TURBOCHARGER INSPECTION [SKYACTIV-D 2.2]

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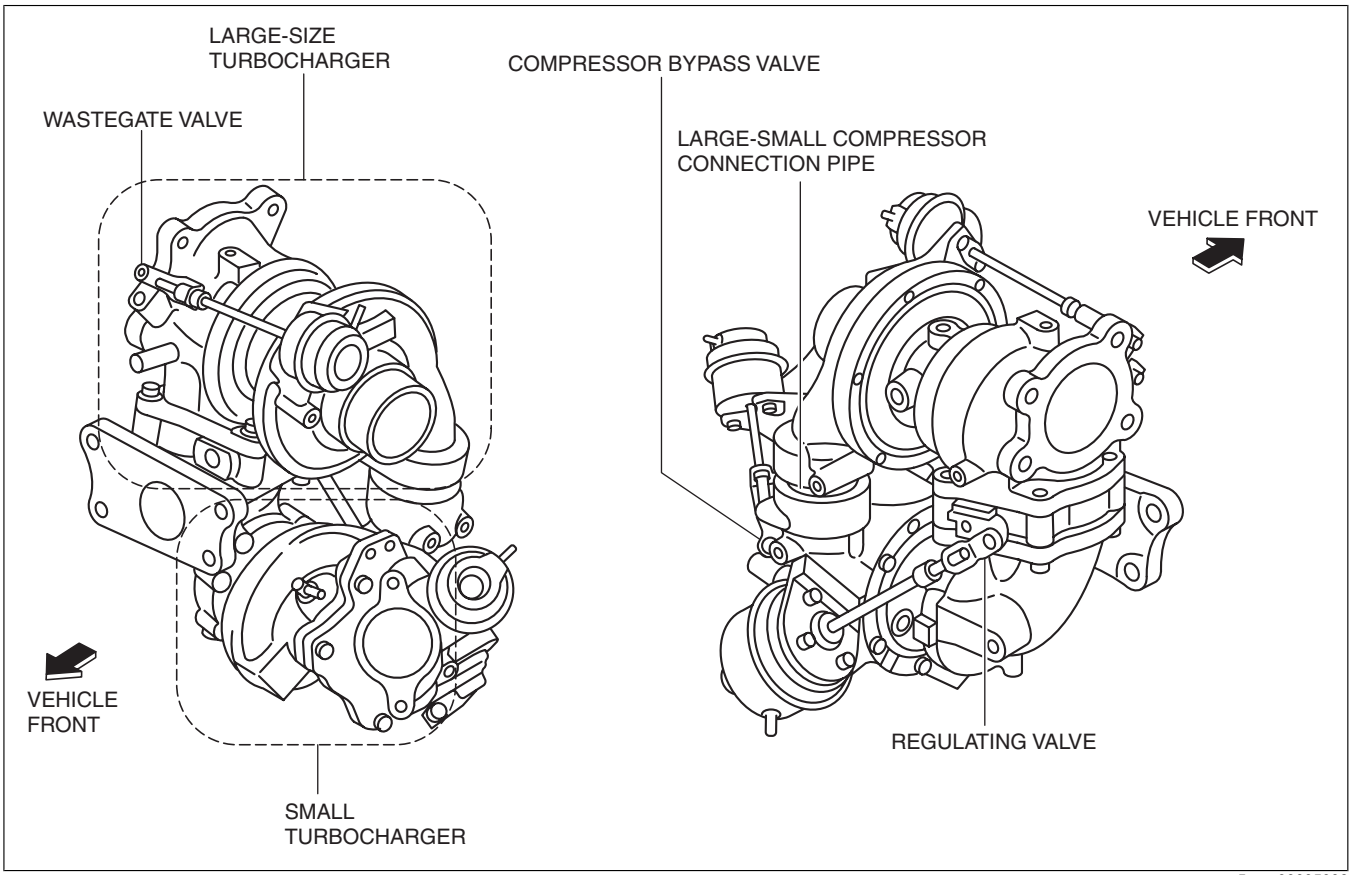
Prior Inspection

