case of contamination, replace the chain cover with new one after the inspection is completed.	Go to step 9.

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9	Check the camshaft condition.	Remove the timing chain and rotate camshafts. Compare the rotating friction of all 4 camshafts. Is there particular friction in the camshaft which had DTC? Is there any scratch or damage on the surface of the cam journal? Is any additional resistance felt? Compare the intake camshaft with the exhaust camshaft. Is there any scratch or damage on the surface of the cam journal?	Replace cam carrier and camshaft with new one. Go to step 10.	Go to step 10.
10	Check the oil line between the oil pump and the cam sprocket. Replace the oil filter on the cam carrier. (Don't reuse)	Refer to the applicable section of Service Manual to remove cam carrier. Is there any contamination or clog visually in the cam carrier or cylinder head oil line? Is there any contamination or clog visually in the oil line between the sprocket and the camshaft? Remove the sprocket from the camshaft. Is there any contamination or clog visually in the sprocket oil line? Is there any contamination or clog visually in the camshaft oil line?	In case of a problem, repair the wrong part and replace cam sprocket with new one. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of service manual and apply correct type of THREE BOND with proper quantity. *Please do not push an oil filter excessively. The upper end of the oil filter should be flush with the cam carrier. Go to step 11.	*Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. *Please do not push an oil filter excessively. The upper end of the oil filter should be flush with the cam carrier. Go to step 11.
11	Check the oil strainer.	Is there any debris or contamination in the oil strainer on the oil pan?	In case of a problem, remove the debris and clean it. Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of service manual and apply cor-rect type of THREE BOND with proper quantity. Go to step 12.	Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. Go to step 12.
12	Check the learning value. 1) Clear the memory by using SSM. 2) Turn IG on. 3) Read the "VVT Initial Position Learning Value" by using SSM "Data Monitor". (Refer to 4.1 in Chapter 4)	Is the following value out of normal range? "VVT Initial Position Learning Value" + "[VVT Adv. Ang. Amount] – 27deg." *"[VVT Adv. Ang. Amount] – 27deg." is read out in the step 3 of this troubleshooting. *Refer to Chapter 7 which shows a normal range of the learning value.	Replace the ECU with a new one. Drive the test driving cycle. END	END

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(2)-3. P0016 for Work Support

		Troubleshooting for P0016, 17, 18 or 19 - No.3 Work Support: Models for SSM "Work Support" showing "VVT Initial Position Learning Value" Displayed "VVT Adv. Ang. Amount" at the standard angle is "0 deg.".		BRZ: 13MY and after

	Step	Check	YES	NO
1	Check the DTC	Is there any DTC other than P0016, 17, 18 or 19?	Go to the concerned DTC troubleshooting.	Save the FFD. Go to step 2.
2	Check the engine oil condition.	Does the oil level gauge show out of range? Is the oil excessively dirty? Is the oil clotted due to use of additives? Is undesignated viscosity oil used?	Correct the oil level. Replace the engine oil and oil filter. Go to step 3.	Go to step 3.
3	Check the chain timing. 1) Clear the memory by using SSM. 2) Disconnect the oil control valve connector. DTC comes on but there is no problem for this check process. 3) Start the engine and check the "VVT Adv. Ang. Amount" at idle within 10 sec. from starting the engine by using SSM. (Refer to 4.1 in Chapter 4)	Does "VVT Adv. Ang. Amount" have more than ± 10 deg. difference from the reference value (0 deg.)? - Connect the connector after the check. - Record the "AVCS advance timing value" because the step below uses the value. *Detailed process 1. Clear the memory by using SSM. 2. Disconnect the applicable AVCS connector which had the DTC. 3. Turn IG on and start monitor the AVCS advance timing value which is the item "VVT Adv. Ang. Amount" in the SSM. 4. Start engine and read out "VVT Adv. Ang. Amount" within 10 sec. (The value changes to "0" after 10 sec.) 5. Stop the engine.	Correct the chain timing. Go to step 12.	Go to step 4.
4	Replace the oil control valve with a brand new one. Is the car is fixed? 1) Replace the oil control valve with a brand new one. 2) Clear the memory by using SSM. 3) Perform the drive cycle (Refer to Chapter 5) 4) Read the "AVCS diagnostic value" by using SSM. Please refer to Chapter 6 to read out MODE$06.	Is the diagnostic value of applicable AVCS ≧ 1000? If the value is less than 1000, is the value definitely greater than the opposite side AVCS value (more than 1.5 times the opposite side value +100)? SEE **"APPENDIX A"** AT THE END OF CHAPTER 3 If the value is 0, the diagnosis process has not yet completed. Continue to perform a drive cycle without stopping the engine. * The diagnostic value is updated repeatedly, therefore, please watch it while having an assistant test drive the vehicle.	Go to step 5.	Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter. Go to step 12.
5	Check the harness.	Is there a poor contact among the oil control valve, cam angle sensor, crank angle sensor and ECU? - Is there any damage on the connector pin of oil control valve, cam angle sensor, crank angle sensor or ECU? - Are following resistances more than 1Ω? Between the oil control valve and the ECU. Between the cam angle sensor and the ECU. Between the crank angle sensor and the ECU. *Connector Numbers are found in Chapter 8.	Repair the problem. Go to step 6.	Go to step 7.

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6	Is the car is fixed? 1) Clear the memory by using SSM. 2) Perform the drive cycle. (Refer to Chapter 5) 3) Read the "AVCS diagnostic value" by using SSM. Please refer to Chapter 6 to read out MODE$06.	Is the diagnostic value of applicable AVCS ≧ 1000? If the value is less than 1000, is the value definitely greater than the opposite side AVCS value (more than 1.5 times the opposite side value +100)? SEE **"APPENDIX A"** AT THE END OF CHAPTER 3 If the value is 0, the diagnosis process has not yet completed. Continue to perform a drive cycle without stopping the engine. * The diagnostic value is updated repeatedly, therefore, please watch it while having an assistant test drive the vehicle.	Go to step 7.	Go to step 12.
7	Check engine oil pressure.	The engine oil pressure is lower than standard?	Go to step 8. Replace the chain cover with new one after the inspection is completed.	Go to step 8.
8	Check the oil passage in the chain cover.	Is there any abnormality of the O-ring for suction and discharge port of the oil pump? Is there any abnormality of the O-rings for oil passage to both sides of cylinder heads? Is there any damage or contamination with the oil control valve? Is there any contamination in the oil pump ports? **NOTE:** Do not disassemble the timing chain cover.	Repair the problem. Go to step 9. In case of contamination, replace the chain cover with new one after the inspection is completed.	Go to step 9.
9	Check the camshaft condition.	Remove the timing chain and rotate camshafts. Compare the rotating friction of all 4 camshafts. Is there particular friction in the camshaft which had DTC? Is there any scratch or damage on the surface of the cam journal? Is any additional resistance felt? Compare the intake camshaft with the exhaust camshaft Is there any scratch or damage on the surface of the cam journal?	Replace cam carrier and camshaft with new one. Go to step 10.	Go to step 10.

Continued...

10	Check the oil line between the oil pump and the cam sprocket. Replace the oil filter on the cam carrier. (Don't reuse)	Refer to the applicable section of Service Manual to remove cam carrier. Is there any contamination or clog visually in the cam carrier or cylinder head oil line? Is there any contamination or clog visually in the oil line between the sprocket and the camshaft? Remove the sprocket from the camshaft. Is there any contamination or clog visually in the sprocket oil line? Is there any contamination or clog visually in the camshaft oil line?	In case a problem, repair the wrong part and replace cam sprocket with new one. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. *Please do not push in oil filter excessively. The upper end of the oil filter should be flush with the cam carrier. Go to step 11.	*Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. *Please do not push in oil filter excessively. The upper end of the oil filter should be flush with the cam carrier. Go to step 11.
11	Check the oil strainer.	Is there any debris or contamination in the oil strainer on the oil pan?	In case of a problem, remove the debris and clean it. Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. Go to step 12.	Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the filter. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. Go to step 12.
12	Check the learning value. 1) Clear the memory by using SSM. 2) Turn IG on. 3) Read the "VVT Initial Position Learning Value" by using SSM "Work Support". (Refer to 4.2 in Chapter 4)	Is the following value out of normal range? "VVT Initial Position Learning Value" + "VVT Adv. Ang. Amount" *"VVT Adv. Ang. Amount" is read out in the step 3 of this troubleshooting. *Refer to Chapter 7 which shows a normal range of the learning value.	Replace the ECU with a new one. Drive the test driving cycle. END	END

