GROUP 00

GENERAL

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GENERAL <ELECTRICAL> 00E

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GROUP 00

GENERAL

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VEHICLE IDENTIFICATION

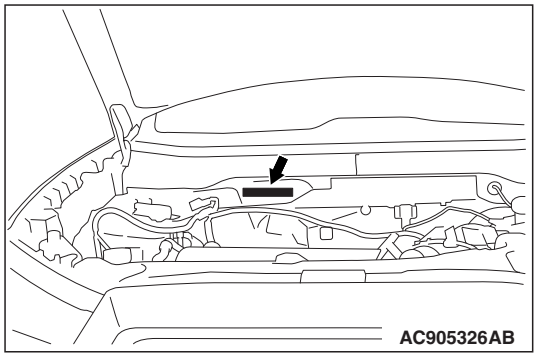
MODELS

M1001000307676

Model code		Seating capacity	Engine model	Transmission model	Fuel supply system
GF4W	XLHYZLAZ	5-persons	6B31 (2,998 mL) SOHC MIVEC petrol engine	W6AJA (Electronic control 4WD, INVECS-II 6A/T with sport mode)	MPI

VEHICLE IDENTIFICATION NUMBER (CHASSIS NUMBER)

M1001005603421



The vehicle identification number (chassis number) is stamped or scratched on the toeboard inside the engine compartment.

CODE CHART



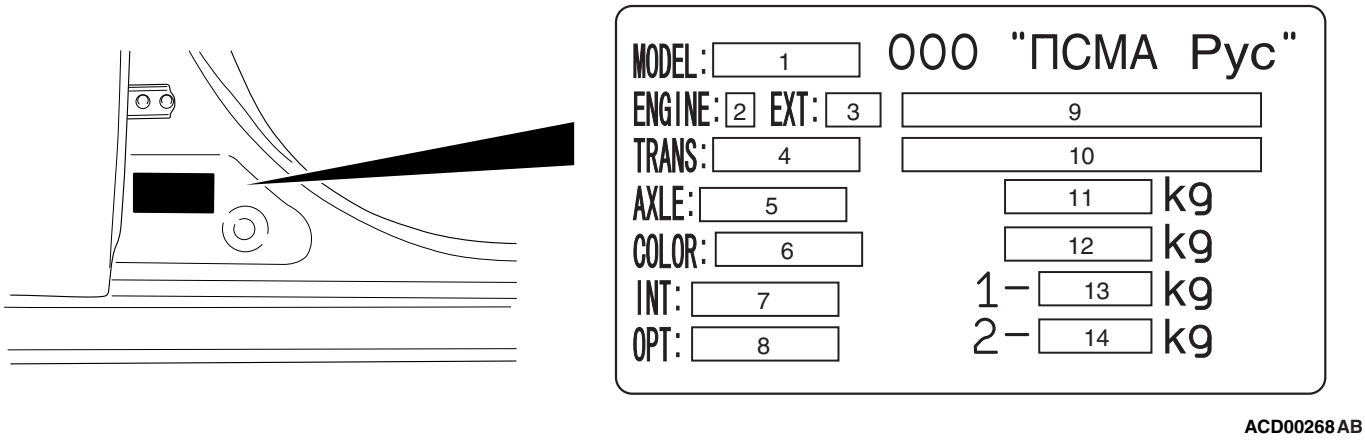
ACA01649AB

No.	Item	Content	
1	World Manufacturer Identifier (WMI)	Z8T	PCMA-rus
2	Body type	X	4-door with hatchback-type tail gate
3	Transmission	L	6A/T
4	Car line and development order	CW	Wagon
5	Engine	6	3.0 L petrol engine
6	Vehicle type	W	Station wagon
7	Model year	D	2013 year
8	Assembly plant	M	Kaluga (PCMA-rus)
9	Serial number	900001 to 940000	

VEHICLE IDENTIFICATION

M1001000404168

MANUFACTURER LABEL



ACD00268AB

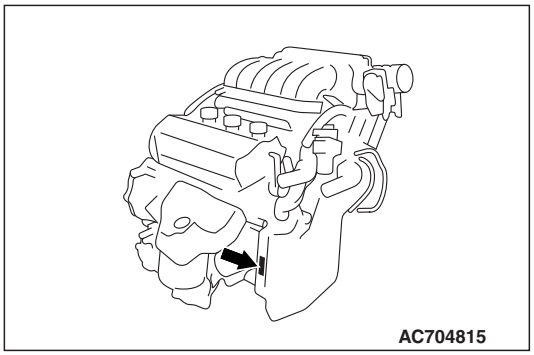
The manufacturer label is adhered on the bottom of the centre pillar. The label shows model code, engine model, transmission model, body colour code, chassis number and weight.

No.	Item	Sample	Content
1	MODEL	GF4WXLHYZLAZ	GF4W: Vehicle model
			XLHYZLAZ: Model series
2	ENGINE	6B3	Engine model
3	EXT	W16	Body colour code
4	TRANS	W6AJA	Transmission model
5	AXLE	3360	Rear axle gear ratio
6	COLOUR	W42	Body colour code
7	INT	87V	Interior code
8	OPT	03V	Equipment code
9	Approval number	–	To be shown by "Homologation Documents"
10	Chassis number	–	To be shown by "Numbering System of VIN Documents"
11	Gross vehicle weight	–	Gross vehicle weight
12	Gross combined weight	–	Gross combined weight
13	Front axle weight	–	Gross axle weight front
14	Rear axle weight	–	Gross axle weight rear

For monotone colour vehicles, the body colour code shall be indicated.

ENGINE MODEL STAMPING

M1001005701239



The engine model is stamped on the cylinder block.

These engine model numbers are as shown as follows.

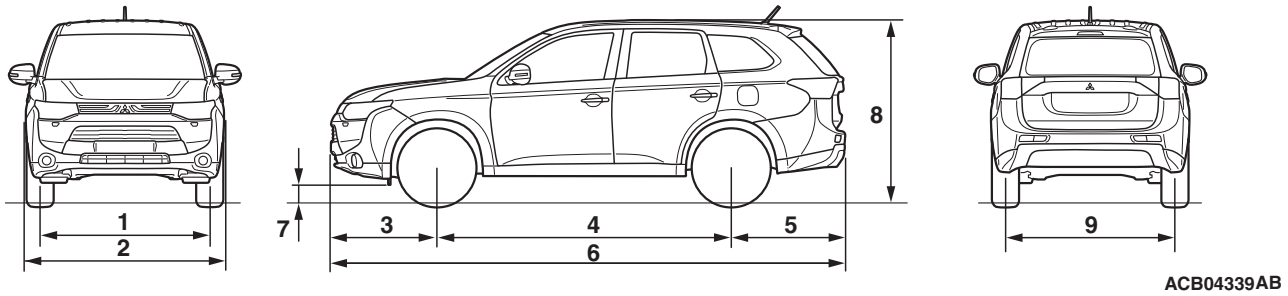
Engine model	Engine displacement
6B31	2,998 mL

The engine serial number is stamped near the engine model number.

Engine number	AA0201 to YY9999

GENERAL DATA AND SPECIFICATIONS

M1001000908109



Item			GF4W
			XLHYZLAZ
Vehicle dimension mm	Front track	1	1,540
	Overall width	2	1,800
	Front overhang	3	955
	Wheelbase	4	2,670
	Rear overhang	5	1,030
	Overall length	6	4,655
	Ground clearance (unladen)	7	215
	Overall height (unladen)	8	1,680
	Rear track	9	1,540
Vehicle weight kg	Kerb weight – Without full optional parts		1,570
	Kerb weight – With full optional parts		1,620
	Gross vehicle weight		2,270
	Gross axle weight rating-front		1,150
	Gross axle weight rating-rear		1,250
	Gross combination weight		3,950
Seating capacity			5

Item		GF4W
		XLHYZLAZ
Engine	Model No.	6B31
	Type	SOHC MIVEC petrol engine
	Total displacement mL	2,998
	Max. output <EEC> kW/rpm	164/6,250
	Max. torque <EEC> N·m/rpm	284/3,750
Fuel system	Fuel supply system	Electrical fuel injection (Direct injection-Diesel engine control system)
Transmission	Model code	W6AJA
	Type	Electronic control 4WD, INVECS-II 6A/T with sport mode
Turning radius m	Body	5.73
	Wheel	5.3

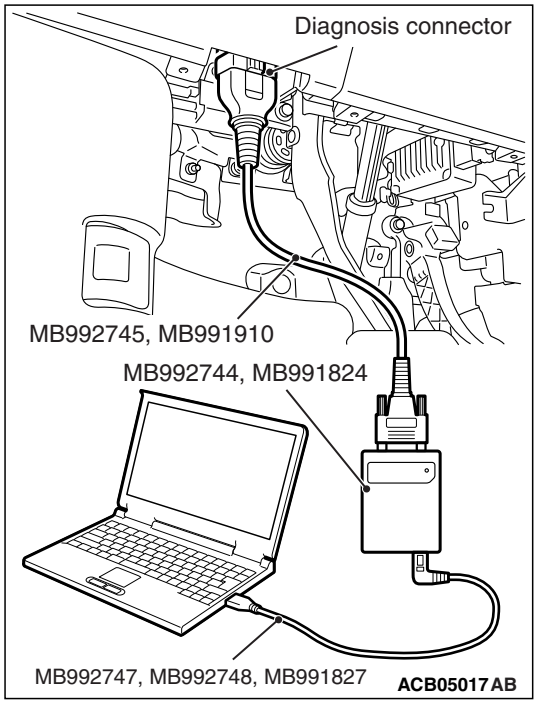
PRECAUTIONS BEFORE SERVICE

CODING LIST

M1001015002438

VARIANT CODING

The coding data can be checked by operating M.U.T.-III.



NOTE: For details on how to use the M.U.T.-III, refer to the "M.U.T.-III operation manual."

1. Ensure that the ignition switch is at the "LOCK" (OFF) position.
2. Start up the personal computer.
3. Connect special tool V.C.I.-Lite USB cable (MB992747/MB992748) or M.U.T.-III USB cable (MB991827) to V.C.I.-Lite (MB992744) or V.C.I. (MB991824) and the personal computer.
4. Connect V.C.I.-Lite main harness A (MB992745) or M.U.T.-III main harness A (MB991910) to the V.C.I.-Lite or V.C.I.
5. Connect the V.C.I.-Lite main harness A or M.U.T.-III main harness A to the diagnosis connector of the vehicle.

   NOTE: When the V.C.I.-Lite is connected to the diagnosis connector, the V.C.I.-Lite indicator lamp will be illuminated in a green colour.
6. Turn the V.C.I. power switch to the "ON" position. <When using the V.C.I.>

   NOTE: When the V.C.I. is energised, the V.C.I. indicator lamp will be illuminated in a green colour.
7. Start the M.U.T.-III system on the personal computer and turn the ignition switch to the "ON" position.
8. On the system selection screen, select "MPI/GDI/DIESEL" to check the engine-ECU data, "SRS-AIR BAG" to check the SRS-ECU data, and "ETACS" to check the ETACS-ECU data.

9. Select "Coding."
10. Select "Coding Information & Copy."
11. If the displayed coding information is different from the corresponding initial setting in the list, replace the ECU with a correctly coded one. For replacement of the engine-ECU, refer to GROUP 13F – Engine-ECU P.13F-232. For replacement of the SRS-ECU, refer to GROUP 52B – SRS Control Unit. For replacement of the ETACS-ECU, refer to GROUP 54A – ETACS.

ENGINE ECU CODING DATA LIST

NOTE: The items to be displayed may differ depending on the version of the M.U.T.-III.

Item name	Initial value
Final gear ratio	3.36

ETACS-ECU CODING DATA LIST

NOTE: The items to be displayed may differ depending on the version of the M.U.T.-III.

Item name	Initial value
Engine type	6B31 MIVEC
EPS type	Type 3
Vehicle Type for A.S.C.	Type 3
TCL Type	Type 7
HSA Type	Type 4
ACC Type for A.S.C.	Not present
Gate auto OPN by HD SW customize	Enable (def. E)
ETG Buzzer	Type A

OPTION CODING

LIST <Engine-ECU>

Item name
Cruise control

Item name
Speed limit function

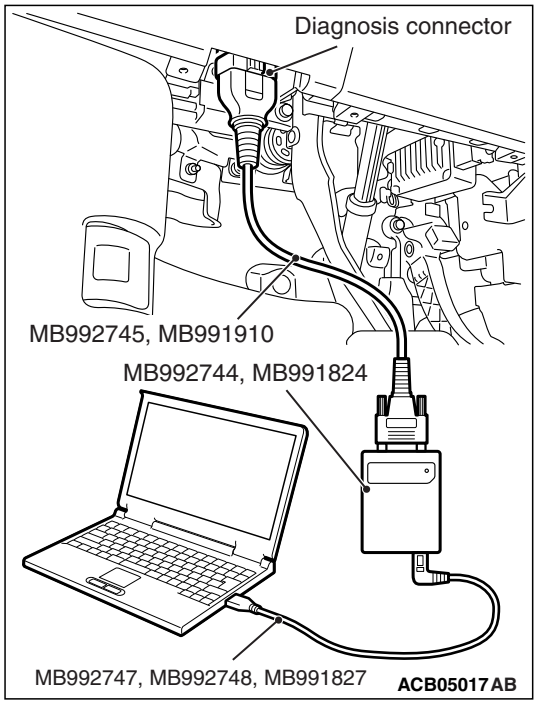
INITIALISATION PROCEDURE FOR LEARNING VALUE IN MPI ENGINE

M1001011701647

Initialise learning values in the MPI engine when one of the following service operations is performed.

- At replacing engine assembly.
- At replacing and cleaning injector.
- At replacing and cleaning throttle body.
- At replacing detonation sensor.

INITIALISATION PROCEDURE



⚠ CAUTION

To prevent damage to M.U.T.-III, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting M.U.T.-III.

1. After the ignition switch is in "LOCK" (OFF) position, connect the M.U.T.-III to the diagnosis connector.
2. Turn the ignition switch to the "ON" position.
3. Select "MPI/GDI/DIESEL" from System select Screen of the M.U.T.-III.
4. Select "Special Function" from MPI/GDI/DIESEL Screen.
5. Select "Learned value reset" from Special Function Screen.
6. Select "All learned value" from Learned value reset Screen
7. Initialise the learning value by pressing the "OK" button.
8. After initialising the learning value, the learning value of MPI engine idling is necessary. (refer to Learning Procedure for Idling in MPI Engine P.00-7).

LEARNING PROCEDURE FOR IDLING IN MPI ENGINE

M1001011801570

PURPOSE

When the engine-ECU is replaced, or when the learning value is initialised, the idling is not stabilized because the learning value in MPI engine is not completed. In this case, carry out the learning method for the idling through the following procedures.

LEARNING PROCEDURE

1. Start the engine and carry out the warm-up for the engine coolant temperature to reach 80°C or more.

   When the engine coolant temperature is 80°C or more, the warm-up is not needed if the ignition switch is in "ON" position once.
2. Place the ignition switch in "LOCK" (OFF) position and stop the engine.
3. After 10 seconds or more, start the engine again.
4. For 10 minutes, carry out the idling under the condition shown below and then confirm the engine has the normal idling.
   - Transmission: "P" range
   - Operation in lamps, fan and attachments: Not to be operated
   - Engine coolant temperature: 80°C or more

   NOTE: When the engine stalls during the idling, check the dirtiness (on the throttle valve) of the throttle body and then perform the service from Procedure 1 again.

INITIALISATION PROCEDURE FOR THROTTLE VALVE CONTROL SERVO

Disconnecting and reconnecting the battery cables causes the throttle valve closed-position value learned to be erased from the memory. This may prevent the idle speed control from being executed properly. When the battery cables have been disconnected and reconnected, initialise the throttle valve control servo in the following manner.

1. Turn the ignition switch to "ON" and then to "LOCK" (OFF).
2. Keep the ignition switch in "LOCK" (OFF) for at least 10 seconds.

NOTES

GROUP 00E

GENERAL <ELECTRICAL>

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CIRCUIT DIAGRAM 00E-2

OUTLINE OF CHANGE

COMPONENT LOCATIONS

M1001016000372

Location of changes	Reference page	Description of changes
RELAY	P.70-2	Due to the adoption of 6B3 engine, some component locations have been changed.
SENSOR	P.70-3	
SOLENOID AND SOLENOID VALVE	P.70-6	
EARTH CABLE	P.70-7	
EARTH	P.70-8	

CONFIGURATION DIAGRAMS

M1001016100443

Connector symbol	Name	Reference page	Description of change
–	OVERALL CONFIGURATION DIAGRAM <6B3>	P.80-2	Due to the adoption of 6B3 engine, a configuration diagram has been added.
A	ENGINE COMPARTMENT <6B3>	P.80-3	
B	ENGINE AND TRANSMISSION <6B3>	P.80-5	

CIRCUIT DIAGRAM

M1001008400632

Main title	Sub title	Reference page	Description of changes
CENTRALIZED JUNCTION	–	P.90-3	Due to the adoption of 6B3 engine, the contents of the centralized junction has been changed.
POWER DISTRIBUTION SYSTEM	4B1, 4J1, 6B3	P.90-11	Due to the adoption of 6B3 engine, the circuit diagram has been changed.
STARTING SYSTEM	6B3, 4B1, 4J1-CVT (VEHICLES WITHOUT AS&G SYSTEM)	P.90-15	
IGNITION SYSTEM	6B3	P.90-16	Due to the adoption of 6B3 engine, a circuit diagram has been added.
CHARGING SYSTEM	4B1, 6B3 (LHD)	P.90-18	Due to the adoption of 6B3 engine, the circuit diagram has been changed.

Main title	Sub title	Reference page	Description of changes
ENGINE CONTROL SYSTEM	6B3	P.90-20	Due to the adoption of 6B3 engine, a circuit diagram has been added.
COOLING SYSTEM	6B3	P.90-24	
A/T	6B3	P.90-26	
HEADLAMP	LHD	P.90-29	• The power supply circuit to the headlamp relay has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
TAIL LAMP, POSITION LAMP, LICENCE PLATE LAMP AND LAMP REMINDER BUZZER	LHD	P.90-32	• The power supply circuit to the fuse (BF3) has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
HEADLAMP MANUAL LEVELLING SYSTEM	–	P.90-36	The power supply circuit to the headlamp relay has been restricted to "6B3."
HEADLAMP AUTOMATIC LEVELLING SYSTEM	LHD	P.90-37	• The power supply circuit to the headlamp relay has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
FRONT FOG LAMP	–	P.90-39	• The power supply circuit to the fuses (BF3, F5) has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3."
REAR FOG LAMP	–	P.90-41	• The power supply circuit to the fuse (BF3) has been restricted to "6B3." • The power supply circuits (+B1, +B2) to the ETACS-ECU have been restricted to "6B3."
ROOM LAMP, LUGGAGE COMPARTMENT LAMP AND IGNITION KEY CYLINDER ILLUMINATION LAMP	–	P.90-43	• The power supply circuit to the fuse (BF3) has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3."

Main title	Sub title	Reference page	Description of changes
VANITY MIRROR LAMP	–	P.90-46	The power supply circuit to the fuse (BF3) has been restricted to "6B3."
GLOVE BOX LAMP	–	P.90-47	• The power supply circuit to the fuse (BF3) has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3."
TURN-SIGNAL LAMP AND HAZARD WARNING LAMP	–	P.90-48	
STOP LAMP	–	P.90-50	The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3."
BACK-UP LAMP	CVT, A/T	P.90-51	
HORN	–	P.90-52	The power supply circuit to the fuse (F9) has been restricted to "6B3."
METER AND GAUGE	LHD	P.90-53	• The power supply circuit to the fuse (BF3) has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
FUEL WARNING LAMP, OIL PRESSURE WARNING LAMP AND BRAKE WARNING LAMP	4B1, 4J1, 6B3 (LHD)	P.90-55	Due to the adoption of 6B3 engine, the engine oil pressure switch circuit has been changed.
POWER WINDOWS	LHD	P.90-57	• The power supply circuit to the fuse (BF3) has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3."
CENTRAL DOOR LOCKING SYSTEM	VEHICLES WITH KOS (LHD)	P.90-59	• The power supply circuit to the fuse (BF3) has been restricted to "6B3." • The power supply circuits (+B1, +B2) to the ETACS-ECU have been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
ELECTRIC TAILGATE	LHD	P.90-63	• The power supply circuit to the fuses (BF1, BF3) has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
AIR CONDITIONER	4B1, 4J1, 6B3 (LHD)	P.90-66	Due to the adoption of 6B3 engine, the circuit diagram has been changed.

Main title	Sub title	Reference page	Description of changes
WINDSHIELD WIPER AND WASHER	LHD	P.90-69	• The power supply circuit to the fuse (BF3) has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
REAR WIPER AND WASHER	–	P.90-71	• The power supply circuit to the fuse (BF3) has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3."
HEADLAMP WASHER	–	P.90-73	• The power supply circuit to the fuses (BF3, F7) has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3."
REAR WINDOW DEFOGGER	–	P.90-74	• The power supply circuits (+B1, +B2) to the ETACS-ECU have been restricted to "6B3."
WIPER DEICER	–	P.90-75	• The power supply circuit to the fuse (F2) has been restricted to "6B3." • The power supply circuits (+B1, +B2) to the ETACS-ECU have been restricted to "6B3."
HEATED DOOR MIRROR	LHD	P.90-77	The power supply circuits (+B1, +B2) to the ETACS-ECU have been restricted to "6B3."
ELECTRIC RETRACTABLE REMOTE CONTROLLED MIRROR	LHD	P.90-79	• The power supply circuits (+B1, +B2) to the ETACS-ECU have been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
AUDIO SYSTEM	LHD	P.90-82	• The power supply circuit to the fuse (BF3) has been restricted to "6B3." • The power supply circuits (+B1, +B2) to the ETACS-ECU have been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
MMCS	LHD	P.90-86	
HANDS-FREE INTERFACE SYSTEM	VEHICLES WITHOUT MMCS (LHD)	P.90-91	• The power supply circuit to the fuse (BF3) has been restricted to "6B3." • The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
	VEHICLES WITH MMCS (LHD)	P.90-94	
ACCESSORY SOCKET AND CIGARETTE LIGHTER	–	P.90-97	The power supply circuit (+B2) to the ETACS-ECU has been restricted to "6B3."

Main title	Sub title	Reference page	Description of changes
ONE-TOUCH START SYSTEM (OSS)	4B1, 4J1, 6B3 (LHD)	P.90-98	Due to the addition of vehicles with A/T, the circuit diagram has been changed.
CRUISE CONTROL SYSTEM	4B1, 4J1, 6B3 (LHD)	P.90-102	Due to the adoption of 6B3 engine, the circuit diagram has been changed.
ACTIVE STABILITY CONTROL (ASC) AND HILL START ASSIST (HSA)	LHD	P.90-104	
ELECTRONIC CONTROLLED 4WD	LHD	P.90-107	• The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
SUNROOF	–	P.90-109	The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3."
SRS	LHD	P.90-111	
ELECTRIC POWER STEERING SYSTEM	LHD	P.90-113	Due to the adoption of 6B3 engine, the circuit diagram has been changed.
HEATED SEAT	–	P.90-115	The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3."
POWER SEAT	–	P.90-117	• The power supply circuit to the fusible link (No. 24) has been restricted to "6B3."
REAR VIEW CAMERA	VEHICLES WITH DISPLAY AUDIO	P.90-118	The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3."
DOOR AJAR WARNING BUZZER	LHD	P.90-119	• The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
PARKING BRAKE REMINDER BUZZER	LHD	P.90-121	The CAN circuit of the engine-ECU has been restricted to "6B3."
CAN	LHD	P.90-123	• The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3." • The CAN circuit of the engine-ECU has been restricted to "6B3."
SPARE CONNECTOR	FOR TRAILER LAMPS	P.90-125	The power supply circuit (+B1) to the ETACS-ECU has been restricted to "6B3."

GROUP 11

ENGINE

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GROUP 11I

ENGINE MECHANICAL <6B3>

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SERVICE SPECIFICATIONS

M1112000303103

Item		Standard value	Limit
Valve clearance (at cold) mm	Intake valve	0.10	–
Basic ignition timing		5°BTDC ± 3°	–
Ignition timing		Approximately 10°BTDC	–
Idle speed r/min		650 ± 100	–
CO contents %		0.3 or less	–
HC contents ppm		200 or less	–
Compression pressure (at engine speed of 200 r/min) kPa		1,460	1,050
Compression pressure difference of all cylinders kPa		–	Maximum 98
Intake manifold vacuum kPa		–	Minimum 60
Cylinder head bolt outside diameter mm		–	0.1
Timing belt auto-tensioner rod protrusion amount mm		9.1 – 13.4	–

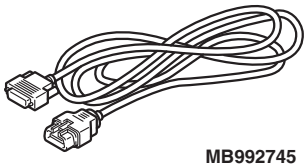
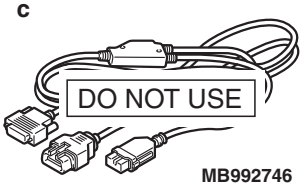
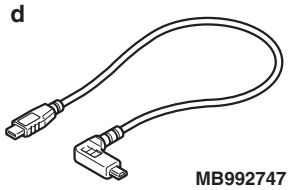
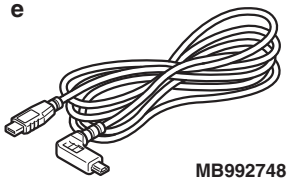
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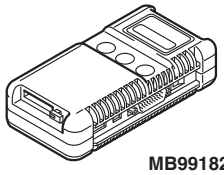
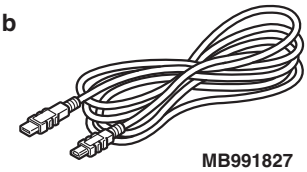
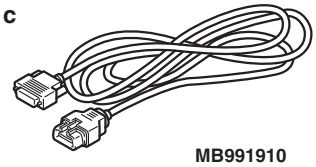
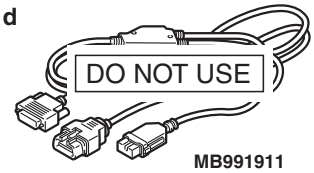
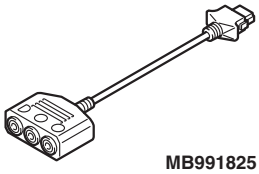
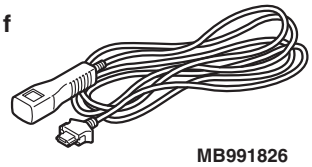
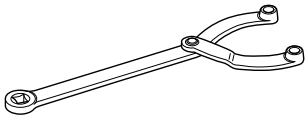
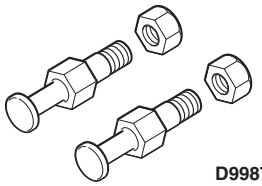
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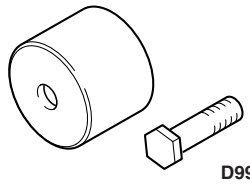
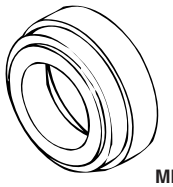
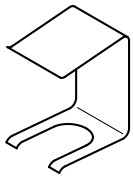
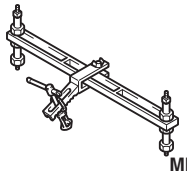
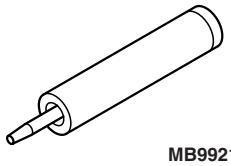
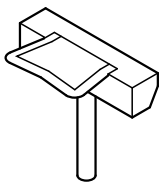
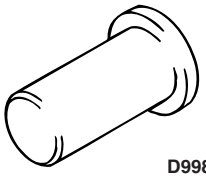
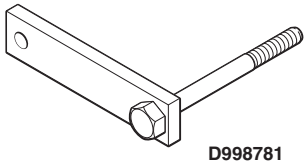
Item	Specified sealant
Taper plug	Three bond 1215, 1212D or equivalent
Engine upper oil pan	Three bond 1227D, Three bond 1217G (MITSUBISHI MOTORS GENUINE Part No.1000A923), LOCTITE 5971, LOCTITE 5970, LOCTITE 5900 or equivalent
Engine lower oil pan	Three bond 1227D, Three bond 1217G (MITSUBISHI MOTORS GENUINE Part No.1000A923), Three bond 1207F (MITSUBISHI MOTORS GENUINE Part No.1000A992), LOCTITE 5971, LOCTITE 5970, LOCTITE 5900 or equivalent
Drive plate mounting bolt	Three bond 1324 or exact equivalent

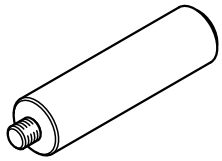
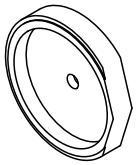
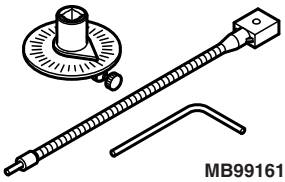
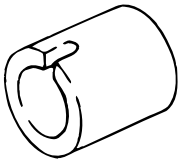
SPECIAL TOOLS

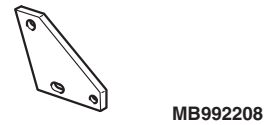
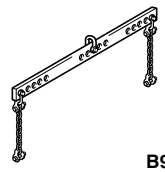
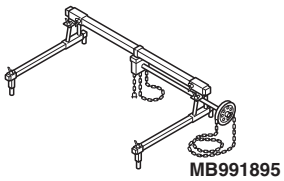
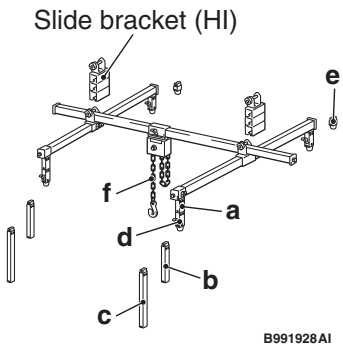
M1112000603353

Tool	Number	Name	Use
a  MB992744 b  MB992745 c  MB992746 d  MB992747 e  MB992748 ACB05421AB	a. MB992744 b. MB992745 c. MB992746 d. MB992747 e. MB992748	a. Vehicle communication interface-Lite (V.C.I.-Lite) b. V.C.I.-Lite main harness A (for vehicles with CAN communication) c. V.C.I.-Lite main harness B (for vehicles without CAN communication) d. V.C.I.-Lite USB cable short e. V.C.I.-Lite USB cable long	• Checking the ignition timing • Checking the idle speed

Tool	Number	Name	Use
a  MB991824 b  MB991827 c  MB991910 d  MB991911 e  MB991825 f  MB991826 MB991955	MB991955 a: MB991824 b: MB991827 c: MB991910 d: MB991911 e: MB991825 f: MB991826	M.U.T.-III sub assembly a: Vehicle communication interface (V. C. I.) b: M.U.T.-III USB cable c: M.U.T.-III main harness A (Vehicles with CAN communication system) d: M.U.T.-III main harness B (Vehicles without CAN communication system) e: M.U.T.-III adapter harness f: M.U.T.-III trigger harness	**⚠ CAUTION** **For vehicles with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly.** • Ignition timing check • Curb idle speed check • Idle mixture check • Erasing the diagnosis code
 B990767	MB990767	Front hub and flange yoke holder	Holding the crankshaft pulley and camshaft sprocket
 D998719	MD998719	Pin	

Tool	Number	Name	Use
 D998713	MD998713	Camshaft oil seal installer	Press-in of the camshaft oil seal
 MD998777	MD998777	Camshaft oil seal installer adapter	Press-fitting the camshaft oil seal (left bank)
 D998443	MD998443	Auto-lash adjuster holder	Holding the auto-lash adjuster
 MD998772	MD998772	Valve spring compressor	Compressing valve spring
 MB992182	MB992182	Valve stem seal installer	Valve stem seal installation
 D998727	MD998727	Oil pan FIPG cutter	Engine lower oil pan removal
 D998382	MD998382	Crankshaft front oil seal installer	Press-in of the crankshaft front oil seal
 D998781	MD998781	Flywheel stopper	Securing the drive plate

Tool	Number	Name	Use
	MB992075	Handle	Crankshaft rear oil seal installation
 MB992183	MB992183	Crankshaft rear oil seal installer	
 MB991614	MB991614	Angle gauge	Cylinder head bolt installation
	MD998716	Crankshaft wrench	Rotating the crankshaft when installing the timing belt

Tool	Number	Name	Use
 MB992208	MB992208	Engine hanger plate A	Support of engine assembly *NOTE: Engine hanger balancer (MB991454) is a part of the engine hanger assembly (MB991453).*
 B991454	MB991454	Engine hanger balancer	
 MB991895	MB991895	Engine hanger	
 B991928AI	MB991928 a: MB991929 b: MB991930 c: MB991931 d: MB991932 e: MB991933 f: MB991934	Engine hanger a: Joint (50) × 2 b: Joint (90) × 2 c: Joint (140) × 2 d: Foot (standard) × 4 e: Foot (short) × 2 f: Chain and hook assembly	

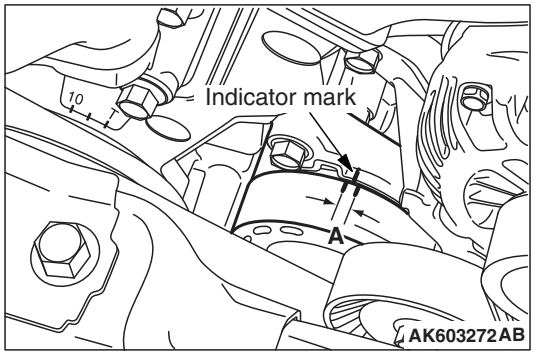
ON-VEHICLE SERVICE

ALTERNATOR & OTHERS BELT TENSION CHECK AND ADJUSTMENT

M1111003101604

⚠ CAUTION

Check the alternator & others belt tension after turning the crankshaft clockwise one turn or more.



1. Make sure that the indicator mark is within the area marked with A in the illustration.
2. If the mark is out of the area, replace the alternator & others belt. (Refer to P.11I-17).

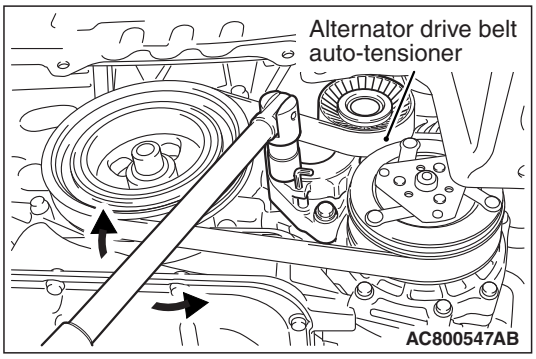
   NOTE: The alternator & others belt tension check is not necessary as alternator drive belt auto-tensioner is adopted.

ALTERNATOR DRIVE BELT AUTO-TENSIONER CHECK

M1111003001629

OPERATION CHECK

1. Turn OFF the engine from the idle state then check to see that the alternator & others belt is not protruding from the pulley width of the alternator drive belt auto-tensioner.
2. Remove the alternator & others belt (Refer to P.11I-17).

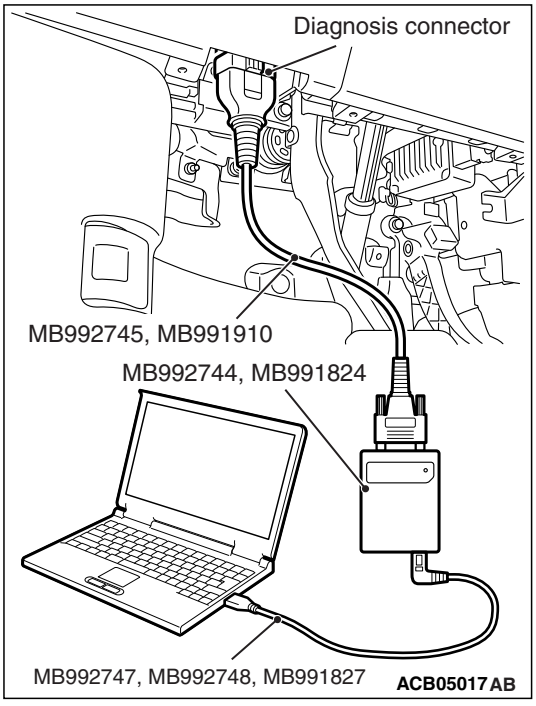


3. Securely insert the spindle handle or ratchet handle with a 12.7 mm insertion angle into the jig hole of the alternator drive belt auto-tensioner. Turn the alternator drive belt auto-tensioner to the left and right to check and see that there is no threading.
4. If there are any problems in the procedure 1 or 3, replace the alternator drive belt auto-tensioner (Refer to P.11I-40).
5. Install the alternator & others belt (Refer to P.11I-17).

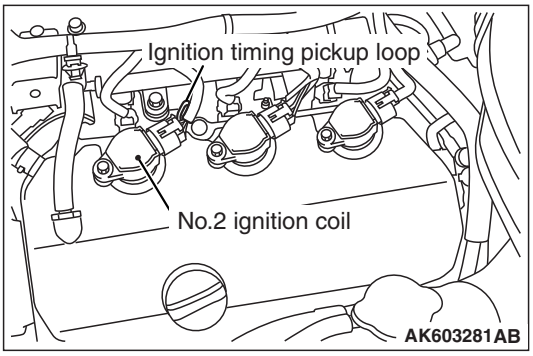
IGNITION TIMING CHECK

M1111001703383

1. Before inspection, set the vehicle to the pre-inspection condition.



2. Turn the ignition switch to the "LOCK" (OFF) position and then connect the M.U.T.-III to the diagnosis connector.



3. Set the timing light to the power supply line (terminal No.3) of the ignition coil No.2.

   NOTE: The power supply line is looped and also longer than the other ones.
4. Start the engine and run it at idle.
5. Check that the idle speed is approximately 650 r/min.
6. Select No.11 of the M.U.T.-III Actuator test.
7. Check that basic ignition timing is within the standard value.

   Standard value: 5° BTDC ± 3°
8. If the basic ignition timing is outside the standard value, inspect the MPI system (Refer to GROUP 13F – Troubleshooting – Inspection chart for trouble symptom P.13F-151).

⚠ CAUTION

If the test is not cancelled, a forced driving will continue for 27 minutes. Driving under this condition may damage the engine.

9. Cancel the actuator test function item No. 11, Basic ignition timing set mode, on M.U.T.-III.
10. Check that ignition timing is at the standard value.

    Standard value: approximately 10° BTDC

    NOTE: Ignition timing fluctuates about ±7°, even under normal operating condition.

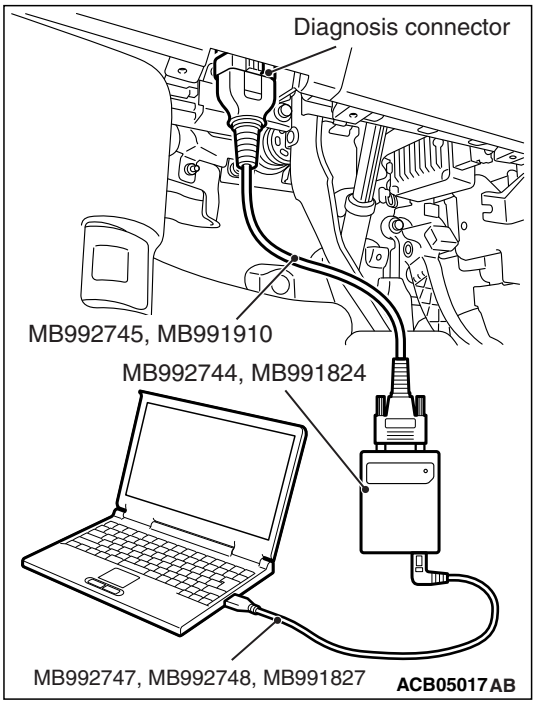
    NOTE: It is automatically further advanced by about 5° from 10° BTDC at higher altitudes.

    NOTE: Wait till approximately 1 minute passes after the engine started, and check the ignition timing when the engine stabilized.
11. Remove the timing light.
12. Turn the ignition switch to the "LOCK" (OFF) position and then remove the M.U.T.-III.

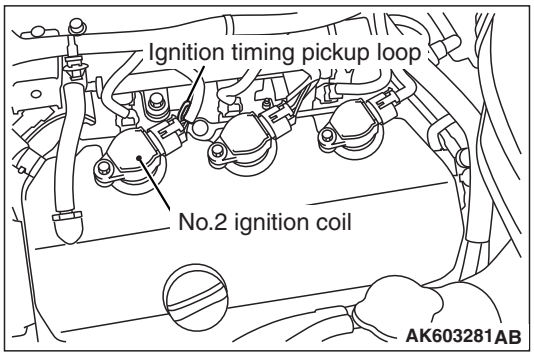
IDLE SPEED CHECK

M1111003503415

1. Before inspection, set the vehicle to the pre-inspection condition.



2. Turn the ignition switch to the "LOCK" (OFF) position and then connect the M.U.T.-III to the diagnosis connector.



3. Set the timing light to the power supply line (terminal No.3) of the ignition coil No. 2.

   NOTE: The power supply line is looped and also longer than the other ones.
4. Start the engine and let it run at idle.
5. Check that ignition timing is at the standard value.

   Standard value: approximately 10° BTDC

NOTE:
- *The ignition timing may fluctuate within ±7°. This is normal.*
- *In higher altitude, the ignition timing is more advanced than the standard value by approximately 5°.*
- *Wait till approximately 1 minute passes after the engine started, and check the ignition timing when the engine stabilized.*

6. Check the idle speed.

   Standard value: 650 ± 100 r/min

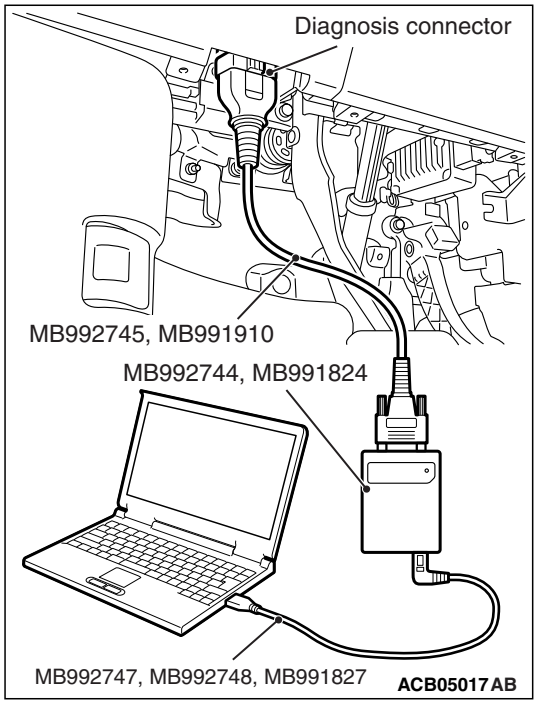
   NOTE: The idle speed is controlled automatically by the idle speed control system.

   NOTE: When using the M.U.T.-III, select item No. 2 and take a reading of the idle speed.
7. If the idle speed is outside the standard value, inspect the MPI system (Refer to GROUP 13F – Troubleshooting – Inspection chart for trouble symptom P.13F-151).
8. Remove the timing light.
9. Turn the ignition switch to the "LOCK" (OFF) position and then disconnect the M.U.T.-III.

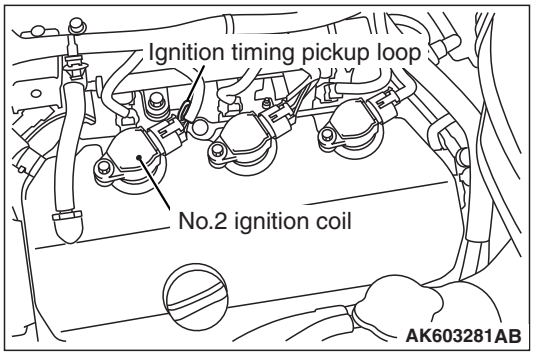
IDLE MIXTURE CHECK

M1111002102370

1. Before inspection, set the vehicle to the pre-inspection condition.



2. Turn the ignition switch to the "LOCK" (OFF) position and then connect the M.U.T.-III to the diagnosis connector.



3. Set the timing light to the power supply line (terminal No.1) of the ignition coil No.2.

   NOTE: The power supply line is looped and also longer than the other ones.
4. Start the engine and let it run at idle.
5. Check that ignition timing is at the standard value.

   Standard value: approximately 10° BTDC

   NOTE:
   - *The ignition timing may fluctuate within ±7°. This is normal.*
   - *In higher altitude, the ignition timing is more advanced than the standard value by approximately 5°.*
   - *Wait till approximately 1 minute passes after the engine started, and check the ignition timing when the engine stabilized.*
6. Run the engine at 2,500 r/min for 2 minutes.
7. Set the CO, HC tester.
8. Check the CO contents and the HC contents at idle.

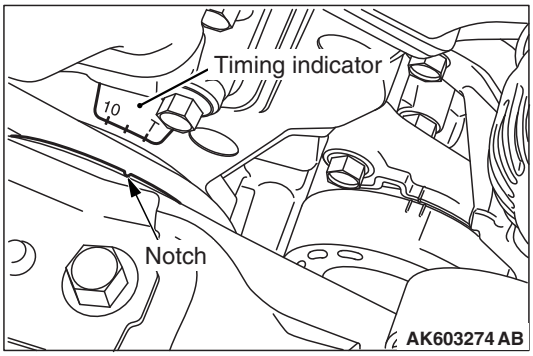
   Standard value
   CO contents: 0.3 % or less
   HC contents: 200 ppm or less
9. If there is a deviation from the standard value, inspect the MPI system (Refer to GROUP 13F – Troubleshooting – Inspection chart for trouble symptom P.13F-151).
10. Remove the HC, CO tester and timing light.
11. Turn the ignition switch to the "LOCK" (OFF) position and then remove the M.U.T.-III.

VALVE CLEARANCE CHECK AND ADJUSTMENT <Intake valve>

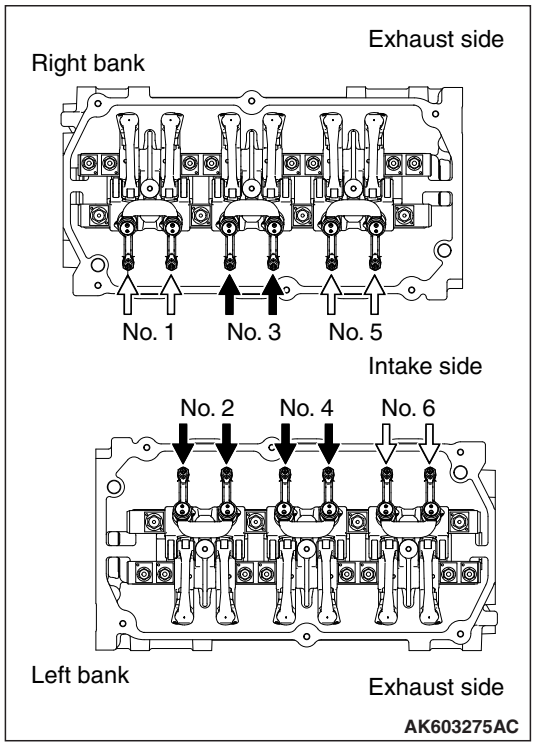
M1111001502353

NOTE: Perform the valve clearance check and adjustment at the engine cold state.

1. Turn the ignition switch to the "LOCK" (OFF) position.
2. Remove all ignition coils.
3. Remove the rocker cover.



4. Turn the crankshaft clockwise until the notch on the pulley is lined up with the "T" mark on the timing indicator.



5. Valve clearance inspection and adjustment can be performed on rocker arms indicated by white arrow mark when the No. 1 cylinder piston is at the top dead centre on the compression stroke, and on rocker arms indicated by black arrow mark when the No. 4 cylinder piston is at the top dead centre on the compression stroke.

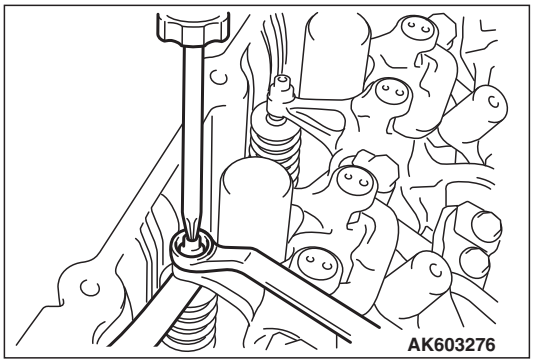
   NOTE: If the rocker arm of No. 6 cylinder at the inlet side is moved up and down and the rocker arm is moved, No. 1 cylinder is at top dead centre on compression stroke. If the rocker arm of No. 6 cylinder at the inlet side is moved up and down and the rocker arm is not moved, No. 4 cylinder is at top dead centre on compression stroke.

6. Measure the valve clearance for intake side.

   If the valve clearance is not as specified, loosen the rocker arm lock nut and adjust the clearance using a thickness gauge while turning the adjusting screw.

   Standard value (cold engine):
   Intake valve: 0.10 mm

NOTE: Valve clearance check and adjustment is unnecessary for exhaust side due to auto lash adjuster installed.



7. While holding the adjusting screw with a screwdriver to prevent it from turning, tighten the lock nut to the specified torque.

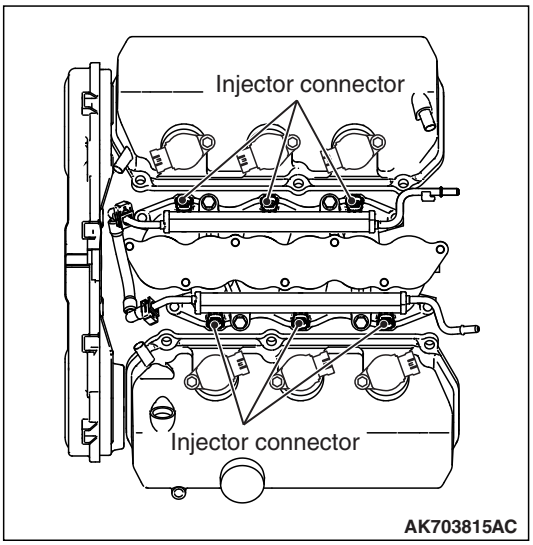
   Tightening torque: 9 ± 1 N·m

8. Turn the crankshaft through 360 degree angle to line up the notch on the crankshaft pulley with the "T" mark on the timing indicator.
9. Repeat steps 6 and 7 on other valves for clearance adjustment.
10. Install the rocker cover.
11. Install the ignition coils.

COMPRESSION PRESSURE CHECK

M1111002604315

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Remove all of the ignition coils and spark plugs.

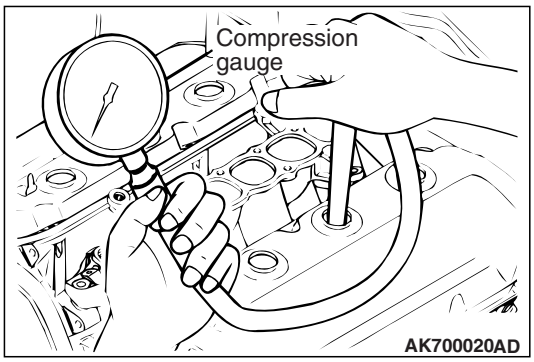


3. Disconnect the injector connector.

⚠ WARNING

Keep away from the spark plug hole when cranking. If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.

4. Cover the spark plug hole with a shop towel etc., and after the engine has been cranked, check that no foreign material is adhering to the shop towel.



5. Set compression gauge to one of the spark plug holes.
6. Crank the engine and measure the compression pressure.

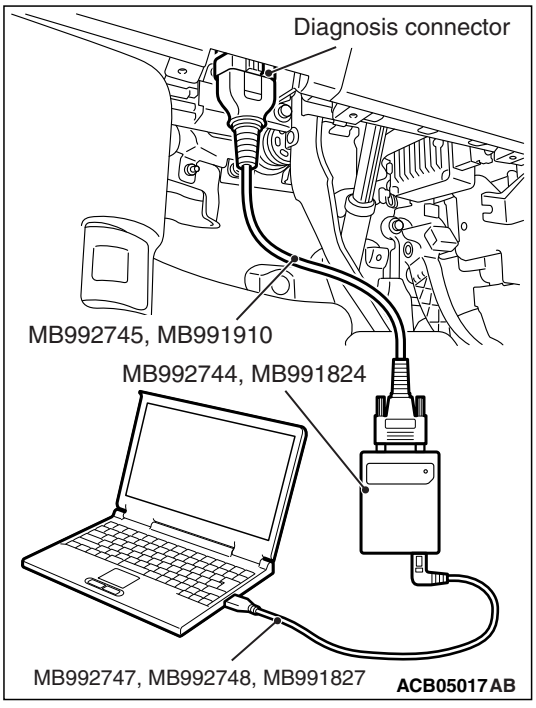
   Standard value (at engine speed of 200 r/min):
   1,460 kPa

   Limit (at engine speed of 200 r/min):
   Minimum 1,050 kPa

7. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

   Limit: Maximum 98 kPa

8. If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps from 5 to 7.
   (1) If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
   (2) If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.
9. Connect the injector connector.
10. Install the spark plugs and ignition coils.

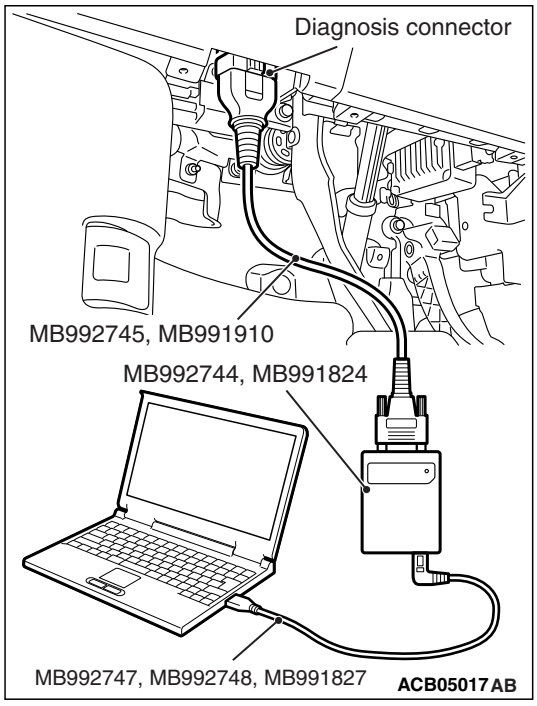


11. Use the M.U.T.-III to erase the diagnosis codes.

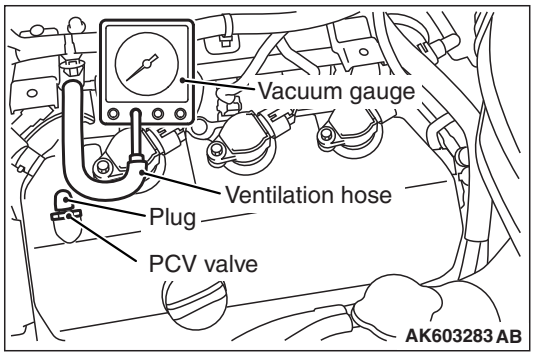
    NOTE: This will erase the diagnosis code resulting from the injector connector being disconnected.

MANIFOLD VACUUM CHECK

M1111002702725



1. Before inspection, set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to "LOCK" (OFF) position.
3. Connect the M.U.T.-III to the diagnosis connector.



4. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and connect a vacuum gauge to the ventilation hose.
5. Plug the PCV valve.
6. Start the engine and check that idle speed is within the standard valve.

   Standard value: 650 ± 100 r/min

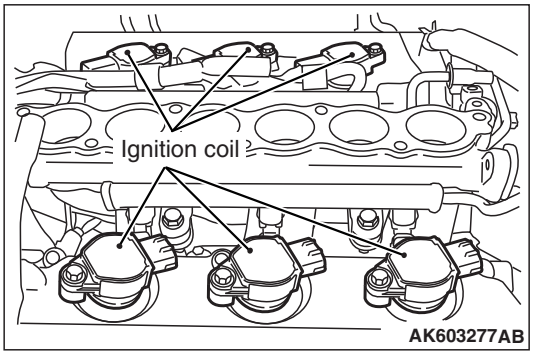
7. Check the intake manifold vacuum.

   Limit: Minimum 60 kPa

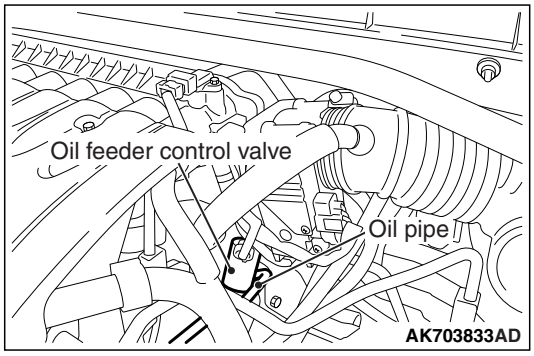
8. Turn the ignition switch to the "LOCK" (OFF) position.
9. Remove the vacuum gauge and then connect the vacuum hose.
10. Disconnect the M.U.T.-III.

ROCKER ARM PISTON OPERATION CHECK

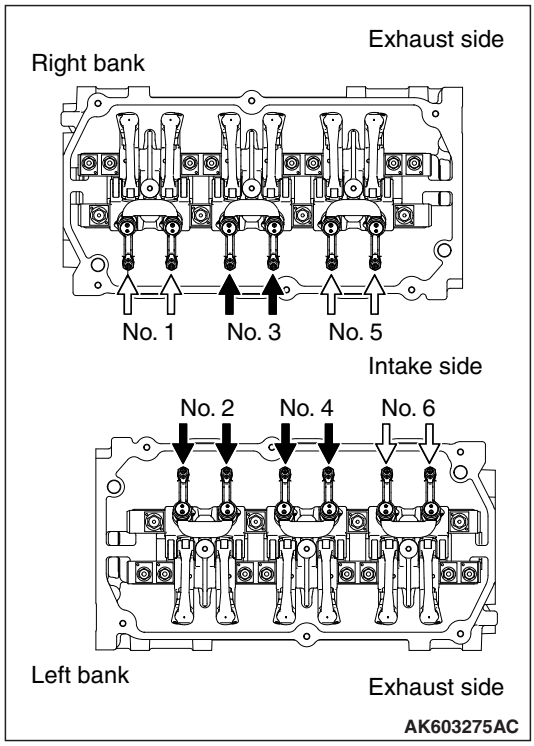
M1111051000669



1. Remove all of the ignition coils.
2. Remove the rocker cover.

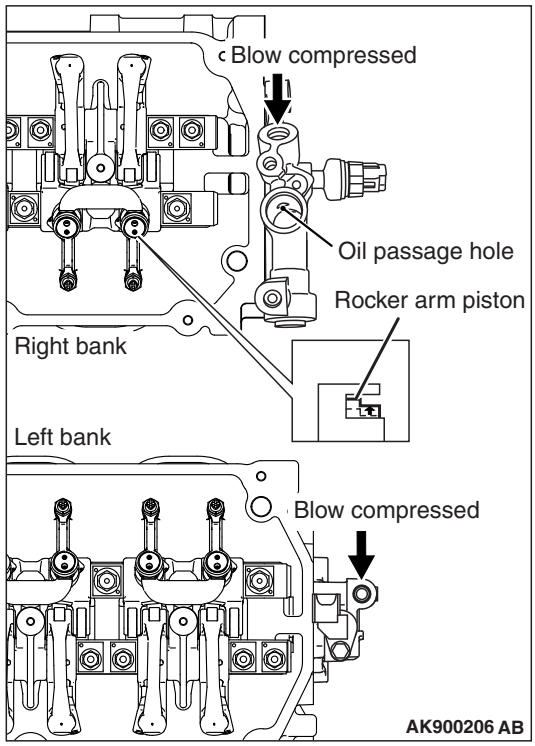


3. Remove the oil feeder control valve.
4. Remove the oil pipe.
5. Turn the crankshaft clockwise until the notch on the crankshaft pulley is lined up with "T" mark on the lower cover of timing belt.



6. The rocker arm piston operation check can be performed on rocker arms indicated by white arrow mark when the No. 1 cylinder piston is at the top dead centre on the compression stroke, and on rocker arms indicated by black arrow mark when the No. 4 cylinder piston is at the top dead centre on the compression stroke.

NOTE: If the rocker arm of No. 6 cylinder at the inlet side is moved up and down and the rocker arm is moved, No. 1 cylinder is at top dead centre on compression stroke. If the rocker arm of No. 6 cylinder at the inlet side is moved up and down and the rocker arm is not moved, No. 4 cylinder is at top dead centre on compression stroke.



7. While putting your hands over the oil passage hole located at the back of the oil feeder control valve installation hole in order to prevent air leakage, use an air blow gun to blow compressed air to the oil pipe installation hole at the right bank side. At that time, check that the rocker arm piston at the right bank side is operated.

NOTE: To surely perform the check, wrap the top of the air blow gun with a vinyl tape. Prevent compressed air leakage as much as possible. The pressure of 620 kPa or more is necessary for the compressed air.

8. Use the air blow gun to blow the compressed air to the oil pipe installation hole at the left bank side. At that time, check that the rocker arm piston at the left bank side is operated.

NOTE: To surely perform the check, wrap the top of the air blow gun with a vinyl tape. Prevent compressed air leakage as much as possible. The pressure of 620 kPa or more is necessary for the compressed air.

9. Turn the crankshaft clockwise until the notch on the crankshaft pulley is lined up with "T" mark on the lower cover of timing belt.
10. Confirm the rest of the rocker arm pistons under the procedure 7 - 8.
11. When the rocker arm piston does not operate, replace the rocker arm assembly.

12. Install the oil pipe and the oil feeder control valve. (Refer to Camshaft and valve Stem Seal – Removal and Installation P.11I-22.)
13. Install the rocker cover.
14. Install all of the ignition coils.

LASH ADJUSTER CHECK <Exhaust valve>

M1111002901210

If an abnormal noise (knocking) that seems to be coming from the lash adjuster is heard after starting the engine and does not stop, carry out the following check.

NOTE:

- *If the vehicle is parked on a slope fir a long period of time, the amount of oil inside the lash adjuster will decrease, and air may get into the high pressure chamber when starting the engine.*
- *After parking the vehicle for long periods, the oil drains out of the oil passage, and it takes time for the oil to be supplied to the lash adjuster, so air can get into the high-pressure chamber.*
- *If either of the above situations occurs, the abnormal noise can be eliminated by bleeding the air from inside the lash adjusters.*
- *The abnormal noise which is caused by a problem with the lash adjusters is generated after the engine is started, and will vary according to the engine speed. However, this noise is not related to the actual engine load.*
  Because of this, if the noise does not occur immediately after the engine is started, if it does not change in accordance with the engine speed, or if it changes in accordance with the engine load, the source of the noise is not the lash adjusters.
- *If there is a problem with the lash adjusters, the noise will almost never disappear, even if the engine has been run at idle to let it warm up.*
  The only case where the noise might disappear is if the oil in the engine has not been looked after properly and oil sludge has caused the lash adjusters to stick.

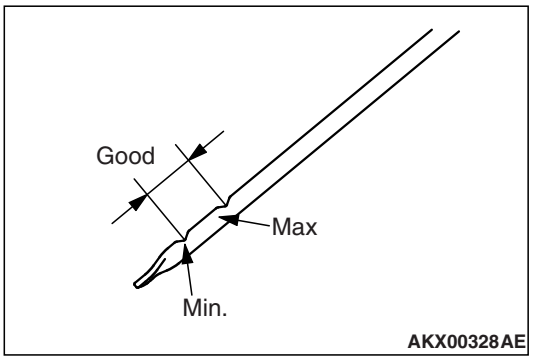
1. Start the engine.
2. Check that the noise occurs immediately after the engine is started, and that the noise changes in accordance with changes in the engine speed.

   If the noise does not occur immediately after the engine is started, or if it does not change in accordance with the engine speed, the problem is not being caused by the lash adjusters, so check for some other cause of the problem. Moreover, if the noise does not change in accordance with the engine speed, the cause of the problem is probably not with the engine (In these cases, the lash adjusters are normal).
3. While the engine is idling, check that the noise level does not change when the engine load is varied (for example, by shifting from N to D).

   If the noise level changes, the cause of the noise is probably parts striking because of worn crankshaft bearings or connecting rod bearings (In such cases, the lash adjusters are normal).
4. After the engine has warmed up, run it at idle and check if any noise can be heard.

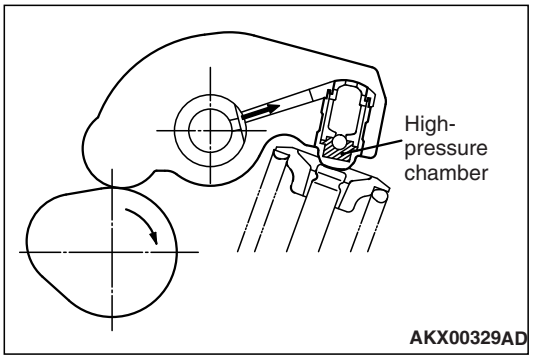
   If the noise has become smaller or disappeared, oil sludge could make the lash adjusters stick. Clean the lash adjusters (Refer to GROUP 11J – Rocker Arms and Camshaft – Rocker Arms and Camshaft Inspection P.11J-36). If not improved, go to Step 5.
5. Bleed air from the lash adjusters (Refer to P.11I-16).
6. If the noise has not disappeared even after the air bleeding, clean the lash adjusters (Refer to, GROUP 11J – Rocker Arms and Camshaft – Rocker Arms and Camshaft Inspection P.11J-36).

<LASH ADJUSTER AIR BLEEDING>

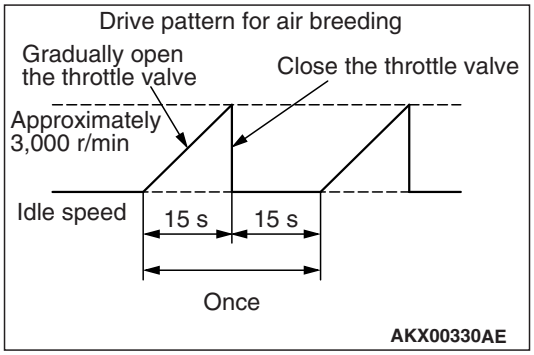


1. Check the engine oil and replenish or replace the oil if necessary.

   NOTE:
   - *If there is an only small amount of oil, air will be drawn in through the oil screen and will get into the oil passage.*
   - *If the amount of oil is greater than normal, then the oil will being mixed by the crankshaft and a large amount of air may get mixed into the oil.*
   - *If the oil is degenerated, air and oil will not separate easily in oil, and the amount of air mixed into the oil will increase.*



   - *If the air which has been mixed in with the oil due to any of the above reasons gets into the high pressure chamber of the lash adjuster, the air inside the high pressure chamber will be compressed when the valve is open and the lash adjuster will over-compress, resulting in abnormal noise when the valve close. This is the same effect as if the valve clearance is adjusted to be too large by mistake. If the air inside the lash adjusters is then released, the operation of the lash adjusters will return to normal.*



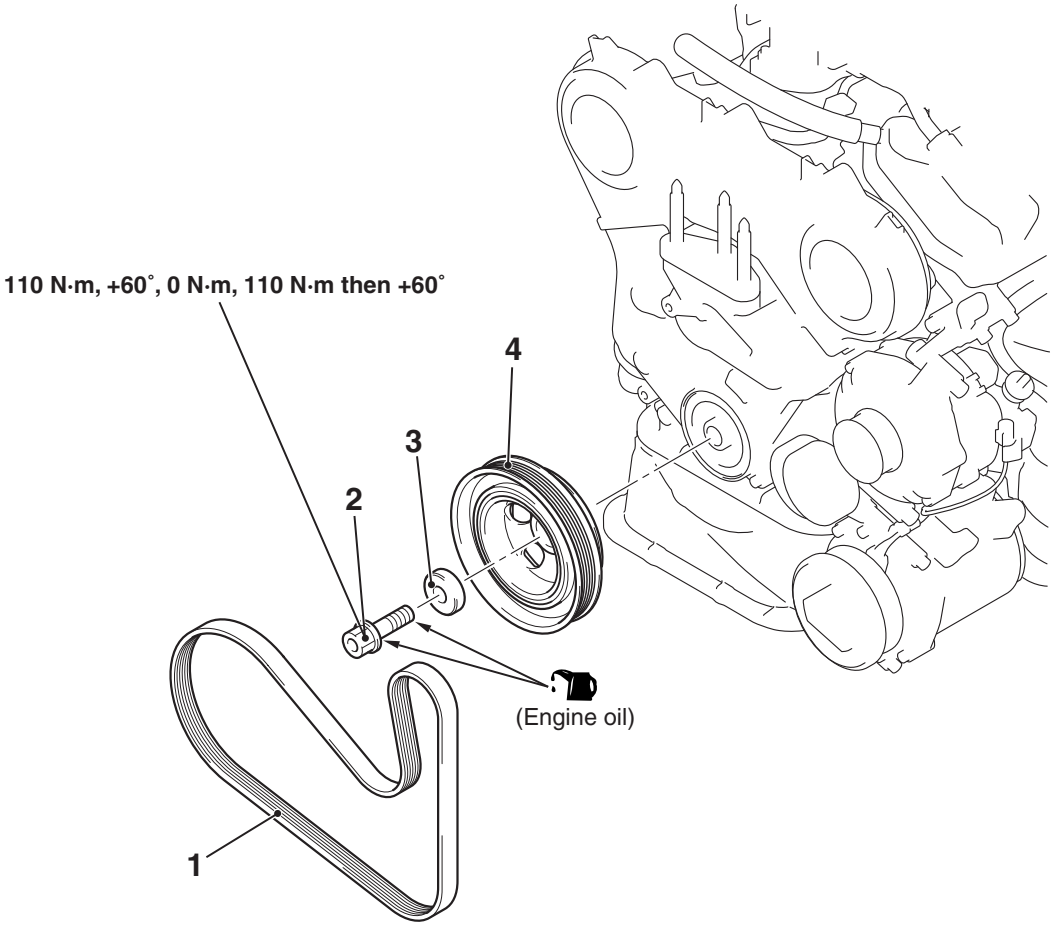
2. Run the engine at idle for 1 – 3 minutes to let it warm up.
3. With no load on the engine, repeat the drive pattern shown in the illustration at left and check if the abnormal noise disappears (The noise should normally disappear after 10 – 30 repetitions, but if there is no change in the noise level after 30 repetitions or more, the problem is probably not due to air inside the lash adjusters).
4. After the noise has disappeared, repeat the drive pattern shown in the illustration at left a further 5 times.
5. Run the engine at idle for 1 – 3 minutes and check that the noise has disappeared.

CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

M1112001605103

Pre-removal Operation	Post-installation Operation
• Engine Room Under Cover Front B and Engine Room Side Cover (RH) Removal (Refer to GROUP 51 – Under Cover).	• Alternator Drive Belt Tension Check (Refer to P.11I-8). • Engine Room Under Cover Front B and Engine Room Side Cover (RH) Installation (Refer to GROUP 51 – Under Cover).



ACD00435AB

Removal steps

<<**A**>> 1. Alternator drive belt
<<**B**>> >>**A**<< 2. Crankshaft pulley centre bolt

Removal steps (Continued)

<<**B**>> >>**A**<< 3. Crankshaft pulley washer
<<**B**>> >>**A**<< 4. Crankshaft pulley

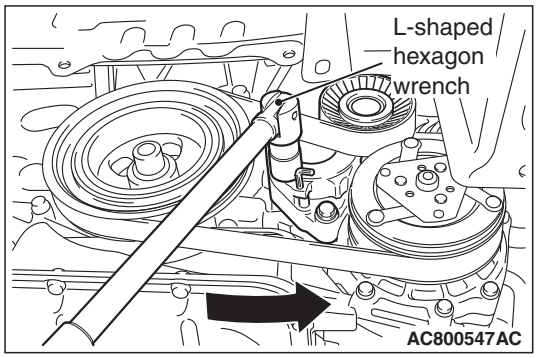
REMOVAL SERVICE POINTS

<<A>> ALTERNATOR DRIVE BELT REMOVAL

To introduce the serpentine drive system with the alternator drive belt auto-tensioner, the following operations will be required.

⚠ CAUTION

To reuse the alternator drive belt, draw an arrow indicating the rotating direction on the back of the alternator drive belt using chalk to install the same direction.

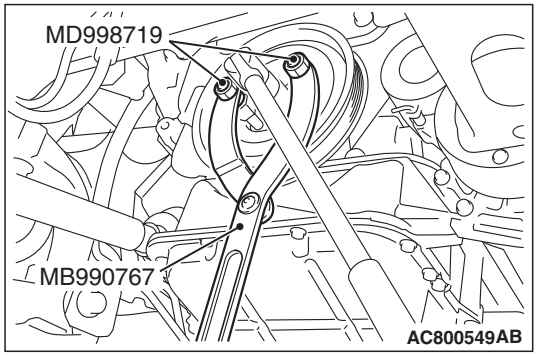


1. Turn the alternator drive belt auto-tensioner to anti-clockwise, and insert the L-shaped hexagon wrench to the alternator drive belt auto-tensioner hole in order to fix the auto-tensioner.
2. Remove the alternator drive belt.

<<B>> CRANKSHAFT PULLEY CENTRE BOLT/ CRANKSHAFT PULLEY WASHER/CRANKSHAFT PULLEY REMOVAL

⚠ CAUTION

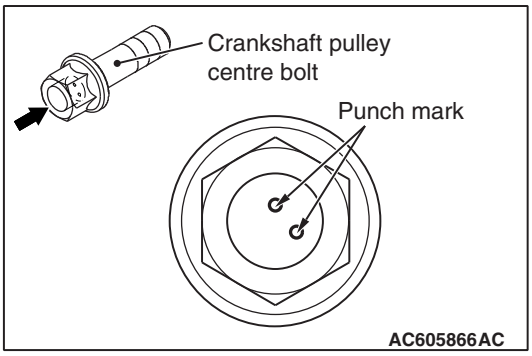
Use only the specified special tools, or a damaged pulley damper could result.



1. Use the following special tools to support the crankshaft pulley:
   - Front hub and flange yoke holder (MB990767)
   - Pin (MD998719)

⚠ CAUTION

Provide one punch mark on the head of the crankshaft pulley centre bolt each time the bolt is removed. Replace the bolt that already has three punch marks (The evidence of having been tightened three times).



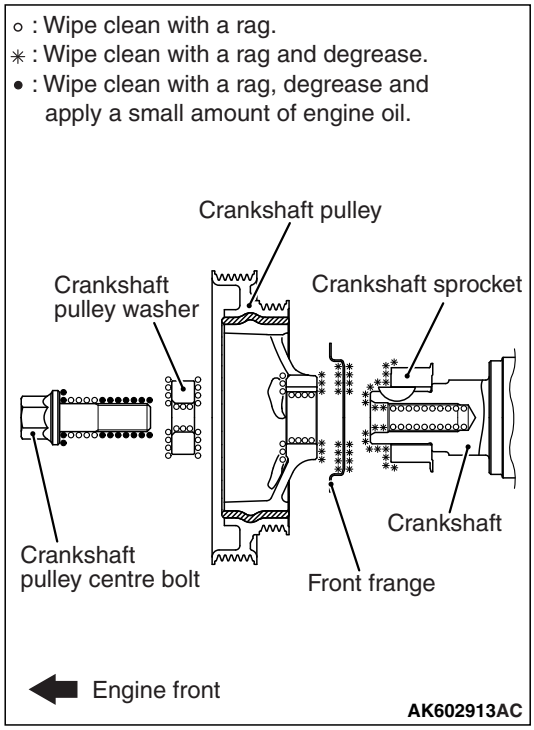
2. Loosen the crankshaft pulley centre bolt and remove the crankshaft pulley washer and crankshaft pulley.

INSTALLATION SERVICE POINTS

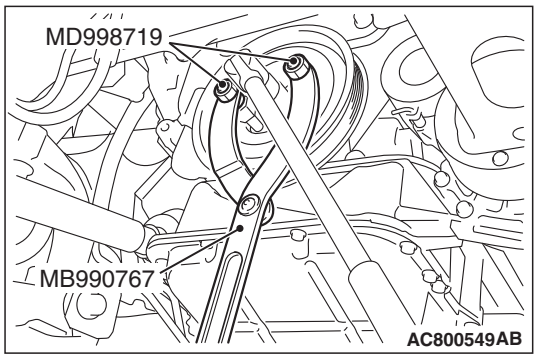
>>A<< CRANKSHAFT PULLEY/CRANKSHAFT PULLEY WASHER/CRANKSHAFT PULLEY CENTRE BOLT INSTALLATION

⚠ CAUTION

Before installing the crankshaft pulley centre bolt, check the number of punch marks on its head (The bolt is reusable if it is two or less). If the bolt has three punch marks, replace it.

