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Page : 1 of 80

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**Subject : Inspection Procedure for 1CD-FTV, 1KD-FTV and 2KD-FTV Engines**

This Service Bulletin corresponds to the problem of the common-rail diesel engine when no DTC is present. 3 inspection procedures for the following problems are described.

- Rough idling
- Excessive engine vibrations
- Engine knocking
- Engine rattling
- Lack of engine power
- Engine hesitation

Refer to the inspection procedures when these problems occur.

**Contents**

Inspection Procedures	See Page(s)
Rough Idling, Excessive Engine Vibrations	2
Engine Knocking, Engine Rattling	21
Lack of Engine Power, Engine Hesitation	41
APPENDIX	66

## ROUGH IDLING OR EXCESSIVE ENGINE VIBRATIONS

### HINT:

This troubleshooting procedure checks for rough idling and excessive engine vibrations.

### CIRCUIT DESCRIPTION

Malfunction Condition	Main Trouble Areas	Related Trouble Areas
<ul style="list-style-type: none"> <li>• Rough idling or juddering due to abnormal combustion</li> <li>• Juddering when vehicle starting due to clutch system malfunctions</li> </ul>	<p>(a) Injector malfunctions</p> <ul style="list-style-type: none"> <li>• Injector piston movement malfunction</li> <li>• Injector stuck closed</li> <li>• Injector stuck open</li> <li>• Deposit in injector</li> <li>• Malfunctions in injector circuit</li> </ul> <p>(b) Clutch system malfunctions</p> <ul style="list-style-type: none"> <li>• Clutch system (juddering when vehicle starting)</li> </ul>	<ul style="list-style-type: none"> <li>• Injector compensation code</li> <li>• Fuel leak</li> <li>• Engine mounting insulator</li> <li>• Intake air system leakage</li> <li>• Intake air system blockage</li> <li>• EGR system</li> <li>• Intake shutter system</li> <li>• Mass air flow meter</li> <li>• Supply pump</li> <li>• Pressure discharge valve</li> <li>• Fuel pressure sensor</li> <li>• EDU (If P0200 set simultaneously)</li> <li>• Low quality fuel</li> <li>• Vehicle modifications</li> <li>• ECM</li> </ul>

### HINT:

- Specified values in the following troubleshooting flowchart are for reference only. Variations in the Data List result values may occur depending on the measuring conditions or the vehicle's age. Do not judge the vehicle to be normal even when the Data List values indicate a standard level. There are possibly some concealed factors of the malfunction.
- Check that the vehicle has not been modified in any way prior to the vehicle inspection.

### INSPECTION PROCEDURE

#### HINT:

Before troubleshooting, conduct the following in accordance with the respective BASIC INSPECTIONS instructed each repair manual.

- (a) Check the fuel quality.
- (b) Check the fuel for air.
- (c) Check the fuel system for blockages.
- (d) Check the air filter.
- (e) Check the engine oil.
- (f) Check the engine coolant.
- (g) Check the engine idling speed and the maximum engine speed.
- (h) Check the vacuum pump.

**1 For M/T vehicle:  
Check malfunction condition.**

(a) Identify when rough idling or juddering occurs.

**Result:**

Driving Condition	Proceed To
When idling	A
When engaging engine clutch at vehicle start	B (Clutch system judders)

**B**

**Repair or replace clutch system.**

**A**

**2 Check wire harness and connector in engine room.**

(a) Check the wire harness and connector connections of common rail system components.

**HINT:**

Check the following components and system:

- Sensors
- Supply pump
- Common rail
- Injectors
- EDU
- Turbocharger system
- Intake and exhaust system

**OK: The wire harnesses and connectors are connected securely.**

**NG**

**Repair or replace.**

**OK**

**3 For w/ pressure discharge valve:  
Check DTCs output (relating to pressure discharge valve).**

**HINT:**

Conduct the inspection below to detect malfunctions in the pressure discharge valve. If any of the DTCs relating to the pressure discharge valve are set, problem areas can be identified.

- (a) Start the engine.
- (b) Stop the engine and wait for at least 10 seconds.
- (c) Perform steps (a) and (b) again described above (to allow the ECM to set pressure discharge valve malfunction DTCs).

**NEXT**

**4 Read output DTCs (relating to engine).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / DTC.
- (d) Read pending DTCs.

**Result:**

Display (DTC Output)	Proceed To
No DTCs	A
Engine related DTCs	B

**B**

**Repair or replace engine control system according to DTC output.**

**A**

**5 Check DTCs output (relating to fuel system and intake system).**

HINT:

Drive the vehicle according to the driving pattern below to allow the ECM to set DTCs relating to malfunctions of the fuel system, EGR system and intake shutter. If any of the DTCs are set, problem areas can be identified.

- (a) Select the following menu items: CHECK MODE
- (b) Fully warm up the engine.
- (c) Allow the engine to idle for 5 minutes or more (to set DTCs relating to rough idling).
- (d) Drive the vehicle at more than 40 km/h for 30 seconds or more.
- (e) Decelerate and stop the vehicle.

HINT:

Do not stop the engine.

- (f) Perform steps (d) and (e) 4 times or more.
- (g) Stop the engine and wait for at least 10 seconds.
- (h) Perform steps (d) and (g) again described above (to set DTCs relating to the EGR system and intake shutter).
- (i) Drive the vehicle at more than 70 km/h for at least 1 minute (to set DTCs relating to the supply pump).

**NEXT****6 Read output DTCs (relating to engine).**

- (a) Select the following menu items: Powertrain / Engine and ECT / DTC.
- (b) Read pending DTCs.

**Result:**

Display (DTC Output)	Proceed To
No DTCs	A
Engine related DTCs	B

**B****Repair or replace engine control system according to DTC output.****A**

**7 Perform active test using intelligent tester II (fuel leak test).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Start the engine and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Fuel leak test.
- (d) Visually check the supply pump, injector and fuel line located between the supply pump and common rail for fuel leaks. Also, perform the same check on the fuel line between the common rail and the injector.

**HINT:**

There may be fuel leaks inside the components, such as the supply pump.

**OK: No leakage.**

**NG****Repair or replace.****OK**

**8 Read value using intelligent tester II (MAF, PIM and common rail pressure).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Start the engine and warm it up and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (d) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - PIM
  - MAF
  - Common Rail Pressure

**HINT:**

Standard range of each item are listed on the APPENDIX: Standard Range Lists of PIM, MAF and Common Rail Pressure (on page 66). Check the results by referring to the appropriate list for the model.

**Standard:**

Item	Result	Proceed To
PIM	Standard range	A
	Both PIM and MAF outside standard range	B
	Only PIM outside standard range	C
MAF	Standard range	A
	Both PIM and MAF outside standard range	B
	Only MAF outside standard range	D
Common Rail Pressure	Standard range	A
	Common rail pressure outside standard range	E

**B**

**Go to step 13.**

**C**

**Go to DTC (related to manifold absolute sensor).**

**D**

**Go to DTC (related to mass air flow meter).**

**HINT:**

It is possible that sensor with stick foreign objects make some drivability problem.

**E**

**Go to step 26.**

**A**



**9 Read value of intelligent tester II (revised injection volume #1 to #4 and injection volume).**

- (a) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
- Revised Injection Volume #1, #2, #3 and #4
  - Injection Volume

**HINT:**

Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.

**Standard:**

Item	Result	Proceed To
Revised Injection Volume	Standard range	A
	Outside standard range	B
Injection Volume	Standard range	A
	Outside standard range	B

**B**

**Go to step 16.**

**A**

**10 For w/ injector compensation code type injector: Check injector compensation code. (Refer to appropriate inspection procedures of each repair manual.)**

**HINT:**

If the injector compensation code is not correctly registered, it may cause malfunctions.

**OK: The compensation codes of the installed injector and the ECM are the same.**

**NG**

**Register injector compensation code.**

**OK**

**11 Clear battery.**

- (a) Disconnect the negative battery terminal for at least 2 minutes.
- (b) Reconnect the negative battery terminal.
- (c) Check whether the malfunction has been successfully repaired by performing a driving test.

**OK: Malfunction has been repaired successfully.**

NG

**Go to step 12.**

OK

**Check for intermittent problems.**

**12 Check engine mounting insulator.**

- (a) Visually check that the engine mounting insulator is installed correctly and is not crooked or twisted.

**OK: No abnormalities.**

NG

**Repair or replace.**

OK

**13 Check intake and exhaust system.**

- (a) Check for air leakage and any blockages between the air cleaner and the turbocharger.
- (b) Check for air leakage and any blockages between the turbocharger and the intake manifold.

**OK: No air leakage or blockages.**

NG

**Repair or replace.**

OK

**14** Check EGR valve. (Refer to appropriate inspection procedures of each repair manual.)

**NG**

Repair or replace.

**OK**

**15** Check intake shutter. (Refer to appropriate inspection procedures of each repair manual.)

OK: No malfunction.

**NG**

Repair or replace intake shutter.

**OK**

Go to step 18.

<b>16</b>	<b>Identify malfunctioning cylinder injector.</b>
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**HINT:**

This operation is based on the premise that the common rail pressure is normal.

- (a) Follow the instructions in the table below according to the check result when using an intelligent tester II.

**HINT:**

Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.