(2)-4. P0016 for No Learning Value

	Troubleshooting for P0016, 17, 18 or 19 - No.4 No learning data: Models for SSM No showing "VVT Initial Position Learning Value" Displayed "VVT Adv. Ang. Amount" at the standard angle is "0 deg.".		IMPREZA: 12MY and 13MY XV: 13MY FORESTER 2.5L NA: 11MY, 12MY and 13MY	
	Step	**Check**	**YES**	**NO**
1	Check the DTC	Is there any DTC other than P0016, 17, 18 or 19?	Go to the concerned DTC troubleshooting.	Save the FFD. Go to step 2.
2	Check the engine oil condition.	Does the oil level gauge show out of range? Is the oil excessively dirty? Is the oil clotted due to use of additives? Is undesignated viscosity oil used?	Correct the oil level. Replace the engine oil and oil filter. Go to step 3.	Go to step 3.
3	Check the chain timing. 1) Clear the memory by using SSM. 2) Disconnect the oil control valve connector. DTC comes on but there is no problem for this check process. 3) Start the engine and check the "VVT Adv. Ang. Amount" at idle within 10 sec. from starting the engine by using SSM. (Refer to 4.1 in Chapter 4)	Does "VVT Adv. Ang. Amount" have more than ± 10 deg. difference from the reference value (0 deg.)? - Connect the connector after the check. - Record the "VVT Adv. Ang. Amount" because the step below uses the value. *Detailed process 1. Clear the memory by using SSM. 2. Disconnect the applicable AVCS connector which had the DTC. 3. Turn IG on and start monitor the AVCS advance timing value which is the item "VVT Adv. Ang. Amount" in the SSM. 4. Start engine and read out "VVT Adv. Ang. Amount" within 10 sec. (The value changes to "0" after 10 sec.) 5. Stop the engine.	Correct the chain timing. Go to step 12.	Go to step 4.
4	Replace the oil control valve with a brand new one. Is the car is fixed? 1) Replace the oil control valve with a brand new one. 2) Clear the memory by using SSM. 3) Perform the drive cycle. (Refer to Chapter 5) 4) Read the "AVCS diagnostic value" by using SSM. Please refer to Chapter 6 to read out MODE$06.	Is the diagnostic value of applicable AVCS ≧ 1000? If the value is less than 1000, is the value definitely greater than the opposite side AVCS value (more than 1.5 times the opposite side value +100)? SEE **"APPENDIX A"** AT THE END OF CHAPTER 3 If the value is 0, the diagnosis process has not yet completed. Continue to perform a drive cycle without stopping the engine. * The diagnostic value is updated repeatedly, therefore, please watch it while having an assistant test drive the vehicle.	Go to step 5.	Change the engine oil. Idle the engine for 5minutes. Change the engine oil and the oil filter. Go to step 12.

Continued...

5	Check the harness.	Is there a poor contact among the oil control valve, cam angle sensor, crank angle sensor and ECU? - Is there any damage on the connector pin of oil control valve, cam angle sensor, crank angle sensor or ECU? - Are following resistances more than 1Ω? Between the oil control valve and the ECU. Between the cam angle sensor and the ECU. Between the crank angle sensor and the ECU. *Connector Numbers are found in Chapter 8.	Repair the problem. Go to step 6.	Go to step 7.
6	Is the car is fixed? 1) Clear the memory by using SSM. 2) Perform the drive cycle. (Refer to Chapter 5) 3) Read the "AVCS diagnostic value" by using SSM. Please refer to Chapter 6 to read out MODE$06.	Is the diagnostic value of applicable AVCS ≧ 1000? If the value is less than 1000, is the value definitely greater than the opposite side AVCS value (more than 1.5 times the opposite side value +100)? SEE **"APPENDIX A"** AT THE END OF CHAPTER 3 If the value is 0, the diagnosis process has not yet completed. Continue to perform a drive cycle without stopping the engine. * The diagnostic value is updated repeatedly, therefore, please watch it while having an assistant test drive the vehicle.	Go to step 7.	Go to step 12.
7	Check engine oil pressure.	Is the engine oil pressure lower than specification?	Go to step 8. Replace the chain cover with new one after the inspection is completed.	Go to step 8.
8	Check the oil passage in the chain cover.	Is there any abnormality of the O-ring for suction port and discharge port of the oil pump? Is there any abnormality of the O-rings for oil passage to both sides of cylinder heads? Is there any damage or contamination with the oil control valve? Is there any contamination in the oil pump ports? **NOTE:** Do not disassemble the timing chain cover.	Repair the problem. Go to step 9. In case of contamination, replace the chain cover with new one after the inspection is completed.	Go to step 9.
9	Check the camshaft condition.	Remove the timing chain and rotate camshafts. Compare the rotating friction of all 4 camshafts. Is there particular friction in the camshaft which had DTC? Is there any scratch or damage on the surface of the cam journal? Is any additional resistance felt? Compare the intake camshaft with the exhaust camshaft. Is there any scratch or damage on the surface of the cam journal?	Replace Cam carrier and camshaft with new one. Go to step 10.	Go to step 10.

Continued...

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10	Check the oil line between the oil pump and the cam sprocket. Replace the oil filter on the cam carrier. (Don't reuse)	Refer to the applicable section of Service Manual to remove cam carrier. Is there any contamination or clog visually in the cam carrier or cylinder head oil line? Is there any contamination or clog visually in the oil line between the sprocket and the camshaft? Remove the sprocket from the camshaft. Is there any contamination or clog visually in the sprocket oil line? Is there any contamination or clog visually in the camshaft oil line?	In case of a problem, repair the wrong part and replace cam sprocket with new one. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of service manual and apply correct type of THREE BOND with proper quantity. *Please do not push in oil filter excessively. The upper end of the oil filter should be flush with the cam carrier. Go to step 11.	*Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. *Please do not push in oil filter excessively. The upper end of the oil filter should be flush with the cam carrier. Go to step 11.
11	Check the oil strainer.	Is there any debris or contamination in the oil strainer on the oil pan?	In case of a problem, remove the debris and clean it. Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. Go to step 12.	Change the engine oil. Idle the engine for 5 minutes. Change the engine oil and the oil filter. *Don't apply too much THREE BOND when reassembling. Refer to the applicable section of Service Manual and apply correct type of THREE BOND with proper quantity. Go to step 12.
12	Is the car is fixed? 1) Clear the memory by using SSM. 2) Perform the drive cycle. (Refer to Chapter 5)	Same DTC reset again?	Replace the ECU with new one. Drive the test driving cycle. END	END

Continued...

APPENDIX "A"

During diagnosis of these AVCS-related DTCs, step 3 (or step 4) begins with the Check question: "Is the diagnostic value of applicable AVCS greater than or equal (≥) to 1000?" The next question is: "If the value is less than 1000, is the value definitely greater than the other AVCS values? What defines "*definitely greater*"? What judgement criteria should be used to determine if the value displayed is OK or NG? The following will help make this step easier to understand and eliminate confusion about this step of the diagnosis.

Use the formula below to determine whether the AVCS value measured is OK (X < Z) or NG (X > Z) by comparing the suspect bank value (X) to the solution value (Z).

Formula: (Y) x 1.5 + 100 = Z

- Y= comparison bank
- Z= solution

For this example, we will use the Troubleshooting Chart for P000A / P0011 with the trouble suspected to be on the Bank 1 (P000A) side of the engine.

The following (example) values will be assigned:

- Observed (suspect) Bank 1 SSM (MODE$06) Value = 900 and we will call that (X).
- Observed (comparison) Bank 2 SSM (MODE$06) Value = 300 and we will call that (Y).

Example calculation #1: X = 900 and Y = 300 (a *large* difference between B1 and B2 values)

Calculation: (Y) 300 x 1.5 + 100 = 550 (Z). Since (X) 900 is greater than (Z) 550, the result in this example is "**NG**". Therefore, in this example where the value (X) is definitely greater, the Technician should proceed to the next step on the Troubleshooting chart.

For this example, we will use the Troubleshooting Chart for P000C / P0021 with the trouble suspected to be on the Bank 2 (P000C) side of the engine.