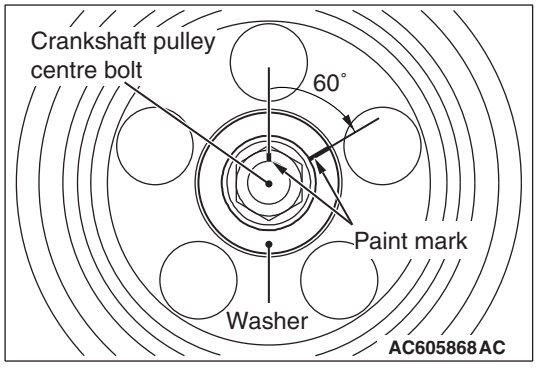


1. Wipe the dirt on the crankshaft pulley washer using a rag.
2. Using a rag, wipe the dirt on the crankshaft pulley, the front flange, the crankshaft sprocket, the thread hole of the crankshaft and then remove the grease.
3. Install the front flange and crankshaft pulley.
4. Apply an adequate and minimum amount of engine oil to the threads of crankshaft pulley centre bolt and the outer surface of washer.



5. Use the following special tools as during removal to support the crankshaft pulley:
   - Front hub and flange yoke holder (MB990767)
   - Pin (MD998719)
6. Tighten the crankshaft pulley centre bolt to the specified torque.

   Tightening torque: 110 N·m



7. Make a paint mark on the crankshaft pulley centre bolt.

⚠ CAUTION
- **If the crankshaft pulley centre bolt is turned less than 60 degrees, proper fastening performance may not be achieved. Be careful to tighten the crankshaft pulley centre bolt exactly 60 degrees.**
- **If the crankshaft pulley centre bolt is overtightened (exceeding 60 degrees), loosen the crankshaft pulley centre bolt completely and then retighten it by repeating the tightening procedure from step 6.**

8. Make a paint mark on the crankshaft pulley centre bolt end at a position 60 degrees from the paint mark made on the washer in the direction of tightening the crankshaft pulley centre bolt.
9. Turn the crankshaft pulley centre bolt another 60 degrees and make sure that the paint marks on the washer and crankshaft pulley centre bolt are aligned.
10. Loosen the crankshaft pulley centre bolt fully.
11. Tighten the crankshaft pulley centre bolt to the specified torque again.

    Tightening torque: 110 N·m

⚠ CAUTION
- **If the crankshaft pulley centre bolt is turned less than 60 degrees, proper fastening performance may not be achieved. Be careful to tighten the crankshaft pulley centre bolt exactly 60 degrees.**
- **If the crankshaft pulley centre bolt is overtightened (exceeding 60 degrees), loosen the crankshaft pulley centre bolt completely and then retighten it by repeating the tightening procedure from step 6.**

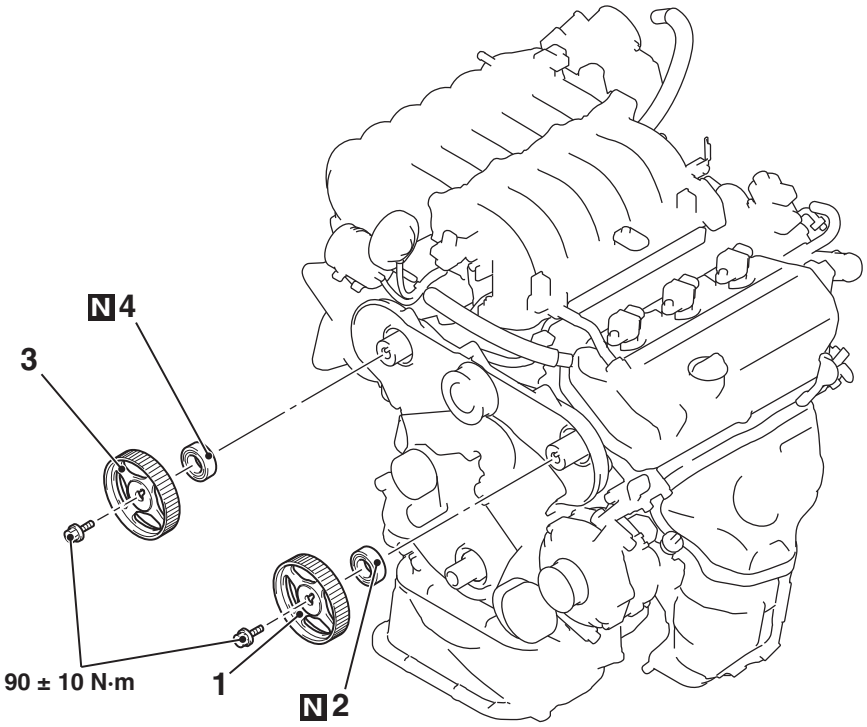
12. Make a paint mark on the crankshaft pulley centre bolt end at a position 60 degrees from the paint mark made on the washer in the direction of tightening the crankshaft pulley centre bolt.

CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

M1112002200415

Pre-removal and Post-installation Operation
- Timing Belt Removal and Installation (Refer to P.11I-40).



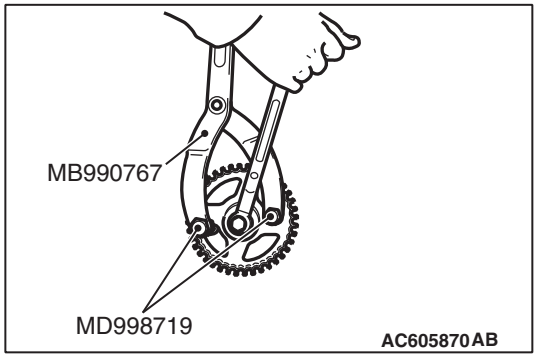
AC605869AB

Removal steps

<<**A**>>	>>**B**<<	1.	Left bank camshaft sprocket
<<**B**>>	>>**A**<<	2.	Camshaft oil seal
<<**A**>>	>>**B**<<	3.	Right bank camshaft sprocket
<<**B**>>	>>**A**<<	4.	Camshaft oil seal

REMOVAL SERVICE POINTS

<<A>> CAMSHAFT SPROCKET REMOVAL



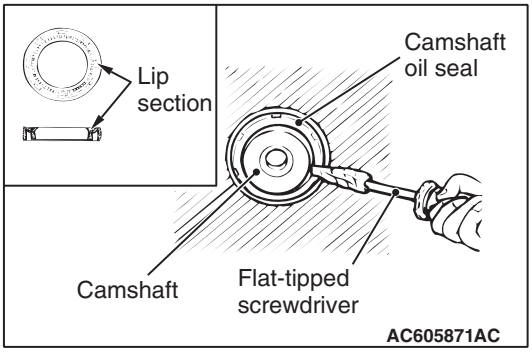
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Use the following special tools to remove the camshaft sprocket.
- Front hub and flange yoke holder (MB990767)
- Pin (MD998719)

<<B>> CAMSHAFT OIL SEAL REMOVAL

1. Make a notch in the camshaft oil seal lip section with a knife, etc.

⚠ CAUTION
Be careful not to damage the camshaft and the cylinder head.



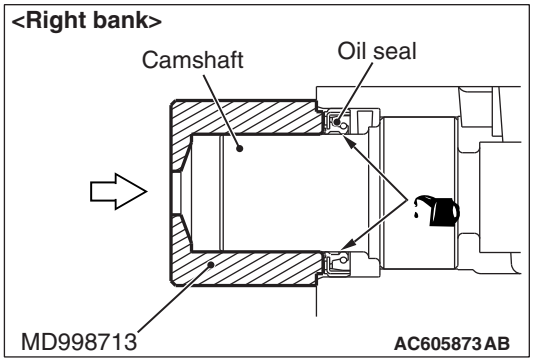
AC605871AC

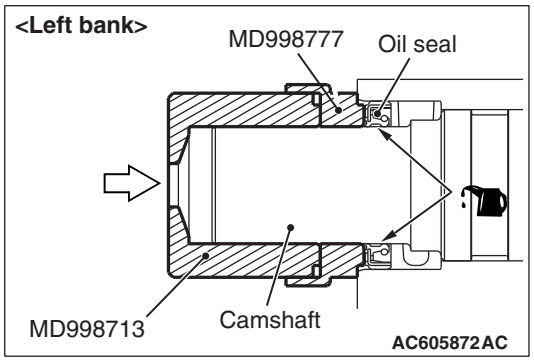
2. Cover the end of a flat-tipped screwdriver with a shop towel and insert into the notched section of the camshaft oil seal, and pry out the camshaft oil seal to remove it.

INSTALLATION SERVICE POINTS

>>A<< CAMSHAFT OIL SEAL INSTALLATION

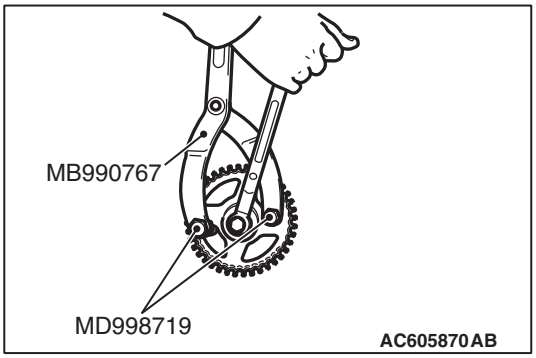
1. Apply an adequate and minimum amount of engine oil to the camshaft oil seal lip.





2. Use the following special tools to press-fit the camshaft oil seal.
   - Camshaft oil seal installer (MD998713)
   - Camshaft oil seal installer adapter (MD998777)

>>B<< CAMSHAFT SPROCKET INSTALLATION



1. Use the following special tools in the same way as during removal to install the camshaft sprocket.
   - Front hub and flange yoke holder (MB990767)
   - Pin (MD998719)
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

   Tightening torque: 90 ± 10 N·m

CAMSHAFT AND VALVE STEM SEAL

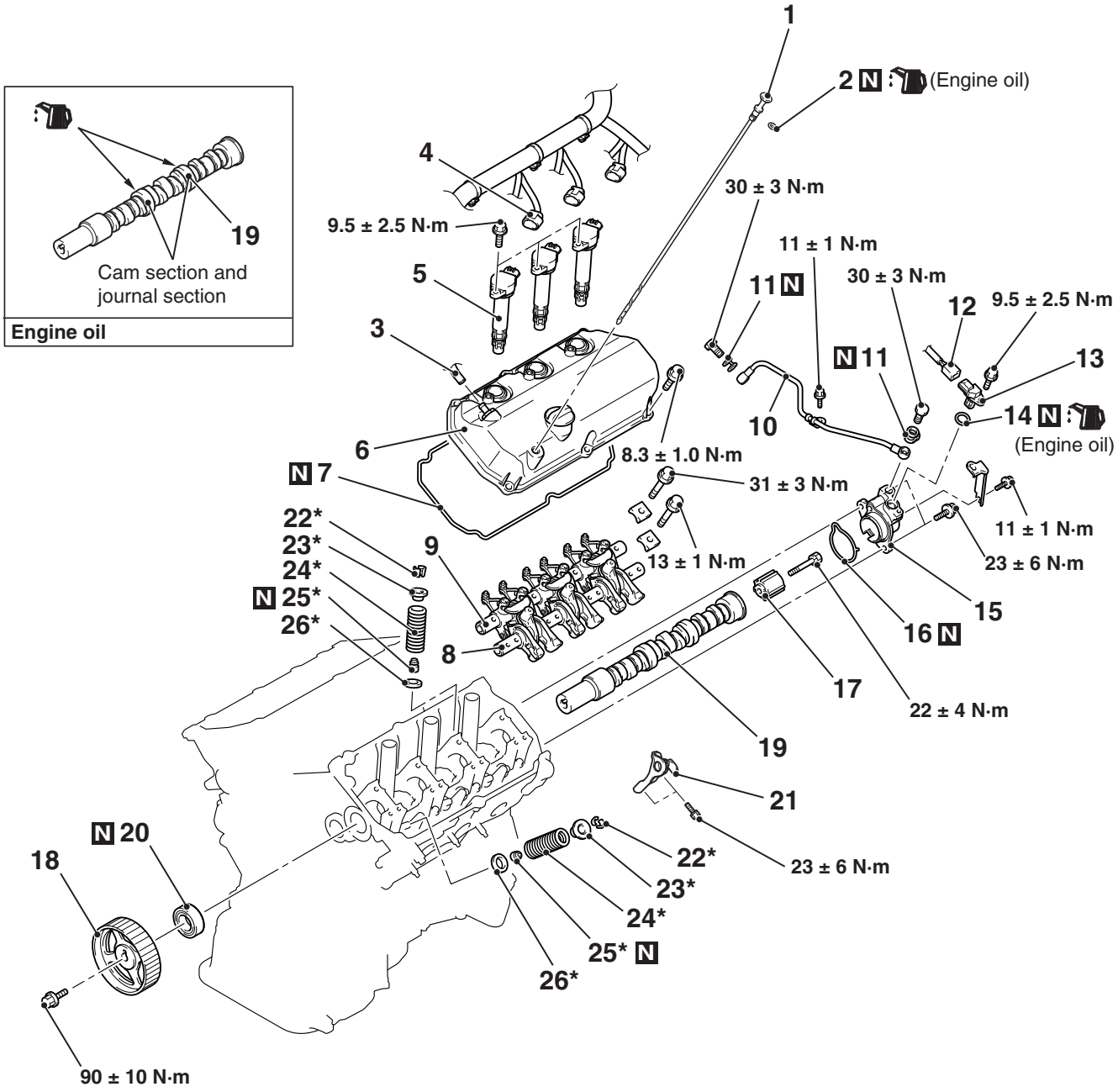
REMOVAL AND INSTALLATION

M1112006602370

⚠ CAUTION

***Remove and assemble the marked parts in each cylinder unit.**

<LEFT BANK>



AC809144AB

Camshaft removal steps

- Engine cover (Refer to GROUP 16 – Ignition System, Ignition Coil P.16-19).
- Timing belt (Refer to P.11I-40).
- Thermostat housing (Refer to GROUP 14 – Water Hose and Water Pipe P.14-10).

Camshaft removal steps

1. Engine oil level gauge
2. O-ring
3. PCV hose connection
4. Ignition coil connector
5. Ignition coil

>>I<<

6. Rocker cover
7. Rocker cover gasket

Camshaft removal steps

- Valve clearance check and adjustment (Inlet valve) (Refer to P.11I-11) <Installation only>.

<<A>> >>H<< 8. Rocker arm, shaft and lash adjuster assembly (exhaust side)

<<A>> >>H<< 9. Rocker arm and shaft assembly (inlet side)

10. Oil pipe
11. Gasket
12. Camshaft position sensor connector
13. Camshaft position sensor
14. O-ring
15. Camshaft position sensor support
16. Camshaft position sensor support gasket
17. Camshaft position sensing cylinder

<<B>> >>E<< 18. Camshaft sprocket

19. Camshaft

<<C>> >>D<< 20. Camshaft oil seal

Valve stem seal removal steps

- Engine cover (Refer to GROUP 16 – Ignition System, Ignition Coil P.16-19).

1. Engine oil level gauge
2. O-ring
3. PCV hose connection
4. Ignition coil connector
5. Ignition coil

>>I<< 6. Rocker cover

7. Rocker cover gasket

- Valve clearance check and adjustment (Inlet valve) (Refer to P.11I-11) <Installation only>.

<<A>> >>H<< 8. Rocker arm, shaft and lash adjuster assembly (exhaust side)

<<A>> >>H<< 9. Rocker arm and shaft assembly (inlet side)

- Spark plug (Refer to GROUP 16 – Ignition System, Ignition Coil P.16-19).

21. Engine hanger

<<D>> >>C<< 22. Valve spring retainer lock

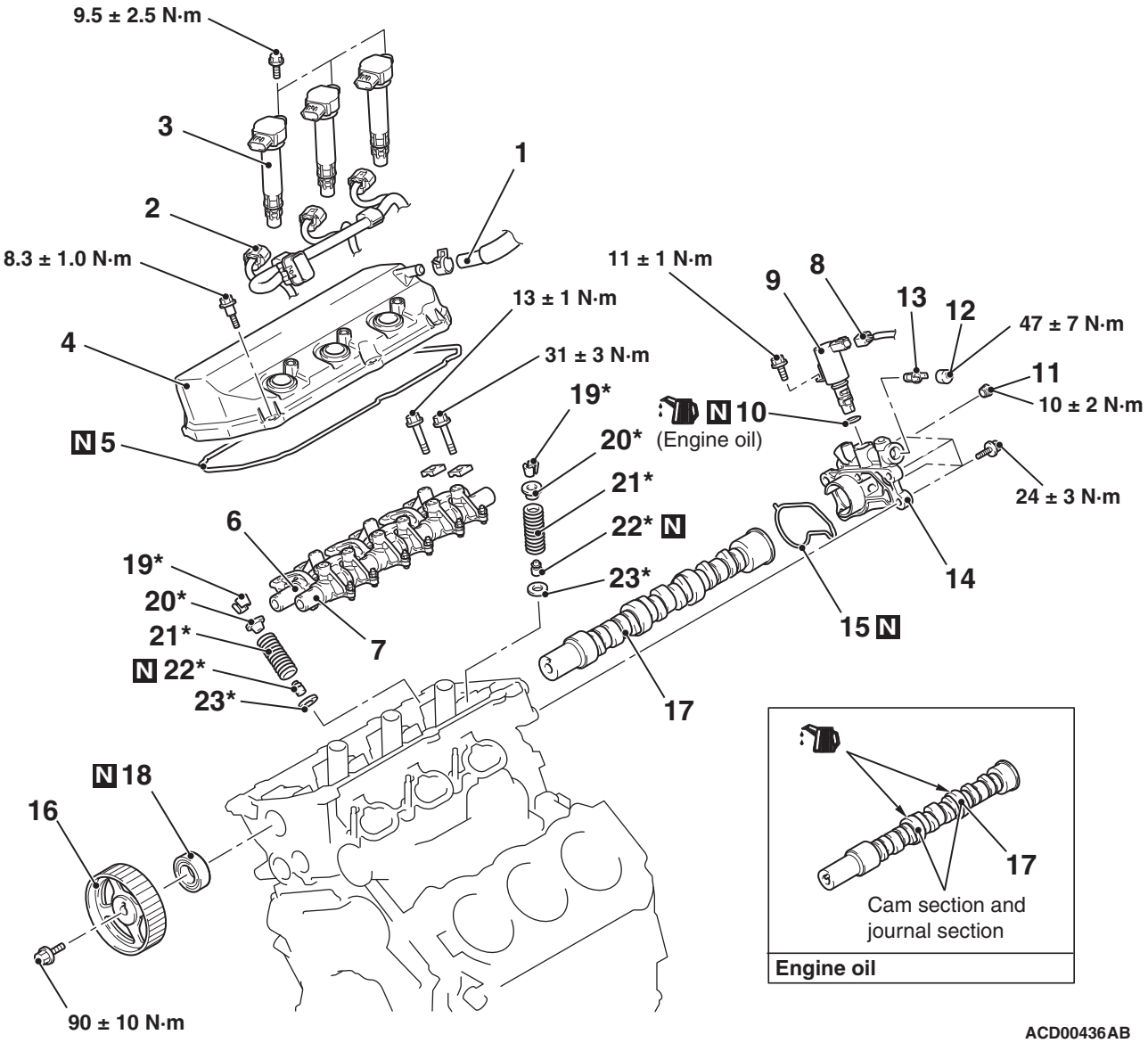
23. Valve spring retainer

>>B<< 24. Valve spring

>>A<< 25. Valve stem seal

26. Valve spring seat

<RIGHT BANK>



Camshaft removal steps

- Air intake plenum (Refer to GROUP 15 – Air Intake Plenum P.15-3).
- Timing belt (Refer to P.11I-40).
- Thermostat housing (Refer to GROUP 14 – Water Hose and Water Pipe P.14-10).

1. Breather hose connection
2. Ignition coil connector
3. Ignition coil

>>I<< 4. Rocker cover

5. Rocker cover gasket

- Valve clearance check and adjustment (Inlet valve) (Refer to P.11I-11) <Installation only>.

<<A>> >>H<< 6. Rocker arm, shaft and lash adjuster assembly (exhaust side)

<<A>> >>H<< 7. Rocker arm and shaft assembly (inlet side)

Camshaft removal steps

8. Engine oil control valve connector

>>G<< 9. Engine oil control valve

>>G<< 10. O-ring

>>F<< 11. Taper plug

12. Plug
13. Engine oil control valve filter
14. Engine oil control valve housing
15. Engine oil control valve housing gasket

<<B>> >>E<< 16. Camshaft sprocket

- Engine-ECU (Refer to GROUP 13F – Engine-ECU P.13F-232).
- Air cleaner bracket (Refer to GROUP 15 – Air Cleaner P.15-11).

17. Camshaft

<<C>> >>D<< 18. Camshaft oil seal

Valve stem seal removal steps

- Air intake plenum (Refer to GROUP 15 – Air Intake Plenum P.15-3).
- Timing belt (Refer to P.11I-40).

1. Breather hose connection
2. Ignition coil connector
3. Ignition coil

>>I<< 4. Rocker cover

5. Rocker cover gasket

- Valve clearance check and adjustment (Inlet valve) (Refer to P.11I-11) <Installation only>.

<<A>> >>H<< 6. Rocker arm, shaft and lash adjuster assembly (exhaust side)

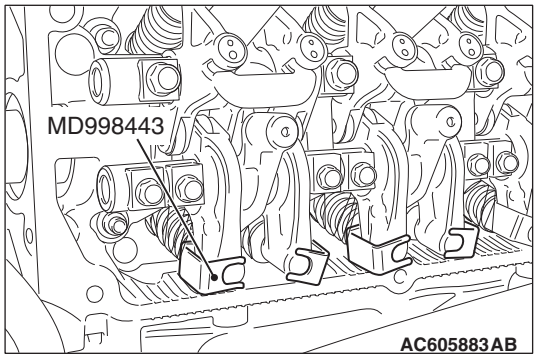
<<A>> >>H<< 7. Rocker arm and shaft assembly (inlet side)

- Spark plug (Refer to GROUP 16 – Ignition System, Ignition Coil P.16-19).

<<D>> >>C<< 19. Valve spring retainer lock
20. Valve spring retainer
>>B<< 21. Valve spring
>>A<< 22. Valve stem seal
23. Valve spring seat

REMOVAL SERVICE POINTS

<<A>> ROCKER ARM, SHAFT AND LASH ADJUSTER ASSEMBLY (EXHAUST SIDE)/ROCKER ARM AND SHAFT ASSEMBLY (INLET SIDE) REMOVAL

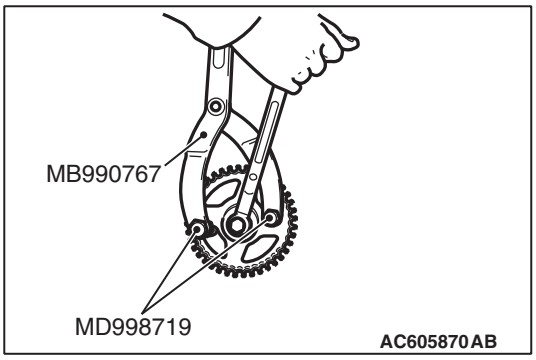


1. Install special tool auto-lash adjuster holder (MD998443) as shown in the illustration so that the lash adjusters will not fall out.

⚠ CAUTION
Never disassemble the rocker arm and shaft assembly.

2. Loosen the rocker arm and shaft assembly mounting bolts, and then remove the rocker arm and shaft assembly with the bolts still attached.

<<B>> CAMSHAFT SPROCKET REMOVAL



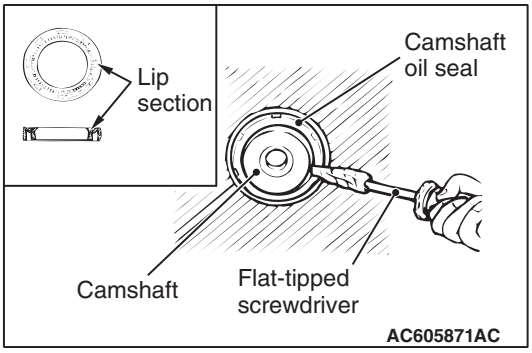
Use the following special tools to remove the camshaft sprocket.

- Front hub and flange yoke holder (MB990767)
- Pin (MD998719)

<<C>> CAMSHAFT OIL SEAL REMOVAL

1. Make a notch in the camshaft oil seal lip section with a knife, etc.

⚠ CAUTION
Be careful not to damage the camshaft and the cylinder head.

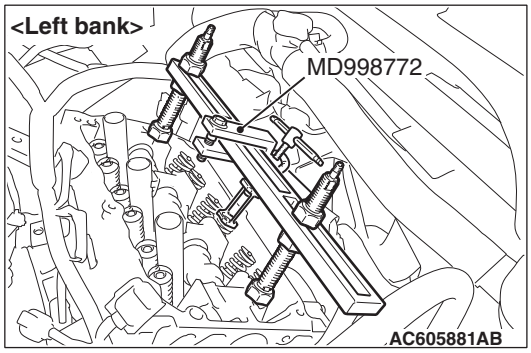


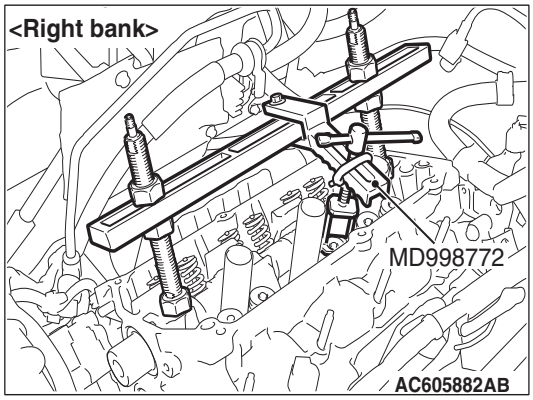
2. Cover the end of a flat-tipped screwdriver with a shop towel and insert into the notched section of the camshaft oil seal, and pry out the camshaft oil seal to remove it.

<<D>> VALVE SPRING RETAINER LOCK REMOVAL

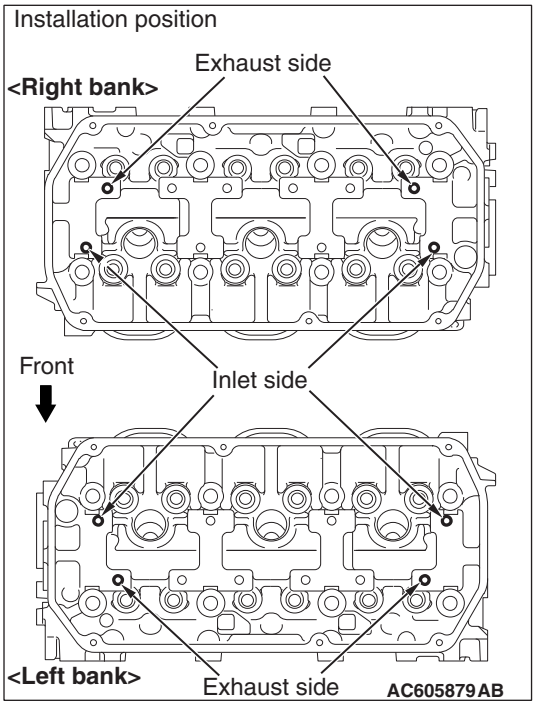
⚠ CAUTION

When removing valve spring retainer lock, leave the piston of each cylinder in the TDC (Top Dead Centre) position. The valve may fall into the cylinder if the piston is not properly in the TDC position.





Use special tool valve spring compressor (MD998772) to compress the valve spring, and remove the valve spring retainer locks.



NOTE: Installation position of special tool (MD998772) is different between exhaust side and inlet side.

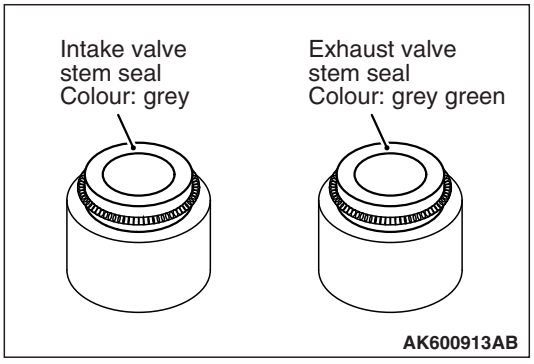
INSTALLATION SERVICE POINTS

>>A<< VALVE STEM SEAL INSTALLATION

⚠ CAUTION

Valve stem seal for intake valves and for exhaust valves are different. Be sure to install the correct ones.

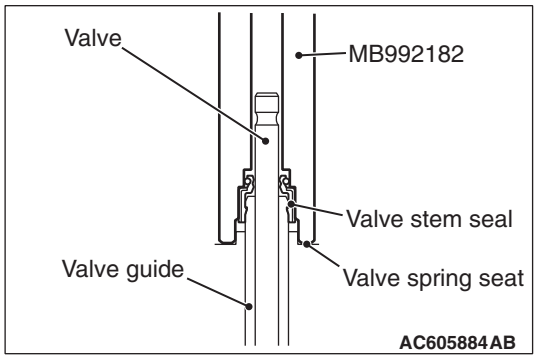
- **Valve stem seal identification colour.**
  Intake: GREY
  Exhaust: GREY GREEN



1. Apply an adequate and minimum amount of engine oil to the valve stem seal.

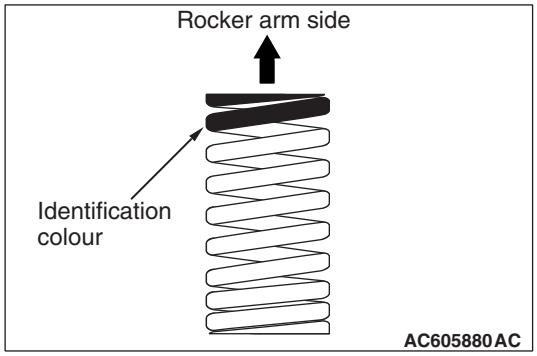
⚠ CAUTION

- **Valve stem seal cannot be reused.**
- **Special tool valve stem seal installer (MB992182) must be used to install the valve stem seal. Improper installation could result in oil leaking past the valve guide.**



2. Use special tool valve stem seal installer (MB992182) to fill a new valve stem seal in the valve guide using the valve stem area as a guide.

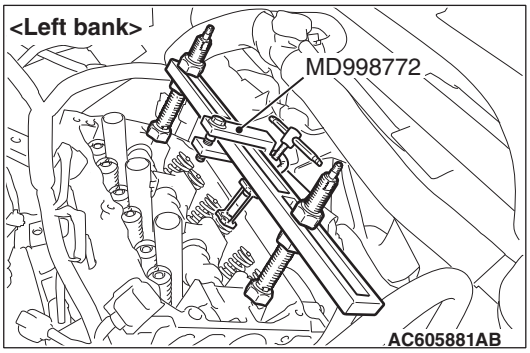
>>B<< VALVE SPRING INSTALLATION

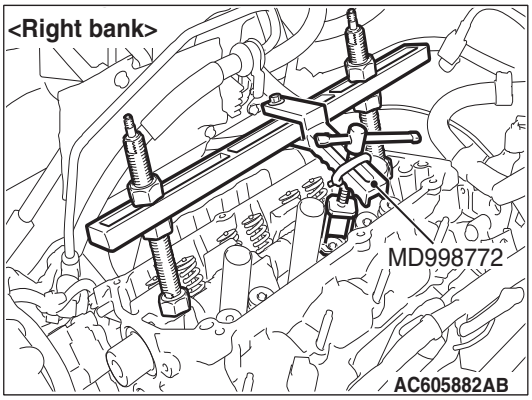


Install the valve spring with its identification colour painted end facing the locker arm.

Identification colour
Intake: White
Exhaust: Blue

>>C<< VALVE SPRING RETAINER LOCK INSTALLATION

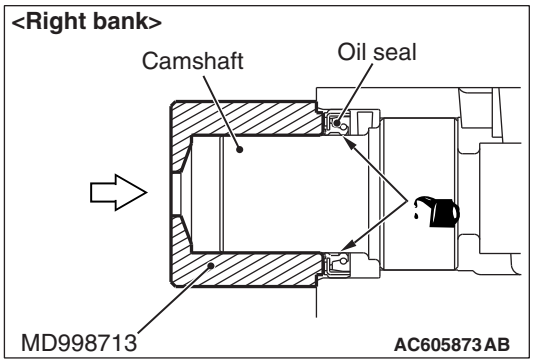


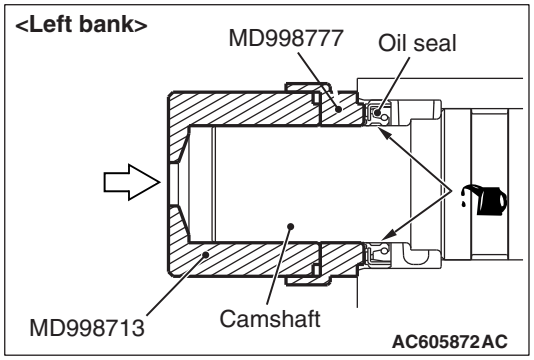


Use special tool valve spring compressor (MD998772) to compress the valve spring in the same manner as removal, and install the valve spring retainer locks.

>>D<< CAMSHAFT OIL SEAL INSTALLATION

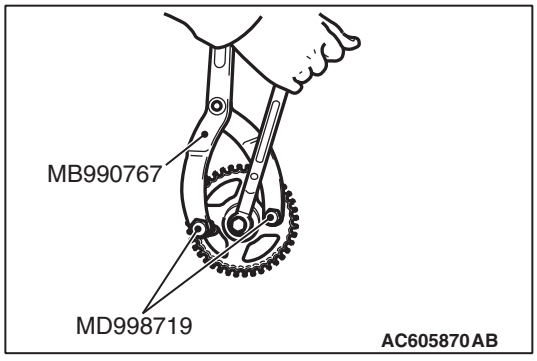
1. Apply an adequate and minimum amount of engine oil to the camshaft oil seal lip.





2. Use the following special tools to press-fit the camshaft oil seal.
   - Camshaft oil seal installer (MD998713)
   - Camshaft oil seal adapter installer (MD998777)

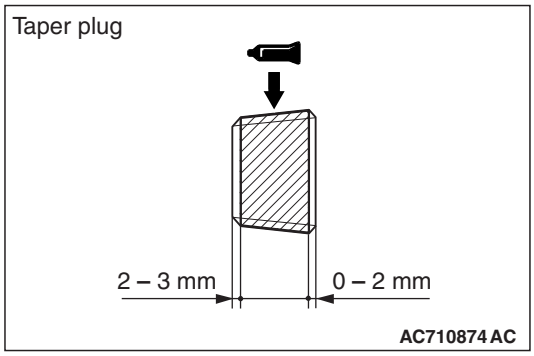
>>E<< CAMSHAFT SPROCKET INSTALLATION



1. Use the following special tools in the same way as during removal to install the camshaft sprocket.
   - Front hub and flange yoke holder (MB990767)
   - Pin (MD998719)
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

   Tightening torque: 90 ± 10 N·m

>>F<< TAPER PLUG INSTALLATION



1. Apply the specified sealant to the thread of the taper plug.

   Specified Sealant: Three bond 1215 or equivalent

   NOTE: Install the taper plug immediately after applying sealant.

⚠ CAUTION

After the installation, until a sufficient period of time (one hour or more) elapses, do not apply the oil or water to the sealant application area or start the engine.

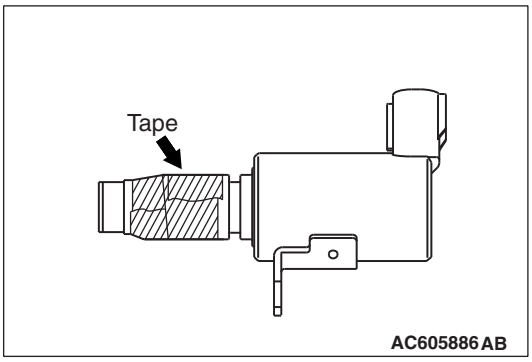
2. Tighten the taper plug to the specified torque.

   Tightening torque: 10 ± 2 N·m

>>G<< O-RING/ENGINE OIL CONTROL VALVE INSTALLATION

⚠ CAUTION

- **Never re-use the O-ring.**
- **Before installing O-ring, wind sealing tape around the oil passages cut-out area of engine oil control valve, to prevent damage. If the O-ring is damaged, it can cause an oil leak.**

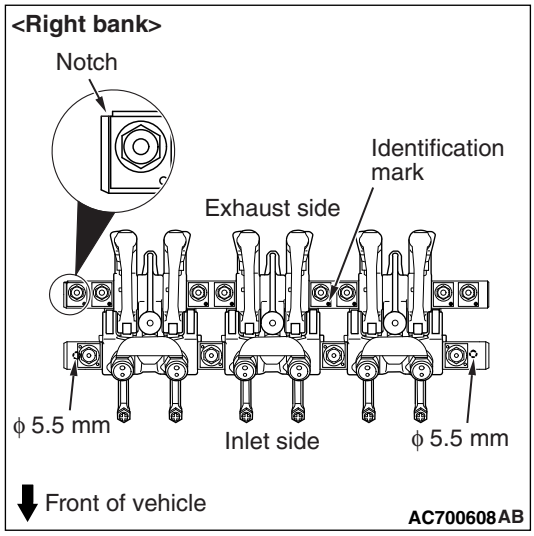


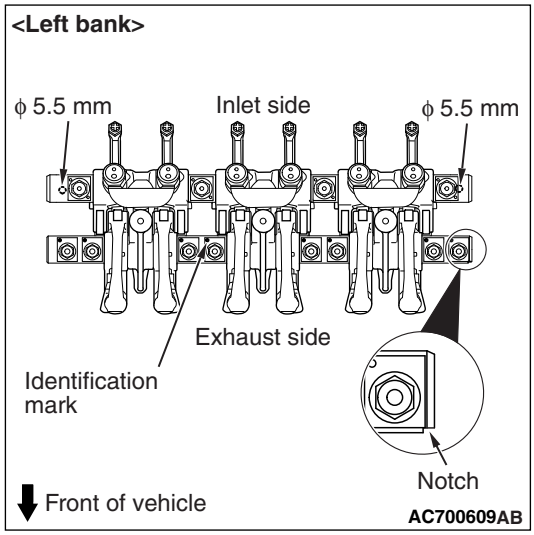
1. Apply an adequate and minimum amount of engine oil to the O-ring and then install it to the engine oil control valve.

2. Install the engine oil control valve to the cylinder head.
3. Tighten the engine oil control valve.

Tightening torque: 11 ± 1 N·m

>>H<< ROCKER ARM AND SHAFT ASSEMBLY (INLET SIDE)/ROCKER ARM, SHAFT AND LASH ADJUSTER ASSEMBLY (EXHAUST SIDE) INSTALLATION



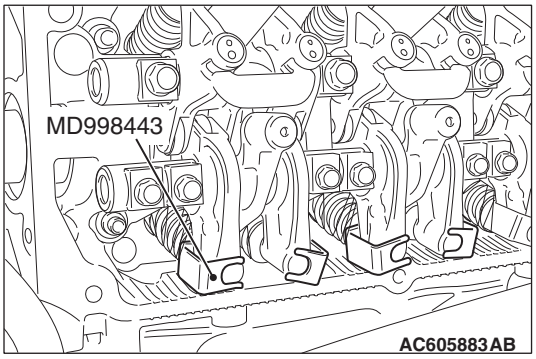


1. Install the inlet side rocker arm and shaft assembly so that the ϕ5.5 mm holes of rocker arm shaft face the cylinder head side.
2. Tighten the inlet side rocker arm shaft mounting bolts to the specified torque.

Tightening torque: 31 ± 3 N·m

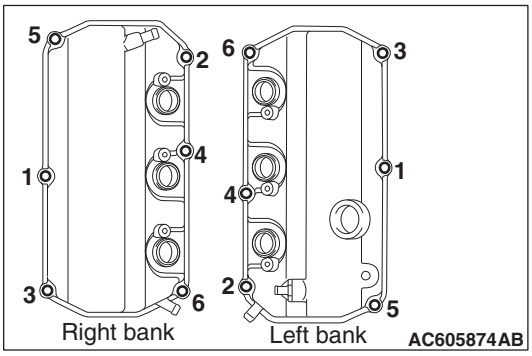
3. Install the exhaust side rocker arm, shaft and lash adjuster assembly so that the notch of rocker arm shaft is located as shown in the figure.
4. Check that the identification mark of exhaust side rocker shaft cap is located as shown in the figure.
5. Tighten the exhaust side rocker arm shaft mounting bolts to the specified torque.

Tightening torque: 13 ± 1 N·m



6. Remove special tool auto-lash adjuster holder (MD998443).

>>I<< ROCKER COVER INSTALLATION



Tighten the rocker cover mounting bolts to the specified torque in order of the numbers shown in the illustration.

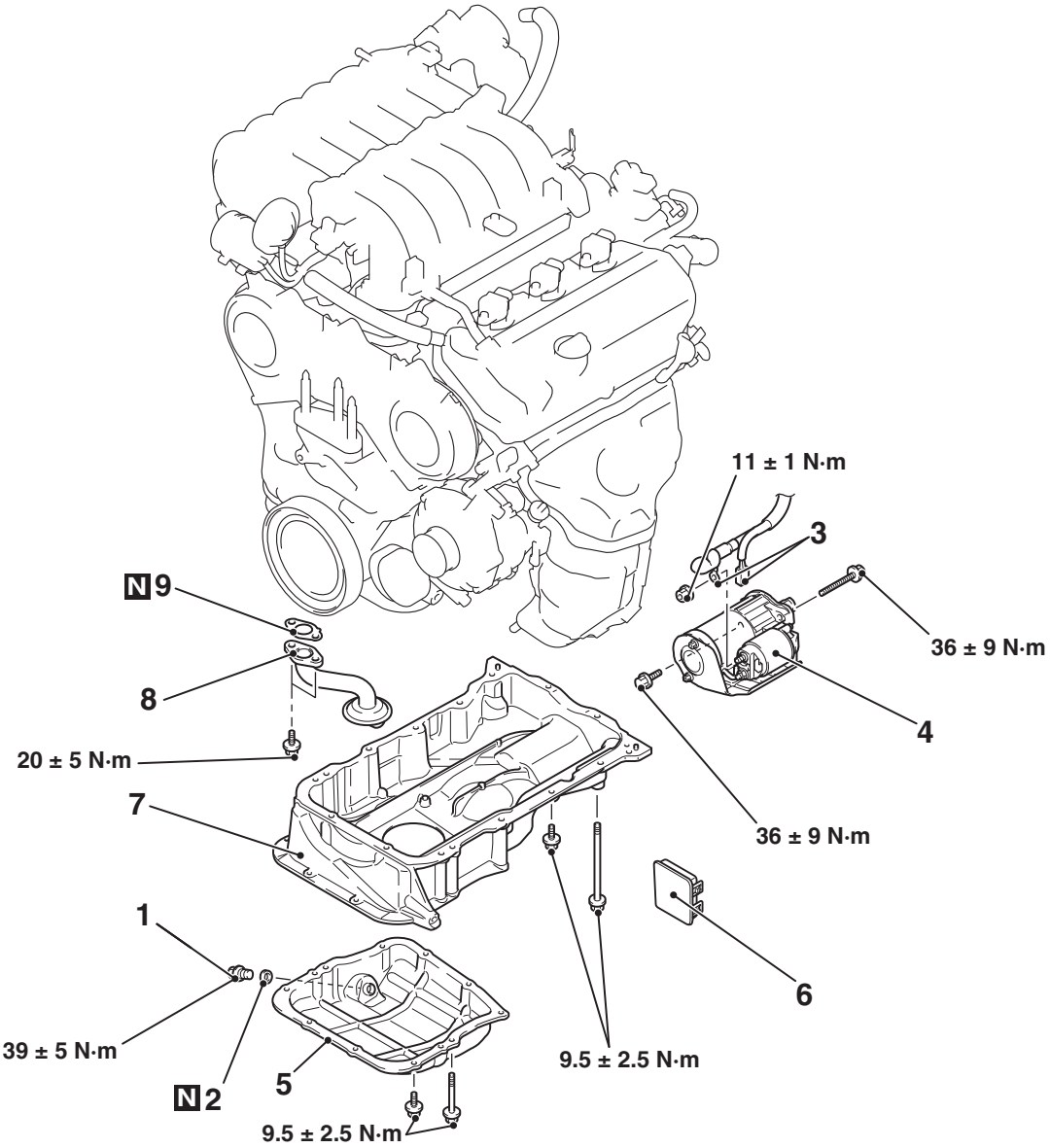
Tightening torque: 8.3 ± 1.0 N·m

OIL PAN AND OIL STRAINER

REMOVAL AND INSTALLATION

M1112008301231

Pre-removal operation	Post-installation operation
• Engine Room Under Cover Front B Removal (Refer to GROUP 51 – Under Cover). • Engine Oil Draining (Refer to GROUP 12 – On-vehicle Service, Engine Oil Replacement).	• Engine Oil Refilling (Refer to GROUP 12 – On-vehicle Service, Engine Oil Replacement). • Engine Room Under Cover Front B Installation (Refer to GROUP 51 – Under Cover).



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Removal steps

1. Engine oil pan drain plug
>>**C**<< 2. Engine oil pan drain plug gasket
3. Starter connector and terminal connection
4. Starter assembly
<<**A**>> >>**B**<< 5. Engine lower oil pan

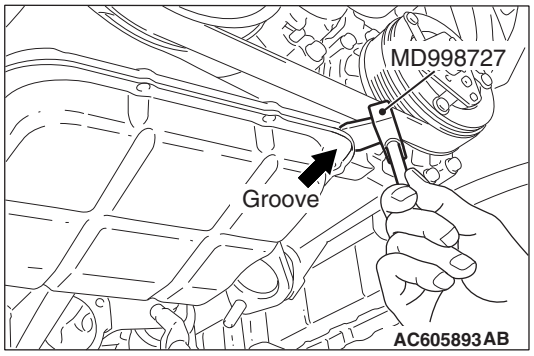
Removal steps (Continued)

- Front exhaust pipe (Refer to GROUP 15 – Exhaust Pipe and Main Muffler P.15-13).

6. Engine oil pan cover
<<**B**>> >>**A**<< 7. Engine upper oil pan
8. Oil strainer
9. Oil strainer gasket

REMOVAL SERVICE POINTS

<<A>> ENGINE LOWER OIL PAN REMOVAL



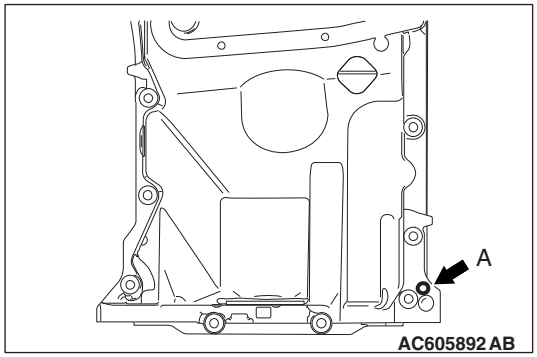
Insert special tool oil pan FIPG cutter (MD998727), into the groove shown in the illustration. Strike and slide it and then cut the liquid gasket.

<<B>> ENGINE UPPER OIL PAN REMOVAL

1. Remove the engine upper oil pan mounting bolts.

⚠ CAUTION

Do not use special tool oil pan FIPG cutter (MD998727). The engine upper oil pan is made of aluminium and this tool will damage it.

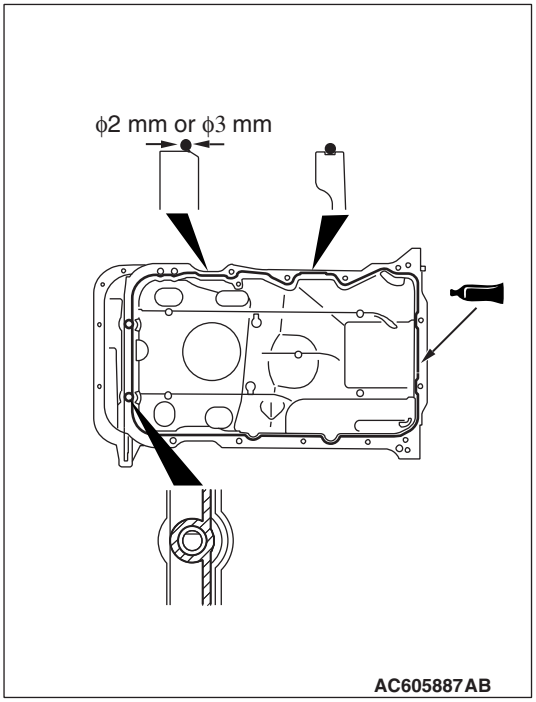


2. Screw in the bolt (M10 × 1.25) into bolt hole A in the location shown. Then lift the upper oil pan and remove it.

INSTALLATION SERVICE POINTS

>>A<< ENGINE UPPER OIL PAN INSTALLATION

1. Remove sealant from the engine upper oil pan and cylinder block mating surfaces.
2. Degrease the sealant-coated surface and the engine upper oil pan mating surface.



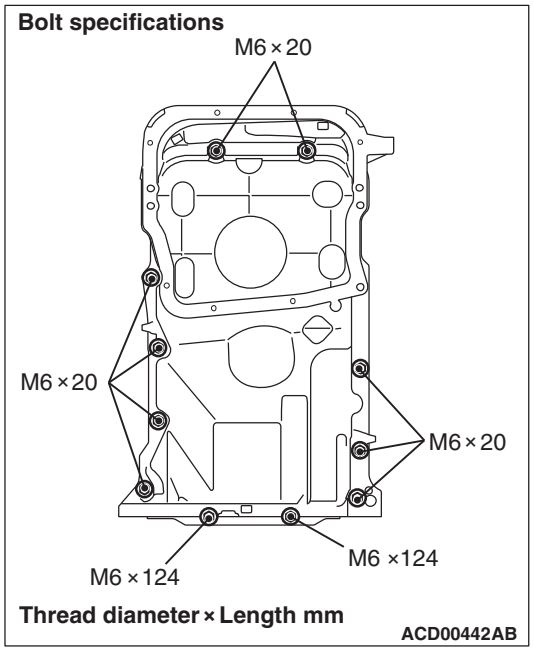
3. Apply a bead of the sealant to the cylinder block mating surface of the engine upper oil pan as shown.

   Specified sealant: Three bond 1227D or equivalent

   NOTE: The sealant should be applied in a continuous bead approximately 4 mm in diameter.

   NOTE: Install the engine upper oil pan immediately after applying sealant.
4. Assemble the engine upper oil pan to the cylinder block within three minutes after applying the sealant.

⚠ CAUTION
After the installation, until a sufficient period of time (one hour or more) elapses, do not apply the oil or water to the sealant application area or start the engine.

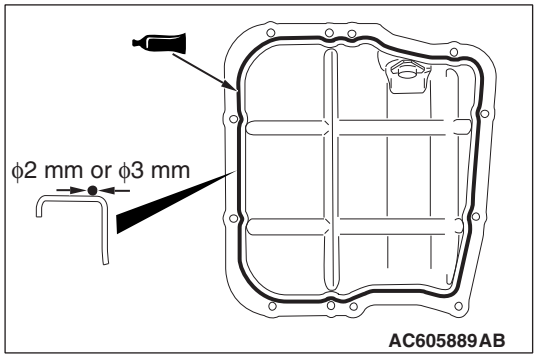


5. Install the mounting bolts to the engine upper oil pan as shown, and tighten them to the specified torque.

   Tightening torque: 9.5 ± 2.5 N·m

>>B<< ENGINE LOWER OIL PAN INSTALLATION

1. Remove sealant from the engine lower oil pan and engine upper oil pan.
2. Degrease the sealant-coated surface and the engine lower oil pan mating surface.

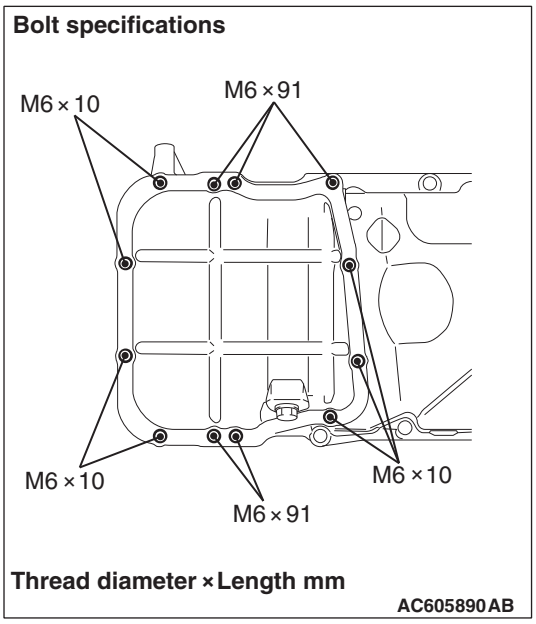


3. Apply a bead of the sealant to the mating surface of the engine lower oil pan as shown.

   Specified sealant: Three bond 1227D or equivalent

   NOTE: Install the engine lower oil pan immediately after applying sealant.

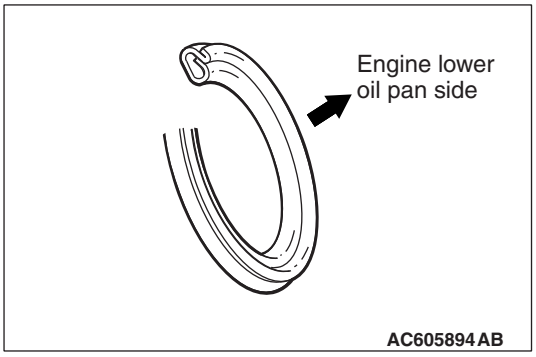
⚠ CAUTION
After the installation, until a sufficient period of time (one hour or more) elapses, do not apply the oil or water to the sealant application area or start the engine.



4. Install the mounting bolts to the engine lower oil pan as shown, and tighten them to the specified torque.

   Tightening torque: 9.5 ± 2.5 N·m

>>C<< ENGINE OIL PAN DRAIN PLUG INSTALLATION



Replace the engine oil pan drain plug gasket with a new gasket. Install the new engine oil pan drain plug gasket in the direction shown in the illustration.

INSPECTION

M1112008400183

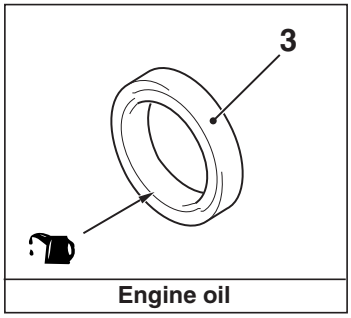
- Check the engine oil pan for cracks.
- Check the engine oil pan sealant-coated surface for damage and deformation.
- Check the oil strainer for cracked, clogged or damaged wire net and pipe.

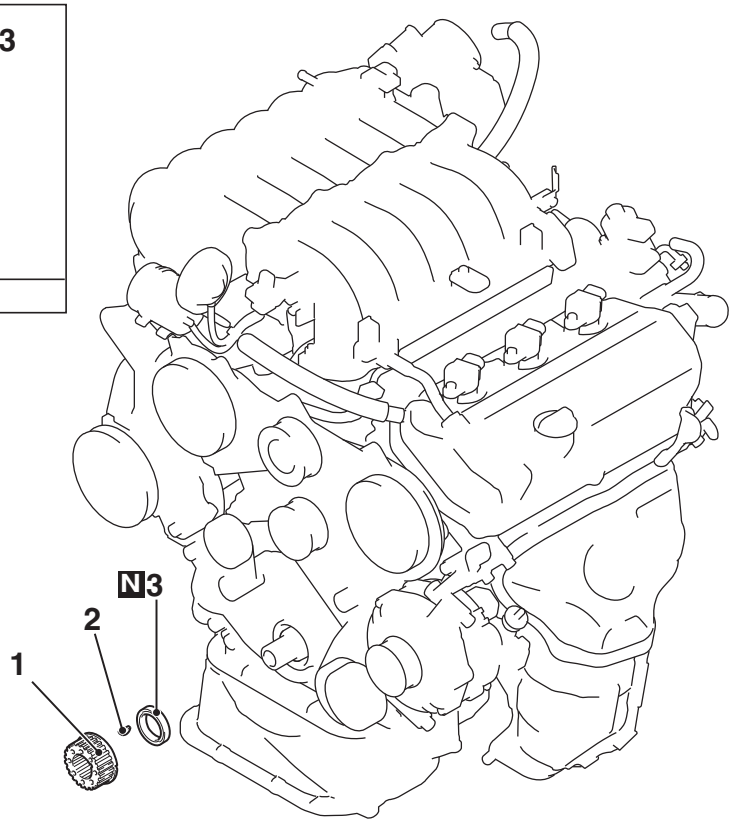
CRANKSHAFT FRONT OIL SEAL

REMOVAL AND INSTALLATION

M1112003400627

Pre-removal and Post-installation Operation
- Timing Belt Removal and Installation (Refer to P.11I-40).





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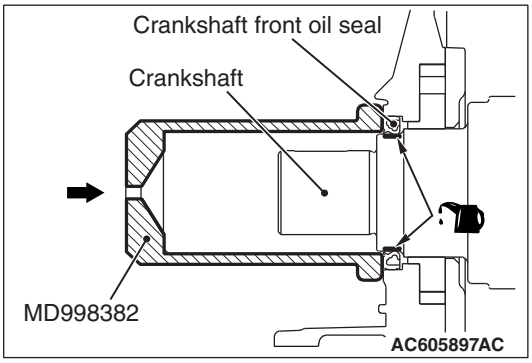
Removal steps

>>B<< 1. Crankshaft sprocket
2. Key
>>A<< 3. Crankshaft front oil seal

INSTALLATION SERVICE POINTS

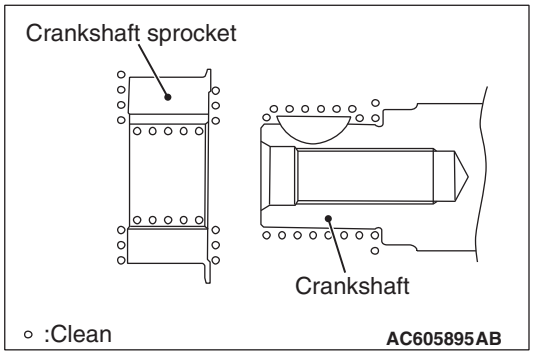
>>A<< CRANKSHAFT FRONT OIL SEAL INSTALLATION

1. Apply an adequate and minimum amount of engine oil to the crankshaft front oil seal lip.



2. Using special tool crankshaft front oil seal installer (MD998382), tap the crankshaft front oil seal into the front case.

>>B<< CRANKSHAFT SPROCKET INSTALLATION



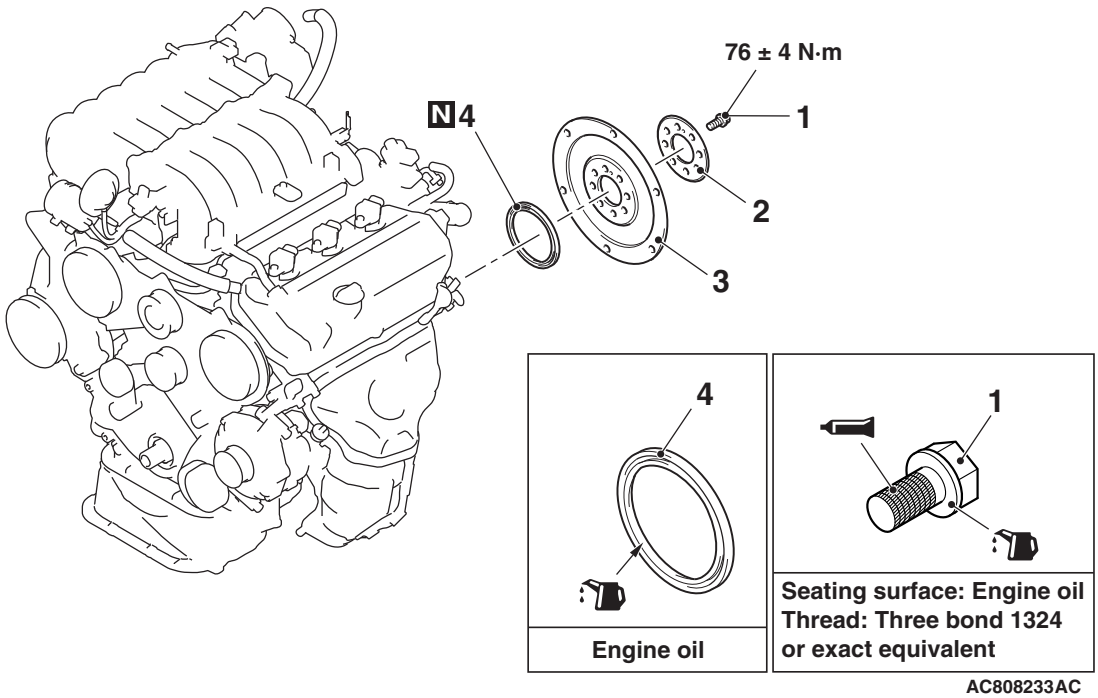
Clean the crankshaft and crankshaft sprocket, and mount them.

CRANKSHAFT REAR OIL SEAL

REMOVAL AND INSTALLATION

M1112003700844

Pre-removal and Post-installation Operation
- Transmission Assembly Removal and Installation (Refer to GROUP 23C – Transmission Assembly P.23C-16).



Removal steps

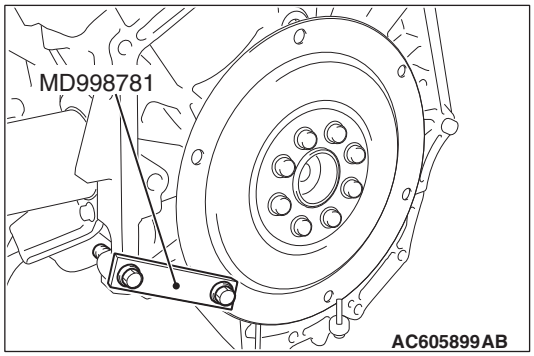
<<A>> >>B<< 1. Drive plate mounting bolt
2. Adaptor plate

Removal steps (Continued)

3. Drive plate
>>A<< 4. Crankshaft rear oil seal

REMOVAL SERVICE POINT

<<A>> DRIVE PLATE MOUNTING BOLT REMOVAL

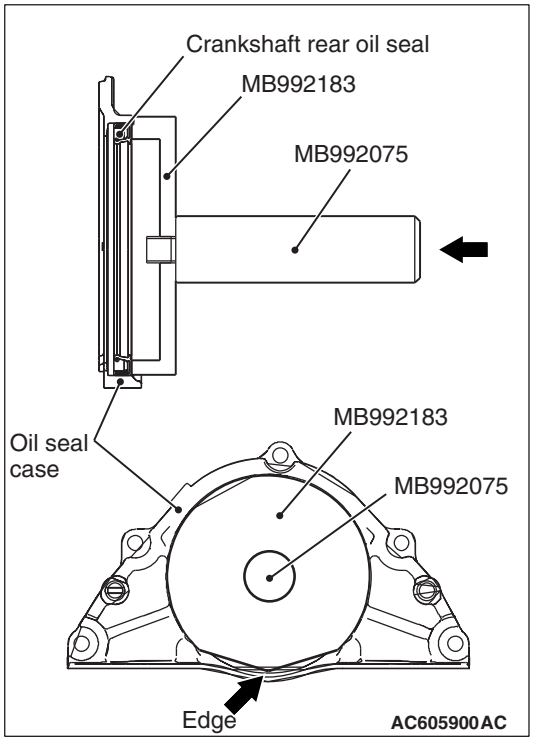


Use special tool flywheel stopper (MD998781) to secure the drive plate and remove the drive plate mounting bolts.

INSTALLATION SERVICE POINTS

>>A<< CRANKSHAFT REAR OIL SEAL INSTALLATION

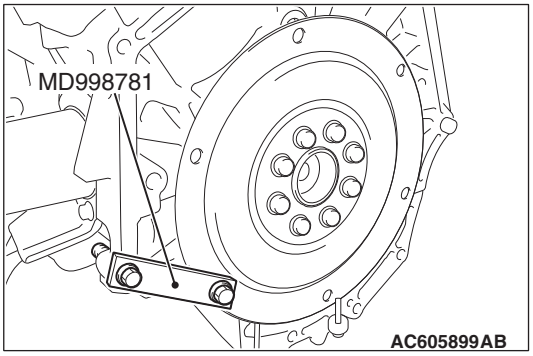
1. Apply a small amount of engine oil to the entire inner diameter of the crankshaft rear oil seal lip.



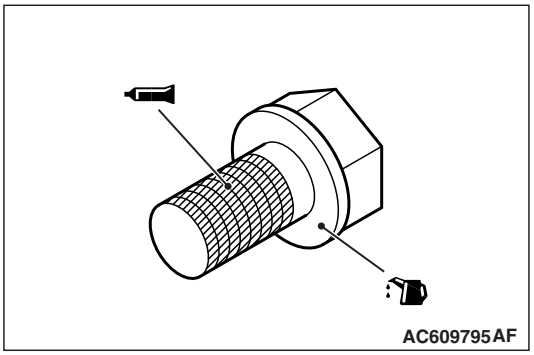
2. Use the following special tools, press-fit a new crankshaft rear oil seal into the oil seal case.
   - Handle (MB992075)
   - Crankshaft rear oil seal installer (MB992183)

>>B<< DRIVE PLATE MOUNTING BOLT INSTALLATION

1. Remove the sealant, the engine oil, and other adhering materials from the drive plate installation face, the crankshaft screw hole and drive plate mounting bolts.
2. Install the drive plate and drive plate adapter plate to the crankshaft.



3. Use special tool flywheel stopper (MD998781) to secure the drive plate in the same manner as removal.



4. Apply the engine oil to the installation face of the drive plate mounting bolts for the drive plate.
5. Apply specified sealant to the drive plate mounting bolts threads.

   Specified sealant: Three bond 1324 or exact equivalent

6. Tighten the drive plate mounting bolts to the specified torque.

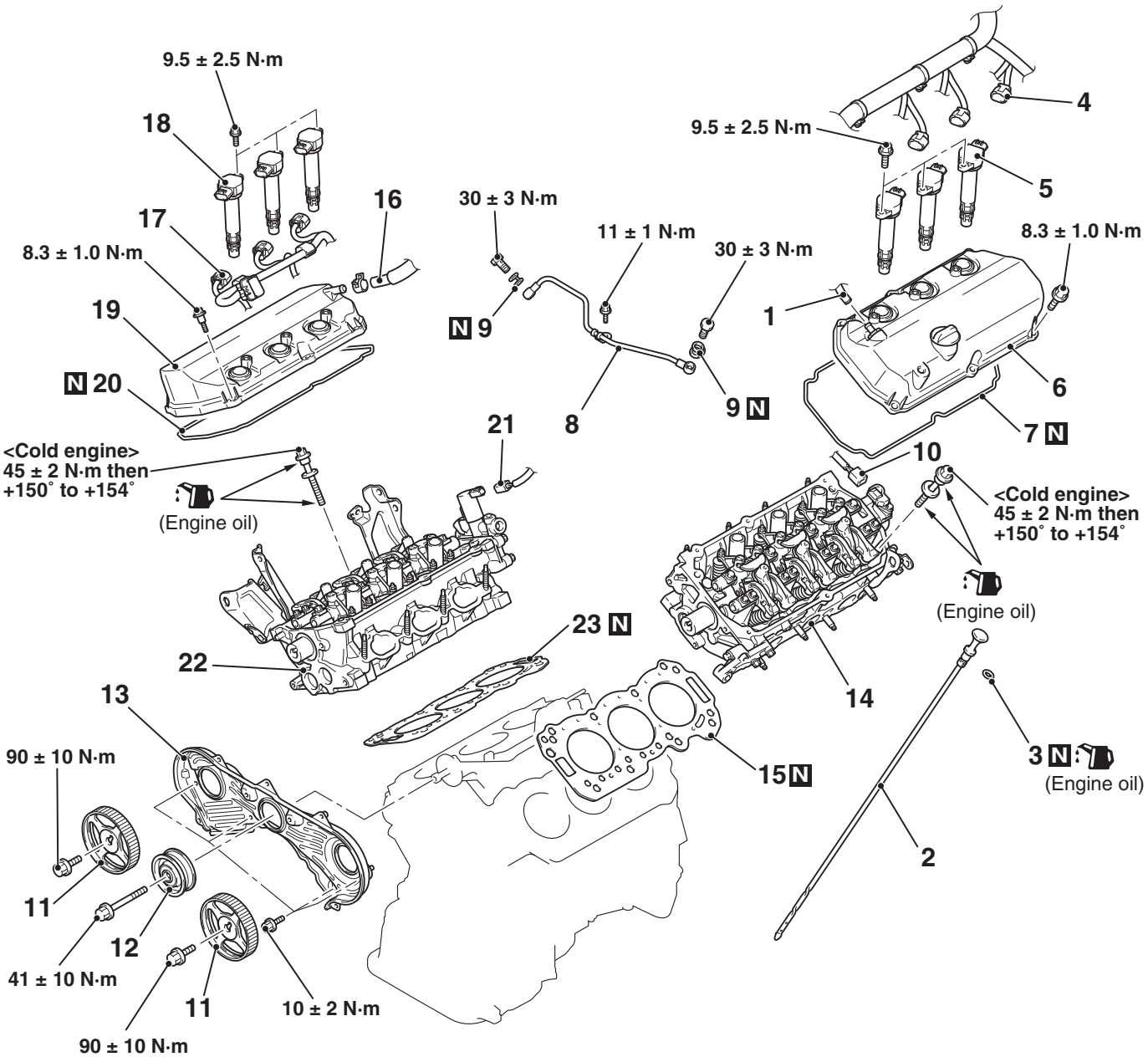
   Tightening torque: 76 ± 4 N·m

CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

M1112004005445

Pre-removal operation	Post-installation operation
• Fuel Line Pressure Reduction [Refer to GROUP 13F – On-vehicle Service, Fuel Pump Connector Disconnection (How to Reduce Pressurized Fuel Lines) P.13F-213]. • Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6). • Alternator Removal (Refer to GROUP 16 – Charging System, Alternator Assembly P.16-3). • Thermostat Housing Removal (Refer to GROUP 14 – Water Hose and Water Pipe P.14-10). • Intake Manifold Removal (Refer to GROUP 15 – Intake Manifold P.15-5). • Exhaust Manifold Removal (Refer to GROUP 15 – Exhaust Manifold P.15-8). • Timing Belt Removal (Refer to P.11I-40).	• Timing Belt Installation (Refer to P.11I-40). • Exhaust Manifold Installation (Refer to GROUP 15 – Exhaust Manifold P.15-8). • Intake Manifold Installation (Refer to GROUP 15 – Intake Manifold P.15-5). • Thermostat Housing Installation (Refer to GROUP 14 – Water Hose and Water Pipe P.14-10). • Alternator Installation (Refer to GROUP 16 – Charging System, Alternator Assembly P.16-3). • Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6). • Fuel Leak Check



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Removal steps

1. PCV hose connection
2. Engine oil level gauge
3. O-ring
4. Ignition coil connector
5. Ignition coil
6. Rocker cover
7. Rocker cover gasket
8. Oil pipe
9. Gasket
10. Camshaft position sensor connector

<<A>> >>B<< 11. Camshaft sprocket

12. Idler pulley

Removal steps (Continued)

13. Timing belt rear cover

<<B>> >>A<< 14. Left bank cylinder head assembly

>>A<< 15. Cylinder head gasket

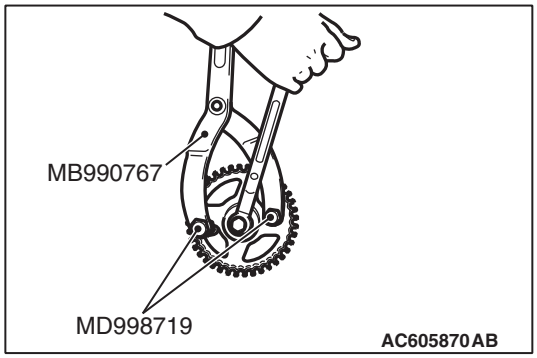
16. Breather hose connection
17. Ignition coil connector
18. Ignition coil
19. Rocker cover
20. Rocker cover gasket
21. Oil feeder control valve connector

<<B>> >>A<< 22. Right bank cylinder head assembly

>>A<< 23. Cylinder head gasket

REMOVAL SERVICE POINTS

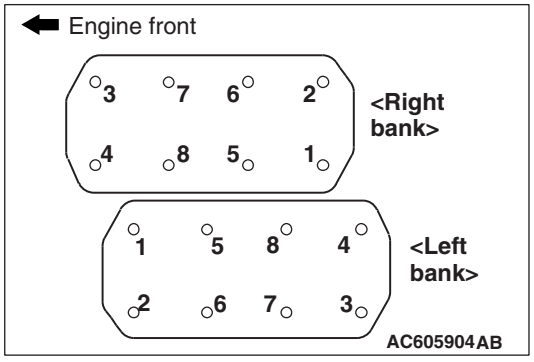
<<A>> CAMSHAFT SPROCKET REMOVAL



Use the following special tools to remove the camshaft sprocket.

- Front hub and flange yoke holder (MB990767)
- Pin (MD998719)

<<B>> CYLINDER HEAD ASSEMBLY REMOVAL



Loosen the bolts in two or three steps in the order of the numbers shown in the illustration, and remove them.

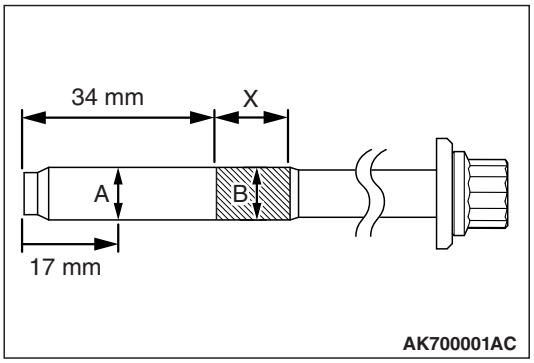
INSTALLATION SERVICE POINTS

>>A<< CYLINDER HEAD GASKET/CYLINDER HEAD ASSEMBLY INSTALLATION

⚠ CAUTION

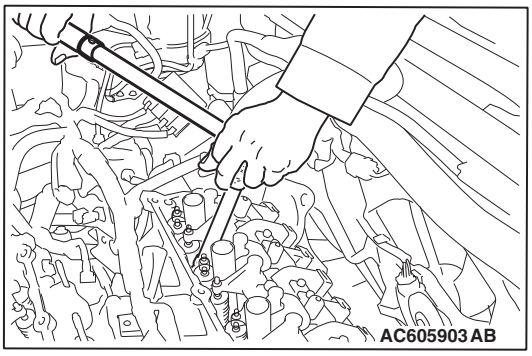
Be careful that no foreign material gets into the cylinder, coolant passages or oil passages. Engine damage may result.

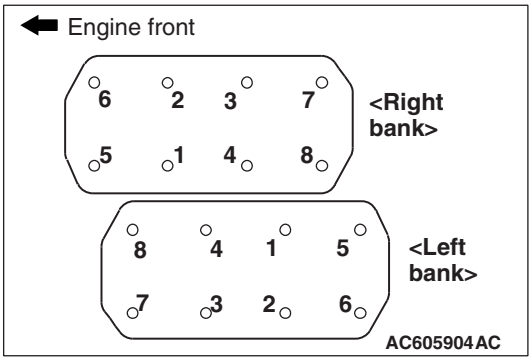
1. Use a scraper to clean the gasket surface of the cylinder head assembly and cylinder block.
2. Install the cylinder head gasket and cylinder head assembly to the cylinder block.