**Result:**

Injection Volume	Less than standard range	Standard range	More than standard range
Revised Injection Volume #1 to #4			
3.0 mm <sup>3</sup> or more, -3.0 mm <sup>3</sup> or less	A	B	B
Between -3.0 mm <sup>3</sup> and 3.0 mm <sup>3</sup>	--	Normal	C*

Proceed To	Inspection Areas	Descriptions
A	Inspect and repair cylinder injector with revised injection volume of less than -3.0 mm <sup>3</sup> : <ul style="list-style-type: none"> <li>• Perform power balance inspection and identify malfunctioning cylinder. Replace the injector of malfunctioning cylinder</li> </ul>	Abnormal value cylinder injector injects excessively large quantity of fuel
B	Identify malfunctioning cylinders by conducting power balance test: <ul style="list-style-type: none"> <li>• Perform power balance inspection to identify malfunctioning cylinders</li> <li>• Clean malfunctioning cylinder injector, then check and repair it</li> </ul>	(a) If revised injection volume of more than 3.0 mm <sup>3</sup> Abnormal value cylinder injector injects excessively small quantity of fuel: <ul style="list-style-type: none"> <li>• Fuel injection volume too low due to injector nozzle being blocked by deposits</li> </ul> (b) If revised injection volume of less than -3.0 mm <sup>3</sup> Abnormal value cylinder injector injects excessively large quantity of fuel: <ul style="list-style-type: none"> <li>• Fuel injection volume too high due to injector nozzle being stuck open by deposits</li> </ul>
C	Inspect and repair all cylinder injectors: <ul style="list-style-type: none"> <li>• Clean all cylinder injectors, and then inspect and repair them</li> </ul>	All cylinder injectors inject excessively small quantity of fuel: <ul style="list-style-type: none"> <li>• Fuel injection volume too low due to all cylinder injector nozzles being blocked by deposits</li> </ul>

\*: When the Injection Volume displayed on the intelligent tester II is too large despite the Common Rail Pressure and Revised Injection Volume #1 to #4 in the Data List being normal, the injector may have a clogging malfunction. In this case, there may be deposits inside or outside the injector.

**HINT:**

- Despite the injector functioning normally, the indicated Revised Injection Volume #1 to #4 value may be outside the normal operating range due to compensation for other problems (such as low compression).
- Revised Injection Volume is the value used to correct the fuel injection volumes of each cylinder, in order to optimize (compensate for the unevenness between) all the cylinder combustion condition. If any of the cylinders malfunction, the fuel injection volumes for the normal cylinders are corrected simultaneously. As a result, the Revised Injection Volume may deviate from the standard range.

**B**

Go to step 18.

**C**

Go to step 23.

**A**

**17 Perform active test using intelligent tester II (injection cut for identifying malfunctioning cylinder).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Start the engine and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Injector cut #1, #2, #3 and #4.
- (d) Check the four cylinders in sequence to identify any faulty cylinders by performing the power-balance inspection.

HINT:

- While the engine is idling, if the idling stability variation is small despite cutting off the fuel injection, the cylinder is malfunctioning.
- With normal cylinders, the engine idles roughly when the fuel injection is cut off.

**NEXT**

**Replace injector of malfunctioning cylinder.**

**18 Perform active test using intelligent tester II (injection cut for identifying malfunctioning cylinder).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Start the engine and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Injector cut #1, #2, #3 and #4.
- (d) Check the four cylinders in sequence to identify any faulty cylinders by performing the power-balance inspection.

**HINT:**

- While the engine is idling, if the idling stability variation is small despite cutting off the fuel injection, the cylinder is malfunctioning.
- With normal cylinders, the engine idles roughly when the fuel injection is cut off.

**NEXT****19 Check cylinder compression pressure of malfunction cylinder. (Refer to appropriate inspection procedures of each repair manual.)****OK: The cylinder compression pressure is normal.****NG****Repair or replace.****OK**

**20 Check malfunctioning cylinder injector for deposit.****HINT:**

If an injector is contaminated with deposits, the fuel injection volume deviates from the standard range. This may cause malfunctions.

- (a) Check the injector for any deposits.

**Result:**

Injector Condition	Proceed To
Deposits	A
No deposits	B

**B****Replace injector of malfunction cylinder.****A****21 Clean injector.**

- (a) Wipe away deposits from the tips of the injectors.

**HINT:**

- Solvent or carbon removal agent help remove the deposits easily.
- Exercise extreme care not to damage the injectors while wiping off the deposits.

**NEXT**



<b>22</b>	<b>Read value using intelligent tester II (revised injection volume #1 to #4 and injection volume).</b>
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- (a) Reinstall the injector to cylinder head.
- (b) Connect the intelligent tester II to the DLC3.
- (c) Turn the ignition switch to ON and turn the intelligent tester II ON.
- (d) Start the engine and warm it up.
- (e) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (f) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - Revised Injection Volume #1, #2, #3 and #4
  - Injection Volume

**HINT:**

- Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.
- When the values are outside the standard range, deposits inside the injector may be causing the problem.

**OK: The values are within the standard range.**

**NG****Replace injector of malfunctioning cylinder.****OK****End**

**23 Check all cylinder injectors for deposit.****HINT:**

If an injector is contaminated with deposits, the fuel injection volume deviates from the standard range. This may cause malfunctions.

- (a) Check the injector for any deposits.

**Result:**

Injector Condition	Proceed To
Deposits	A
No deposits	B

**B****Replace injector of all cylinder.****A****24 Clean injector.**

- (a) Wipe away deposits from the tips of the injectors.

**HINT:**

- Solvent or carbon removal agent help remove the deposits easily.
- Exercise extreme care not to damage the injectors while wiping off the deposits.

**NEXT**

<b>25</b>	<b>Read value using intelligent tester II (revised injection volume #1 to #4 and injection volume).</b>
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- (a) Reinstall the injector to cylinder head.
- (b) Connect the intelligent tester II to the DLC3.
- (c) Turn the ignition switch to ON and turn the intelligent tester II ON.
- (d) Start the engine and warm it up.
- (e) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (f) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - Revised Injection Volume #1, #2, #3 and #4
  - Injection Volume

**HINT:**

- Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.
- When the values are outside the standard range, deposits inside the injector may be causing the problem.

**OK: The values are within the standard range.**

**NG**

**Replace injector of all cylinder.**

**OK**

**End**

**26** Inspect fuel pressure sensor. (Refer to appropriate inspection procedures of each repair manual.)

NG

Replace fuel pressure sensor.

OK

**27** Inspect supply pump assy. (Refer to appropriate inspection procedures of each repair manual.)

NG

Replace supply pump assy.

OK

**Check and replace common rail assy. (pressure discharge valve or pressure limiter) (Refer to appropriate inspection procedures of each repair manual.)**

## ENGINE KNOCKING OR RATTLING

### HINT:

- This troubleshooting procedure checks for knocking and rattling.
- Knocking is most likely to occur while the engine is idling.

### CIRCUIT DESCRIPTION

Malfunction Condition	Main Trouble Areas	Related Trouble Area
<ul style="list-style-type: none"><li>• Knocking and abnormal sound due to extremely rich combustion</li><li>• Abnormal sound due to friction between parts</li></ul>	<p>(a) Injector malfunctions</p> <ul style="list-style-type: none"><li>• Injector piston movement malfunction</li><li>• Injector stuck closed</li><li>• Injector stuck open</li><li>• Deposits in injector</li><li>• Injector circuit malfunction</li></ul> <p>(b) Abnormal common rail pressure</p> <ul style="list-style-type: none"><li>• Supply pump</li><li>• Fuel pulsation sound</li><li>• Air in fuel</li></ul> <p>(c) Friction between parts</p> <p>(d) Compression pressure</p>	<ul style="list-style-type: none"><li>• Injector compensation codes</li><li>• Fuel leakage</li><li>• Intake air system leakage</li><li>• Intake air system blockage</li><li>• EGR system</li><li>• Intake shutter system</li><li>• Fuel pressure sensor</li><li>• Manifold absolute pressure sensor</li><li>• Mass air flow meter</li><li>• Atmosphere air pressure sensor (built into ECM)</li><li>• Vehicle modifications</li><li>• Low quality fuel</li><li>• Lack of fuel</li><li>• ECM</li></ul>

### HINT:

- Specified values in the following troubleshooting flowchart are for reference only. Variations in the Data List result values may occur depending on the measuring conditions or the vehicle's age. Do not judge the vehicle to be normal even when the Data List values indicate a standard level. There are possibly some concealed factors of the malfunction.
- Check that the vehicle has not been modified in any way prior to the vehicle inspection.

### INSPECTION PROCEDURE

### HINT:

Before troubleshooting, conduct the following in accordance with the respective BASIC INSPECTIONS instructed each repair manual.

- Check the fuel quality.
- Check the fuel for air.
- Check the fuel system for blockages.
- Check the air filter.
- Check the engine oil.
- Check the engine coolant.
- Check the engine idling speed and the maximum engine speed.
- Check the vacuum pump.

**1 Check sound area.**

(a) Find source of the abnormal sound using a mechanic's stethoscope.

Result	Proceed To
Sound from supply pump or knocking	A
Sound from parts other than supply pump	B

**B****Repair or replace.****A****2 Check wire harness and connector in engine room.**

(a) Check the wire harness and connector connections of common rail system components.

HINT:

Check the following components and system:

- Sensors
- Supply pump
- Common rail
- Injectors
- EDU
- Turbocharger system
- Intake and exhaust system

**OK: The wire harnesses and connectors are connected securely.**

**NG****Repair or replace.****OK**

**3 For w/ pressure discharge valve:  
Check DTCs output (relating to pressure discharge valve).**

**HINT:**

Conduct the inspection below to detect malfunctions in the pressure discharge valve. If any of the DTCs relating to the pressure discharge valve are set, problem areas can be identified.

- (a) Start the engine.
- (b) Stop the engine and wait for at least 10 seconds.
- (c) Perform steps (a) and (b) again described above (to allow the ECM to set pressure discharge valve malfunction DTCs).

**NEXT**

**4 Read output DTCs (relating to engine).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / DTC.
- (d) Read pending DTCs.