1. Inspect the idle speed. (See ENGINE TUNE-UP [SKYACTIV-D 2.2].)
2. Inspect the cooling system. (See NO.22 COOLING SYSTEM CONCERNS-OVERHEATING [SKYACTIV-D 2.2].)
3. Verify if a Soot Accumulation in DPF too high or DPF Inspection Required message is displayed in the TFT LCD.
   - If a Soot Accumulation in DPF too high message is displayed, perform compulsory DPF regeneration. (See COMPULSORY DIESEL PARTICULATE FILTER REGENERATION [SKYACTIV-D 2.2].)
   - If a DPF Inspection Required message is displayed, perform a DTC inspection. (See DTC TABLE [SKYACTIV-D 2.2].)
4. Verify if the fuel tank level warning light is illuminated.
   - If it is illuminated, refuel.
   - If it is not illuminated, verify if the fuel being used is appropriate.
5. Inspect the fuel filter. (See FUEL FILTER INSPECTION [SKYACTIV-D 2.2].)
6. Inspect the vacuum pump and vacuum lines. (See VACUUM PUMP INSPECTION.) (See VACUUM LINE INSPECTION.)
7. Inspect the cooling fan. (See COOLING FAN MOTOR REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
8. Inspect the fan control module. (See FAN CONTROL MODULE INSPECTION [SKYACTIV-D 2.2].)
9. Inspect the charge air cooler. (See CHARGE AIR COOLER INSPECTION [SKYACTIV-D 2.2].)
10. Inspect the intake-air system related hoses for disconnection.
11. Inspect the air cleaner element. (See AIR CLEANER ELEMENT INSPECTION [SKYACTIV-D 2.2].)

Symptom Troubleshooting Selection

MALFUNCTION	DIAGNOSTIC SYSTEM INSPECTION ITEMS
• Turbocharger malfunction — Large-type turbine malfunction — Large-type turbine wheel damage, sticking — Large-type compressor malfunction — Large-type compressor wheel damage, sticking — Small-type turbine malfunction — Small-type turbine wheel damage, sticking — Small-type compressor malfunction — Small-type compressor wheel damage, sticking • Compressor bypass valve malfunction • Wastegate valve malfunction	(See Charging Deficiency Inspection.)
• Turbocharger shaft seal malfunction	(See Oil Leakage Inspection.)
• Interference with turbocharger rotation mechanism housing	(See Abnormal Noise Inspection.)

Structural view



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Charging Deficiency Inspection
Malfunction location determination (large-type turbocharger, small-type turbocharger)

1. Shift the selector lever (ATX) or shift lever (MTX) to the following position:
   - ATX:Selector lever is in P position.
   - MTX:Shift lever is in neutral position.
2. Start the engine.
3. Connect the M-MDS to the DLC-2.
4. Display PID MAP and BARO using the data logger function.
5. Depress the accelerator pedal and verify the MAP and BARO value when the engine rotation speed rises to 3,500 rpm or more.

   Difference between MAP and BARO is less than 10 kPa {75 mmHg, 3.0 inHg}
   - Perform charging deficiency inspection for large-type turbocharger. (See Large-type turbocharger charging deficiency inspection.)

   Difference between MAP and BARO is 10 kPa {75 mmHg, 3.0 inHg} or more
   - Perform charging deficiency inspection for small-type turbocharger. (See Small-type turbocharger charging deficiency inspection.)