The following (example) values will be assigned:

- Observed (suspect) Bank 2 SSM (MODE$06) Value = 900 and we will call that (X).
- Observed (comparison) Bank 1 SSM (MODE$06) Value = 800 and we will call that (Y).

Example calculation #2: X = 900 and Y = 800 (a *small* difference between B1 and B2 values):

Calculation: (Y) 800 x 1.5 + 100 = 1300 (Z). Since (X) 900 is less than (Z) 1300, the result in this example is "**OK**". Therefore, in this example where the value (X) is not definitely greater, the Technician should proceed with the work described in the "NO" column of the Troubleshooting chart for this test (change oil, idle engine for 5 minutes, change oil again and the oil filter).

CHAPTER 4: Reading SSM Data:

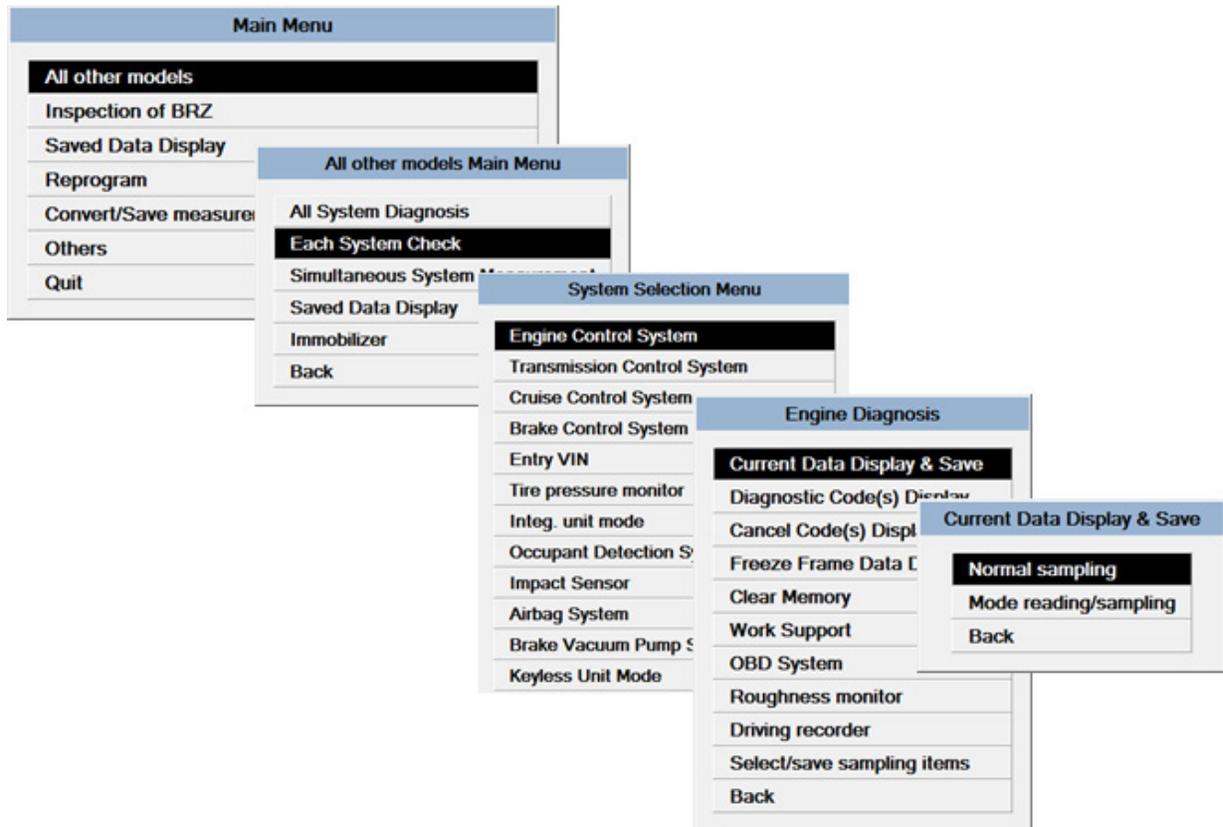**4.1- SSM Data Monitor for "VVT Adv. Ang. Amount" or "VVT Initial Position Learning Value".**
"VVT Adv. Ang. Amount" for all models
"VVT Initial Position Learning Value" for all models except BRZ

(1). SSMIII
All other models →Each System Check → Engine Control System → Current Data Display & Save → Normal sampling

Continued...

Main Menu

- All other models
- Inspection of BRZ
- Saved Data Display
- Reprogram
- Convert/Save measure
- Others
- Quit

All other models Main Menu

- All System Diagnosis
- Each System Check
- Simultaneous System Measurement
- Saved Data Display
- Immobilizer
- Back

System Selection Menu

- Engine Control System
- Transmission Control System
- Cruise Control System
- Brake Control System
- Entry VIN
- Tire pressure monitor
- Integ. unit mode
- Occupant Detection S
- Impact Sensor
- Airbag System
- Brake Vacuum Pump S
- Keyless Unit Mode

Engine Diagnosis

- Current Data Display & Save
- Diagnostic Code(s) Display
- Cancel Code(s) Displ
- Freeze Frame Data D
- Clear Memory
- Work Support
- OBD System
- Roughness monitor
- Driving recorder
- Select/save sampling items
- Back

Current Data Display & Save

- Normal sampling
- Mode reading/sampling
- Back

"VVT Adv. Ang. Amount" (L&R)

Item	Value	Unit	Maximum	Minimum	Average
☐ RESUME/ACCEL Switch	OFF		-	-	-
☐ Main Switch	OFF		-	-	-
☐ distance change SW	OFF		-	-	-
☐ CC Cancel SW	OFF		-	-	-
☐ All Cylinders Fuel cut	OFF		-	-	-
☐ Oil level switch	HIGH level		-	-	-
☐ ELCM switching valve	Open		-	-	-
☐ ELCM pump	OFF		-	-	-
☐ TGV Output	OFF		-	-	-
☐ TGV Drive	Close		-	-	-
☐ Radiator Fan Relay #1	OFF		-	-	-
☐ Radiator Fan Relay #2	OFF		-	-	-
☐ Rear O2 Rich Signal	Lean		-	-	-
☑ Coolant Temp.	94	°C	94	93	93
☑ VVT Adv. Ang. Amount R	0	deg	0	0	0
☑ VVT Adv. Ang. Amount L	0	deg	0	0	0
☑ VVT Initial Position Learning Value #1	28.9	°CA	28.9	28.7	28.8
☑ VVT Initial Position Learning Value #2	27.9	°CA	28.0	27.8	27.9
☐ Fuel level resistance	39.0	ohm	39.5	39.0	39.0
☐ ALT Duty	35	%	36	35	35
☐ Alternator control mode	---		-	-	-
☐ Mass Air Flow	2.5	g/s	2.8	2.5	2.6
☐ Throttle Opening Angle	13	%	13	13	13
☐ Ignition timing adv. #1	4.5	°	6.5	2.5	4.0
☐ Short term fuel trim B1	0.8	%	1.6	0.8	0.8
☐ Long term fuel trim B1	-5.5	%	-5.5	-6.3	-6.3
☐ Mani. Absolute Pressure	33	kPa	34	32	32

Continued...

"VVT Initial Position Learning Value" (#1 & #2)

Item	Value	Unit	Maximum	Minimum	Average
☐ RESUME/ACCEL Switch	OFF		-	-	-
☐ Main Switch	OFF		-	-	-
☐ distance change SW	OFF		-	-	-
☐ CC Cancel SW	OFF		-	-	-
☐ All Cylinders Fuel cut	OFF		-	-	-
☐ Oil level switch	HIGH level		-	-	-
☐ ELCM switching valve	Open		-	-	-
☐ ELCM pump	OFF		-	-	-
☐ TGV Output	OFF		-	-	-
☐ TGV Drive	Close		-	-	-
☐ Radiator Fan Relay #1	OFF		-	-	-
☐ Radiator Fan Relay #2	OFF		-	-	-
☐ Rear O2 Rich Signal	Lean		-	-	-
☑ Coolant Temp.	94	°C	94	93	93
☑ VVT Adv. Ang. Amount R	0	deg	0	0	0
☑ VVT Adv. Ang. Amount L	0	deg	0	0	0
☑ VVT Initial Position Learning Value #1	28.8	°CA	28.9	28.7	28.8
☑ VVT Initial Position Learning Value #2	27.9	°CA	28.0	27.8	27.9
☐ Fuel level resistance	39.0	ohm	39.5	39.0	39.0
☐ ALT Duty	36	%	36	35	35
☐ Alternator control mode	---		-	-	-
☐ Mass Air Flow	2.6	g/s	2.8	2.5	2.6
☐ Throttle Opening Angle	13	%	13	13	13
☐ Ignition timing adv. #1	3.5	°	6.5	2.5	4.0
☐ Short term fuel trim B1	0.8	%	1.6	0.8	0.8
☐ Long term fuel trim B1	-5.5	%	-5.5	-6.3	-6.3
☐ Mani. Absolute Pressure	33	kPa	34	32	32