**Result:**

Display (DTC Output)	Proceed To
No DTCs	A
Engine related DTCs	B

**B**

**Repair or replace engine control system according to DTC output.**

**A**

**5 Check DTCs output (relating to fuel system and intake system).**

HINT:

Drive the vehicle according to the driving pattern below to allow the ECM to set DTCs relating to malfunctions of the fuel system, EGR system and intake shutter. If any of the DTCs are set, problem areas can be identified.

- (a) Select the following menu items: CHECK MODE
- (b) Fully warm up the engine.
- (c) Allow the engine to idle for 5 minutes or more (to set DTCs relating to rough idling).
- (d) Drive the vehicle at more than 40 km/h for 30 seconds or more.
- (e) Decelerate and stop the vehicle.

HINT:

Do not stop the engine.

- (f) Perform steps (d) and (e) 4 times or more.
- (g) Stop the engine and wait for at least 10 seconds.
- (h) Perform steps (d) and (g) again described above (to set DTCs relating to the EGR system and intake shutter).
- (i) Drive the vehicle at more than 70 km/h for at least 1 minute (to set DTCs relating to the supply pump).

**NEXT****6 Read output DTCs (relating to engine).**

- (a) Select the following menu items: Powertrain / Engine and ECT / DTC.
- (b) Read pending DTCs.

**Result:**

Display (DTC Output)	Proceed To
No DTCs	A
Engine related DTCs	B

**B****Repair or replace engine control system according to DTC output.****A**



**7 Perform active test using intelligent tester II (fuel leak test).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Start the engine and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Fuel leak test.
- (d) Visually check the supply pump, injector and fuel line located between the supply pump and common rail for fuel leaks. Also, perform the same check on the fuel line between the common rail and the injector.

**HINT:**

There may be fuel leaks inside the components, such as the supply pump.

**OK: No leakage.**

**NG****Repair or replace.****OK**

**8 Read value using intelligent tester II (MAF, PIM and common rail pressure).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Start the engine and warm it up and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (d) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - PIM
  - MAF
  - Common Rail Pressure

**HINT:**

Standard range of each item are listed on the APPENDIX: Standard Range Lists of PIM, MAF and Common Rail Pressure (on page 66). Check the results by referring to the appropriate list for the model.

**Standard:**

Item	Result	Proceed To
PIM	Standard range	A
	Both PIM and MAF outside standard range	B
	Only PIM outside standard range	C
MAF	Standard range	A
	Both PIM and MAF outside standard range	B
	Only MAF outside standard range	D
Common Rail Pressure	Standard range	A
	Common rail pressure outside standard range	E

**B**

**Go to step 12.**

**C**

**Go to DTC (related to manifold absolute sensor).**

**D**

**Go to DTC (related to mass air flow meter).**

**HINT:**

It is possible that sensor with stick foreign objects make some drivability problem.

**E**

**Go to step 28.**

**A**

**9 Read value using intelligent tester II (revised injection volume #1 to #4 and injection volume).**

(a) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.

- Revised Injection Volume #1, #2, #3 and #4
- Injection Volume

HINT:

Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.

**Standard:**

Item	Result	Proceed To
Revised Injection Volume	Standard range	A
	Outside standard range	B
Injection Volume	Standard range	A
	Outside standard range	B

**B****Go to step 21.****A****10 For w/ injector compensation code type injector:  
Check injector compensation code. (Refer to appropriate inspection procedures of each repair manual.)**

HINT:

If the injector compensation code is not correctly registered, it may cause malfunctions.

**OK: The compensation codes of the installed injector and the ECM are the same.**

**NG****Register injector compensation code.****OK**

**11 Clear battery.**

- (a) Disconnect the negative battery terminal for at least 2 minutes.
- (b) Reconnect the negative battery terminal.
- (c) Check whether the malfunction has been successfully repaired by performing a driving test.

**OK: Malfunction has been repaired successfully.**

NG

Go to step 12.

OK

Check for intermittent problems.

**12 Check intake and exhaust system.**

- (a) Check for air leakage and any blockages between the air cleaner and the turbocharger.
- (b) Check for air leakage and any blockages between the turbocharger and the intake manifold.

**OK: No air leakage or blockages.**

NG

Repair or replace.

OK

**13** Check EGR valve. (Refer to appropriate inspection procedures of each repair manual.)

**NG**

Repair or replace.

**OK**

**14** Check intake shutter. (Refer to appropriate inspection procedures of each repair manual.)

OK: No malfunction.

**NG**

Repair or replace intake shutter.

**OK**

**15** Check combustion sound.

(a) Confirm type of sound emitted.

Result	Proceed To
Knocking	A
Sound from supply pump	B

**B**

Go to step 26.

**A**

**16 Perform active test using intelligent tester II (injection cut for identifying malfunctioning cylinder).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Start the engine and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Injector cut #1, #2, #3 and #4.
- (d) Check the four cylinders in sequence to identify any faulty cylinders by performing the power-balance inspection.

**HINT:**

- While the engine is idling, if the idling stability variation is small despite cutting off the fuel injection, the cylinder is malfunctioning.
- With normal cylinders, the engine idles roughly when the fuel injection is cut off.

**NEXT****17 Check cylinder compression pressure of malfunction cylinder. (Refer to appropriate inspection procedures of each repair manual.)****OK: The cylinder compression pressure is normal.****NG****Repair or replace.****OK**

**18 Check malfunctioning cylinder injector for deposit.****HINT:**

If an injector is contaminated with deposits, the fuel injection volume deviates from the standard range. This may cause malfunctions.

- (a) Check the injector for any deposits.

**Result:**

Injector Condition	Proceed To
Deposits	A
No deposits	B

**B****Replace injector of malfunctioning cylinder.****A****19 Clean injector.**

- (a) Wipe away deposits from the tips of the injectors.

**HINT:**

- Solvent or carbon removal agent help remove the deposits easily.
- Exercise extreme care not to damage the injectors while wiping off the deposits.

**NEXT**



<b>20</b>	<b>Read value using intelligent tester II (revised injection volume #1 to #4 and injection volume).</b>
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- (a) Reinstall the injector to cylinder head.
- (b) Connect the intelligent tester II to the DLC3.
- (c) Turn the ignition switch to ON and turn the intelligent tester II ON.
- (d) Start the engine and warm it up.
- (e) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (f) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - Revised Injection Volume #1, #2, #3 and #4
  - Injection Volume

**HINT:**

- Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.
- When the values are outside the standard range, deposits inside the injector may be causing the problem.

**OK: The values are within the standard range.**

**NG****Replace injector of malfunctioning cylinder.****OK****End**

<b>21</b>	<b>Identify malfunctioning cylinder injector.</b>
-----------	---

**HINT:**

This operation is based on the premise that the common rail pressure is normal.

- (a) Follow the instructions in the table below according to the check result when using an intelligent tester II.

**HINT:**

Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.

**Result:**

Injection Volume	Less than standard range	Standard range	More than standard range
Revised Injection Volume #1 to #4			
3.0 mm <sup>3</sup> or more, -3.0 mm <sup>3</sup> or less	A	B	B
Between -3.0 mm <sup>3</sup> and 3.0 mm <sup>3</sup>	--	Normal	C*

Proceed To	Inspection Areas	Descriptions
A	Inspect and repair cylinder injector with revised injection volume of less than -3.0 mm <sup>3</sup> : <ul style="list-style-type: none"> <li>• Perform power balance inspection and identify malfunctioning cylinder. Replace the injector of malfunctioning cylinder</li> </ul>	Abnormal value cylinder injector injects excessively large quantity of fuel
B	Identify malfunctioning cylinders by conducting power balance test: <ul style="list-style-type: none"> <li>• Perform power balance inspection to identify malfunctioning cylinders</li> <li>• Clean malfunctioning cylinder injector, then check and repair it</li> </ul>	(a) If revised injection volume of more than 3.0 mm <sup>3</sup> Abnormal value cylinder injector injects excessively small quantity of fuel: <ul style="list-style-type: none"> <li>• Fuel injection volume too low due to injector nozzle being blocked by deposits</li> </ul> (b) If revised injection volume of less than -3.0 mm <sup>3</sup> Abnormal value cylinder injector injects excessively large quantity of fuel: <ul style="list-style-type: none"> <li>• Fuel injection volume too high due to injector nozzle being stuck open by deposits</li> </ul>
C	Inspect and repair all cylinder injectors: <ul style="list-style-type: none"> <li>• Clean all cylinder injectors, and then inspect and repair them</li> </ul>	All cylinder injectors inject excessively small quantity of fuel: <ul style="list-style-type: none"> <li>• Fuel injection volume too low due to all cylinder injector nozzles being blocked by deposits</li> </ul>

\*: When the Injection Volume displayed on the intelligent tester II is too large despite the Common Rail Pressure and Revised Injection Volume #1 to #4 in the Data List being normal, the injector may have a clogging malfunction. In this case, there may be deposits inside or outside the injector.

**HINT:**

- Despite the injector functioning normally, the indicated Revised Injection Volume #1 to #4 value may be outside the normal operating range due to compensation for other problems (such as low compression).
- Revised Injection Volume is the value used to correct the fuel injection volumes of each cylinder, in order to optimize (compensate for the unevenness between) all the cylinder combustion condition. If any of the cylinders malfunction, the fuel injection volumes for the normal cylinders are corrected simultaneously. As a result, the Revised Injection Volume may deviate from the standard range.

**B**

Go to step 18.

**C**

Go to step 23.

**A****22 Perform active test using intelligent tester II (injection cut for identifying malfunctioning cylinder).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Start the engine and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Injector cut #1, #2, #3 and #4.
- (d) Check the four cylinders in sequence to identify any faulty cylinders by performing the power-balance inspection.

**HINT:**

- While the engine is idling, if the idling stability variation is small despite cutting off the fuel injection, the cylinder is malfunctioning.
- With normal cylinders, the engine idles roughly when the fuel injection is cut off.