3. Check in the following procedure before reusing the cylinder head bolt.
   (1) Measure the outside diameter "A".
   (2) Measure the smallest outside diameter "B" within the range "X" shown in the illustration.
   (3) If the difference of outside diameter of thread exceeds the limit, replace the cylinder head bolt.

   Limit: 0.1mm



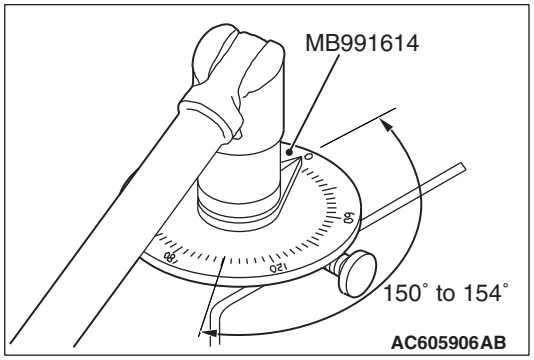


4. Tighten the bolts to the specified torque in the order shown in the illustration (in two or three cycles).

   Tightening torque: 45 ± 2 N·m

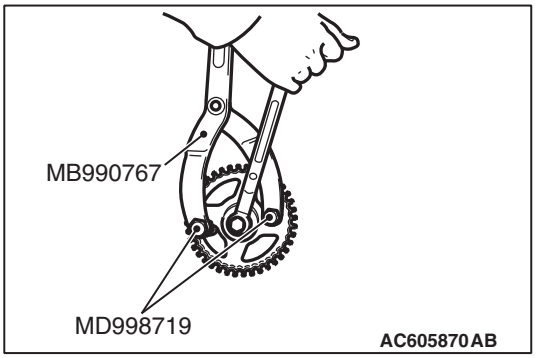
⚠ CAUTION

- **When the tightening angle is smaller than the specified tightening angle, the appropriate tightening capacity cannot be secured.**
- **When the tightening angle is larger than the specified tightening angle, remove the bolt to start from the beginning again according to the procedure.**



5. Using special tool angle gauge (MB991614), tighten the cylinder head bolt another 150 to 154 degrees again.

>>B<< CAMSHAFT SPROCKET INSTALLATION



1. Use the following special tools in the same way as during removal to install the camshaft sprocket.
   - Front hub and flange yoke holder (MB990767)
   - Pin (MD998719)
2. Tighten the camshaft sprocket mounting bolt to the specified torque.

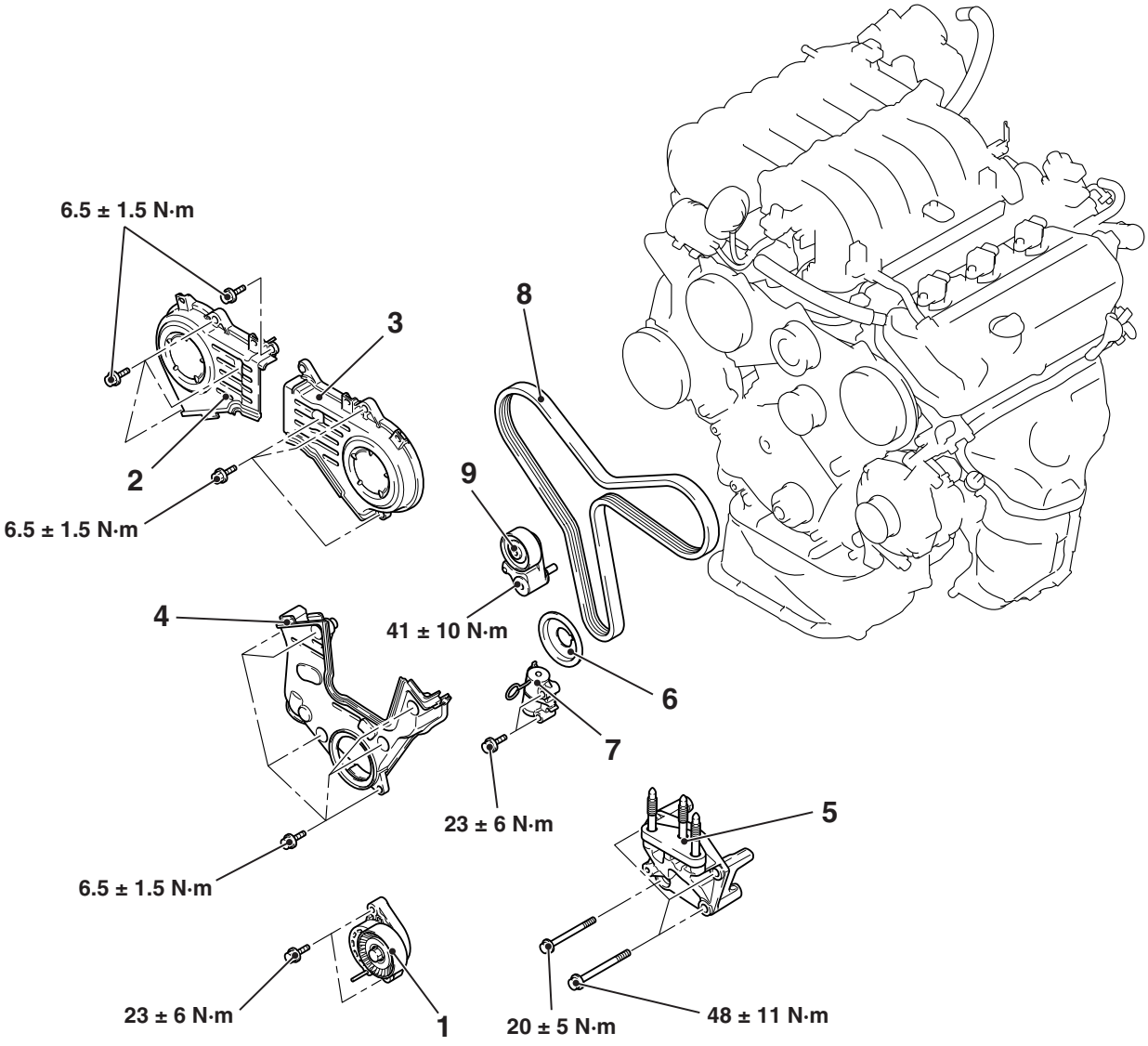
   Tightening torque: 90 ± 10 N·m

TIMING BELT

REMOVAL AND INSTALLATION

M1112004302919

Pre-removal operation	Post-installation operation
• Engine Cover Removal (Refer to GROUP 16 – Ignition System, Ignition Coil <6B3>P.16-19). • Engine Room Under Cover Front B and Engine Room Side Cover (RH) Removal (Refer to GROUP 51 – Under Cover). • Crankshaft Pulley Removal (Refer to P.11I-17).	• Crankshaft Pulley Installation (Refer to P.11I-17). • Engine Room Under Cover Front B and Engine Room Side Cover (RH) Installation (Refer to GROUP 51 – Under Cover). • Engine Cover Installation (Refer to GROUP 16 – Ignition System, Ignition Coil <6B3>P.16-19).



AC605911AC

Removal steps

1. Alternator drive belt auto-tensioner
2. Timing belt front upper cover, right
3. Timing belt front upper cover, left
4. Timing belt lower cover
- Engine mounting bracket (Refer to GROUP 32 – Engine Mounting P.32-2).

Removal steps (Continued)

5. Engine support bracket
6. Front flange

<<A>> >>A<< 7. Timing belt auto-tensioner

<<B>> >>A<< 8. Timing belt

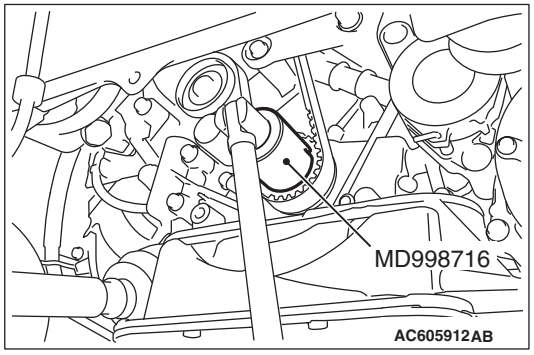
9. Tensioner pulley assembly

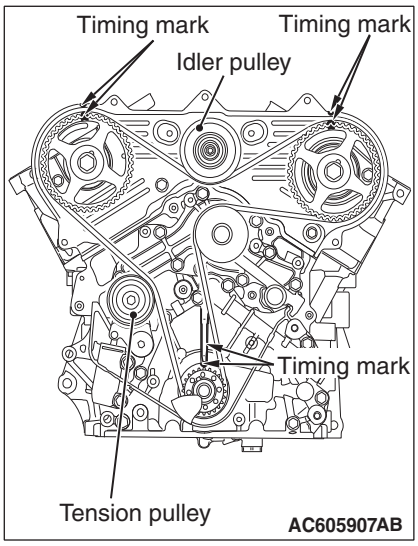
REMOVAL SERVICE POINTS

<<A>> TIMING BELT AUTO-TENSIONER REMOVAL

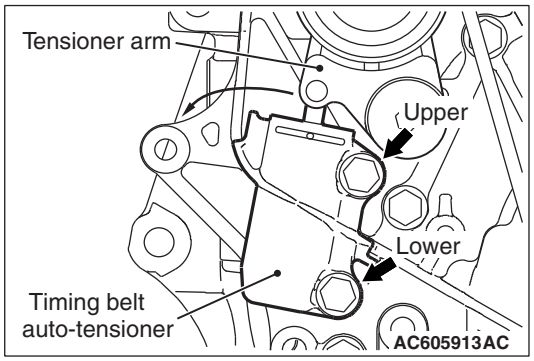
⚠ CAUTION

Never turn the crankshaft anti-clockwise.





1. Use special tool crankshaft wrench (MD998716) to turn the crankshaft clockwise to align each timing mark and to set the No. 1 cylinder to compression top dead centre.



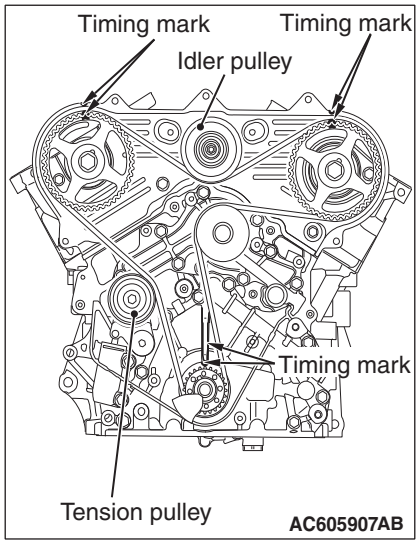
2. Remove the upper mounting bolt of the timing belt auto-tensioner.

⚠ CAUTION

The timing belt auto-tensioner rotates centring on the flange bolt due to the rod thrust, so please make sure your finger is not trapped.

3. Loosen the lower mounting bolt of the timing belt auto-tensioner slowly and slide the timing belt auto-tensioner slightly. Remove the rod from the tensioner arm.
4. Remove the lower mounting bolt of the timing belt auto-tensioner.

<<B>> TIMING BELT REMOVAL



1. Check that the timing marks of each sprocket are aligned.
2. If the timing belt is to be reused, chalk an arrow on the flat side of the belt, indicating the clockwise direction.
3. Loosen the centre bolt of the tensioner pulley, then remove the timing belt.

INSTALLATION SERVICE POINT

>>A<< TIMING BELT/TIMING BELT AUTO-TENSIONER INSTALLATION

⚠ CAUTION

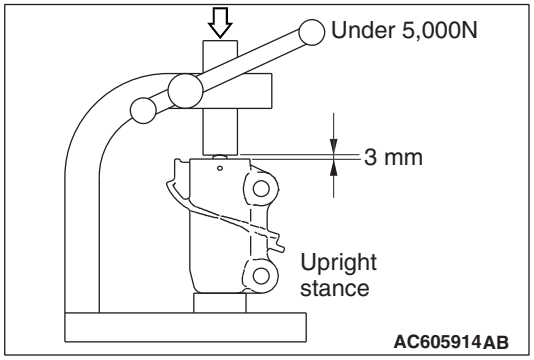
Always bleed the timing belt auto-tensioner of air before installing the timing belt auto-tensioner (Refer to P.11I-43).

1. Insert the pin into the rod of the timing belt auto-tensioner under the following procedures.

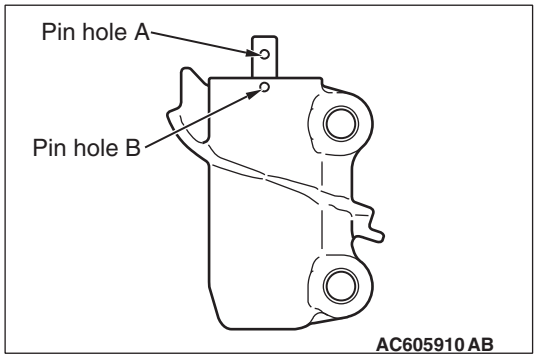
⚠ CAUTION

Notable factors for inserting pin

- **Always use the vertical press and put the timing belt auto-tensioner vertically.**
- **Do not apply the load of 5,000 N or more to the rod.**
- **Do not press the rod beyond the dimension shown in the illustration.**



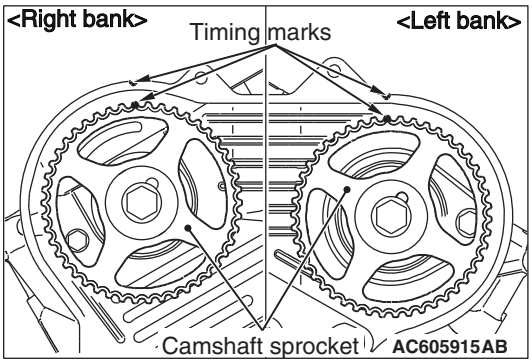
(1) Put the timing belt auto-tensioner vertically to the vertical press not to be in the sideways direction.

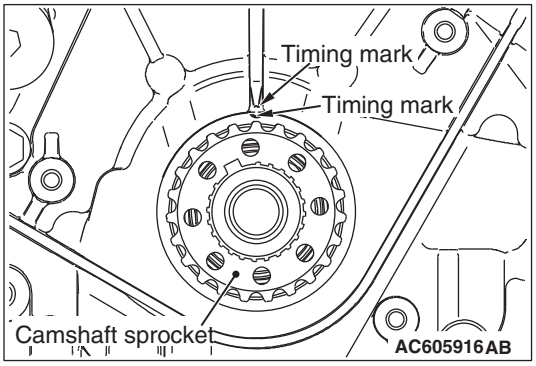


(2) Slowly close the vice to force the rod in until the hole (A) of the rod is lined up with set hole (B) of the cylinder.
(3) Insert a pin into the set holes.
(4) Remove the timing belt auto-tensioner from the vice.

2. Install the timing belt auto-tensioner with the setting pin, and tighten the mounting bolts to the specified torque.

Tightening torque: 23 ± 6 N·m

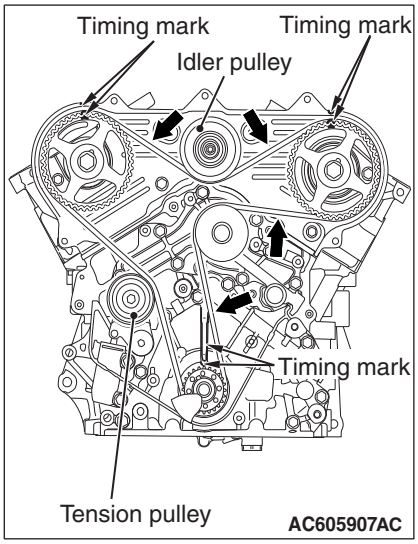




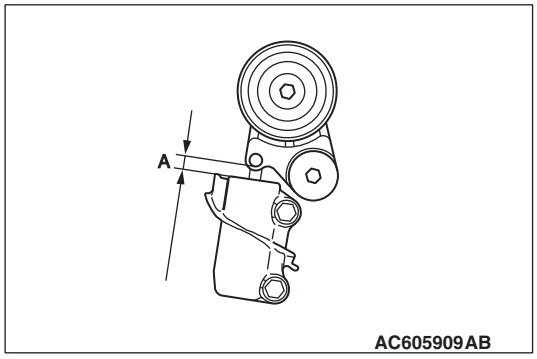
3. Align the timing marks on the camshaft sprockets with those on the timing belt rear cover and the timing mark on the crankshaft sprocket with that on the engine block as shown in the illustration.

⚠ CAUTION

The camshaft sprocket (right bank) can turn easily due to the spring force applied, so be careful not to get your fingers caught.



4. Install the timing belt by the following procedure so that there is no deflection in the timing belt between each sprocket and pulley.
   (1) Crankshaft sprocket
   (2) Water pump pulley
   (3) Camshaft sprocket (Left bank)
   (4) Idler pulley
   (5) Camshaft sprocket (Right bank)
   (6) Tensioner pulley
5. Apply the force to the camshaft sprocket (Right bank) anti-clockwise until the tension side of timing belt is tight. Check all the timing marks again.
6. Remove the setting pin that has been inserted into the timing belt auto-tensioner.
7. Turn the crankshaft clockwise twice to align the timing marks.



8. Wait for at least five minutes, then check that the timing belt auto-tensioner pushrod extends within the standard value range.

   Standard value (A): 9.1 – 13.4 mm

9. If not, repeat the operation in steps 1 to 8 above.
10. Check again that the timing marks of the each sprockets are aligned.

INSPECTION

M1112004400910

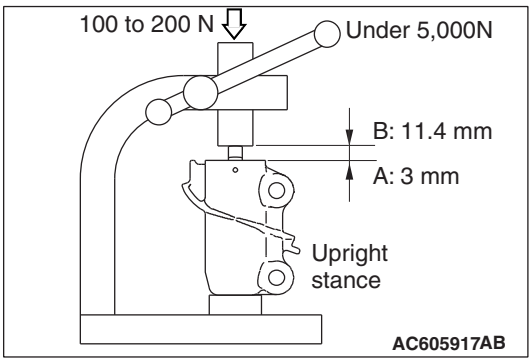
TIMING BELT AUTO-TENSIONER CHECK

1. Check for oil leak from seal, and replace it if leak is detected.
2. Check for wear or damage at the top of the rod. Replace it, if required.

AIR BLEEDING METHOD

⚠ CAUTION

- **Always use the vertical press and put the timing belt auto-tensioner vertically.**
- **Do not apply the load of 5,000 N or more to the rod.**
- **Do not press the rod beyond Dimension "A" shown in the illustration.**



1. Set the timing belt auto-tensioner as shown in the illustration.
2. Press the rod slowly down to the lowest point "A" shown in the illustration.
3. Repeat the procedure 2 three times.
4. While the rod is projected at the point "B" shown in the illustration, push the rod with 100 – 200 N. Check the enough stiffness. If the stiffness is not enough, replace the timing belt auto-tensioner.
5. Press down the rod slowly. Put the pin through the hole and secure it.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

M1112001007118

⚠ CAUTION

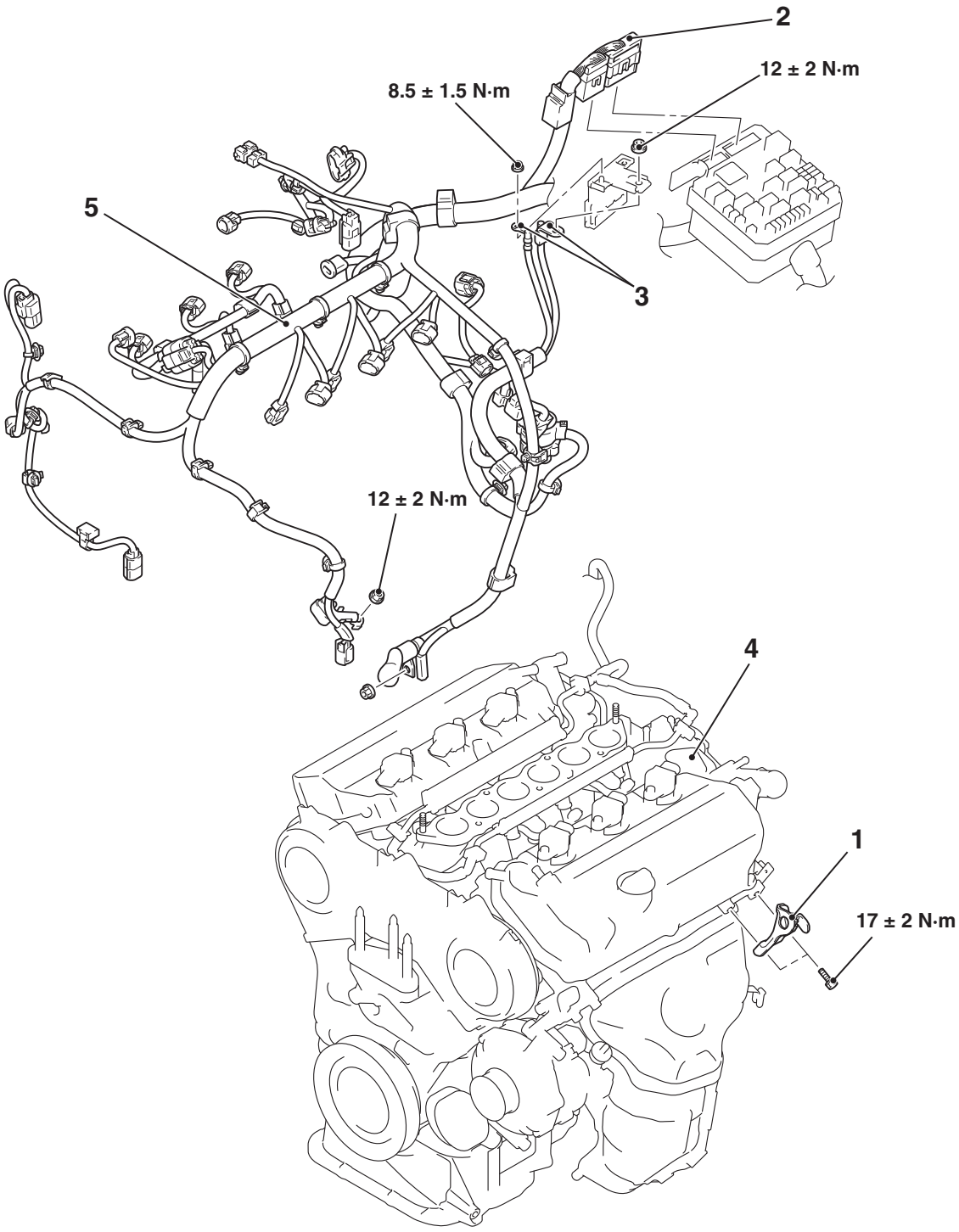
When the engine assembly replacement is performed, use M.U.T.-III to initialise the learning value (Refer to GROUP 00 – Initialisation Procedure for Learning Value in MPI Engine P.00-7).

Pre-removal Operation

- Hood Removal (Refer to GROUP 42A – Hood <LHD>).
- Hood Removal (Refer to GROUP 42A – Hood <RHD>).
- Fuel Line Pressure Reduction [Refer to GROUP 13F – On-vehicle Service, Fuel Pump Connector Disconnection (How to Reduce Pressurized Fuel Lines) P.13F-213].
- Engine Room Under Cover Front B and Engine Room Side Cover (RH) Removal (Refer to GROUP 51 – Under Cover).
- Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6).
- Engine Oil Draining (Refer to GROUP 12 – On-vehicle Service, Engine Oil Replacement).
- Transmission Fluid Draining (Refer to GROUP 23C – On-vehicle Service, A/T Fluid Replacement P.23C-15).
- Transfer Oil Draining (Refer to GROUP 23C – On-vehicle Service, Transfer Oil Replacement).
- Engine Cover Removal (Refer to GROUP 16 – Ignition System, Ignition Coil P.16-19).
- Air Cleaner Assembly Removal (Refer to GROUP 15 – Air Cleaner P.15-11).
- Engine-ECU Removal (Refer to GROUP 13F – Engine-ECU P.13F-232).
- Battery and Battery Tray Removal (Refer to GROUP 54A – Battery).
- Front Exhaust Pipe and Front Exhaust Pipe RH Removal (Refer to GROUP 15 – Exhaust Pipe and Main Muffler P.15-13).
- Strut Tower Bar Removal (Refer to GROUP 42A – Strut Tower Bar).
- Drive shaft Removal (Refer to GROUP 26 – Drive shaft Assembly P.26-2).
- Propeller Shaft Removal (Refer to GROUP 25 – Propeller Shaft).
- Rear Roll Stopper Removal (Refer to GROUP 32 – Engine Roll Stopper and Centremember).
- Transfer Removal (Refer to GROUP 23C – Transfer Assembly P.23C-20).
- Transfer Removal (Refer to GROUP 23C – Transfer Assembly P.23C-20).
- Starter Removal (Refer to GROUP 16 – Starting System, Starter Assembly P.16-10).
- Radiator Upper Hose and Radiator Lower Hose Removal (Refer to GROUP 14 – Radiator P.14-13).

Post-installation Operation

- Radiator Upper Hose and Radiator Lower Hose Installation (Refer to GROUP 14 – Radiator P.14-13).
- Starter Installation (Refer to GROUP 16 – Starting System, Starter Assembly P.16-10).
- Transfer Installation (Refer to GROUP 23C – Transfer Assembly P.23C-20).
- Transfer Installation (Refer to GROUP 23C – Transfer Assembly P.23C-20).
- Rear Roll Stopper Installation (Refer to GROUP 32 – Engine Roll Stopper and Centremember).
- Propeller Shaft Installation (Refer to GROUP 25 – Propeller Shaft).
- Drive shaft Installation (Refer to GROUP 26 – Drive shaft Assembly P.26-2).
- Strut Tower Bar Installation (Refer to GROUP 42A – Strut Tower Bar).
- Front Exhaust Pipe and Front Exhaust Pipe RH Installation (Refer to GROUP 15 – Exhaust Pipe and Main Muffler P.15-13).
- Battery and Battery Tray Installation (Refer to GROUP 54A – Battery).
- Engine-ECU Installation (Refer to GROUP 13F – Engine-ECU P.13F-232).
- Air Cleaner Assembly Installation (Refer to GROUP 15 – Air Cleaner P.15-11).
- Alternator Drive Belt Tension Check (Refer to P.11I-8).
- Engine Oil Refilling (Refer to GROUP 12 – On-vehicle Service, Engine Oil Replacement).
- Transmission Fluid Refilling (Refer to GROUP 23C – On-vehicle Service, A/T Fluid Replacement P.23C-15).
- Transfer Oil Refilling (Refer to GROUP 23C – On-vehicle Service, Transfer Oil Replacement).
- Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6).
- Fuel Leak Check.
- Engine Cover Installation (Refer to GROUP 16 – Ignition System, Ignition Coil P.16-19).
- Engine Room Under Cover Front B and Engine Room Side Cover (RH) Installation (Refer to GROUP 51 – Under Cover).
- Hood Installation (Refer to GROUP 42A – Hood <LHD>).
- Hood Installation (Refer to GROUP 42A – Hood <RHD>).



ACD00439AB

Removal steps

- Drive belt (Refer to P.11I-17.)
- Earth cable connection

<<**A**>> >>**B**<<

- Fuel high-pressure hose connection
- Heater hose connection
- Air intake plenum (Refer to GROUP 15 – Air Intake Plenum P.15-3).

Removal steps (Continued)

- Right bank exhaust manifold (Refer to GROUP 15 – Exhaust Manifold P.15-8).

1. Engine hanger

- Transmission assembly (Refer to GROUP 23C – Transmission Assembly P.23C-16).

Removal steps (Continued)

- A/C compressor and clutch assembly (Refer to GROUP 55 – Compressor Assembly P.55-4).

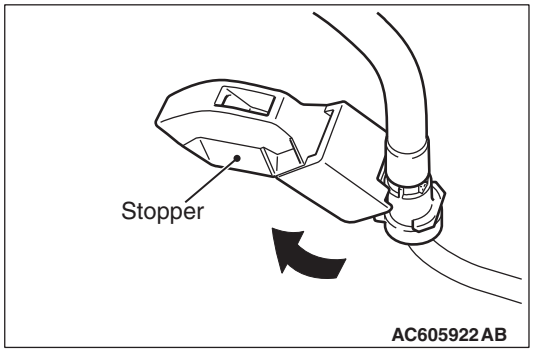
2. Control wiring harness connection (relay box side)
3. Control wiring harness connection (battery side)

<<**B**>> >>**A**<<
- Engine mounting bracket

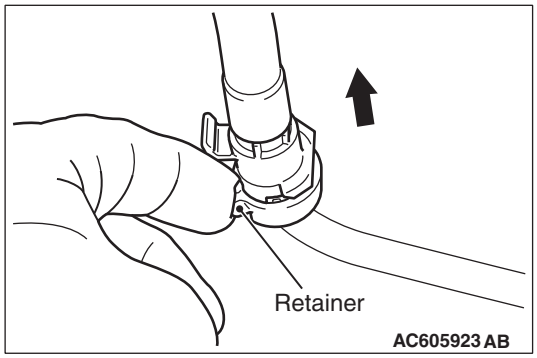
<<**C**>> >>**A**<<
4. Engine assembly
5. Control wiring harness

REMOVAL SERVICE POINTS

<<A>> FUEL HIGH-PRESSURE HOSE DISCONNECTION



1. Remove the fuel high-pressure hose stopper.



2. Remove the fuel high-pressure hose in the direction shown in the figure while the retainer is pulled up.

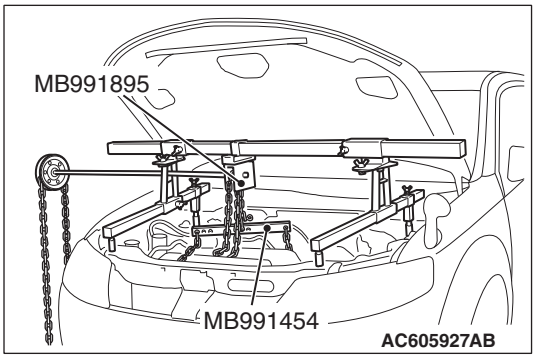
   NOTE: If the retainer is released, install it after removing the fuel high-pressure hose.

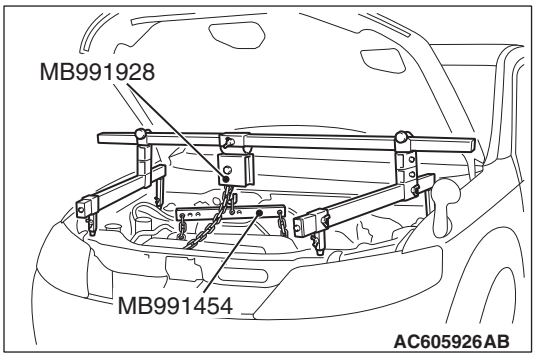
<<B>> ENGINE MOUNTING BRACKET REMOVAL

⚠ CAUTION

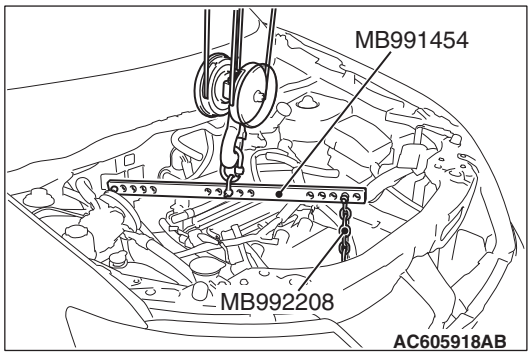
When supporting the engine and transmission assembly with a garage jack, be careful not to deform the engine oil pan.

1. Place a garage jack against the engine oil pan with a piece of wood in between to support the engine assembly.





2. Remove the special tool engine hanger (MB991895 or MB991928) for supporting the engine which were installed when removing the transmission assembly.



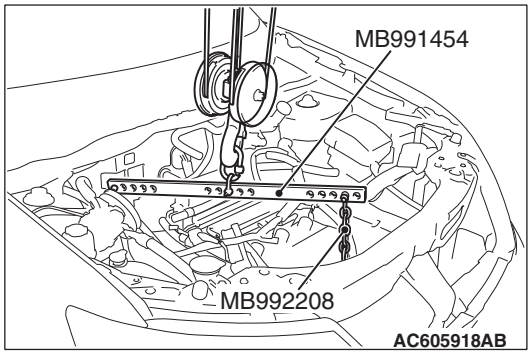
3. The installation position at the right bank side of special tool engine hanger balancer (MB991454) for supporting the engine installed when removing the transmission assembly has been changed from special tool engine hanger plate A (MB992208) (Right bank) to engine right hanger, and support the engine assembly using the chain block or others.
4. Loosen the engine mounting bracket mounting nuts and bolt, and remove the engine mounting bracket.

<<C>> ENGINE ASSEMBLY REMOVAL

After checking that all cables, hoses and wiring harness connectors and so on are disconnected from the engine, lift the chain block slowly to remove the engine assembly upward from the engine compartment.

INSTALLATION SERVICE POINTS

>>A<< ENGINE ASSEMBLY/ENGINE MOUNTING BRACKET INSTALLATION

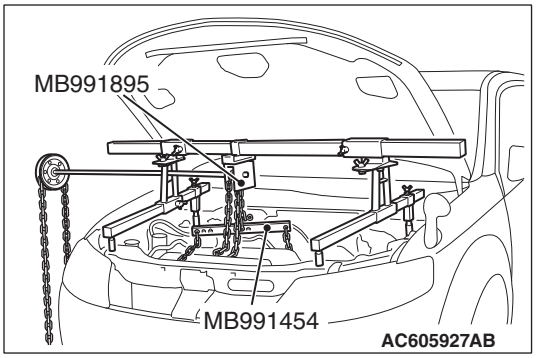


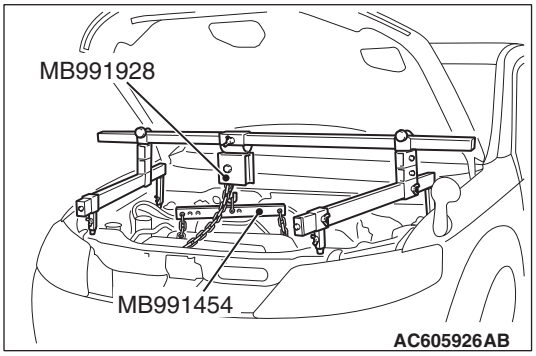
1. Install the engine assembly, being careful not to pinch the cables, hoses or wiring harness connectors.

⚠ CAUTION

When supporting the engine and transmission assembly with a garage jack, be careful not to deform the engine oil pan.

2. Place a garage jack against the engine oil pan with a piece of wood in between to support the engine assembly.





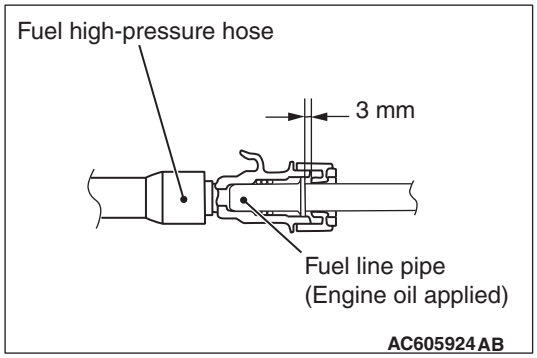
3. Remove the chain block or others and install the special tool engine hanger (MB991895 or MB991928) (Refer to GROUP 23C – Transmission Assembly P.23C-16).

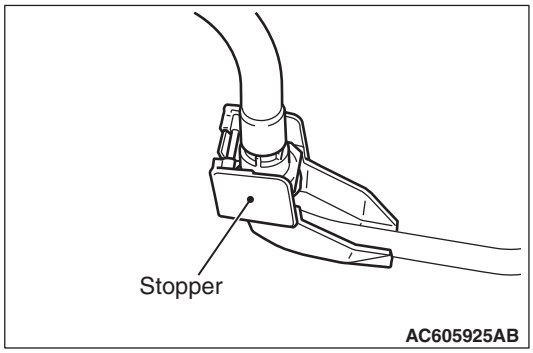
   At this time, contrary to the removal, the installation position at the right bank side of special tool engine hanger balancer (MB991454) for supporting the engine has been changed from engine right hanger to special tool engine hanger plate A (MB992208) (Right bank).

>>B<< FUEL HIGH-PRESSURE HOSE CONNECTION

⚠ CAUTION

After connecting the fuel high-pressure hose, slightly pull it to ensure that it is installed securely. Also confirm that there is a play approximately 3 mm. Then install the stopper securely.





Apply a small amount of engine oil to the fuel line pipe and then install the fuel high-pressure hose.

GROUP 11J

ENGINE OVERHAUL <6B3>

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GENERAL SPECIFICATIONS

M1113000203295

Item			Specifications
Engine model No.			6B31
Type			60° V, SOHC
Number of cylinders			6
Combustion chamber			Pentroof type
Total displacement mL			2,998
Cylinder bore mm			87.6
Piston stroke mm			82.9
Compression ratio			10.5
Valve timing	Inlet valve	Opens (BTDC)	-1° Low speed cam
			18° High speed cam
		Closes (ABDC)	37° Low speed cam
			86° High speed cam
	Exhaust valve	Opens (BBDC)	54°
		Closes (ATDC)	20°
Auto lash adjuster		Inlet	Non-equipped
		Exhaust	Equipped

SERVICE SPECIFICATIONS

M1113000303797

Item			Standard value	Limit
Timing belt				
Auto tensioner rod length mm			9.1 – 13.4	–
Valve clearance mm			0.07 – 0.13	–
Rocker cover and camshaft				
Camshaft cam height mm	Inlet	Low speed cam	37.28	Minimum 36.78
		High speed cam	36.23	Minimum 35.73
	Exhaust		37.84	Minimum 37.34
Camshaft journal outside diameter mm			45	–
Cylinder head and valves				
Cylinder head flatness of gasket surface mm			Less than 0.03	0.05
Cylinder head grinding limit of gasket surface mm (Total resurfacing depth of cylinder head and cylinder block)			–	0.15
Cylinder head overall height mm			120	–
Valve thickness of valve head (margin) mm	Inlet		1.0	Minimum 0.5
	Exhaust		1.2	Minimum 0.7

Item		Standard value	Limit
Valve overall height mm	Inlet	111.84	Minimum 111.34
	Exhaust	114.04	Minimum 113.54
Valve stem outside diameter mm		6.0	–
Valve thickness to valve guide clearance mm	Inlet	0.020 – 0.047	0.10
	Exhaust	0.035 – 0.062	0.15
Valve spring free height mm	Inlet	63.77	Minimum 62.77
	Exhaust	59.90	Minimum 58.90
Valve spring load/installed height N / mm		245.2 / 49.2	–
Valve spring out-of-squareness		2° or less	4°
Valve seat valve contact width mm		0.9 – 1.3	–
Valve guide inside diameter mm		6.0	–
Valve guide press-in height mm		16.7 – 17.3	–
Piston and connecting rod			
Piston outside diameter mm		87.6	–
Piston ring side clearance mm	No. 1	0.04 – 0.08	0.1
	No. 2	0.03 – 0.07	0.1
Piston ring end gap mm	No. 1	0.18 – 0.33	0.8
	No. 2	0.28 – 0.48	0.8
	Oil ring side rail	0.10 – 0.60	1.0
Piston pin outside diameter mm		22.0	–
Piston pin press-in load N (Room temperature)		5,000 – 15,000	–
Crankshaft pin oil clearance mm		0.012 – 0.039	0.1
Connecting rod big end side clearance mm		0.10 – 0.25	0.4
Crankshaft and cylinder block			
Crankshaft axial play mm		0.05 – 0.25	0.3
Crankshaft journal outside diameter mm		69	–
Crankshaft pin outside diameter mm		53	–
Crankshaft journal oil clearance mm	No.1, 4 journal	0.018 – 0.038	0.1
	No.2, 3 journal	0.024 – 0.044	0.1
Cylinder block flatness of gasket surface mm		0.05	0.1
Cylinder block grinding limit of gasket surface mm [Total resurfacing depth of both cylinder head and cylinder block]		–	0.15
Cylinder block overall height mm (Crankshaft centre to cylinder head top)		215	–
Cylinder block inside diameter mm		87.6	–
Cylindricity mm		0.015	–

REWORK DIMENSIONS

M1113024301160

Item			Standard value
Cylinder head and valves			
Cylinder head oversize valve seat bore diameter mm	Intake	0.30 O.S.	36.300 – 36.325
	Exhaust	0.30 O.S.	32.300 – 32.325
Cylinder head oversize valve guide bore diameter mm		0.05 O.S.	11.050 – 11.068

TORQUE SPECIFICATIONS

M1113023405724

Item	N·m
Alternator	
Crankshaft pulley centre bolt	110, +60°, 0, 110 then +60°
Alternator bolt	47 ± 11
Alternator bracket bolt	23 ± 6
Air intake plenum and throttle body	
Solenoid valve bolt	5.0 ± 1.0
EGR pipe bolt	23 ± 6
Throttle body bolt	23 ± 6
Boost sensor bolt	5.0 ± 1.0
Throttle body stay bolt	23 ± 6
Engine hanger right bolt	23 ± 6
Air intake plenum stay bolt	23 ± 6
Air intake plenum bolt	22 ± 1
Timing belt	
Timing belt front cover bolt	7.0 ± 1.0
Engine support bracket bolt M8	20 ± 5
Engine support bracket bolt M10	48 ± 11
Crank angle sensor cover bolt	9.5 ± 2.5
Crank angle sensor bolt	9.5 ± 2.5
Auto-tensioner bolt	23 ± 6
Idler pulley bolt	41 ± 10
Tensioner arm bolt	41 ± 10
Camshaft sprocket bolt	90 ± 10
Timing belt rear cover bolt	10 ± 2
Inlet manifold	
Ignition coil bolt	9.5 ± 2.5
Spark plugs	18 ± 2
Injector and delivery bolt	12 ± 1
Inlet manifold nut	22 ± 1

Item	N·m
Water hose and pipe	
Coolant temperature sensor	30 ± 9
EGR valve bolt	23 ± 6
Cover bolt	23 ± 6
Eye bolt	30 ± 3
Oil pipe bolt	11 ± 1
Water inlet fitting bolt	23 ± 6
Thermostat housing bolt	23 ± 6
Oil feeder control valve bolt	11 ± 1
Taper plug	10 ± 2
Oil feeder control valve housing bolt	24 ± 3
Water pump bolt	23 ± 6
Exhaust manifold	
Oxygen sensor	44 ± 5
Exhaust manifold cover bolt	16 ± 4
Exhaust manifold left bracket bolt	47 ± 11
Exhaust manifold right bracket bolt (Exhaust manifold side)	43 ± 8
Exhaust manifold right bracket bolt (Cylinder block side)	47 ± 11
Exhaust manifold bolt (bolt, washer assembly)	41 ± 10
Exhaust manifold nut	49 ± 5
Engine hanger bolt	23 ± 6
Rocker cover and camshaft	
PCV valve	2.5 ± 0.4
Rocker cover bolt	8.3 ± 1.0
Rocker arms and shaft bolt intake side	31 ± 3
Rocker arms and shaft bolt exhaust side	13 ± 1
Rocker arm adjusting nut	9.0 ± 1.0
Cam position sensing cylinder bolt	22 ± 4
Camshaft position sensor bolt	9.5 ± 2.5
Camshaft position sensor support bolt	23 ± 6
Cylinder head and valves	
Cylinder head bolt	45 ± 2 then +150 to 154°
Oil pan and oil pump	
Drain plug	39 ± 5
Oil filter <MD360935>	14 ± 2
Oil filter <MD332687, MD365876>	16 ± 4
Oil filter cover bolt	23 ± 6
Heat protector bolt	10 ± 2
Oil pressure switch	10 ± 2
Oil pan, lower bolt	10 ± 2

Item	N·m
Oil pan, upper bolt	10 ± 2
Oil screen bolt	20 ± 5
Bearing cap bolt	20 ± 2 then +90°
Plate bolt	23 ± 6
Oil pump case bolt	23 ± 6
Piston and connecting rod	
Connecting rod cap nut	20 ± 2 then +90°
Crankshaft and cylinder block	
Drive plate bolt	76 ± 4
Rear plate bolt	10 ± 2
Oil seal case bolt	10 ± 2
Bearing cap bolt	24 ± 2 then +90°
Crankshaft sensing ring bolt	12 ± 2
Detonation sensor	20 ± 2
Bank stiffener bolt	23 ± 6

SEALANTS

M1113000503876

Points of application	Specified sealant/adhesive
Coolant temperature sensor	Three bond 1324N, LOCTITE 262 or equivalent
Taper plug	Three bond 1212D, Three bond 1215 or equivalent
Oil pressure switch	
Oil pan upper	Three bond 1227D, Three bond 1217G (MITSUBISHI MOTORS GENUINE Part No,1000A923), LOCTITE 5971, LOCTITE 5900, LOCTITE 5970 or equivalent
Oil pan lower	Three bond 1227D, Three bond 1217G (MITSUBISHI MOTORS GENUINE Part No,1000A923), Three bond 1207F (MITSUBISHI MOTORS GENUINE Part No.1000A992), LOCTITE 5971, LOCTITE 5900, LOCTITE 5970 or equivalent
Oil pump case	
Oil seal case	
Drive plate bolt	Three bond 1324 or equivalent

NOTE: The number in square brackets shows the genuine part number.

LIQUID GASKET (FIPG)

FIPG is used for some parts in the engine. It is necessary to pay attention to an application amount, application procedure and applied surface condition for this gasket to fully achieve its purpose.
Too small amount causes leakage while too much amount squeezes out to block or narrow water and oil passages. Therefore, it is absolutely essential to apply a correct amount of liquid sealant continuously without break to eliminate leakage from joints.
FIPG used for engine parts hardens reacting with moisture in the air, and is usually used for metal flanges.

⚠ CAUTION

Reapply the FIPG with care to the followings.

1. **Completely remove the old FIPG including the residue in gaps of parts.**
2. **Using Mitsubishi genuine parts cleaner (MZ100387) or equivalent, degrease the FIPG application surface carefully.**
3. **According to the FIPG application procedures, apply it accurately.**

DISASSEMBLY

Parts assembled with FIPG can be easily disassembled without using a special method. In some cases, however, it is necessary to lightly tap parts with a wooden hammer or similar tool to break sealant between mating surfaces. Or lightly driving a smooth and thin gasket scraper in mating surfaces is useful, but full care must be exercised not to damage mating surfaces. As special too oil pan FIPG cutter (MD998727) is set, use this tool.

CLEANING OF GASKET SURFACE

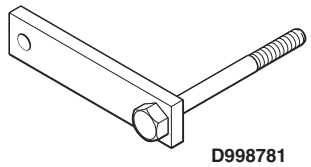
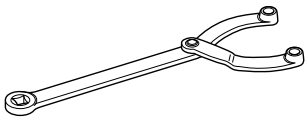
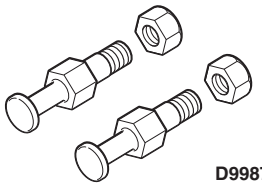
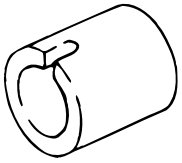
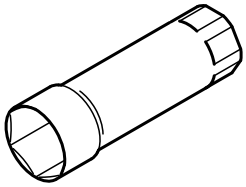
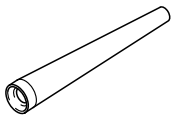
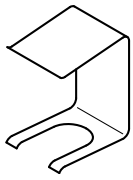
Completely remove all deposits from the gasket surface with a gasket scraper or wire brush. Make sure that the surface to which FIPG is applied is smooth. The gasket surface must be free from grease and foreign substances. Be sure to remove old FIPG that has entered mounting holes and screw holes.

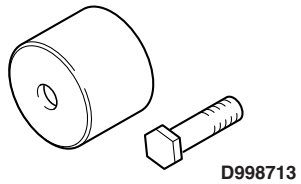
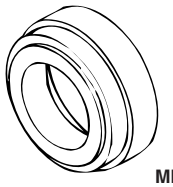
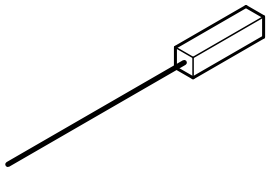
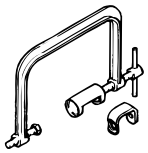
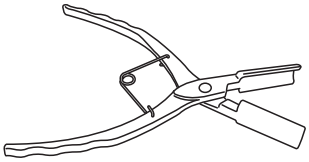
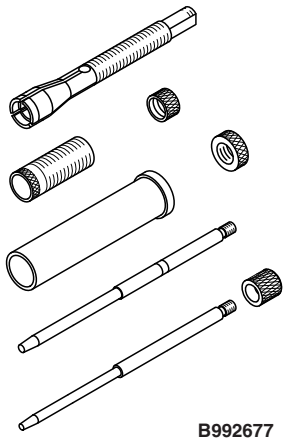
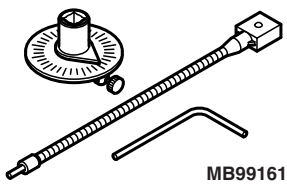
APPLICATION PROCEDURE

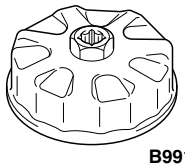
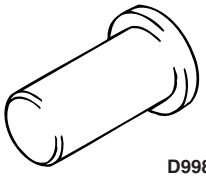
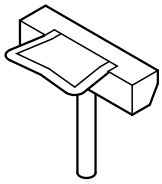
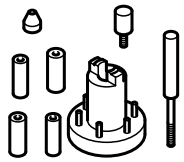
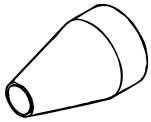
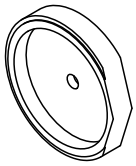
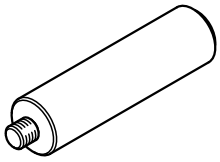
Apply FIPG in a determined diameter and continuously without break. Completely enclose the periphery of mounting holes. FIPG can be wiped off if it is not hardened. Install parts in place while FIPG is still wet. Take care not to allow FIPG to adhere to other locations than necessary locations during installation. Do not pour oil or water on applied locations or do not start the engine until sufficient time (approximately one hour) passes. The application procedure of FIPG may differ depending on areas. Follow the procedure in the body of the manual to apply FIPG.

SPECIAL TOOLS

M1113000602687

Tool	Part No.	Tool name	Application
 D998781	MD998781	Flywheel stopper	Holding drive plate
 B990767	MB990767	End yoke holder	Holding camshaft sprocket when loosening or torquing bolt
 D998719	MD998719	Pin	
	MD998716	Crankshaft wrench	Turning crankshaft
	MB991398	Spark plug wrench	Removal and installation of spark plug
 B992106	MB992106	O-ring installer	Installation of O-ring on injector injection nozzle side
 D998443	MD998443	Lash adjuster holder (8)	Supporting of the lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed

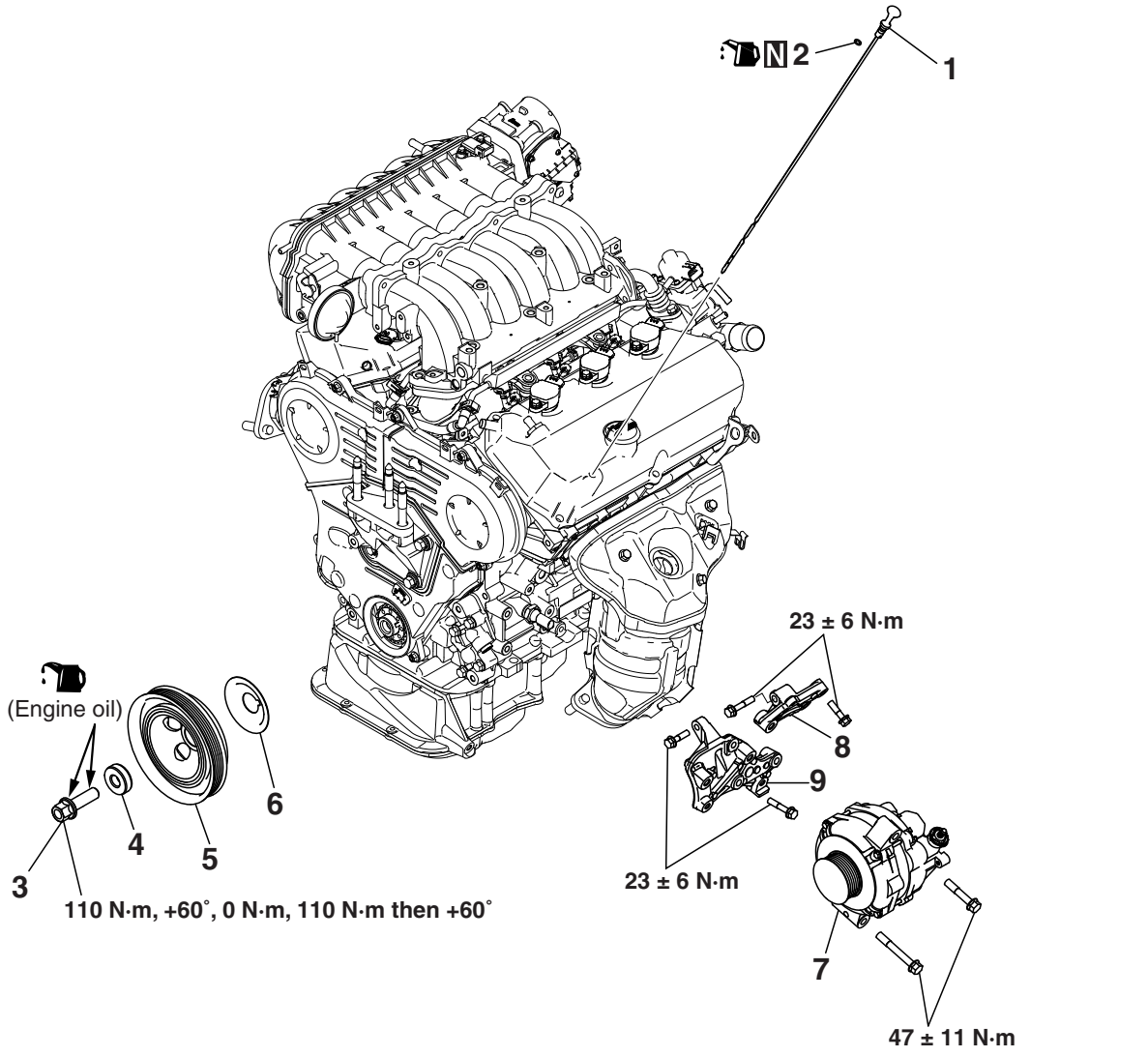
Tool	Part No.	Tool name	Application
 D998713	MD998713	Camshaft oil seal installer	Installation of camshaft oil seal
 MD998777	MD998777	Camshaft oil seal installer adaptor	Installation of camshaft oil seal (left bank) (use with MD998713)
	MD998442	Air bleed wire	Air bleeding of auto lash adjuster
	MD998735	Valve spring compressor	Compression of valve spring
	MB992085	Valve stem seal pliers	Removal of valve stem seal
 B992677	MB992677	Valve stem seal installer adjustable	Installation of valve stem seal
 MB991614	MB991614	Angle gauge	Installation of cylinder head bolt and bearing cap bolt (beam side)

Tool	Part No.	Tool name	Application
 B991396	MB991396	Oil filter wrench	Installation of oil filter
 D998382	MD998382	Crankshaft front oil seal installer	Installation of crankshaft front oil seal
 D998727	MD998727	Oil pan FIPG cutter	Removal of oil pan lower
	MD998780	Piston pin setting tool	Removal and installation of piston pin
	MB991659	Guide D	
 MB992183	MB992183	Crankshaft rear oil seal installer	Installation of crankshaft rear oil seal
	MB992075	Handle	

ALTERNATOR

REMOVAL AND INSTALLATION

M1113027600747



ACD00323AB

Removal steps

1. Oil level gauge
2. O-ring

<<A>> >>B<< 3. Crankshaft pulley centre bolt

4. Crankshaft pulley washer
5. Crankshaft pulley

Removal steps (Continued)

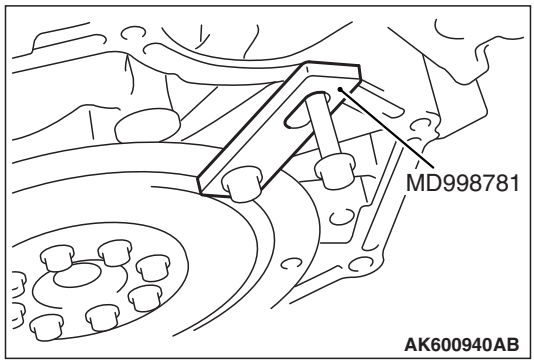
6. Front flange

>>A<< 7. Alternator

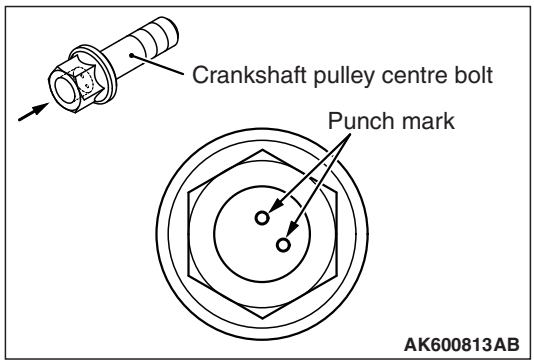
8. Alternator bracket upper
9. Alternator bracket lower

REMOVAL SERVICE POINTS

<<A>> CRANKSHAFT PULLEY CENTRE BOLT REMOVAL



1. Using special tool Flywheel stopper (MD998781), hold the drive plate.
2. Remove the crankshaft pulley centre bolt.



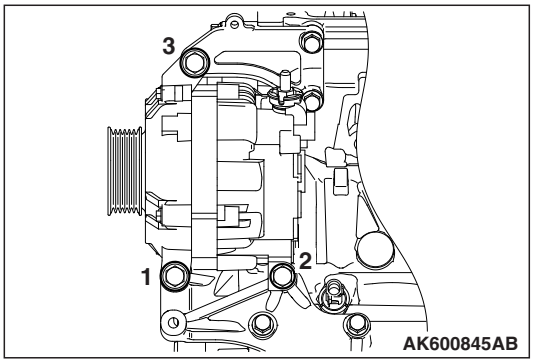
⚠ CAUTION

provide one punch mark on the head of the crankshaft pulley centre bolt each time the bolt is removed. Replace the bolt that already has three punch marks. (the evidence of having been tightened three times)

INSTALLATION SERVICE POINT

>>A<< ALTERNATOR INSTALLATION

1. Temporarily tighten the alternator to the alternator bracket.



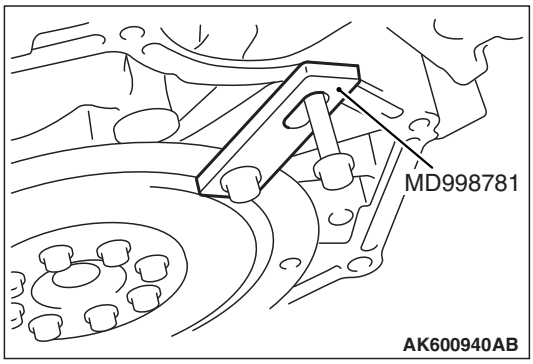
2. In accordance with the tightening order shown in the illustration, tighten the installation bolts for the alternator to the specified torque.

Tightening torque: 47 ± 11 N·m

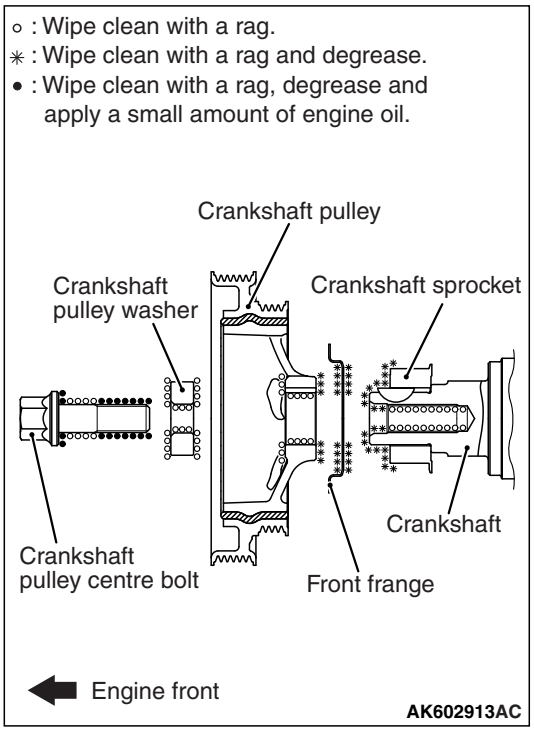
>>B<< CRANKSHAFT PULLEY CENTRE BOLT INSTALLATION

⚠ CAUTION

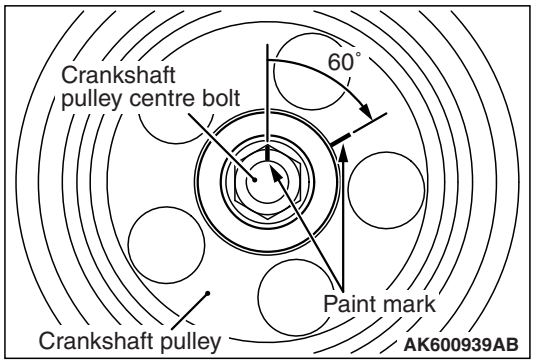
before installing the crankshaft pulley centre bolt, check the number of punch marks on its head. (the bolt is reusable if it is two or less.) If the bolt has three punch marks, replace it.



1. Using special tool Flywheel stopper (MD998781), hold the drive plate.



2. Wipe the dirt on the crankshaft pulley washer using a rag.
3. Using a rag, wipe the dirt on the crankshaft pulley, the front flange, the crankshaft sprocket, the thread hole of the crankshaft and then remove the grease.
4. Install the front flange and crankshaft pulley.
5. Apply an appropriate and minimum amount of engine oil to the threads of crankshaft pulley centre bolt and lower part of the flange.
6. Install the crankshaft pulley washer to the crankshaft pulley centre bolt.
7. Tighten the crankshaft pulley centre bolt to 110 N·m.

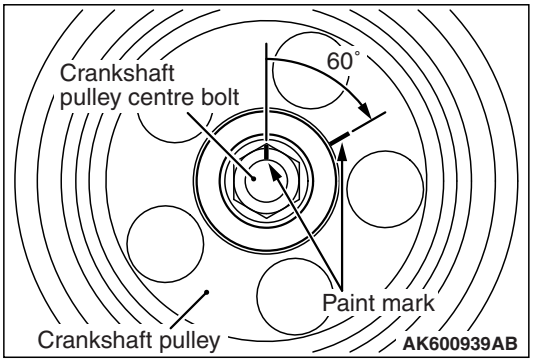


8. Make a paint mark on the crankshaft pulley centre bolt.
9. Make a paint mark on the bolt end at a position 60° from the paint mark made on the crankshaft pulley in the direction of tightening the crankshaft pulley centre bolt.

⚠ CAUTION

- **When the tightening angle is smaller than the specified tightening angle, the appropriate tightening capacity cannot be secured.**
- **When the tightening angle is larger than the specified tightening angle, remove the bolt to start from the beginning again according to the procedure.**

10. Turn the crankshaft pulley centre bolt another 60° and make sure that the paint marks on the crankshaft pulley and crankshaft pulley centre bolt are aligned.
11. Loosen the crankshaft pulley centre bolt fully.
12. Tighten the crankshaft pulley centre bolt to 110 N·m.



13. Make a paint mark on the crankshaft pulley centre bolt.
14. Make a paint mark on the bolt end at a position 60° from the paint mark made on the crankshaft pulley in the direction of tightening the crankshaft pulley centre bolt.

⚠ CAUTION

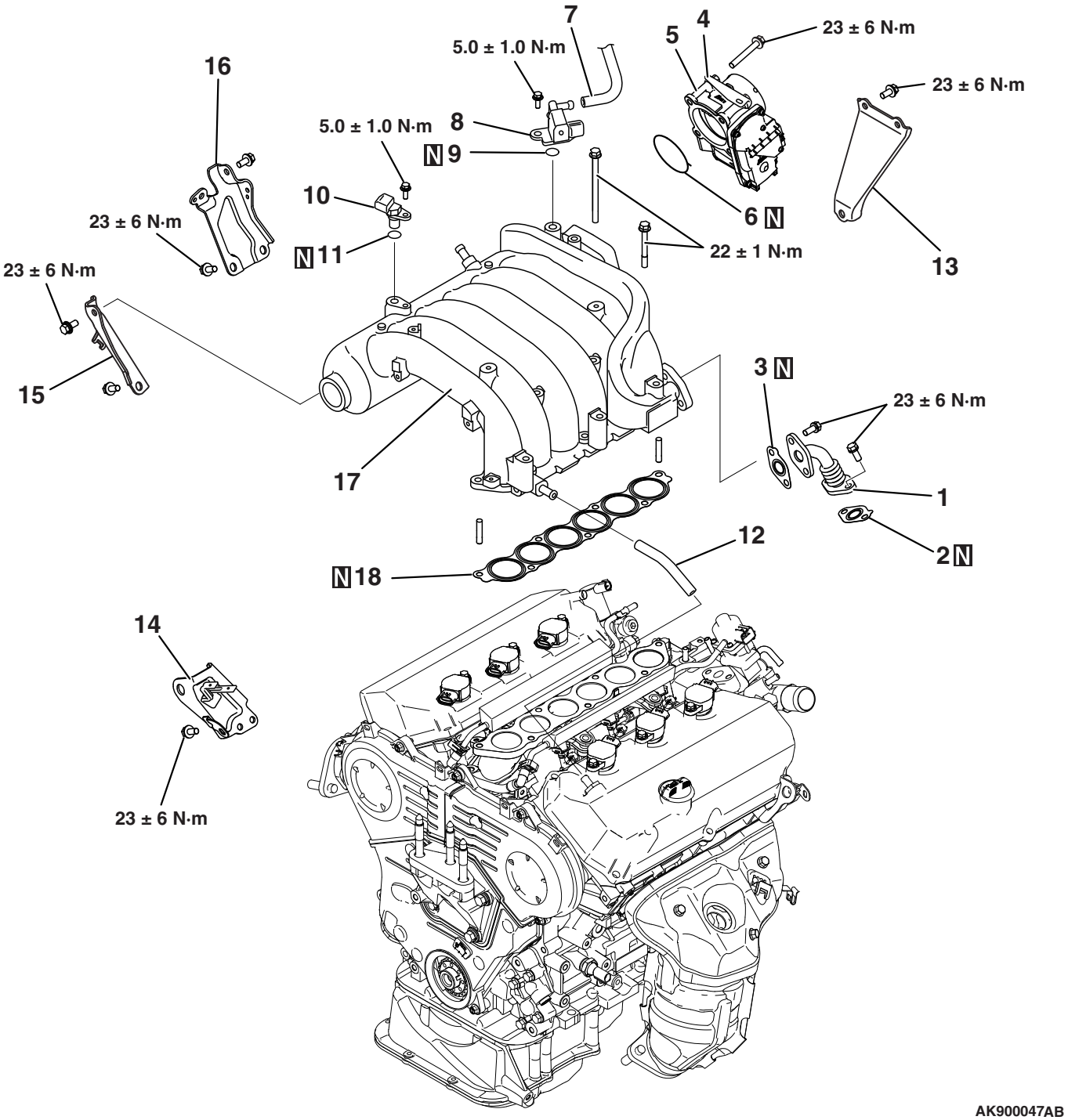
- **When the tightening angle is smaller than the specified tightening angle, the appropriate tightening capacity cannot be secured.**
- **When the tightening angle is larger than the specified tightening angle, remove the bolt to start from the beginning again according to the procedure.**

15. Turn the crankshaft pulley centre bolt another 60° and make sure that the paint marks on the crankshaft pulley and crankshaft pulley centre bolt are aligned.

AIR INTAKE PLENUM AND THROTTLE BODY ASSEMBLY

REMOVAL AND INSTALLATION

M1113003300463



AK900047AB

Removal steps

1. EGR pipe (Vehicles with EGR system)
- **>>E<<** 2. EGR pipe gasket (Vehicles with EGR system)
3. EGR pipe gasket (Vehicles with EGR system)
4. Harness bracket
5. Throttle body
- **>>D<<** 6. Throttle body gasket

Removal steps (Continued)

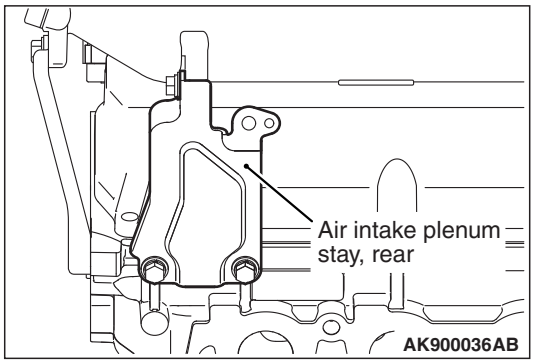
7. Vacuum hose
8. Solenoid valve
9. O-ring
10. Boost sensor
11. O-ring
12. Purge hose
- **>>C<<** 13. Throttle body stay
14. Engine hanger, right

Removal steps (Continued)

>>B<< 15. Air inlet plenum stay, front
>>A<< 16. Air intake plenum stay, rear
17. Air intake plenum
18. Air intake plenum gasket

INSTALLATION SERVICE POINTS

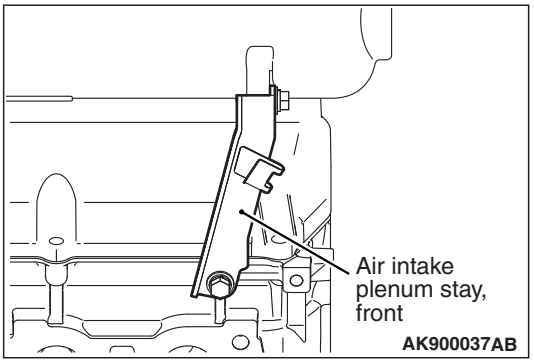
>>A<< AIR INTAKE PLENUM STAY, REAR INSTALLATION



1. After temporarily tightening the rear air intake plenum stay with the installation bolts, check that the inlet manifold fastens securely to the cylinder head.
2. Tighten the rear air intake plenum stay to the specified torque.

Tightening torque: 23 ± 6 N·m

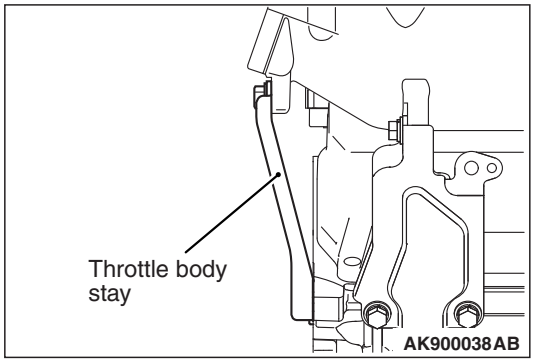
>>B<< AIR INTAKE PLENUM STAY, FRONT INSTALLATION



1. After temporarily tightening the front air intake plenum stay with the installation bolts, check that the inlet manifold fastens securely to the cylinder head.
2. Tighten the front air intake plenum stay to the specified torque.

Tightening torque: 23 ± 6 N·m

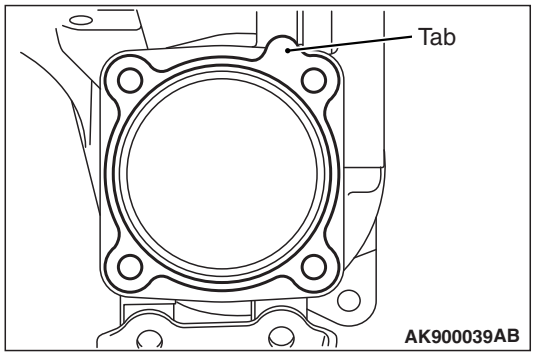
>>C<< THROTTLE BODY STAY INSTALLATION



1. After temporarily tightening the throttle body stay with the installation bolts, check that the throttle body fastens securely to the cylinder head.
2. Tighten the throttle body stay to the specified torque.

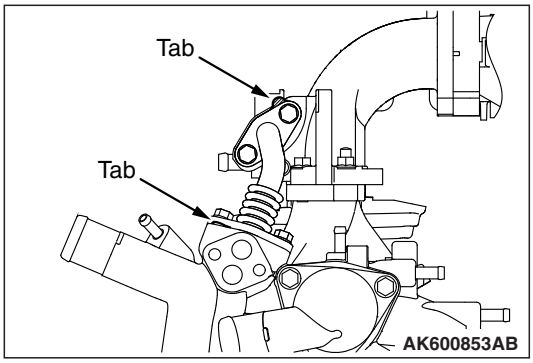
Tightening torque: 23 ± 6 N·m

>>D<< THROTTLE BODY GASKET INSTALLATION



Install the throttle body gasket so that the tab is positioned as shown in the illustration.

>>E<< EGR PIPE GASKET INSTALLATION

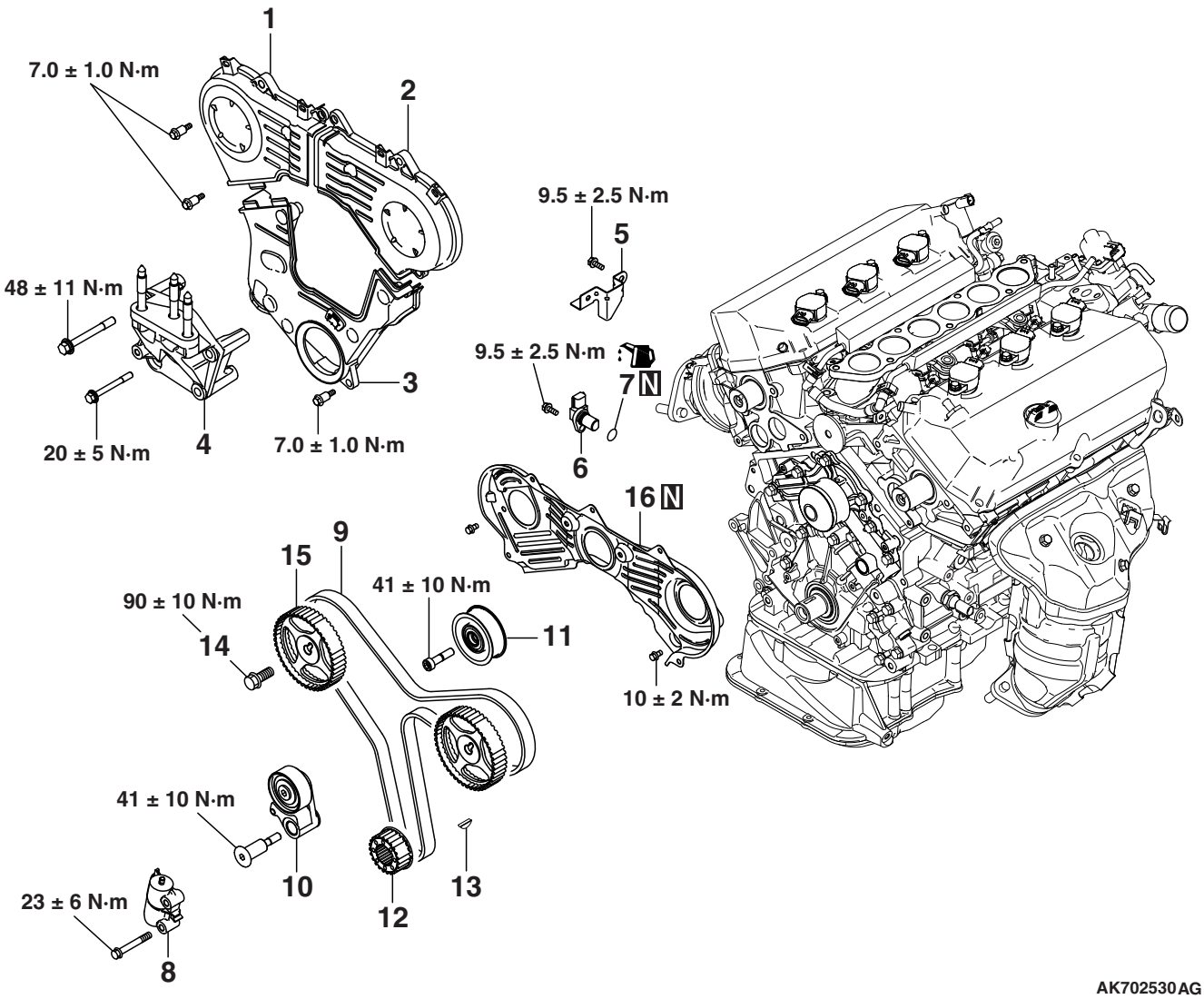


Install the EGR pipe gasket so that the tab is positioned as shown in the illustration.