(2). SSM4:

Diagnosis → Each System → Engine
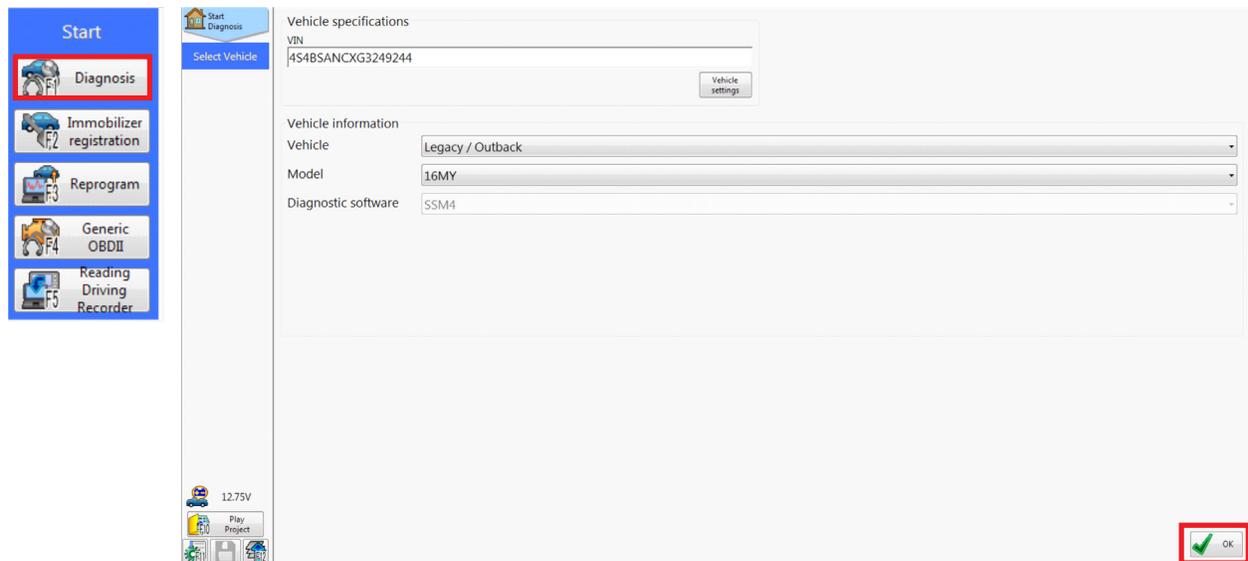
Continued...
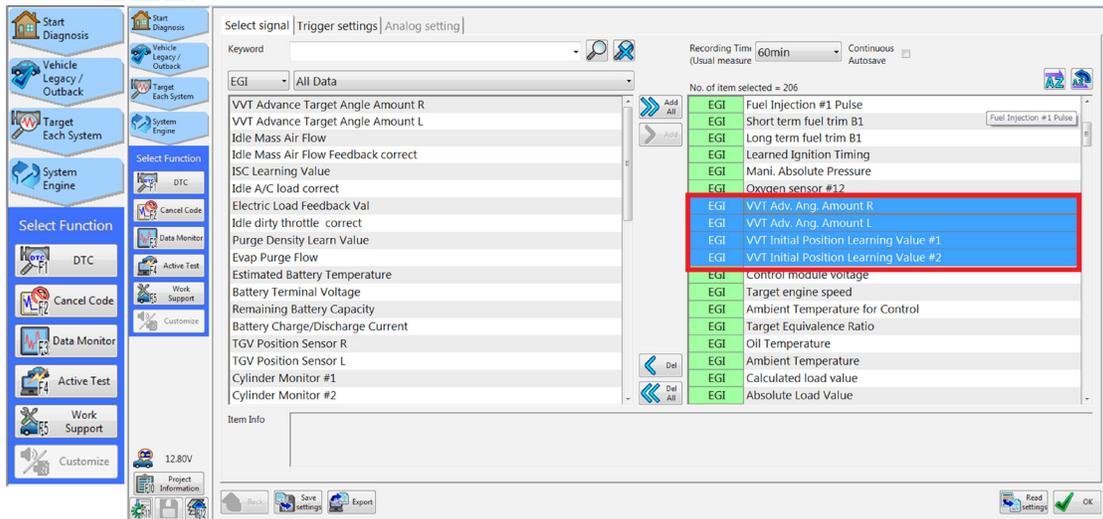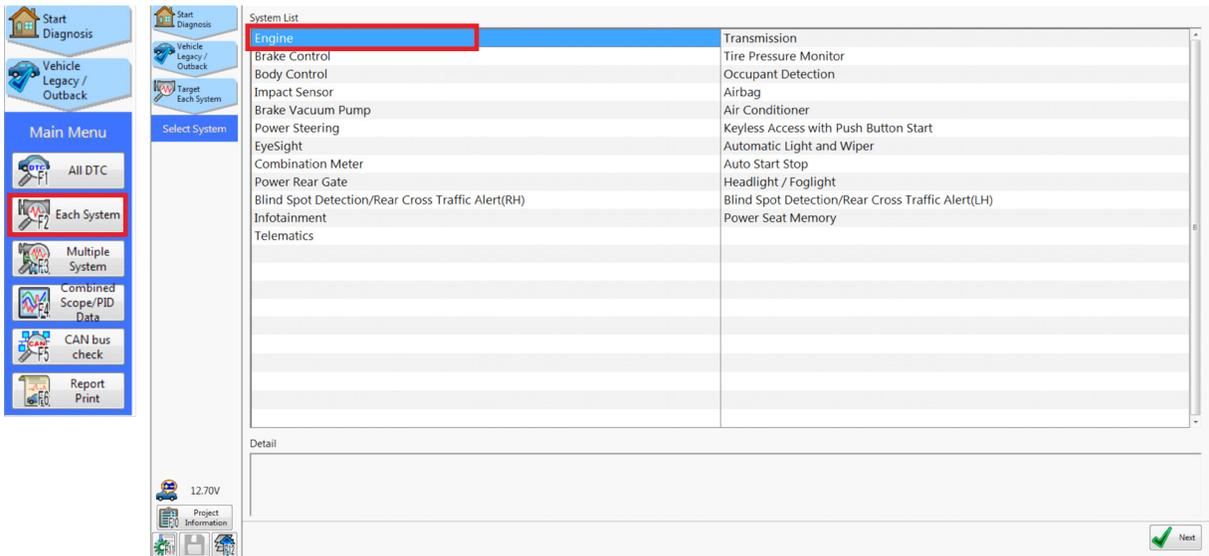
"VVT Adv. Ang. Amount" (R & L)

		Item	Value	Unit	Maximum	Minimum	Average
☐	EGI	ELCM switching valve	Open		-	-	-
☐	EGI	ELCM pump	OFF		-	-	-
☐	EGI	Absolute Evap Sys. Pressure	14.8	psig	14.8	14.8	14.8
☐	EGI	Engine Speed	708	rpm	723	692	709
☐	EGI	Mass Air Flow	0.35	lb/min	0.37	0.33	0.35
☐	EGI	Vehicle Speed	0	MPH	0	0	0
☐	EGI	Throttle Opening Angle	13	%	13	13	13
☐	EGI	Accel. Opening Angle	0.0	%	0.0	0.0	0.0
☐	EGI	A/F Sensor #1	0.99		1.01	0.98	0.99
☐	EGI	Ignition timing adv. #1	4.5	°	6.0	3.5	4.5
☐	EGI	Coolant Temp.	219	°F	219	219	219
☐	EGI	Fuel Injection #1 Pulse	2.56	ms	2.56	2.56	2.56
☐	EGI	Short term fuel trim B1	0.0	%	0.0	0.0	0.0
☐	EGI	Long term fuel trim B1	-5.5	%	-5.5	-5.5	-5.5
☐	EGI	Learned Ignition Timing	0.0	deg	0.0	0.0	0.0
☐	EGI	Mani. Absolute Pressure	4.6	psig	4.8	4.6	4.7
☐	EGI	Oxygen sensor #12	0.155	V	0.155	0.150	0.155
☐	EGI	VVT Adv. Ang. Amount R	0	deg	0	0	0
☐	EGI	VVT Adv. Ang. Amount L	0	deg	0	0	0
☐	EGI	VVT Initial Position Learning Value #1	28.9	°CA	28.9	28.9	28.9
☐	EGI	VVT Initial Position Learning Value #2	27.9	°CA	27.9	27.9	27.9
☐	EGI	Control module voltage	12.803	V	12.837	12.534	12.725
☐	EGI	Target engine speed	700	rpm	700	700	700
☐	EGI	Ambient Temperature for Control	91.4	°F	91.4	91.4	91.4

Continued...