Large-type turbocharger charging deficiency inspection

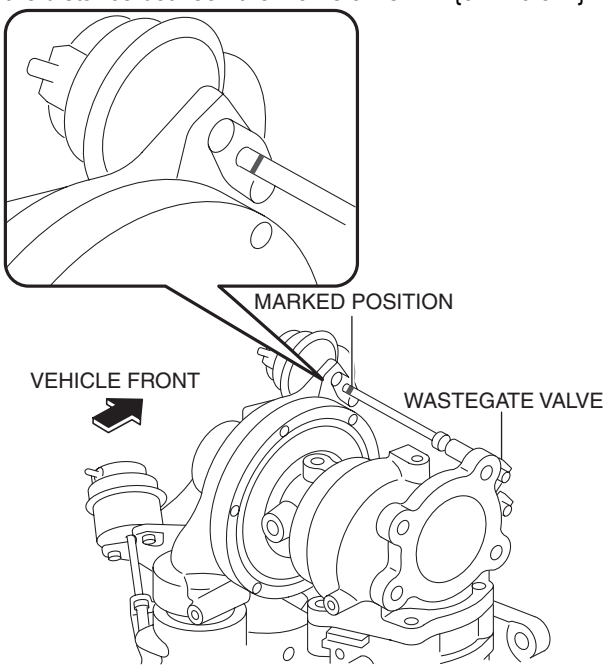
Possible cause

MALFUNCTION OCCURRENCE LOCATION		PHENOMENON	CAUSE	INSPECTION ORDER
Large-type compressor side	Large-small compressor connection pipe	Pressurization leak	Connection looseness or disconnection of large-small compressor connection pipe	1
	Compressor bypass valve	Pressurization leak	Crack in compressor bypass valve outlet	2
		Small valve opening angle	Valve sticking Rod link deformity Vacuum malfunction in compressor bypass solenoid valve	6

MALFUNCTION OCCURRENCE LOCATION		PHENOMENON	CAUSE	INSPECTION ORDER
Large-type turbine side	Between turbine inlet and cylinder head Regulating valve Between turbine outlet and catalytic converter	Exhaust gas leakage	Cracks Gasket deterioration	3, 11
Regulating valve		Small valve opening angle	Valve sticking Rod link deformity, deviation, interference Vacuum malfunction in regulating solenoid valve	4, 13
		Exhaust gas leakage	Cracks	12
Wastegate valve		Large valve opening angle	Valve sticking Rod link deformity Vacuum malfunction in wastegate solenoid valve	5
		Exhaust gas leakage	Valve deformity Foreign matter adhering to seal surface	10
Large-type compressor wheel		Wheel damage or sticking	Foreign matter penetration Rotation exceeds threshold maximum	7
Large-type turbocharger shaft or bearing		Sticking or dislodged, broken large-type compressor installation nut	Foreign matter penetration Deficient lubrication	8
Large-type turbine wheel		Wheel damage or sticking	Foreign matter penetration Rotation exceeds threshold maximum	9

Large-type turbocharger charging deficiency inspection (on-vehicle inspection)

STEP	INSPECTION	RESULTS	ACTION
1	**INSPECTION OF PRESSURIZATION LEAKAGE FROM LARGE-SMALL COMPRESSOR CONNECTION PIPE** • Inspect for disconnection, looseness in large-small compressor connection pipe. • If there is even slight looseness, apply soapy water and verify if bubbles are produced while running the engine under no load (selector lever in P position, engine speed 3000 to 3500 rpm.) • Are bubbles produced?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
2	**INSPECTION OF PRESSURIZATION LEAKAGE FROM COMPRESSOR BYPASS VALVE OUTLET** • Inspect the compressor bypass valve outlet area for cracks. • If cracking locations cannot be discerned, apply soapy water and verify if bubbles are produced while running the engine under no load (selector lever in P position, engine speed 3000 to 3500 rpm.) • Are there cracks or bubbles produced?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
3	**INSPECTION OF EXHAUST GAS LEAKAGE FROM LARGE-TYPE TURBINE SIDE** • Inspect the following locations for the sound of exhaust gas leakage. — Between turbine inlet and cylinder head — Regulating valve — Between turbine outlet and catalytic converter • Is there exhaust gas leakage?	Yes	Go to Step 11 of the large-type turbocharger charging deficiency inspection (single-unit inspection).
		No	Go to the next step.
4	**REGULATING VALVE OPENING ANGLE INSPECTION** • Verify PID REGVP and REGVP_DSD using the M-MDS data logger function. • Maintain the engine speed at 3,500 rpm or more for 10 s. • Is the difference between REGVP and REGVP_DSD 1.0 mm {0.039 in} or more?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Inspect the vacuum pipe. If it is normal, go to the next step. If there is any malfunction, repair or replace the malfunctioning part.