TIMING BELT

REMOVAL AND INSTALLATION

M1113001902465



AK702530AG

Removal steps

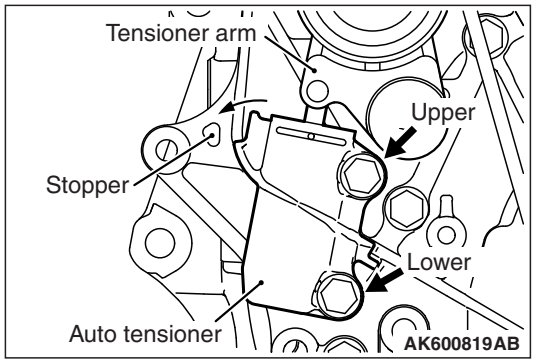
1. Timing belt front upper cover, right
2. Timing belt front upper cover, left
3. Timing belt front lower cover
4. Engine support bracket, right
5. Crank angle sensor cover <Vehicles without Electronically-controlled 4WD>
6. Crank angle sensor
7. O-ring

Removal steps (Continued)

<<A>> >>D<< 8. Auto-tensioner
<<B>> >>E<< 9. Timing belt
10. Tensioner arm
<<C>> >>C<< 11. Idler pulley
>>B<< 12. Crankshaft sprocket
13. Key
<<D>> >>A<< 14. Camshaft sprocket bolt
15. Camshaft sprocket
16. Timing belt rear cover

REMOVAL SERVICE POINTS

<<A>> AUTO-TENSIONER REMOVAL



1. Remove the upper tightening bolt of the auto-tensioner.

⚠ CAUTION

The auto-tensioner rotates centring on the flange bolt due to the rod thrust, so please make sure your finger is not trapped.

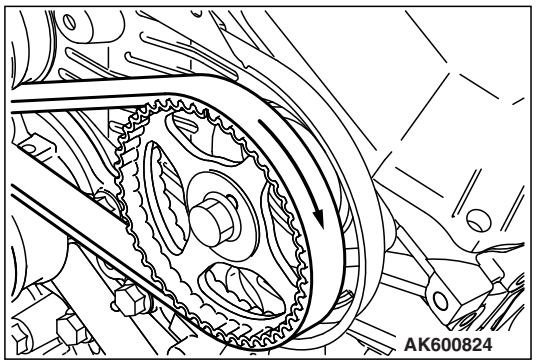
2. Slowly loosen the (lower) tightening bolts of the auto-tensioner. Remove the auto-tensioner rod from the tensioner arm and tilt the auto-tensioner to the stopper position.
3. Remove the lower tightening bolt of the auto-tensioner.

<<B>> TIMING BELT REMOVAL

1. Before the timing belt is removed, align the timing marks of the camshaft sprocket and crankshaft sprocket with the No.1 at the Top Dead centre of the compression stroke.

⚠ CAUTION

Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be kept free from oil and water. Do not immerse parts in cleaning solvent.

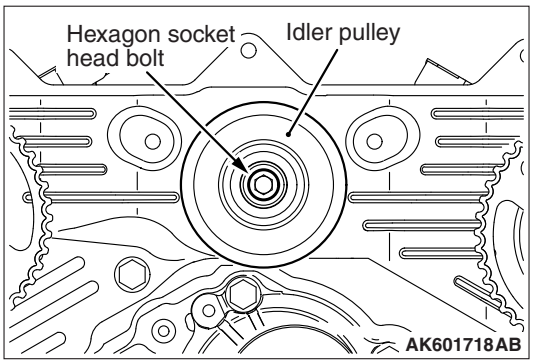


Mark the belt running direction for reference in reinstallation.

NOTE: If there is oil or water on any part, check the front case oil seal, camshaft oil seal, and water pump for leaks.

NOTE: After the timing belt is removed, do not turn the crankshaft sprocket and the camshaft sprocket.

<<C>> IDLER PULLEY REMOVAL

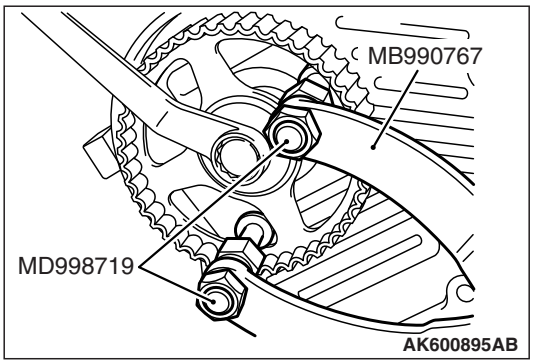


⚠ CAUTION

Because of the shallow hexagon hole of the hexagon socket head bolt, firmly insert the tool and carefully work not to damage the hexagon hole.

Remove the idler pulley using a hexagon wrench with 8 mm width across flats.

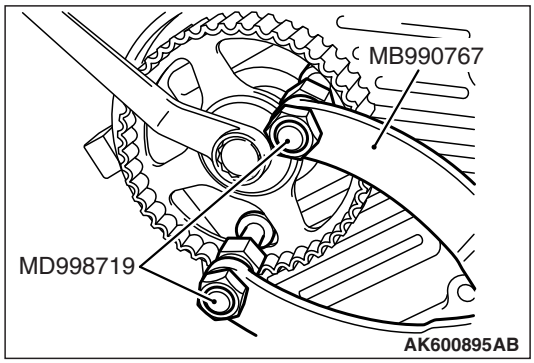
<<D>> CAMSHAFT SPROCKET BOLT REMOVAL



Use special tools End yoke holder (MB990767) and Pins (MD998719) to prevent the camshaft sprocket from turning, and then loosen the camshaft sprocket bolt.

INSTALLATION SERVICE POINTS

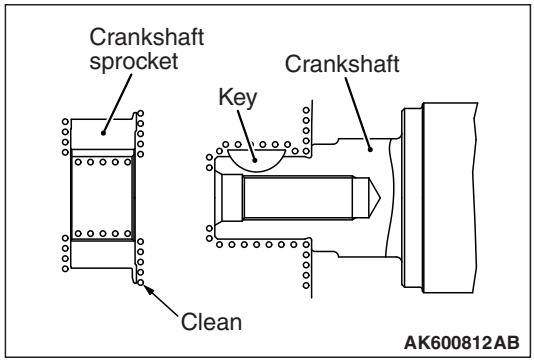
>>A<< CAMSHAFT SPROCKET BOLT INSTALLATION



Use special tools End yoke holder (MB990767) and Pins (MD998719) to prevent the camshaft sprocket from turning, and then tighten the camshaft sprocket bolt.

Tightening torque: 90 ± 10 N·m

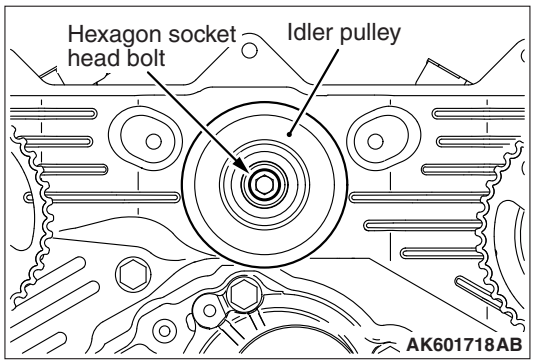
>>B<< CRANKSHAFT SPROCKET INSTALLATION



1. Clean the hole in the crankshaft sprocket.
2. Clean and degrease the mating surfaces of the crankshaft sprocket.

   NOTE: Degreasing is necessary to prevent decrease in friction on the mating surfaces.
3. Install the crankshaft sprocket to the crankshaft.

>>C<< IDLER PULLEY INSTALLATION



⚠ CAUTION

Because of the shallow hexagon hole of the hexagon socket head bolt, firmly insert the tool and carefully work not to damage the hexagon hole.

Install the idler pulley using a hexagon wrench with 8 mm width across flats.

>>D<< AUTO-TENSIONER INSTALLATION

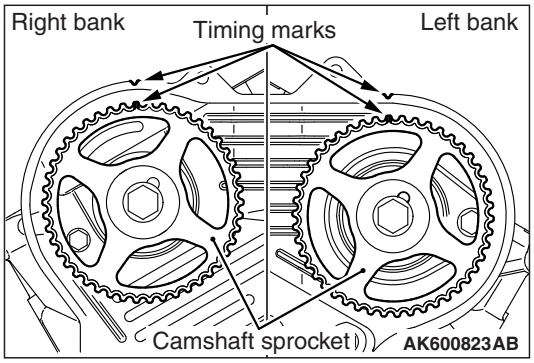
⚠ CAUTION

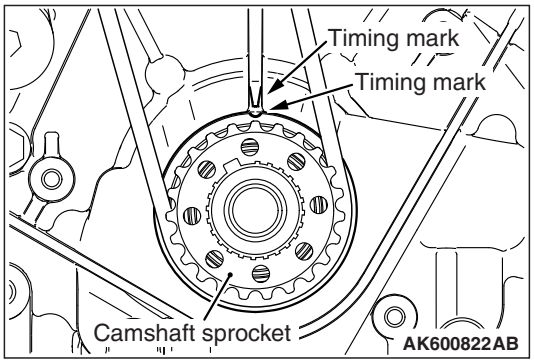
Always bleed the auto-tensioner of air before installing the auto-tensioner. (Refer to auto tensioner inspection P.11J-21 .)

>>E<< TIMING BELT INSTALLATION

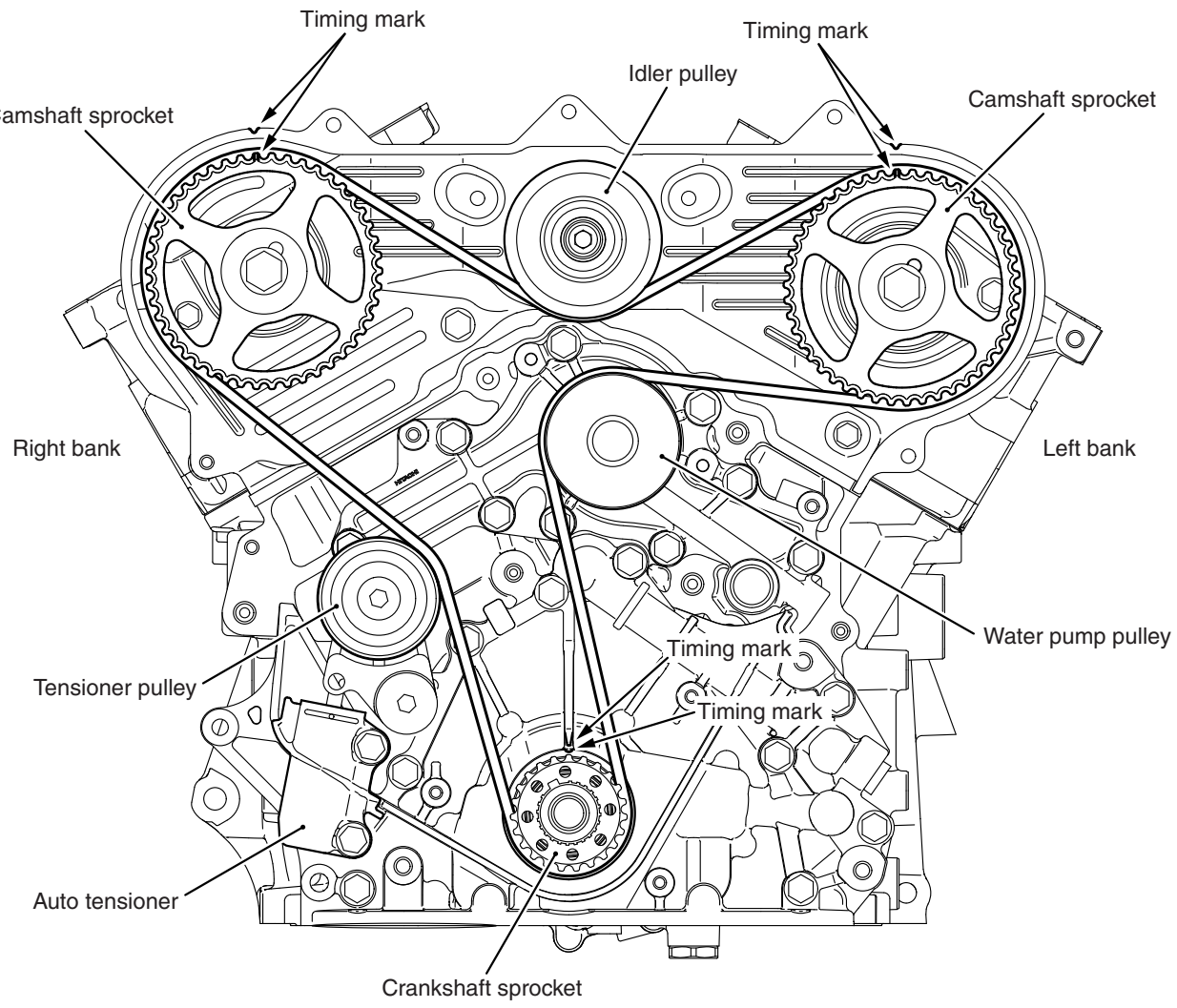
⚠ CAUTION

Remove and install the timing belt, aligning the timing marks of the crankshaft sprocket and the camshaft sprocket with the No.1 at the Top Dead centre of the compression stroke.



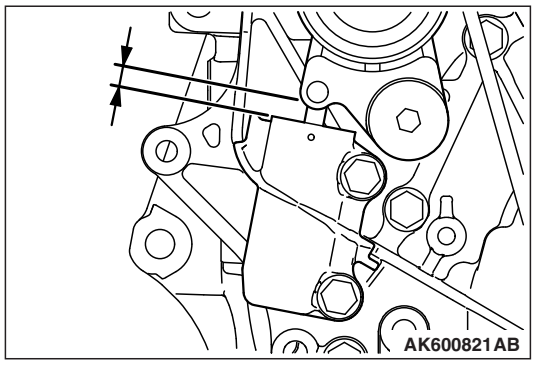


1. Check the timing marks of the crankshaft sprocket and the camshaft sprocket are aligned with the No.1 at the Top Dead centre of the compression stroke. If they are not, align the timing marks again, paying attention to the interference between the valve and the piston.
2. Install the timing belt on each sprocket in the following sequence.
   (1) Install the timing belt on the crankshaft sprocket and then on the water pump pulley, while tightening it to prevent slackness.
   (2) Line up the timing marks of the left bank camshaft sprockets.
   (3) Install the timing belt on the idler pulley, while taking up the slack.
   (4) Install the timing belt on the right bank camshaft sprocket.
   (5) Install the timing belt on the tensioner pulley.
3. Check to see that the timing marks of all the sprockets are in a alignment.
4. Pull out the pin of the auto-tensioner.



AK600820AB

5. Using special tool Crankshaft wrench (MD998716), rotate the crankshaft two turns clockwise and leave it alone for approximately five minutes.



6. Check that the projection of the rod of the auto-tensioner is within the standard value.

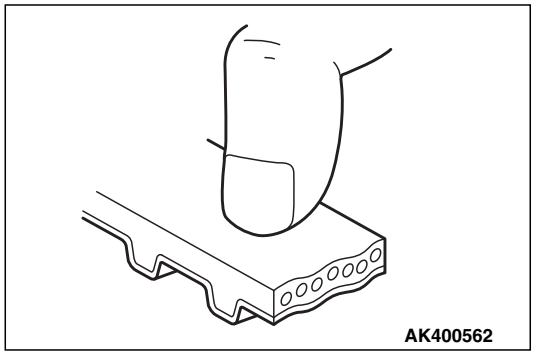
Standard value: 9.1 – 13.4 mm

INSPECTION

M1113002001451

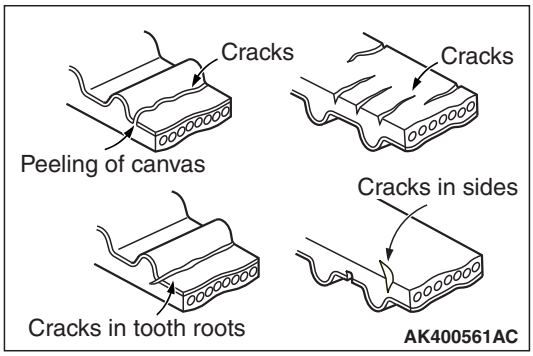
TIMING BELT

Replace the belt if any of the following conditions exist:

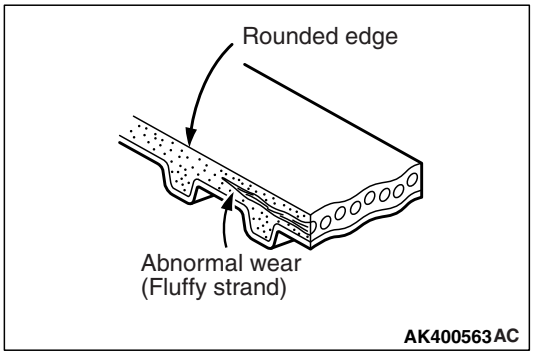


1. Hardening of rubber backing.

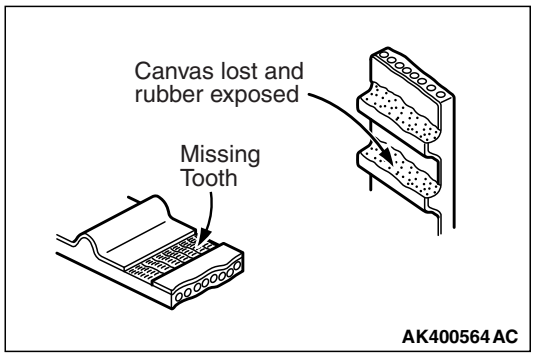
   Back side should be glossy without resilience and leave no indent when pressed with fingernail.



2. Cracks on rubber back.
3. Cracks or peeling of canvas.
4. Cracks at bottom of ribs.
5. Cracks on belt sides.



6. Abnormal wear of belt sides. Normal wear is indicated if the sides are sharp as if cut by a knife. Abnormal wear is indicated if the sides are ragged.



7. Abnormal wear on teeth.

   Initial stage:
   Canvas worn (fluffy canvas fibres, rubbery texture gone, white discolouration, canvas texture indistinct)
   Final stage:
   Canvas worn, exposing rubber (tooth width reduced)

8. Missing tooth.

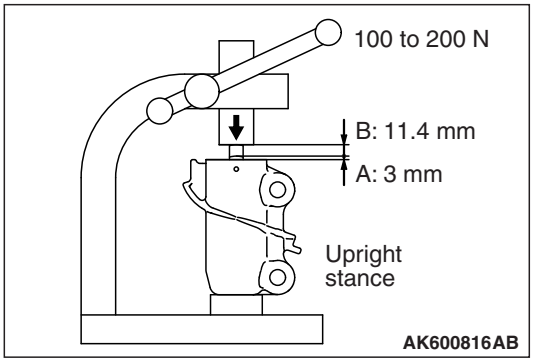
AUTO TENSIONER

If the rod moves slightly when pushing down the rod with 100 – 200 N, bleed the auto-tensioner of air because air enters.

AIR BLEEDING METHOD

⚠ CAUTION

- **Always use the vertical press and put the auto-tensioner vertically.**
- **For breakage prevention, Do not apply the load of 5,000 N or more to the rod.**
- **Do not press the rod beyond Dimension "A" shown in the illustration.**



1. Set the auto tensioner as shown in the illustration.
2. Press the rod slowly down to the lowest point "A" shown in the illustration.
3. Repeat the procedure 2 three times.
4. While the rod is projected at the point "B" shown in the illustration, push the rod with 100 – 200 N. Check the enough stiffness. If the stiffness is not enough, replace the auto tensioner.
5. Press the rod slowly down. Put the pin through the hole and fix it.

⚠ CAUTION

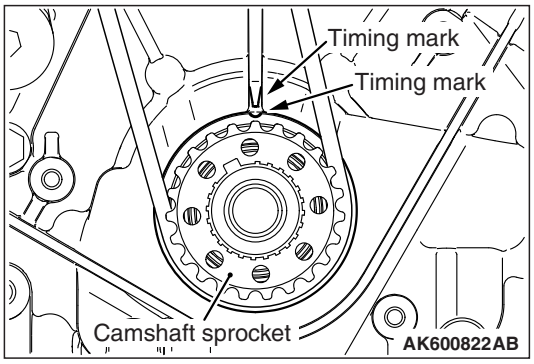
After the air bleeding operation has been completed, do not tilt the auto-tensioner to 60° or more from the right angle position.

VALVE CLEARANCE ADJUSTMENT

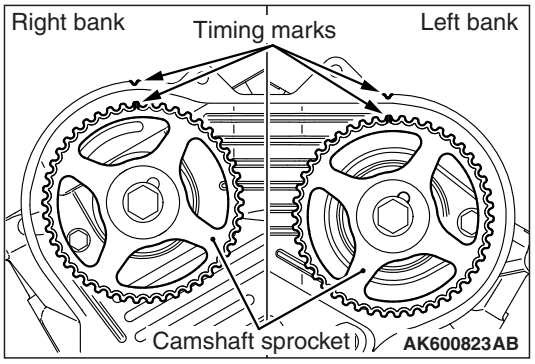
1. Remove the rocker cover and ignition coil.

⚠ CAUTION

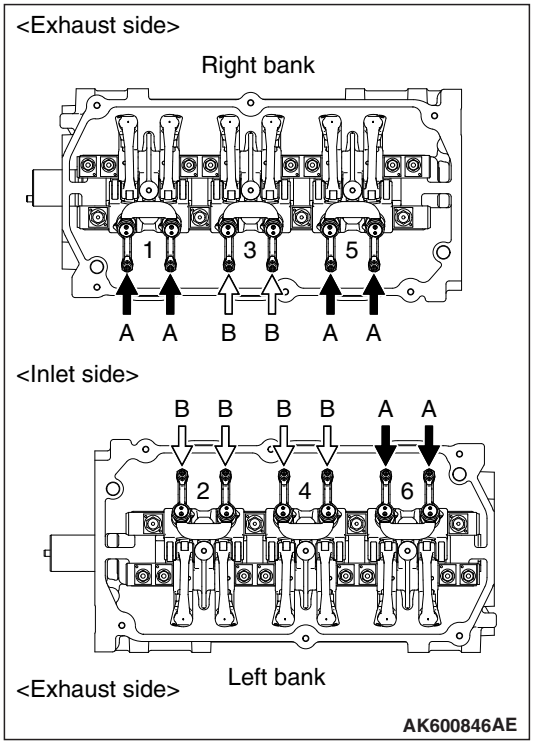
Rotate the crankshaft clockwise at any time.



2. Turn the crankshaft clockwise, and align the crankshaft sprocket timing mark with the position shown in the illustration.



3. At that time, check the right and left camshaft sprocket timing marks are in position as shown in the illustration.

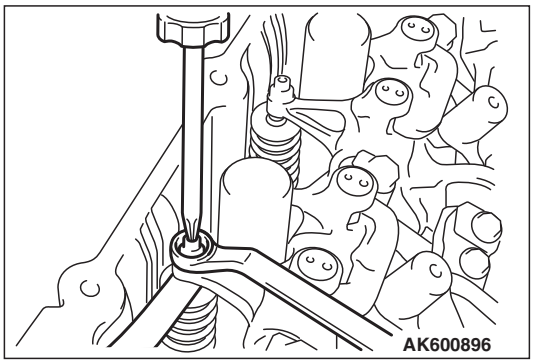


4. Measure the valve clearances marked with arrows shown in the illustration.

   A: When No.1 cylinder is on the top dead centre of compression stroke.

   B: When No.4 cylinder is on the top dead centre of compression stroke.

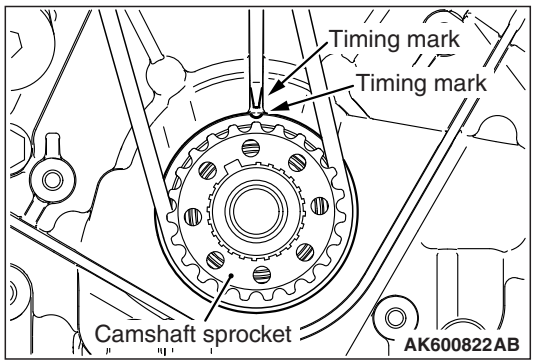
   NOTE: The valve clearance adjustment at the exhaust side is not necessary because the auto lash adjuster exists.



5. Using a free gauge, adjust the clearance between the valve stem end and the adjusting screw.

   Standard value: 0.07 – 0.13 mm

6. Hold the adjusting screw not rotating through a driver and then tighten the rock nut.

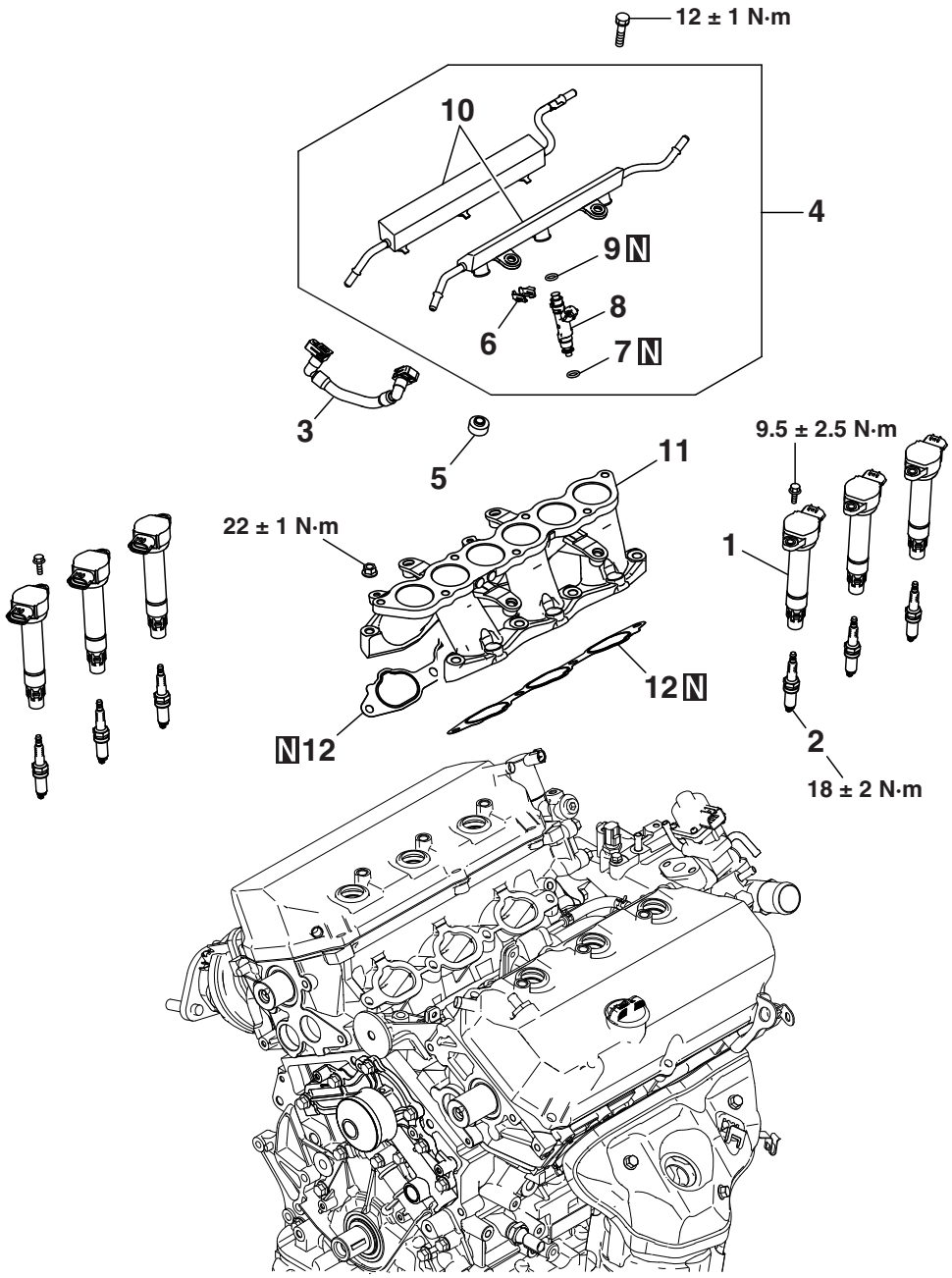


7. Rotate the crankshaft one time clockwise and then align the timing mark with the timing mark on the crankshaft sprocket. (Place No. 4 cylinder on the top dead centre of compression stroke.)
8. Adjust the valve clearance for the rest of the valves.
9. Install the rocker cover and ignition coil.

INLET MANIFOLD

REMOVAL AND INSTALLATION

M1113026101021



AK600807AG

Removal steps

1. Ignition coil

<<A>> >>F<< 2. Spark plugs

<<B>> >>E<< 3. Fuel high pressure tube

4. Delivery pipe and injector
5. Insulator

>>D<< 6. Injector support

Removal steps (Continued)

>>C<< 7. O-ring

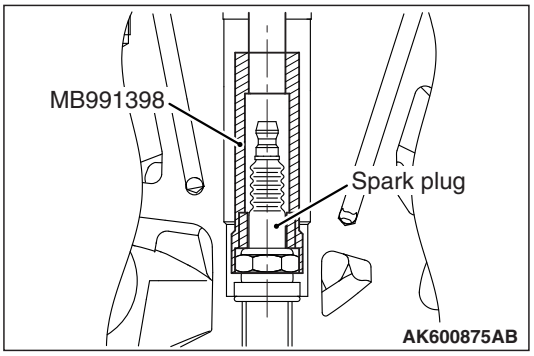
>>B<< 8. Injector

9. O-ring
10. Delivery pipe
11. Inlet manifold

>>A<< 12. Inlet manifold gasket

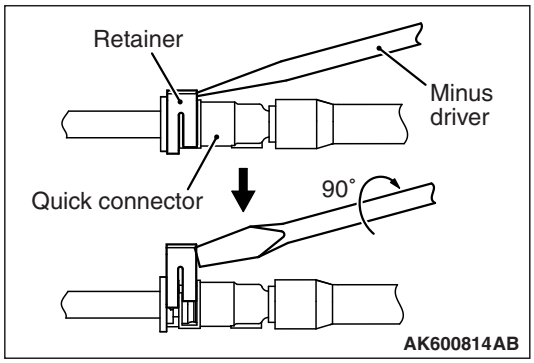
REMOVAL SERVICE POINT

<<A>> SPARK PLUG REMOVAL



Using special tool Spark plug wrench (MB991398), removal the spark plug.

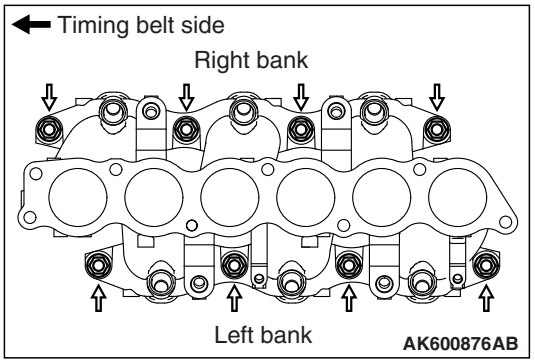
<<B>> FUEL HIGH PRESSURE TUBE REMOVAL



1. Insert a flathead screwdriver into the clearance between the quick connector and the retainer.
2. Rotate the flathead screwdriver 90°, hold up the retainer.
3. Remove the fuel high-pressure tube.

INSTALLATION SERVICE POINTS

>>A<< INLET MANIFOLD INSTALLATION



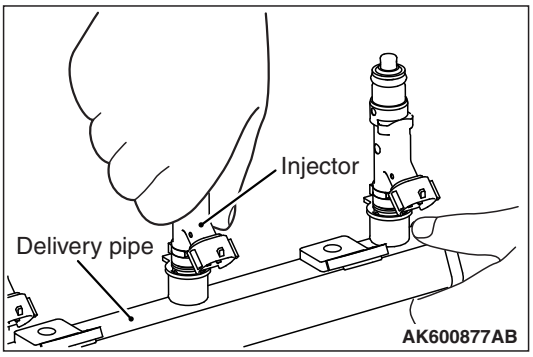
1. Tighten the nuts on the right bank to 6.5 ± 1.5 N·m.
2. Tighten the nuts on the right bank to the specified torque.

   Tightening torque: 22 ± 1 N·m
3. Tighten the nuts on the left bank to the specified torque.

   Tightening torque: 22 ± 1 N·m
4. Tighten the nuts on the right bank and those on the left bank again in that order.

   Tightening torque: 22 ± 1 N·m

>>B<< INJECTOR INSTALLATION

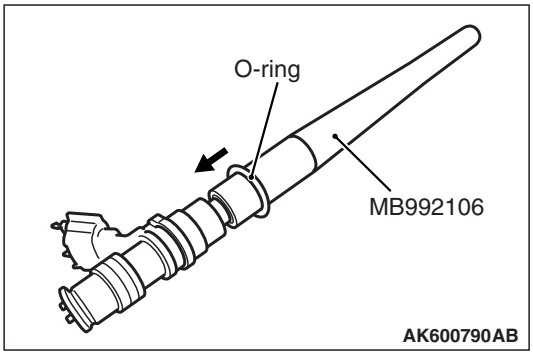


⚠ CAUTION

Use care not to let gasoline enter the delivery pipe.

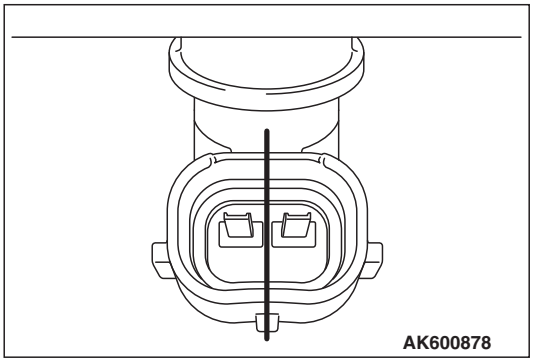
1. Apply gasoline to the O-ring.
2. Insert the injector into the delivery pipe.
3. Make sure the injector rotates smoothly. If not, remove the injector to check the O-ring for damage, and replace the O-ring if necessary. Then reinsert the injector and check that it rotates smoothly.

>>C<< O-RING INSTALLATION

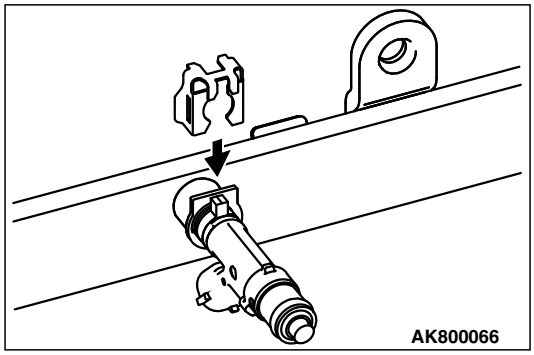


When inserting an O-ring into the injector on the injection nozzle side, use special tool O-ring installer (MB992106) to gradually expand the O-ring, and fit it in place.

>>D<< INJECTOR SUPPORT INSTALLATION

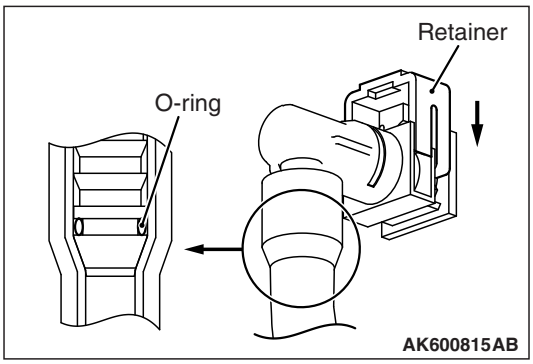


1. Make sure that the protrusion of the injector is at the centre as shown in the illustration.



2. Securely assemble the injector to the injector groove and delivery pipe collar.

>>E<< FUEL HIGH PRESSURE TUBE INSTALLATION



⚠ CAUTION

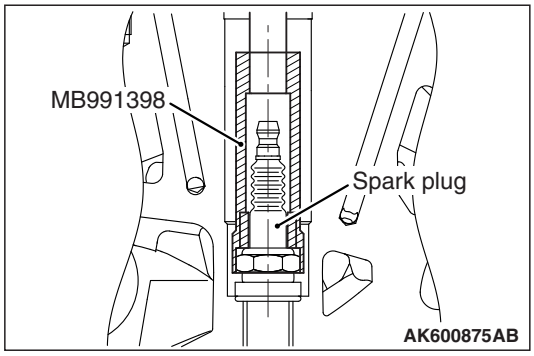
Pay attention that the o-ring of the quick connector has neither scratches nor a fall.

1. Insert the quick connector of the fuel high pressure tube into the delivery pipe.
2. Fit the retainer of the fuel high-pressure tube in the direction shown in the illustration.

   NOTE: Make sure the fuel high pressure tube is not pulled out when pulled lightly.

   NOTE: Must confirm there is play of about 1 mm between quick connector and delivery pipe.

>>F<< SPARK PLUG INSTALLATION



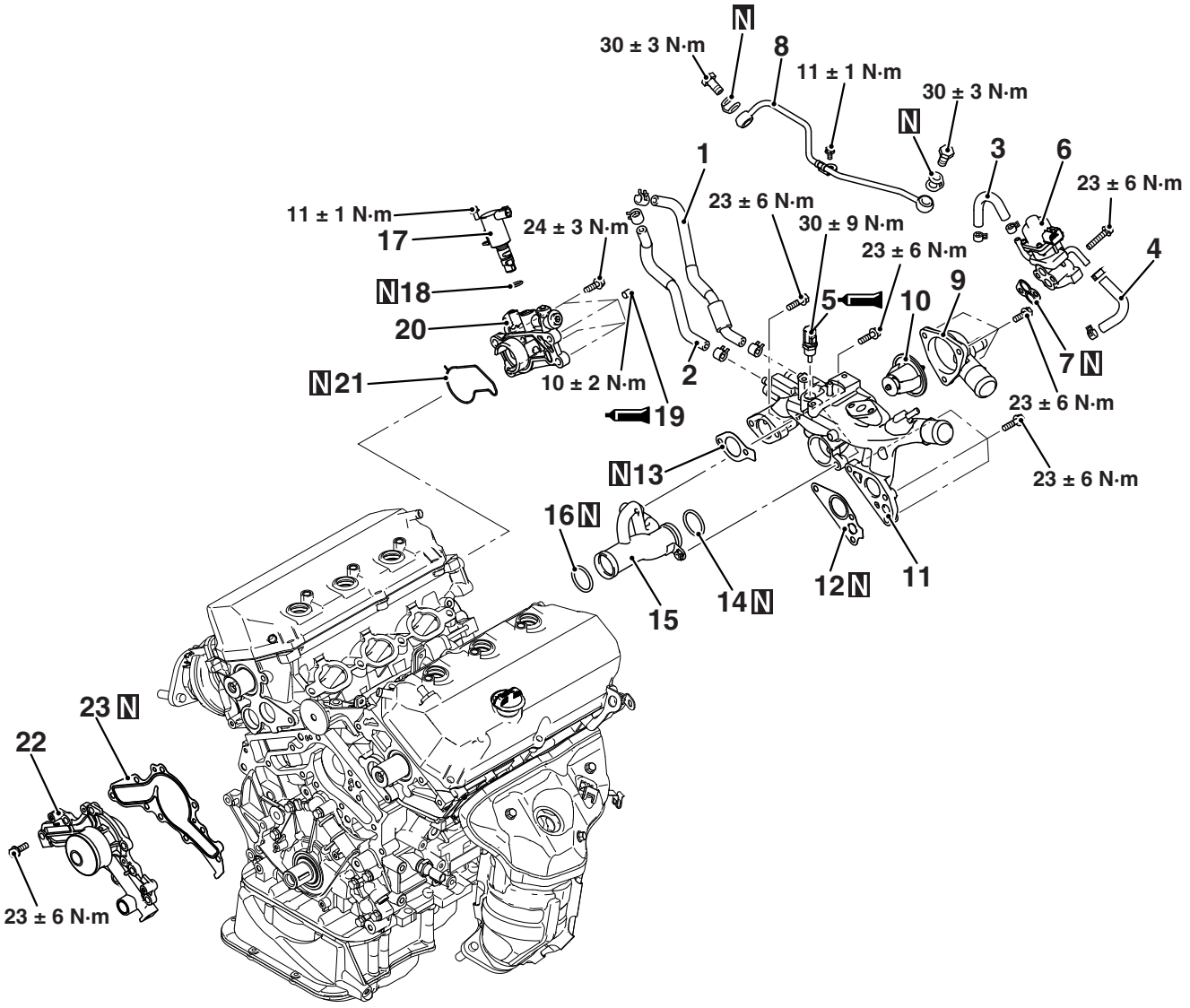
Using special tool Spark plug wrench (MB991398), tighten the spark plug to the specified torque.

Tightening torque: 18 ± 2 N·m

WATER HOSE AND PIPE

REMOVAL AND INSTALLATION

M1113010201041



ACD00314AB

Removal steps

1. Water hose
2. Water hose
3. Water hose
4. Water hose

>>I<< 5. Coolant temperature sensor

6. EGR valve

>>H<< 7. EGR valve gasket

>>G<< 8. Oil pipe

9. Water inlet fitting

>>F<< 10. Thermostat

11. Thermostat housing
12. Thermostat housing gasket

Removal steps (Continued)

>>E<< 13. Thermostat housing gasket

>>D<< 14. O-ring

>>D<< 15. Water pipe

>>D<< 16. O-ring

>>C<< 17. Oil feeder control valve (OCV)

18. O-ring

>>B<< 19. Plug

>>A<< 20. Oil feeder control valve housing

>>A<< 21. Oil feeder control valve housing gasket

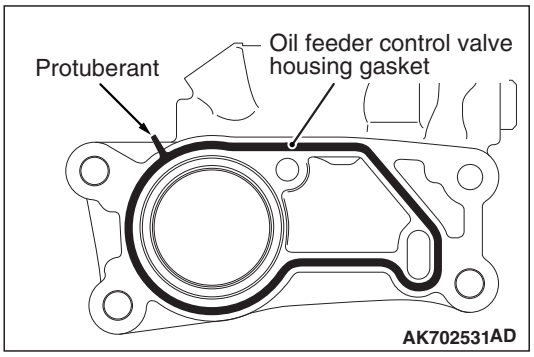
22. Water pump
23. Water pump gasket

INSTALLATION SERVICE POINTS

>>A<< OIL FEEDER CINTROL VALVE HOUSING / GASKET INSTALLATION

⚠ CAUTION

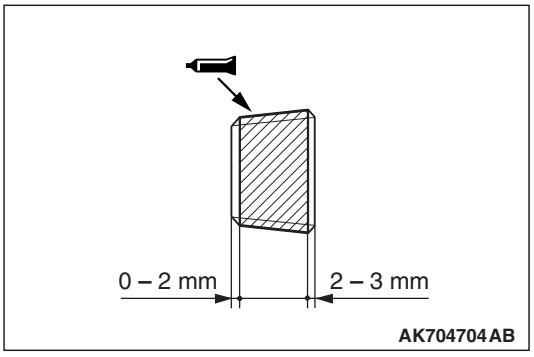
- **Oil passage shall be free from foreign matters.**
- **Shall confirm fully that matching plane and such are free from foreign matters.**



1. Install the oil feeder control valve housing gasket and oil seal case gasket so that the protuberant is positioned as shown in the illustration.
2. Tighten the oil feeder control valve housing and oil seal case to the specified torque.

Tightening torque: 24 ± 3 N·m (18 ± 1 ft-lb)

>>B<< TAPER PLUG INSTALLATION



1. Apply sealant to the threads of the oil pressure switch or taper plug.

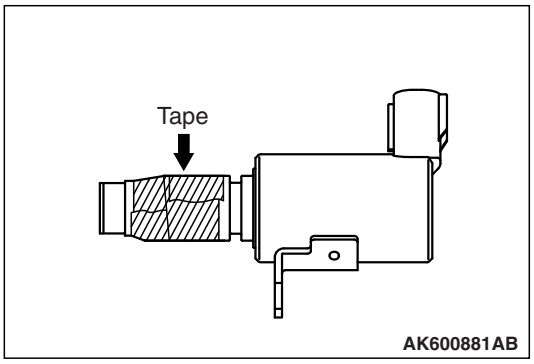
Specified sealant:
Three bond 1212D, Three bond 1215 or equivalent

2. Install the oil pressure switch or taper plug to the oil feeder control valve housing.

>>C<< OIL FEEDER CONTROL VALVE (OCV) INSTALLATION

⚠ CAUTION

- **Never re-use the O-ring.**
- **Before installing O-ring, wind sealing tape around the oil passages cut-out area of oil feeder control valve, to prevent damage. If the O-ring is damaged, it can cause an oil leak.**



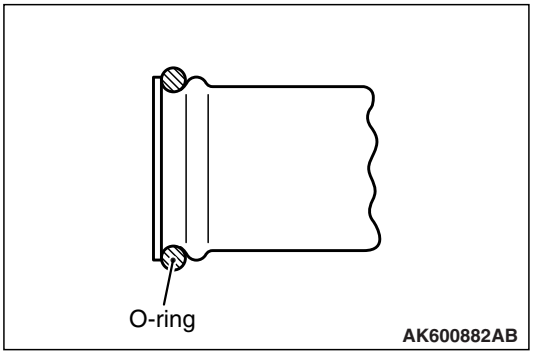
1. Apply a small amount of engine oil to the O-ring and then install it to the oil feeder control valve.
2. Install the oil feeder control valve to the cylinder head.
3. Tighten the oil feeder control valve.

Tightening torque: 11 ± 1 N·m

>>D<< WATER PIPE / O-RING INSTALLATION

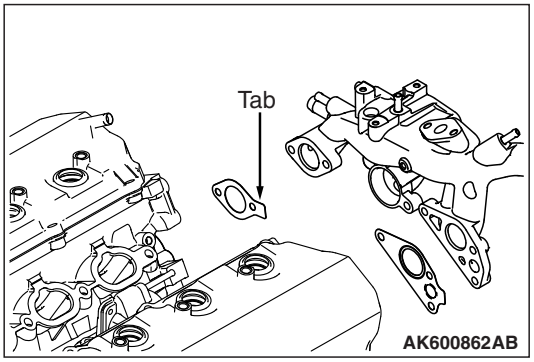
⚠ CAUTION

Keep the O-ring free of oil or grease.



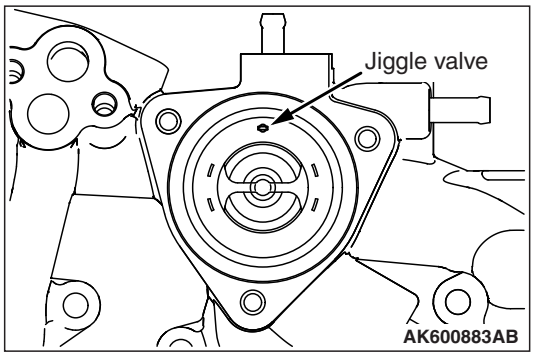
1. Wet the O-ring (with water) to ease assembly.
2. Install the water pipe into the thermostat housing.

>>E<< THERMOSTAT HOUSING GASKET INSTALLATION



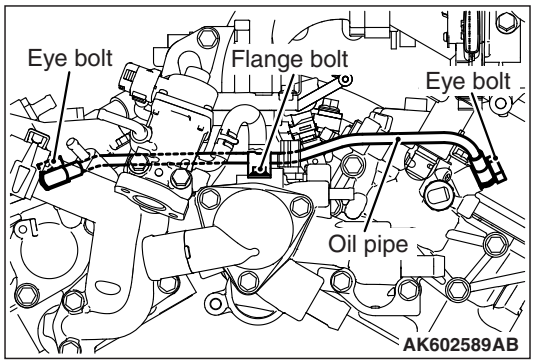
Install the thermostat housing gasket so that the tab is positioned as shown in the illustration.

>>F<< THERMOSTAT INSTALLATION



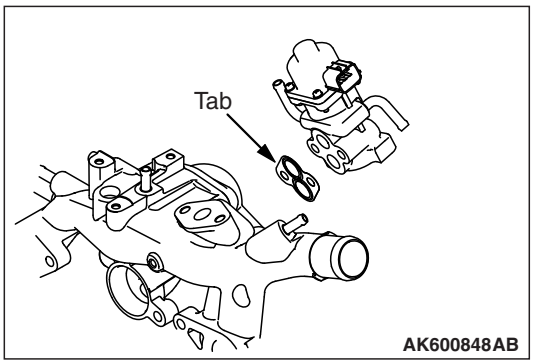
Install the thermostat in the thermostat housing with its jiggle valve located at the top position.

>>G<< OIL PIPE INSTALLATION



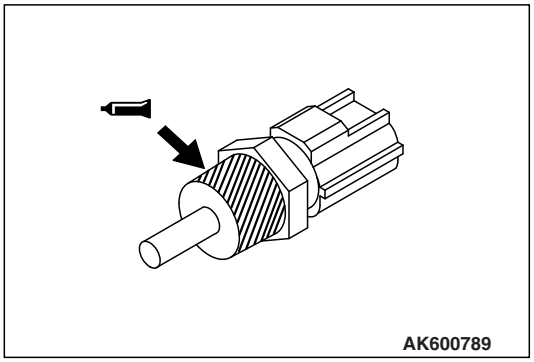
1. Temporarily tighten the eye bolts on the both ends of the oil pipe.
2. Temporarily tighten the flange bolt on the clamp.
3. Tighten the eye bolts on the both ends of the oil pipe to the specified torque.
4. Tighten the flange bolt on the clamp to the specified torque.

>>H<< EGR VALVE GASKET INSTALLATION



Install the EGR valve gasket so that the tab is positioned as shown in the illustration.

>>I<< COOLANT TEMPERATURE SENSOR INSTALLATION



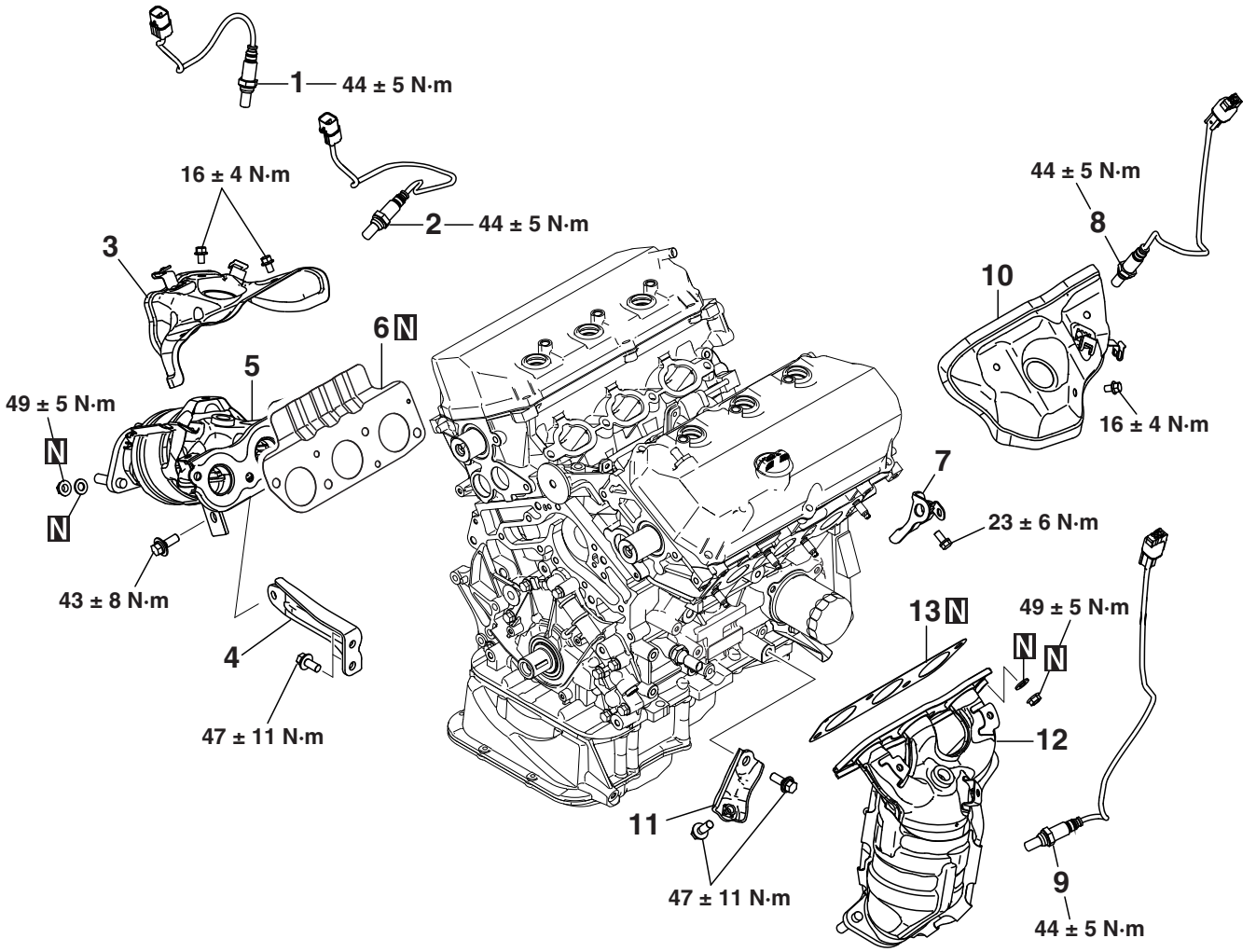
Apply sealant to the coolant temperature sensor.

Specified sealant:
Three bond 1324, LOCTITE 262 or equivalent

EXHAUST MANIFOLD

REMOVAL AND INSTALLATION

M1113004902185



ACD00308AB

Removal steps

1. Right bank oxygen sensor (front)
2. Right bank oxygen sensor (rear)
3. Exhaust manifold cover, right

>>D<< 4. Exhaust manifold bracket, right

5. Exhaust manifold, right

>>C<< 6. Exhaust manifold gasket

7. Engine hanger
8. Left bank oxygen sensor (front)
9. Left bank oxygen sensor (rear)
10. Exhaust manifold cover, left

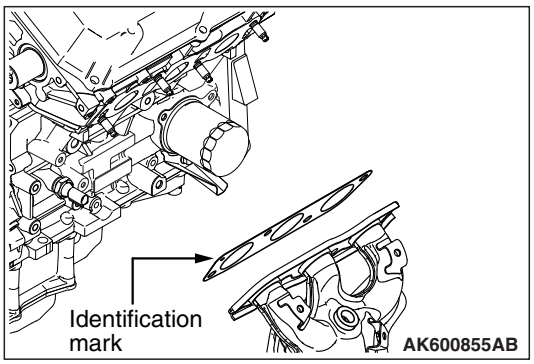
>>B<< 11. Exhaust manifold bracket, left

12. Exhaust manifold, left

>>A<< 13. Exhaust manifold gasket

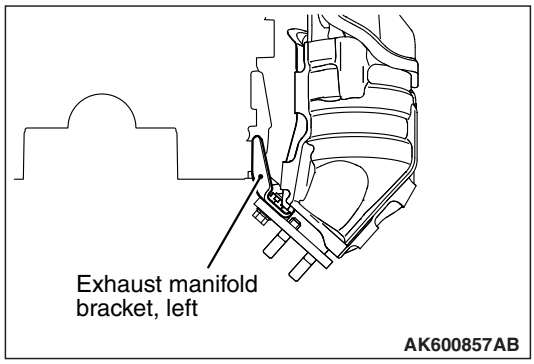
INSTALLATION SERVICE POINTS

>>A<< EXHAUST MANIFOLD GASKET INSTALLATION



Install the exhaust manifold gasket so that the identification mark is positioned as shown in the illustration.

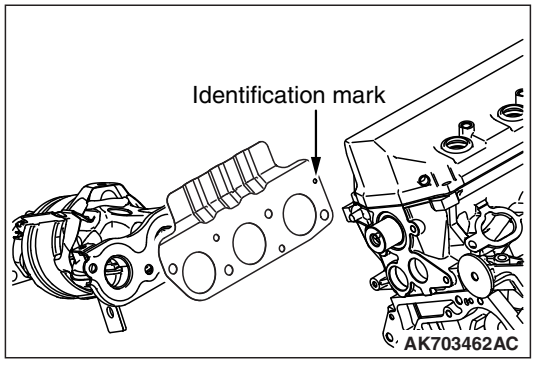
>>B<< EXHAUST MANIFOLD BRACKET, LEFT INSTALLATION



After temporarily tightening the left exhaust manifold bracket with the installation bolts, check the exhaust manifold fastens securely to the cylinder block. Tighten the left exhaust manifold bracket to the specified tightening torque.

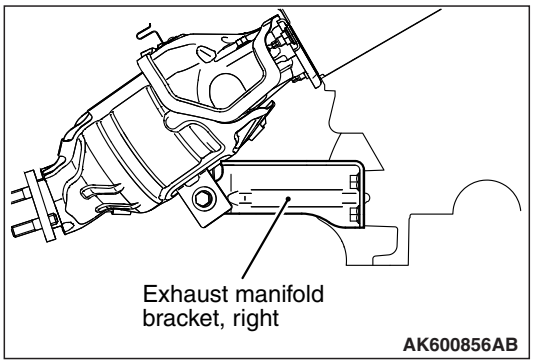
Tightening torque: 47 ± 11 N·m

>>C<< EXHAUST MANIFOLD GASKET INSTALLATION



Install the exhaust manifold gasket so that the identification mark is positioned as shown in the illustration.

>>D<< EXHAUST MANIFOLD BRACKET, RIGHT INSTALLATION



1. After temporarily tightening the right exhaust manifold bracket with the installation bolts, check the exhaust manifold fastens securely to the cylinder block. Tighten the right exhaust manifold bracket to the specified tightening torque.
2. Tighten the cylinder block side bolt to the specified tightening torque.

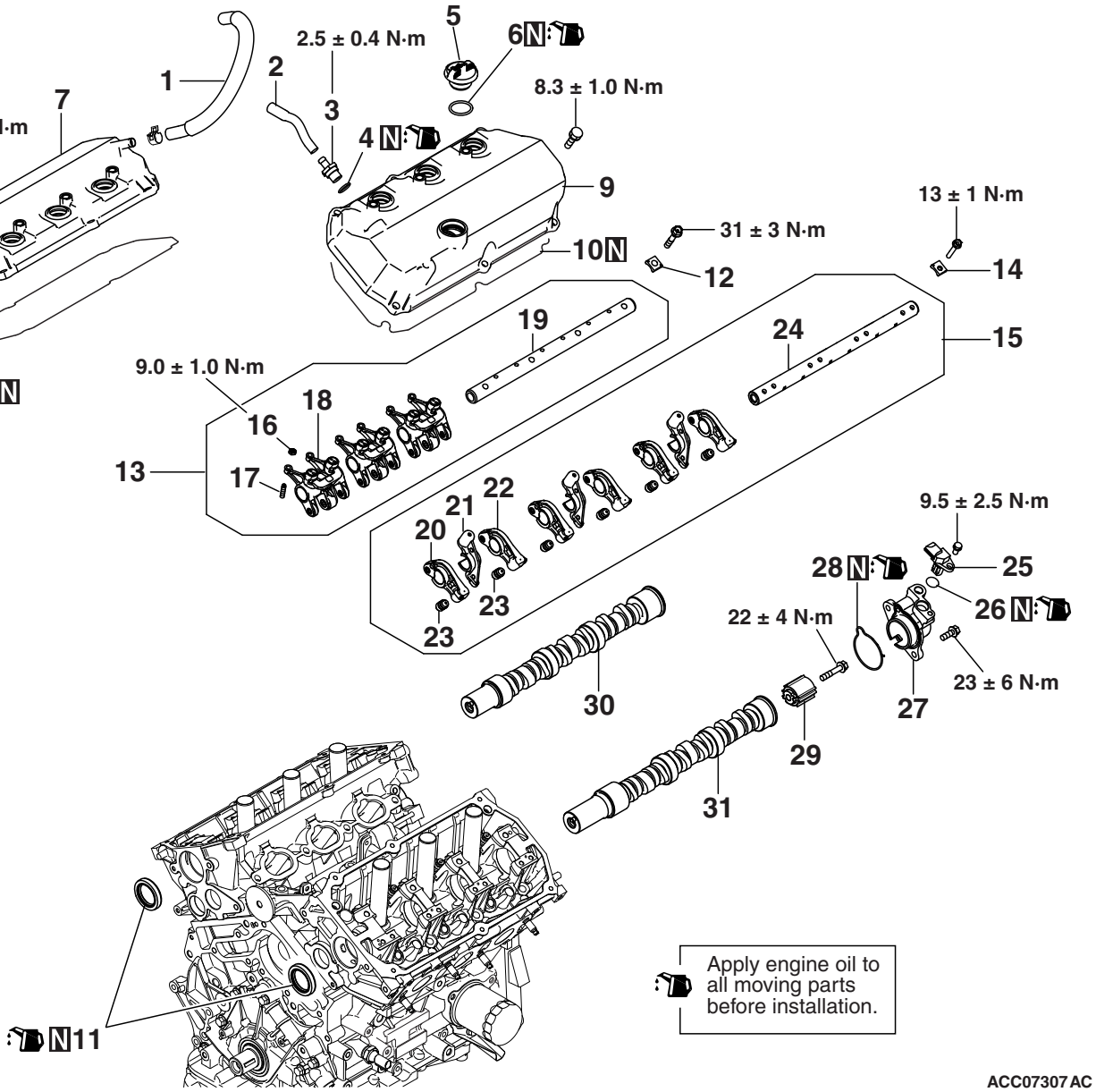
   Tightening torque: 47 ± 11 N·m
3. Tighten the exhaust manifold side bolt to the specified tightening torque.

   Tightening torque: 43 ± 8 N·m

ROCKER COVER AND CAMSHAFT

REMOVAL AND INSTALLATION

M1113005700252



Removal steps

1. Breather hose
2. PCV hose
3. PCV valve
4. O-ring
5. Oil filler cap
6. O-ring

>>G<< 7. Rocker cover, right

8. Rocker cover gasket

>>G<< 9. Rocker cover, left

10. Rocker cover gasket

>>F<< 11. Camshaft oil seal

>>E<< 12. Rocker shaft cap, inlet

<<A>> >>E<< 13. Rocker arms and shaft, inlet

>>E<< 14. Rocker shaft cap, exhaust

<<A>> >>E<< 15. Rocker arms and shaft, exhaust

Removal steps (Continued)

16. Nut

>>D<< 17. Adjusting screw

18. Rocker arm assembly
19. Rocker arm shaft, inlet
20. Rocker arm C
21. Piston arm assembly
22. Rocker arm D

>>C<< 23. Lash adjuster

24. Rocker arm shaft, exhaust
25. Camshaft position sensor
26. O-ring
27. Camshaft position sensor support
28. Camshaft position sensor support gasket

<<B>> >>B<< 29. Cam position sensing cylinder

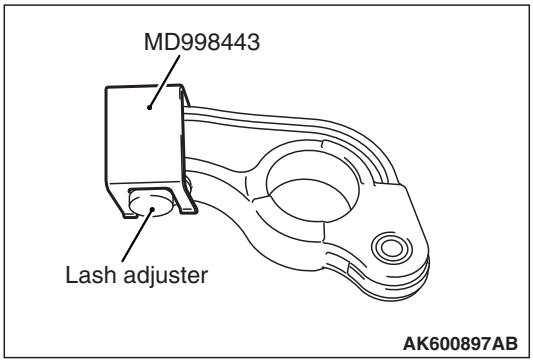
Removal steps (Continued)

>>A<< 30. Camshaft, right
>>A<< 31. Camshaft, left

REMOVAL SERVICE POINTS

<<A>> ROCKER ARMS AND SHAFT ASSEMBLY REMOVAL

1. When the rocker arm is removed from the rocker shaft, tag them to show the installation location for the reinstallation of the rocker arm, the piston arm assembly and so on.



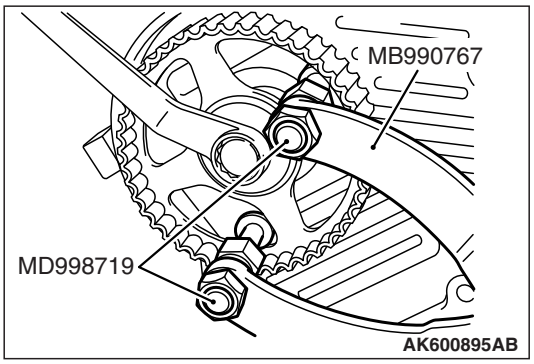
2. <Exhaust side only>

   Set special tool Lash adjuster holder (MD998443) to prevent the lash adjuster coming from free and falling to the floor.

⚠ CAUTION

If the lash adjuster is re-used, clean the lash adjuster. (Refer to lash adjuster inspection P.11J-36.)

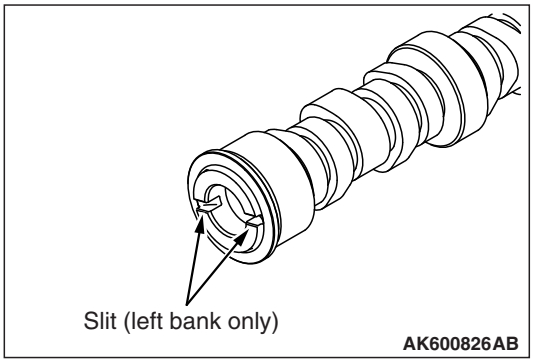
<<B>> CAM POSITION SENSING CYLINDER REMOVAL



Install the camshaft sprocket and the camshaft sprocket bolt to the camshaft. Using the special tools End yoke holder (MB990767) and Pins (MD998719), prevent the cam position sensing cylinder from rotating and remove it.

INSTALLATION SERVICE POINTS

>>A<< CAMSHAFT, RIGHT / CAMSHAFT, LEFT INSTALLATION



⚠ CAUTION

Use care to prevent confusion of the right and left bank camshafts.

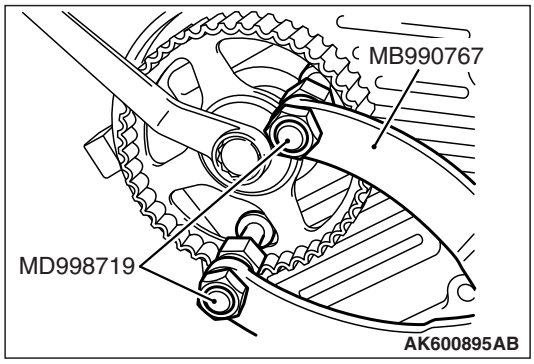
1. Apply engine oil to the camshaft journals and cams and then install the camshafts.

   NOTE: The left bank camshaft is identified by a slit 4 mm wide at the rear end of the camshaft.

2. Install the cylinder head, placing the dowel pin of the camshaft upward.

>>B<< CAM POSITION SENSING CYLINDER INSTALLATION

1. Mate the groove on the camshaft rear end face properly with the protrusion of the cam position sensing cylinder so that the cam position sensing cylinder can be installed.

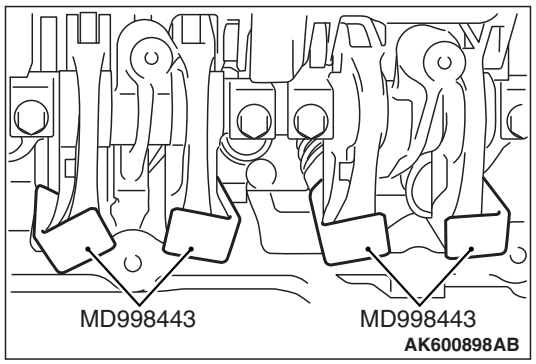


2. Install the camshaft sprocket and the camshaft sprocket bolt to the camshaft. Using the special tools End yoke holder (MB990767) and Pins (MD998719), prevent the cam position sensing cylinder from rotating and tighten it to the specified torque.

>>C<< LASH ADJUSTER INSTALLATION

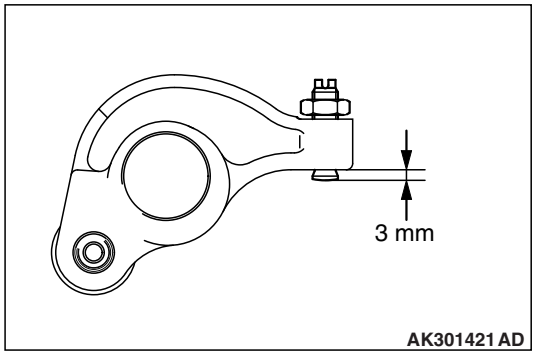
⚠ CAUTION

If the lash adjuster is re-used, clean the lash adjuster. (Refer to lash adjuster inspection P.11J-36.)



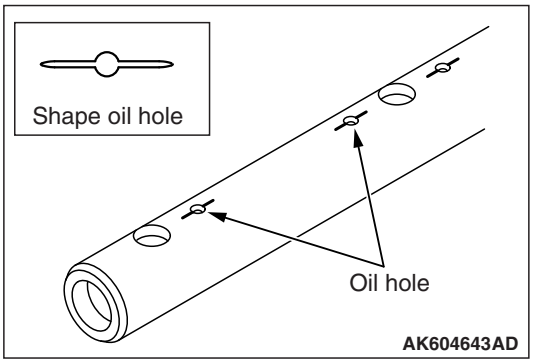
Fit the lash adjuster onto the rocker arm without allowing diesel fuel to spill out. Fit special tool Lash adjuster holder (MD998443) to prevent the lash adjuster coming from free and falling to the floor.

>>D<< ADJUSTING SCREW INSTALLATION

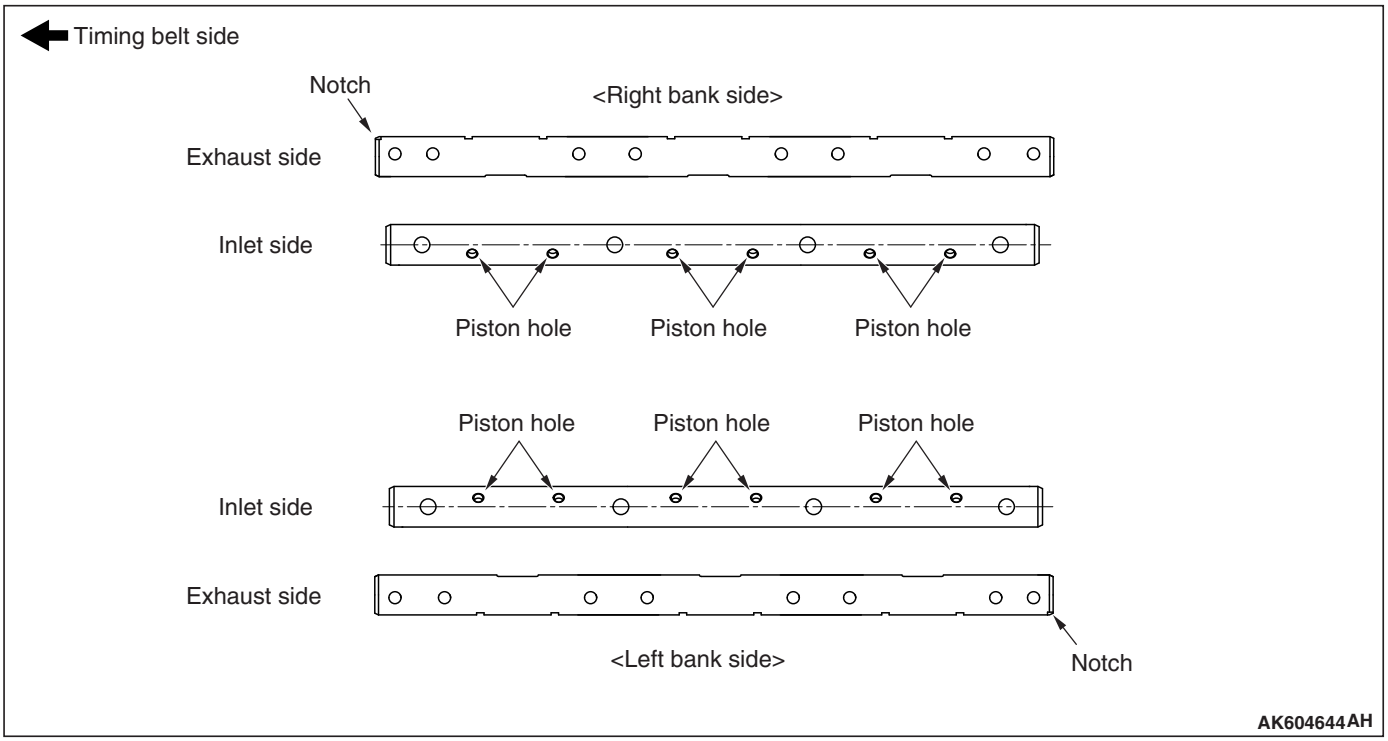


Install provisionally the screw to rocker arm, insert it so that end of the screw is flush with the edge of the rocker arm or projects slightly 3 mm.

>>E<< ROCKER ARMS AND SHAFT / ROCKER SHAFT CAP INSTALLATION



1. Place each rocker arm shaft with the side having the oil holes of the illustrated shape facing down (toward the cylinder head).



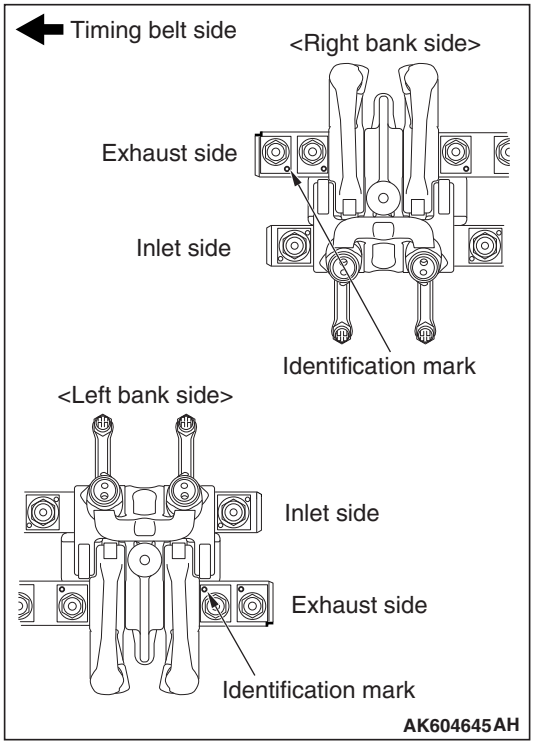
2. Check that the oil holes on each rocker arm shaft are in the positions shown in the illustration.

   NOTE: The inlet rocker arm shafts have four bolt holes each.

3. Check that the notch on each exhaust side rocker arm shaft is at the positions shown in the illustration.

   NOTE: The exhaust rocker arm shafts have eight bolt holes each.

4. According the tags showing the reinstallation locations, install the rocker arms and all other parts on each rocker arm shaft.

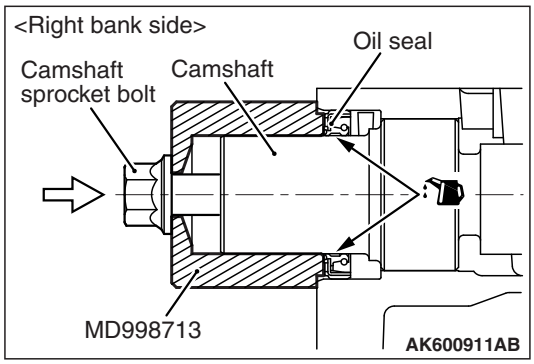


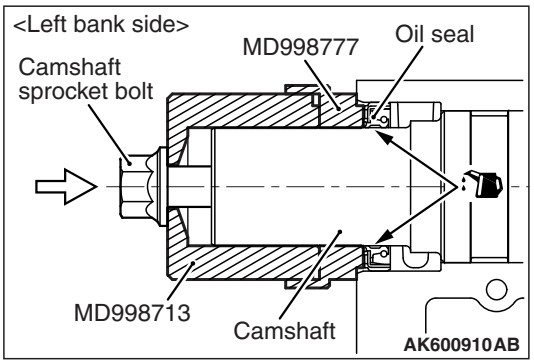
5. When installing the rocker arm shaft, check that the identification marks are at the positions shown in the illustration.
6. Tighten the inlet rocker arm shaft bolts so the specified torque of 31 ± 3 N·m.