**NEXT****Replace malfunctioning cylinder injector.**

**23 Check all cylinder injectors for deposit.****HINT:**

If an injector is contaminated with deposits, the fuel injection volume deviates from the standard range. This may cause malfunctions.

- (a) Check the injector for any deposits.

**Result:**

Injector Condition	Proceed To
Deposits	A
No deposits	B

**B****Replace injector of all cylinder.****A****24 Clean injector.**

- (a) Wipe away deposits from the tips of the injectors.

**HINT:**

- Solvent or carbon removal agent help remove the deposits easily.
- Exercise extreme care not to damage the injectors while wiping off the deposits.

**NEXT**

**25 Read value using intelligent tester II (revised injection volume #1 to #4 and injection volume).**

- (a) Reinstall the injector to cylinder head.
- (b) Connect the intelligent tester II to the DLC3.
- (c) Turn the ignition switch to ON and turn the intelligent tester II ON.
- (d) Start the engine and warm it up.
- (e) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (f) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - Revised Injection Volume #1, #2, #3 and #4
  - Injection Volume

**HINT:**

- Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.
- When the values are outside the standard range, deposits inside the injector may be causing the problem.

**OK: The values are within the standard range.**

**NG****Replace injector of all cylinder.****OK****End**

**26    Bleed air from fuel system.**

- (a) Pump the priming pump until it becomes hard, to bleed the air.

**NEXT****27    Confirm whether knocking has been successfully repaired.**

- (a) Check whether the knocking has been successfully repaired by performing a driving test.

**NEXT****END**

**28** Inspect fuel pressure sensor. (Refer to appropriate inspection procedures of each repair manual.)

**NG**

Replace fuel pressure sensor.

**OK**

**29** Inspect supply pump assy. (Refer to appropriate inspection procedures of each repair manual.)

**NG**

Replace supply pump assy.

**OK**

**Check and replace common rail assy. (pressure discharge valve or pressure limiter) (Refer to appropriate inspection procedures of each repair manual.)**



## LACK OF POWER OR HESITATION

### HINT:

This troubleshooting procedure checks for the cause of an obvious lack of engine power (the vehicle speed does not reach the target speed in the high speed range) while the vehicle is being driven.

### CIRCUIT DESCRIPTION

Malfunction Condition	Main Trouble Areas	Related Trouble Areas
<ul style="list-style-type: none"><li>• Lack of power caused by abnormal fuel injection volume (supply pump malfunction or injector malfunction)</li><li>• Lack of power caused by intake air volume shortage (turbocharger malfunction, front exhaust pipe or exhaust manifold converter blocked)</li></ul>	<p>(a) Injector malfunctions</p> <ul style="list-style-type: none"><li>• Injector piston movement malfunction</li><li>• Injector stuck closed</li><li>• Injector stuck open</li><li>• Deposits in injector</li><li>• Injector circuit malfunction</li></ul> <p>(b) Abnormal common rail pressure</p> <ul style="list-style-type: none"><li>• Supply pump</li></ul> <p>(c) Abnormal intake air volume</p> <ul style="list-style-type: none"><li>• Turbocharger</li><li>• Front exhaust pipe blockage</li><li>• Exhaust manifold converter blockage</li></ul>	<ul style="list-style-type: none"><li>• Pressure discharge valve (P1271 set simultaneously)</li><li>• Mass air flow meter</li><li>• Intake air system leakage</li><li>• Intake air system blockage</li><li>• EGR system</li><li>• Fuel filter element is clogged</li><li>• Intake shutter system</li><li>• Compression pressure</li><li>• Injector compensation code</li><li>• Fuel leak</li><li>• Glow plug</li><li>• Fuel pressure sensor</li><li>• EDU (If P0200 set simultaneously)</li><li>• Vehicle modifications</li><li>• Low quality fuel</li><li>• Frozen fuel</li><li>• ECM</li></ul>

### HINT:

- Specified values in the following troubleshooting flowchart are for reference only. Variations in the Data List result values may occur depending on the measuring conditions or the vehicle's age. Do not judge the vehicle to be normal even when the Data List values indicate a standard level. There are possibly some concealed factors of the malfunction.
- Check that the vehicle has not been modified in any way prior to the vehicle inspection.

## INSPECTION PROCEDURE

### HINT:

Before troubleshooting, conduct the following in accordance with the respective BASIC INSPECTIONS instructed each repair manual.

- Check the fuel quality.
- Check the fuel for air.
- Check the fuel system for blockages.
- Check the air filter.
- Check the engine oil.
- Check the engine coolant.
- Check the engine idling speed and the maximum engine speed.
- Check the vacuum pump.

**1 Check wire harness and connector in engine room.**

(a) Check the wire harness and connector connections of common rail system components.

HINT:

Check the following components and system:

- Sensors
- Supply pump
- Common rail
- Injectors
- EDU
- Turbocharger system
- Intake and exhaust system

**OK: The wire harnesses and connectors are connected securely.**

NG

Repair or replace.

OK

**2 For w/ pressure discharge valve:  
Check DTCs output (relating to pressure discharge valve).**

HINT:

Conduct the inspection below to detect malfunctions in the pressure discharge valve. If any of the DTCs relating to the pressure discharge valve are set, problem areas can be identified.

- Start the engine.
- Stop the engine and wait for at least 10 seconds.
- Perform steps (a) and (b) again described above (to allow the ECM to set pressure discharge valve malfunction DTCs).

NEXT

**3 Read output DTCs (relating to engine).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / DTC.
- (d) Read pending DTCs.

**Result:**

Display (DTC Output)	Proceed To
No DTCs	A
Engine related DTCs	B

**B****Repair or replace engine control system according to DTC output.****A****4 Check DTCs output (relating to fuel system and intake system).****HINT:**

Drive the vehicle according to the driving pattern below to allow the ECM to set DTCs relating to malfunctions of the fuel system, EGR system and intake shutter. If any of the DTCs are set, problem areas can be identified.

- (a) Select the following menu items: CHECK MODE
- (b) Fully warm up the engine.
- (c) Allow the engine to idle for 5 minutes or more (to set DTCs relating to rough idling).
- (d) Drive the vehicle at more than 40 km/h for 30 seconds or more.
- (e) Decelerate and stop the vehicle.

**HINT:**

Do not stop the engine.

- (f) Perform steps (d) and (e) 4 times or more.
- (g) Stop the engine and wait for at least 10 seconds.
- (h) Perform steps (d) and (g) again described above (to set DTCs relating to the EGR system and intake shutter).
- (i) Drive the vehicle at more than 70 km/h for at least 1 minute (to set DTCs relating to the supply pump).

**NEXT**

**5 Read output DTCs (relating to engine).**

- (a) Select the following menu items: Powertrain / Engine and ECT / DTC.  
(b) Read pending DTCs.

**Result:**

Display (DTC Output)	Proceed To
No DTCs	A
Engine related DTCs	B

**B****Repair or replace engine control system according to DTC output.****A****6 Perform active test using intelligent tester II (fuel leak test).**

- (a) Connect the intelligent tester II to the DLC3.  
(b) Start the engine and turn the intelligent tester II ON.  
(c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Fuel leak test.  
(d) Visually check the supply pump, injector and fuel line located between the supply pump and common rail for fuel leaks. Also, perform the same check on the fuel line between the common rail and the injector.

**HINT:**

There may be fuel leaks inside the components, such as the supply pump.

**OK: No leakage.****NG****Repair or replace.****OK**

**7 Check white smoke.**

- (a) Rev up the engine from an idling speed to 3,000 rpm several times to check whether white smoke is emitted from the exhaust pipe.
- (b) Check that the intake system pipes and hoses are not excessively contaminated with oil.

**HINT:**

If the presence of white smoke in the exhaust gas is confirmed, there is a high possibility of mechanical problems in the turbocharger or engine.

Result	Proceed To
No malfunction	A
White smoke emitted, or intake system pipes and hoses excessively contaminated with oil	B

**B****Go to step 29.****A**

**8 Read value using intelligent tester II (MAF, PIM and common rail pressure).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Start the engine and warm it up and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (d) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - PIM
  - MAF
  - Common Rail Pressure

**HINT:**

Standard range of each item are listed on the APPENDIX: Standard Range Lists of PIM, MAF and Common Rail Pressure (on page 66). Check the results by referring to the appropriate list for the model.

**Standard:**

Item	Result	Proceed To
PIM	Standard range	A
	Both PIM and MAF outside standard range	B
	Only PIM outside standard range	C
MAF	Standard range	A
	Both PIM and MAF outside standard range	B
	Only MAF outside standard range	D
Common Rail Pressure	Standard range	A
	Common rail pressure outside standard range	E

**B**

**Go to step 30.**

**C**

**Go to DTC (related to manifold absolute sensor).**

**D**

**Go to DTC (related to mass air flow meter).**

**HINT:**

It is possible that sensor with stick foreign objects make some drivability problem.

**E**

**Go to step 37.**

**A**

**9 Read value using intelligent tester II (revised injection volume #1 to #4 and injection volume).**

(a) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.

- Revised Injection Volume #1, #2, #3 and #4
- Injection Volume

**HINT:**

Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.

**Standard:**

Item	Result	Proceed To
Revised Injection Volume	Standard range	A
	Outside standard range	B
Injection Volume	Standard range	A
	Outside standard range	B

**B****Go to step 16.****A****10 For w/ injector compensation code type injector:  
Check injector compensation code. (Refer to appropriate inspection procedures of each repair manual.)****HINT:**

If the injector compensation code is not correctly registered, it may cause malfunctions.

**OK: The compensation codes of the installed injector and the ECM are the same.**

**NG****Register injector compensation.****OK**



**11 Clear battery.**

- (a) Disconnect the negative battery terminal for at least 2 minutes.
- (b) Reconnect the negative battery terminal.
- (c) Check whether the malfunction has been successfully repaired by performing a driving test.