STEP	INSPECTION	RESULTS	ACTION
5	**WASTEGATE VALVE OPENING ANGLE INSPECTION** • Perform the following inspections: — Move the wastegate valve rod by hand in the axial direction. • Does it move normally? **Caution** **• Do not apply excessive load to the rod.** **• Do not use a tool.** — Remove the wastegate valve vacuum pipe, and inspect the lift amount using the vacuum pump. • Starting with a change in lift amount of approx. -6 kPa {-45 mmHg, -2 inHg}, is the maximum lift (approx. 6 mm {0.2 in}) at a rate of approx. -20 kPa {-150 mmHg, -5.9 inHg} while conforming smoothly to the vacuum amount? — After marking the rod with the engine stopped, mark the rod again while the engine is idling. Then, turn off the engine and measure the distance between the two marked locations. • Is the distance between the marks 5—8 mm {0.2—0.3 in}?  • Is there any malfunction in the inspection results?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
6	**COMPRESSOR BYPASS VALVE OPENING ANGLE INSPECTION** • Perform the following inspections: — Is the compressor bypass valve link deviated? — Remove the air pipe of the compressor outlet and verify that the compressor bypass valve closes normally and that there are no gaps. — Remove the compressor bypass valve vacuum pipe, and verify the lift amount with a vacuum pump. Starting with a change in lift amount of approx. -30 kPa {-225 mmHg, -8.9 inHg}, is the maximum lift amount (approx. 11 mm {0.43 in}) at approx. -60 kPa {-450 mmHg, -18 inHg}? • Is there any malfunction in the inspection results?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
7	**LARGE-TYPE COMPRESSOR WHEEL INSPECTION** • Remove the intake air hose and, using a mirror, visually inspect the wheel condition from the intake air side. • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
8	**LARGE-TYPE TURBOCHARGER SHAFT AND BEARING INSPECTION** • Rotate the induction side by hand and inspect for play in the axial direction. • Does the shaft not rotate smoothly or is there play of 0.5 mm {0.02 in} or more?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
9	**LARGE-TYPE TURBINE WHEEL INSPECTION** • Remove the catalytic converter and visually inspect the wheel condition from the exhaust gas side. (See EXHAUST SYSTEM REMOVAL/INSTALLATION [SKYACTIV-D 2.2].) • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
10	**INSPECTION OF GAS LEAKAGE FROM WASTEGATE VALVE** • Remove the catalytic converter and visually inspect the valve from the exhaust gas side. (If there is foreign matter adhering such as carbon to the seal surface, remove it.) (See EXHAUST SYSTEM REMOVAL/INSTALLATION [SKYACTIV-D 2.2].) • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Remove the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].) Go to Step 13 of the large-type turbocharger charging deficiency inspection (single-unit inspection).

Large-type turbocharger charging deficiency inspection (single-unit inspection)

STEP	INSPECTION	RESULTS	ACTION
11	**INSPECTION OF EXHAUST GAS LEAKAGE FROM TURBOCHARGER INSTALLATION AREA** • Visually inspect the following parts: — Gasket between turbine inlet area and cylinder head — Gasket between turbine outlet area and catalytic converter • Is there evidence of exhaust gas leakage on the gasket*, or cracks spreading to the edge of the gasket?	Yes	If there is evidence of exhaust gas leakage on the gasket, replace with an appropriate gasket. If there are cracks on the edge of the gasket, replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
12	**INSPECT FOR EXHAUST GAS LEAKAGE FROM THE TURBINE HOUSING OR REGULATING VALVE** • Are there cracks penetrating the turbine housing and regulating valve housing?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
13	**INSPECTION OF REGULATING VALVE OPENING ANGLE** • Visually inspect the link area of the regulating valve. • Is there deviation or interference?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	The large-type turbocharger is normal.