7. Tighten the exhaust rocker arm shaft bolts so the specified torque of 13 ± 1 N·m

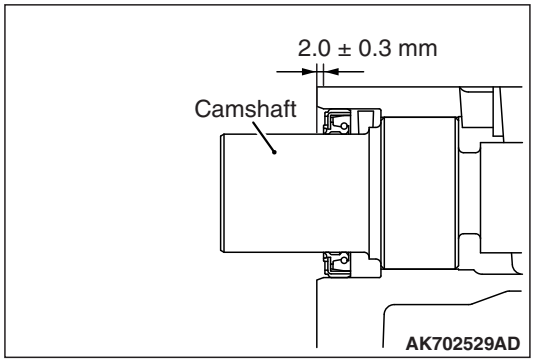
   NOTE: Pay attention to the installation direction of the rocker shaft cap at the exhaust side.
8. Remove the special tool lash adjuster holder (MD998443).

>>F<< CAMSHAFT OIL SEAL INSTALLATION



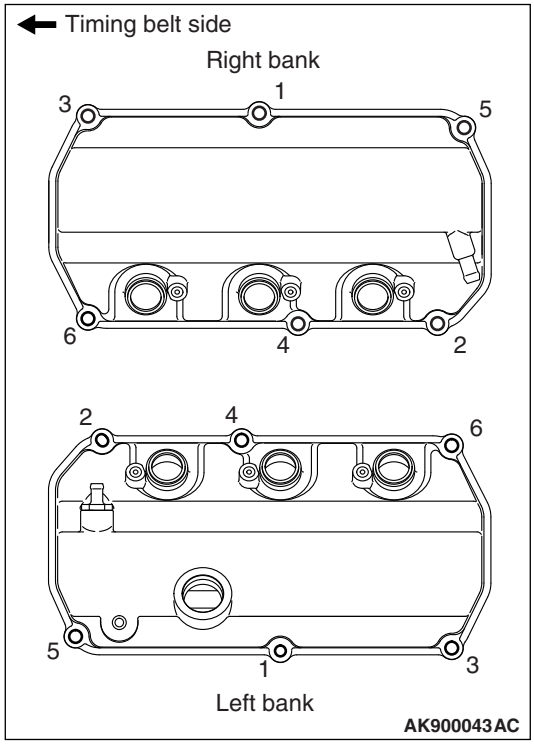


1. Use special tools MD998713 and MD998777 to install the camshaft oil seal.
2. Screw the camshaft sprocket bolt until the special tool touches the end face of the cylinder head.



3. Oil seal shall be pressed fit to position.

>>G<< ROCKER COVER, RIGHT / ROCKER COVER, LEFT INSTALLATION

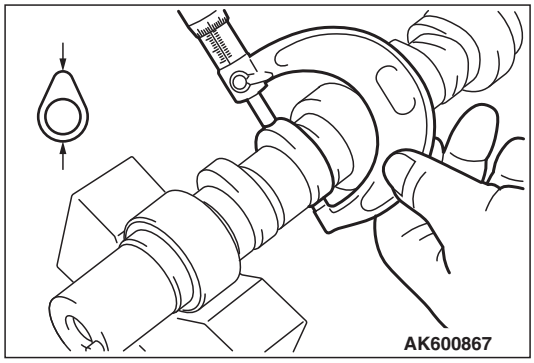


Tighten the rocker cover to the specified torque in the sequence shown in the illustration.

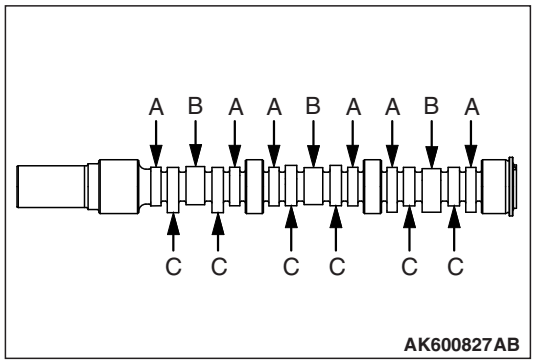
INSPECTION

M1113005800118

CAMSHAFT



Measure the cam height. If it is below the limit, replace the camshaft.

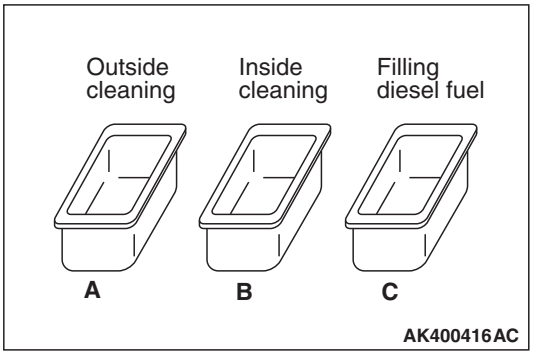


	Standard value	Minimum limit
A: Inlet low speed cam	37.28 mm	36.78 mm
B: Inlet high speed cam	36.23 mm	35.73 mm
C: Exhaust cam	37.89 mm	37.39 mm

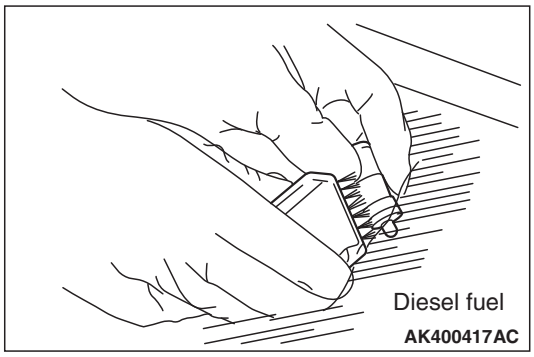
LASH ADJUSTER

⚠ CAUTION

- **The lash adjusters are precision-engineered mechanisms. Do not allow them to become contaminated by dirt or other foreign substances.**
- **Do not attempt to disassemble the lash adjusters.**
- **Use only fresh diesel fuel to clean the lash adjusters.**

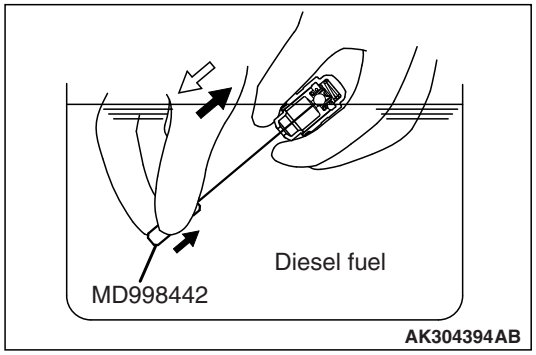


1. Prepare three containers and approximately five litres of diesel fuel. Pour into each container the diesel fuel in an amount enough for a lash adjuster placed in the container in its upright position to completely submerge.



2. Place the lash adjuster in container A and wash its outside surface.

   NOTE: Use a nylon brush if there are hard-to-remove deposits.

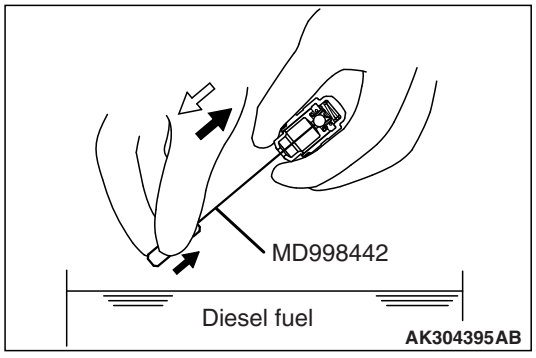


⚠ CAUTION

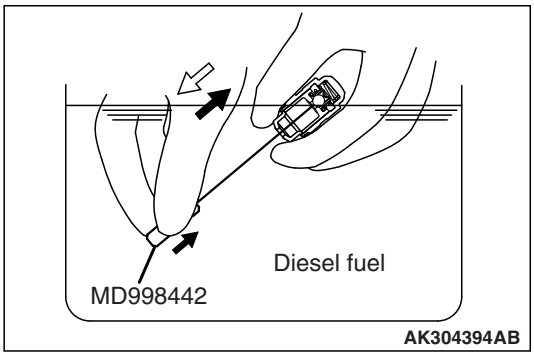
The steel ball spring of the lash adjuster is extremely weak. The lash adjuster's functionality may be badly affected if the special tool is inserted too strongly.

3. While gently pushing the internal steel ball using the special tool Air bleed wire (MD998442), move the plunger in and out 5 – 10 times to eliminate stiffness in the plunger and expel contaminated oil.

   NOTE: The plunger must be free from jamming and any other abnormalities. If a defect is found in plunger operation, replace the lash adjuster.



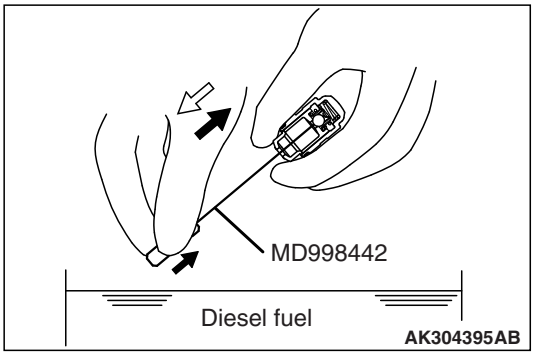
4. Take the lash adjuster out of the container, then move the plunger by pushing the steel ball gently to discharge the diesel fuel from the pressure chamber.



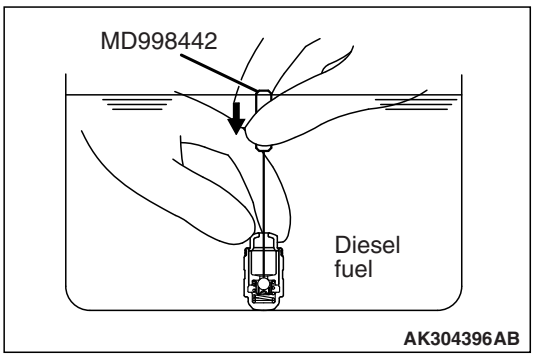
⚠ CAUTION

The steel ball spring of the lash adjuster is extremely weak. The lash adjuster's functionality may be badly affected if the special tool is inserted too strongly.

5. Soak the lash adjuster in the diesel fuel in container B. Move the plunger in and out 5 – 10 times by gently pushing the internal steel ball using the special tool Air bleed wire (MD998442) until the plunger moves smoothly to wash the lash adjuster's pressure chamber.



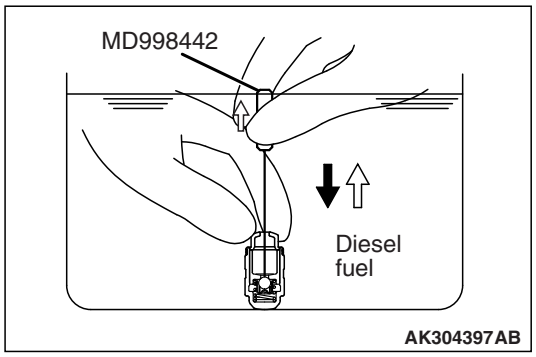
6. Take the lash adjuster out of the container, then move the plunger by pushing the steel ball gently to discharge the diesel fuel from the pressure chamber.



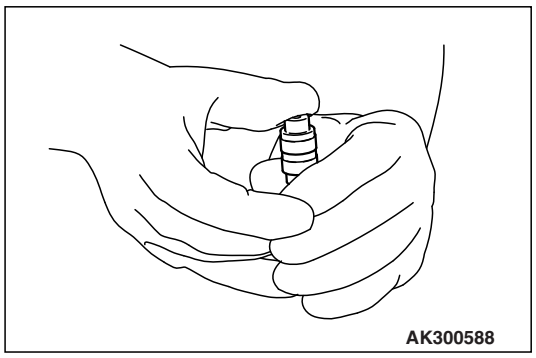
⚠ CAUTION

Do not use container C for cleaning. If cleaning is performed in container C, foreign matter could enter the pressure chamber when the chamber is filled with diesel fuel.

7. Soak the lash adjuster in the diesel fuel in container C. Gently push the internal steel ball using the special tool Air bleed wire (MD998442).



8. Place the lash adjuster upright with the plunger at the top. Push the plunger firmly until it makes a full stroke, then return the plunger slowly and release the hold of the steel ball to allow the pressure chamber to be filled with diesel fuel.



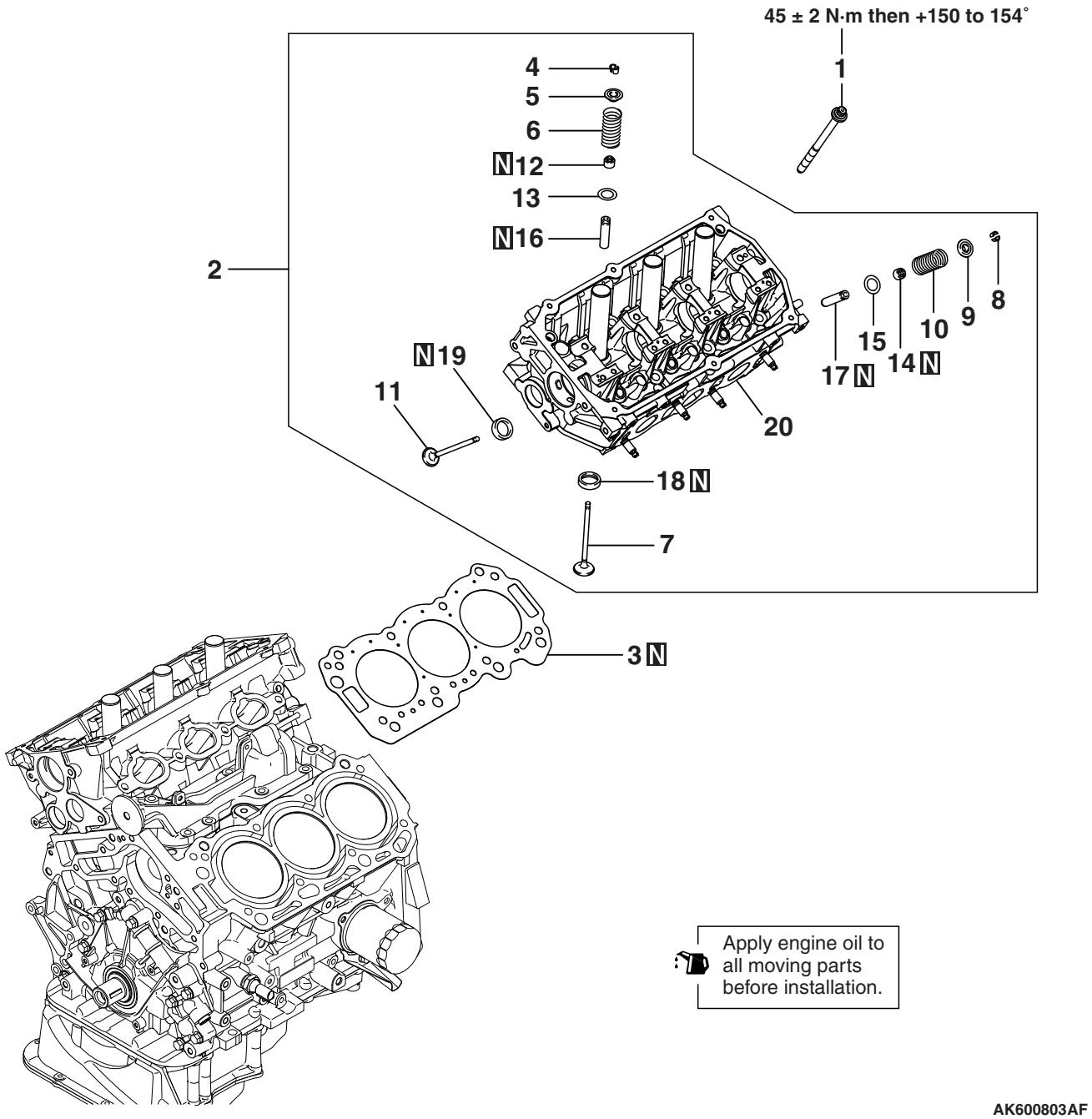
NOTE: If the lash adjuster contracts, perform the operations 7. through 9. again. Replace the lash adjuster if it still contracts even after the pressure chamber has completely been filled with diesel fuel (air has been bled).

9. Take the lash adjuster out of the container, place it upright with the plunger at the top, and push the plunger firmly. The plunger must not move at all.
10. Keep the serviced lash adjusters in their upright positions to prevent diesel fuel from spilling out. Protect them from dust or other foreign matter. Install the lash adjusters onto the engine as soon as possible.

CYLINDER HEAD AND VALVES

REMOVAL AND INSTALLATION

M1113006903689



AK600803AF

Removal steps

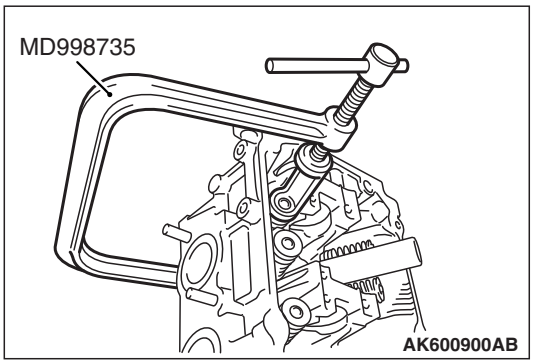
	>>D<<	1.	Cylinder head bolt
		2.	Cylinder head assembly
		3.	Cylinder head gasket
<<A>>	>>C<<	4.	Retainer lock
		5.	Valve spring retainer
	>>B<<	6.	Valve spring
		7.	Inlet valve
<<A>>	>>C<<	8.	Retainer lock
		9.	Valve spring retainer
	>>B<<	10.	Valve spring

Removal steps (Continued)

		11.	Exhaust valve
<<B>>	>>A<<	12.	Valve stem seal
		13.	Valve spring seat
<<B>>	>>A<<	14.	Valve stem seal
		15.	Valve spring seat
		16.	Inlet valve guide
		17.	Exhaust valve guide
		18.	Inlet valve seat
		19.	Exhaust valve seat
		20.	Cylinder head

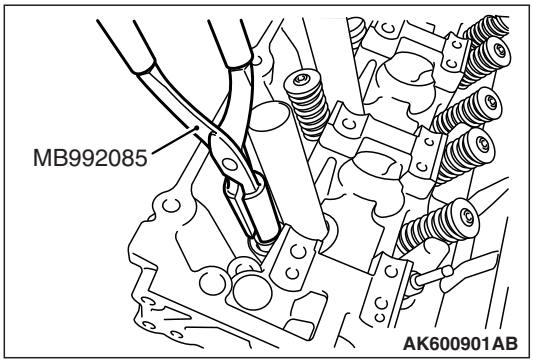
REMOVAL SERVICE POINTS

<<A>> RETAINER LOCK REMOVAL



1. Using special tool Valve spring compressor (MD998735), compress the spring.
2. Remove the retainer locks.

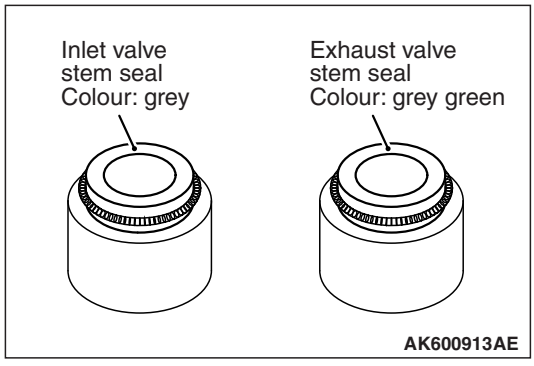
<<B>> VALVE STEM SEAL REMOVAL



Using the special tool Valve stem seal pliers (MB992085), nip the valve stem seal and remove it.

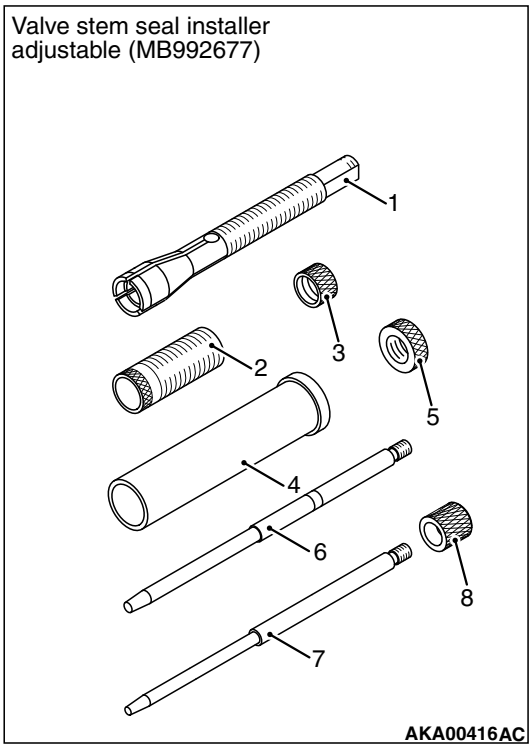
INSTALLATION SERVICE POINTS

>>A<< VALVE STEM SEAL INSTALLATION



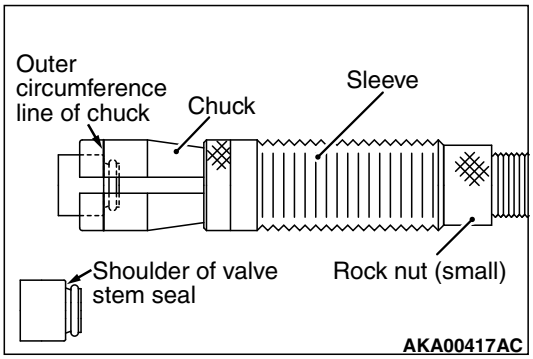
⚠ CAUTION

- **Valve stem seals for inlet valves and for exhaust valves are different. Be sure to install the correct ones.**
- **Valve stem seal identification colour.**
  Inlet: Grey
  Exhaust: Grey green

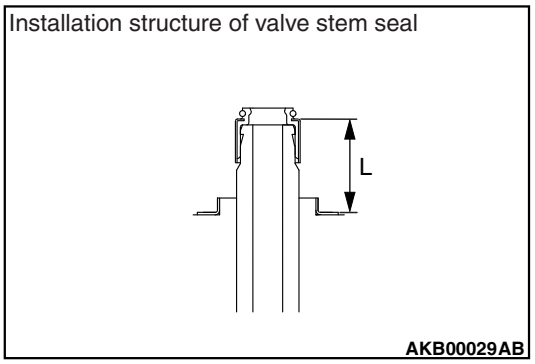


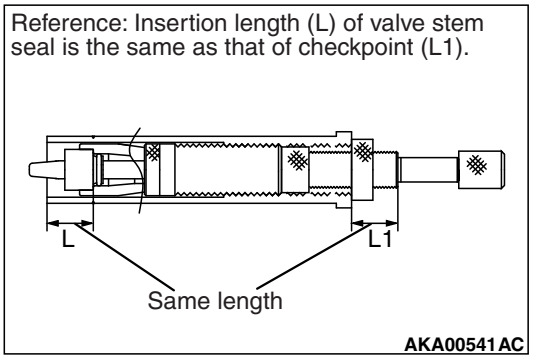
Use a special tool to install the valve stem seal, obeying the following procedures:

1. The special tool valve stem seal installer adjustable (MB992677) is composed of the components shown in the illustration.
   1: Chuck
   2: Sleeve
   3: Rock nut (small)
   4: Outer pipe
   5: Rock nut (large)
   6: Guide pin (5.9)
   7: Guide pin (4.9)
   8: Cap
2. Adjust the inside chuck diameter, obeying the following procedures.



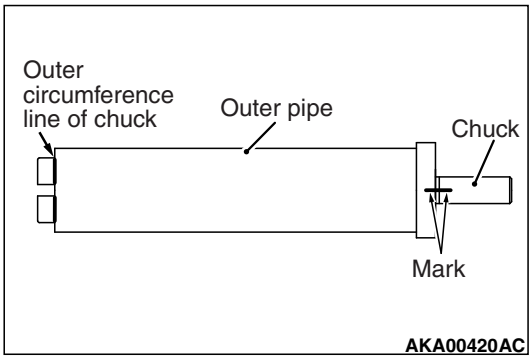
(1) Install the sleeve to the chuck as shown in the illustration.
(2) Install the shoulder of the valve stem seal to the chuck, aligning with the outer circumference line of the chuck as shown in the illustration.
(3) Turn the sleeve to wring the chuck.
(4) Stop the sleeve at the position where you can easily remove the valve stem seal by hand.
(5) Use the (small) rock nut to fix the sleeve.





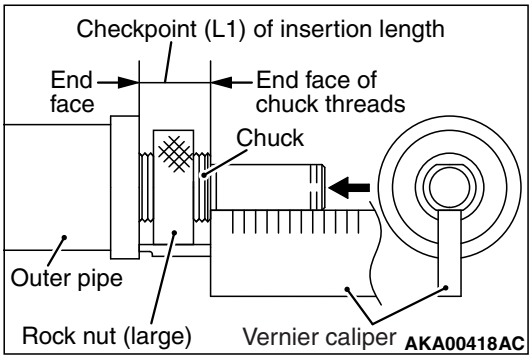
3. Adjust the stem seal insertion length, obeying the following procedures.

   Set the valve stem seal insertion length (L) of 18.2mm.

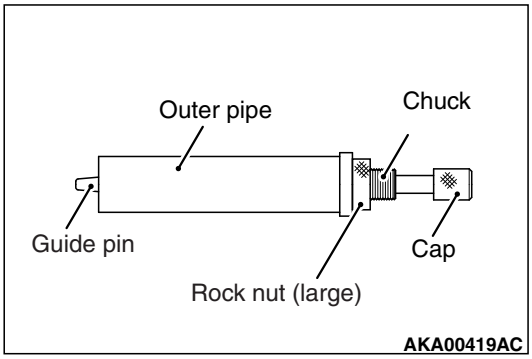


(1) The position, in which the end face of the outer pipe is aligned with the outer circumference line of the chuck, is 0mm of the insertion length. Insert the chuck and the sleeve into the outer pipe to fit the nut as shown in the illustration.
(2) Turn the chuck to adjust the valve stem seal insertion length.

   NOTE: The insertion length can change by 1mm per the chuck turn.
   To easily know how many times the chuck is turned, put the mark at the position shown in the illustration.

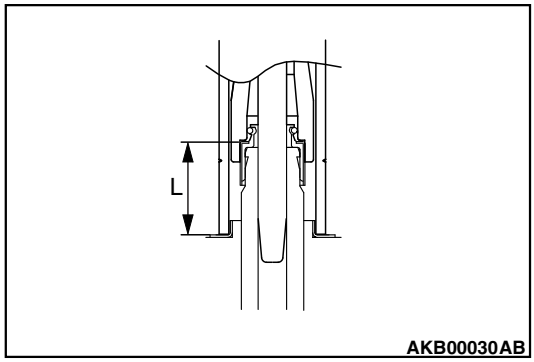


(3) Use a vernier caliper to measure the checkpoint (L1) of the insertion length shown in the illustration. Check the insertion length.
(4) Use the (large) rock nut to fix the sleeve.



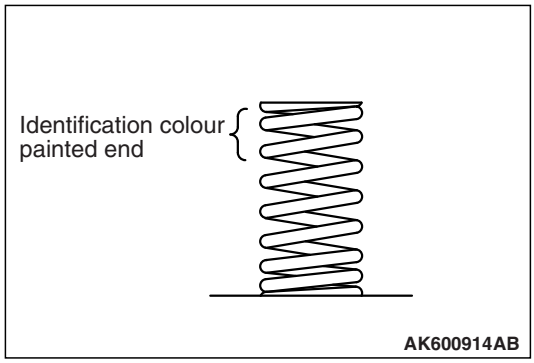
4. Install the cap to the guide pin (5.9).
5. Install the guide pin (5.9) as shown in the illustration.

6. Apply the engine oil to the valve stem seal to set the chuck.
7. Install the valve spring seat.



8. Use the plastic hammer to insert the valve stem seal.

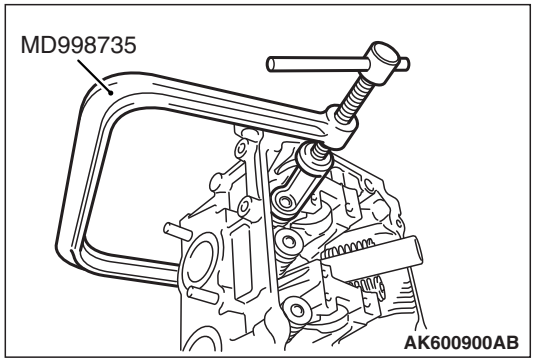
>>B<< VALVE SPRING INSTALLATION



Install the valve spring end with its identification colour toward the spring retainer.

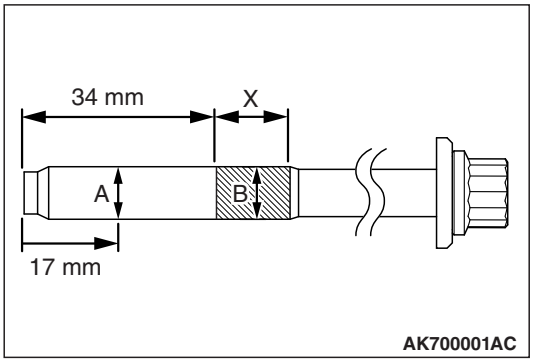
Identification colour
Inlet: White
Exhaust: Blue

>>C<< RETAINER LOCK INSTALLATION



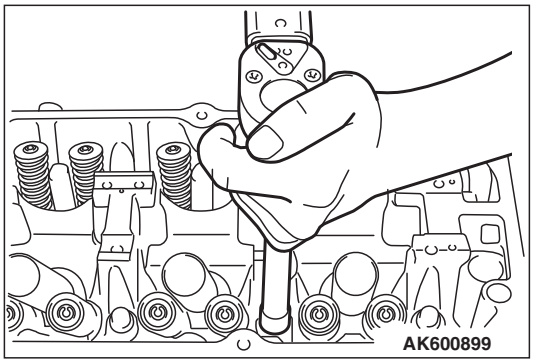
Using special tool Valve spring compressor (MD998735), compress the valve spring and insert the retainer lock into position.

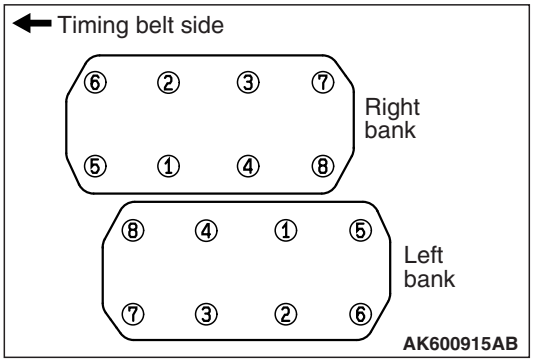
>>D<< CYLINDER HEAD BOLT INSTALLATION



1. Check in the following procedure before reusing the cylinder head bolt.
   (1) Measure the outside diameter "A".
   (2) Measure the smallest outside diameter "B" within the range "X" shown in the illustration.
   (3) If the difference of outside diameter of thread exceeds the limit, replace the cylinder head bolt.

   Limit: 0.1mm

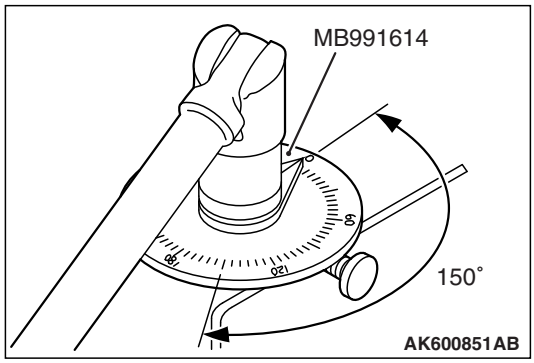




⚠ CAUTION
Attach the head bolt washer in the direction shown in the figure.

2. Tighten the bolts in the illustrated sequence two or three rounds.

   Tightening torque: 45 ± 2 N·m



⚠ CAUTION

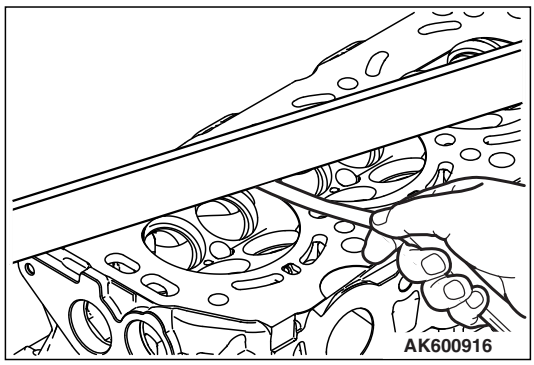
- **When the tightening angle is smaller than the specified tightening angle, the appropriate tightening capacity cannot be secured.**
- **When the tightening angle is larger than the specified tightening angle, remove the bolt to start from the beginning again according to the procedure.**

3. Using the special tool Angle gauge (MB991614), tighten the cylinder head bolt another 150°.

INSPECTION

M1113007002482

CYLINDER HEAD



1. Check the cylinder head gasket surface for flatness by using a straight edge and feeler gauge.

   Standard value: Less than 0.03 mm
   Limit: 0.05 mm

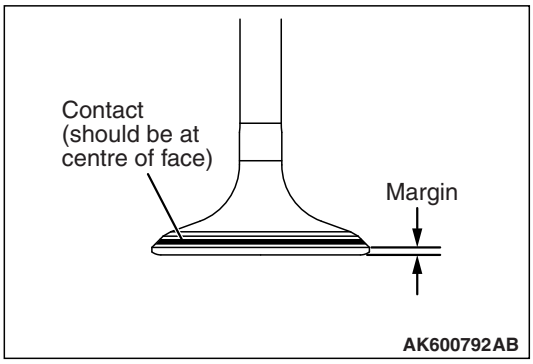
2. If the service limit is exceeded, correct to meet the specification.

   Grinding limit: *0.15 mm
   *** Includes combined with cylinder block grinding.**

   *If the service limit is exceeded, correct to meet the specification.

   Cylinder head height (specification when new):
   120 mm

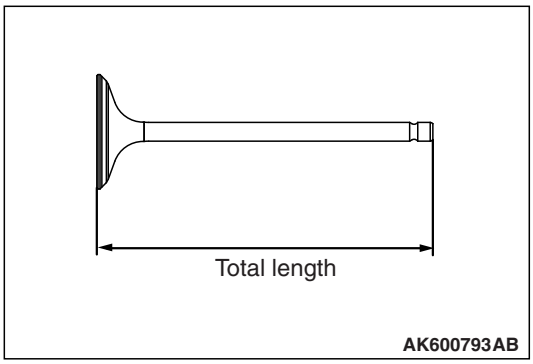
VALVE



1. Check the valve seat contact. Valve seat contact should be uniform at the centre of the valve face. If incorrect, reface using a valve refacer.
2. If the margin is below the limit, replace the valve.

   Standard value:
   Inlet 1.0 mm
   Exhaust 1.2 mm

   Minimum limit:
   Inlet 0.5 mm
   Exhaust 0.7 mm

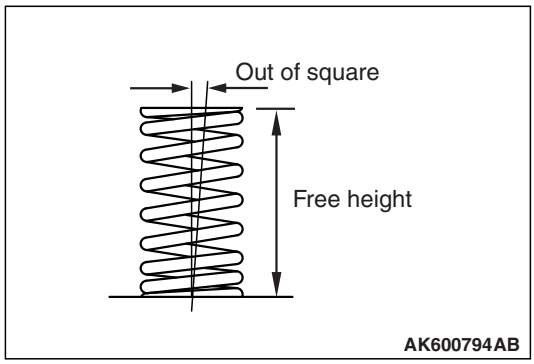


3. Measure the valve's total length. If the measurement is less than the limit, replace the valve.

   Standard value:
   Inlet 111.84 mm
   Exhaust 114.04 mm

   Minimum limit:
   Inlet 111.34 mm
   Exhaust 113.54 mm

VALVE SPRING



1. Measure the free height of the spring. If it is less than the limit, replace.

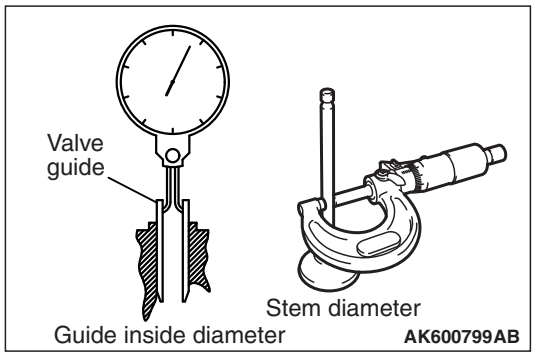
   Standard value:
   Inlet 63.77 mm
   Exhaust 59.90 mm

   Minimum limit:
   Inlet 62.77 mm
   Exhaust 58.90 mm

2. Measure the squareness of the spring. If it exceeds the limit, replace.

   Standard value: 2° or less
   Limit: 4°

VALVE GUIDE



Measure the clearance between the valve guide and valve stem. If it exceeds the limit, replace the valve guide or valve, or both.

Standard value:
Inlet 0.020 – 0.047 mm
Exhaust 0.035 – 0.062 mm

Limit:
Inlet 0.10 mm
Exhaust 0.15 mm

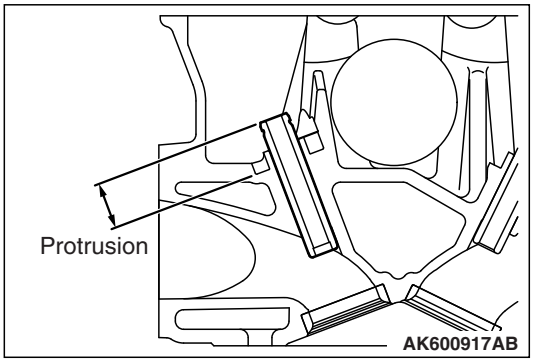
VALVE GUIDE REPLACEMENT PROCEDURE

1. Using a press, remove the valve guide toward the cylinder block.

⚠ CAUTION
Do not install a valve guide of the same size again.

2. Rebore the valve guide hole of the cylinder head so that it fits the press-fitted oversize valve guide.

   Valve guide hole diameters
   0.05 oversize: 11.050 – 11.068 mm



3. Press-fit the valve guide until it projects by the specified amount.

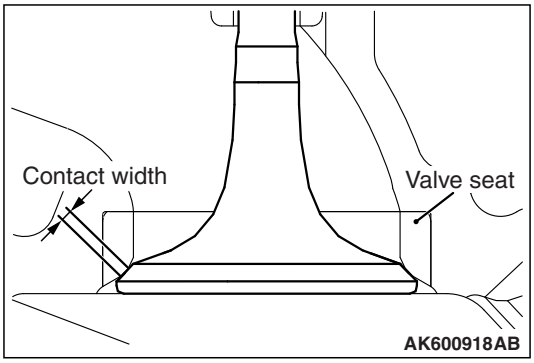
   Standard value: 16.7 – 17.3 mm

   NOTE: When press-fitting the valve guide, work from the cylinder head top surface.

   NOTE: Pay attention to the difference in length of the valve guides. [Inlet side: 45.5 mm; exhaust side: 52.5 mm]

   NOTE: After installing the valve guides, insert new valves in them to check for smooth operation.

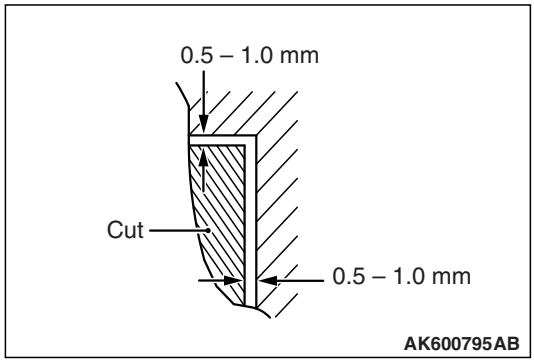
VALVE SEAT



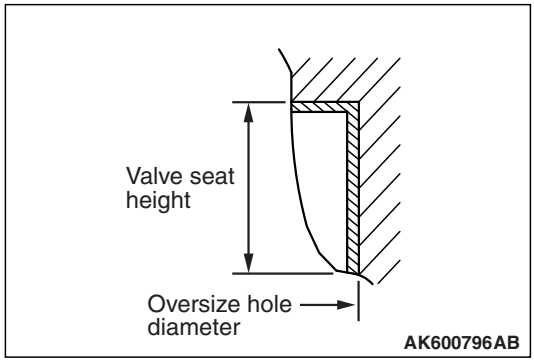
Assemble the valve, then measure the contact width. If the measurement exceeds the specified limit, replace the valve seat.

Standard value: 0.9 – 1.3 mm

VALVE SEAT REPLACEMENT PROCEDURE



1. Cut the valve seat from the inside to thin the wall thickness. Then, remove the valve seat.



2. Rebore the valve seat hole in the cylinder head to a selected oversize valve seat diameter.

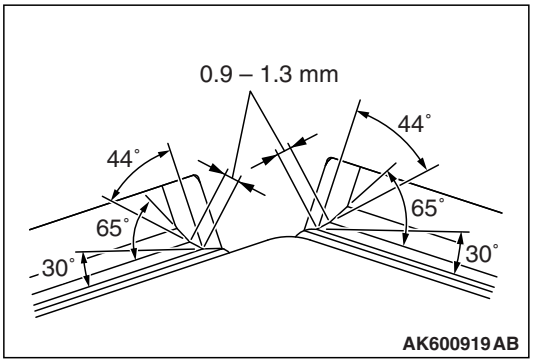
   Inlet seat ring hole diameters
   0.3 oversize: 36.300 – 36.325 mm

   Exhaust seat ring hole diameters
   0.3 oversize: 32.300 – 32.325 mm

3. Before fitting the valve seat, either heat the cylinder head up to approximately 250°C or cool the valve seat in liquid nitrogen, to prevent the cylinder head bore from galling.
4. Using a valve seat cutter, correct the valve seat to the specified width and angle.

   See "VALVE SEAT RECONDITIONING PROCEDURE" on the previous page.

VALVE SEAT RECONDITIONING PROCEDURE

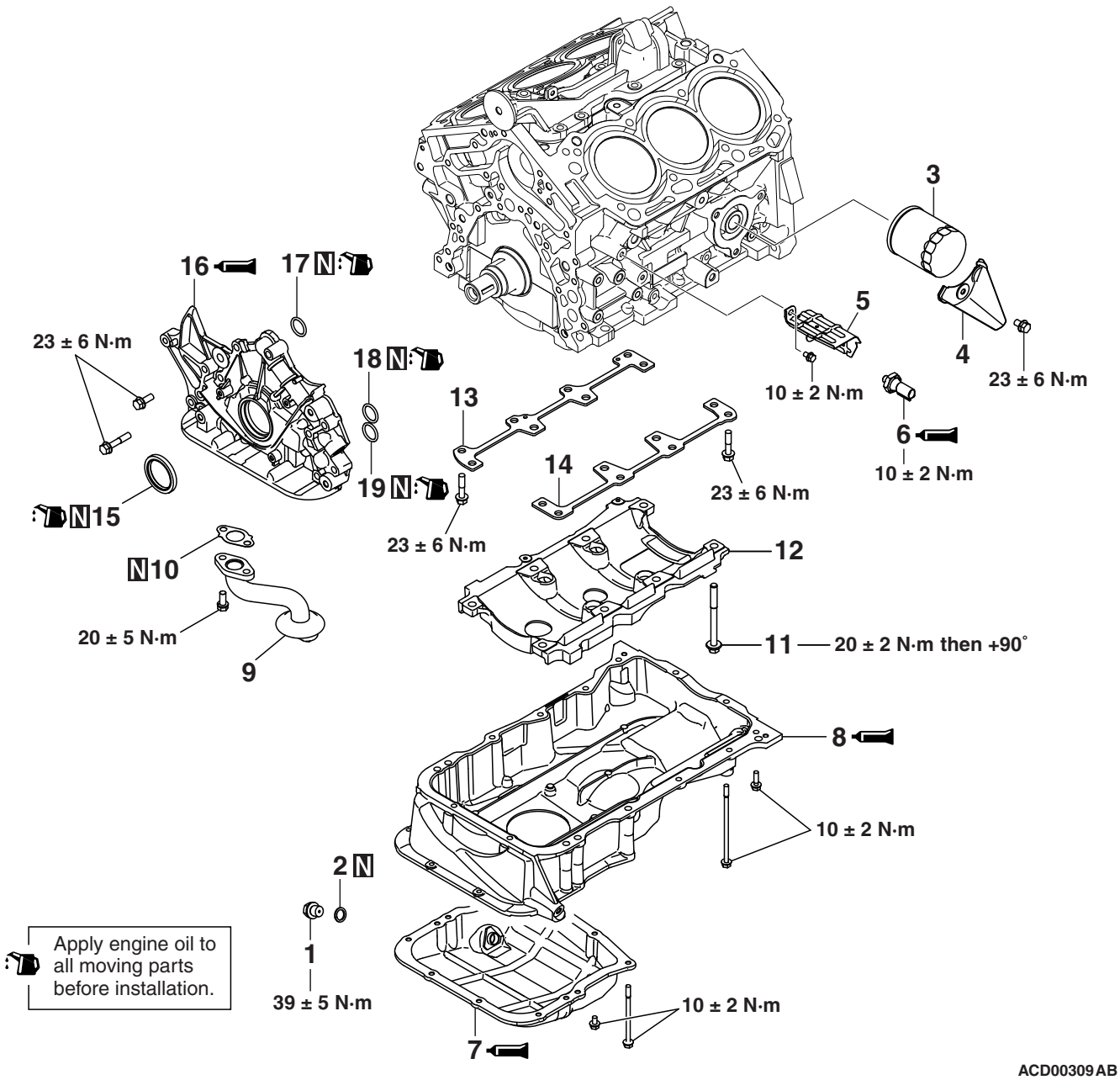


1. Before correcting the valve seat, check for clearance between the valve guide and valve and, if necessary, replace the valve guide.
2. Using the seat grinder, correct to obtain the specified seat width and angle.
3. After correcting the valve seat, lap the valve and valve seat using lapping compound. Then, check the valve stem projection.

OIL PAN AND OIL PUMP

REMOVAL AND INSTALLATION

M1113008102277



ACD00309AB

Removal steps

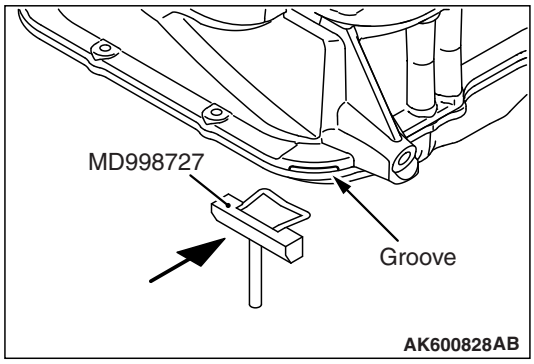
	1.	Drain plug
>>J<<	2.	Drain plug gasket
>>I<<	3.	Oil filter
>>H<<	4.	Oil filter cover
	5.	Heat protector
>>G<<	6.	Oil pressure switch
<<A>> >>F<<	7.	Oil pan, lower
<<B>> >>E<<	8.	Oil pan, upper
	9.	Oil screen
>>D<<	10.	Oil screen gasket

Removal steps (Continued)

>>C<<	11.	Bearing cap bolt
>>C<<	12.	Beam
>>C<<	13.	Right plate
>>C<<	14.	Left plate
>>B<<	15.	Crankshaft front oil seal
>>A<<	16.	Oil pump case
	17.	O-ring
	18.	O-ring
	19.	O-ring

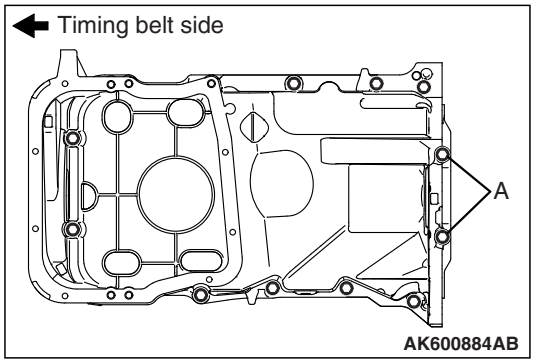
REMOVAL SERVICE POINTS

<<A>> OIL PAN LOWER REMOVAL



Insert the special tool Oil pan FIPG cutter (MD998727), into the groove shown in the illustration. Strike and slide it and then cut the liquid gasket.

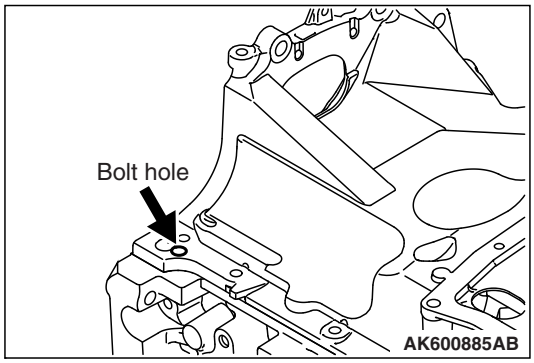
<<B>> OIL PAN UPPER REMOVAL



1. Remove the bolts A shown in the illustration first.
2. Remove all other bolts.

⚠ CAUTION

Do not use a scraper or special tool to remove the oil pan upper.



3. Thread the M10 × 1.25 pitch bolt into the illustrated bolt hole to remove the oil pan upper.

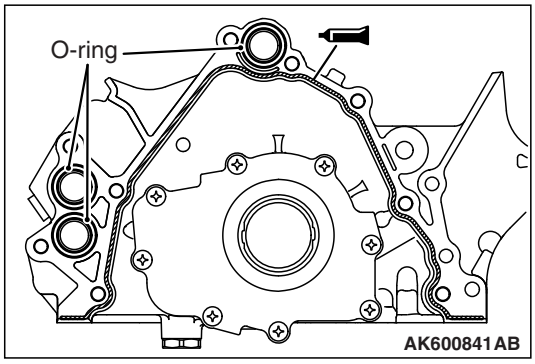
INSTALLATION SERVICE POINTS

>>A<< OIL PUMP CASE INSTALLATION

⚠ CAUTION

Carefully work so that the rests of the liquid gasket cannot enter to the oil passage or water passage.

1. Remove all the rests of the liquid gasket on the oil pump case and the cylinder block.
2. Using white gasoline and so on, Degrease and clean the plane where the liquid gasket is applied and the both sides of the chamfered areas where the liquid gasket collects.
3. After degreasing and cleaning the plane and the both sides, always spray compressed air into the oil passage and the water passage. Check that the oil passage and the water passage are free of foreign materials such as liquid gasket.



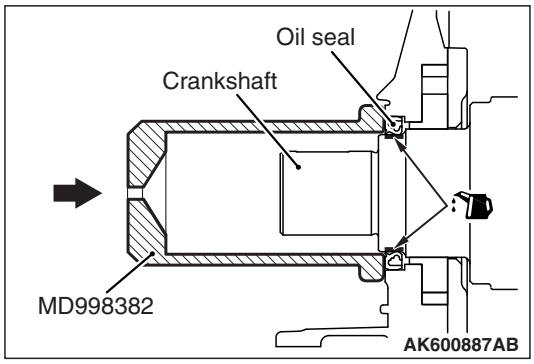
4. As shown in the illustration, apply a 2.0 ± 0.5 mm diameter bead of sealant to the area on the oil pump case.

   Specified sealant:
   Three bond 1217G or equivalent

5. After checking that the o-ring is installed at three places, install the oil pump case to the cylinder block.
6. Tighten the oil pump case to the specified torque.

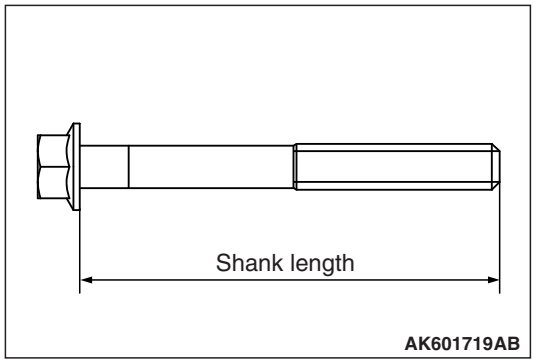
   Tightening torque: 23 ± 6 N·m

>>B<< CRANKSHAFT OIL SEAL INSTALLATION



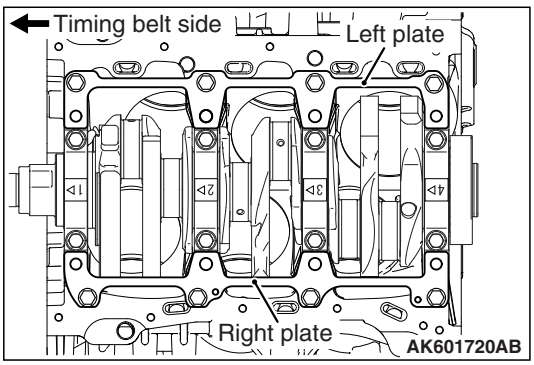
Using special tool Crankshaft front oil seal installer (MD998382), press-fit the oil seal into the oil pump case.

>>C<< BEAM / BEARING CAP BOLT INSTALLATION



1. Before installing the bearing cap bolt, check the bolt screw head is not damaged. If the screw head extremely gets damaged, replace it with a new bolt. The standard length of the new bolt measured from under the head is as follows:

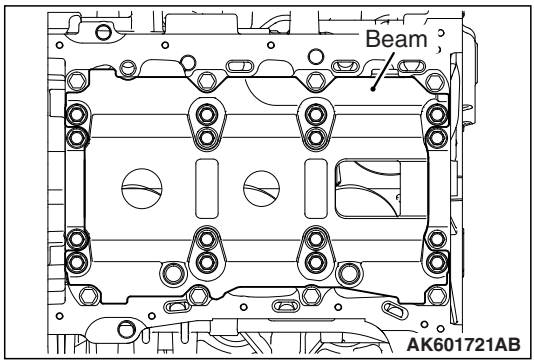
   Standard value: 100.7 – 101.7 mm



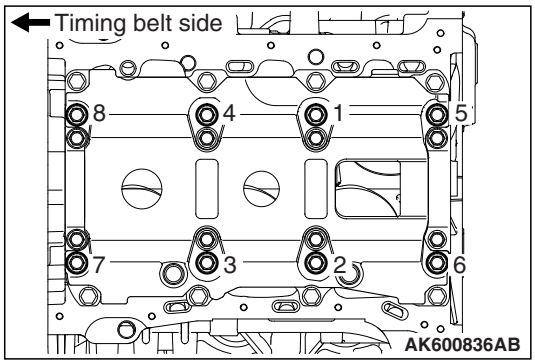
⚠ CAUTION

When the beam is removed and installed, never loosen the tightening bolts of the crankshaft bearing cap.

2. Put the right and left plates on the crankshaft bearing, Temporarily tighten bolt.



3. Put the beam on them, Temporarily tighten bolt.

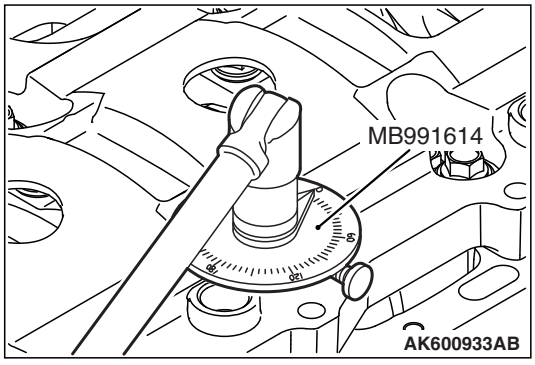


4. Tighten the beam bolts to the specified torque in the tightening sequence shown.

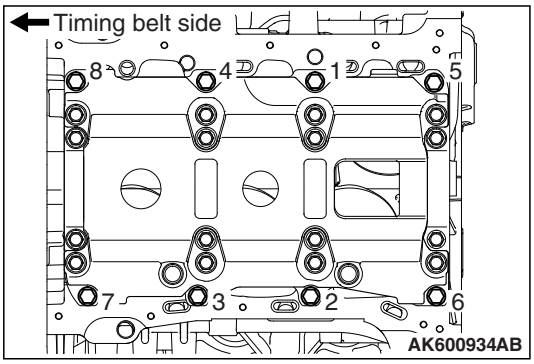
   Tightening torque: 20 ± 2 N·m

⚠ CAUTION

- **When the tightening angle is smaller than the specified tightening angle, the appropriate tightening capacity cannot be secured.**
- **When the tightening angle is larger than the specified tightening angle, remove the bolt to start from the beginning again according to the procedure.**



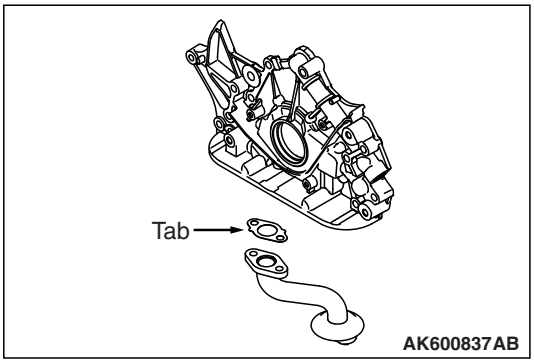
5. Using the special tool Angle gauge (MB991614), tighten the beam bolt (M9) 90° in accordance with the tightening order.



6. Tighten the plate bolts to the specified torque in the tightening sequence shown.

Tightening torque: 23 ± 6 N·m

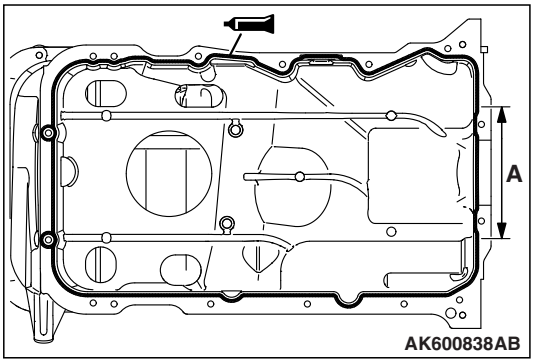
>>D<< OIL SCREEN GASKET INSTALLATION



Install the oil screen gasket so that the tab is positioned as shown in the illustration.

>>E<< OIL PAN UPPER INSTALLATION

1. Completely remove liquid gasket adhering to the cylinder block and oil pan upper.
2. Using white gasoline and so on, degrease the cylinder block and oil pan upper.

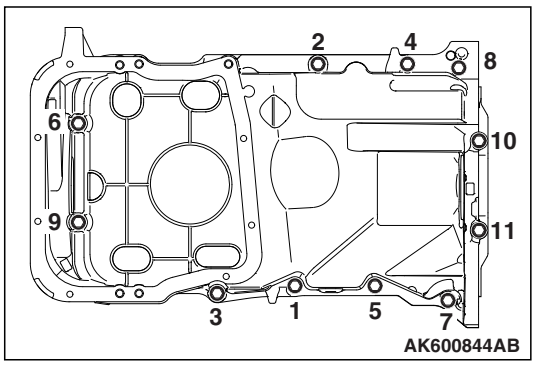


3. Apply a 2.5 ± 0.5 mm diameter bead of sealant to the oil pan. Be sure to install the oil pan quickly while the sealant is wet.

Specified sealant:
Three bond 1217G or equivalent

NOTE: Install the oil pan within 15 minutes after applying liquid gasket.

NOTE: Then wait at least one hour. Never start the engine or let engine oil or coolant touch the adhesion surface during that time.



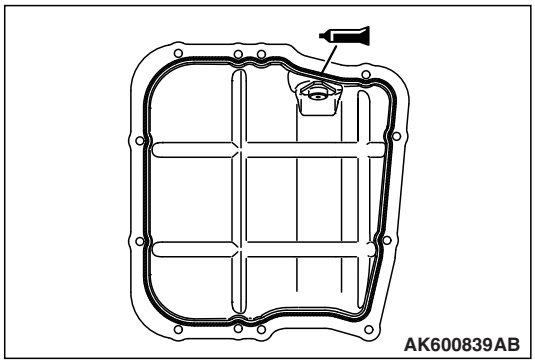
4. Tighten the upper oil pan bolts in the sequence shown.

Tightening torque: 10 ± 2 N·m

5. After installation, keep the sealed area away from the oil and coolant for approximately one hour.

>>F<< OIL PAN LOWER INSTALLATION

1. Completely remove liquid gasket adhering to the oil pan upper and oil pan lower.
2. Using white gasoline and so on, degrease the oil pan upper and oil pan lower.



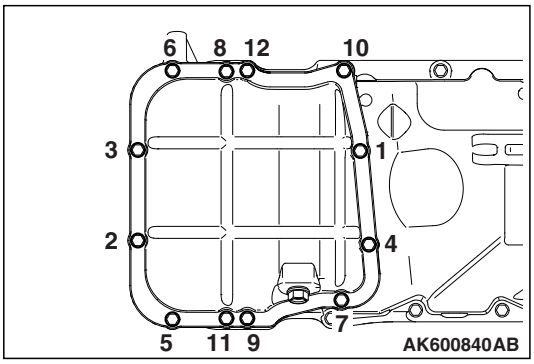
⚠ CAUTION
When installing the upper oil pan, be sure not to expel the sealant from the oil pan flange at portion A in the illustration.

3. Apply a 2.5 ± 0.5 mm diameter bead of sealant to the oil pan. Be sure to install the oil pan quickly while the sealant is wet.

Specified sealant:
Three bond 1217G or equivalent

NOTE: Install the oil pan within 15 minutes after applying liquid gasket.

NOTE: Then wait at least one hour. Never start the engine or let engine oil or coolant touch the adhesion surface during that time.



4. Tighten the upper oil pan bolts in the sequence shown.

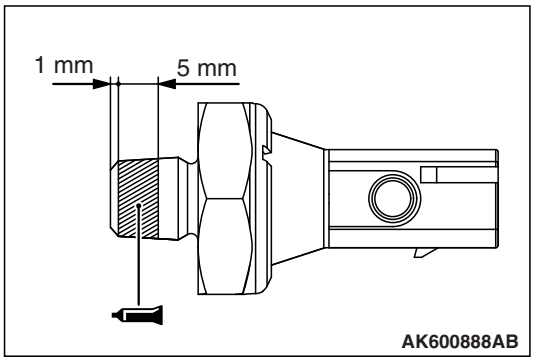
   Tightening torque: 10 ± 2 N·m

5. After installation, keep the sealed area away from the oil and coolant for approximately one hour.

>>G<< OIL PRESSURE SWITCH INSTALLATION

⚠ CAUTION

- **Use care not to allow the sealant to plug the oil passage.**
- **The threaded part tip of the switch must be clear of the sealant.**



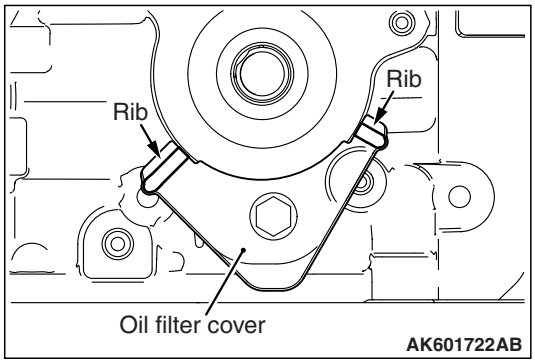
1. Completely remove existing sealant from the oil pressure switch and the switch mounting hole on the oil pump case.
2. Apply sealant to the threaded part of the oil pressure switch as shown.

   Specified sealant:
   Three bond 1212D, Three bond 1215, Three bond 1194 or equivalent

3. Install the oil pressure switch to the oil pump case by tightening to a specified torque.

   Tightening torque: 10 ± 2 N·m

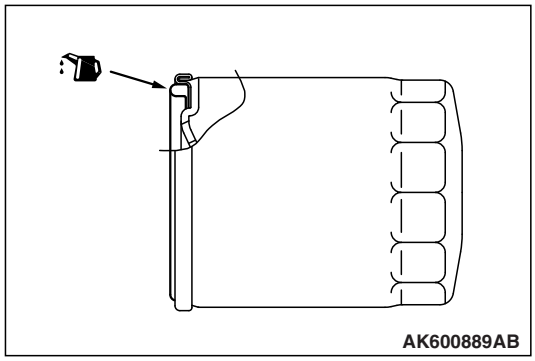
>>H<< OIL FILTER COVER INSTALLATION



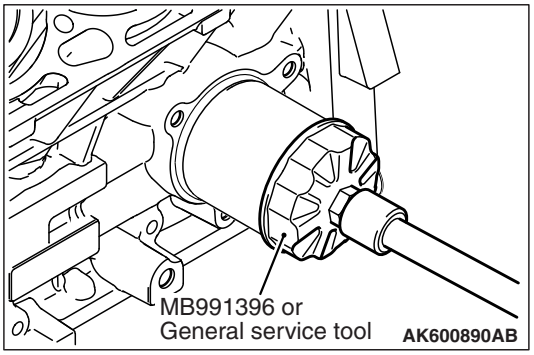
⚠ CAUTION

Do not damage the sealed area.
Check the right and left ribs of the oil filter cover touch the outer circumference of the oil filter boss.

>>I<< OIL FILTER INSTALLATION



1. Clean the filter mounting surface on the front case.
2. Apply engine oil to the O-ring of the oil filter.



⚠ CAUTION

If the filter is tightened by hand only, it will be insufficiently torqued, resulting in oil leaks.

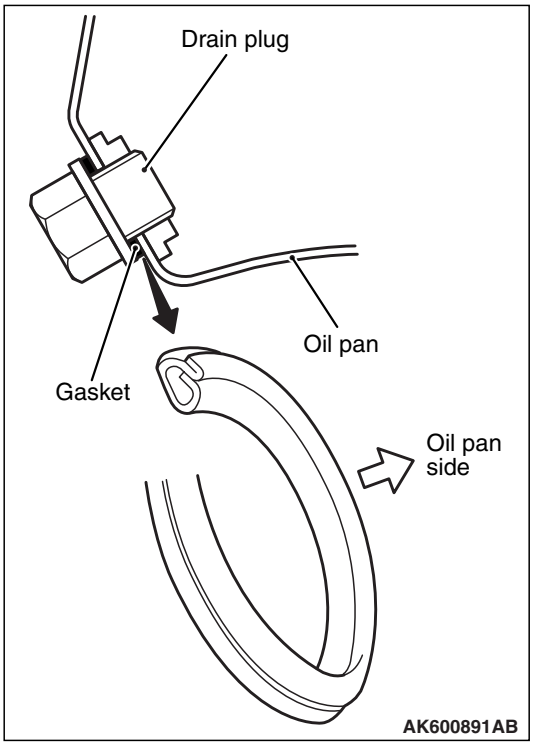
3. Screw the oil filter in and tighten the oil filter to the specified torque using a commercially available special tool oil filter wrench (MB991396) or general tool from where the O-ring has come into contact with the oil filter mounting surface.

   Tightening torque:
   MD332687, MD365876 16 ± 4 N·m <approx. 1 turn>
   MD360935 14 ± 2 N·m <approx. 3/4 of a turn>

>>J<< DRAIN PLUG GASKET INSTALLATION

⚠ CAUTION

If the gasket is installed in the wrong direction, oil leaks will occur.

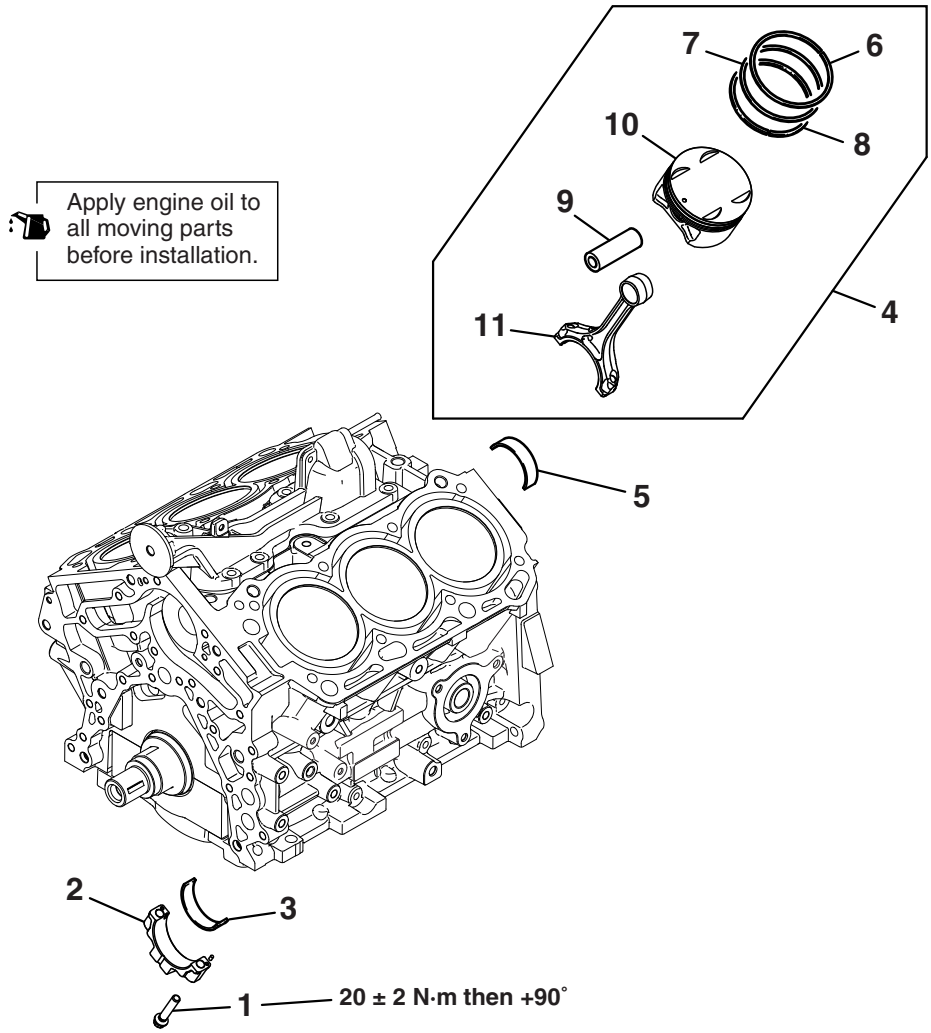


Install the drain plug gasket as illustrated.

PISTON AND CONNECTING ROD

REMOVAL AND INSTALLATION

M1113008404155



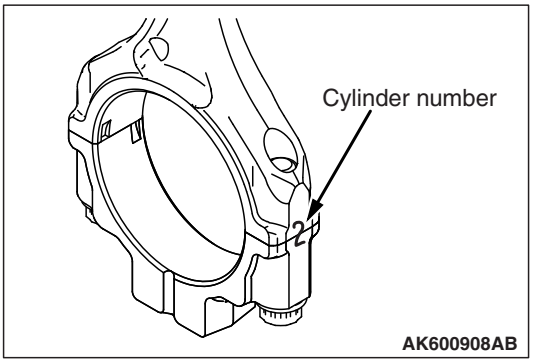
AK600801AF

Removal steps

	>>G<<	1. Connecting rod bolt
<<A>>	>>F<<	2. Connecting rod cap
	>>D<<	3. Connecting rod bearing, lower
	>>E<<	4. Piston and connecting rod assembly
	>>D<<	5. Connecting rod bearing, upper
	>>C<<	6. Piston ring no.1
	>>C<<	7. Piston ring no.2
	>>B<<	8. Oil ring
<<B>>	>>A<<	9. Piston pin
		10. Piston
		11. Connecting rod

REMOVAL SERVICE POINTS

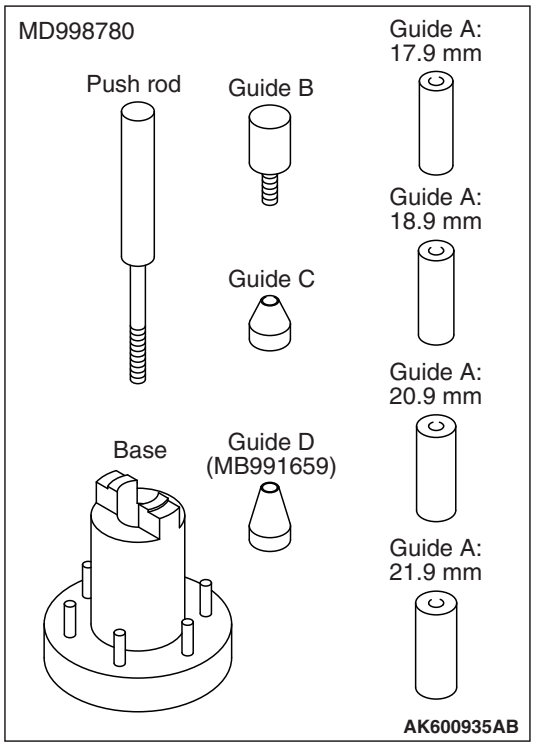
<<A>> CONNECTING ROD CAP REMOVAL



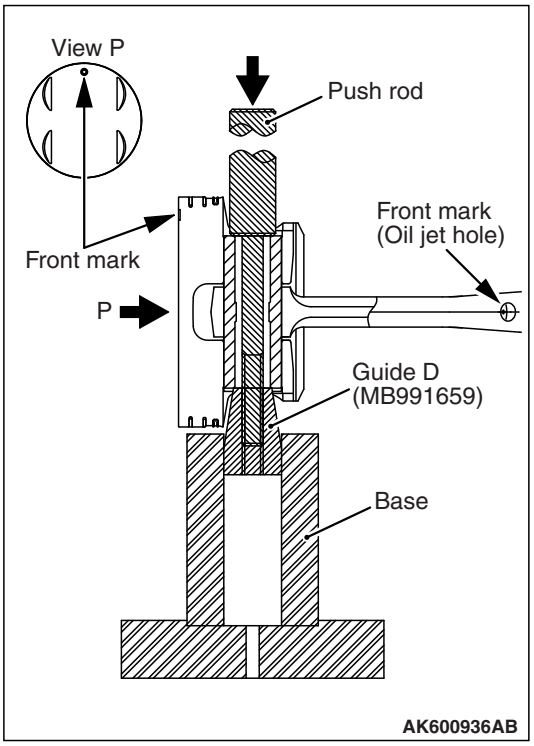
1. Mark the cylinder number on the side of the connecting rod big end for correct reassembly.

2. Keep the removed connecting rods, caps, and bearings in order according to the cylinder number.

<<B>> PISTON PIN REMOVAL



1. The special tool Piston pin setting tool (MD998780) consists of the elements shown in the illustration.
2. When removing the piston pin, the special tool Guide D (MB991659) is also used.

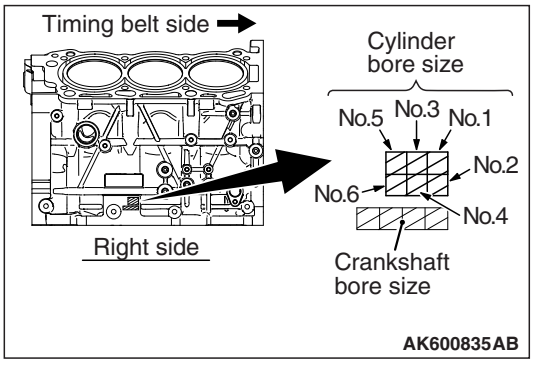


3. Insert Push rod, into the piston from the front mark side, then attach Guide D, to the push rod.
4. Place the piston and connecting rod assembly on Base, with the front mark facing up.
5. Use a press to remove the piston pin.

   NOTE: Keep the disassembled pistons, piston pins and connecting rods per cylinder.