**OK: Malfunction has been repaired successfully.**

NG

Go to step 12.

OK

Check for intermittent problems.

**12 Bleed air from fuel system.**

- (a) Pump the priming pump until it cannot be pumped any more, to bleed the air.

NEXT

**13 Confirm whether lack of power has been successfully repaired.**

- (a) Check whether the lack of power has been successfully repaired by performing a driving test.

**OK: Lack of power has been repaired successfully.**

NG

Go to step 14

OK

End

**14**    **Inspect glow plug circuit and glow plug assy. (Refer to appropriate inspection procedures of each repair manual.)**

**OK: No malfunction.**

**NG**

**Repair or replace.**

**OK**

**15**    **Check intake and exhaust system.**

- (a) Check for air leakage and any blockages between the air cleaner and the turbocharger.
- (b) Check for air leakage and any blockages between the turbocharger and the intake manifold.

**OK: No air leakage or blockages.**

**NEXT**

**End**

<b>16</b>	<b>Identify malfunctioning cylinder injector.</b>
-----------	---

**HINT:**

This operation is based on the premise that the common rail pressure is normal.

- (a) Follow the instructions in the table below according to the check result when using an intelligent tester II.

**HINT:**

Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.

**Result:**

Injection Volume	Less than standard range	Standard range	More than standard range
Revised Injection Volume #1 to #4			
3.0 mm <sup>3</sup> or more, -3.0 mm <sup>3</sup> or less	A	B	B
Between -3.0 mm <sup>3</sup> and 3.0 mm <sup>3</sup>	--	Normal	C*

Proceed To	Inspection Areas	Descriptions
A	Inspect and repair cylinder injector with revised injection volume of less than -3.0 mm <sup>3</sup> : <ul style="list-style-type: none"> <li>• Perform power balance inspection and identify malfunctioning cylinder. Replace the injector of malfunctioning cylinder</li> </ul>	Abnormal value cylinder injector injects excessively large quantity of fuel
B	Identify malfunctioning cylinders by conducting power balance test: <ul style="list-style-type: none"> <li>• Perform power balance inspection to identify malfunctioning cylinders</li> <li>• Clean malfunctioning cylinder injector, then check and repair it</li> </ul>	(a) If revised injection volume of more than 3.0 mm <sup>3</sup> Abnormal value cylinder injector injects excessively small quantity of fuel: <ul style="list-style-type: none"> <li>• Fuel injection volume too low due to injector nozzle being blocked by deposits</li> </ul> (b) If revised injection volume of less than -3.0 mm <sup>3</sup> Abnormal value cylinder injector injects excessively large quantity of fuel: <ul style="list-style-type: none"> <li>• Fuel injection volume too high due to injector nozzle being stuck open by deposits</li> </ul>
C	Inspect and repair all cylinder injectors: <ul style="list-style-type: none"> <li>• Clean all cylinder injectors, and then inspect and repair them</li> </ul>	All cylinder injectors inject excessively small quantity of fuel: <ul style="list-style-type: none"> <li>• Fuel injection volume too low due to all cylinder injector nozzles being blocked by deposits</li> </ul>

\*: When the Injection Volume displayed on the intelligent tester II is too large despite the Common Rail Pressure and Revised Injection Volume #1 to #4 in the Data List being normal, the injector may have a clogging malfunction. In this case, there may be deposits inside or outside the injector.

**HINT:**

- Despite the injector functioning normally, the indicated Revised Injection Volume #1 to #4 value may be outside the normal operating range due to compensation for other problems (such as low compression).
- Revised Injection Volume is the value used to correct the fuel injection volumes of each cylinder, in order to optimize (compensate for the unevenness between) all the cylinder combustion condition. If any of the cylinders malfunction, the fuel injection volumes for the normal cylinders are corrected simultaneously. As a result, the Revised Injection Volume may deviate from the standard range.

**B**

Go to step 18.

**C**

Go to step 23.

**A****17****Perform active test using intelligent tester II (injection cut for identifying malfunctioning cylinder).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Start the engine and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Injector cut #1, #2, #3 and #4.
- (d) Check the four cylinders in sequence to identify any faulty cylinders by performing the power-balance inspection.

HINT:

- While the engine is idling, if the idling stability variation is small despite cutting off the fuel injection, the cylinder is malfunctioning.
- With normal cylinders, the engine idles roughly when the fuel injection is cut off.

**NEXT****Replace malfunctioning cylinder injector.**

**18 Perform active test using intelligent tester II (injection cut for identifying malfunctioning cylinder).**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Start the engine and turn the intelligent tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Injector cut #1, #2, #3 and #4.
- (d) Check the four cylinders in sequence to identify any faulty cylinders by performing the power-balance inspection.

**HINT:**

- While the engine is idling, if the idling stability variation is small despite cutting off the fuel injection, the cylinder is malfunctioning.
- With normal cylinders, the engine idles roughly when the fuel injection is cut off.

**NEXT****19 Check cylinder compression pressure of malfunction cylinder. (Refer to appropriate inspection procedures of each repair manual.)****OK: The cylinder compression pressure is normal.****NG****Repair or replace.****OK**

**20 Check malfunctioning cylinder injector for deposit.****HINT:**

If an injector is contaminated with deposits, the fuel injection volume deviates from the standard range. This may cause malfunctions.

- (a) Check the injector for any deposits.

**Result:**

Injector Condition	Proceed To
Deposits	A
No deposits	B

**B****Replace injector of malfunctioning cylinder.****A****21 Clean injector.**

- (a) Wipe away deposits from the tips of the injectors.

**HINT:**

- Solvent or carbon removal agent help remove the deposits easily.
- Exercise extreme care not to damage the injectors while wiping off the deposits.

**NEXT**

**22 Read value using intelligent tester II (revised injection volume #1 to #4 and injection volume).**

- (a) Reinstall the injector to cylinder head.
- (b) Connect the intelligent tester II to the DLC3.
- (c) Turn the ignition switch to ON and turn the intelligent tester II ON.
- (d) Start the engine and warm it up.
- (e) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (f) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - Revised Injection Volume #1, #2, #3 and #4
  - Injection Volume

**HINT:**

- Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.
- When the values are outside the standard range, deposits inside the injector may be causing the problem.

**OK: The values are within the standard range.**

**NG****Replace injector of malfunction cylinder.****OK****End**



**23 Check all cylinder injectors for deposit.****HINT:**

If an injector is contaminated with deposits, the fuel injection volume deviates from the standard range. This may cause malfunctions.

- (a) Check the injector for any deposits.

**Result:**

Injector Condition	Proceed To
Deposits	A
No deposits	B

**B****Replace injector of all cylinder.****A****24 Clean injector.**

- (a) Wipe away deposits from the tips of the injectors.

**HINT:**

- Solvent or carbon removal agent help remove the deposits easily.
- Exercise extreme care not to damage the injectors while wiping off the deposits.

**NEXT**

**25 Read value using intelligent tester II (revised injection volume #1 to #4 and injection volume).**

- (a) Reinstall the injector to cylinder head.
- (b) Connect the intelligent tester II to the DLC3.
- (c) Turn the ignition switch to ON and turn the intelligent tester II ON.
- (d) Start the engine and warm it up.
- (e) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (f) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - Revised Injection Volume #1, #2, #3 and #4
  - Injection Volume

**HINT:**

- Standard range of each item are listed on the APPENDIX: Standard Range Lists of Revised Injection Volume and Injection Volume (on page 66). Check the results by referring to the appropriate list for the model.
- When the values are outside the standard range, deposits inside the injector may be causing the problem.

**OK: The values are within the standard range.**

**NG****Replace injector of all cylinder.****OK****End**

**26** Check EGR valve. (Refer to appropriate inspection procedures of each repair manual.)

NG

Repair or replace.

OK

**27** Check intake shutter. (Refer to appropriate inspection procedures of each repair manual.)

OK: No malfunction.

NG

Repair or replace.

OK

**28** Check intake and exhaust system.

- (a) Check for air leakage and any blockages between the air cleaner and the turbocharger.
- (b) Check for air leakage and any blockages between the turbocharger and the intake manifold.

OK: No air leakage or blockages.

NG

Repair or replace.

OK

**29 Check turbocharger (mechanical problem).**

- (a) Disconnect the air cleaner hose.
- (b) Use a mirror to visually check the turbocharger for any mechanical problems.
- (c) When the engine is cold, check that the impellor of the turbocharger rotates smoothly, and confirm whether there is any damage to it.

**OK: No problem.**

**NG**

**Repair or replace.**

**OK**

**30 w/ VN type turbochrger:  
Check vacuum hose connections (turbocharger – VRV for turbocharger – vacuum pump)**

- (a) Check that the vacuum hoses are installed correctly.
- (b) Check the vacuum hoses for any cracks and damage.
- (c) Check the vacuum hoses for air leaks and any blockage.

**OK: The vacuum hoses are appropriately connected to each other.**

**NG**

**Repair or replace vacuum hose.**

**OK**

**31 Inspect vacuum regulating valve.**

- (a) Check the negative pressure (vacuum) applied to the actuator using a vacuum gauge.
- (b) Confirm that the vacuum decreased according to raised engine speeds.

**OK: The vacuum decreased in accordance with raised engine speeds.**

**NG****Replace vacuum regulating valve.****OK****32 For 1CD-FTV engines:  
Inspect turbocharger actuator.**

- (a) Apply a high negative pressure (minimum: -60 kPa) to the turbocharger actuator using a vacuum pump.
- (b) Allow the negative pressure in the actuator to decrease gradually.
- (c) Measure the turbocharger actuator stroke from the initial position of the actuator rod.