Small-type turbocharger charging deficiency inspection

Possible cause

MALFUNCTION OCCURRENCE LOCATION		PHENOMENON	CAUSE	INSPECTION ORDER
Small-type compressor side	Large-small compressor connection pipe	Pressurization leak	Connection looseness or disconnection of large-small compressor connection pipe	1
	Compressor bypass valve	Pressurization leak	Crack in compressor bypass valve outlet	2
		Large valve opening angle	Valve sticking Rod link deformity Vacuum malfunction in compressor bypass solenoid valve	6
		Exhaust gas leakage	Valve deformity Foreign matter adhering to seal surface	7

MALFUNCTION OCCURRENCE LOCATION		PHENOMENON	CAUSE	INSPECTION ORDER
Small-type turbine side	Between turbine inlet and cylinder head Between turbine outlet and catalytic converter	Exhaust gas leakage	Cracks Gasket deterioration	3, 10
Regulating valve		Large valve opening angle	Valve sticking Rod link deformity Vacuum malfunction in regulating solenoid valve	4, 5, 12
		Exhaust gas leakage	Cracks Valve deformity Foreign matter adhering to seal surface	10, 11
Small-type compressor wheel		Wheel damage or sticking	Foreign matter penetration Rotation exceeds threshold maximum	8
Small-type turbocharger shaft or bearing		Sticking or dislodged, broken small-type compressor installation nut	Foreign matter penetration Deficient lubrication	9

Small-type turbocharger charging deficiency inspection (on-vehicle inspection)

STEP	INSPECTION	RESULTS	ACTION
1	**INSPECTION OF PRESSURIZATION LEAKAGE FROM LARGE-SMALL COMPRESSOR CONNECTION PIPE** • Inspect for disconnection, looseness in large-small compressor connection pipe. • If there is even slight looseness, apply soapy water and verify if bubbles are produced while running the engine under no load (selector lever in P position, engine speed 3000 to 3500 rpm.) • Are bubbles produced?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
2	**INSPECTION OF PRESSURIZATION LEAKAGE FROM COMPRESSOR BYPASS VALVE OUTLET** • Inspect the compressor bypass valve outlet area for cracks. • If cracking locations cannot be discerned, apply soapy water and verify if bubbles are produced while running the engine under no load (selector lever in P position, engine speed 3000 to 3500 rpm.) • Are there cracks or bubbles produced?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
3	**INSPECTION OF EXHAUST GAS LEAKAGE FROM SMALL-TYPE TURBINE SIDE** • Inspect the following locations for the sound of exhaust gas leakage. — Between turbine inlet and cylinder head — Between turbine outlet and catalytic converter • Is there exhaust gas leakage?	Yes	Go to Step 9 of the Small-type turbocharger charging deficiency inspection (single-unit inspection).
		No	Go to the next step.
4	**REGULATING VALVE OPENING ANGLE INSPECTION** • Verify PID REGVP and REGVP_DSD using the M-MDS data logger function. • Idle the engine. • Is the difference between REGVP and REGVP_DSD 1.0 mm {0.039 in} or more?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Inspect the vacuum pipe. If it is normal, go to the next step. If there is any malfunction, repair or replace the malfunctioning part.
5	**REGULATING VALVE OPENING ANGLE INSPECTION** • Display PID REGV using the M-MDS data logger function. • Idle the engine. • Is the value for REGV 50 % or more?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Inspect the vacuum pipe. If it is normal, go to the next step. If there is any malfunction, repair or replace the malfunctioning part.

STEP	INSPECTION	RESULTS	ACTION
6	**COMPRESSOR BYPASS VALVE OPENING ANGLE INSPECTION** • Perform the following inspections: — Is the compressor bypass valve link deviated? — Remove the air pipe of the compressor outlet and verify that the compressor bypass valve closes normally and that there are no gaps. — Remove the compressor bypass valve vacuum pipe, and verify the lift amount with a vacuum pump. Starting with a change in lift amount of approx. -30 kPa {-225 mmHg, -8.9 inHg}, is the maximum lift amount (approx. 11 mm {0.43 in}) at approx. -60 kPa {-450 mmHg, -18 inHg}? • Is there any malfunction in the inspection results?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
7	**INSPECT FOR GAS LEAKAGE FROM COMPRESSOR BYPASS VALVE** • Remove the intake air hose and visually inspect the compressor bypass valve. (If there is foreign matter adhering such as carbon to the seal surface, remove it.) • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
8	**INSPECTION OF SMALL-TYPE COMPRESSOR WHEEL** • Open the compressor bypass valve and visually inspect the wheel condition from the intake air side. • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
9	**INSPECTION OF SMALL-TYPE TURBOCHARGER SHAFT AND BEARING** • Open the compressor bypass valve and verify that the rotation is smooth using a long object (long rod) from the intake air side. **Caution** **• Do not apply excessive load. Otherwise, the compressor wheel could be damaged.** • Is the part normal?	Yes	Go to Step 12 of the Small-type turbocharger charging deficiency inspection (single-unit inspection).
		No	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)