INSTALLATION SERVICE POINTS

>>A<< PISTON PIN INSTALLATION

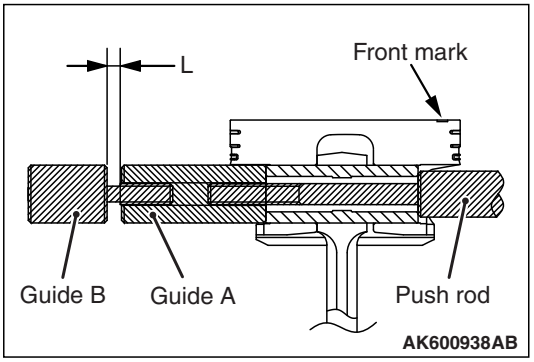


1. When replacing the piston, note the cylinder bore size mark on the cylinder block as illustrated, and select a piston according to the flowing table.

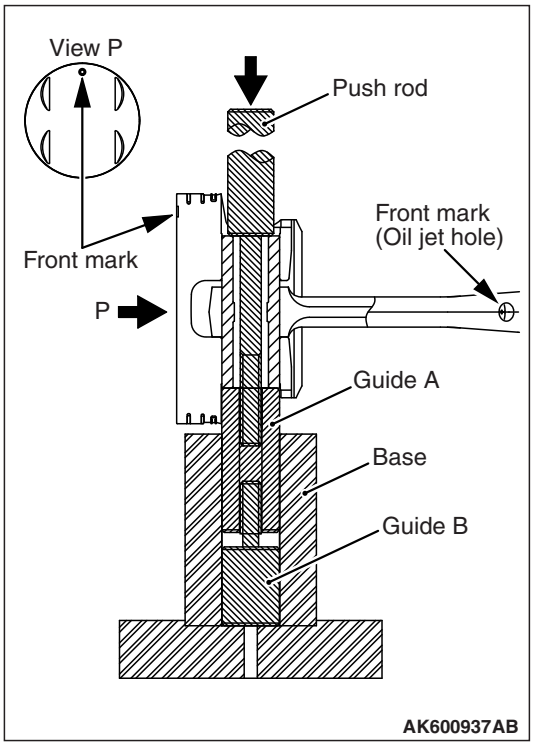
Cylinder bore size mark	Piston size mark
A	A
B	B

NOTE: The piston size mark shows on the top of the piston.

2. Insert the push rod into the piston pin and install the guide A.
3. Align the front mark of the piston with that of the connecting rod. Align the piston with the connecting rod.
4. Apply engine oil to the outer circumference of the piston pin.
5. Insert the piston pin guide A installed at step 2 into the pin hole from the front mark of the piston.

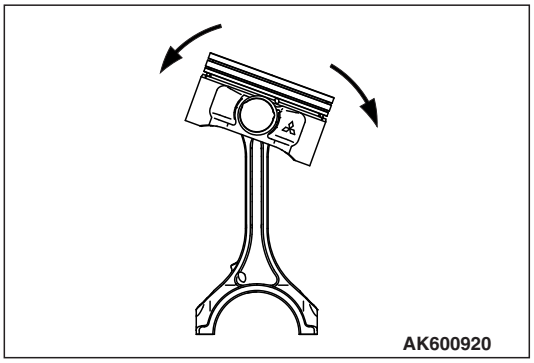


6. Screw the guide B into A until the clearance "L" reaches 3.75 mm between A and B.



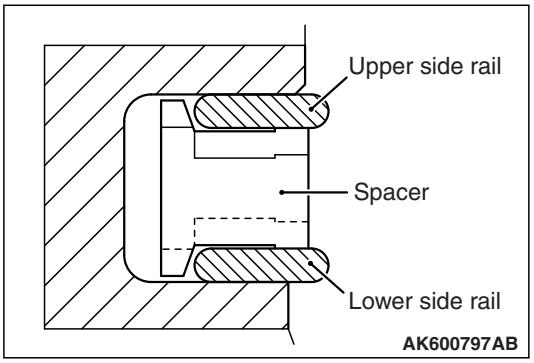
7. Place the piston and connecting rod assembly onto Base, with the front marks facing up.
8. Install the piston pin using a press. If the required press force is less than the standard value, replace the piston and piston pin assembly or the connecting rod, or both.

   Standard value: 5,000 – 15,000 N



9. Check that the piston moves smoothly.

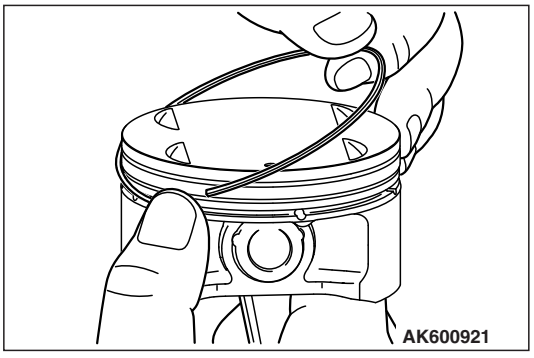
>>B<< OIL RING INSTALLATION



1. Fit the oil ring spacer into the piston ring groove.

   NOTE: The side rails and spacer may be installed in either direction.

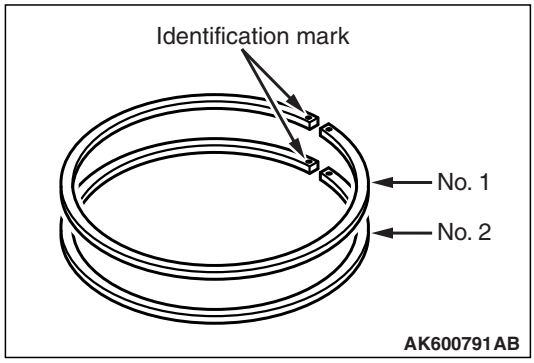
⚠ CAUTION
Do not use any piston ring expander when installing the side rail. If will break the side rail.



2. Install the upper side rail.

   To install the side rail, first fit one end of the rail into the piston groove, then press the remaining portion into the position by finger. See illustration.
3. Install the lower side rail in the same procedure as described in step 2.
4. Make sure that the side rails move smoothly in both directions.

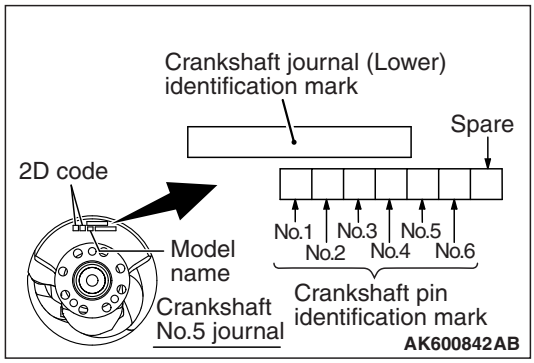
>>C<< PISTON RING NO.2 / PISTON RING NO.1 INSTALLATION



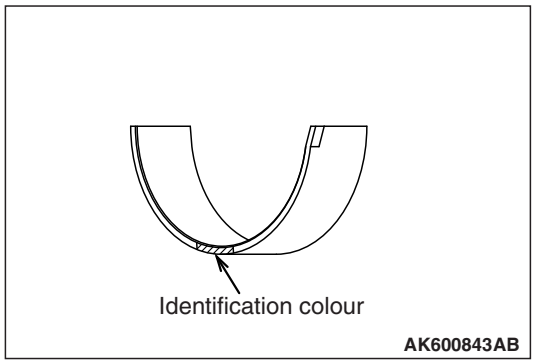
To prevent wrong installation, check the identification mark of each piston ring. The identification mark is stamped near the ring gap:

Identification mark
Number 1 ring: T1
Number 2 ring: 2T

>>D<< CONNECTING ROD BEARING INSTALLATION



1. If the connecting rod bearing is replaced, select based on the identification mark of crankshaft (illustrated) and the table shown below.

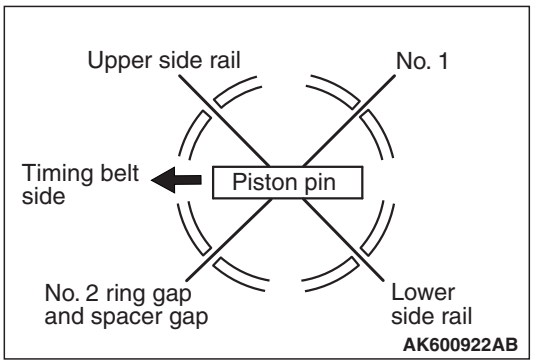


2. Every connecting rod bearing is identified by the paint mark at the illustrated location.

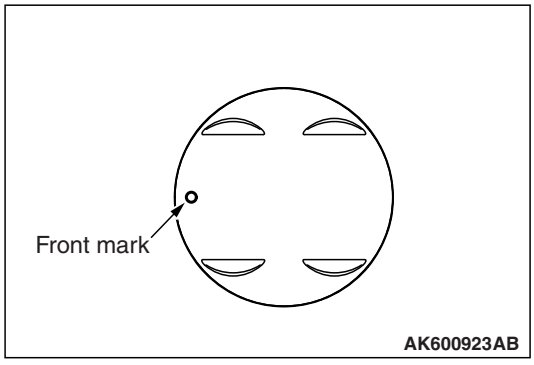
Crankshaft pin identification mark	Bearing identification colour
1	Black
2	Purple
3	Green

3. Install the selected bearing in the big end and in the cap of the connecting rod.

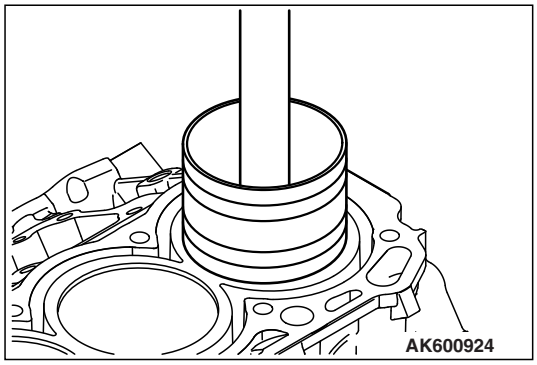
>>E<< PISTON AND CONNECTING ROD INSTALLATION



1. Liberally coat the circumference of the piston, piston ring, and oil ring with engine oil.
2. Arrange the piston ring and oil ring gaps (side rail and spacer) as shown in the illustration.
3. Rotate the crankshaft so that the crank pin is on the centre of the cylinder bore.

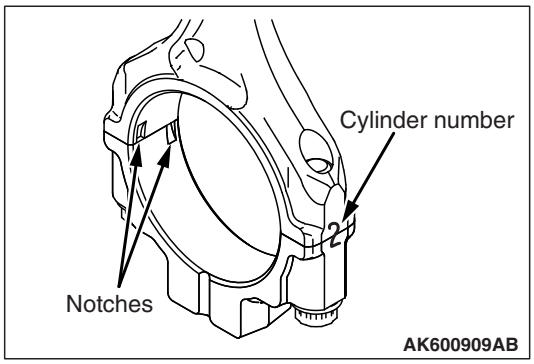


4. Insert the piston and connecting rod assembly into the cylinder with the front mark on the piston crown pointing to the timing belt side.

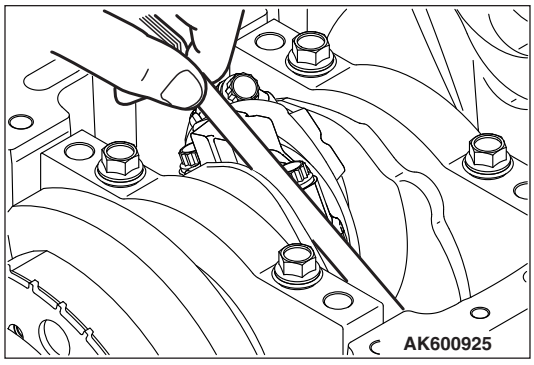


5. Using a suitable piston ring compressor tool, install the piston and connecting rod assembly into the cylinder block.

>>F<< CONNECTING ROD CAP INSTALLATION



1. Verifying the mark made during disassembly, install the bearing cap to the connecting rod. If the connecting rod is new with no index mark, make sure that the bearing locking notches are on the same side as shown.

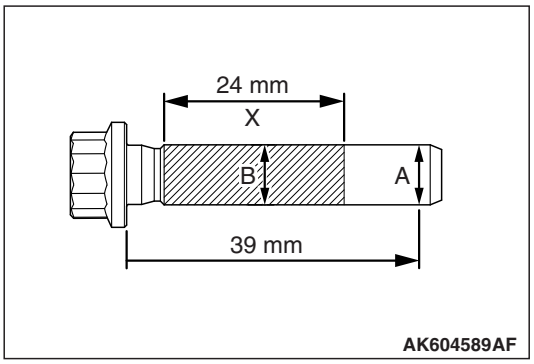


2. Make sure that the connecting rod big end side clearance meets the specification.

Standard value: 0.10 – 0.25 mm
Limit: 0.4 mm

>>G<< CONNECTING ROD CAP BOLT INSTALLATION

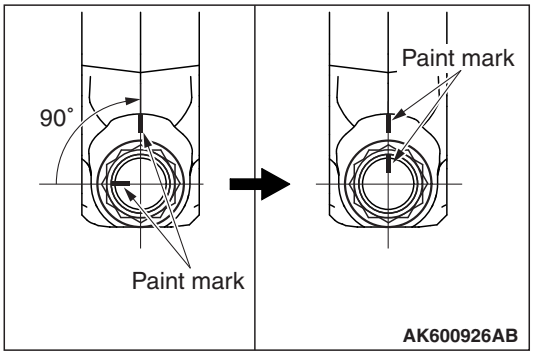
1. Check in the following procedure before reusing the connecting rod bolt.



(1) Measure the outside diameter "A."
(2) Measure the smallest outside diameter "B" within the range "X" shown in the illustration.
(3) If the difference of outside diameter of thread exceeds the limit, replace the connecting rod bolt.

Limit: 0.1 mm

2. Apply engine oil to the threaded portion and seating face of the bolt.
3. To correctly install the cap, loosely install the bolts with fingers.
4. Alternately, tighten the bolts in several steps to the specified torque of 20 ± 2 N·m.



5. Make a paint mark on the head of each bolt.

⚠ CAUTION

- **When the tightening angle is smaller than the specified tightening angle, the appropriate tightening capacity cannot be secured.**
- **When the tightening angle is larger than the specified tightening angle, remove the bolt to start from the beginning again according to the procedure.**

6. Put another paint mark on the bolt head at 90° in the tightening direction from the first paint mark.

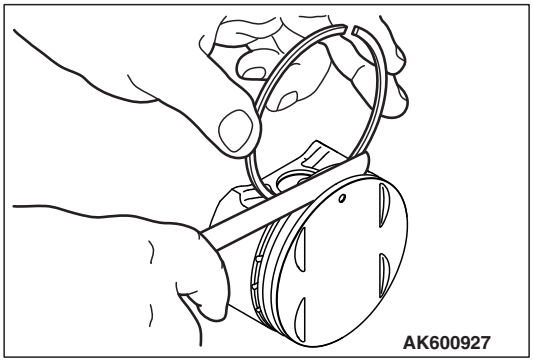
7. Tighten the bolt 90°. The paint mark on the connecting rod should be aligned with the paint mark on the bolt.

INSPECTION

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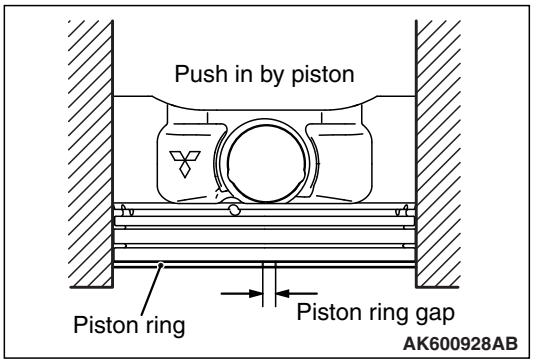
PISTON RING

1. Check the piston ring for damage, excessive wear, and breakage. Replace if defects are evident. If the piston has been replaced with a new one, the piston rings must also be replaced with new ones.



2. Check for clearance between the piston ring and ring groove. If the limit is exceeded, replace the ring or piston, or both.

Standard value:
Number 1: 0.04 – 0.08 mm
Number 2: 0.03 – 0.07 mm
Limit: 0.1 mm



3. Insert the piston ring into the cylinder bore. Force the ring down with a piston, the piston crown being in contact with the ring, to correctly position it at right angles to the cylinder wall. Then, measure the end gap with a feeler gauge.

If the ring gap is excessive, replace the piston ring.

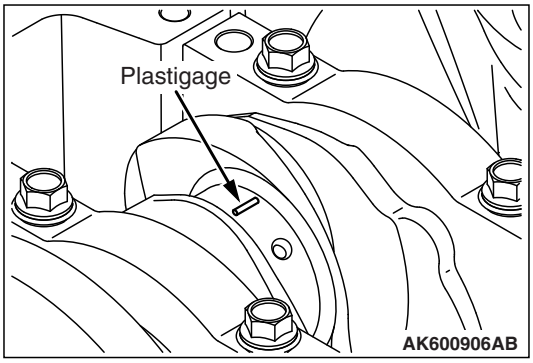
Standard value:
Number 1: 0.18 – 0.33 mm
Number 2: 0.28 – 0.48 mm
Oil: 0.10 – 0.60 mm

Limit:
Number 1, Number 2: 0.8 mm
Oil: 1.0 mm

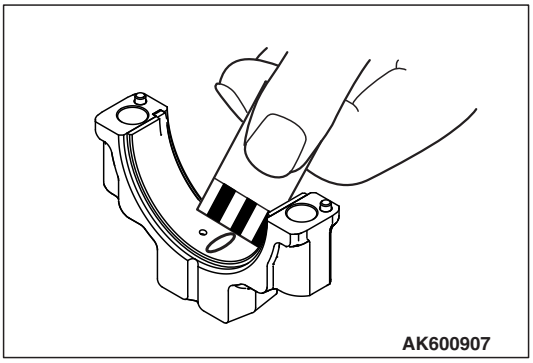
CRANKSHAFT PIN OIL CLEARANCE <PLASTIGAGE METHOD>

The crankshaft oil clearance can be measured easily by using plastigage method, as follows:

1. Remove oil from the crankshaft pin and the bearing inner surface.



2. Cut plastigage to the same length as the width of the bearing and place it on the pin in parallel with its axis.
3. Install the connecting rod cap carefully and tighten the nuts to the specified torque.
4. Carefully remove the connecting rod cap.



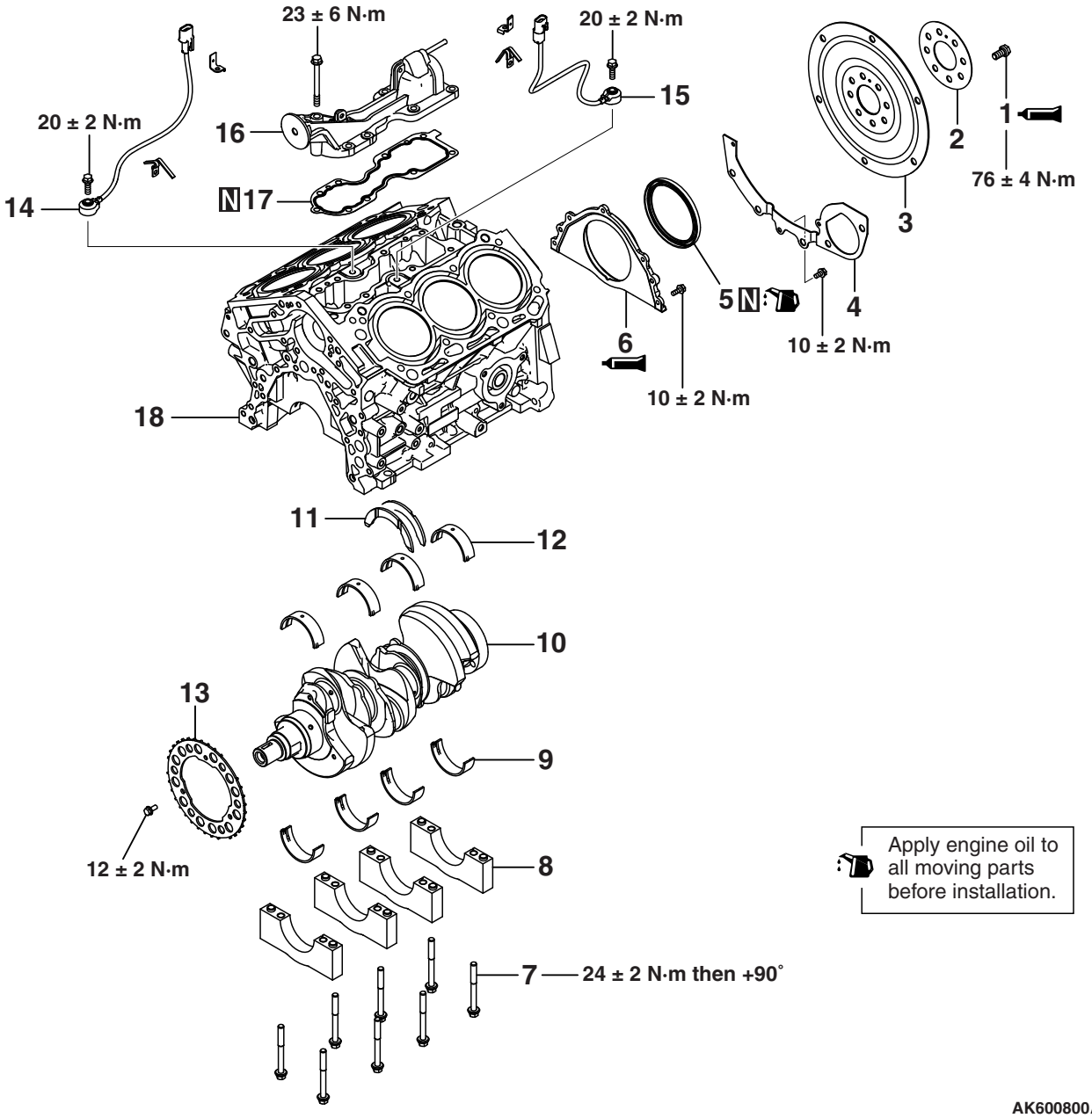
5. Measure the width of the smashed plastigage at its widest section by using a scale printed on the plastigage bag.

Standard value: 0.012 – 0.039 mm
Limit: 0.1 mm

CRANKSHAFT AND CYLINDER BLOCK

REMOVAL AND INSTALLATION

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Removal steps

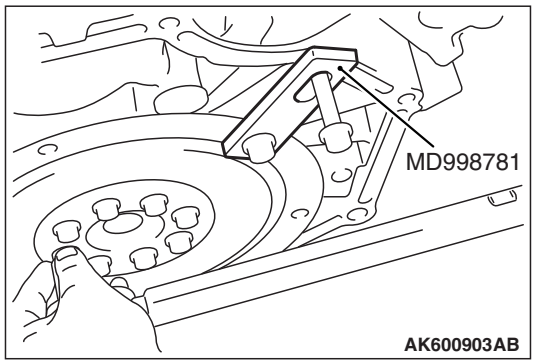
<<A>> >>H<< 1. Drive plate bolt
2. Adapter plate
3. Drive plate
4. Rear plate
>>G<< 5. Crankshaft rear oil seal
>>F<< 6. Oil seal case
>>E<< 7. Bearing cap bolt
<<B>> >>E<< 8. Bearing cap
>>D<< 9. Crankshaft bearing, lower

Removal steps (Continued)

10. Crankshaft
>>C<< 11. Thrust bearing
>>B<< 12. Crankshaft bearing, upper
>>A<< 13. Crankshaft sensing ring
14. Detonation sensor
15. Detonation sensor
16. Bank stiffener
17. Bank stiffener gasket
18. Cylinder block

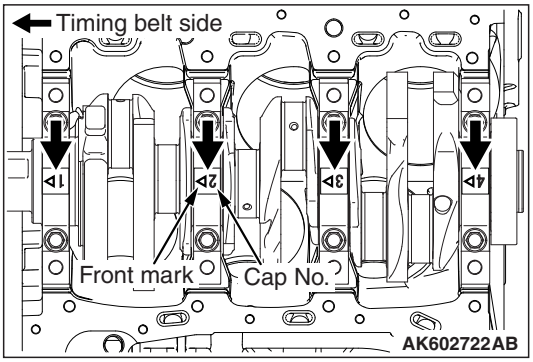
REMOVAL SERVICE POINT

<<A>> DRIVE PLATE BOLT REMOVAL



1. Using special tool Flywheel stopper (MD998781), hold the drive plate.
2. Remove the drive plate bolt.

<<B>> BEARING CAP REMOVAL

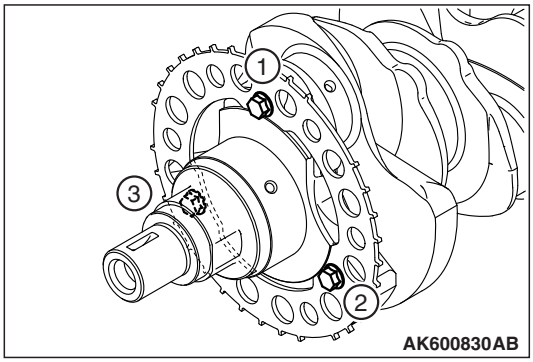


Using indelible ink, show the front mark and the cap No. on the bearing cap if they cannot be seen.

INSTALLATION SERVICE POINTS

>>A<< CRANKSHAFT SENSING RING INSTALLATION

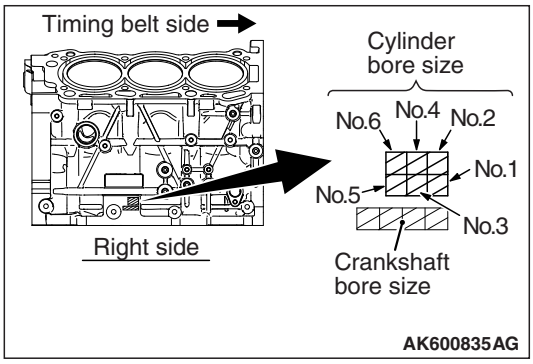
1. Apply the engine oil to the thread portions and the sealed portions on the installation bolts.



2. In accordance with the tightening order shown in the illustration, tighten the crankshaft sensing ring to the specified torque.

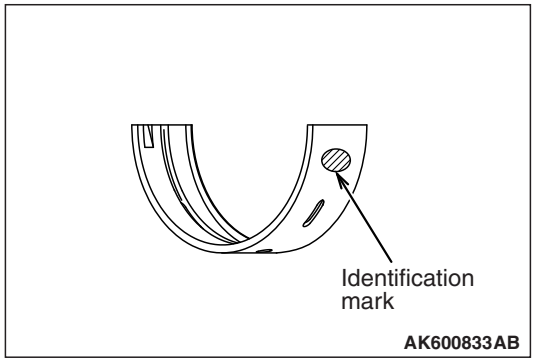
Tightening torque: 12 ± 2 N·m

>>B<< CRANKSHAFT BEARING UPPER INSTALLATION



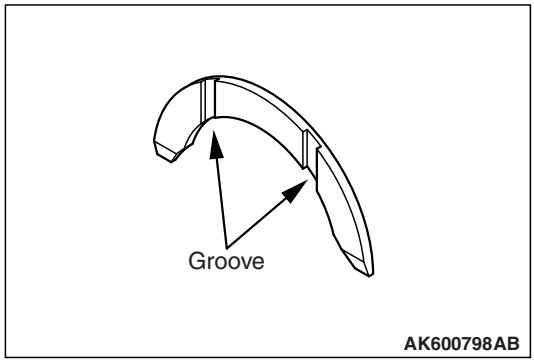
1. If the upper crankshaft bearing is replaced, select based on the identification mark of cylinder block (illustrated) and the table shown below.

Crankshaft journal (Upper)	**Crankshaft bearing**
Identification mark	**Identification mark**
Number 1 and 4 journal	
1	1
2	2
3	3
Number 2 and 3 journal	
0	0
1	1
2	2



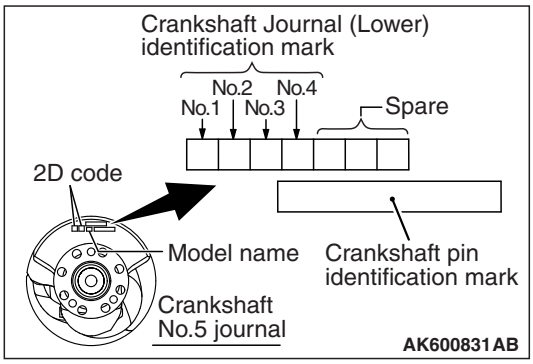
2. The upper crankshaft bearing has the identification mark on the location shown in the illustration.
3. Install the upper selected crankshaft bearing.

>>C<< CRANKSHAFT THRUST BEARING INSTALLATION



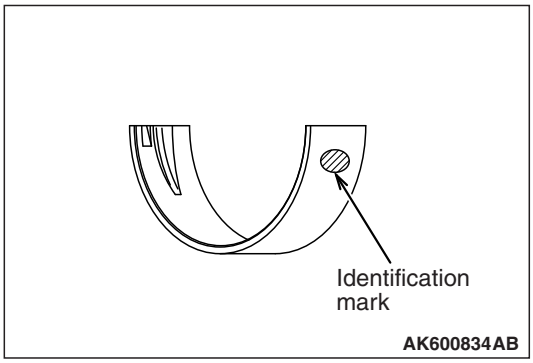
1. Install the thrust bearing in the No.3 bearing bore in the cylinder block and in the bearing cap. For easier installation, apply engine oil to the bearings; this will help hold them in position.
2. The thrust bearings must be installed with their groove toward the crankshaft web.

>>D<< CRANKSHAFT BEARING LOWER INSTALLATION



1. If the lower crankshaft bearing is replaced, select based on the identification mark of crankshaft (illustrated) and the table shown below.

Crankshaft journal (Lower)	Crankshaft bearing
Identification mark	**Identification mark**
0	0
1	1
2	2
3	3
4	4

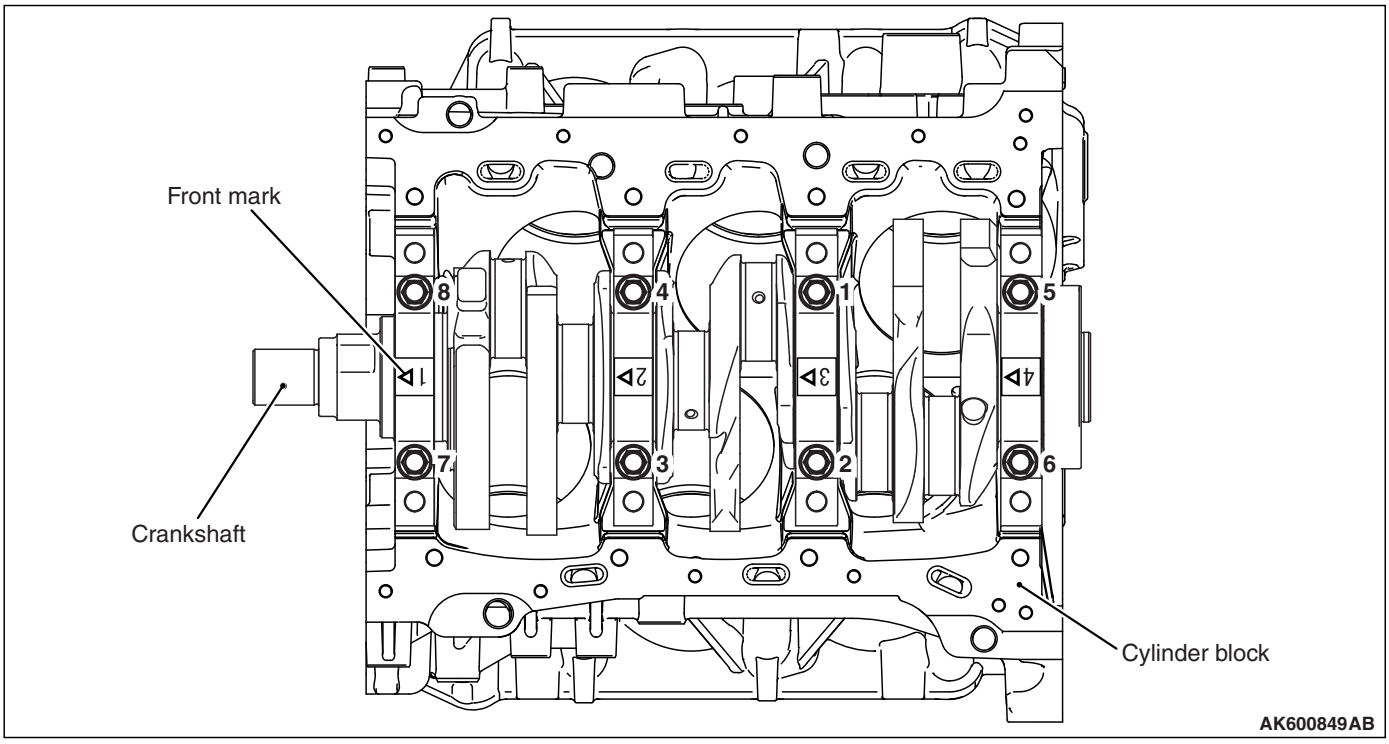


2. The lower crankshaft bearing has the identification mark on the location shown in the illustration.
3. Install the lower selected crankshaft bearing.

>>E<< BEARING CAP / BEARING CAP BOLT INSTALLATION

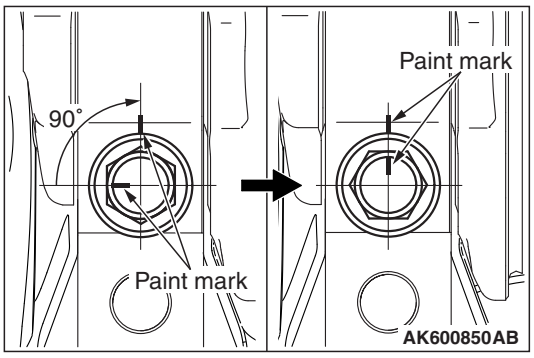
1. Before installing the bearing cap bolt, check the bolt screw head is not damaged. If the screw head extremely gets damaged, replace it with a new bolt. The standard length of the new bolt measured from under the head is as follows:

Standard value: 91.2 – 92.2 mm



2. Attach the bearing cap on the cylinder block as shown in the illustration.
3. Tighten the bearing cap bolts to specified torque in the sequence shown in the illustration.

   Tightening torque: 24 ± 2 N·m

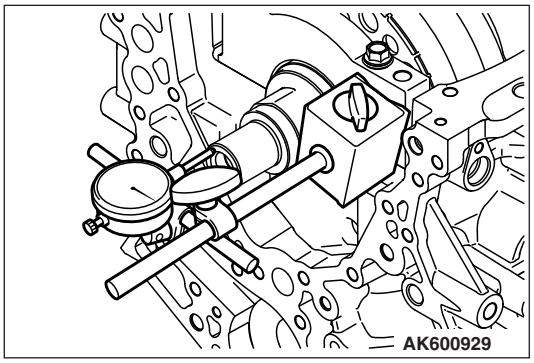


4. Make a paint mark on the head of each bolt.

⚠ CAUTION

- **When the tightening angle is smaller than the specified tightening angle, the appropriate tightening capacity cannot be secured.**
- **When the tightening angle is larger than the specified tightening angle, remove the bolt to start from the beginning again according to the procedure.**

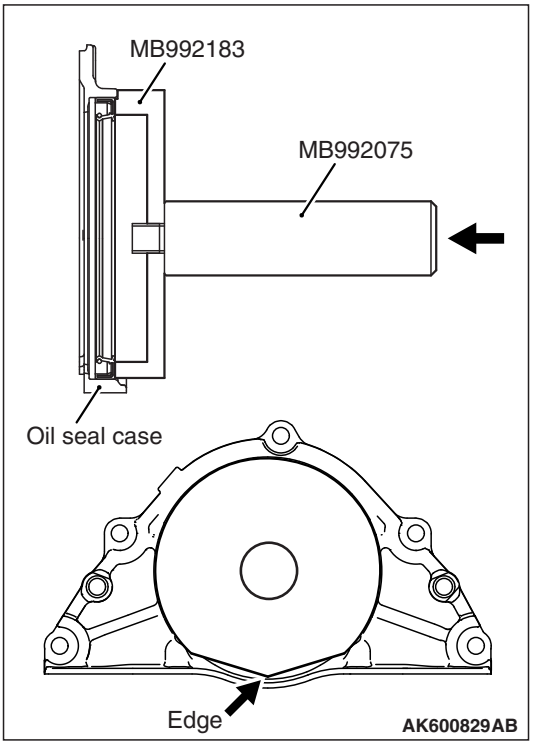
5. Make a paint mark on the bearing cap 90° from the paint mark made on the bolt, in the direction of tightening the bolt.
6. Turn each bolt 90° in the tightening sequence specified in step 2, and make sure that the paint marks on the bolt and cap are aligned.
7. Check that the crankshaft rotates smoothly.



8. Check the axial play. If it exceeds the limit value, replace the thrust bearing.

   Standard value: 0.05 – 0.25 mm
   Limit: 0.3 mm

>>F<< CRANKSHAFT REAR OIL SEAL INSTALLATION

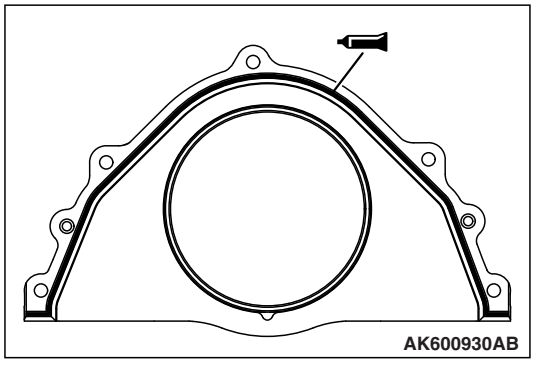


Using special tools Handle (MB992075) and Crankshaft rear oil seal installer (MB992183), press-fit a new crankshaft rear oil seal into the oil seal case.

NOTE: Put the edge position in place as shown in the illustration.

>>G<< OIL SEAL CASE INSTALLATION

1. Completely remove liquid gasket adhering to the oil seal case and cylinder block.
2. Degrease the oil seal case and cylinder block.



3. Apply a 2.5 ± 0.5 mm diameter bead of sealant to the oil seal case.

   Specified sealant:
   Three bond 1217G or equivalent

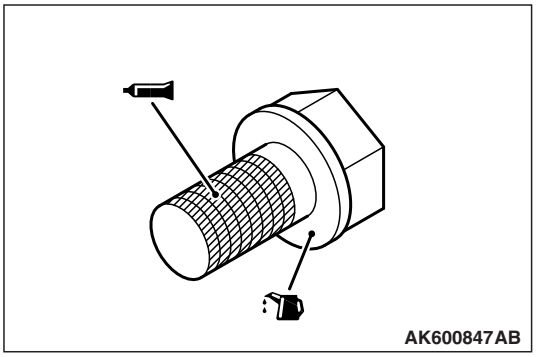
4. Apply a small amount of engine oil to the entire circumference of the oil seal lip section, and place the oil seal case on the cylinder block.

   NOTE: Install the oil seal case within 15 minutes after applying liquid gasket.

   NOTE: Then wait at least one hour. Never start the engine or let engine oil or coolant touch the adhesion surface during that time.

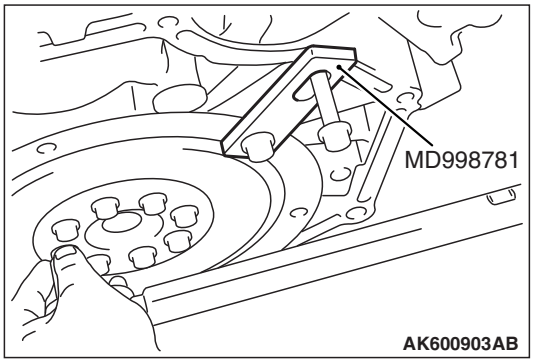
>>H<< DRIVE PLATE BOLT INSTALLATION

1. Cleanly remove sealant, oil and dust on the drive plate bolt, the drive plate and the threaded portions of the crankshaft.



2. Apply oil to the drive plate and the seating surface of the drive plate bolt.
3. Apply oil to the threaded hole of the crankshaft
4. Apply sealant to the thread portions of the drive plate bolt.

   Specified sealant:
   Three bond 1324 or equivalent



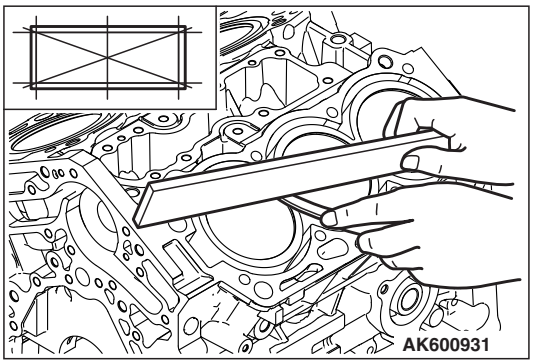
5. Using special tool Flywheel stopper (MD998781), hold the drive plate.
6. Tighten the drive plate bolt to the specified torque.

   Tightening torque: 76 ± 4 N·m

INSPECTION

M1113008801961

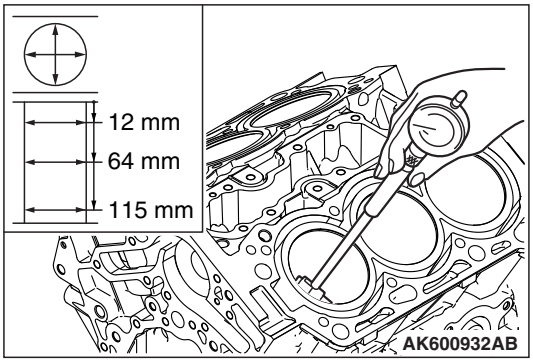
CYLINDER BLOCK



1. Using a straightedge and free gauge, check the block top surface for warpage. Make sure that the surface is free from gasket chips and other objects.

   Standard value: 0.05 mm
   Limit: 0.1 mm

2. If the distortion is excessive, replace the cylinder block.



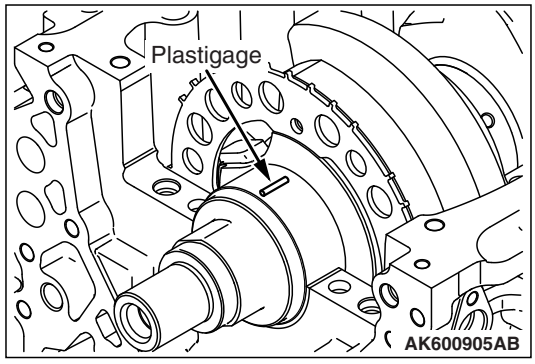
3. Check cylinder walls for scratches and seizure. If defects are evident, correct (bored to oversize) or replace.
4. Using cylinder gauge, measure the cylinder bore, and cylindricity. If worn badly, correct cylinder to an oversize and replace piston and piston rings. Measurement points are shown in illustration.

   Standard value
   Cylinder I.D.: 87.6 mm
   Cylindricity: 0.015 mm

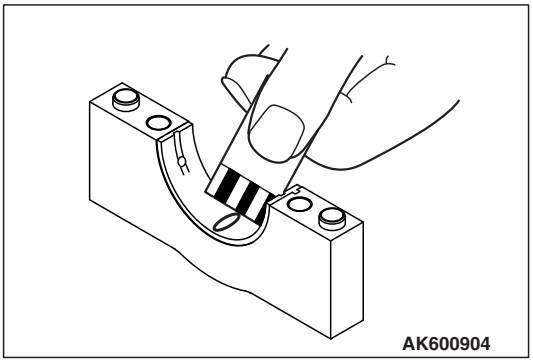
CRANKSHAFT OIL CLEARANCE (PLASTIGAGE METHOD)

The crankshaft oil clearance can be measured easily by using a plastigage, as follows:

1. Remove oil and grease and any other foreign matters from crankshaft journal and bearing inner surface.
2. Install the crankshaft.



3. Cut the plastigage to the same length as the width of bearing and place it on journal in parallel with its axis.



4. Gently place the crankshaft bearing cap over it and tighten the bolts to the specified torque.
5. Remove the bolts and gently remove the crankshaft bearing cap.
6. Measure the width of the smashed plastigage at its widest section by using a scale printed on the plastigage bag.

   Standard value:
   Number 1 and 4 journal
   0.018 – 0.038 mm
   Number 2 and 3 journal
   0.024 – 0.044 mm
   Limit: 0.1 mm

NOTES

GROUP 12

ENGINE LUBRICATION

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OIL FILTER STUD REPLACEMENT 12-3
OIL PRESSURE CHECK 12-3
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GENERAL INFORMATION

M1121000101866

The service procedures below have been added due to the introduction of 6B3 engine.

- Engine oil quantity
- Engine oil check
- Oil filter stud replacement
- Engine oil pressure switch removal and installation

SERVICE SPECIFICATION

M1121000301097

Item		Standard value
Oil pressure kPa	at idle	29 or more
	at 3,500 r/min	294 – 686

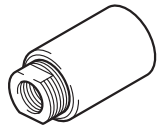
LUBRICANTS

M1121000403067

Item		Specification
Engine oil quantity L	Engine oil filter	0.3
	Total	4.3

SPECIAL TOOLS

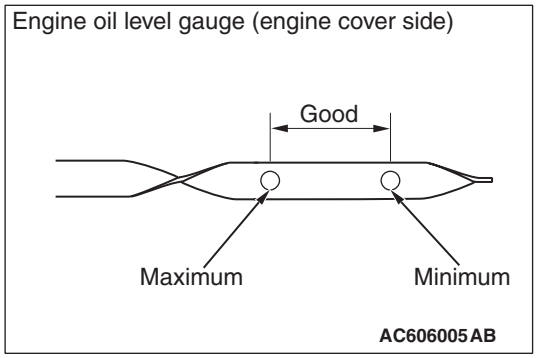
M1121000602529

Tool	Number	Name	Use
 MB992676	MB992676	Oil filter stud setter	Installation of engine oil filter stud

ON-VEHICLE SERVICE

ENGINE OIL CHECK

M1121000901549



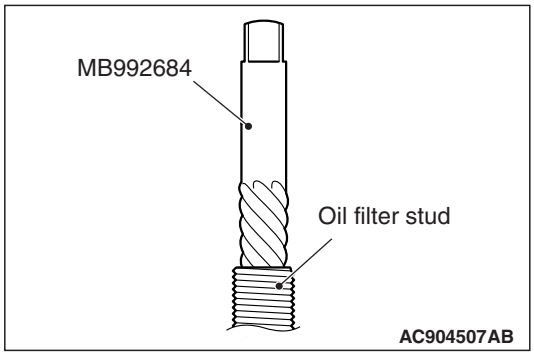
1. Pull out the engine oil level gauge, clean off the engine oil on the engine oil level gauge, and then reinsert the engine oil level gauge.
2. Pull out the engine oil level gauge, and check the engine oil level is within the marks on one side of the engine oil level gauge (engine cover side).

   NOTE:
   - *Checking the oil might be difficult shortly after stopping the engine or engine oil change.*
   - *If difficult, take some time (approx. 30 sec.) and try again.*
   - *Refer to the information label indicating the engine oil check process on the rocker cover.*
3. Check that the engine oil is not excessively dirty, that there is no coolant or gasoline mixed in, and that it is sufficiently thick and slippery.

OIL FILTER STUD REPLACEMENT

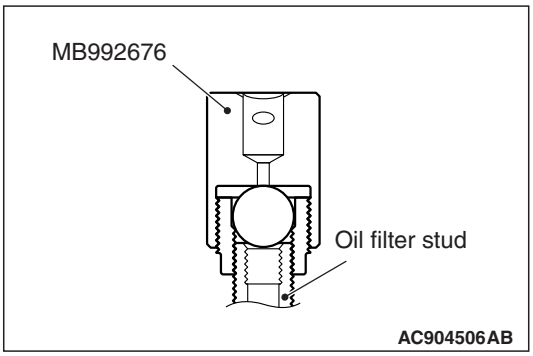
M1121003800128

1. Remove the engine oil filter. (Refer to engine oil filter replacement.)



2. Remove the oil filter stud using the screw extractor (Recommended tool: MB992684), or equivalent.

   NOTE: This recommended tool is a component of the screw extractor set (MB992678).



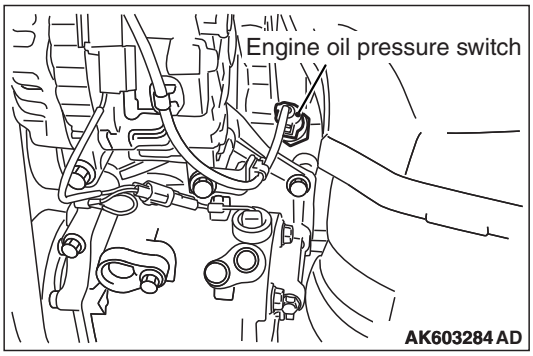
3. Using the oil filter stud setter (Special tool: MB992676), install the new oil filter stud and tighten it to the specified torque.

   Tightening torque: 49 ± 5 N·m
4. Install the engine oil filter. (Refer to engine oil filter replacement .)

OIL PRESSURE CHECK

M1121002302610

1. Check engine oil level.



2. Remove the engine oil pressure switch.

   (Refer to engine oil pressure switch removal and installation P.12-4)
3. Install the oil pressure gauge.

   NOTE: Use an adapter of PT 1/8 thread.
4. Run the engine to warm it.
5. After the engine has been warmed up, check that oil pressure is within the standard value.

   Standard value:
   At idle: 29 kPa or more
   At 3,500 r/min: 294 – 686 kPa
6. Remove the oil pressure gauge.
7. Install the engine oil pressure switch.

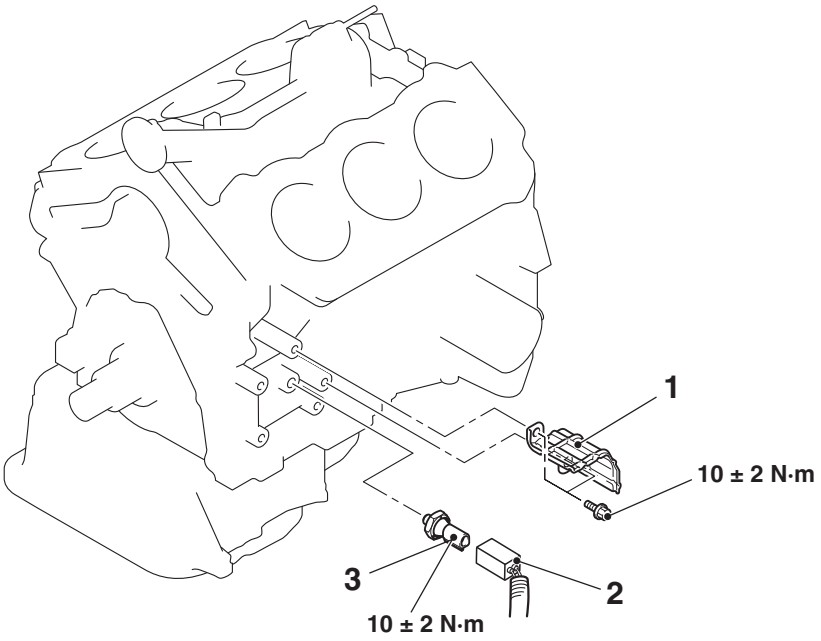
   (Refer to engine oil pressure switch removal and installation P.12-4)

ENGINE OIL PRESSURE SWITCH

REMOVAL AND INSTALLATION

M1121002502205

Pre-removal Operation	Post-installation Operation
• Engine Room Under Cover Front A, B Removal (Refer to GROUP 51 – Under Cover).	• Engine Room Under Cover Front A, B Installation (Refer to GROUP 51 – Under Cover).



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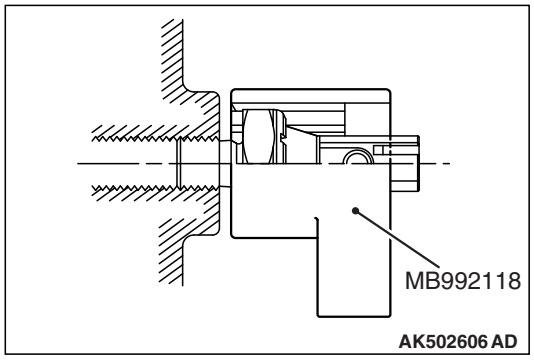
Removal steps

1. Heat protector
2. Engine oil pressure switch connector connection

<<A>> >>A<< 3. Engine oil pressure switch

REMOVAL SERVICE POINT

<<A>> ENGINE OIL PRESSURE SWITCH REMOVAL

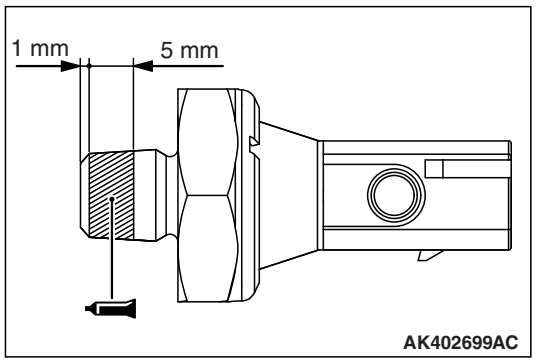


AK502606AD

Use special tool oil pressure switch wrench (MB992118) to remove the engine oil pressure switch.

INSTALLATION SERVICE POINT

>>A<< ENGINE OIL PRESSURE SWITCH INSTALLATION



AK402699AC

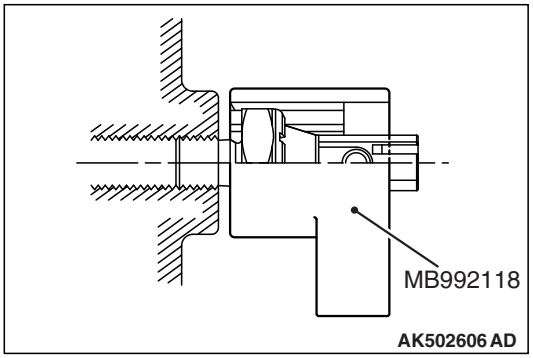
1. Apply sealant to the engine oil pressure switch thread.

   Specified sealant: ThreeBond 1141J or equivalent

   NOTE: Install the engine oil pressure switch immediately after applying sealant.

⚠ CAUTION

After the installation, until a sufficient period of time (one hour or more) elapses, do not apply the oil or water to the sealant application area or start the engine.



2. In the same manner as removal, use special tool oil pressure switch wrench (MB992118) to tighten the engine oil pressure switch to the specified torque.

   Tightening torque: 10 ± 2 N·m

NOTES

GROUP 13

FUEL

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MULTIPOINT FUEL INJECTION (MPI) <6B3>. 13F

NOTES

GROUP 13B

FUEL SUPPLY

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GENERAL INFORMATION

M1131000107058

The service procedure is basically the same as for 4B1-4WD.

GROUP 13F

MULTIPOINT FUEL INJECTION (MPI) <6B3>

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GENERAL INFORMATION

M1131000107047

The Multipoint Fuel Injection System consists of sensors which detect the engine conditions, the engine-ECU which controls the system based on signals from these sensors, and actuators which operate under the control of the engine-ECU. The engine-ECU carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the engine-ECU is equipped with several diagnosis modes which simplify trouble-shooting when a problem develops.

FUEL INJECTION CONTROL

The injector drive times and injection timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions.
A single injector is mounted at the intake port of each cylinder. Fuel is sent under pressure from the fuel tank by the fuel pump, with the pressure being regulated by the fuel pressure regulator. The fuel thus regulated is distributed to each of the injectors.
Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-2-3-4-5-6. This is called sequential fuel injection. The engine-ECU provides a richer air/fuel mixture by carrying out "open-loop" control when the engine is cold or operating under high load conditions in order to maintain engine performance. In addition, when the engine is warm or operating under normal conditions, the engine-ECU controls the air/fuel mixture by using the oxygen sensor signal to carry out "closed-loop" control in order to obtain the theoretical air/fuel mixture ratio that provides the maximum cleaning performance from the three way catalyst.

THROTTLE VALVE OPENING CONTROL

This system electronically controls the opening of the throttle valve. The engine-ECU detects the amount of travel of the accelerator pedal via the accelerator pedal position sensor, and controls the actuation of the throttle valve control servo, which is mounted on the throttle body, in order to attain the target throttle valve opening that has been predetermined in accordance with driving conditions.

IDLE SPEED CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that passes through the throttle valve in accordance with changes in idling conditions and engine load during idling.
The engine-ECU drives the throttle valve control servo to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and A/C and other electrical load. In addition, when the A/C switch is turned off and on while the engine is idling, the throttle valve control servo adjusts the throttle valve passes through air amount according to the engine load conditions to avoid fluctuations in the engine speed.

IGNITION TIMING CONTROL

The power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing in order to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the engine-ECU from the engine speed, intake air volume, engine coolant temperature and atmospheric pressure.

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in one of the sensors or actuators related to emission control, the engine warning lamp (check engine lamp) illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
- The RAM data inside the engine-ECU that is related to the sensors and actuators can be read by means of the M.U.T.-III. In addition, the actuators can be force-driven under certain circumstances.

OTHER CONTROL FUNCTIONS

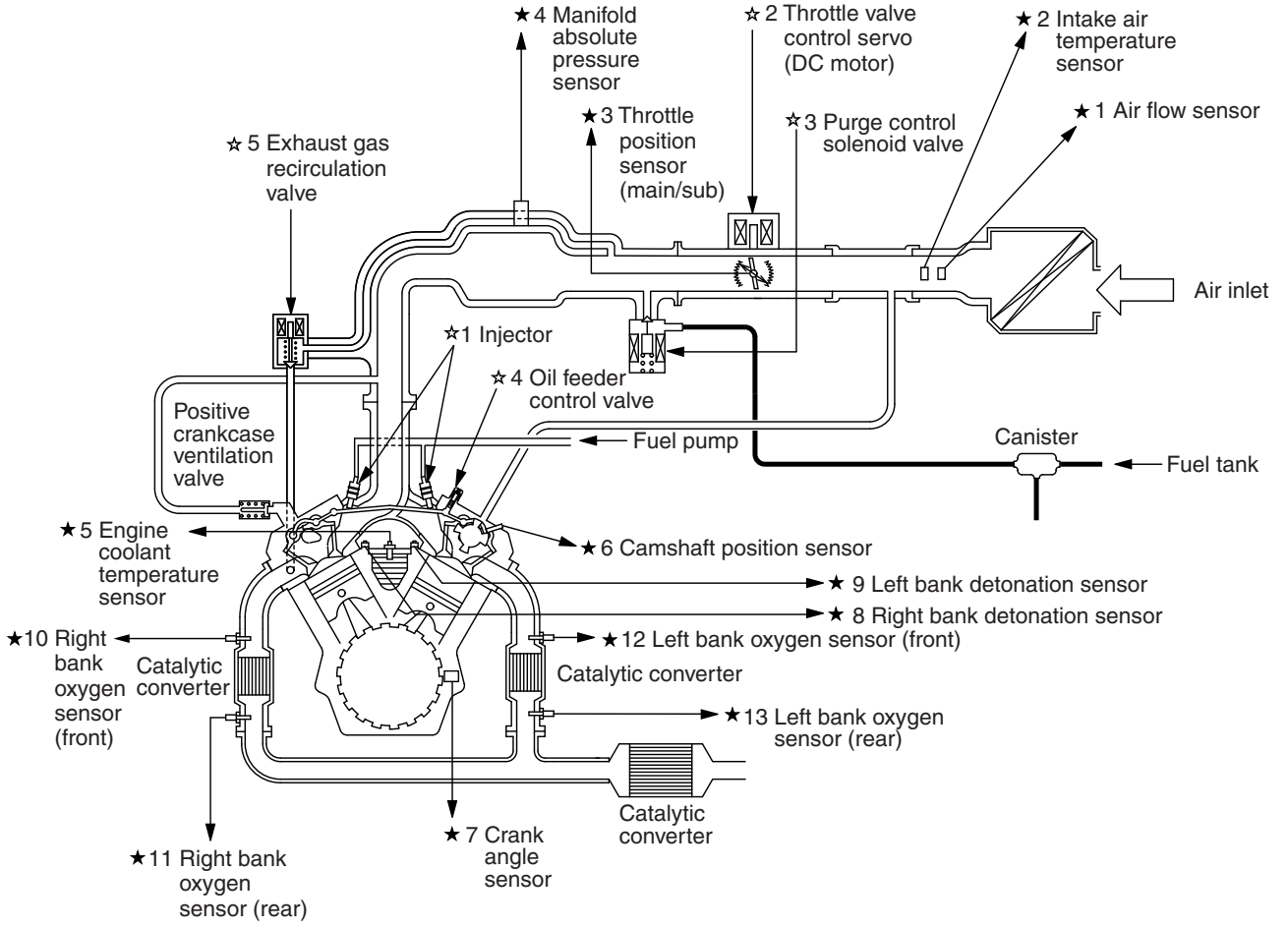
1. Fuel Pump Control
   Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Compressor Relay Control
   Turns the compressor clutch of the A/C ON and OFF.
3. Oil Feeder Control Valve Control
   The engine-ECU effects duty cycle control on the oil feeder control valve, in accordance with the engine speed. This regulates the supply of engine oil to the intake rocker shaft, which switches the cams.
4. Alternator Output Current Control
   Prevents alternator output current from increasing suddenly and idle speed from dropping at times such as when the headlamp are turned on.
5. Purge Control Solenoid Valve Control
   Refer to GROUP 17 – Emission Control <MPI> – Evaporative Emission Control System – General Information (Evaporative Emission Control System) P.17-6.
6. Exhaust Gas Recirculation Valve Control
   Refer to GROUP 17 – Emission Control <MPI> – Exhaust Gas Recirculation (EGR) Valve – General Information (Exhaust Gas Recirculation System) P.17-7.

GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	65
	Throttle position sensor	Hall element type
	Throttle valve control servo	DC motor type, having brushes
Engine-ECU	Identification No.	E6T80374
Sensors	Air flow sensor	Heat sensitizing type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Accelerator pedal position sensor	Hall element type
	Camshaft position sensor	Magneto resistance element type
	Crank angle sensor	Magneto resistance element type
	Detonation sensor	Piezoelectric type
	Power steering fluid pressure switch	Contact switch type
	Manifold absolute pressure sensor	Semiconductor type
Actuators	Engine control relay	Contact switch type
	Fuel pump relay	Contact switch type
	Injector type and number	Electromagnetic type, 6
	Injector identification mark	KLN 340C
	Throttle valve control servo relay	Contact switch type
	Oil feeder control valve	Duty cycle type solenoid valve
	Exhaust gas recirculation valve	Stepper motor
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator	Regulator pressure kPa	324

MULTI-POINT FUEL INJECTION SYSTEM DIAGRAM

★ 1 Air flow sensor ★ 2 Intake air temperature sensor ★ 3 Throttle position sensor (main/sub) ★ 4 Manifold absolute pressure sensor ★ 5 Engine coolant temperature sensor ★ 6 Camshaft position sensor ★ 7 Crank angle sensor ★ 8 Right bank detonation sensor ★ 9 Left bank detonation sensor ★ 10 Right bank oxygen sensor (front) ★ 11 Right bank oxygen sensor (rear) ★ 12 Left bank oxygen sensor (front) ★ 13 Left bank oxygen sensor (rear)	● Accelerator pedal position sensor (main/sub) ● Engine oil pressure switch (for warning lamp) ● Power supply ● Ignition switch-IG ● Ignition switch-ST ● Power steering fluid pressure switch ● Alternator FR terminal ● Alternator L terminal ● CAN communication (input signal)	⇨	Engine-ECU ● Barometric pressure sensor	⇨	☆ 1 Injector ☆ 2 Throttle valve control servo (DC motor) ☆ 3 Purge control solenoid valve ☆ 4 Oil feeder control valve ☆ 5 Exhaust gas recirculation valve	● Engine control relay ● Fuel pump relay ● A/C compressor relay ● Ignition coil ● Throttle valve control servo relay ● Alternator G terminal ● Right bank oxygen sensor (front) heater ● Right bank oxygen sensor (rear) heater ● Left bank oxygen sensor (front) heater ● Left bank oxygen sensor (rear) heater ● Diagnosis output ● CAN communication (output signal)



AKD00148 AB

SERVICE SPECIFICATION(S)

M1131000303414

Item		Specifications
Intake air temperature sensor resistance kΩ	at –20°C	13 – 17
	at 0 °C	5.3 – 6.7
	at 20 °C	2.3 – 3.0
	at 80 °C	0.30 – 0.45
Engine coolant temperature sensor resistance kΩ	at –20°C	14 – 17
	at 0 °C	(5.1 – 6.5)*
	at 20 °C	2.1 – 2.7
	at 40 °C	(0.9 – 1.3)*
	at 60 °C	(0.48 – 0.68)*
	at 80 °C	0.26 – 0.36
Fuel pressure kPa		Approximately 324
Injector coil resistance (at 20°C) Ω		10.5 – 13.5
Oxygen sensor output voltage V		0.6 – 1.0
Oxygen sensor heater resistance Ω	Front (at 20°C)	4.5 – 8.0
	Rear (at 20°C)	11 – 18
Throttle valve control servo coil resistance (at 20°C) Ω		0.3 – 100
Oil feeder control valve resistance (at 20°C) Ω		6.9 – 7.9

*NOTE: *: The value in parentheses is only advisory.*

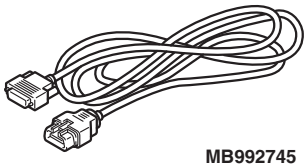
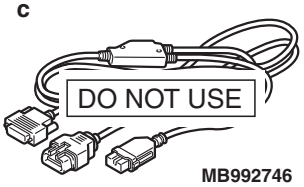
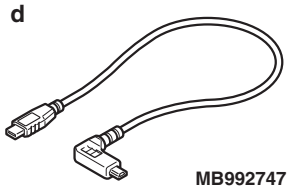
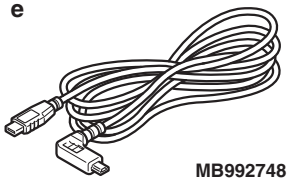
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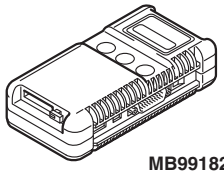
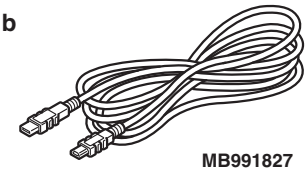
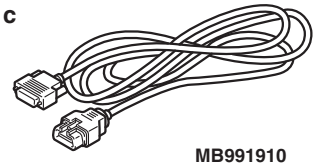
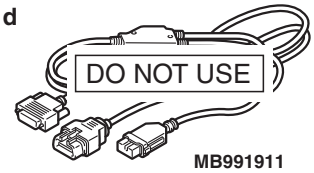
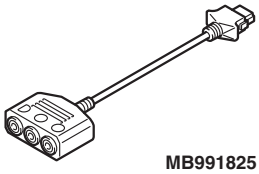
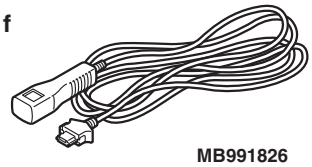
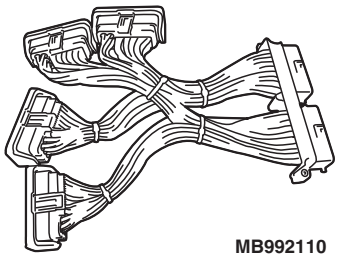
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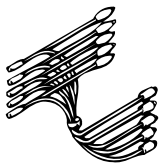
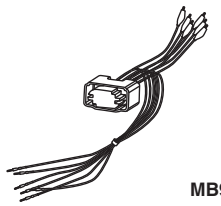
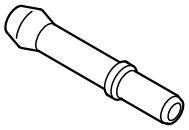
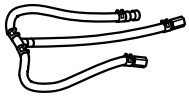
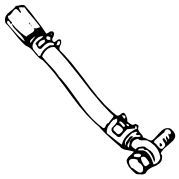
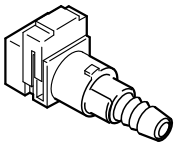
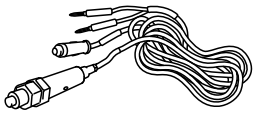
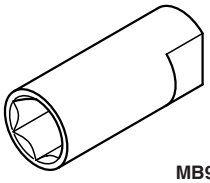
Points of application	Specified sealant
Engine coolant temperature sensor threaded portion	Loctite 262 or THREEBOND 1324N

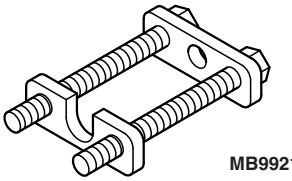
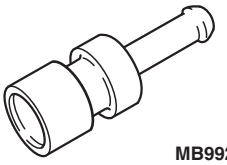
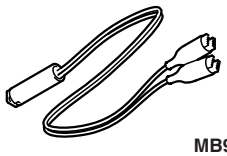
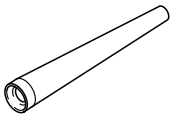
SPECIAL TOOLS

M1131000604269

Tool	Number	Name	Use
a  MB992744 b  MB992745 c  MB992746 d  MB992747 e  MB992748 ACB05421AB	a. MB992744 b. MB992745 c. MB992746 d. MB992747 e. MB992748	a. Vehicle communication interface-Lite (V.C.I.-Lite) b. V.C.I.-Lite main harness A (for vehicles with CAN communication) c. V.C.I.-Lite main harness B (for vehicles without CAN communication) d. V.C.I.-Lite USB cable short e. V.C.I.-Lite USB cable long	• MPI system inspection

Tool	Number	Name	Use
a  MB991824 b  MB991827 c  MB991910 d  MB991911 e  MB991825 f  MB991826 MB991955	MB991955 a: MB991824 b: MB991827 c: MB991910 d: MB991911 e: MB991825 f: MB991826	M.U.T.-III sub assembly a: Vehicle communication interface (V. C. I.) b: M.U.T.-III USB cable c: M.U.T.-III main harness A (Vehicles with CAN communication system) d: M.U.T.-III main harness B (Vehicles without CAN communication system) e: M.U.T.-III adapter harness f: M.U.T.-III trigger harness	**⚠ CAUTION** **For vehicle with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly.** • MPI system inspection • Fuel pressure test
 MB992110	MB992110	Power plant ECU check harness	• Measurement of voltage during troubleshooting • Measure engine-ECU terminal voltage. • Inspection using an oscilloscope
	MB991709	Test harness	• Measurement of voltage during troubleshooting • Inspection using an oscilloscope

Tool	Number	Name	Use
 MB991658	MB991658	Test harness	• Measurement of voltage during troubleshooting • Inspection using an oscilloscope • Oxygen sensor check
 MB992143	MB992143	Test harness	Measurement of voltage during troubleshooting
 MB992001	MB992001	Hose adaptor	• Measure fuel pressure • Check the spray condition of injectors
 MB992076	MB992076	Injector test set	
	MD998709	Adapter hose	Measure fuel pressure
 MB992049	MB992049	Quick connector	
 MB991981	MB991981	Fuel pressure gauge set	
 MB992042	MB992042	Engine coolant temperature sensor wrench	Removal and installation of the engine coolant temperature sensor.

Tool	Number	Name	Use
 MB992184	MB992184	Injector test holder assembly	Check the spray condition of injectors
 MB992088	MB992088	Injector test nipple	
 MB991607	MB991607	Injector test harness	
 B992106	MB992106	O-ring installer	Installation of O-ring on fuel injector injection nozzle side

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

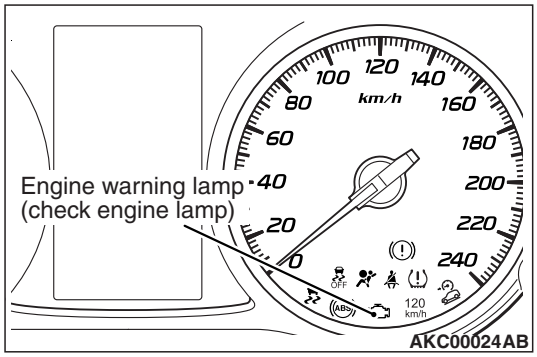
M1131150002843

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – Contents of Troubleshooting.

DIAGNOSIS FUNCTION

M1131155505109

ENGINE WARNING LAMP (CHECK ENGINE LAMP)



When the abnormal condition occurs with respect to the items of Multipoint Fuel Injection (MPI) system shown in the table, the engine warning lamp is illuminated. When the lamp remains illuminated after the engine start, or when the lamp is illuminated while the engine is running, check the diagnosis code output. There are two methods for checking the indicator lamp burn out: When the ignition switch is in ON position, the indicator lamp is illuminated, and then extinguished few seconds later. When the ignition switch is in ON position and the engine starts, the indicator lamp is extinguished.

NOTE: When the A/T-ECU detects malfunctions related to the automatic transmission, the engine warning lamp is also illuminated.

ENGINE WARNING LAMP INSPECTION ITEMS

⚠ CAUTION

The engine warning lamp continuously illuminates when the engine-ECU malfunctions.

Code No.	Diagnosis item
P001A	Oil feeder control valve system
P0031	Right bank oxygen sensor (front) heater circuit low input
P0032	Right bank oxygen sensor (front) heater circuit high input
P0037	Right bank oxygen sensor (rear) heater circuit low input
P0038	Right bank oxygen sensor (rear) heater circuit high input
P0051	Left bank oxygen sensor (front) heater circuit low input
P0052	Left bank oxygen sensor (front) heater circuit high input
P0057	Left bank oxygen sensor (rear) heater circuit low input
P0058	Left bank oxygen sensor (rear) heater circuit high input
P0068*1	Trustful check air flow sensor
P0102*1	Air flow sensor circuit low input
P0103*1	Air flow sensor circuit high input
P0107	Manifold absolute pressure sensor circuit low input
P0108	Manifold absolute pressure sensor circuit high input
P0112*1	Intake air temperature sensor circuit low input
P0113*1	Intake air temperature sensor circuit high input
P0117*1	Engine coolant temperature sensor circuit low input
P0118*1	Engine coolant temperature sensor circuit high input
P0121*1	Trustful check throttle position sensor (main)
P0122*1	Throttle position sensor (main) circuit low input
P0123*1	Throttle position sensor (main) circuit high input
P0131	Right bank oxygen sensor (front) circuit low voltage
P0132	Right bank oxygen sensor (front) circuit high voltage
P0133	Right bank oxygen sensor (front) circuit slow response
P0134*1	Right bank oxygen sensor (front) circuit no activity detected
P0137	Right bank oxygen sensor (rear) circuit low voltage
P0138	Right bank oxygen sensor (rear) circuit high voltage
P0151	Left bank oxygen sensor (front) circuit low voltage
P0152	Left bank oxygen sensor (front) circuit high voltage
P0153	Left bank oxygen sensor (front) circuit slow response
P0154*1	Left bank oxygen sensor (front) circuit no activity detected
P0157	Left bank oxygen sensor (rear) circuit low voltage
P0158	Left bank oxygen sensor (rear) circuit high voltage
P0171	Right bank abnormal fuel system (lean)
P0172	Right bank abnormal fuel system (rich)

Code No.	Diagnosis item
P0174	Left bank abnormal fuel system (lean)
P0175	Left bank abnormal fuel system (rich)
P0221*1	Trustful check throttle position sensor (sub)
P0222*1	Throttle position sensor (sub) circuit low input
P0223*1	Throttle position sensor (sub) circuit high input
P0261	No. 1 injector circuit low input
P0262	No. 1 injector circuit high input
P0264	No. 2 injector circuit low input
P0265	No. 2 injector circuit high input
P0267	No. 3 injector circuit low input
P0268	No. 3 injector circuit high input
P0270	No. 4 injector circuit low input
P0271	No. 4 injector circuit high input
P0273	No. 5 injector circuit low input
P0274	No. 5 injector circuit high input
P0276	No. 6 injector circuit low input
P0277	No. 6 injector circuit high input
P0300*2	Random/multiple cylinder misfire detected
P0301*2	No. 1 cylinder misfire detected
P0302*2	No. 2 cylinder misfire detected
P0303*2	No. 3 cylinder misfire detected
P0304*2	No. 4 cylinder misfire detected
P0305*2	No. 5 cylinder misfire detected
P0306*2	No. 6 cylinder misfire detected
P0335*1	Crank angle sensor system
P0340*1	Camshaft position sensor system
P0421	Warm up catalyst malfunction (right bank)
P0431	Warm up catalyst malfunction (left bank)
P0458	Purge control solenoid valve circuit low input
P0459	Purge control solenoid valve circuit high input
P0602*1	Variant coding system
P0604*1	RAM error
P0606*1	Engine-ECU main processor malfunction
P060B*1	A/D converter
P060D*1	Trustful check accelerator pedal position sensor
P061A	Torque monitoring
P061C	Trustful check engine speed

Code No.	Diagnosis item
P062F*1	EEPROM malfunction
P0630*1	Chassis number not programmed
P0638*1	Throttle valve control servo circuit range/performance problem
P0642*1	Throttle position sensor power supply
P0657*1	Throttle valve control servo relay circuit malfunction
P1238*1	Air flow sensor trustful for torque monitoring
P1590*1	A/T-ECU to engine-ECU communication error in torque reduction request
P1603*1	Battery backup circuit malfunction
P2100*1	Throttle valve control servo circuit (open)
P2101*1	Throttle valve control servo magneto malfunction
P2122*1	Accelerator pedal position sensor (main) circuit low input
P2123*1	Accelerator pedal position sensor (main) circuit high input
P2127*1	Accelerator pedal position sensor (sub) circuit low input
P2128*1	Accelerator pedal position sensor (sub) circuit high input
P2135*1	Throttle position sensor (main and sub) range/performance problem
P2138*1	Accelerator pedal position sensor (main and sub) range/performance problem
P2228*1	Barometric pressure sensor circuit low input
P2229*1	Barometric pressure sensor circuit high input
P2252	Oxygen sensor offset circuit low voltage
P2253	Oxygen sensor offset circuit high voltage
U0101*1	A/T-ECU time-out
U0141*1	ETACS-ECU time-out

*NOTE: After the engine-ECU has detected a malfunction, the engine warning lamp illuminates when the engine is next turned on and the same malfunction is re-detected. However, for items marked with a "*1" in the diagnosis code number column, the engine warning lamp illuminates only on the first detection of the malfunction.*

*NOTE: The codes marked with a "*2" in the diagnosis code number column have the following two conditions for illuminating the engine warning lamp.*

- *In case that the misfire causing the damaged catalyst is detected, the engine warning lamp is illuminated at the time.*
- *In case that the misfire deteriorating the exhaust gas is detected, the engine warning lamp is illuminated when the same malfunction is redetected after the next engine start.*

METHOD OF READING AND ERASING DIAGNOSIS CODES

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – Diagnosis Function.