HINT:

Standard range of each item are listed on the APPENDIX: Standard Range Lists of turbocharger actuator stroke (on page 66). Check the results by referring to the appropriate list for the model.

**Standard: The turbocharger actuator stroke is standard level.**

**NG****Replace turbocharger.****OK****33 Replace front exhaust pipe assy.****NEXT**

**34 Confirm whether malfunction has been successfully repaired.**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Turn the ignition switch to ON and turn the intelligent tester II ON.
- (c) Start the engine and warm it up.
- (d) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (e) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - PIM
  - MAF

**HINT:**

Standard range of each item are listed on the APPENDIX: Standard Range Lists of PIM, MAF and Common Rail Pressure (on page 66). Check the results by referring to the appropriate list for the model.

**OK: The values are within the standard range.**

**NG****Go to step 35****OK****End****35 Replace exhaust manifold converter assy.****NEXT**

**36 Confirm whether malfunction has been successfully repaired.**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Turn the ignition switch to ON and turn the intelligent tester II ON.
- (c) Start the engine and warm it up.
- (d) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (e) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - PIM
  - MAF

**HINT:**

Standard range of each item are listed on the APPENDIX: Standard Range Lists of PIM, MAF and Common Rail Pressure (on page 66). Check the results by referring to the appropriate list for the model.

**OK: The values are within the standard range.**

**NG****Replace turbocharger.****OK****End**

**37** Check and replace fuel filter element assy.

**NEXT**

**38** Confirm whether malfunctioning has been success fully repaired.

- (a) Connect the intelligent tester II to the DLC3.
- (b) Turn the ignition switch to ON and turn the intelligent tester II ON.
- (c) Start the engine and warm it up.
- (d) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (e) Select the following menu items in order and read the corresponding values displayed on the intelligent tester II.
  - Common Rail Pressure

HINT:

Standard range of each item are listed on the APPENDIX: Standard Range Lists of PIM, MAF and Common Rail Pressure (on page 66). Check the results by referring to the appropriate list for the model.

**OK: The values are within the standard range.**

**NG**

**End**

**OK**

**39** Inspect fuel pressure sensor. (Refer to appropriate inspection procedures of each repair manual.)

**NG**

**Replace fuel pressure sensor.**

**OK**



# Service Bulletin

Ref. No. : EG-4010

Page : 65 of 80

40 Inspect supply pump assy. (Refer to appropriate inspection procedures of each repair manual.)

NG

Replace supply pump assy.

OK

Check and replace common rail assy. (pressure discharge valve or pressure limiter) (Refer to appropriate inspection procedures of each repair manual.)

## APPENDIX

### INDEX

#### (Standard Range Lists of Turbocharger Actuator Stroke):

Model	See Page
CLR##-#####	67
CLA##-#####	67
CLM##-#####	67
CDT250-####Y#	67
CDE120-####X#	67

### INDEX

#### (Standard Range Lists of PIM, MAF and Common Rail Pressure):

Model	See Page
CDT220-#####	68
CDE120-####H#	68
CDE110-#####	69
CDE120-####Y#	69
CLR##-#####	70
CLA##-#####	71
CLM##-#####	72
CDT250-####Y#	73
CDE120-####X#	73
2KD-FTV Engine w/o Intercooler	74
2KD-FTV Engine w/ Intercooler	75
KDJ##-##### 1KD-FTV Engine	76
KDJ###-##### 1KD-FTV Engine	76
KDN##-##### 1KD-FTV Engine	77

### INDEX

#### (Standard Range Lists of Revised Injection Volume and Injection Volume):

Model	See Page
1CD-FTV Engine	78
2KD-FTV Engine	79
1KD-FTV Engine	80

## Standard Range Lists of Turbocharger Actuator Stroke:

**Model (CLR##-#####, CLA##-##### and CLM##-#####):**

Apply pressure	-48 to -53.4 kPa (-360 to -401 mmHg, -14.18 to -15.77 in.Hg)	-26.7 to -34.7 kPa (-200 to -260 mmHg, -7.89 to -10.25 in.Hg)	-3.8 to -15.9 kPa (-29 to -119 mmHg, -1.12 to -4.70 in.Hg)
Strokes	0.20 mm (0.008 in.)	5.0 mm (0.197 in.)	10.0 mm (0.394 in.)
Vane Positions	Fully closed	Half open	Fully open

**Model (CDT250-####Y# and CDE120-####X#):**

Apply pressure	-48 to -53.4 kPa (-360 to -401 mmHg, -14.18 to -15.77 in.Hg)	-26.7 to -34.7 kPa (-200 to -260 mmHg, -7.89 to -10.25 in.Hg)	-4.5 to -15.2 kPa (-33 to -114 mmHg, -1.33 to -4.49 in.Hg)
Strokes	0.20 mm (0.008 in.)	5.0 mm (0.197 in.)	10.0 mm (0.394 in.)
Vane Positions	Fully closed	Half open	Fully open

## Standard Range Lists of PIM, MAF and Common Rail Pressure:

Model (CDT220-##### and CDE120-####H#):

Item	Engine Speed *1	Standard Range	Description
PIM *2	Ignition switch ON (engine stopped)	Same as atmospheric pressure	Intake manifold internal pressure detected by intake pressure sensor
	Idling	85 to 110 kPa (638 to 825 mmHg, 25.10 to 32.49 in.Hg)	
	3,000 rpm (no engine load)	90 to 130 kPa (675 to 975 mmHg, 26.58 to 38.40 in.Hg)	
MAF *2, *4	Ignition switch ON (engine stopped)	0 g/s	Intake air volume detected by mass air flow meter
	Idling	6.0 to 13.0 g/s	
	2,500 rpm (no engine load)	26.3 to 43.8 g/s	
Common Rail Pressure *3	Idling	27 to 37 MPa	Common rail internal fuel pressure
	2,000 rpm (no engine load)	44 to 60 MPa	
	3,000 rpm (no engine load)	53 to 70 MPa	
	3,000 rpm (driving with full throttle acceleration)	115 to 125 MPa	
	3,500 rpm (driving with full throttle acceleration)	125 to 130 MPa	
	4,000 rpm (driving with full throttle acceleration)	133 to 138 MPa	

### HINT:

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

\*2: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the stable boost pressure is maintained for approximately 10 seconds.

\*3: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the vehicle is accelerated for approximately 10 seconds.

\*4: When the mass air flow meter malfunctions, the MAF output may deviate from the standard (referential) range when the engine idles and is accelerated from 3,000 to 4,000 rpm with full throttle acceleration.

**Model (CDE110-##### and CDE120-####Y#):**

Item	Engine Speed *1	Standard Range	Description
PIM *2	Ignition switch ON (engine stopped)	Same as atmospheric pressure	Intake manifold internal pressure detected by intake pressure sensor
	Idling	85 to 110 kPa (638 to 825 mmHg, 25.10 to 32.49 in.Hg)	
	3,000 rpm (no engine load)	90 to 130 kPa (675 to 975 mmHg, 26.58 to 38.40 in.Hg)	
MAF *2, *4	Ignition switch ON (engine stopped)	0 g/s	Intake air volume detected by mass air flow meter
	Idling	3.0 to 9.0 g/s	
Common Rail Pressure *3	Idling	25 to 45 MPa	Common rail internal fuel pressure
	2,000 rpm (no engine load)	41 to 64 MPa	
	3,000 rpm (no engine load)	58 to 74 MPa	
	3,000 rpm (driving with full throttle acceleration)	115 to 125 MPa	
	3,500 rpm (driving with full throttle acceleration)	125 to 130 MPa	
	4,000 rpm (driving with full throttle acceleration)	133 to 138 MPa	

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

\*2: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the stable boost pressure is maintained for approximately 10 seconds.

\*3: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the vehicle is accelerated for approximately 10 seconds.

\*4: When the mass air flow meter malfunctions, the MAF output may deviate from the standard (referential) range when the engine idles and is accelerated from 3,000 to 4,000 rpm with full throttle acceleration.

**Model (CLR##-#####):**

Item	Engine Speed *1	Standard Range	Description
PIM *2	Ignition switch ON (engine stopped)	Same as atmospheric pressure	Intake manifold internal pressure detected by intake pressure sensor
	Idling	93 to 103 kPa (698 to 773 mmHg, 27.47 to 30.42 in.Hg)	
	3,000 rpm (no engine load)	124 to 139 kPa (930 to 1,043 mmHg, 36.62 to 41.05 in.Hg)	
	3,000 rpm (driving with full throttle acceleration)	199 to 219 kPa (1,493 to 1,643 mmHg, 58.77 to 64.68 in.Hg)	
	3,500 rpm (driving with full throttle acceleration)	197 to 217 kPa (1,478 to 1,628 mmHg, 58.18 to 64.09 in.Hg)	
	4,000 rpm (driving with full throttle acceleration)	191 to 211 kPa (1,433 to 1,583 mmHg, 56.41 to 62.32 in.Hg)	
MAF *2, *4	Ignition switch ON (engine stopped)	0 g/s	Intake air volume detected by mass air flow meter
	Idling	5.7 to 9.1 g/s	
	3,000 rpm (no engine load)	34 to 54 g/s	
	3,000 rpm (driving with full throttle acceleration)	93 to 113 g/s	
	3,500 rpm (driving with full throttle acceleration)	106 to 126 g/s	
	4,000 rpm (driving with full throttle acceleration)	116 to 136 g/s	
Common Rail Pressure *3	Idling	30 to 37 MPa	Common rail internal fuel pressure
	2,000 rpm (no engine load)	46 to 57 MPa	
	3,000 rpm (no engine load)	54 to 87 MPa	
	3,000 rpm (driving with full throttle acceleration)	115 to 125 MPa	
	3,500 rpm (driving with full throttle acceleration)	124 to 134 MPa	
	4,000 rpm (driving with full throttle acceleration)	130 to 140 MPa	

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

\*2: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the stable boost pressure is maintained for approximately 10 seconds.