"VVT Initial Position Learning Value" (#1 & #2)

		Item	Value	Unit	Maximum	Minimum	Average
	EGI	ELCM switching valve	Open		-	-	-
	EGI	ELCM pump	OFF		-	-	-
	EGI	Absolute Evap Sys. Pressure	14.8	psig	14.8	14.8	14.8
	EGI	Engine Speed	687	rpm	1812	604	898
	EGI	Mass Air Flow	0.33	lb/min	2.61	0.32	0.73
	EGI	Vehicle Speed	0	MPH	0	0	0
	EGI	Throttle Opening Angle	13	%	22	13	15
	EGI	Accel. Opening Angle	0.0	%	15.7	0.0	2.6
	EGI	A/F Sensor #1	1.00		1.10	0.92	1.00
	EGI	Ignition timing adv. #1	4.0	°	14.5	-1.0	6.3
	EGI	Coolant Temp.	217	°F	219	208	214
	EGI	Fuel Injection #1 Pulse	2.56	ms	6.14	2.30	3.20
	EGI	Short term fuel trim B1	-0.8	%	7.0	-9.4	-0.1
	EGI	Long term fuel trim B1	-4.7	%	0.8	-5.5	-4.1
	EGI	Learned Ignition Timing	0.0	deg	1.0	0.0	0.1
	EGI	Mani. Absolute Pressure	4.8	psig	10.4	4.5	5.8
	EGI	Oxygen sensor #12	0.565	V	0.685	0.150	0.369
	EGI	VVT Adv. Ang. Amount R	0	deg	24	-1	2
	EGI	VVT Adv. Ang. Amount L	0	deg	20	0	2
	EGI	VVT Initial Position Learning Value #1	28.9	°CA	28.9	28.8	28.9
	EGI	VVT Initial Position Learning Value #2	27.9	°CA	27.9	27.9	27.9
	EGI	Control module voltage	12.764	V	12.930	12.534	12.755
	EGI	Target engine speed	675	rpm	700	625	669
	EGI	Ambient Temperature for Control	91.4	°F	91.4	91.4	91.4

4.2- SSM Work Support Reading "VVT Initial Position Learning Value" for BRZ

(1). SSMIII

Inspection of BRZ → Each System Check → Engine Control System → Work Support → → VVT Initial Position Learning Value Display
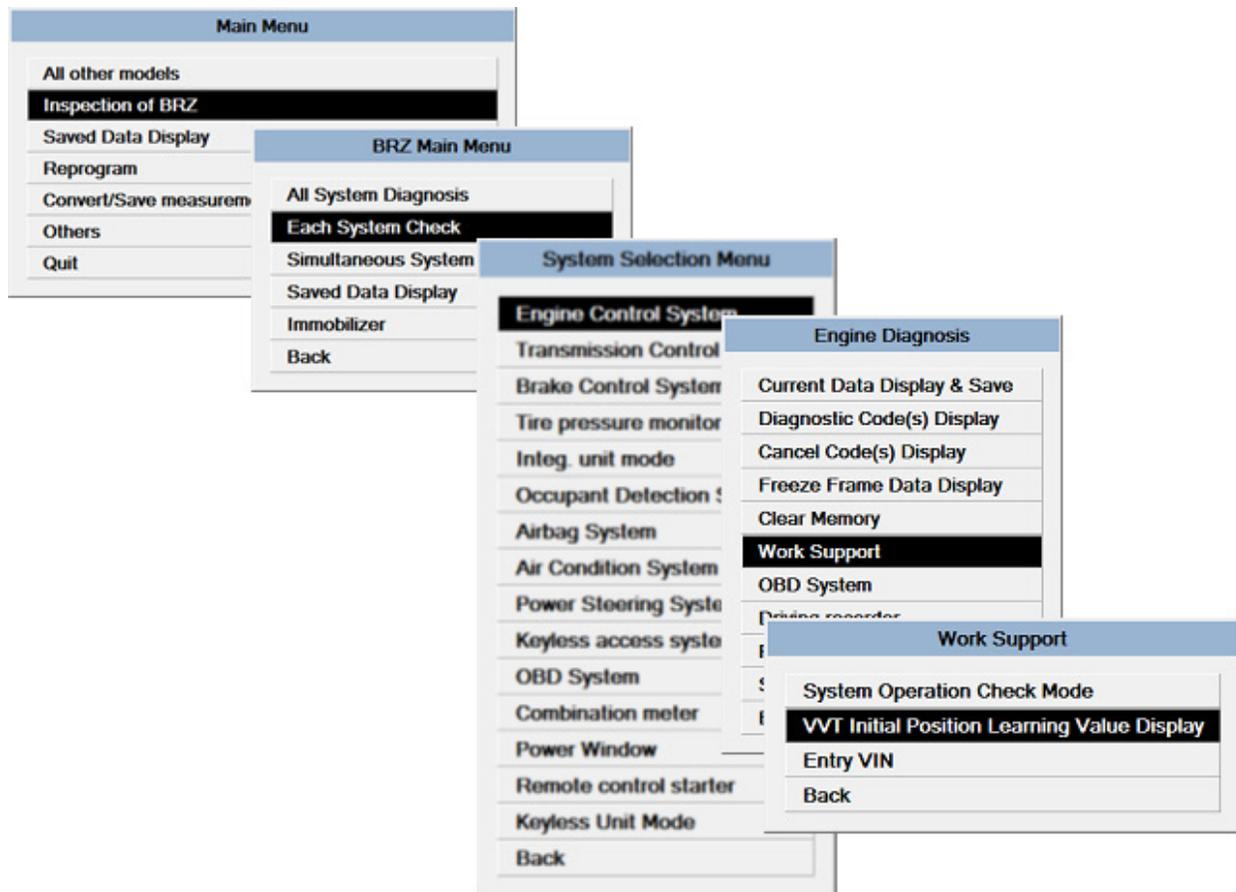
VVT Initial Position Learning Value Display for BRZ on SSM III

Item	Value	Unit	Maximum	Minimum	Average
☐ VVT Initial Position Learning Val...	59.83	°FR	59.83	59.83	59.83
☐ VVT Initial Position Learning Val...	58.12	°FR	58.12	58.12	58.12
☐ VVT Ex Initial Position Learning ...	88.46	°FR	88.46	88.46	88.46
☐ VVT Ex Initial Position Learning ...	87.45	°FR	87.45	87.45	87.45