INSPECTION WITH M.U.T.-III SERVICE DATA AND ACTUATOR TEST

Reading service data or performing an actuator test using M.U.T.-III enables you to check the vehicle body harnesses and components for abnormalities. Sensor input or output to the actuator can be displayed in numerical values or graphs in the service data while in the actuator test the actuator can be forced to drive (ON/OFF driving in the specified time).

DIAGNOSIS PROCEDURE

1. Connect M.U.T.-III to perform inspection with the service data and actuator test function.
2. If any abnormality is found, inspect and repair vehicle body harnesses and components.
3. After repair, check that input and output have returned to normal.
4. If a failure code which is caused by inspection and repair work is generated, erase the failure code.
5. Disconnect M.U.T.-III and perform a test run to check that the malfunction phenomenon is resolved.

PROVISIONAL DIAGNOSIS CODE CONFIRMED

If detecting the malfunction during the first drive cycle, the engine-ECU temporarily stores the diagnosis code as the provisional diagnosis code. If detecting the same malfunction during the next drive cycle, the engine-ECU determines that the malfunction exists. The engine-ECU outputs the diagnosis code. On the M.U.T.-III, it is possible to display the stored provisional diagnosis code which the engine-ECU had detected during the first drive cycle. This makes it possible to confirm in one drive cycle whether the malfunction could happen again after the repair.

CONFIRMATION METHOD

1. After the ignition switch is in "LOCK" (OFF) position, connect the M.U.T.-III to the diagnosis connector.
2. Turn the ignition switch to the "ON" position.
3. Select "MPI/GDI/DIESEL" from System select Screen of the M.U.T.-III.
4. Select "Special Function" from MPI/GDI/DIESEL Screen.
5. Select "Provisional DTCs" from Special Function Screen.

CHECKING FREEZE FRAME DATA

When the engine-ECU determines a malfunction and stores the diagnosis code, it stores a sensor input condition and control condition during malfunction detection for each detected diagnosis code. The data of this function is called freeze frame data.

Analyzing this freeze frame data with M.U.T.-III allows for efficient troubleshooting. The display items of freeze frame data are shown below.

DISPLAY ITEM LIST

Item No.	Data Item	Unit·Condition
1	Odometer	km
2	Ignition cycle (Warm up cycle)	–
4	Accumulated minute*1	min
AA*2	Air flow sensor	g/s
AB*2	Throttle position sensor (main)	%
BA*2	Target EGR	%
BB*2	Barometric pressure sensor	kPa
BC*2	Relative throttle position sensor	%
BD*2	Throttle position sensor (sub)	%
BE*2	Accelerator pedal position sensor (main)	%
BF*2	Accelerator pedal position sensor (sub)	%
C0*2	Fuel system status 1	• CL (closed loop)*3 • OL (open loop)*4 • OL: DRV (open loop-drive condition)*5 • OL: SYS (open loop-system failure)*6 • CL: HO2S (closed loop-system failure)*7
C1*2	Fuel system status 2	• CL (closed loop)*3 • OL (open loop)*4 • OL: DRV (open loop-drive condition)*5 • OL: SYS (open loop-system failure)*6 • CL: HO2S (closed loop-system failure)*7
C2*2	Calculated load value	%
C3*2	Engine coolant temperature sensor	°C
C4*2	Short term fuel trim 1	%
C5*2*9	Short term fuel trim 3	****
C6*2	Long term fuel trim 1	%
C7*2*9	Long term fuel trim 3	****

Item No.	Data Item	Unit·Condition
C8*2	Short term fuel trim 2	%
C9*2*9	Short term fuel trim 4	****
CA*2	Long term fuel trim 2	%
CB*2*9	Long term fuel trim 4	****
CC*2	Manifold absolute pressure sensor	kPa
CD*2	Crank angle sensor	r/min
CE*2	Vehicle speed	km/h
CF*2	Advance ignition	°CA
D0*2	Intake air temperature sensor	°C
D1*2	Time since engine running*8	sec
D6*2	Purge solenoid duty	%
D8*2	Power supply voltage	V
D9*2	Absolute load value	%
DA*2	Target equivalence ratio	–
DB*2	Intake air temperature sensor	°C
DC*2	Throttle actuator	%
DD*2	Relative accelerator pedal position sensor	%

*NOTE: *1: Accumulated time from malfunction detection up to now*

*NOTE: *2: The items of Freeze Frame Data can be seen by selecting "Freeze Frame Data (OBD)" on "Self-diagnosis" screen of M.U.T.-III. When system malfunctions are detected, the first detected malfunction data only is stored.*

*NOTE: *3: Condition in which oxygen sensor signals are fed back to the engine-ECU for controlling fuel*

*NOTE: *4: Condition in which fuel is controlled without oxygen sensor signals being fed back to the engine-ECU because the condition to shift to the closed loop is not met.*

*NOTE: *5: Condition of open loop due to acceleration and deceleration driving*

*NOTE: *6: Condition of open loop due to system failure*

*NOTE: *7: Condition of closed loop due to system failure*

*NOTE: *8: Time between engine start and malfunction detection*

*NOTE: *9: Data items are displayed on M.U.T.-III display, but the V-type 6-cylinder engine is not applicable and its data is displayed as "N/A" or "****".*

FAIL-SAFE AND BACKUP FUNCTION

This function exercises control, by predetermined control logic, to keep a condition in which a vehicle can be safely driven when main sensor failures are detected by the diagnosis function.

List of fail-safe and backup function items

Code No.	Diagnosis item	Control content during malfunction
P001A	Oil feeder control valve system	Does not switch to high-speed cam.
P0068	Trustful check air flow sensor	Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.
P0102	Air flow sensor circuit low input	Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.
P0103	Air flow sensor circuit high input	Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.
P0107	Manifold absolute pressure sensor circuit low input	Control as if the inlet manifold vacuum pressure is 101 kPa.
P0108	Manifold absolute pressure sensor circuit high input	Control as if the inlet manifold vacuum pressure is 101 kPa.
P0112	Intake air temperature sensor circuit low input	Control as if the intake air temperature is 25°C.
P0113	Intake air temperature sensor circuit high input	Control as if the intake air temperature is 25°C.
P0117	Engine coolant temperature sensor circuit low input	Control as if the engine coolant temperature is 80°C.
P0118	Engine coolant temperature sensor circuit high input	Control as if the engine coolant temperature is 80°C.
P0121	Trustful check throttle position sensor (main)	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (sub) fails.
P0122	Throttle position sensor (main) circuit low input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (sub) fails.
P0123	Throttle position sensor (main) circuit high input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (sub) fails.
P0221	Trustful check throttle position sensor (sub)	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (main) fails.

Code No.	Diagnosis item	Control content during malfunction
P0222	Throttle position sensor (sub) circuit low input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (main) fails.
P0223	Throttle position sensor (sub) circuit high input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (main) fails.
P0300	Random/multiple cylinder misfire detected	The supply of fuel to the misfiring cylinder can possibly be cut.
P0301	No. 1 cylinder misfire detected	The supply of fuel to the misfiring cylinder can possibly be cut.
P0302	No. 2 cylinder misfire detected	The supply of fuel to the misfiring cylinder can possibly be cut.
P0303	No. 3 cylinder misfire detected	The supply of fuel to the misfiring cylinder can possibly be cut.
P0304	No. 4 cylinder misfire detected	The supply of fuel to the misfiring cylinder can possibly be cut.
P0327	Detonation sensor circuit low input	Fix the ignition timing with an allowance against detonation.
P0328	Detonation sensor circuit high input	Fix the ignition timing with an allowance against detonation.
P0340	Camshaft position sensor system	• Engine runs in learned pattern until engine stops. • After stopping the engine, do not start the engine. • Does not switch to high-speed cam.
P0513	Immobilizer malfunction	Engine start is prohibited.
P0604	RAM error	• Microcomputer is reset. or • Throttle opening degree position is in default position.
P0606	Engine-ECU main processor malfunction	Throttle opening degree position is in default position.
P060B	A/D converter	Throttle opening degree position is in default position.
P060D	Trustful check accelerator pedal position sensor	Throttle opening degree position is in default position.
P061A	Torque monitoring	Throttle opening degree position is in default position.
P061C	Trustful check engine speed	Throttle opening degree position is in default position.

Code No.	Diagnosis item	Control content during malfunction
P061F	Fail-safe control system	Microcomputer is reset.
P0622	Alternator FR terminal system	Prohibits alternator output suppression control against current consumers (operates as a normal alternator).
P0638	Throttle valve control servo circuit range/performance problem	Throttle opening degree position is in default position.
P0642	Throttle position sensor power supply	Throttle opening degree position is in default position.
P0657	Throttle valve control servo relay circuit malfunction	Throttle opening degree position is in default position.
P1231	Trustful check active stability control (ASC)	Torque requested by active stability control (ASC) is ignored.
P1238	Air flow sensor trustful for torque monitoring	Throttle opening degree position is in default position.
P1240	Trustful check ignition angle	Ignition retard is not carried out.
P1242	Fail safe control monitoring	Throttle opening degree position is in default position.
P1243	Inquiry/response error	Microcomputer is reset.
P1247	Trustful Check CVT	Torque requested by CVT-ECU is ignored.
P1248	4WD plausibility	Does not control electronically controlled 4WD.
P1590	A/T-ECU to engine-ECU communication error in torque reduction request	Engine output is restricted.
P1603	Battery backup circuit malfunction	All diagnosis codes are stored once failure judgement is completed.
P2100	Throttle valve control servo circuit (open)	Throttle opening degree position is in default position.
P2101	Throttle valve control servo magneto malfunction	Throttle opening degree position is in default position.
P2122	Accelerator pedal position sensor (main) circuit low input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.
P2123	Accelerator pedal position sensor (main) circuit high input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.
P2127	Accelerator pedal position sensor (sub) circuit low input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if accelerator pedal position sensor (main) fails.

Code No.	Diagnosis item	Control content during malfunction
P2128	Accelerator pedal position sensor (sub) circuit high input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if accelerator pedal position sensor (main) fails.
P2135	Throttle position sensor (main and sub) circuit range/performance problem	Throttle opening degree position is in default position.
P2138	Accelerator pedal position sensor (main and sub) circuit range/performance	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.
P2228	Barometric pressure sensor circuit low input	Control as if the barometric pressure is 101 kPa.
P2229	Barometric pressure sensor circuit high input	Control as if the barometric pressure is 101 kPa.
P2253	Oxygen sensor offset circuit high voltage	Does not control air-fuel ratio closed loop.
U0114	4WD-ECU time-out	Decrease the engine output torque limit.
U0167	KOS-ECU communication error	Engine start is prohibited.
U0415	ASC-ECU CAN data abnormality	Torque requested by active stability control (ASC) is ignored.

INSPECTION CHART FOR DIAGNOSIS CODE

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⚠ *WARNING*

When touching the throttle valve, surely shut off the driving circuits of the throttle valve. In the event that the throttle valve is operated, a finger might be injured as the result of being caught by the throttle valve.

⚠ CAUTION

When the ignition switch is turned ON with the connector disconnected in proceeding with trouble-shooting, the diagnosis code may be stored in other systems. Erase codes if diagnosis codes of all the systems are checked and the codes are output after completion of the troubleshooting.

Code No.	Diagnosis item	Reference page
P001A	Oil feeder control valve system	P.13F-25
P0031	Right bank oxygen sensor (front) heater circuit low input	P.13F-26
P0032	Right bank oxygen sensor (front) heater circuit high input	P.13F-27
P0037	Right bank oxygen sensor (rear) heater circuit low input	P.13F-28
P0038	Right bank oxygen sensor (rear) heater circuit high input	P.13F-29
P0051	Left bank oxygen sensor (front) heater circuit low input	P.13F-30
P0052	Left bank oxygen sensor (front) heater circuit high input	P.13F-31
P0057	Left bank oxygen sensor (rear) heater circuit low input	P.13F-32
P0058	Left bank oxygen sensor (rear) heater circuit high input	P.13F-33
P0068	Trustful check air flow sensor	P.13F-34
P0102	Air flow sensor circuit low input	P.13F-34
P0103	Air flow sensor circuit high input	P.13F-36
P0107	Manifold absolute pressure sensor circuit low input	P.13F-37
P0108	Manifold absolute pressure sensor circuit high input	P.13F-39
P0112	Intake air temperature sensor circuit low input	P.13F-40
P0113	Intake air temperature sensor circuit high input	P.13F-41
P0117	Engine coolant temperature sensor circuit low input	P.13F-43
P0118	Engine coolant temperature sensor circuit high input	P.13F-44
P0121	Trustful check throttle position sensor (main)	P.13F-46
P0122	Throttle position sensor (main) circuit low input	P.13F-46
P0123	Throttle position sensor (main) circuit high input	P.13F-48
P0131	Right bank oxygen sensor (front) circuit low voltage	P.13F-49
P0132	Right bank oxygen sensor (front) circuit high voltage	P.13F-50
P0133	Right bank oxygen sensor (front) circuit slow response	P.13F-51
P0134	Right bank oxygen sensor (front) circuit no activity detected	P.13F-52
P0137	Right bank oxygen sensor (rear) circuit low voltage	P.13F-54
P0138	Right bank oxygen sensor (rear) circuit high voltage	P.13F-55

Code No.	Diagnosis item	Reference page
P0151	Left bank oxygen sensor (front) circuit low voltage	P.13F-56
P0152	Left bank oxygen sensor (front) circuit high voltage	P.13F-58
P0153	Left bank oxygen sensor (front) circuit slow response	P.13F-59
P0154	Left bank oxygen sensor (front) circuit no activity detected	P.13F-60
P0157	Left bank oxygen sensor (rear) circuit low voltage	P.13F-61
P0158	Left bank oxygen sensor (rear) circuit high voltage	P.13F-63
P0171	Right bank abnormal fuel system (lean)	P.13F-64
P0172	Right bank abnormal fuel system (rich)	P.13F-65
P0174	Left bank abnormal fuel system (lean)	P.13F-67
P0175	Left bank abnormal fuel system (rich)	P.13F-68
P0221	Trustful check throttle position sensor (sub)	P.13F-70
P0222	Throttle position sensor (sub) circuit low input	P.13F-70
P0223	Throttle position sensor (sub) circuit high input	P.13F-72
P0261	No. 1 injector circuit low input	P.13F-73
P0262	No. 1 injector circuit high input	P.13F-74
P0264	No. 2 injector circuit low input	P.13F-75
P0265	No. 2 injector circuit high input	P.13F-76
P0267	No. 3 injector circuit low input	P.13F-77
P0268	No. 3 injector circuit high input	P.13F-79
P0270	No. 4 injector circuit low input	P.13F-80
P0271	No. 4 injector circuit high input	P.13F-81
P0273	No. 5 injector circuit low input	P.13F-82
P0274	No. 5 injector circuit high input	P.13F-83
P0276	No. 6 injector circuit low input	P.13F-84
P0277	No. 6 injector circuit high input	P.13F-85
P0300	Random/multiple cylinder misfire detected	P.13F-86
P0301	No. 1 cylinder misfire detected	P.13F-88
P0302	No. 2 cylinder misfire detected	P.13F-90
P0303	No. 3 cylinder misfire detected	P.13F-91
P0304	No. 4 cylinder misfire detected	P.13F-92
P0305	No. 5 cylinder misfire detected	P.13F-94
P0306	No. 6 cylinder misfire detected	P.13F-95
P0327	Right bank detonation sensor circuit low input	P.13F-97
P0328	Right bank detonation sensor circuit high input	P.13F-98
P0332	Left bank detonation sensor circuit low input	P.13F-99

Code No.	Diagnosis item	Reference page
P0333	Left bank detonation sensor circuit high input	P.13F-100
P0335	Crank angle sensor system	P.13F-100
P0340	Camshaft position sensor system	P.13F-102
P0421	Warm up catalyst malfunction (right bank)	P.13F-104
P0431	Warm up catalyst malfunction (left bank)	P.13F-105
P0458	Purge control solenoid valve circuit low input	P.13F-106
P0459	Purge control solenoid valve circuit high input	P.13F-107
P0489	Exhaust gas recirculation valve (stepper motor) circuit malfunction (earth short)	P.13F-108
P0490	Exhaust gas recirculation valve (stepper motor) circuit malfunction (battery short)	P.13F-110
P0513	Immobilizer malfunction	P.13F-110
P0602	Variant coding system	P.13F-111
P0604	RAM error	P.13F-112
P0606	Engine-ECU main processor malfunction	P.13F-112
P060B	A/D converter	P.13F-113
P060D	Trustful check accelerator pedal position sensor	P.13F-114
P061A	Torque monitoring	P.13F-115
P061C	Trustful check engine speed	P.13F-116
P061F	Fail-safe control system	P.13F-116
P0622	Alternator FR terminal system	P.13F-117
P062F	EEPROM malfunction	P.13F-118
P0630	Chassis number not programmed	P.13F-118
P0638	Throttle valve control servo circuit range/performance problem	P.13F-119
P0642	Throttle position sensor power supply	P.13F-120
P0657	Throttle valve control servo relay circuit malfunction	P.13F-121
P1231	Trustful check active stability control (ASC)	P.13F-123
P1238	Air flow sensor trustful for torque monitoring	P.13F-123
P1240	Trustful check ignition angle	P.13F-124
P1242	Fail-safe control monitoring	P.13F-125
P1243	Inquiry/response error	P.13F-125
P1247	Trustful check A/T	P.13F-126
P1248	Trustful check 4WD-ECU	P.13F-126
P1590	A/T-ECU to engine-ECU communication error in torque reduction request	P.13F-127
P1603	Battery backup circuit malfunction	P.13F-127

Code No.	Diagnosis item	Reference page
P2100	Throttle valve control servo circuit (open)	P.13F-128
P2101	Throttle valve control servo magneto malfunction	P.13F-129
P2122	Accelerator pedal position sensor (main) circuit low input	P.13F-130
P2123	Accelerator pedal position sensor (main) circuit high input	P.13F-131
P2127	Accelerator pedal position sensor (sub) circuit low input	P.13F-132
P2128	Accelerator pedal position sensor (sub) circuit high input	P.13F-134
P2135	Throttle position sensor (main and sub) range/performance problem	P.13F-135
P2138	Accelerator pedal position sensor (main and sub) range/performance problem	P.13F-136
P2228	Barometric pressure sensor circuit low input	P.13F-137
P2229	Barometric pressure sensor circuit high input	P.13F-138
P2252	Oxygen sensor offset circuit low voltage	P.13F-138
P2253	Oxygen sensor offset circuit high voltage	P.13F-139
P2530	Ignition switch-IG1 circuit	P.13F-139
U0101	A/T-ECU time-out	P.13F-140
U0114	4WD-ECU time-out	P.13F-142
U0121	ASC-ECU time-out	P.13F-143
U0131	EPS-ECU time-out	P.13F-145
U0141	ETACS-ECU time-out	P.13F-146
U0167	KOS-ECU communication error	P.13F-148
U0415	ASC-ECU CAN data abnormality	P.13F-149

NOTE:

- *Do not replace the engine-ECU until a through terminal check reveals there are no short/open circuit.*
- *Check that the engine-ECU earth circuit is normal before checking for the cause of the problem.*

DIAGNOSIS CODE PROCEDURES

Code No. P001A: Oil Feeder Control Valve System

OPERATION

- Power is supplied to the oil feeder control valve from the engine control relay.
- The engine-ECU connector terminal OCV makes the power transistor in the unit be in ON position, and that makes currents go on the oil feeder control valve.

FUNCTION

- The oil feeder control valve switches the cams to operate the MIVEC in the low-speed or high-speed mode in accordance with the signals from the engine-ECU.

TROUBLE JUDGEMENT

Check Conditions

- Ignition switch is "ON" position
- Oil feeder control valve is OFF.
- Battery positive voltage is more than 10 V and is less than 16.5 V.
- 0.1 second has elapsed after the abovementioned conditions have been met.

Judgement Criterion

- The engine-ECU terminal voltage of oil feeder control valve circuit is less than 1.5 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Does not operate the MIVEC in high-speed mode.

PROBABLE CAUSES

- Failed oil feeder control valve
- Open/short circuit or harness damage in oil feeder control valve circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check oil feeder control valve itself.

- Oil feeder control valve check (Refer to P.13F-225).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the oil feeder control valve.

STEP 2. Voltage measurement at oil feeder control valve connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the oil feeder control valve connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between engine control relay connector and oil feeder control valve connector.

STEP 3. Check of short to earth, open circuit and damage in OCV line between oil feeder control valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Check of damage in power supply line between engine control relay connector and oil feeder control valve connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0031: Right Bank Oxygen Sensor (front) Heater Circuit Low Input

OPERATION

- Power is supplied to the heater power terminal of the right bank oxygen sensor (front) connector from the engine control relay.
- The heater of the right bank oxygen sensor (front) connector is controlled by the power transistor in the engine-ECU connector terminal OHFL.

FUNCTION

- The power supply to the right bank oxygen sensor (front) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the right bank oxygen sensor (front) heater enables the right bank oxygen sensor (front) to provide good response even when the exhaust emission temperature is low.

TROUBLE JUDGEMENT

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank oxygen sensor (front) heater is on.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion

- The right bank oxygen sensor (front) heater current is less than 0.17 A for 2 seconds.

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank oxygen sensor (front) heater is off.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion

- The right bank oxygen sensor (front) heater voltage is less than 2.0 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed right bank oxygen sensor (front) heater
- Open/short circuit or harness damage in right bank oxygen sensor (front) heater circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check right bank oxygen sensor (front) itself.

- Right bank oxygen sensor (front) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the right bank oxygen sensor (front).

STEP 2. Voltage measurement at right bank oxygen sensor (front) connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the right bank oxygen sensor (front) connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between right bank oxygen sensor (front) connector and engine control relay connector.

STEP 3. Check of short to earth, open circuit and damage in OHFL line between right bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Check of damage in power supply line between right bank oxygen sensor (front) connector and engine control relay connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0032: Right Bank Oxygen Sensor (front) Heater Circuit High Input

OPERATION
- Power is supplied to the heater power terminal of the right bank oxygen sensor (front) connector from the engine control relay.
- The heater of the right bank oxygen sensor (front) connector is controlled by the power transistor in the engine-ECU connector terminal OHFL.

FUNCTION
- The power supply to the right bank oxygen sensor (front) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the right bank oxygen sensor (front) heater enables the right bank oxygen sensor (front) to provide good response even when the exhaust emission temperature is low.

TROUBLE JUDGEMENT

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank oxygen sensor (front) heater is on.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion
- The right bank oxygen sensor (front) heater current is more than 10.5 A for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed right bank oxygen sensor (front) heater
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check right bank oxygen sensor (front) itself.
- Right bank oxygen sensor (front) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the right bank oxygen sensor (front).

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0037: Right Bank Oxygen Sensor (rear) Heater Circuit Low Input

OPERATION

- Power is supplied to the heater power terminal of the right bank oxygen sensor (rear) connector from the engine control relay.
- The heater of the right bank oxygen sensor (rear) connector is controlled by the power transistor in the engine-ECU connector terminal OHRL.

FUNCTION

- The power supply to the right bank oxygen sensor (rear) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the right bank oxygen sensor (rear) heater enables the right bank oxygen sensor (rear) to provide good response even when the exhaust emission temperature is low.

TROUBLE JUDGEMENT

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank oxygen sensor (rear) heater is on.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion

- The right bank oxygen sensor (rear) heater current is less than 0.17 A for 2 seconds.

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank oxygen sensor (rear) heater is off.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion

- The right bank oxygen sensor (rear) heater voltage is less than 2.0 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed right bank oxygen sensor (rear) heater
- Open/short circuit or harness damage in right bank oxygen sensor (rear) heater circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check right bank oxygen sensor (rear) itself.

- Right bank oxygen sensor (rear) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the right bank oxygen sensor (rear).

STEP 2. Voltage measurement at right bank oxygen sensor (rear) connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the right bank oxygen sensor (rear) connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between right bank oxygen sensor (rear) connector and engine control relay connector.

STEP 3. Check of short to earth, open circuit and damage in OHRL line between right bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Check of harness damage in power supply line between right bank oxygen sensor (rear) connector and engine control relay connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0038: Right Bank Oxygen Sensor (rear) Heater Circuit High Input

OPERATION
- Power is supplied to the heater power terminal of the right bank oxygen sensor (rear) connector from the engine control relay.
- The heater of the right bank oxygen sensor (rear) connector is controlled by the power transistor in the engine-ECU connector terminal OHRL.

FUNCTION
- The power supply to the right bank oxygen sensor (rear) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the right bank oxygen sensor (rear) heater enables the right bank oxygen sensor (rear) to provide good response even when the exhaust emission temperature is low.

TROUBLE JUDGEMENT

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank oxygen sensor (rear) heater is on.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion
- The right bank oxygen sensor (rear) heater current is more than 10.5 A for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed right bank oxygen sensor (rear) heater
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check right bank oxygen sensor (rear) itself.
- Right bank oxygen sensor (rear) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the right bank oxygen sensor (rear).

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0051: Left Bank Oxygen Sensor (front) Heater Circuit Low Input

OPERATION

- Power is supplied to the heater power terminal of the left bank oxygen sensor (front) connector from the engine control relay.
- The heater of the left bank oxygen sensor (front) connector is controlled by the power transistor in the engine-ECU connector terminal OHFL.

FUNCTION

- The power supply to the left bank oxygen sensor (front) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the left bank oxygen sensor (front) heater enables the left bank oxygen sensor (front) to provide good response even when the exhaust emission temperature is low.

TROUBLE JUDGEMENT

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank oxygen sensor (front) heater is on.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion

- The left bank oxygen sensor (front) heater current is less than 0.17 A for 2 seconds.

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank oxygen sensor (front) heater is off.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion

- The left bank oxygen sensor (front) heater voltage is less than 2.0 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed left bank oxygen sensor (front) heater
- Open/short circuit or harness damage in left bank oxygen sensor (front) heater circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check left bank oxygen sensor (front) itself.

- Left bank oxygen sensor (front) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the left bank oxygen sensor (front).

STEP 2. Voltage measurement at left bank oxygen sensor (front) connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the left bank oxygen sensor (front) connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between left bank oxygen sensor (front) connector and engine control relay connector.

STEP 3. Check of short to earth, open circuit and damage in OHFL line between left bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Check of harness damage in power supply line between left bank oxygen sensor (front) connector and engine control relay connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0052: Left Bank Oxygen Sensor (front) Heater Circuit High Input

OPERATION
- Power is supplied to the heater power terminal of the left bank oxygen sensor (front) connector from the engine control relay.
- The heater of the left bank oxygen sensor (front) connector is controlled by the power transistor in the engine-ECU connector terminal OHFL.

FUNCTION
- The power supply to the left bank oxygen sensor (front) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the left bank oxygen sensor (front) heater enables the left bank oxygen sensor (front) to provide good response even when the exhaust emission temperature is low.

TROUBLE JUDGEMENT

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank oxygen sensor (front) heater is on.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion
- The left bank oxygen sensor (front) heater current is more than 10.5 A for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed left bank oxygen sensor (front) heater
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check left bank oxygen sensor (front) itself.
- Left bank oxygen sensor (front) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the left bank oxygen sensor (front).

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0057: Left Bank Oxygen Sensor (rear) Heater Circuit Low Input

OPERATION

- Power is supplied to the heater power terminal of the left bank oxygen sensor (rear) connector from the engine control relay.
- The heater of the left bank oxygen sensor (rear) connector is controlled by the power transistor in the engine-ECU connector terminal OHRL.

FUNCTION

- The power supply to the left bank oxygen sensor (rear) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the left bank oxygen sensor (rear) heater enables the left bank oxygen sensor (rear) to provide good response even when the exhaust emission temperature is low.

TROUBLE JUDGEMENT

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank oxygen sensor (rear) heater is on.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion

- The left bank oxygen sensor (rear) heater current is less than 0.17 A for 2 seconds.

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank oxygen sensor (rear) heater is off.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion

- The left bank oxygen sensor (rear) heater voltage is less than 2.0 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed left bank oxygen sensor (rear) heater
- Open/short circuit or harness damage in left bank oxygen sensor (rear) heater circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check left bank oxygen sensor (rear) itself.

- Left bank oxygen sensor (rear) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the left bank oxygen sensor (rear).

STEP 2. Voltage measurement at left bank oxygen sensor (rear) connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the left bank oxygen sensor (rear) connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between left bank oxygen sensor (rear) connector and engine control relay connector.

STEP 3. Check of short to earth, open circuit and damage in OHRL line between left bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Check of harness damage in power supply line between left bank oxygen sensor (rear) connector and engine control relay connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0058: Left Bank Oxygen Sensor (rear) Heater Circuit High Input

OPERATION
- Power is supplied to the heater power terminal of the left bank oxygen sensor (rear) connector from the engine control relay.
- The heater of the left bank oxygen sensor (rear) connector is controlled by the power transistor in the engine-ECU connector terminal OHRL.

FUNCTION
- The power supply to the left bank oxygen sensor (rear) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the left bank oxygen sensor (rear) heater enables the left bank oxygen sensor (rear) to provide good response even when the exhaust emission temperature is low.

TROUBLE JUDGEMENT

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank oxygen sensor (rear) heater is on.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion
- The left bank oxygen sensor (rear) heater current is more than 10.5 A for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed left bank oxygen sensor (rear) heater
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check left bank oxygen sensor (rear) itself.
- Left bank oxygen sensor (rear) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the left bank oxygen sensor (rear).

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0068: Trustful Check Air Flow Sensor

FUNCTION

- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (main or sub) signal.

TROUBLE JUDGEMENT

Check Conditions

- Engine is running.
- Throttle position sensor (main or sub) is normal.

Judgement Criterion

- The difference between volumetric efficiency (actual measurement) by the air flow sensor and volumetric efficiency estimated from the throttle position sensor (main) exceeds the specified value.

or

- The difference between volumetric efficiency (actual measurement) by the air flow sensor and volumetric efficiency estimated from the throttle position sensor (sub) exceeds the specified value.

FAIL-SAFE AND BACKUP FUNCTION

- Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.

PROBABLE CAUSES

- Failed air flow sensor
- Harness damage in air flow sensor circuit or loose connector contact
- Failed intake air system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P0068 output?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 10: Air flow sensor

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Check air flow sensor system. Check code No. P0102: air flow sensor circuit low input (Refer to P.13F-34). Check code No. P0103: air flow sensor circuit high input (Refer to P.13F-36).

Code No. P0102: Air Flow Sensor Circuit Low Input

OPERATION

- Power is supplied by the engine control relay to the air flow sensor, and the air flow sensor is earthed through the engine-ECU connector terminal AFSE.
- The air flow sensor outputs a sensor signal, which is input into the engine-ECU connector terminal AFS.

FUNCTION

- The air flow sensor outputs current that varies in accordance with the intake air volume.
- The engine-ECU uses the amperage output by the air flow sensor and the engine speed signal in order to determine the basic injection duration of the injector.

TROUBLE JUDGEMENT

Check Condition

- More than 3 seconds have passed since the ignition switch was turn to "ON" position.

Judgement Criterion

- Air flow sensor output voltage is less than 0.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.
- Engine output is restricted.

PROBABLE CAUSES

- Failed air flow sensor
- Open/short circuit or harness damage in air flow sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 10: Air flow sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Voltage measurement at air flow sensor connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the air flow sensor connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between engine control relay connector and air flow sensor connector.

STEP 3. Resistance measurement at air flow sensor connector (AFSE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the air flow sensor connector (AFSE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check of open circuit and damage in AFSE line between air flow sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 10: Air flow sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 6. Check of harness damage in power supply line between engine control relay connector and air flow sensor connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Check of short to earth, open circuit and damage in AFS line between air flow sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair the connector(s) or wiring harness.

STEP 8. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Go to Step 9.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 9. Replace the air flow sensor

- After replacing the air flow sensor, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0103: Air Flow Sensor Circuit High Input

OPERATION

- Power is supplied by the engine control relay to the air flow sensor, and the air flow sensor is earthed through the engine-ECU connector terminal AFSE.
- The air flow sensor outputs a sensor signal, which is input into the engine-ECU connector terminal AFS.

FUNCTION

- The air flow sensor outputs current that varies in accordance with the intake air volume.
- The engine-ECU uses the amperage output by the air flow sensor and the engine speed signal in order to determine the basic injection duration of the injector.

TROUBLE JUDGEMENT

Check Condition

- More than 3 seconds have passed since the ignition switch was turned to "ON" position.

Judgement Criterion

- Air flow sensor output voltage is more than 4.9 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.
- Engine output is restricted.

PROBABLE CAUSES

- Failed air flow sensor
- Open/short circuit in air flow sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 10: Air flow sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Resistance measurement at air flow sensor connector (AFSE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the air flow sensor connector (AFSE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of open circuit and damage in AFSE line between air flow sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 10: Air flow sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check of short to earth in AFS line between air flow sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Go to Step 7.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 7. Replace the air flow sensor

- After replacing the air flow sensor, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0107: Manifold Absolute Pressure Sensor Circuit Low Input

OPERATION

- A power voltage of 5 V is applied to the manifold absolute pressure sensor power terminal from the engine-ECU connector terminal MAP5 and earthed to the engine-ECU connector terminal MAPE from the manifold absolute pressure sensor.
- The sensor signal is inputted to the engine-ECU connector terminal MAP from the manifold absolute pressure sensor output terminal.

FUNCTION

- The manifold absolute pressure sensor detects a change in inlet manifold pressure and inputs the signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.

TROUBLE JUDGEMENT

- Engine coolant temperature is more than 0°C at the engine starts.

or

Check Conditions

- More than 8 minutes have passed since the engine starting sequence was completed, when the engine coolant temperature at engine start is less than 0°C.
- Volumetric efficiency is more than 20 %.

Judgement Criterion

- Manifold absolute pressure is 5 kPa or lower for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Control as if the inlet manifold vacuum pressure is 101 kPa.

PROBABLE CAUSES

- Failed manifold absolute pressure sensor
- Open/short circuit or harness damage in manifold absolute pressure sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 8: Manifold absolute pressure sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Voltage measurement at manifold absolute pressure sensor connector (MAP5 line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the manifold absolute pressure sensor connector (MAP5 line) and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of short to earth, and open circuit in MAP5 line between manifold absolute pressure sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 8: Manifold absolute pressure sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Resistance measurement at manifold absolute pressure sensor connector (MAPE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the manifold absolute pressure sensor connector (MAPE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 7.
NO : Go to Step 6.

STEP 6. Check of harness damage in MAPE line between manifold absolute pressure sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 7. Check of harness damage in MAP5 line between manifold absolute pressure sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair the connector(s) or wiring harness.

STEP 8. Check of short to earth, open circuit and damage in MAP line between manifold absolute pressure sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair the connector(s) or wiring harness.

STEP 9. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Go to Step 10.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 10. Replace the manifold absolute pressure sensor

- After replacing the manifold absolute pressure sensor, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0108: Manifold Absolute Pressure Sensor Circuit High Input

OPERATION

- A power voltage of 5 V is applied to the manifold absolute pressure sensor power terminal from the engine-ECU connector terminal MAP5 and earthed to the engine-ECU connector terminal MAPE from the manifold absolute pressure sensor.
- The sensor signal is inputted to the engine-ECU connector terminal MAP from the manifold absolute pressure sensor output terminal.

FUNCTION

- The manifold absolute pressure sensor detects a change in inlet manifold pressure and inputs the signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.

TROUBLE JUDGEMENT

- Engine coolant temperature is more than 0°C at the engine starts.

or

Check Condition

- More than 8 minutes have passed since the engine starting sequence was completed, when the engine coolant temperature at engine start is less than 0°C.

Judgement Criterion

- Manifold absolute pressure is 117 kPa or higher for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Control as if the inlet manifold vacuum pressure is 101 kPa.

PROBABLE CAUSES

- Failed manifold absolute pressure sensor
- Open circuit in manifold absolute pressure sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 8: Manifold absolute pressure sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Resistance measurement at manifold absolute pressure sensor connector (MAPE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the manifold absolute pressure sensor connector (MAPE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of open circuit in MAPE line between manifold absolute pressure sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 8: Manifold absolute pressure sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code stored?
YES : Go to Step 6.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. Replace the manifold absolute pressure sensor
- After replacing the manifold absolute pressure sensor, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0112: Intake Air Temperature Sensor Circuit Low Input

OPERATION
- A power voltage of 5 V is applied to the intake air temperature sensor power terminal of air flow sensor from the engine-ECU connector terminal ATS.
- The power voltage is earthed to the engine-ECU connector terminal AFSE from the intake air temperature sensor.

FUNCTION
- The intake air temperature sensor converts the intake air temperature into a voltage and inputs the voltage signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.
- The intake air temperature sensor is a kind of resistor, which has characteristics to reduce its resistance as the intake air temperature rises. Therefore, the sensor output voltage varies with the intake air temperature, and becomes lower as the intake air temperature rises.

TROUBLE JUDGEMENT

Check Condition
- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion
- Intake air temperature sensor output voltage is less than 0.2 V for 2 seconds, which means that actual intake air temperature is more than 115°C for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Control as if the intake air temperature is 25°C.

PROBABLE CAUSES
- Failed intake air temperature sensor
- Short circuit or harness damage in intake air temperature sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Item 5: Intake air temperature sensor

OK: At ambient temperature (atmospheric temperature) or equivalent.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check intake air temperature sensor itself.
- Check intake air temperature sensor itself (Refer to P.13F-218).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the air flow sensor.

STEP 3. Voltage measurement at air flow sensor connector (ATS line).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the air flow sensor connector (ATS line) and body earth.

OK: 4.5 – 4.9 V

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check of short circuit to earth in ATS line between air flow sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III data list
- Item 5: Intake air temperature sensor

OK: At ambient temperature (atmospheric temperature) or equivalent.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 6. Resistance measurement at air flow sensor connector (AFSE line).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the air flow sensor connector (AFSE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check of harness damage in AFSE line between air flow sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 8. Check of harness damage in ATS line between air flow sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

Code No. P0113: Intake Air Temperature Sensor Circuit High Input

OPERATION
- A power voltage of 5 V is applied to the intake air temperature sensor power terminal of air flow sensor from the engine-ECU connector terminal ATS.
- The power voltage is earthed to the engine-ECU connector terminal AFSE from the intake air temperature sensor.

FUNCTION
- The intake air temperature sensor converts the intake air temperature into a voltage and inputs the voltage signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.
- The intake air temperature sensor is a kind of resistor, which has characteristics to reduce its resistance as the intake air temperature rises. Therefore, the sensor output voltage varies with the intake air temperature, and becomes lower as the intake air temperature rises.

TROUBLE JUDGEMENT

Check Condition
- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion
- Intake air temperature sensor output voltage is more than 4.6 V for 2 seconds, which means that actual intake air temperature is less than –40°C for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Control as if the intake air temperature is 25°C.

PROBABLE CAUSES
- Failed intake air temperature sensor
- Open circuit in intake air temperature sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Item 5: Intake air temperature sensor

  OK: At ambient temperature (atmospheric temperature) or equivalent.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check intake air temperature sensor itself.

- Check intake air temperature sensor itself (Refer to P.13F-218).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the air flow sensor.

STEP 3. Voltage measurement at air flow sensor connector (ATS line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the air flow sensor connector (ATS line) and body earth.

OK: 4.5 – 4.9 V

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check of open circuit in ATS line between air flow sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III data list

- Item 5: Intake air temperature sensor

  OK: At ambient temperature (atmospheric temperature) or equivalent.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 6. Resistance measurement at air flow sensor connector (AFSE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the air flow sensor connector (AFSE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 7.

STEP 7. Check of open circuit in AFSE line between air flow sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

Code No. P0117: Engine Coolant Temperature Sensor Circuit Low Input

OPERATION

- A power voltage of 5 V is applied to the engine coolant temperature sensor power terminal from the engine-ECU connector terminal WTS.
- The power voltage is earthed to the engine-ECU connector terminal WTSE from the engine coolant temperature sensor.

FUNCTION

- The engine coolant temperature sensor converts the engine coolant temperature into a voltage signal, and inputs the voltage to the engine-ECU.
- In response to the signal, the engine-ECU controls the fuel injection amount and the fast idle speed when the engine is cold state.
- The engine coolant temperature sensor is a kind of resistor, which has characteristics to reduce its resistance as the engine coolant temperature rises. Therefore, the sensor output voltage varies with the engine coolant temperature, and becomes lower as the engine coolant temperature rises.

TROUBLE JUDGEMENT

Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Engine coolant temperature sensor output voltage is less than 0.1 V for 2 seconds., which means that actual engine coolant temperature is more than 140°C for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Control as if the engine coolant temperature is 80°C.

PROBABLE CAUSES

- Failed engine coolant temperature sensor
- Short circuit or harness damage in engine coolant temperature sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Item 6: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120°C

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check engine coolant temperature sensor itself.

- Engine coolant temperature sensor check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the engine coolant temperature sensor.

STEP 3. Voltage measurement at engine coolant temperature sensor connector (WTS line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the engine coolant temperature sensor connector (WTS line) and body earth.

OK: 4.5 – 4.9 V

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check of short circuit to earth in WTS line between engine coolant temperature sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III data list

- Item 6: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120 °C

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 6. Resistance measurement at engine coolant temperature sensor connector (WTSE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the engine coolant temperature sensor connector (WTSE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check of harness damage in WTSE line between engine coolant temperature sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 8. Check of harness damage in WTS line between engine coolant temperature sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

Code No. P0118: Engine Coolant Temperature Sensor Circuit High Input

OPERATION

- A power voltage of 5 V is applied to the engine coolant temperature sensor power terminal from the engine-ECU connector terminal WTS.
- The power voltage is earthed to the engine-ECU connector terminal WTSE from the engine coolant temperature sensor.

FUNCTION

- The engine coolant temperature sensor converts the engine coolant temperature into a voltage signal, and inputs the voltage to the engine-ECU.
- In response to the signal, the engine-ECU controls the fuel injection amount and the fast idle speed when the engine is cold state.
- The engine coolant temperature sensor is a kind of resistor, which has characteristics to reduce its resistance as the engine coolant temperature rises. Therefore, the sensor output voltage varies with the engine coolant temperature, and becomes lower as the engine coolant temperature rises.

TROUBLE JUDGEMENT

Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Engine coolant temperature sensor output voltage is more than 4.6 V for 2 seconds, which means that actual engine coolant temperature is less than –45°C for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Control as if the engine coolant temperature is 80°C.

PROBABLE CAUSES

- Failed engine coolant temperature sensor
- Open circuit in engine coolant temperature sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Item 6: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120°C

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check engine coolant temperature sensor itself.

- Engine coolant temperature sensor check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the engine coolant temperature sensor.

STEP 3. Voltage measurement at engine coolant temperature sensor connector (WTS line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the engine coolant temperature sensor connector (WTS line) and body earth.

OK: 4.5 – 4.9 V

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check of open circuit in WTS line between engine coolant temperature sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III data list

- Item 6: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120 °C

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 6. Resistance measurement at engine coolant temperature sensor connector (WTSE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the engine coolant temperature sensor connector (WTSE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 7.

STEP 7. Check of open circuit in WTSE line between engine coolant temperature sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

Code No. P0121: Trustful Check Throttle Position Sensor (main)

FUNCTION

- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (main) signal.

TROUBLE JUDGEMENT

Check Conditions

- Engine is running.
- Air flow sensor is normal.

Judgement Criterion

- The difference between volumetric efficiency (actual measurement) by the air flow sensor and volumetric efficiency estimated from the throttle position sensor (main) exceeds the specified value.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (sub) fails.

PROBABLE CAUSES

- Failed throttle position sensor (main)
- Harness damage in throttle position sensor (main) circuit or loose connector contact
- Failed intake air system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P0121 stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 13: Throttle position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 3.

STEP 3. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Repair.

Code No. P0122: Throttle Position Sensor (main) Circuit Low Input

OPERATION

- A power voltage of 5 V is applied to the electronic-controlled throttle valve from the engine-ECU connector terminal TPS5.
- The power voltage is earthed to the engine-ECU connector terminal TPSE from the electronic-controlled throttle valve.
- The sensor signal is inputted to the engine-ECU connector terminal TPSM from the electronic-controlled throttle valve output terminal.

FUNCTION

- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve opening angle.

TROUBLE JUDGEMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Throttle position sensor (main) output voltage is less than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (sub) fails.

PROBABLE CAUSES

- Failed throttle position sensor (main)
- Open/short circuit or harness damage in throttle position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 13: Throttle position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Voltage measurement at electronic-controlled throttle valve connector (TPS5 line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the electronic-controlled throttle valve connector (TPS5 line) and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of short to earth and open circuit in TPS5 line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 13: Throttle position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check of harness damage in TPS5 line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check of short to earth, open circuit and damage in TPSM line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Replace the electronic-controlled throttle valve

- After replacing the electronic-controlled throttle valve, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0123: Throttle Position Sensor (main) Circuit High Input

OPERATION

- A power voltage of 5 V is applied to the electronic-controlled throttle valve from the engine-ECU connector terminal TPS5.
- The power voltage is earthed to the engine-ECU connector terminal TPSE from the electronic-controlled throttle valve.
- The sensor signal is inputted to the engine-ECU connector terminal TPSM from the electronic-controlled throttle valve output terminal.

FUNCTION

- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve opening angle.

TROUBLE JUDGEMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Throttle position sensor (main) output voltage is more than 4.8 V.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (sub) fails.

PROBABLE CAUSES

- Failed throttle position sensor (main)
- Open circuit or harness damage in throttle position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 13: Throttle position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Resistance measurement at electronic-controlled throttle valve connector (TPSE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the electronic-controlled throttle valve connector (TPSE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of open circuit and damage in TPSE line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 13: Throttle position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Replace the electronic-controlled throttle valve

- After replacing the electronic-controlled throttle valve, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0131: Right Bank Oxygen Sensor (front) Circuit Low Voltage

OPERATION

- The sensor signal is inputted to the engine-ECU connector terminal O2FL from the right bank oxygen sensor (front) output terminal.
- The right bank oxygen sensor (front) is earthed with engine-ECU connector terminal OFLE.
- The engine-ECU connector terminal OFLE applies an offset voltage of 0.5 V to the right bank oxygen sensor (front).

FUNCTION

- The right bank oxygen sensor (front) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the right bank oxygen sensor (front) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGEMENT

Check Conditions

- Right bank oxygen sensor (front) offset voltage is more than 0.4 V and is less than 0.6 V.
- Battery positive voltage is more than 11 V and is less than 16.5 V.
- Typically 60 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Right bank oxygen sensor (front) output voltage is less than 0.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed right bank oxygen sensor (front)
- Open/short circuit or harness damage in right bank oxygen sensor (front) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AC: Right bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Voltage measurement at right bank oxygen sensor (front) connector (OFLE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the right bank oxygen sensor (front) connector (OFLE line) and body earth.

OK: 0.4 – 0.6 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of short to earth and open circuit in OFLE line between right bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AC: Right bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check of harness damage in OFLE line between right bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Voltage measurement at right bank oxygen sensor (front) connector (O2FL line).
(1) Use special tool test harness (MB991316) to connect connector, and measure at pick-up harness.
(2) Engine: After warm-up
(3) Transmission: P range
(4) Check the voltage between the right bank oxygen sensor (front) connector (O2FL line) and body earth.

OK:
When the engine is 2,500 r/min, the output voltage should repeat 0.9 V or less ⇔ 1.1 to 1.5 V alternately.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check right bank oxygen sensor (front) itself.
- Right bank oxygen sensor (front) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Repair or replace the connector(s), or check and repair the harness of short circuit to earth in O2FL line between right bank oxygen sensor (front) connector and engine-ECU connector.
NO : Replace the right bank oxygen sensor (front).

STEP 8. Check of open circuit and damage in O2FL line between right bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

Code No. P0132: Right Bank Oxygen Sensor (front) Circuit High Voltage

OPERATION
- The sensor signal is inputted to the engine-ECU connector terminal O2FL from the right bank oxygen sensor (front) output terminal.
- The right bank oxygen sensor (front) is earthed with engine-ECU connector terminal OFLE.
- The engine-ECU connector terminal OFLE applies an offset voltage of 0.5 V to the right bank oxygen sensor (front).

FUNCTION
- The right bank oxygen sensor (front) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the right bank oxygen sensor (front) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGEMENT
Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- Right bank oxygen sensor (front) offset voltage is more than 0.4 V and is less than 3.8 V.

Judgement Criterion
- Right bank oxygen sensor (front) output voltage is more than 1.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed right bank oxygen sensor (front)
- Short circuit in right bank oxygen sensor (front) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item AC: Right bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check of short circuit to power supply in O2FL line between right bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check of short circuit to power supply in OFLE line between right bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item AC: Right bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0133: Right Bank Oxygen Sensor (front) Circuit Slow Response

OPERATION
- The sensor signal is inputted to the engine-ECU connector terminal O2FL from the right bank oxygen sensor (front) output terminal.
- The right bank oxygen sensor (front) is earthed with engine-ECU connector terminal OFLE.
- The engine-ECU connector terminal OFLE applies an offset voltage of 0.5 V to the right bank oxygen sensor (front).

FUNCTION
- The right bank oxygen sensor (front) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the right bank oxygen sensor (front) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGEMENT

Check Conditions
- Engine coolant temperature is more than 60°C.
- Engine speed is more than 1,250 r/min and is less than 3,500 r/min.
- Volumetric efficiency is more than 25 % and is less than 65 %.
- Under the closed loop air/fuel control.
- The accelerator pedal is open.
- Short-term fuel trim is more than –25 % and is less than +25 %.
- More than 2 seconds have elapsed after the above mentioned conditions have been met.
- The engine-ECU monitors for this condition for 5 cycles of 12 seconds each during the drive cycle.

Judgement Criterion
- The average of the right bank oxygen sensor (front) rich/lean switching frequency is less than 11 times per 12 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed right bank oxygen sensor (front)
- Loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item AC: Right bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check right bank oxygen sensor (front) itself.
- Right bank oxygen sensor (front) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the right bank oxygen sensor (front).

STEP 3. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item AC: Right bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0134: Right Bank Oxygen Sensor (front) Circuit No Activity Detected

OPERATION
- Check code No. P0131: right bank oxygen sensor (front) circuit low voltage (Refer to P.13F-49).
- Check code No. P0261: No. 1 injector circuit low input (Refer to P.13F-73).
- Check code No. P0267: No. 3 injector circuit low input (Refer to P.13F-77).
- Check code No. P0273: No. 5 injector circuit low input (Refer to P.13F-82).

FUNCTION
- The engine-ECU effects air/fuel ratio feedback control in accordance with the signals from the right bank oxygen sensor (front).
- If the right bank oxygen sensor (front) has deteriorated, corrections will be made by the right bank oxygen sensor (rear).
- Code No. P0134 becomes stored in memory if a failure is detected in the above air/fuel ratio feedback control system.

TROUBLE JUDGEMENT

Check Conditions
- Typically 20 seconds have passed since the engine starting sequence was completed.
- Engine coolant temperature is more than 76°C.
- Engine speed is more than 1,200 r/min.
- Volumetric efficiency is more than 30 %.
- Except while fuel is being shut off.
- Monitoring time: 30 seconds.

Judgement Criterion
- Right bank oxygen sensor (front) output voltage does not get across lean/rich criteria (about 0.5 V) within about 30 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed right bank oxygen sensor (front)
- Harness damage in right bank oxygen sensor (front) circuit
- Failed right bank injector
- Harness damage in right bank injector circuit
- Exhaust leak
- Air drawn in from gaps in gasket, seals, etc.
- Incorrect fuel pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item AC: Right bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check for exhaust leaks.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair.

STEP 3. Check for intake system vacuum leak.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair.

STEP 4. Check right bank oxygen sensor (front) itself.
- Right bank oxygen sensor (front) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 5.
NO : Replace the right bank oxygen sensor (front).

STEP 5. Check No. 1, No. 3 and No. 5 injector itself.
- No. 1, No. 3 and No. 5 injector check (Refer to P.13F-223).

Q: Are the check results normal?
YES : Go to Step 6.
NO : Replace the injectors.

STEP 6. Check of harness damage in O2FL line between right bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Check of harness damage in INJ1, INJ3 and INJ5 line between injector connectors and engine-ECU connector.

Q: Are the check result normal?
YES : Go to Step 8.
NO : Repair the connector(s) or wiring harness.

STEP 8. Fuel pressure measurement.
- Fuel pressure test (Refer to P.13F-213).

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Repair.

Code No. P0137: Right Bank Oxygen Sensor (rear) Circuit Low Voltage

OPERATION

- The sensor signal is inputted to the engine-ECU connector terminal O2RL from the right bank oxygen sensor (rear) output terminal.
- The right bank oxygen sensor (rear) is earthed with engine-ECU connector terminal ORLE.
- The engine-ECU connector terminal ORLE applies an offset voltage of 0.5 V to the right bank oxygen sensor (rear) connector terminal.

FUNCTION

- The right bank oxygen sensor (rear) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the right bank oxygen sensor (rear) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGEMENT

Check Conditions

- Right bank oxygen sensor (rear) offset voltage is more than 0.4 V and is less than 0.6 V.
- Battery positive voltage is more than 11 V and is less than 16.5 V.
- More than 3 minutes have passed since the engine starting sequence was completed.

Judgement Criterion

- Right bank oxygen sensor (rear) output voltage is less than 0.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed right bank oxygen sensor (rear)
- Open/short circuit or harness damage in right bank oxygen sensor (rear) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AD: Right bank oxygen sensor (rear)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Voltage measurement at right bank oxygen sensor (rear) connector (ORLE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the right bank oxygen sensor (rear) connector (ORLE line) and body earth.

OK: 0.4 – 0.6 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of short to earth and open circuit in ORLE line between right bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AD: Right bank oxygen sensor (rear)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check of harness damage in ORLE line between right bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Voltage measurement at right bank oxygen sensor (rear) connector (O2RL line).
(1) Use special tool test harness (MD998464) to connect connector, and measure at pick-up harness.
(2) Transmission: 2nd speed
(3) Drive with wide open throttle
(4) Engine: 3,500 r/min or more
(5) Check the voltage between the right bank oxygen sensor (rear) connector (O2RL line) and body earth.

OK:
The output voltage should be 1.1 – 1.5 V.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check right bank oxygen sensor (rear) itself.
- Right bank oxygen sensor (rear) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Repair or replace the connector(s), or check and repair the harness of short circuit in O2RL line between right bank oxygen sensor (rear) connector and engine-ECU connector.
NO : Replace the right bank oxygen sensor (rear).

STEP 8. Check of open circuit and damage in O2RL line between right bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

Code No. P0138: Right Bank Oxygen Sensor (rear) Circuit High Voltage

OPERATION
- The sensor signal is inputted to the engine-ECU connector terminal O2RL from the right bank oxygen sensor (rear) output terminal.
- The right bank oxygen sensor (rear) is earthed with engine-ECU connector terminal ORLE.
- The engine-ECU connector terminal ORLE applies an offset voltage of 0.5 V to the right bank oxygen sensor (rear) connector terminal.

FUNCTION
- The right bank oxygen sensor (rear) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the right bank oxygen sensor (rear) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGEMENT
Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- Right bank oxygen sensor (rear) offset voltage is more than 0.4 V and is less than 3.8 V.

Judgement Criterion
- Right bank oxygen sensor (rear) output voltage is more than 1.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed right bank oxygen sensor (rear)
- Short circuit in right bank oxygen sensor (rear) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item AD: Right bank oxygen sensor (rear)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check of short circuit to power supply in O2RL line between right bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check of short circuit to power supply in ORLE line between right bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item AD: Right bank oxygen sensor (rear)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0151: Left Bank Oxygen Sensor (front) Circuit Low Voltage

OPERATION
- The sensor signal is inputted to the engine-ECU connector terminal O2FL from the left bank oxygen sensor (front) output terminal.
- The left bank oxygen sensor (front) is earthed with engine-ECU connector terminal OFLE.
- The engine-ECU connector terminal OFLE applies an offset voltage of 0.5 V to the left bank oxygen sensor (front).

FUNCTION
- The left bank oxygen sensor (front) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the left bank oxygen sensor (front) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGEMENT

Check Conditions
- Left bank oxygen sensor (front) offset voltage is more than 0.4 V and is less than 0.6 V.
- Battery positive voltage is more than 11 V and is less than 16.5 V.
- Typically 60 seconds have passed since the engine starting sequence was completed.

Judgement Criterion
- Left bank oxygen sensor (front) output voltage is less than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed left bank oxygen sensor (front)
- Open/short circuit or harness damage in left bank oxygen sensor (front) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AE: Left bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Voltage measurement at left bank oxygen sensor (front) connector (OFLE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the left bank oxygen sensor (front) connector (OFLE line) and body earth.

OK: 0.4 – 0.6 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of short to earth and open circuit in OFLE line between left bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AE: Left bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check of damage in OFLE line between left bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Voltage measurement at left bank oxygen sensor (front) connector (O2FL line).

(1) Use special tool test harness (MD998464) to connect connector, and measure at pick-up harness.
(2) Engine: After warm-up
(3) Transmission: P range
(4) Check the voltage between the left bank oxygen sensor (front) connector (O2FL line) and body earth.

OK:
When the engine is 2,500 r/min, the output voltage should repeat 0.9 V or less ⇔ 1.1 to 1.5 V alternately.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check left bank oxygen sensor (front) itself.

- Left bank oxygen sensor (front) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Repair or replace the connector(s), or check and repair the harness of short circuit to earth in O2FL line between left bank oxygen sensor (front) connector and engine-ECU connector.
NO : Replace the left bank oxygen sensor (front).

STEP 8. Check of open circuit and damage in O2FL line between left bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

Code No. P0152: Left Bank Oxygen Sensor (front) Circuit High Voltage

OPERATION

- The sensor signal is inputted to the engine-ECU connector terminal O2FL from the left bank oxygen sensor (front) output terminal.
- The left bank oxygen sensor (front) is earthed with engine-ECU connector terminal OFLE.
- The engine-ECU connector terminal OFLE applies an offset voltage of 0.5 V to the left bank oxygen sensor (front).

FUNCTION

- The left bank oxygen sensor (front) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the left bank oxygen sensor (front) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGEMENT

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- Left bank oxygen sensor (front) offset voltage is more than 0.4 V and is less than 3.8 V.

Judgement Criterion

- Left bank oxygen sensor (front) output voltage is less than 1.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed left bank oxygen sensor (front)
- Short circuit in left bank oxygen sensor (front) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AE: Left bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check of short circuit to power supply in O2FL line between left bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check of short circuit to power supply in OFLE line between left bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AE: Left bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0153: Left Bank Oxygen Sensor (front) Circuit Slow Response

OPERATION

- The sensor signal is inputted to the engine-ECU connector terminal O2FL from the left bank oxygen sensor (front) output terminal.
- The left bank oxygen sensor (front) is earthed with engine-ECU connector terminal OFLE.
- The engine-ECU connector terminal OFLE applies an offset voltage of 0.5 V to the left bank oxygen sensor (front).

FUNCTION

- The left bank oxygen sensor (front) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the left bank oxygen sensor (front) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGEMENT

Check Conditions

- Engine coolant temperature is more than 60°C.
- Engine speed is more than 1,250 r/min and is less than 3,500 r/min.
- Volumetric efficiency is more than 25 % and is less than 65 %.
- Under the closed loop air/fuel control.
- The accelerator pedal is open.
- Short-term fuel trim is more than –25 % and is less than +25 %.
- More than 2 seconds have elapsed after the above mentioned conditions have been met.
- The engine-ECU monitors for this condition for 5 cycles of 12 seconds each during the drive cycle.

Judgement Criterion

- The average of the left bank oxygen sensor (front) rich/lean switching frequency is less than 6 times per 12 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed left bank oxygen sensor (front)
- Loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AE: Left bank oxygen sensor (front)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Check left bank oxygen sensor (front) itself.

- Left bank oxygen sensor (front) check (Refer to P.13F-219).

Q: Is the check result normal?

YES : Go to Step 3.

NO : Replace the left bank oxygen sensor (front).

STEP 3. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AE: Left bank oxygen sensor (front)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

Code No. P0154: Left Bank Oxygen Sensor (Front) Circuit No Activity Detected

OPERATION

- Check code No. P0151: left bank oxygen sensor (front) circuit low voltage (Refer to P.13F-56).
- Check code No. P0264: No. 2 injector circuit low input (Refer to P.13F-75).
- Check code No. P0270: No. 4 injector circuit low input (Refer to P.13F-80).
- Check code No. P0276: No. 6 injector circuit low input (Refer to P.13F-84).

FUNCTION

- The engine-ECU effects air/fuel ratio feedback control in accordance with the signals from the left bank oxygen sensor (front).
- If the left bank oxygen sensor (front) has deteriorated, corrections will be made by the left bank oxygen sensor (rear).
- Code No. P0154 becomes stored in memory if a failure is detected in the above air/fuel ratio feedback control system.

TROUBLE JUDGEMENT

Check Conditions

- Typically 20 seconds have passed since the engine starting sequence was completed.
- Engine coolant temperature is more than 76°C.
- Engine speed is more than 1,200 r/min.
- Volumetric efficiency is more than 30 %.
- Except while fuel is being shut off.
- Monitoring time: 30 seconds.

Judgement Criterion

- Left bank oxygen sensor (front) output voltage does not get across lean/rich criteria (about 0.5 V) within about 30 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed left bank oxygen sensor (front)
- Harness damage in left bank oxygen sensor (front) circuit
- Failed left bank injector
- Harness damage in left bank injector circuit
- Exhaust leak
- Air drawn in from gaps in gasket, seals, etc.
- Incorrect fuel pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AE: Left bank oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check for exhaust leaks.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair.

STEP 3. Check for intake system vacuum leak.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair.

STEP 4. Check left bank oxygen sensor (front) itself.

- Left bank oxygen sensor (front) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Go to Step 5.
NO : Replace the left bank oxygen sensor (front).

STEP 5. Check No. 2, No. 4 and No. 6 injector itself.

- No. 2, No. 4 and No. 6 injector check (Refer to P.13F-223).

Q: Are the check results normal?
YES : Go to Step 6.
NO : Replace the injectors.

STEP 6. Check of damage in O2FL line between left bank oxygen sensor (front) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Check of damage in INJ2, INJ4 and INJ6 line between injector connectors and engine-ECU connector.

Q: Are the check result normal?
YES : Go to Step 8.
NO : Repair the connector(s) or wiring harness.

STEP 8. Fuel pressure measurement.
- Fuel pressure test (Refer to P.13F-213).

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Repair.

Code No. P0157: Left Bank Oxygen Sensor (rear) Circuit Low Voltage

OPERATION
- The sensor signal is inputted to the engine-ECU connector terminal O2RL from the left bank oxygen sensor (rear) output terminal.
- The left bank oxygen sensor (rear) is earthed with engine-ECU connector terminal ORLE.
- The engine-ECU connector terminal ORLE applies an offset voltage of 0.5 V to the left bank oxygen sensor (rear) connector terminal.

FUNCTION
- The left bank oxygen sensor (rear) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the left bank oxygen sensor (rear) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGEMENT

Check Conditions
- Left bank oxygen sensor (rear) offset voltage is more than 0.4 V and is less than 0.6 V.
- Battery positive voltage is more than 11 V and is less than 16.5 V.
- More than 3 minutes have passed since the engine starting sequence was completed.

Judgement Criterion
- Left bank oxygen sensor (rear) output voltage is less than 0.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed left bank oxygen sensor (rear)
- Open/short circuit or harness damage in left bank oxygen sensor (rear) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item AF: Left bank oxygen sensor (rear)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Voltage measurement at left bank oxygen sensor (rear) connector (ORLE line).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the left bank oxygen sensor (rear) connector (ORLE line) and body earth.

OK: 0.4 – 0.6 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of short to earth and open circuit in ORLE line between left bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AF: Left bank oxygen sensor (rear)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check of harness damage in ORLE line between left bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Voltage measurement at left bank oxygen sensor (rear) connector (O2RL line).

(1) Use special tool test harness (MB991316) to connect connector, and measure at pick-up harness.
(2) Transmission: 2nd speed
(3) Drive with wide open throttle
(4) Engine: 3,500 r/min or more
(5) Check the voltage between the left bank oxygen sensor (rear) connector (O2RL line) and body earth.

OK:
The output voltage should be 1.1 – 1.5 V.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check left bank oxygen sensor (rear) itself.

- Left bank oxygen sensor (rear) check (Refer to P.13F-219).

Q: Is the check result normal?
YES : Repair or replace the connector(s), or check and repair the harness of short circuit to earth in O2RL line between left bank oxygen sensor (rear) connector and engine-ECU connector.
NO : Replace the left bank oxygen sensor (rear).

STEP 8. Check of open circuit and damage in O2RL line between left bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

Code No. P0158: Left Bank Oxygen Sensor (rear) Circuit High Voltage

OPERATION

- The sensor signal is inputted to the engine-ECU connector terminal O2RL from the left bank oxygen sensor (rear) output terminal.
- The left bank oxygen sensor (rear) is earthed with engine-ECU connector terminal ORLE.
- The engine-ECU connector terminal ORLE applies an offset voltage of 0.5 V to the left bank oxygen sensor (rear) connector terminal.

FUNCTION

- The left bank oxygen sensor (rear) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the left bank oxygen sensor (rear) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGEMENT

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- Left bank oxygen sensor (rear) offset voltage is more than 0.4 V and is less than 3.8 V.

Judgement Criterion

- Left bank oxygen sensor (rear) output voltage is more than 1.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed left bank oxygen sensor (rear)
- Short circuit in left bank oxygen sensor (rear) heater circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AF: Left bank oxygen sensor (rear)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check of short circuit to power supply in O2RL line between left bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check of short circuit to power supply in ORLE line between left bank oxygen sensor (rear) connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AF: Left bank oxygen sensor (rear)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0171: Right Bank Abnormal Fuel System (lean)

OPERATION
- Check code No. P0261: No. 1 injector circuit low input (Refer to P.13F-73).
- Check code No. P0267: No. 3 injector circuit low input (Refer to P.13F-77).
- Check code No. P0273: No. 5 injector circuit low input (Refer to P.13F-82).

FUNCTION
- If the fuel system goes out of order, the fuel correction value will become larger.
- The engine-ECU checks whether the fuel trim value is within a specified range.

TROUBLE JUDGEMENT

Check Conditions
- Engine coolant temperature is less than 100°C when the engine is started.
- Intake air temperature is less than 60°C when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76°C.
- Air flow sensor output is more than 7.7 g/sec.

Judgement Criterion
- Long-term fuel trim is more than +12.5 % for 5 seconds.

or
- Short-term fuel trim is more than +10.0 % for 5 seconds.

Check Conditions
- Engine coolant temperature is less than 100°C when the engine is started.
- Intake air temperature is less than 60°C when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76°C.
- Air flow sensor output is less than 7.7 g/sec.

Judgement Criterion
- Long-term fuel trim is more than +12.5 % for 5 seconds.

or
- Short-term fuel trim is more than +20.0 % for 5 seconds.

Check Conditions
- Engine coolant temperature is more than 76°C.
- Under the closed loop air/fuel ratio control.

Judgement Criterion
- Long-term fuel trim is +12.5 % for 2 seconds.

or
- Short-term fuel trim is +25.0 % for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed intake air temperature sensor
- Failed air flow sensor
- Failed No. 1, No. 3 and No. 5 injector
- Air drawn in from gaps in gasket, seals, etc.
- Failed engine coolant temperature sensor
- Failed manifold absolute pressure sensor
- Failed barometric pressure sensor
- Exhaust leak
- Incorrect fuel pressure
- Use of incorrect or contaminated fuel
- Harness damage in injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check for exhaust leaks

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair.

STEP 2. Check for intake system vacuum leaks.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair.

STEP 3. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor

Q: Are the check results normal?
YES : Go to Step 4.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13F-21).

STEP 4. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item BB: Barometric pressure sensor

Q: Is the check result normal?
YES : Go to Step 5.
NO : Replace the engine-ECU.

STEP 5. Check No. 1, No. 3 and No. 5 injector itself.
- No. 1, No. 3 and No. 5 injector check (Refer to P.13F-223).

Q: Are the check results normal?
YES : Go to Step 6.
NO : Replace the injectors.

STEP 6. Check of harness damage in INJ1, INJ3 and INJ5 line between injector connectors and engine-ECU connector.

Q: Are the check results normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Fuel pressure measurement.
- Fuel pressure test (Refer to P.13F-213).

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair.

STEP 8. Check fuel.
- Check for entry of foreign matter (water, diesel fuel, etc.) into fuel.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Replace the fuel.

STEP 9. Replace No. 1, No. 3 and No. 5 injectors.
- After replacing the injectors, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0172: Right Bank Abnormal Fuel System (rich)

OPERATION
- Check code No. P0261: No. 1 injector circuit low input (Refer to P.13F-73).
- Check code No. P0267: No. 3 injector circuit low input (Refer to P.13F-77).
- Check code No. P0273: No. 5 injector circuit low input (Refer to P.13F-82).

FUNCTION
- If the fuel system goes out of order, the fuel correction value will become larger.
- The engine-ECU checks whether the fuel trim value is within a specified range.

TROUBLE JUDGEMENT

Check Conditions
- Engine coolant temperature is less than 100°C when the engine is started.
- Intake air temperature is less than 60°C when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76°C.
- Air flow sensor output is more than 7.7 g/sec.

Judgement Criterion
- Long-term fuel trim is less than –12.5 % for 5 seconds.

or
- Short-term fuel trim is less than –10.0 % for 5 seconds.

Check Conditions
- Engine coolant temperature is less than 100°C when the engine is started.
- Intake air temperature is less than 60°C when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76°C.
- Air flow sensor output is less than 7.7 g/sec.

Judgement Criterion
- Long-term fuel trim is less than –12.5 % for 5 seconds.

or
- Short-term fuel trim is less than –10.0 % for 5 seconds.

Check Conditions
- Engine coolant temperature is more than 76°C.
- Under the closed loop air/fuel ratio control.

Judgement Criterion
- Long-term fuel trim is –12.5 % for 2 seconds.

or
- Short-term fuel trim is –25.0 % for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed intake air temperature sensor
- Failed air flow sensor
- Failed No. 1, No. 3 and No. 5 injector
- Failed engine coolant temperature sensor
- Failed manifold absolute pressure sensor
- Failed barometric pressure sensor
- Incorrect fuel pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor

Q: Are the check results normal?
YES : Go to Step 2.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13F-21).

STEP 2. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item BB: Barometric pressure sensor

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the engine-ECU.

STEP 3. Check No. 1, No. 3 and No. 5 injector itself.
- No. 1, No. 3 and No. 5 Injector check (Refer to P.13F-223).

Q: Are the check results normal?
YES : Go to Step 4.
NO : Replace the injectors.

STEP 4. Fuel pressure measurement.
- Fuel pressure test (Refer to P.13F-213).

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair.

STEP 5. Replace No. 1, No. 3 and No. 5 injectors.
- After replacing the injectors, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0174: Left Bank Abnormal Fuel System (lean)

OPERATION

- Check code No. P0264: No. 2 injector circuit low input (Refer to P.13F-75).
- Check code No. P0270: No. 4 injector circuit low input (Refer to P.13F-80).
- Check code No. P0276: No. 6 injector circuit low input (Refer to P.13F-84).

FUNCTION

- If the fuel system goes out of order, the fuel correction value will become larger.
- The engine-ECU checks whether the fuel trim value is within a specified range.

TROUBLE JUDGEMENT

Check Conditions

- Engine coolant temperature is less than 100°C when the engine is started.
- Intake air temperature is less than 60°C when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76°C.
- Air flow sensor output is more than 7.7 g/sec.

Judgement Criterion

- Long-term fuel trim is more than +12.5 % for 5 seconds.

or

- Short-term fuel trim is more than +10.0 % for 5 seconds.

Check Conditions

- Engine coolant temperature is more than 100°C when the engine is started.
- Intake air temperature is more than 60°C when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76°C.
- Air flow sensor output is more than 12 g/sec.

Judgement Criterion

- Long-term fuel trim is more than +7.7 % for 5 seconds.

or

- Short-term fuel trim is more than +20.0 % for 5 seconds.

Check Conditions

- Engine coolant temperature is more than 76°C.
- Under the closed loop air/fuel ratio control.

Judgement Criterion

- Long-term fuel trim is +12.5 % for 2 seconds.

or

- Short-term fuel trim is +25.0 % for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed intake air temperature sensor
- Failed air flow sensor
- Failed No. 2, No. 4 and No. 6 injector
- Air drawn in from gaps in gasket, seals, etc.
- Failed engine coolant temperature sensor
- Failed manifold absolute pressure sensor
- Failed barometric pressure sensor
- Exhaust leak
- Incorrect fuel pressure
- Use of incorrect or contaminated fuel
- Harness damage in injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check for exhaust leaks

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair.

STEP 2. Check for intake system vacuum leaks.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair.

STEP 3. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor

Q: Are the check results normal?
YES : Go to Step 4.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13F-21).

STEP 4. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item BB: Barometric pressure sensor

Q: Is the check result normal?
YES : Go to Step 5.
NO : Replace the engine-ECU.

STEP 5. Check No. 2, No. 4 and No. 6 injector itself.
- No. 2, No. 4 and No. 6 injector check (Refer to P.13F-223).

Q: Are the check results normal?
YES : Go to Step 6.
NO : Replace the injectors.

STEP 6. Check of harness damage in INJ2, INJ4 and INJ6 line between injector connectors and engine-ECU connector.

Q: Are the check results normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Fuel pressure measurement.
- Fuel pressure test (Refer to P.13F-213).

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair.

STEP 8. Check fuel.
- Check for entry of foreign matter (water, diesel fuel, etc.) into fuel.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Replace the fuel.