\*3: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the vehicle is accelerated for approximately 10 seconds.

\*4: When the mass air flow meter malfunctions, the MAF output may deviate from the standard (referential) range when the engine idles and is accelerated from 3,000 to 4,000 rpm with full throttle acceleration.

**Model (CLA##-#####):**

Item	Engine Speed *1	Standard Range	Description
PIM *2	Ignition switch ON (engine stopped)	Same as atmospheric pressure	Intake manifold internal pressure detected by intake pressure sensor
	Idling	93 to 103 kPa (698 to 773 mmHg, 27.47 to 30.42 in.Hg)	
	3,000 rpm (no engine load)	124 to 139 kPa (930 to 1,043 mmHg, 36.62 to 41.05 in.Hg)	
	3,000 rpm (driving with full throttle acceleration)	199 to 219 kPa (1,493 to 1,643 mmHg, 58.77 to 64.68 in.Hg)	
	3,500 rpm (driving with full throttle acceleration)	197 to 217 kPa (1,478 to 1,628 mmHg, 58.18 to 64.09 in.Hg)	
	4,000 rpm (driving with full throttle acceleration)	191 to 211 kPa (1,433 to 1,583 mmHg, 56.41 to 62.32 in.Hg)	
MAF *2, *4	Ignition switch ON (engine stopped)	0 g/s	Intake air volume detected by mass air flow meter
	Idling	5.9 to 10.2 g/s	
	3,000 rpm (no engine load)	34 to 54 g/s	
	3,000 rpm (driving with full throttle acceleration)	93 to 113 g/s	
	3,500 rpm (driving with full throttle acceleration)	106 to 126 g/s	
	4,000 rpm (driving with full throttle acceleration)	116 to 136 g/s	
Common Rail Pressure *3	Idling	30 to 38 MPa	Common rail internal fuel pressure
	2,000 rpm (no engine load)	44 to 55 MPa	
	3,000 rpm (no engine load)	54 to 87 MPa	
	3,000 rpm (driving with full throttle acceleration)	115 to 125 MPa	
	3,500 rpm (driving with full throttle acceleration)	124 to 134 MPa	
	4,000 rpm (driving with full throttle acceleration)	130 to 140 MPa	

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

\*2: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the stable boost pressure is maintained for approximately 10 seconds.

\*3: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the vehicle is accelerated for approximately 10 seconds.

\*4: When the mass air flow meter malfunctions, the MAF output may deviate from the standard (referential) range when the engine idles and is accelerated from 3,000 to 4,000 rpm with full throttle acceleration.

**Model (CLM##-#####):**

Item	Engine Speed *1	Standard Range	Description
PIM *2	Ignition switch ON (engine stopped)	Same as atmospheric pressure	Intake manifold internal pressure detected by intake pressure sensor
	Idling	93 to 103 kPa (698 to 773 mmHg, 27.47 to 30.42 in.Hg)	
	3,000 rpm (no engine load)	124 to 139 kPa (930 to 1,043 mmHg, 36.62 to 41.05 in.Hg)	
	3,000 rpm (driving with full throttle acceleration)	199 to 219 kPa (1,493 to 1,643 mmHg, 58.77 to 64.68 in.Hg)	
	3,500 rpm (driving with full throttle acceleration)	197 to 217 kPa (1,478 to 1,628 mmHg, 58.18 to 64.09 in.Hg)	
	4,000 rpm (driving with full throttle acceleration)	191 to 211 kPa (1,433 to 1,583 mmHg, 56.41 to 62.32 in.Hg)	
MAF *2, *4	Ignition switch ON (engine stopped)	0 g/s	Intake air volume detected by mass air flow meter
	Idling	5.3 to 9.4 g/s	
	3,000 rpm (no engine load)	34.3 to 56.3 g/s	
	3,000 rpm (driving with full throttle acceleration)	93 to 113 g/s	
	3,500 rpm (driving with full throttle acceleration)	106 to 126 g/s	
	4,000 rpm (driving with full throttle acceleration)	116 to 136 g/s	
Common Rail Pressure *3	Idling	29 to 33 MPa	Common rail internal fuel pressure
	2,000 rpm (no engine load)	44 to 55 MPa	
	3,000 rpm (no engine load)	54 to 87 MPa	
	3,000 rpm (driving with full throttle acceleration)	115 to 125 MPa	
	3,500 rpm (driving with full throttle acceleration)	124 to 134 MPa	
	4,000 rpm (driving with full throttle acceleration)	130 to 140 MPa	

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

\*2: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the stable boost pressure is maintained for approximately 10 seconds.

\*3: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the vehicle is accelerated for approximately 10 seconds.

\*4: When the mass air flow meter malfunctions, the MAF output may deviate from the standard (referential) range when the engine idles and is accelerated from 3,000 to 4,000 rpm with full throttle acceleration.



**Model (CDT250-####Y# and CDE120-####X#):**

Item	Engine Speed *1	Standard Range	Description
PIM *2	Ignition switch ON (engine stopped)	Same as atmospheric pressure	Intake manifold internal pressure detected by intake pressure sensor
	Idling	92 to 102 kPa (690 to 765 mmHg, 27.17 to 30.13 in.Hg)	
	3,000 rpm (no engine load)	115 to 130 kPa (863 to 975 mmHg, 33.97 to 38.40 in.Hg)	
	3,000 rpm (driving with full throttle acceleration)	202 to 222 kPa (1,515 to 1,665 mmHg, 59.66 to 65.57 in.Hg)	
	3,500 rpm (driving with full throttle acceleration)	202 to 222 kPa (1,515 to 1,665 mmHg, 59.66 to 65.57 in.Hg)	
	4,000 rpm (driving with full throttle acceleration)	92 to 112 kPa (690 to 840 mmHg, 27.17 to 33.08 in.Hg)	
MAF *2, *4	Ignition switch ON (engine stopped)	0 g/s	Intake air volume detected by mass air flow meter
	Idling	3 to 9 g/s	
	3,000 rpm (no engine load)	30 to 36 g/s	
	3,000 rpm (driving with full throttle acceleration)	95 to 115 g/s	
	3,500 rpm (driving with full throttle acceleration)	107 to 127 g/s	
	4,000 rpm (driving with full throttle acceleration)	110 to 130 g/s	
Common Rail Pressure *3	Idling	29 to 35 MPa	Common rail internal fuel pressure
	2,000 rpm (no engine load)	37 to 70 MPa	
	3,000 rpm (no engine load)	50 to 72 MPa	
	3,000 rpm (driving with full throttle acceleration)	145 to 155 MPa	
	3,500 rpm (driving with full throttle acceleration)	152 to 162 MPa	
	4,000 rpm (driving with full throttle acceleration)	155 to 162 MPa	

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

\*2: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the stable boost pressure is maintained for approximately 10 seconds.

\*3: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the vehicle is accelerated for approximately 10 seconds.

\*4: When the mass air flow meter malfunctions, the MAF output may deviate from the standard (referential) range when the engine idles and is accelerated from 3,000 to 4,000 rpm with full throttle acceleration.

**Model (2KD-FTV Engine w/o Intercooler):**

Item	Engine Speed *1	Standard Range	Description
PIM *2	Ignition switch ON (engine stopped)	Same as atmospheric pressure	Intake manifold internal pressure detected by intake pressure sensor
	Idling	92 to 102 kPa (690 to 765 mmHg, 27.17 to 30.13 in.Hg)	
	3,000 rpm (no engine load)	122 to 132 kPa (915 to 990 mmHg, 36.03 to 38.99 in.Hg)	
	3,000 rpm (driving with full throttle acceleration)	182 to 192 kPa (1,365 to 1,440 mmHg, 53.75 to 56.71 in.Hg)	
	3,500 rpm (driving with full throttle acceleration)	180 to 190 kPa (1,350 to 1,425 mmHg, 53.16 to 56.12 in.Hg)	
	4,000 rpm (driving with full throttle acceleration)	176 to 186 kPa (1,320 to 1,395 mmHg, 51.98 to 54.94 in.Hg)	
MAF *2, *4	Ignition switch ON (engine stopped)	0 g/s	Intake air volume detected by mass air flow meter
	Idling	4 to 9 g/s	
	3,000 rpm (no engine load)	40 to 60 g/s	
	3,000 rpm (driving with full throttle acceleration)	87 to 107 g/s	
	3,500 rpm (driving with full throttle acceleration)	100 to 120 g/s	
	4,000 rpm (driving with full throttle acceleration)	110 to 130 g/s	
Common Rail Pressure *3	Idling	25 to 35 MPa	Common rail internal fuel pressure
	2,000 rpm (no engine load)	40 to 50 MPa	
	3,000 rpm (no engine load)	43 to 53 MPa	
	3,000 rpm (driving with full throttle acceleration)	108 to 118 MPa	
	3,500 rpm (driving with full throttle acceleration)	127 to 137 MPa	
	4,000 rpm (driving with full throttle acceleration)	130 to 140 MPa	

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

\*2: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the stable boost pressure is maintained for approximately 10 seconds.

\*3: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the vehicle is accelerated for approximately 10 seconds.

\*4: When the mass air flow meter malfunctions, the MAF output may deviate from the standard (referential) range when the engine idles and is accelerated from 3,000 to 4,000 rpm with full throttle acceleration.