(2). SSM4

Diagnosis → Each System → Engine → Work Support → VVT Initial Position Learning Value Display
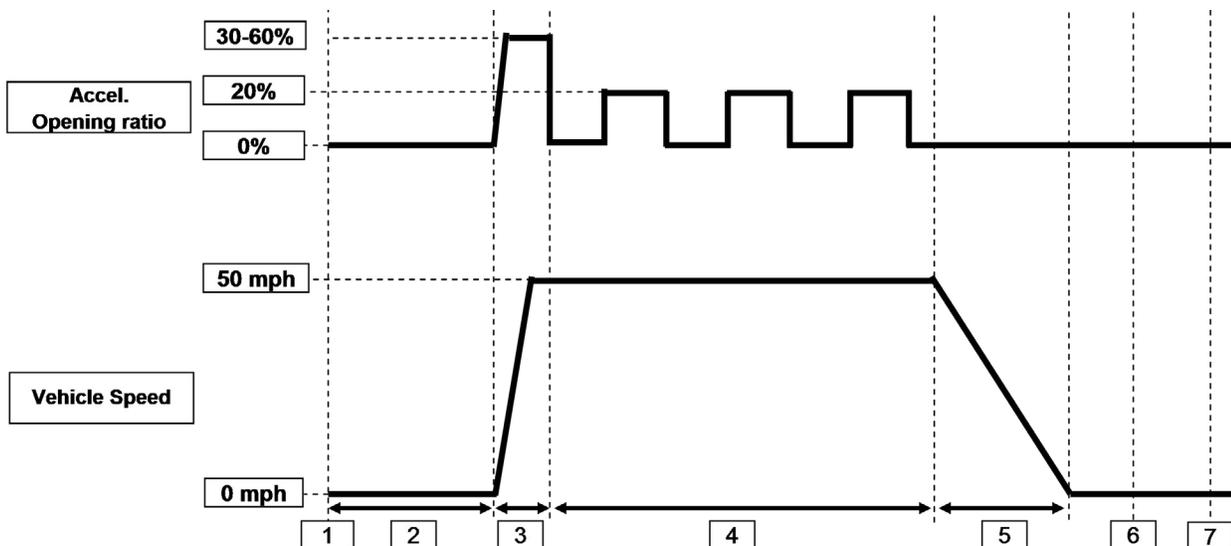
VVT Initial Position Learning Value for BRZ Using SSM4
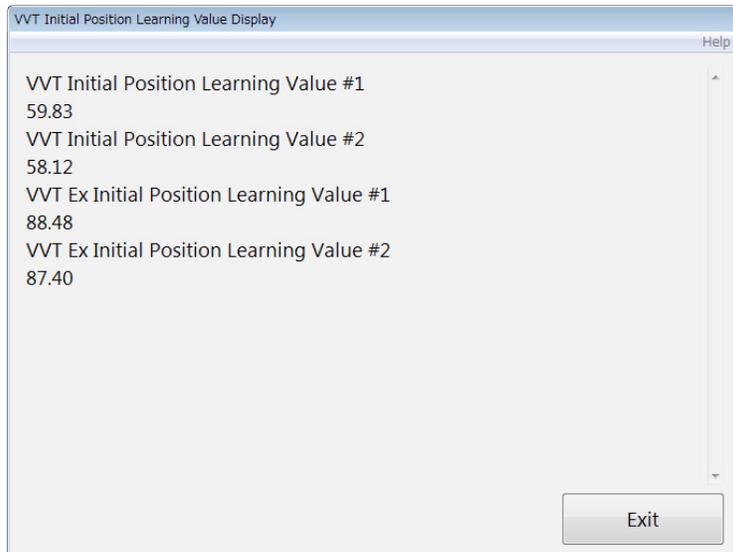
CHAPTER 5: Drive Cycle for Duplication Test:

(1). Clear the memory by using the SSM

(2). Start the engine in a warmed up condition (coolant temp. should be more than 160 deg.F.).

(3). Idling the engine for 3 min. or more.

(4). Accelerate to 50 mph.

(5). Keep the acceleration pedal at 0% for 5 sec. then move to 20% and hold for 5 seconds.
   Repeat this mode for 20 minutes or more. The vehicle speed should be kept around 50mph while in this mode.
   (The diagnosis process is completed repeatedly during this step. This step requires 2 people. One person should monitor the diagnostic value while another person is performing the driving cycle because the diagnostic value cannot be saved).

(6). Foot off accelerator pedal (0%) and decelerate for more than 5 seconds.
   (The learning process is completed during this part).

(7). Idle the engine and check the SSM data (Initial position learning value, diagnosis value).

(8). If the SSM shows the data is OK, turn the engine off to finish the procedure.

*Remarks:
⁺Acceleration level can be changed depending on the traffic situation.
⁺If no diagnosis data is memorized, perform driving cycle again without turning the engine off.

CHAPTER 6: OBD MODE $06 Monitor

Read out diagnosis value of OBD MODE&06 monitor:
Mode$06 stands for "Test result for continuously and non-continuously monitored system supported" and one of the OBD-II diagnosis modes. It shows diagnosis value "Val.", threshold, "Min.", "Max." and diagnosis test result: "Result".

"MID" stands for OBD Monitor ID and shows items being tested. MID $35 means Right bank [Bank 1] AVCS test and MID $36 means Left bank [Bank 2] AVCS test.

"TID" stands for The Test ID which shows specific test item being run. $8B and $8C are positive and negative side of the intake AVCS slow response. $8D and $8E are positive and negative side of the exhaust AVCS slow response.

While the test is not completed, the Result shows "-". If it is completed, "OK" or "NG" is displayed and the diagnostic test is repeated.
"Min" and "Max" is threshold of normal range. If the diagnosis value is greater than the threshold, then "NG" is displayed and MIL is turned on.

The inspection procedure in this bulletin uses the diagnosis value for judgment of the symptom duplication or completion of the repair because the trouble symptom is intermittent and sometimes hard to duplicate. Threshold value of the diagnosis value for the judgment is newly setup and smaller than the criteria of MIL ON. Therefore, it is possible to judge the trouble even though there is no MIL condition.

For example: the threshold is "4000" deg. in the table described in Chapter 7.3. The judgment criteria in the troubleshooting in Chapter 4 is "1000". That means if the diagnosis value "Val." is greater than 4000, then MIL turns on. However, if the "Val." is greater than 1000, it should be judged failure of the AVCS system. The case completely and constantly failure the "Val." should be greater than 4000, but in the case of intermittent or slightly failure case, it could be between 1000 and 4000. This strategy is able to catch such cases.

Continued...

6.1- SSM III

Each System Check → Engine Control System → OBD System → Result of on-board monitor test
The diagnosis results will be displayed.
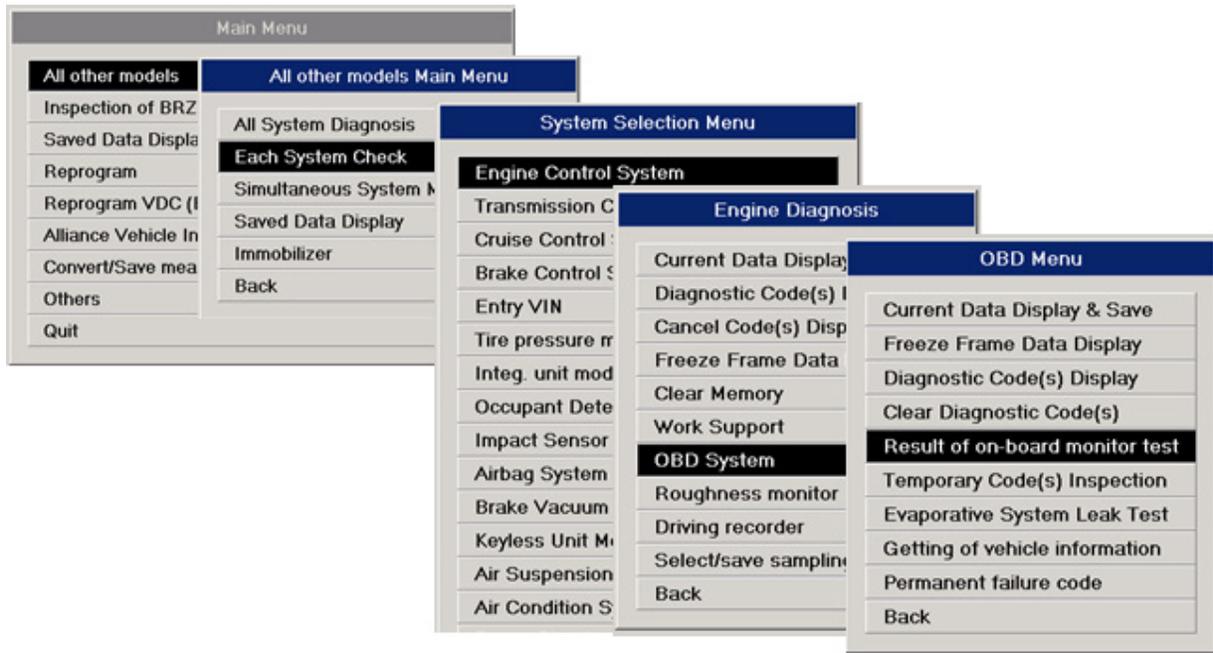
*For more details, see Chapter 6.3 below.