Small-type turbocharger charging deficiency inspection (single-unit inspection)

STEP	INSPECTION	RESULTS	ACTION
10	**INSPECTION OF EXHAUST GAS LEAKAGE FROM TURBOCHARGER INSTALLATION AREA** • Visually inspect the following parts: — Gasket between turbine inlet area and cylinder head — Gasket between turbine outlet area and catalytic converter • Is there evidence of exhaust gas leakage on the gasket*, or cracks spreading to the edge of the gasket?	Yes	If there is evidence of exhaust gas leakage on the gasket, replace with an appropriate gasket. If there are cracks on the edge of the gasket, replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
11	**INSPECT FOR EXHAUST GAS LEAKAGE FROM THE TURBINE HOUSING OR REGULATING VALVE** • Are there cracks penetrating the turbine housing and regulating valve housing?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
12	**INSPECTION OF REGULATING VALVE OPENING ANGLE** • Visually inspect the link area of the regulating valve. • Is there deviation or interference?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	The Small-type turbocharger is normal.

* : Evidence of burning from exhaust gas leakage or soot adhering to the exterior side of the gasket bead.

Oil Leakage Inspection
Oil leakage inspection of compressor side

Possible cause

MALFUNCTION OCCURRENCE LOCATION	PHENOMENON	CAUSE	INSPECTION ORDER
Regulating valve	Largel valve opening angle	Valve sticking Rod link deformity Vacuum malfunction in regulating solenoid valve	1
Compressor bypass valve	Large valve opening angle	Valve sticking Rod link deformity Vacuum malfunction in compressor bypass solenoid valve	2
	Exhaust gas leakage	Valve deformity Foreign matter adhering to seal surface	5
Large-type compressor wheel	Wheel damage or sticking	Foreign matter penetration Rotation exceeds threshold maximum	3
Large-type turbocharger shaft or bearing	Sticking or dislodged, broken large-type compressor installation nut	Foreign matter penetration Deficient lubrication	4
Small-type compressor wheel	Wheel damage or sticking	Foreign matter penetration Rotation exceeds threshold maximum	6
Small-type turbocharger shaft or bearing	Sticking or dislodged, broken small-type compressor installation nut	Foreign matter penetration Deficient lubrication	7

Oil leakage inspection of compressor side

STEP	INSPECTION	RESULTS	ACTION
1	**REGULATING VALVE OPENING ANGLE INSPECTION** • Verify PID REGVP and REGVP_DSD using the M-MDS data logger function. • Idle the engine. • Is the difference between REGVP and REGVP_DSD 1.0 mm {0.039 in} or more?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Inspect the vacuum pipe. If it is normal, go to the next step. If there is any malfunction, repair or replace the malfunctioning part.
2	**COMPRESSOR BYPASS VALVE OPENING ANGLE INSPECTION** • Perform the following inspections: — Is the compressor bypass valve link deviated? — Remove the air pipe of the compressor outlet and verify that the compressor bypass valve closes normally and that there are no gaps. — Remove the compressor bypass valve vacuum pipe, and verify the lift amount with a vacuum pump. Starting with a change in lift amount of approx. -30 kPa {-225 mmHg, -8.9 inHg}, is the maximum lift amount (approx. 11 mm {0.43 in}) at approx. -60 kPa {-450 mmHg, -18 inHg}? • Is there any malfunction in the inspection results?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
3	**LARGE-TYPE COMPRESSOR WHEEL INSPECTION** • Remove the intake air hose and, using a mirror, visually inspect the wheel condition from the intake air side. • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
4	**LARGE-TYPE TURBOCHARGER SHAFT AND BEARING INSPECTION** • Rotate the induction side by hand and inspect for play in the axial direction. • Does the shaft not rotate smoothly or is there play of 0.5 mm {0.02 in} or more?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
5	**INSPECT FOR GAS LEAKAGE FROM COMPRESSOR BYPASS VALVE** • Remove the intake air hose and visually inspect the compressor bypass valve. (If there is foreign matter adhering such as carbon to the seal surface, remove it.) • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
6	**INSPECTION OF SMALL-TYPE COMPRESSOR WHEEL** • Open the compressor bypass valve and visually inspect the wheel condition from the intake air side. • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
7	**INSPECTION OF SMALL-TYPE TURBOCHARGER SHAFT AND BEARING** • Open the compressor bypass valve and verify that the rotation is smooth using a long object (long rod) from the intake air side. **Caution** **• Do not apply excessive load. Otherwise, the compressor wheel could be damaged.** • Is the part normal?	Yes	The turbocharger is normal.
		No	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)