**Model (2KD-FTV Engine w/ Intercooler):**

Item	Engine Speed *1	Standard Range	Description
PIM *2	Ignition switch ON (engine stopped)	Same as atmospheric pressure	Intake manifold internal pressure detected by intake pressure sensor
	Idling	93 to 103 kPa (698 to 773 mmHg, 27.47 to 30.42 in.Hg)	
	3,000 rpm (no engine load)	120 to 130 kPa (900 to 975 mmHg, 35.44 to 38.40 in.Hg)	
	3,000 rpm (driving with full throttle acceleration)	178 to 188 kPa (1,335 to 1,410 mmHg, 52.57 to 55.53 in.Hg)	
	3,500 rpm (driving with full throttle acceleration)	177 to 187 kPa (1,328 to 1,403 mmHg, 52.28 to 55.23 in.Hg)	
	4,000 rpm (driving with full throttle acceleration)	172 to 182 kPa (1,290 to 1,365 mmHg, 50.80 to 53.75 in.Hg)	
MAF *2, *4	Ignition switch ON (engine stopped)	0 g/s	Intake air volume detected by mass air flow meter
	Idling	4 to 9 g/s	
	3,000 rpm (no engine load)	37 to 57 g/s	
	3,000 rpm (driving with full throttle acceleration)	96 to 116 g/s	
	3,500 rpm (driving with full throttle acceleration)	110 to 130 g/s	
	4,000 rpm (driving with full throttle acceleration)	120 to 140 g/s	
Common Rail Pressure *3	Idling	25 to 35 MPa	Common rail internal fuel pressure
	2,000 rpm (no engine load)	40 to 50 MPa	
	3,000 rpm (no engine load)	43 to 53 MPa	
	3,000 rpm (driving with full throttle acceleration)	108 to 118 MPa	
	3,500 rpm (driving with full throttle acceleration)	127 to 137 MPa	
	4,000 rpm (driving with full throttle acceleration)	130 to 140 MPa	

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

\*2: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the stable boost pressure is maintained for approximately 10 seconds.

\*3: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the vehicle is accelerated for approximately 10 seconds.

\*4: When the mass air flow meter malfunctions, the MAF output may deviate from the standard (referential) range when the engine idles and is accelerated from 3,000 to 4,000 rpm with full throttle acceleration.

**Model (KDJ##-##### 1KD-FTV Engine) (KDJ###-##### 1KD-FTV Engine):**

Item	Engine Speed *1	Standard Range	Description
PIM *2	Ignition switch ON (engine stopped)	Same as atmospheric pressure	Intake manifold internal pressure detected by intake pressure sensor
	Idling	92 to 102 kPa (690 to 765 mmHg, 27.17 to 30.13 in.Hg)	
	3,000 rpm (no engine load)	107 to 117 kPa (803 to 878 mmHg, 31.60 to 34.56 in.Hg)	
	3,000 rpm (driving with full throttle acceleration)	195 to 215 kPa (1,463 to 1,613 mmHg, 57.59 to 63.50 in.Hg)	
	3,500 rpm (driving with full throttle acceleration)	193 to 213 kPa (1,448 to 1,598 mmHg, 57.00 to 62.91 in.Hg)	
	4,000 rpm (driving with full throttle acceleration)	180 to 200 kPa (1,350 to 1,500 mmHg, 53.16 to 59.07 in.Hg)	
MAF *2, *4	Ignition switch ON (engine stopped)	0 g/s	Intake air volume detected by mass air flow meter
	Idling	5 to 10 g/s	
	3,000 rpm (no engine load)	52 to 72 g/s	
	3,000 rpm (driving with full throttle acceleration)	132 to 152 g/s	
	3,500 rpm (driving with full throttle acceleration)	150 to 170 g/s	
	4,000 rpm (driving with full throttle acceleration)	155 to 175 g/s	
Common Rail Pressure *3	Idling	30 to 40 MPa	Common rail internal fuel pressure
	2,000 rpm (no engine load)	45 to 55 MPa	
	3,000 rpm (no engine load)	62 to 82 MPa	
	3,000 rpm (driving with full throttle acceleration)	127 to 137 MPa	
	3,500 rpm (driving with full throttle acceleration)	130 to 140 MPa	
	4,000 rpm (driving with full throttle acceleration)	130 to 140 MPa	

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

\*2: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the stable boost pressure is maintained for approximately 10 seconds.

\*3: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the vehicle is accelerated for approximately 10 seconds.

\*4: When the mass air flow meter malfunctions, the MAF output may deviate from the standard (referential) range when the engine idles and is accelerated from 3,000 to 4,000 rpm with full throttle acceleration.

**Model (KDN###-##### 1KD-FTV Engine):**

Item	Engine Speed *1	Standard Range	Description
PIM *2	Ignition switch ON (engine stopped)	Same as atmospheric pressure	Intake manifold internal pressure detected by intake pressure sensor
	Idling	95 to 105 kPa (713 to 788 mmHg, 28.06 to 31.01 in.Hg)	
	3,000 rpm (no engine load)	138 to 158 kPa (1,035 to 1,185 mmHg, 40.76 to 46.67 in.Hg)	
	3,000 rpm (driving with full throttle acceleration)	184 to 204 kPa (1,380 to 1,530 mmHg, 54.34 to 60.25 in.Hg)	
	3,500 rpm (driving with full throttle acceleration)	174 to 194 kPa (1,305 to 1,455 mmHg, 51.39 to 57.29 in.Hg)	
MAF *2, *4	Ignition switch ON (engine stopped)	0 g/s	Intake air volume detected by mass air flow meter
	Idling	8 to 13 g/s	
	3,000 rpm (no engine load)		
	3,000 rpm (driving with full throttle acceleration)	103 to 133 g/s	
	3,500 rpm (driving with full throttle acceleration)	114 to 144 g/s	
Common Rail Pressure *3	Idling	30 to 40 MPa	Common rail internal fuel pressure
	2,000 rpm (no engine load)	45 to 55 MPa	
	3,000 rpm (no engine load)	60 to 80 MPa	
	3,000 rpm (driving with full throttle acceleration)	125 to 145 MPa	
	3,500 rpm (driving with full throttle acceleration)	125 to 145 MPa	
	4,000 rpm (driving with full throttle acceleration)	125 to 145 MPa	

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

\*2: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the stable boost pressure is maintained for approximately 10 seconds.

\*3: This value is indicated when the ambient temperature is 25°C (77°F) and the atmospheric pressure is 101kPa (758 mmHg, 29.83 in.Hg), and the vehicle is accelerated for approximately 10 seconds.

\*4: When the mass air flow meter malfunctions, the MAF output may deviate from the standard (referential) range when the engine idles and is accelerated from 3,000 to 4,000 rpm with full throttle acceleration.

## Standard Range Lists of Revised Injection Volume and Injection Volume: Model (1CD-FTV Engine):

Item	Engine Speed *1	Standard Range	Description
Revised Injection Volume #1	Idling	-3.0 to 3.0 mm <sup>3</sup>	Value of injector fuel injection volume compensates for differences in combustion condition of the each cylinders • Positive values indicate control which corrects combustion degradation • Negative values indicate control which corrects excessive combustion pressure • If problems exist, Revised Injection Volume may deviate from -3.0 mm and 3.0 mm range
Revised Injection Volume #2	Idling	-3.0 to 3.0 mm <sup>3</sup>	
Revised Injection Volume #3	Idling	-3.0 to 3.0 mm <sup>3</sup>	
Revised Injection Volume #4	Idling	-3.0 to 3.0 mm <sup>3</sup>	
Injection Volume	Idling	3.0 to 10.0 mm <sup>3</sup>	Fuel injection volume value controlled by the ECM • The ECM controls the fuel injection volume based on NE signal, fuel temperature, engine coolant temperature, intake air temperature, boost pressure, atmospheric pressure, EGR volume, and MAF

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

**Model (2KD-FTV Engine):**

Item	Engine Speed *1	Standard Range	Description
Revised Injection Volume #1	Idling	-3.0 to 3.0 mm <sup>3</sup>	Value of injector fuel injection volume compensates for differences in combustion condition of the each cylinders • Positive values indicate control which corrects combustion degradation • Negative values indicate control which corrects excessive combustion pressure • If problems exist, Revised Injection Volume may deviate from -3.0 mm and 3.0 mm range
Revised Injection Volume #2	Idling	-3.0 to 3.0 mm <sup>3</sup>	
Revised Injection Volume #3	Idling	-3.0 to 3.0 mm <sup>3</sup>	
Revised Injection Volume #4	Idling	-3.0 to 3.0 mm <sup>3</sup>	
Injection Volume	Idling	4.0 to 11.0 mm <sup>3</sup>	Fuel injection volume value controlled by the ECM • The ECM controls the fuel injection volume based on NE signal, fuel temperature, engine coolant temperature, intake air temperature, boost pressure, atmospheric pressure, EGR volume, and MAF

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.

**Model (1KD-FTV Engine):**

Item	Engine Speed *1	Standard Range	Description
Revised Injection Volume #1	Idling	-3.0 to 3.0 mm <sup>3</sup>	Value of injector fuel injection volume compensates for differences in combustion condition of the each cylinders • Positive values indicate control which corrects combustion degradation • Negative values indicate control which corrects excessive combustion pressure • If problems exist, Revised Injection Volume may deviate from -3.0 mm and 3.0 mm range
Revised Injection Volume #2	Idling	-3.0 to 3.0 mm <sup>3</sup>	
Revised Injection Volume #3	Idling	-3.0 to 3.0 mm <sup>3</sup>	
Revised Injection Volume #4	Idling	-3.0 to 3.0 mm <sup>3</sup>	
Injection Volume	Idling	5.0 to 12.0 mm <sup>3</sup>	Fuel injection volume value controlled by the ECM • The ECM controls the fuel injection volume based on NE signal, fuel temperature, engine coolant temperature, intake air temperature, boost pressure, atmospheric pressure, EGR volume, and MAF

**HINT:**

\*1: The A/C switch and all accessory switches should be OFF with a fully warm engine.