MID	TID	ScalingID	Val.	Min. [F8]	Max.	Result
$01	$84	$1E	0.0000000 l...	0.0000000 l...	0.0000000 l...	OK
$01	$85	$1E	0.0000000 l...	0.0000000 l...	0.0000000 l...	OK
$01	$91	$20	0.0000000	0.0000000	0.0000000	OK
$01	$92	$10	0.000 s	0.000 s	0.000 s	OK
$01	$A3	$20	0.0000000	0.0000000	0.0000000	OK
$01	$A4	$10	0.000 s	0.000 s	0.000 s	OK
$01	$AC	$10	0.000 s	0.000 s	0.000 s	OK
$01	$AD	$10	0.000 s	0.000 s	0.000 s	OK
$01	$AE	$10	0.000 s	0.000 s	0.000 s	OK
$01	$AF	$10	0.000 s	0.000 s	0.000 s	OK
$01	$CD	$20	0.0000000	0.0000000	0.0000000	OK
$01	$CF	$20	0.0000000	0.0000000	0.0000000	OK
$01	$DF	$10	0.000 s	0.000 s	0.000 s	OK
$02	$05	$10	0.000 s	0.000 s	0.000 s	OK
$02	$06	$10	0.448 s	0.000 s	4.000 s	OK
$02	$07	$0B	0.000 V	0.000 V	0.000 V	OK
$02	$08	$0B	0.000 V	0.000 V	0.000 V	OK
$02	$D1	$10	0.000 s	0.000 s	0.000 s	OK
$02	$D2	$10	4.576 s	0.000 s	5.504 s	OK
$21	$89	$3B	$0000	$0000	$0000	OK
$31	$8A	$17	36.28 kPa	0.00 kPa	655.35 kPa	OK
$35	$8B	$9D	148.5 °	0.0 °	4000.0 °	OK
$35	$8C	$9D	-187.0 °	-4000.0 °	0.0 °	OK
$35	$8D	$9D	157.0 °	0.0 °	4000.0 °	OK
$35	$8E	$9D	-185.5 °	-4000.0 °	0.0 °	OK
$35	$D3	$9D	-2.0 °	-100.0 °	100.0 °	OK
$35	$D5	$9D	0.0 °	-10.0 °	10.0 °	OK
$35	$D6	$9D	0.0 °	-10.0 °	10.0 °	OK

Continued...

6.2- SSM4

Generic OBDII → Each System → ECM-Engine Control → OBD Mode test result
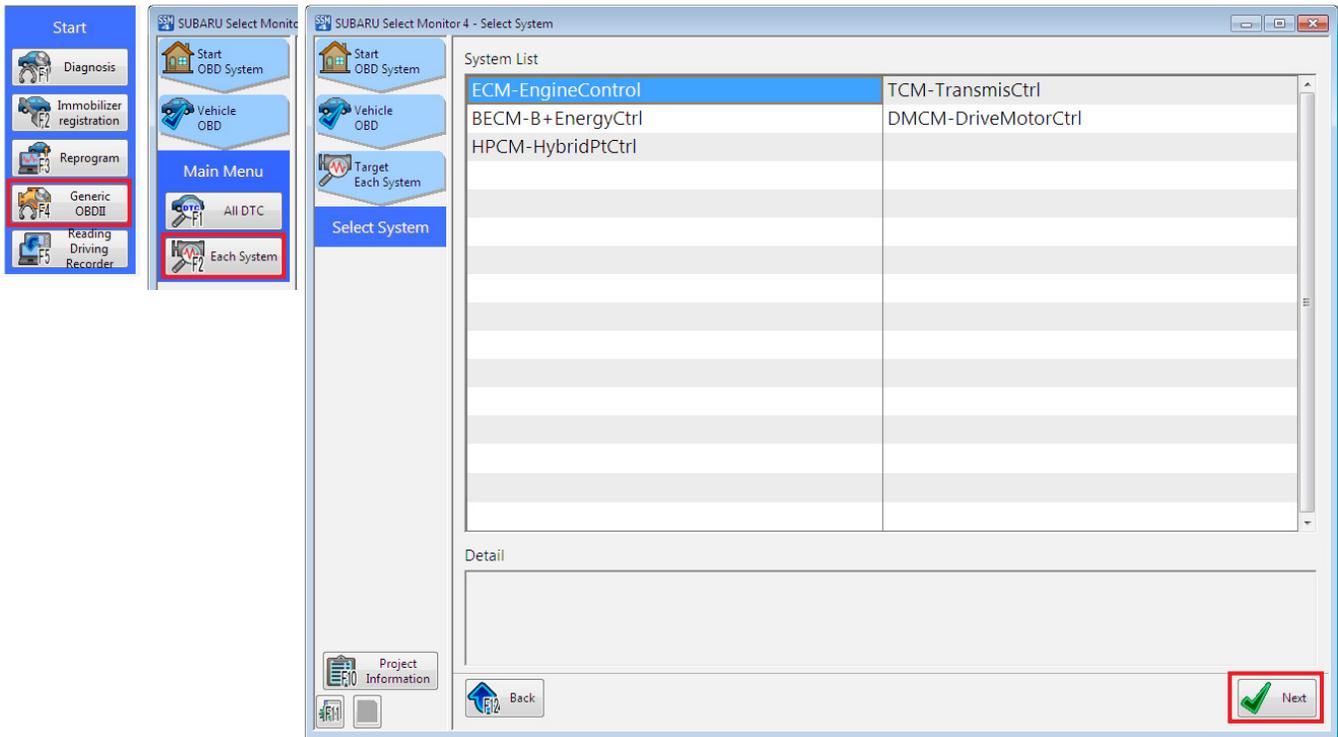
*For more details, see Chapter 6.3 below.

MID	TID	Scaling ID	Value	Unit	Minimum	Maximum	Result
$01	$AF	$10	0.001	s	0.000	0.200	OK
$01	$CD	$20	9.7968750		1.8242188	255.9960938	OK
$01	$CF	$20	0.0078125		0.0000000	0.0703125	OK
$02	$05	$10	0.064	s	0.000	0.480	OK
$02	$06	$10	0.352	s	0.000	4.000	OK
$02	$07	$0B	0.000	V	0.000	0.150	OK
$02	$08	$0B	0.817	V	0.550	65.535	OK
$02	$D1	$10	0.864	s	0.000	4.000	OK
$02	$D2	$01	98		0	3750	OK
$21	$89	$20	0.1484375		0.0000000	8.0000000	OK
$31	$8A	$17	4.17	psi	0.36	95.03	OK
$35	$8B	$9D	726.0	‹	0.0	4000.0	OK
$35	$8C	$9D	-788.5	‹	-4000.0	0.0	OK
$35	$D5	$9D	3.0	‹	-10.0	10.0	OK
$36	$8B	$9D	657.0	‹	0.0	4000.0	OK
$36	$8C	$9D	-671.5	‹	-4000.0	0.0	OK
$36	$D5	$9D	3.0	‹	-10.0	10.0	OK
$3C	$C1	$FE	-0.43	psi	-1.19	-0.03	OK
$3C	$C2	$FE	-0.44	psi	-0.62	1.19	OK
$3C	$C3	$FE	0.00	psi	-1.19	0.05	OK
$3C	$C4	$FE	-0.44	psi	-0.62	-0.18	OK
$3C	$C5	$FE	0.04	psi	0.03	1.19	OK
$3C	$C6	$35	134.27	s	27.52	655.35	OK
$3C	$C7	$FE	0.00	psi	-1.19	0.05	OK
$3C	$C8	$FE	-0.45	psi	-0.70	-0.17	OK
$3C	$C9	$FE	0.00	psi	-1.19	0.14	OK

Continued...

Check the diagnosis value "Val." as described the troubleshooting in the 4th chapter. If the value is greater than 1000 then it judges failure.

(1). 2.0L Turbo and 2.0 NA Models
  *Intake AND Exhaust AVCS-equipped models

			MID	TID	Scaling ID	Val.		Min.	Max.	Result
Right Bank Bank 1	INTAKE	+	$35	$8B	$9D	148.5°		0.0°	4000°	OK
		-	$35	$8C	$9D	-187.0°		-4000°	0.0°	OK
	EXHAUST	+	$35	$8D	$9D	157.0°		0.0°	4000°	OK
		-	$35	$8E	$9D	-185.5°		-4000°	0.0°	OK
Left Bank Bank 2	INTAKE	+	$36	$8B	$9D	162.0°		0.0°	4000°	OK
		-	$36	$8C	$9D	-154.0°		-4000°	0.0°	OK
	EXHAUST	+	$36	$8D	$9D	155.0°		0.0°	4000°	OK
		-	$36	$8E	$9D	-169.5°		-4000°	0.0°	OK

Diagnosis Value → Val. Normal Range (Threshold) → Min., Max.