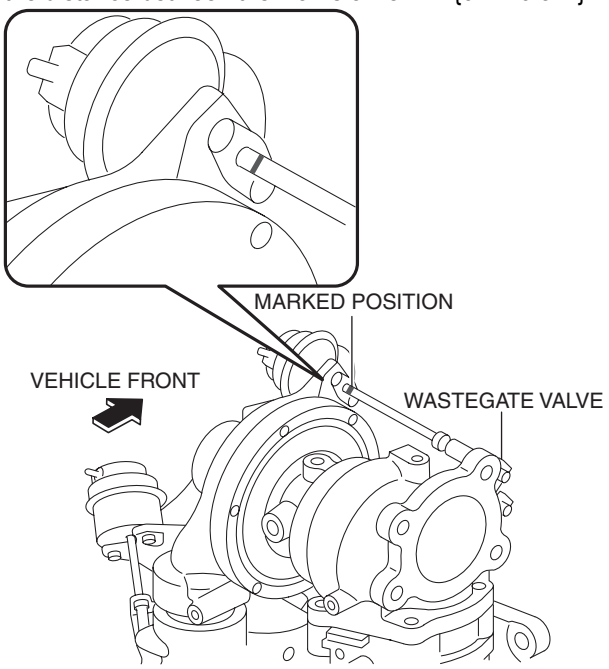
Oil leakage inspection on turbine side

Possible cause

MALFUNCTION OCCURRENCE LOCATION	PHENOMENON	CAUSE	INSPECTION ORDER
Regulating valve	Largel valve opening angle	Valve sticking Rod link deformity Vacuum malfunction in regulating solenoid valve	1
Wastegate valve	Large valve opening angle	Valve sticking Rod link deformity Vacuum malfunction in wastegate solenoid valve	2
	Exhaust gas leakage	Valve deformity Foreign matter adhering to seal surface	6
Large-type turbocharger shaft or bearing	Sticking or dislodged, broken large-type compressor installation nut	Foreign matter penetration Deficient lubrication	3
Small-type turbocharger shaft or bearing	Sticking or dislodged, broken small-type compressor installation nut	Foreign matter penetration Deficient lubrication	4
Large-type turbine wheel	Wheel damage or sticking	Foreign matter penetration Rotation exceeds threshold maximum	5

Oil leakage inspection on turbine side

STEP	INSPECTION	RESULTS	ACTION
1	**REGULATING VALVE OPENING ANGLE INSPECTION** • Verify PID REGVP and REGVP_DSD using the M-MDS data logger function. • Is the difference less than 1.0 mm {0.039 in}?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Inspect the vacuum pipe. If it is normal, go to the next step. If there is any malfunction, repair or replace the malfunctioning part.

STEP	INSPECTION	RESULTS	ACTION
2	**WASTEGATE VALVE OPENING ANGLE INSPECTION** • Perform the following inspections: — Move the wastegate valve rod by hand in the axial direction. • Does it move normally? **Caution** **• Do not apply excessive load to the rod.** **• Do not use a tool.** — Remove the wastegate valve vacuum pipe, and inspect the lift amount using the vacuum pump. • Starting with a change in lift amount of approx. -6 kPa {-45 mmHg, -2 inHg}, is the maximum lift (approx. 6 mm {0.2 in}) at a rate of approx. -20 kPa {-150 mmHg, -5.9 inHg} while conforming smoothly to the vacuum amount? — After marking the rod with the engine stopped, mark the rod again while the engine is idling. Then, turn off the engine and measure the distance between the two marked locations. • Is the distance between the marks 5—8 mm {0.2—0.3 in}?  • Is there any malfunction in the inspection results?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
3	**LARGE-TYPE TURBOCHARGER SHAFT AND BEARING INSPECTION** • Rotate the induction side by hand and inspect for play in the axial direction. • Does the shaft not rotate smoothly or is there play of 0.5 mm {0.02 in} or more?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
4	**INSPECTION OF SMALL-TYPE TURBOCHARGER SHAFT AND BEARING** • Open the compressor bypass valve and verify that the rotation is smooth using a long object (long rod) from the intake air side. **Caution** **• Do not apply excessive load. Otherwise, the compressor wheel could be damaged.** • Is the part normal?	Yes	Go to Step 11 of the Small-type turbocharger charging deficiency inspection (single-unit inspection).
		No	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
5	**LARGE-TYPE TURBINE WHEEL INSPECTION** • Remove the catalytic converter and visually inspect the wheel condition from the exhaust gas side. (See EXHAUST SYSTEM REMOVAL/INSTALLATION [SKYACTIV-D 2.2].) • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/ INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
6	**INSPECTION OF GAS LEAKAGE FROM WASTEGATE VALVE** • Remove the catalytic converter and visually inspect the valve from the exhaust gas side. (If there is foreign matter adhering such as carbon to the seal surface, remove it.) (See EXHAUST SYSTEM REMOVAL/INSTALLATION [SKYACTIV-D 2.2].) • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
		No	The turbocharger is normal.

Abnormal Noise Inspection

Possible cause

MALFUNCTION OCCURRENCE LOCATION	PHENOMENON	CAUSE	INSPECTION ORDER
Large-type compressor wheel	Wheel damage or sticking	Foreign matter penetration Rotation exceeds threshold maximum	1
Large-type turbocharger shaft or bearing	Sticking or dislodged, broken large-type compressor installation nut	Foreign matter penetration Deficient lubrication	2
Small-type compressor wheel	Wheel damage or sticking	Foreign matter penetration Rotation exceeds threshold maximum	3
Small-type turbocharger shaft or bearing	Sticking or dislodged, broken small-type compressor installation nut	Foreign matter penetration Deficient lubrication	4
Large-type turbine wheel	Wheel damage or sticking	Foreign matter penetration Rotation exceeds threshold maximum	5

Abnormal noise inspection

STEP	INSPECTION	RESULTS	ACTION
1	**LARGE-TYPE COMPRESSOR WHEEL INSPECTION** • Remove the intake air hose and, using a mirror, visually inspect the wheel condition from the intake air side. • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
2	**LARGE-TYPE TURBOCHARGER SHAFT AND BEARING INSPECTION** • Rotate the induction side by hand and inspect for play in the axial direction. • Does the shaft not rotate smoothly or is there play of 0.5 mm {0.02 in} or more?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
3	**INSPECTION OF SMALL-TYPE COMPRESSOR WHEEL** • Open the compressor bypass valve and visually inspect the wheel condition from the intake air side. • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
4	**INSPECTION OF SMALL-TYPE TURBOCHARGER SHAFT AND BEARING** • Open the compressor bypass valve and verify that the rotation is smooth using a long object (long rod) from the intake air side. **Caution** **• Do not apply excessive load. Otherwise, the compressor wheel could be damaged.** • Is the part normal?	Yes	Go to Step 11 of the Small-type turbocharger charging deficiency inspection (single-unit inspection).
		No	Replace the turbocharger. (See TURBOCHARGER REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
5	**LARGE-TYPE TURBINE WHEEL INSPECTION** • Remove the catalytic converter and visually inspect the wheel condition from the exhaust gas side. (See EXHAUST SYSTEM REMOVAL/INSTALLATION [SKYACTIV-D 2.2].) • Is there deformity or damage?	Yes	Replace the turbocharger. (See TURBOCHARGER REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
		No	The turbocharger is normal.