*Diagnostic values listed here are just examples

(2). LEGACY / OUTBACK 2.5L NA, FORESTER 2.5L NA
  * Intake ONLY AVCS equipped models

			MID	TID	Scaling ID	Val.	Min.	Max.	Result
Right Bank Bank 1	INTAKE	+	$35	$8B	$9D	148.5°	0.0°	4000°	OK
		-	$35	$8C	$9D	-187.0°	-4000°	0.0°	OK
Left Bank Bank 2	INTAKE	+	$36	$8B	$9D	162.0°	0.0°	4000°	OK
		-	$36	$8C	$9D	-154.0°	-4000°	0.0°	OK

Diagnosis Value → Val. Normal Range (Threshold) → Min., Max.

*Diagnostic values listed here are just examples

CHAPTER 7: AVCS Initial Learning Value
   If the "VVT Initial Position Learning Value" is within the normal range, the chain timing is correct. The normal range is + and – 10deg from the Standard angle.

Model		Normal Range				Standard	
		INTAKE		EXHAUST		INTAKE	EXHAUST
		Min.	Max.	Min.	Max.		
LEGACY / OUTBACK	2.5L NA	21.5	41.5	-	-	31.5	-
FORESTER	2.5L NA	21.5	41.5	-	-	31.5	-
FORESTER	2.0L DIT	68.0	88.0	97.0	117.0	78.0	107.0
WRX	2.0L DIT	68.5	88.5	98.5	118.5	78.5	108.5
IMPREZA / XV	2.0L NA	50.5	70.5	79.5	99.5	60.5	89.5
BRZ	2.0L NA	52.0	72.0	78.0	98.0	62.0	88.0

Continued...

Model	MY		Description	ECU		Bulkhead connector			Sensor / Actuator	
				Connector	Pin	Connector		Pin	Connector	Pin
IMPREZA/ XV	EXC. HEV 12MY 13MY 14MY		Intake oil control solenoid (LH)	B134	17	B21	E2	32	E37	1
			Intake oil control solenoid (RH)	B134	34	B21	E2	21	E38	1
			Exhaust oil control solenoid (LH)	B134	5	B21	E2	42	E66	1
			Exhaust oil control solenoid (RH)	B134	7	B21	E2	7	E63	1
			Intake camshaft position sensor (LH)	B137	16	B21	E2	13	E35	2
			Intake camshaft position sensor (RH)	B137	24	B21	E2	2	E36	2
			Exhaust camshaft position sensor (LH)	B137	29	B21	E2	26	E65	2
			Exhaust camshaft position sensor (RH)	B137	23	B21	E2	15	E62	2
			Crankshaft position sensor	B137	17	B21	E2	3	E10	1
	EXC. HEV 15MY HEV 14MY 15MY		Intake oil control solenoid (LH)	B134	16	B21	E2	33	E37	2
			Intake oil control solenoid (RH)	B134	17	B21	E2	22	E38	2
			Exhaust oil control solenoid (LH)	B134	5	B21	E2	43	E66	2
			Exhaust oil control solenoid (RH)	B134	7	B21	E2	17	E63	2
			Intake camshaft position sensor (LH)	B136	15	B21	E2	13	E35	2
			Intake camshaft position sensor (RH)	B136	26	B21	E2	2	E35	2
			Exhaust camshaft position sensor (LH)	B136	25	B21	E2	26	E65	2
			Exhaust camshaft position sensor (RH)	B136	14	B21	E2	15	E62	2
			Crankshaft position sensor	B136	16	B21	E2	3	E10	1
LEGACY/ OUTBACK	2.5L	13MY 14MY	Crankshaft position sensor	B136	16	B21	E2	3	E10	1
			Intake oil control solenoid (LH)	B134	16	B21	E2	33	E37	2
			Intake oil control solenoid (RH)	B134	17	B21	E2	22	E38	2
			Intake camshaft position sensor (LH)	B136	15	B21	E2	13	E35	2
			Intake camshaft position sensor (RH)	B136	26	B21	E2	2	E36	2
		15MY 16MY	Crankshaft position sensor	E158	40	-	-	-	E10	1
			Intake camshaft position sensor RH	E158	54	-	-	-	E36	2
			Intake camshaft position sensor LH	E158	41	-	-	-	E35	2
			Intake oil control solenoid RH	E158	20	-	-	-	E38	2
			Intake oil control solenoid LH	E158	6	-	-	-	E37	2
FORESTER	2.5L	11MY 12MY 13MY	Crankshaft position sensor	B137	17	B21	E2	3	E10	1
			Intake oil control solenoid (LH)	B134	17	B21	E2	32	E37	1
			Intake oil control solenoid (RH)	B134	34	B21	E2	21	E38	1
			Intake camshaft position sensor (LH)	B137	16	B21	E2	13	E35	2
			Intake camshaft position sensor (RH)	B137	24	B21	E2	2	E36	2
		14MY 15MY 16MY	Crankshaft position sensor	B136	16	-	-	-	E10	1
			Intake oil control solenoid (LH)	B134	16	-	-	-	E37	2
			Intake oil control solenoid (RH)	B134	17	-	-	-	E38	2
			Intake camshaft position sensor (LH)	B136	15	-	-	-	E35	2
			Intake camshaft position sensor (RH)	B136	26	-	-	-	E36	2
	2.0L DIT	14MY 15MY 16MY	Crankshaft position sensor	E158	19	-	-	-	E10	2
			Intake camshaft position sensor (LH)	E158	21	-	-	-	E35	2
			Intake camshaft position sensor (RH)	E158	20	-	-	-	E36	2
			Exhaust camshaft position sensor (LH)	E158	33	-	-	-	E65	2
			Exhaust camshaft position sensor (RH)	E158	32	-	-	-	E62	2
			Intake oil control solenoid (LH)	E159	15	-	-	-	E37	2
			Intake oil control solenoid (RH)	E159	7	-	-	-	E38	2
			Exhaust oil control solenoid (LH)	E159	31	-	-	-	E66	2
			Exhaust oil control solenoid (RH)	E159	23	-	-	-	E63	2

Continued...

Model	MY	Description	ECU		Bulkhead connector			Sensor / Actuator	
			Connector	Pin	Connector		Pin	Connector	Pin
WRX 2.0L DIT	15MY 16MY	Crankshaft position sensor	E158	19	-	-	-	E10	2
		Intake camshaft position sensor (LH)	E158	21	-	-	-	E35	2
		Intake camshaft position sensor (RH)	E158	20	-	-	-	E36	2
		Exhaust camshaft position sensor (LH)	E158	33	-	-	-	E65	2
		Exhaust camshaft position sensor (RH)	E158	32	-	-	-	E62	2
		Intake oil control solenoid (LH)	E159	15	-	-	-	E37	2
		Intake oil control solenoid (RH)	E159	7	-	-	-	E38	2
		Exhaust oil control solenoid (LH)	E159	31	-	-	-	E66	2
		Exhaust oil control solenoid (RH)	E159	23	-	-	-	E63	2
BRZ 2.0L	13MY 14MY 15MY 16MY	Crankshaft position sensor	A34	16	-	-	-	C33	2
		Intake camshaft position sensor (LH)	A34	15	-	-	-	C26	2
		Intake camshaft position sensor (RH)	A34	26	-	-	-	C12	2
		Exhaust camshaft position sensor (LH)	A34	25	-	-	-	C25	2
		Exhaust camshaft position sensor (RH)	A34	14	-	-	-	C6	2
		Intake oil control solenoid (LH)	A36	16	-	-	-	C24	2
		Intake oil control solenoid (RH)	A36	17	-	-	-	C7	2
		Exhaust oil control solenoid (LH)	A36	5	-	-	-	C23	2
		Exhaust oil control solenoid (RH)	A36	7	-	-	-	C5	2

IMPORTANT REMINDERS:

- SOA strongly discourages the printing and/or local storage of service information as previously released information and electronic publications may be updated at any time.
- Always check for any open recalls or campaigns anytime a vehicle is in for servicing.
- Always refer to STIS for the latest service information before performing any repairs.