STEP 9. Replace No. 2, No. 4 and No. 6 injectors.
- After replacing the injectors, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0175: Left Bank Abnormal Fuel System (rich)

OPERATION
- Check code No. P0264: No. 2 injector circuit low input (Refer to P.13F-75).
- Check code No. P0270: No. 4 injector circuit low input (Refer to P.13F-80).
- Check code No. P0276: No. 6 injector circuit low input (Refer to P.13F-84).

FUNCTION
- If the fuel system goes out of order, the fuel correction value will become larger.
- The engine-ECU checks whether the fuel trim value is within a specified range.

TROUBLE JUDGEMENT

Check Conditions
- Engine coolant temperature is less than 100°C when the engine is started.
- Intake air temperature is less than 60°C when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76°C.
- Air flow sensor output is more than 7.7 g/sec.

Judgement Criterion
- Long-term fuel trim is less than –12.5 % for 5 seconds.

or
- Short-term fuel trim is less than –10.0 % for 5 seconds.

Check Conditions
- Engine coolant temperature is less than 100°C when the engine is started.
- Intake air temperature is less than 60°C when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76°C.
- Air flow sensor output is less than 7.7 g/sec.

Judgement Criterion
- Long-term fuel trim is less than –12.5 % for 5 seconds.

or
- Short-term fuel trim is less than –10.0 % for 5 seconds.

Check Conditions
- Engine coolant temperature is more than 76°C.
- Under the closed loop air/fuel ratio control.

Judgement Criterion
- Long-term fuel trim is –12.5 % for 2 seconds.

or
- Short-term fuel trim is –25.0 % for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed intake air temperature sensor
- Failed air flow sensor
- Failed No. 2, No. 4 and No. 6 injector
- Failed engine coolant temperature sensor
- Failed manifold absolute pressure sensor
- Failed barometric pressure sensor
- Incorrect fuel pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor

Q: Are the check results normal?
YES : Go to Step 2.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13F-21).

STEP 2. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item BB: Barometric pressure sensor

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the engine-ECU.

STEP 3. Check No. 2, No. 4 and No. 6 injector itself.
- No. 2, No. 4 and No. 6 Injector check (Refer to P.13F-223).

Q: Are the check results normal?
YES : Go to Step 4.
NO : Replace the injectors.

STEP 4. Fuel pressure measurement.
- Fuel pressure test (Refer to P.13F-213).

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair.

STEP 5. Replace No. 2, No. 4 and No. 6 injectors.
- After replacing the injectors, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0221: Trustful Check Throttle Position Sensor (sub)

FUNCTION
- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (sub) signal.

TROUBLE JUDGEMENT
Check Conditions
- Engine is running.
- Air flow sensor is normal.

Judgement Criterion
- The difference between volumetric efficiency (actual measurement) by the air flow sensor and volumetric efficiency estimated from the throttle position sensor (sub) exceeds the specified value.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (sub) fails.

PROBABLE CAUSES
- Failed throttle position sensor (sub)
- Harness damage in throttle position sensor (sub) circuit or loose connector contact
- Failed intake air system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P0221 stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item 15: Throttle position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 3.

STEP 3. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Repair.

Code No. P0222: Throttle Position Sensor (sub) Circuit Low Input

OPERATION
- A power voltage of 5 V is applied to the electronic-controlled throttle valve from the engine-ECU connector terminal TPS5.
- The power voltage is earthed to the engine-ECU connector terminal TPSE from the electronic-controlled throttle valve.
- The sensor signal is inputted to the engine-ECU connector terminal TPSS from the electronic-controlled throttle valve output terminal.

FUNCTION
- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve opening angle.

TROUBLE JUDGEMENT
Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Throttle position sensor (sub) output voltage is less than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (main) fails.

PROBABLE CAUSES
- Failed throttle position sensor (sub)
- Open/short circuit or harness damage in throttle position sensor (sub) circuit or loose connector contact

- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 15: Throttle position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Voltage measurement at electronic-controlled throttle valve connector (TPS5 line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the electronic-controlled throttle valve connector (TPS5 line) and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of short to earth and open circuit in TPS5 line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 15: Throttle position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check of damage in TPS5 line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check of short to earth, open circuit and damage in TPSS line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Replace the electronic-controlled throttle valve

- After replacing the electronic-controlled throttle valve, reconfirm whether the diagnosis code is stored.

Q: Is the diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0223: Throttle Position Sensor (sub) Circuit High Input

OPERATION

- A power voltage of 5 V is applied to the electronic-controlled throttle valve from the engine-ECU connector terminal TPS5.
- The power voltage is earthed to the engine-ECU connector terminal TPSE from the electronic-controlled throttle valve.
- The sensor signal is inputted to the engine-ECU connector terminal TPSS from the electronic-controlled throttle valve output terminal.

FUNCTION

- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve opening angle.

TROUBLE JUDGEMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Throttle position sensor (sub) output voltage is more than 4.8 V.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (main) fails.

PROBABLE CAUSES

- Failed throttle position sensor (sub)
- Open circuit or harness damage in throttle position sensor (sub) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 15: Throttle position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Resistance measurement at electronic-controlled throttle valve connector (TPSE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the electronic-controlled throttle valve connector (TPSE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 3.

STEP 3. Check of open circuit and damage in TPSE line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 15: Throttle position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

STEP 5. Replace the electronic-controlled throttle valve

- After replacing the electronic-controlled throttle valve, reconfirm whether the diagnosis code is stored.

Q: Is the diagnosis code stored?

YES : Replace the engine-ECU.

NO : Check end.

Code No. P0261: No. 1 Injector Circuit Low Input

OPERATION

- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ1 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION

- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT

Check Condition

- Engine is running.

Judgement Criterion

- The supply voltage is less than 3 V without the injector driving.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed No. 1 injector
- Open/short circuit or harness damage in No. 1 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 1: No. 1 injector

OK: Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Check No. 1 injector itself.

- Injector check (Refer to P.13F-223).

Q: Is the check result normal?

YES : Go to Step 3.

NO : Replace the No. 1 injector.

STEP 3. Voltage measurement at No. 1 injector connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the No. 1 injector connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between engine control relay connector and No. 1 injector connector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 1 injector connector.

Q: Is the check result normal?

YES : Go to Step 5.

NO : Repair the connector(s) or wiring harness.

STEP 5. Check of short to earth, open circuit and damage in INJ1 line between No. 1 injector connector and engine-ECU connector.

Q: Is the check result normal?

YES : Go to Step 6.

NO : Repair the connector(s) or wiring harness.

STEP 6. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).

(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ1 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

Code No. P0262: No. 1 Injector Circuit High Input

OPERATION

- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ1 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION

- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT

Check Condition

- Engine is running.

Judgement Criterion

- The coil current is more than 4.5 A with the injector driving.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed No. 1 injector
- Open/short circuit or harness damage in No. 1 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 1: No. 1 injector

OK: Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Check No. 1 injector itself.

- Injector check (Refer to P.13F-223).

Q: Is the check result normal?

YES : Go to Step 3.

NO : Replace the No. 1 injector.

STEP 3. Check of short circuit to power supply in INJ1 line between No. 1 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).
(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ1 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0264: No. 2 Injector Circuit Low Input

OPERATION
- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ2 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION
- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT

Check Condition
- Engine is running.

Judgement Criterion
- The supply voltage is less than 3 V without the injector driving.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed No. 2 injector
- Open/short circuit or harness damage in No. 2 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 2 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 2 injector itself.
- Injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the No. 2 injector.

STEP 3. Voltage measurement at No. 2 injector connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the No. 2 injector connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between engine control relay connector and No. 2 injector connector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 2 injector connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of short to earth, open circuit and damage in INJ2 line between No. 2 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).

(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ2 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0265: No. 2 Injector Circuit High Input

OPERATION

- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ2 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION

- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT

Check Condition

- Engine is running.

Judgement Criterion

- The coil current is more than 4.5 A with the injector driving.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed No. 2 injector
- Open/short circuit or harness damage in No. 2 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 2 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 2 injector itself.
- Injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the No. 2 injector.

STEP 3. Check of short circuit to power supply in INJ2 line between No. 2 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).
(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ2 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0267: No. 3 Injector Circuit Low Input

OPERATION
- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ3 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION
- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT

Check Condition
- Engine is running.

Judgement Criterion
- The supply voltage is less than 3 V without the injector driving.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed No. 3 injector
- Open/short circuit or harness damage in No. 3 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 3 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 3 injector itself.

- Injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the No. 3 injector.

STEP 3. Voltage measurement at No. 3 injector connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the No. 3 injector connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between engine control relay connector and No. 3 injector connector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 3 injector connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of short to earth, open circuit and damage in INJ3 line between No. 3 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).

(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ3 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0268: No. 3 Injector Circuit High Input

OPERATION

- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ3 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION

- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT

Check Condition

- Engine is running.

Judgement Criterion

- The coil current is more than 4.5 A with the injector driving.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed No. 3 injector
- Open/short circuit or harness damage in No. 3 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 1: No. 3 injector

OK: Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Check No. 3 injector itself.

- Injector check (Refer to P.13F-223).

Q: Is the check result normal?

YES : Go to Step 3.

NO : Replace the No. 3 injector.

STEP 3. Check of short circuit to power supply in INJ3 line between No. 3 injector connector and engine-ECU connector.

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair the connector(s) or wiring harness.

STEP 4. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).

(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ3 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

Code No. P0270: No. 4 Injector Circuit Low Input

OPERATION
- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ4 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION
- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT
Check Condition
- Engine is running.

Judgement Criterion
- The supply voltage is less than 3 V without the injector driving.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed No. 4 injector
- Open/short circuit or harness damage in No. 4 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 4 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 4 injector itself.
- Injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the No. 4 injector.

STEP 3. Voltage measurement at No. 4 injector connector (power supply line).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the No. 4 injector connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between engine control relay connector and No. 4 injector connector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 4 injector connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of short to earth, open circuit and damage in INJ4 line between No. 4 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).

(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ4 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

Code No. P0271: No. 4 Injector Circuit High Input

OPERATION

- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ4 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION

- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT

Check Condition

- Engine is running.

Judgement Criterion

- The coil current is more than 4.5 A with the injector driving.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed No. 4 injector
- Open/short circuit or harness damage in No. 4 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 1: No. 4 injector

OK: Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Check No. 4 injector itself.

- Injector check (Refer to P.13F-223).

Q: Is the check result normal?

YES : Go to Step 3.

NO : Replace the No. 4 injector.

STEP 3. Check of short circuit to power supply in INJ4 line between No. 4 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).
(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ4 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0273: No. 5 Injector Circuit Low Input

OPERATION
- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ5 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION
- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT
Check Condition
- Engine is running.

Judgement Criterion
- The supply voltage is less than 3 V without the injector driving.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed No. 5 injector
- Open/short circuit or harness damage in No. 5 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 5 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 5 injector itself.
- Injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the No. 5 injector.

STEP 3. Voltage measurement at No. 5 injector connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the No. 5 injector connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between engine control relay connector and No. 5 injector connector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 5 injector connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of short to earth, open circuit and damage in INJ5 line between No. 5 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).

(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ5 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0274: No. 5 Injector Circuit High Input

OPERATION

- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ5 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION

- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT

Check Condition

- Engine is running.

Judgement Criterion

- The coil current is more than 4.5 A with the injector driving.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed No. 5 injector
- Open/short circuit or harness damage in No. 4 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 5 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 5 injector itself.
- Injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the No. 5 injector.

STEP 3. Check of short circuit to power supply in INJ5 line between No. 5 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).
(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ5 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0276: No. 6 Injector Circuit Low Input

OPERATION
- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ6 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION
- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT

Check Condition
- Engine is running.

Judgement Criterion
- The supply voltage is less than 3 V without the injector driving.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed No. 6 injector
- Open/short circuit or harness damage in No. 6 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 6 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 6 injector itself.

- Injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the No. 6 injector.

STEP 3. Voltage measurement at No. 6 injector connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the No. 6 injector connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between engine control relay connector and No. 6 injector connector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 6 injector connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of short to earth, open circuit and damage in INJ6 line between No. 6 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).

(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ6 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0277: No. 6 Injector Circuit High Input

OPERATION

- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ6 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION

- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGEMENT

Check Condition

- Engine is running.

Judgement Criterion

- The coil current is more than 4.5 A with the injector driving.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed No. 6 injector
- Open/short circuit or harness damage in No. 6 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 6 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 6 injector itself.
- Injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the No. 6 injector.

STEP 3. Check of short circuit to power supply in INJ6 line between No. 6 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).
(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the engine-ECU connector (INJ6 terminal) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0300: Random/Multiple Cylinder Misfire Detected

OPERATION
- Check code No. P0261: No. 1 injector circuit low input (Refer to P.13F-73).
- Check code No. P0264: No. 2 injector circuit low input (Refer to P.13F-75).
- Check code No. P0267: No. 3 injector circuit low input (Refer to P.13F-77).
- Check code No. P0270: No. 4 injector circuit low input (Refer to P.13F-80).
- Check code No. P0273: No. 5 injector circuit low input (Refer to P.13F-82).
- Check code No. P0276: No. 6 injector circuit low input (Refer to P.13F-84).

FUNCTION
- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGEMENT

Check Conditions
- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than –10°C.
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 11.3 %.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is –0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).

- Misfire has occurred more frequently than allowed during the last 200 revolutions (when the catalyst temperature is higher than 1,000°C).

or

- Misfire has occurred a predetermined value (2 %) or more in the first 1,000 revolutions from engine start-up (corresponding to 1.5 times the limit of emission standard).

or

- After the first 1,000 revolutions, the following criterion is satisfied 4 times cumulatively. Misfire counts per 1,000 revolutions exceeds a predetermined value (2 %) (corresponding to 1.5 times the limit of emission standard).

FAIL-SAFE AND BACKUP FUNCTION

- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES

- Ignition system related part(s) failed
- Failed crank angle sensor
- Failed injector
- Incorrect air-fuel ratio
- Low compression pressure
- Failed engine coolant temperature sensor
- Skipping of timing belt teeth.
- Air drawn in from gaps in gasket, seals, etc.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Item 2: Crank angle sensor

OK: Keep the engine speed constant to make the pulse width of output waveform constant.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Check crank angle sensor system. Check code No. P0335: crank angle sensor system (Refer to P.13F-100).

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).

a. Item 6: Engine coolant temperature sensor
b. Item 26: Long-term fuel trim 1
c. Item 27: Long-term fuel trim 2
d. Item 28: Short-term fuel trim 1
e. Item 29: Short-term fuel trim 2

Q: Are the check results normal?

YES : Go to Step 3.

NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13F-21).

STEP 3. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check spark plug.

- Spark plug check (Refer to GROUP 16 – Ignition System – On-vehicle Service – Spark Plug Check and Cleaning P.16-18).

Q: Is the check result normal?

YES : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).

NO : Replace the spark plug.

STEP 5. Check injector itself.

- Injector check (Refer to P.13F-223).

Q: Is the check result normal?

YES : Go to Step 6.

NO : Replace the injector.

STEP 6. Check compression pressure.

- Check the compression pressure (Refer to GROUP 11I – On-vehicle Service – Compression Pressure Check P.11I-12).

Q: Is the check result normal?

YES : Go to Step 7.

NO : Repair.

STEP 7. Check for intake air from intake hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair.

STEP 8. Check for skipped timing belt teeth.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair.

STEP 9. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0301: No. 1 Cylinder Misfire Detected

OPERATION
- Check code No. P0261: No. 1 injector circuit low input (Refer to P.13F-73).

FUNCTION
- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGEMENT

Check Conditions
- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than –10°C.
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 11.3 %.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is –0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).
- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is more than 1,000°C].

or
- Misfire has occurred a predetermined value (2 %) or more in the first 1,000 revolutions from engine start-up (corresponding to 1.5 times the limit of emission standard).

or
- After the first 1,000 revolutions, the following criterion is satisfied 4 times cumulatively. Misfire counts per 1,000 revolutions exceeds a predetermined value (2 %) (corresponding to 1.5 times the limit of emission standard)

FAIL-SAFE AND BACKUP FUNCTION
- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES
- Ignition system related part(s) failed
- Failed No. 1 injector
- Harness damage in No. 1 injector circuit
- Low compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 2.

STEP 2. Check spark plug.

- Spark plug check (Refer to GROUP 16 – Ignition System – On-vehicle Service – Spark Plug Check and Cleaning P.16-18).

Q: Is the check result normal?
YES : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).
NO : Replace the spark plug.

STEP 3. Check No. 1 injector itself.

- No. 1 injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 4.
NO : Replace the No. 1 injector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 1 injector connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of harness damage in INJ1 line between No. 1 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check compression pressure.

- Check the compression pressure (Refer to GROUP 11I – On-vehicle Service – Compression Pressure Check P.11I-12).

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair.

STEP 7. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0302: No. 2 Cylinder Misfire Detected

OPERATION
- Check code No. P0264: No. 2 injector circuit low input (Refer to P.13F-75).

FUNCTION
- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGEMENT

Check Conditions
- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than –10°C.
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 11.3 %.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is –0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).
- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is more than 1,000°C].

or
- Misfire has occurred a predetermined value (2 %) or more in the first 1,000 revolutions from engine start-up (corresponding to 1.5 times the limit of emission standard).

or
- After the first 1,000 revolutions, the following criterion is satisfied 4 times cumulatively. Misfire counts per 1,000 revolutions exceeds a predetermined value (2 %) (corresponding to 1.5 times the limit of emission standard)

FAIL-SAFE AND BACKUP FUNCTION
- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES
- Ignition system related part(s) failed
- Failed No. 2 injector
- Harness damage in No. 2 injector circuit
- Low compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark.
- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 2.

STEP 2. Check spark plug.
- Spark plug check (Refer to GROUP 16 – Ignition System – On-vehicle Service – Spark Plug Check and Cleaning P.16-18).

Q: Is the check result normal?
YES : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).
NO : Replace the spark plug.

STEP 3. Check No. 2 injector itself.
- No. 2 injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 4.
NO : Replace the No. 2 injector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 2 injector connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of harness damage in INJ2 line between No. 2 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check compression pressure.

- Check the compression pressure (Refer to GROUP 11I – On-vehicle Service – Compression Pressure Check P.11I-12).

Q: Is the check result normal?

YES : Go to Step 7.

NO : Repair.

STEP 7. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?

YES : Replace the engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0303: No. 3 Cylinder Misfire Detected

OPERATION

- Check code No. P0267: No. 3 injector circuit low input (Refer to P.13F-77).

FUNCTION

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGEMENT

Check Conditions

- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than –10°C.
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 11.3 %.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is –0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).

- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is more than 1,000°C].

or

- Misfire has occurred a predetermined value (2 %) or more in the first 1,000 revolutions from engine start-up (corresponding to 1.5 times the limit of emission standard).

or

- After the first 1,000 revolutions, the following criterion is satisfied 4 times cumulatively. Misfire counts per 1,000 revolutions exceeds a predetermined value (2 %) (corresponding to 1.5 times the limit of emission standard)

FAIL-SAFE AND BACKUP FUNCTION

- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES

- Ignition system related part(s) failed
- Failed No. 3 injector
- Harness damage in No. 3 injector circuit
- Low compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark.
- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 2.

STEP 2. Check spark plug.
- Spark plug check (Refer to GROUP 16 – Ignition System – On-vehicle Service – Spark Plug Check and Cleaning P.16-18).

Q: Is the check result normal?
YES : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).
NO : Replace the spark plug.

STEP 3. Check No. 3 injector itself.
- No. 3 injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 4.
NO : Replace the No. 3 injector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 3 injector connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of harness damage in INJ3 line between No. 3 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check compression pressure.
- Check the compression pressure (Refer to GROUP 11I – On-vehicle Service – Compression Pressure Check P.11I-12).

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair.

STEP 7. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0304: No. 4 Cylinder Misfire Detected

OPERATION
- Check code No. P0270: No. 4 injector circuit low input (Refer to P.13F-80).

FUNCTION
- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGEMENT

Check Conditions
- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than –10°C.
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 11.3 %.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is –0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).

- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is more than 1,000°C].

or

- Misfire has occurred a predetermined value (2 %) or more in the first 1,000 revolutions from engine start-up (corresponding to 1.5 times the limit of emission standard).

or

- After the first 1,000 revolutions, the following criterion is satisfied 4 times cumulatively. Misfire counts per 1,000 revolutions exceeds a predetermined value (2 %) (corresponding to 1.5 times the limit of emission standard)

FAIL-SAFE AND BACKUP FUNCTION

- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES

- Ignition system related part(s) failed
- Failed No. 4 injector
- Harness damage in No. 4 injector circuit
- Low compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 2.

STEP 2. Check spark plug.

- Spark plug check (Refer to GROUP 16 – Ignition System – On-vehicle Service – Spark Plug Check and Cleaning P.16-18).

Q: Is the check result normal?
YES : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).
NO : Replace the spark plug.

STEP 3. Check No. 4 injector itself.

- No. 4 injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 4.
NO : Replace the No. 4 injector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 4 injector connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of harness damage in INJ4 line between No. 4 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check compression pressure.

- Check the compression pressure (Refer to GROUP 11I – On-vehicle Service – Compression Pressure Check P.11I-12).

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair.

STEP 7. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0305: No. 5 Cylinder Misfire Detected

OPERATION
- Check code No. P0273: No. 5 injector circuit low input (Refer to P.13F-82).

FUNCTION
- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGEMENT

Check Conditions
- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than –10°C.
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 11.3 %.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is –0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).
- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is more than 1,000°C].

or
- Misfire has occurred a predetermined value (2 %) or more in the first 1,000 revolutions from engine start-up (corresponding to 1.5 times the limit of emission standard).

or
- After the first 1,000 revolutions, the following criterion is satisfied 4 times cumulatively. Misfire counts per 1,000 revolutions exceeds a predetermined value (2 %) (corresponding to 1.5 times the limit of emission standard)

FAIL-SAFE AND BACKUP FUNCTION
- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES
- Ignition system related part(s) failed
- Failed No. 5 injector
- Harness damage in No. 5 injector circuit
- Low compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark.
- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 2.

STEP 2. Check spark plug.
- Spark plug check (Refer to GROUP 16 – Ignition System – On-vehicle Service – Spark Plug Check and Cleaning P.16-18).

Q: Is the check result normal?
YES : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).
NO : Replace the spark plug.

STEP 3. Check No. 5 injector itself.
- No. 5 injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 4.
NO : Replace the No. 5 injector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 5 injector connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of harness damage in INJ5 line between No. 5 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check compression pressure.

- Check the compression pressure (Refer to GROUP 11I – On-vehicle Service – Compression Pressure Check P.11I-12).

Q: Is the check result normal?

YES : Go to Step 7.

NO : Repair.

STEP 7. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?

YES : Replace the engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0306: No. 6 Cylinder Misfire Detected

OPERATION

- Check code No. P0276: No. 6 injector circuit low input (Refer to P.13F-84).

FUNCTION

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGEMENT

Check Conditions

- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than –10°C.
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 11.3 %.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is –0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).

- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is more than 1,000°C].

or

- Misfire has occurred a predetermined value (2 %) or more in the first 1,000 revolutions from engine start-up (corresponding to 1.5 times the limit of emission standard).

or

- After the first 1,000 revolutions, the following criterion is satisfied 4 times cumulatively. Misfire counts per 1,000 revolutions exceeds a predetermined value (2 %) (corresponding to 1.5 times the limit of emission standard)

FAIL-SAFE AND BACKUP FUNCTION

- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES

- Ignition system related part(s) failed
- Failed No. 6 injector
- Harness damage in No. 6 injector circuit
- Low compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark.
- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connector.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 2.

STEP 2. Check spark plug.
- Spark plug check (Refer to GROUP 16 – Ignition System – On-vehicle Service – Spark Plug Check and Cleaning P.16-18).

Q: Is the check result normal?
YES : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).
NO : Replace the spark plug.

STEP 3. Check No. 6 injector itself.
- No. 6 injector check (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 4.
NO : Replace the No. 6 injector.

STEP 4. Check of harness damage in power supply line between engine control relay connector and No. 6 injector connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of harness damage in INJ6 line between No. 6 injector connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check compression pressure.
- Check the compression pressure (Refer to GROUP 11I – On-vehicle Service – Compression Pressure Check P.11I-12).

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair.

STEP 7. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0327: Right Bank Detonation Sensor Circuit Low Input

OPERATION

- The sensor signal is input to the engine-ECU connector terminal K/S2 from the right bank detonation sensor.
- The power voltage is earthed to the engine-ECU connector terminal KS2E from the right bank detonation sensor.

FUNCTION

- The detonation sensor detects the vibration of the cylinder block caused by detonation waves, and inputs a signal to the engine-ECU.
- In response to the signal, the engine-ECU provides controls to retard the ignition timing when the detonation occurs.

TROUBLE JUDGEMENT

Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Right bank detonation sensor output voltage is less than 0.5 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Fix the ignition timing with an allowance against detonation.

PROBABLE CAUSES

- Failed right bank detonation sensor
- Open/short circuit or harness damage in right bank detonation sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Resistance measurement at right bank detonation sensor connector (KS2E line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Measure the resistance between the right bank detonation sensor connector (KS2E line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 4.
NO : Go to Step 2.

STEP 2. Check of open circuit and damage in KS2E line between right bank detonation sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. Check of short to earth, open circuit and damage in K/S2 line between right bank detonation sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Go to Step 6.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. Replace the right bank detonation sensor

- After replacing the right bank detonation sensor, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0328: Right Bank Detonation Sensor Circuit High Input

OPERATION

- The sensor signal is input to the engine-ECU connector terminal K/S2 from the right bank detonation sensor.
- The power voltage is earthed to the engine-ECU connector terminal KS2E from the right bank detonation sensor.

FUNCTION

- The detonation sensor detects the vibration of the cylinder block caused by detonation waves, and inputs a signal to the engine-ECU.
- In response to the signal, the engine-ECU provides controls to retard the ignition timing when the detonation occurs.

TROUBLE JUDGEMENT

Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Right bank detonation sensor output voltage is more than 2.25 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Fix the ignition timing with an allowance against detonation.

PROBABLE CAUSES

- Short circuit in right bank detonation sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check of short circuit to power supply in K/S line between right bank detonation sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair the connector(s) or wiring harness.

STEP 2. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0332: Left Bank Detonation Sensor Circuit Low Input

OPERATION

- The sensor signal is input to the engine-ECU connector terminal K/S from the left bank detonation sensor.
- The power voltage is earthed to the engine-ECU connector terminal K/SE from the left bank detonation sensor.

FUNCTION

- The detonation sensor detects the vibration of the cylinder block caused by detonation waves, and inputs a signal to the engine-ECU.
- In response to the signal, the engine-ECU provides controls to retard the ignition timing when the detonation occurs.

TROUBLE JUDGEMENT

Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Left bank detonation sensor output voltage is less than 0.5 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Fix the ignition timing with an allowance against detonation.

PROBABLE CAUSES

- Failed left bank detonation sensor
- Open/short circuit or harness damage in left bank detonation sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Resistance measurement at left bank detonation sensor connector (K/SE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the left bank detonation sensor connector (K/SE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 4.
NO : Go to Step 2.

STEP 2. Check of open circuit and damage in K/SE line between left bank detonation sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. Check of short to earth, open circuit and damage in K/S line between left bank detonation sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Go to Step 6.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. Replace the left bank detonation sensor

- After replacing the left bank detonation sensor, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0333: Left Bank Detonation Sensor Circuit High Input

OPERATION
- The sensor signal is input to the engine-ECU connector terminal K/S from the left bank detonation sensor.
- The power voltage is earthed to the engine-ECU connector terminal K/SE from the left bank detonation sensor.

FUNCTION
- The detonation sensor detects the vibration of the cylinder block caused by detonation waves, and inputs a signal to the engine-ECU.
- In response to the signal, the engine-ECU provides controls to retard the ignition timing when the detonation occurs.

TROUBLE JUDGEMENT
Check Condition
- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion
- Left bank detonation sensor output voltage is more than 2.25 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Fix the ignition timing with an allowance against detonation.

PROBABLE CAUSES
- Short circuit in left bank detonation sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check of short to power supply in K/S line between left bank detonation sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair the connector(s) or wiring harness.

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0335: Crank Angle Sensor System

OPERATION
- Power is supplied to the crank angle sensor from the engine-ECU connector terminal 5V and is earthed to the engine-ECU connector terminal SGTE from the crank angle sensor.
- A power voltage of 5 V is applied to the crank angle sensor from the engine-ECU connector terminal SGT.

FUNCTION
- The crank angle sensor detects the crank angle (position) and inputs a pulse signal to the engine-ECU.
- In response to the signal, the engine-ECU controls the injector, etc.

TROUBLE JUDGEMENT
Check Condition, Judgement Criterion
- Normal signal pattern has not been input for cylinder identification from the crank angle sensor signal and camshaft position sensor signal for 2 seconds.

Check Condition
- Engine is being cranked.

Judgement Criterion
- Crank angle sensor output voltage has not changed (no pulse signal is input) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Engine stops.

PROBABLE CAUSES

- Failed crank angle sensor
- Open/short circuit or harness damage in crank angle sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 2: Crank angle sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Voltage measurement at crank angle sensor connector (SGT line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the crank angle sensor connector (SGT line) and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of short to power supply, short to earth and open circuit in SGT line between crank angle sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 2: Crank angle sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Voltage measurement at crank angle sensor connector (5V line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the crank angle sensor connector (5V line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 7.
NO : Go to Step 6.

STEP 6. Check of short to earth and open circuit in 5V line between crank angle sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 7. Resistance measurement at crank angle sensor connector (SGTE line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the crank angle sensor connector (SGTE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 9.
NO : Go to Step 8.

STEP 8. Check of open circuit and damage in SGTE line between crank angle sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 9. Perform output wave pattern measurement at crank angle sensor connector (Using an oscilloscope).

(1) Use special tool test harness (MB991709) to connect connector, and measure at pick-up harness.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the crank angle sensor connector (SGT line) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205), its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less. There must be no noise in the output wave pattern.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Go to Step 10.

STEP 10. Check of harness damage in 5V line between crank angle sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 11.
NO : Repair the connector(s) or wiring harness.

STEP 11. Check of harness damage in SGT line between crank angle sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Replace the crank angle sensor. Then go to Step 12.
NO : Repair the connector(s) or wiring harness.

STEP 12. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the crank angle sensor sensing ring.
NO : Check end.

Code No. P0340: Camshaft Position Sensor System

OPERATION

- Power is supplied to the camshaft position sensor from the engine-ECU connector terminal 5V and is earthed to the engine-ECU connector terminal SGCE from the camshaft position sensor.
- A power voltage of 5 V is applied to the camshaft position sensor output terminal from the engine-ECU connector terminal SGC.

FUNCTION

- The camshaft position sensor detects the top dead centre on the compression stroke of the No. 1 cylinder and inputs a pulse signal to the engine-ECU.

TROUBLE JUDGEMENT

Check Condition, Judgement Criterion

- Normal signal pattern has not been input for cylinder identification from the crankshaft position sensor signal and camshaft position sensor signal for 2 seconds.

Check Condition

- Engine speed is more than 500 r/min.
- Engine is being cranked.

Judgement Criterion

- Camshaft position sensor output voltage has not changed (no pulse signal is input) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Engine runs in learned pattern until engine stops.
- Does not restart the engine after it is stopped once.
- Does not control variable valve timing (V.V.T.).
- Does not operate the MIVEC in high-speed mode.

PROBABLE CAUSES

- Failed camshaft position sensor
- Open/short circuit or harness damage in camshaft position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Voltage measurement at camshaft position sensor connector (SGC line).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the camshaft position sensor connector (SGC line) and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 4.
NO : Go to Step 2.

STEP 2. Check of short to power supply, short to earth and open circuit in SGC line between camshaft position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. Voltage measurement at camshaft position sensor connector (5V line).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the camshaft position sensor connector (5V line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 5.

STEP 5. Check of short circuit to earth and open circuit in 5V line between camshaft position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 6. Resistance measurement at camshaft position sensor connector (SGCE line).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the camshaft position sensor connector (SGCE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check of open circuit and damage in SGCE line between camshaft position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 8. Perform output wave pattern measurement at camshaft position sensor connector (Using an oscilloscope).
(1) Use special tool test harness (MB991709) to connect connector, and measure at pick-up harness.
(2) Engine: Idling
(3) Transmission: P range
(4) Check the voltage between the camshaft position sensor connector (SGC line) and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13F-205), its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less. There must be no noise in the output wave pattern.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 9.

STEP 9. Check of harness damage in 5V line between camshaft position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair the connector(s) or wiring harness.

STEP 10. Check of harness damage in SGC line between camshaft position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 11.
NO : Repair the connector(s) or wiring harness.

STEP 11. Check camshaft sensing cylinder.

Q: Is the check result normal?
YES : Go to Step 12.
NO : Replace the camshaft sensing cylinder.

STEP 12. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code stored?
YES : Replace the camshaft position sensor.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0421: Warm Up Catalyst Malfunction (right bank)

FUNCTION
- The signal from the right bank oxygen sensor (rear) differs from the right bank oxygen sensor (front). That is because the catalytic converter purifies exhaust gas. When the catalytic converter has deteriorated, the signal from the right bank oxygen sensor (front) becomes similar to the right bank oxygen sensor (rear).
- The engine-ECU compares the output of the right bank oxygen sensor signals (front and rear).

TROUBLE JUDGEMENT

Check Conditions
- Engine speed is less than 3,500 r/min.
- Accelerator pedal is open.
- Air flow is more than 7.7 – 46 g/sec.
- More than 3 seconds have elapsed after the abovementioned three conditions have been met.
- Under the closed loop air/fuel ratio control.
- Vehicle speed is more than 1.5 km/h.
- The engine-ECU monitors for this condition for 3 cycles of 12 seconds each during the drive cycle.
- Short-term fuel trim is more than –25 % and less than +25 %.
- The cumulative air flow is more than 1,638 g.

Judgement Criterion
- When the monitoring for 12 seconds is carried out 5 times, the frequency ratio of rear and front is more than 0.7.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Right bank catalytic converter deteriorated
- Failed right bank oxygen sensor (front)
- Failed right bank oxygen sensor (rear)
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check for leakage of exhaust emission from exhaust manifold.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair.

STEP 2. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item AC: Right bank oxygen sensor (front)
  b. Item AD: Right bank oxygen sensor (rear)

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13F-21).

STEP 3. M.U.T.-III data list
- Item AC: Right bank oxygen sensor (front)

  OK: 0 – 0.4 and 0.6 – 1.0 volt should alternate 15 times or more within 10 seconds (engine speed at 2,000 r/min).

Q: Is the check result normal?
YES : Go to Step 4.
NO : Replace the right bank oxygen sensor (front).

STEP 4. Replace the right bank oxygen sensor (rear)

- After replacing the right bank oxygen sensor (rear), reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Go to Step 5.
NO : Check end.

STEP 5. Replace the catalytic converter (right bank)

- After replacing the catalytic converter (right bank), reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0431: Warm Up Catalyst Malfunction (left bank)

FUNCTION

- The signal from the left bank oxygen sensor (rear) differs from the left bank oxygen sensor (front). That is because the catalytic converter purifies exhaust gas. When the catalytic converter has deteriorated, the signal from the left bank oxygen sensor (front) becomes similar to the left bank oxygen sensor (rear).
- The engine-ECU compares the output of the left bank oxygen sensor signals (front and rear).

TROUBLE JUDGEMENT

Check Conditions

- Engine speed is less than 3,500 r/min.
- Accelerator pedal is open.
- Air flow is more than 7.7 – 46 g/sec and is less than 60 g/sec.
- More than 3 seconds have elapsed after the abovementioned three conditions have been met.
- Under the closed loop air/fuel ratio control.
- Vehicle speed is more than 1.5 km/h.
- The engine-ECU monitors for this condition for 3 cycles of 12 seconds each during the drive cycle.
- Short-term fuel trim is more than –25 % and less than +25 %.
- The cumulative air flow is more than 1,638 g.

Judgement Criterion

- When the monitoring for 12 seconds is carried out 5 times, the frequency ratio of rear and front is more than 0.7.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Left bank catalytic converter deteriorated
- Failed left bank oxygen sensor (front)
- Failed left bank oxygen sensor (rear)
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check for leakage of exhaust emission from exhaust manifold.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item AE: Left bank oxygen sensor (front)
  b. Item AF: Left bank oxygen sensor (rear)

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13F-21).

STEP 3. M.U.T.-III data list

- Item AE: Left bank oxygen sensor (front)

  OK: 0 – 0.4 and 0.6 – 1.0 volt should alternate 15 times or more within 10 seconds (engine speed at 2,000 r/min).

Q: Is the check result normal?
YES : Go to Step 4.
NO : Replace the left bank oxygen sensor (front).

STEP 4. Replace the left bank oxygen sensor (rear)

- After replacing the left bank oxygen sensor (rear), reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Go to Step 5.
NO : Check end.

STEP 5. Replace the catalytic converter (left bank)

- After replacing the catalytic converter (left bank), reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0458: Purge Control Solenoid Valve Circuit Low Input

OPERATION

- Power is supplied to the purge control solenoid valve connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal PURG makes the power transistor in the unit be in ON position, and that makes currents go on the purge control solenoid valve connector terminal.

FUNCTION

- In response to a signal from the engine-ECU, the purge control solenoid valve controls the flow rate of the purge air to be introduced into the inlet manifold.

TROUBLE JUDGEMENT

Check Conditions

- Engine is being cranked.
- Battery positive voltage is more than 10 V and is less than 16.5 V.

Judgement Criteria

- The solenoid voltage is less than 3 V with the purge control solenoid valve driving.

Check Conditions

- Battery positive voltage is more than 10 V and is less than 16.5 V.

Judgement Criterion

- The solenoid voltage is more than 3 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed purge control solenoid valve
- Open/short circuit or harness damage in purge control solenoid value circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 10: Purge control solenoid valve

OK: Operating sound can be heard and the valve vibrates

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check purge control solenoid valve itself.

- Purge control solenoid valve check (Refer to GROUP 17 – Emission Control <MPI> – Evaporative Emission Control System – Purge Control Solenoid Valve Check).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the purge control solenoid valve.

STEP 3. Voltage measurement at purge control solenoid valve connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the purge control solenoid valve connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector(s), or check and repair the harness of short circuit to earth, and open circuit in power supply line between engine control relay connector and purge control solenoid valve connector.

STEP 4. Voltage measurement at engine-ECU connector (PURG terminal).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the engine-ECU connector (PURG terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in PURG line between purge control solenoid valve connector and engine-ECU connector.

STEP 5. Check of harness damage in PURG line between purge control solenoid valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check of harness damage in power supply line between purge control solenoid valve connector and engine control relay connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. M.U.T.-III actuator test

- Item 10: purge control solenoid valve

OK: Operating sound can be heard and the valve vibrates

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0459: Purge Control Solenoid Valve Circuit High Input

OPERATION

- Power is supplied to the purge control solenoid valve connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal PURG makes the power transistor in the unit be in ON position, and that makes currents go on the purge control solenoid valve connector terminal.

FUNCTION

- In response to a signal from the engine-ECU, the purge control solenoid valve controls the flow rate of the purge air to be introduced into the inlet manifold.

TROUBLE JUDGEMENT

Check Conditions

- Engine is being cranked.
- Battery positive voltage is more than 10 V and is less than 16.5 V.

Judgement Criterion

- The solenoid current is more than 2.3 A with the purge control solenoid driving.
- The engine-ECU monitors this condition once during the drive cycle

Check Condition

- Battery positive voltage is more than 10 V and is less than 16.5 V.

Judgement Criterion

- The solenoid current is more than 2.3 A for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed purge control solenoid valve
- Short circuit or harness damage in purge control solenoid value circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 10: Purge control solenoid valve

  OK: Operating sound can be heard and the valve vibrates

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check of short circuit to power supply in PURG line between purge control solenoid valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. M.U.T.-III actuator test
- Item 10: purge control solenoid valve

  OK: Operating sound can be heard and the valve vibrates

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0489: Exhaust Gas Recirculation Valve (stepper motor) Circuit Malfunction (earth short)

OPERATION
- Power is supplied to the exhaust gas recirculation valve connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal EGRA, EGRB, EGRC and EGRD makes the power transistor in the unit be in ON position, and that makes currents go on the exhaust gas recirculation valve connector terminal.

FUNCTION
- In response to the signal from the engine-ECU, the exhaust gas recirculation valve (stepper motor) controls a flow rate of exhaust gas recirculation.

TROUBLE JUDGEMENT

Check Conditions
- Ignition switch is "ON" position.
- Battery positive voltage is more than 10 V and is less than 16.5 V.

Judgement Criterion
- When the exhaust gas recirculation valve is de-energised, the engine-ECU voltage is less than 1.5 V for 1.4 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed exhaust gas recirculation valve (stepper motor)
- Open/short circuit or harness damage in exhaust gas recirculation valve (stepper motor) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check exhaust gas recirculation valve (stepper motor) itself.
- Exhaust gas recirculation valve (stepper motor) check (Refer to GROUP 17 – Emission Control – Exhaust Gas Recirculation (EGR) System – Exhaust Gas Recirculation Valve (Stepper Motor) Check P.17-8).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the exhaust gas recirculation valve.

STEP 2. Voltage measurement at exhaust gas recirculation valve connector (No.2 and No.5 power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the exhaust gas recirculation valve connector (No.2 and No.5 power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between engine control relay connector and exhaust gas recirculation valve connector.

STEP 3. Voltage measurement at engine-ECU connector (EGRA, EGRB, EGRC, EGRD terminal).

(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Ignition switch: OFF → ON
(3) Check the voltage between the engine-ECU connector (EGRA, EGRB, EGRC and EGRD terminal) and body earth.

OK: To initialise, energise exhaust gas recirculation valve for three seconds and de-energise it.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in EGRA, EGRB, EGRC and EGRD line between exhaust gas recirculation valve connector and engine-ECU connector.

STEP 4. Check of harness damage in No.2, No.5 power supply line between engine control relay connector and exhaust gas recirculation valve connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of harness damage in EGRA, EGRB, EGRC, EGRD line between exhaust gas recirculation valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0490: Exhaust Gas Recirculation Valve (stepper motor) Circuit Malfunction (battery short)

OPERATION
- Power is supplied to the exhaust gas recirculation valve connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal EGRA, EGRB, EGRC and EGRD makes the power transistor in the unit be in ON position, and that makes currents go on the exhaust gas recirculation valve connector terminal.

FUNCTION
- In response to the signal from the engine-ECU, the exhaust gas recirculation valve (stepper motor) controls a flow rate of exhaust gas recirculation.

TROUBLE JUDGEMENT

Check Conditions
- Ignition switch is "ON" position.
- Battery positive voltage is more than 10 V and is less than 16.5 V.

Judgement Criterion
- When the exhaust gas recirculation valve is energised, the engine-ECU voltage is more than 6.7 V for 1.4 seconds.

PROBABLE CAUSES
- Failed exhaust gas recirculation valve (stepper motor)
- Short circuit in exhaust gas recirculation valve circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check of short circuit to power supply in EGRA, EGRB, EGRC, EGRD line between exhaust gas recirculation valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair the connector(s) or wiring harness.

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0513: Immobilizer Malfunction

FUNCTION
- The engine-ECU transmits to and receives from KOS-ECU a control signal to authenticate the ignition key.

NOTE:
- *This code may be displayed due to radio interference if there are multiple registered ignition keys nearby during engine start.*
- *This code may be displayed when the transponder ID code is registered.*
- *This code is also displayed when the ignition key code is not recognised.*
- *When this code is displayed, it is also sent to KOS-ECU.*

TROUBLE JUDGEMENT

Check Condition
- Ignition switch is ON position.

Judgement Criterion
- When the communication error between engine-ECU and KOS-ECU continues more than 2 seconds.

or
- When it was different in the encrypted code sent from KOS-ECU and operation result by engine-ECU.

FAIL-SAFE AND BACKUP FUNCTION
- Engine start is prohibited.

PROBABLE CAUSES
- Failed KOS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation whether diagnosis code is stored in KOS-ECU.

Q: Is diagnosis code stored?
YES : Perform the troubleshooting of KOS system (Refer to GROUP 42B – Troubleshooting – Check Chart for Diagnosis Code).
NO : Go to Step 2.

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the KOS-ECU. After the replacement, put the each identification code into KOS-ECU. (Refer to GROUP 42B – On-vehicle Service – ID Code Registration Procedure). Then go to Step 3.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent malfunctions).

STEP 3. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0602: Variant Coding System

FUNCTION
- The engine-ECU performs proper engine control based on vehicle information entered.
- A vehicle identification number (VIN) is entered at a plant before shipment. This diagnosis code occurs when no vehicle information is entered during engine-ECU replacement.

TROUBLE JUDGEMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Vehicle information is not entered into the engine-ECU.

or
- The tester write area of EEPROM is not normal.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU with one into which vehicle information is correctly entered.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0604: RAM Error

FUNCTION
- Monitors the computation function of the engine-ECU periodically.

TROUBLE JUDGEMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- All RAM data of engine-ECU are defect.

or
- RAM data (engine) is defect.

FAIL-SAFE AND BACKUP FUNCTION
- Microcomputer is reset.

or
- Throttle opening degree position is in default position.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0606: Engine-ECU Main Processor Malfunction

OPERATION
- Check Inspection Procedure – engine-ECU power supply, engine control relay, ignition switch-IG1 system (Refer to P.13F-178).

FUNCTION
- System LSI checks the engine-ECU for abnormal conditions.

TROUBLE JUDGEMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- No surveillance pulse signals should be input.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSES
- Failed engine control relay
- Short circuit in the engine control relay circuit or loose connector contact.
- Open/short circuit or harness damage in the ignition switch (IG) circuit or loose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery.
- Battery check (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-2).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the battery.

STEP 2. Voltage measurement at engine-ECU connector (IGN terminal).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the engine-ECU connector (IGN terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth and open circuit in IGN line between ETACS-ECU connector and engine-ECU connector.

STEP 3. Check of damage in IGN line between ETACS-ECU connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Check engine control relay itself.
- Engine control relay continuity check (Refer to P.13F-217).

Q: Is the check result normal?
YES : Go to Step 5.
NO : Replace the engine control relay.

STEP 5. Check of short circuit to earth in C/R line between engine control relay connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P060B: A/D Converter

FUNCTION
- Monitors whether input voltage from the accelerator pedal position sensor (sub) is normally converted into a digital signal in the engine-ECU.

TROUBLE JUDGEMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- When the input voltage from the accelerator pedal position sensor (sub) is periodically 0 V, the digital value of the input voltage indicates more than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P060D: Trustful Check Accelerator Pedal Position Sensor

FUNCTION

- Compare the output value of the accelerator pedal position sensor (main) with that of the accelerator pedal position sensor (sub).

TROUBLE JUDGEMENT

Check Condition

- Change of accelerator pedal position sensor (sub) output voltage per 40 milliseconds is less than 0.06 V.

Judgement Criterion

- Voltage obtained with the formula given below is more than 0.4 V: accelerator pedal position sensor (main) output voltage – accelerator pedal position sensor (sub) output voltage.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree position is in default position.

PROBABLE CAUSES

- Failed accelerator pedal position sensor
- Harness damage in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P060D stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 11: Accelerator pedal position sensor (main)
  b. Item 12: Accelerator pedal position sensor (sub)

Q: Are the check results normal?
YES : Replace the engine-ECU.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13F-21).

Code No. P061A: Torque Monitoring

FUNCTION

- Compares the actual torque signal computed from an air flow sensor signal with the driver demand torque signal computed from an accelerator pedal position sensor signal.

TROUBLE JUDGEMENT

Check Conditions

- Engine speed is more than 500 r/min.

Judgement Criterion

- The difference between the actual torque signal and the requested torque signal is predetermined value or more.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree position is in default position.

PROBABLE CAUSE

- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P061A stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 10: Air flow sensor
  b. Item 11: Accelerator pedal position sensor (main)
  c. Item 12: Accelerator pedal position sensor (sub)

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13F-21).

STEP 3. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair.

STEP 4. Check throttle valve control servo itself.

- Throttle valve control servo check (Refer to P.13F-225).

Q: Is the check result normal?
YES : Go to Step 5.
NO : Replace the throttle body assembly.

STEP 5. Check of harness damage in ETV+ line between electronic controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check of harness damage in ETV- line between electronic controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P061C: Trustful Check Engine Speed

FUNCTION
- Compares the actual engine speed calculated from the crank angle sensor signal cycle with the estimated engine speed calculated from the number of the crank angle sensor signal pulses after a lapse of the specified time.

TROUBLE JUDGEMENT

Check Condition
- The engine speed monitored with a 120 degree-cycle pulse is more than 500 r/min.

Judgement Criterion
- The difference between the engine speed monitored with a 120 degree-cycle pulse and the engine speed monitored with a 10 degree-cycle pulse is more than 500 r/min.

Check Condition
- The engine speed monitored with a 120 degree-cycle pulse is less than 500 r/min.

Judgement Criterion
- The engine speed monitored with a 10 degree-cycle pulse is more than 1,000 r/min.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P061F: Fail-safe Control System

FUNCTION
- To judge whether fail-safe control can be performed, check that power supply to the throttle valve control servo circuit can be stopped by turning the throttle valve control servo relay to OFF position momentarily.

TROUBLE JUDGEMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Power supply to the throttle valve control servo cannot be shut down (though power supply is stopped).

FAIL-SAFE AND BACKUP FUNCTION
- Microcomputer is reset.

PROBABLE CAUSES
- Failed throttle valve control servo relay circuit
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Go to Step 2.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 2. M.U.T.-III diagnosis code

Q: Is diagnosis code of P0657 stored?
YES : Check throttle valve control servo power system. Check code No. P0657: throttle valve control servo relay circuit malfunction (Refer to P.13F-121).
NO : Replace the engine-ECU.

Code No. P0622: Alternator FR Terminal System

OPERATION

- The energised state of the alternator field coil is inputted from the alternator to the engine-ECU connector terminal ALTF.

FUNCTION

- A signal of the power supply duty ratio for the alternator field coil is inputted to the engine-ECU.
- In response to the signal, the engine-ECU detects the alternator output current and controls the idling speed according to the output current (electric load).

TROUBLE JUDGEMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Input voltage from the alternator FR terminal has continued to be approximately battery positive voltage for 20 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Prohibits alternator output suppression control against current consumers. (operates as a normal alternator.)

PROBABLE CAUSES

- Failed alternator
- Open circuit or harness damage in alternator FR terminal circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Voltage measurement at alternator connector (ALTF line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the alternator connector (ALTF line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Go to Step 2.

STEP 2. Check of open circuit in ALTF line between alternator connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. M.U.T.-III diagnosis code.

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. Voltage measurement at engine-ECU connector (ALTF terminal).

(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idle operation after warm-up
(3) Transmission: P range
(4) Radiator fan: Not operated
(5) Check the voltage between the engine-ECU connector (ALTF terminal) and body earth.

OK: Switching the headlamps to ON from OFF causes the voltage to fall.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 5.

STEP 5. Check of harness damage in ALTF line between alternator connector and engine-ECU connector.

Q: Is the check result normal?
YES : Replace the alternator.
NO : Repair the connector(s) or wiring harness.

Code No. P062F: EEPROM Malfunction

FUNCTION
- To check whether the information such as the idle learned value and so on is stored in the memory of engine-ECU.

TROUBLE JUDGEMENT
Check Condition
- Ignition switch is "ON" position

Judgement Criterion
- The latest data that was flashed while the ignition switch was in "LOOK" (OFF) position are not stored correctly.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0630: Chassis Number not Programmed

FUNCTION
- An engine-ECU checks whether vehicle chassis number is stored or not.

TROUBLE JUDGEMENT
Check Conditions
- Ignition switch is "ON" position.
- EEPROM is normal.

Judgement Criterion
- Chassis number has not been written.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Entered chassis number confirmed.

Q: Is a chassis number entered?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU with one into which vehicle information is correctly entered.

Code No. P0638: Throttle Valve Control Servo Circuit Range/Performance Problem

OPERATION
- The electric current from the engine-ECU connector terminals ETV+, ETV- to the throttle valve control servo is controlled.

FUNCTION
- Engine-ECU checks the electronic controlled throttle system for abnormal conditions.

TROUBLE JUDGEMENT

Check Conditions
- Battery positive voltage is more than 8.3 V.
- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.
- Drop of throttle position sensor (main) output voltage per 100 milliseconds is more than 0.04 V.

Judgement Criterion
- Throttle position sensor (main) output voltage is higher than the target throttle position sensor (main) voltage by more than 0.5 V.

Check Conditions
- Battery positive voltage is more than 8.3 V.
- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.
- Target throttle position sensor (main) output voltage is less than 1.5 V.

Judgement Criteria
- Difference between throttle position sensor (main) output voltage and target throttle position sensor (main) voltage is more than 0.6 V.
- Throttle position sensor (main) output voltage has continued to be higher than the target throttle position sensor (main) voltage by more than 0.5 V.

Check Conditions
- Battery positive voltage is more than 8.3 V.
- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.

Judgement Criterion
- Difference between throttle position sensor (main) output voltage and target throttle position sensor (main) voltage is more than 1 V.

Check Condition
- Battery positive voltage is more than 8.3 V.

Judgement Criterion
- Throttle position sensor (main) default opening learnt value is more than 4 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSES
- Failed throttle valve return spring
- Failed throttle valve operation
- Failed throttle valve control servo
- Harness damage in throttle valve control servo circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check throttle body.
- Check whether the throttle valve return spring is normal.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the throttle body assembly.

STEP 2. Check throttle valve control servo itself.
- Throttle valve control servo check (Refer to P.13F-225).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the throttle body assembly.

STEP 3. Check of harness damage in ETV+ line between electronic controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Check of harness damage in ETV- line between electronic controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0642: Throttle Position Sensor Power Supply

FUNCTION
- Engine-ECU checks the throttle position sensor power voltage for abnormal conditions.

TROUBLE JUDGEMENT

Check Condition
- Battery positive voltage is more than 6.3 V.

Judgement Criterion
- Throttle position sensor power voltage is less than 4.3 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSE
- Failed engine-ECU
- Short circuit in throttle position sensor power voltage to earth.

DIAGNOSIS PROCEDURE

STEP 1. Voltage measurement at electronic-controlled throttle valve connector (TPS5 line).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the electronic-controlled throttle valve connector (TPS5 line) and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 2.

STEP 2. Check of short circuit to earth and open circuit in TPS5 line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0657: Throttle Valve Control Servo Relay Circuit Malfunction

OPERATION

- Battery voltage is applied to the throttle valve control servo relay.
- Battery voltage is applied to the throttle valve control servo relay from the engine control relay.
- Engine-ECU connector terminal C/RL applies current to the throttle valve control servo relay by turning ON the power transistor in the unit in order to turn the relay ON.
- When the throttle valve control servo relay turns ON, battery voltage is supplied by the throttle valve control servo relay to the engine-ECU connector terminal RSB.

FUNCTION

- When the ignition switch ON signal is input into the engine-ECU, the engine-ECU turns ON the throttle valve control servo.

TROUBLE JUDGEMENT

Check Condition

- Battery positive voltage is more than 8.3 V.

Judgement Criterion

- The power line voltage of the electronic controlled throttle system is less than 6.0 V.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree position is in default position.

PROBABLE CAUSES

- Failed throttle valve control servo relay
- Open/short circuit or harness damage in throttle valve control servo relay circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check throttle valve control servo relay itself.

- Throttle valve control servo relay check (Refer to P.13F-218).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the throttle valve control servo relay.

STEP 2. Voltage measurement at throttle valve control servo relay connector (battery side power supply line).

(1) Remove the relay, and measure at the relay box side.
(2) Check the voltage between the throttle valve control servo relay connector (battery side power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth and open circuit in power supply line between battery and throttle valve control servo relay connector.

STEP 3. Voltage measurement at throttle valve control servo relay connector (engine control relay side power supply line).

(1) Remove the relay, and measure at the relay box side.
(2) Ignition switch: ON
(3) Check the voltage between the throttle valve control servo relay connector (engine control relay side power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth and open circuit in power supply line between engine control relay connector and throttle valve control servo relay connector.

STEP 4. Voltage measurement at engine-ECU connector (C/RL terminal).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Short-circuit engine-ECU connector (C/R terminal) to the body earth.
(3) Check the voltage between the engine-ECU connector (C/RL terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth and open circuit in C/RL line between throttle valve control servo relay connector and engine-ECU connector.

STEP 5. Voltage measurement at engine-ECU connector (RSB terminal).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Short-circuit engine-ECU connector (C/R and C/RL terminal) to the body earth.
(3) Check the voltage between the engine-ECU connector (RSB terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth and open circuit in RSB line between throttle valve control servo relay connector and engine-ECU connector.

STEP 6. Check of harness damage in power supply line between battery and throttle valve control servo relay connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Check of harness damage in power supply line between engine control relay connector and throttle valve control servo relay connector.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair the connector(s) or wiring harness.

STEP 8. Check of harness damage in C/RL line between throttle valve control servo relay connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair the connector(s) or wiring harness.

STEP 9. Check of harness damage in RSB line between throttle valve control servo relay connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair the connector(s) or wiring harness.

STEP 10. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P1231: Trustful Check Active Stability Control (ASC)

FUNCTION
- Checks for an abnormal signal of active stability control (ASC) via the CAN communication.

TROUBLE JUDGEMENT
Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- A torque demand signal from the active stability control (ASC) is not normal.

FAIL-SAFE AND BACKUP FUNCTION
- Torque requested by active stability control (ASC) is ignored.

PROBABLE CAUSES
- Failed active stability control system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Go to Step 2.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 2. M.U.T.-III diagnosis code
- Confirm the diagnosis code is stored in the ASC-ECU.

Q: Is diagnosis code stored?
YES : Perform troubleshooting of the active stability control system (ASC) (Refer to GROUP 35C – Troubleshooting – Diagnosis Code Chart).
NO : Replace the engine-ECU.

Code No. P1238: Air Flow Sensor Trustful for Torque Monitoring

FUNCTION
- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (main or sub) signal.

TROUBLE JUDGEMENT
Check Conditions
- The actual volumetric efficiency is higher than the volumetric efficiency estimated by the throttle position sensor(main). Or, the actual volumetric efficiency is more than 60 %.
- Engine speed is more than 750 r/min.

Judgement Criterion
- The difference between the actual volumetric efficiency and the volumetric efficiency estimated by the throttle position sensor (main) is more than 35 %.

Check Conditions
- The actual volumetric efficiency is higher than the volumetric efficiency estimated by the throttle position sensor(sub). Or, the actual volumetric efficiency is more than 60%.
- Engine speed is more than 750 r/min.

Judgement Criterion
- The difference between the actual volumetric efficiency and the volumetric efficiency estimated by the throttle position sensor (sub) is more than 35 %.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSES
- Failed air flow sensor
- Harness damage in air flow sensor circuit or loose connector contact
- Failed intake air system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P1238 stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 10: Air flow sensor

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Check air flow sensor system. Check code No. P0102: air flow sensor circuit low input (Refer to P.13F-34). Check code No. P0103: air flow sensor circuit high input (Refer to P.13F-36).

Code No. P1240: Trustful Check Ignition Angle

FUNCTION

- Checks for an abnormal ignition timing retard angle demand signal from the active stability control.

TROUBLE JUDGEMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- The ignition timing retard angle demand signal is not normal.

FAIL-SAFE AND BACKUP FUNCTION

- Ignition retard is not carried out.

PROBABLE CAUSES

- Failed active stability control
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code related to CAN communication stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III diagnosis code

- Confirm the diagnosis code is stored in the ASC-ECU.

Q: Is diagnosis code stored?
YES : Perform troubleshooting of the active stability control system (ASC) (Refer to GROUP 35C – Troubleshooting – Diagnosis Code Chart).
NO : Replace the engine-ECU.

Code No. P1242: Fail-safe Control Monitoring

FUNCTION
- Monitors the engine speed during fail-safe control.

TROUBLE JUDGEMENT
Check Condition
- During fail-safe control.

Judgement Criterion
- The engine speed is higher than assumed.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P1242 output?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P1243: Inquiry/Response Error

FUNCTION
- Monitors the computation function of the engine-ECU.

TROUBLE JUDGEMENT
Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- The engine-ECU cannot calculate input data.

FAIL-SAFE AND BACKUP FUNCTION
- Microcomputer is reset.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P1247: Trustful Check A/T

FUNCTION
- Checks for an abnormal signal of A/T-ECU.

TROUBLE JUDGEMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- A torque demand signal from A/T-ECU is not normal.

FAIL-SAFE AND BACKUP FUNCTION
- Torque requested by A/T-ECU is ignored.

PROBABLE CAUSES
- Failed A/T system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Go to Step 2.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 2. M.U.T.-III diagnosis code
- Confirm the diagnosis code is stored in the A/T-ECU.

Q: Is diagnosis code stored?
YES : Perform troubleshooting of the A/T system (Refer to GROUP 23C – Troubleshooting – Check Chart for Diagnosis Codes P.23C-6).
NO : Replace the engine-ECU.

Code No. P1248: Trustful Check 4WD-ECU

FUNCTION
- Checks for an abnormal signal of 4WD-ECU.

TROUBLE JUDGEMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- A torque reduction demand signal from 4WD-ECU is not normal.

FAIL-SAFE AND BACKUP FUNCTION
- Disables 4WD.

PROBABLE CAUSES
- Failed 4WD system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Go to Step 2.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 2. M.U.T.-III diagnosis code
- Confirm the diagnosis code is stored in the 4WD-ECU.

Q: Is diagnosis code stored?
YES : Perform troubleshooting of the 4WD system (Refer to GROUP 27C – Troubleshooting – Diagnosis Code Chart).
NO : Replace the engine-ECU.

Code No. P1590: A/T-ECU to Engine-ECU Communication Error in Torque Reduction Request

FUNCTION
- The engine-ECU watches and checks whether communication with the A/T-ECU normal or not.

TROUBLE JUDGEMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Engine-ECU detects an error in communication between engine-ECU and A/T-ECU.

FAIL-SAFE AND BACKUP FUNCTION
- Engine output is restricted.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P1603: Battery Backup Circuit Malfunction

FUNCTION
- The engine-ECU checks open circuit in the battery backup line.

TROUBLE JUDGEMENT

Check Conditions
- Engine starting sequence was completed.
- Battery positive voltage is more than 10 V.

Judgement Criterion
- Battery backup line voltage is less than 6 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- All diagnosis codes are stored once failure judgement is completed.

PROBABLE CAUSES
- Open/short circuit or harness damage in battery backup line circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check the battery condition.

Q: Was the battery terminal removed just before reading the diagnosis code?
YES : Go to Step 2.
NO : Go to Step 3.

STEP 2. M.U.T.-III diagnosis code
- Temporarily place the ignition switch in "LOCK" (OFF) position, and 10 seconds after that, place it in "ON" position again.

Q: Is diagnosis code of P1603 stored?
YES : Go to Step 3.
NO : Check end.

STEP 3. Voltage measurement at engine-ECU connector (BACK terminal).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the voltage between the engine-ECU connector (BACK terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth and open circuit in BACK line between battery and engine-ECU connector.

STEP 4. Check of harness damage in BACK line between the battery and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?

YES : Replace the engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2100: Throttle Valve Control Servo Circuit (open)

OPERATION

- Controls the current that is applied from the engine-ECU connector terminals ETV+, ETV- to the electronic-controlled throttle valve.

FUNCTION

- Engine-ECU varies the direction and the amperage of the current that is applied to the throttle valve control servo in order to control the opening of the throttle valve.

TROUBLE JUDGEMENT

Check Conditions

- Battery positive voltage is more than 8.3 V.
- The difference between the output voltage of the throttle position sensor (main) and the proposed output voltage is 0.1 V or more.
- The difference between the output voltage of the throttle position sensor (sub) and the proposed output voltage is 0.1 V or more.
- Except while engine is being cranked.
- The drive duty of the throttle valve control servo is more than +100 % or less than -100 %.

Judgement Criterion

- The difference between the output voltage of the throttle position sensor (main) and the learning value of the middle-opened degree is 0.2 V or less.

or

- The difference between the output voltage of the throttle position sensor (sub) and the learning value of the middle-opened degree is 0.2 V or less.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree position is in default position.

PROBABLE CAUSES

- Failed throttle valve control servo.
- Open circuit or harness damage in throttle valve control servo circuit or lose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check throttle valve control servo itself.

- Throttle valve control servo check (Refer to P.13F-225).

Q: Is the check result normal?

YES : Go to Step 2.

NO : Replace the throttle body assembly.

STEP 2. Check of open circuit and damage in RSG and RSH line between engine-ECU connector and body earth.

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair the connector(s) or wiring harness.

STEP 3. Check of open circuit and damage in ETV+ line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair the connector(s) or wiring harness.

STEP 4. Check of open circuit and damage in ETV- line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?

YES : Go to Step 5.

NO : Repair the connector(s) or wiring harness.

STEP 5. M.U.T-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2101: Throttle Valve Control Servo Magneto Malfunction

OPERATION
- Controls the current that is applied from the engine-ECU connector terminals ETV+, ETV- to the electronic-controlled throttle valve.

FUNCTION
- Engine-ECU check whether the throttle valve control servo magneto failed.

TROUBLE JUDGEMENT

Check Condition
- Battery positive voltage is more than 8.3 V.

Judgement Criterion
- The coil current of the throttle valve control servo is more than 8 A.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSES
- Failed throttle valve control servo.
- Short circuit or harness damage in throttle valve control servo circuit or lose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check throttle valve control servo itself.
- Throttle valve control servo check (Refer to P.13F-225).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the throttle body assembly.

STEP 2. Check of short to earth and damage in ETV+ line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check of short to earth and damage in ETV- line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2122: Accelerator Pedal Position Sensor (main) Circuit Low Input

OPERATION

- A power voltage of 5 V is applied to the accelerator pedal position sensor from the engine-ECU connector terminal APS5.
- The power voltage is earthed to the engine-ECU connector terminal APSE from the accelerator pedal position sensor.
- The sensor signal is inputted to the engine-ECU connector terminal APSM from the accelerator pedal position sensor output terminal.

FUNCTION

- The accelerator pedal position sensor (main) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGEMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Accelerator pedal position sensor (main) output voltage is less than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTIONS

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.

PROBABLE CAUSES

- Failed accelerator pedal position sensor (main)
- Open/short circuit or harness damage in accelerator pedal position sensor main circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 11: Accelerator pedal position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Voltage measurement at accelerator pedal position sensor connector (APS5 line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the accelerator pedal position sensor connector (APS5 line) and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of open circuit, and short to earth in APS5 line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 11: Accelerator pedal position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check of damage in APS5 line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check of open circuit, short to earth, and damage in APSM line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Replace the accelerator pedal assembly
- After replacing the accelerator pedal assembly, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P2123: Accelerator Pedal Position Sensor (main) Circuit High Input

OPERATION
- A power voltage of 5 V is applied to the accelerator pedal position sensor from the engine-ECU connector terminal APS5.
- The power voltage is earthed to the engine-ECU connector terminal APSE from the accelerator pedal position sensor.
- The sensor signal is inputted to the engine-ECU connector terminal APSM from the accelerator pedal position sensor output terminal.

FUNCTION
- The accelerator pedal position sensor (main) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGEMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Accelerator pedal position sensor (main) output voltage is more than 4.8 V.

FAIL-SAFE AND BACKUP FUNCTIONS
- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.

PROBABLE CAUSES
- Failed accelerator pedal position sensor (main)
- Open circuit or harness damage in accelerator pedal position sensor main circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item 11: Accelerator pedal position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Resistance measurement at accelerator pedal position sensor connector (APSE line).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the accelerator pedal position sensor connector (APSE line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of open circuit, and damage in APSE line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item 11: Accelerator pedal position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Replace the accelerator pedal assembly
- After replacing the accelerator pedal assembly, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P2127: Accelerator Pedal Position Sensor (sub) Circuit Low Input

OPERATION
- A power voltage of 5 V is applied to the accelerator pedal position sensor from the engine-ECU connector terminal 5VV.
- The power voltage is earthed to the engine-ECU connector terminal EV from the accelerator pedal position sensor.
- The sensor signal is inputted to the engine-ECU connector terminal APSS from the accelerator pedal position sensor output terminal.

FUNCTION
- The accelerator pedal position sensor (sub) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGEMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Accelerator pedal position sensor (sub) output voltage is less than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if accelerator pedal position sensor (main) fails.

PROBABLE CAUSES
- Failed accelerator pedal position sensor (sub)
- Open/short circuit or harness damage in accelerator pedal position sensor sub circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13F-186).
  a. Item 12: Accelerator pedal position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Voltage measurement at accelerator pedal position sensor connector (5VV line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the accelerator pedal position sensor connector (5VV line) and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of open circuit, and short to earth in 5VV line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 12: Accelerator pedal position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check of harness damage in 5VV line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check of open circuit, short to earth, and damage in APSS line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Replace the accelerator pedal assembly

- After replacing the accelerator pedal assembly, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P2128: Accelerator Pedal Position Sensor (sub) Circuit High Input

OPERATION

- A power voltage of 5 V is applied to the accelerator pedal position sensor from the engine-ECU connector terminal 5VV.
- The power voltage is earthed to the engine-ECU connector terminal EV from the accelerator pedal position sensor.
- The sensor signal is inputted to the engine-ECU connector terminal APSS from the accelerator pedal position sensor output terminal.

FUNCTION

- The accelerator pedal position sensor (sub) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGEMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Accelerator pedal position sensor (sub) output voltage is more than 2.5 V.

FAIL-SAFE AND BACKUP FUNCTIONS

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if accelerator pedal position sensor (main) fails.

PROBABLE CAUSES

- Failed accelerator pedal position sensor (sub)
- Open circuit or harness damage in accelerator pedal position sensor sub circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 12: Accelerator pedal position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Resistance measurement at accelerator pedal position sensor connector (EV line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the accelerator pedal position sensor connector (EV line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check of open circuit, and damage in EV line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13F-186).
  a. Item 12: Accelerator pedal position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Replace the accelerator pedal assembly

- After replacing the accelerator pedal assembly, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P2135: Throttle Position Sensor (main and sub) Range/Performance Problem

OPERATION

- Check code No. P0122: throttle position sensor (main) circuit low input (Refer to P.13F-46).
- Check code No. P0222: throttle position sensor (sub) circuit low input (Refer to P.13F-70).

FUNCTION

- Engine-ECU checks the throttle position sensor output signal characteristics for abnormal conditions.

TROUBLE JUDGEMENT

Check Conditions

- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.
- Throttle position sensor (sub) output voltage is more than 0.2 V and is less than 4.8 V.

Judgement Criterion

- The sum of the output voltage of the throttle position sensors (main and sub) is less than 4.5 V, or more than 5.5 V.

Check Conditions

- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.
- Throttle position sensor (sub) output voltage is more than 0.2 V and is less than 4.8 V.
- Battery positive voltage is more than 8.3 V.
- Throttle position sensor (main and sub) output voltage has continued to be less than the target throttle position sensor (main) voltage by less than 0.9 V.

Judgement Criterion

- Voltage obtained with the formula given below is more than 0.3 V for 0.3 second: [throttle position sensor (main) output voltage - throttle position sensor (sub) output voltage].

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree position is in default position.

PROBABLE CAUSES

- Failed throttle position sensor
- Harness damage in throttle position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check of harness damage in TPS5 line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair the connector(s) or wiring harness.

STEP 2. Check of harness damage in TPSM line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check of harness damage in TPSS line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Check of harness damage in TPSE line between electronic-controlled throttle valve connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Replace throttle body assembly.

- After replacing the throttle body assembly, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P2138: Accelerator Pedal Position Sensor (main and sub) Range/Performance Problem

OPERATION

- Check code No. P2122: accelerator pedal position sensor (main) circuit low input (Refer to P.13F-130).
- Check code No. P2127: accelerator pedal position sensor (sub) circuit low input (Refer to P.13F-132).

FUNCTION

- Engine-ECU checks the accelerator pedal position sensor output signal characteristics for abnormal conditions.

TROUBLE JUDGEMENT

Check Conditions

- Ignition switch is "ON" position.
- Change of accelerator pedal position sensor (sub) output voltage per 25 milliseconds is less than 0.06 V.

Judgement Criterion

- Voltage obtained with the formula given below is more than 0.39 V for 0.3 second: [accelerator pedal position sensor (sub) output voltage +0.3 V – accelerator pedal position sensor (main) output voltage].

Check Conditions

- Ignition switch is "ON" position.
- Change of accelerator pedal position sensor (sub) output voltage per 25 milliseconds is less than 0.06 V.

Judgement Criterion

- Voltage obtained with the formula given below is more than 0.39 V for 0.2 second: [accelerator pedal position sensor (main) output voltage – accelerator pedal position sensor (sub) output voltage].

FAIL-SAFE AND BACKUP FUNCTIONS

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.

PROBABLE CAUSES

- Failed accelerator pedal position sensor
- Harness damage in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check of harness damage in APS5 line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair the connector(s) or wiring harness.

STEP 2. Check of harness damage in APSM line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check of harness damage in APSE line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Check of harness damage in 5VV line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of harness damage in APSS line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check of harness damage in EV line between accelerator pedal position sensor connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Replace the accelerator pedal assembly
- After replacing the accelerator pedal assembly, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P2228: Barometric Pressure Sensor Circuit Low Input

FUNCTION
- The barometric pressure sensor converts the barometric pressure into a voltage signal and inputs the signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.

TROUBLE JUDGEMENT

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- Battery positive voltage is more than 8 V.

Judgement Criterion
- Barometric pressure sensor output signal is less than 49 kPa for 10 seconds: approximately 4,600 m above sea level.

FAIL-SAFE AND BACKUP FUNCTION
- Control as if the barometric pressure is 101 kPa.

PROBABLE CAUSE
- Failed barometric pressure sensor

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2229: Barometric Pressure Sensor Circuit High Input

FUNCTION

- The barometric pressure sensor converts the barometric pressure into a voltage signal and inputs the signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.

TROUBLE JUDGEMENT

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- Battery positive voltage is more than 8 V.

Judgement Criterion

- Barometric pressure sensor output signal is more than 113 kPa for 10 seconds: approximately 1,200 m below sea level.

FAIL-SAFE AND BACKUP FUNCTION

- Control as if the barometric pressure is 101 kPa.

PROBABLE CAUSE

- Failed barometric pressure sensor

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?

YES : Replace the engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2252: Oxygen Sensor Offset Circuit Low Voltage

FUNCTION

- The engine-ECU watches and checks whether the offset voltage of the oxygen sensor is normal or not.

TROUBLE JUDGEMENT

Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Oxygen sensor offset voltage is less than 0.4 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSE

- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?

YES : Replace the engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2253: Oxygen Sensor Offset Circuit High Voltage

FUNCTION
- The engine-ECU watches and checks whether the offset voltage of the oxygen sensor is normal or not.

TROUBLE JUDGEMENT
Check Condition
- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion
- Oxygen sensor offset voltage is more than 0.6 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Does not control air-fuel ratio closed loop.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2530: Ignition Switch-IG1 Circuit

OPERATION
- When the ignition switch is turned on, the ignition switch ON signal is input into the engine-ECU connector terminal IGN and also into the ETACS-ECU.

FUNCTION
- The engine-ECU compares the ignition switch ON signal sent from the ignition switch with ignition switch information sent from ETACS-ECU. The engine-ECU checks for the abnormality.

TROUBLE JUDGEMENT
Check Condition
- Ignition switch: "ON" → "LOCK" (OFF)

Judgement Criterion
- While the ignition switch ON signal is input into the engine-ECU, the ignition switch information, sent from the ETACS-ECU via CAN, is turned to OFF from ON. This allows the CAN to be stopped.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Short circuit in ignition switch-IG1 circuit or loose connector contact
- Failed CAN
- Failed ETACS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis
- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnostics Table).

STEP 2. M.U.T.-III diagnosis code
- Confirm whether the diagnosis code is stored in the ETACS-ECU.

Q: Is diagnosis code stored?
YES : Perform troubleshooting of ETACS (Refer to GROUP 54A – ETACS – Diagnosis Code Chart).
NO : Go to Step 3.

STEP 3. Check of short circuit to earth in IGN line between engine-ECU connector and ETACS-ECU connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code stored?
YES : Go to Step 5.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. Replace the ETACS-ECU
- After replacing the ETACS-ECU, reconfirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Replace the engine-ECU.
NO : Check end.

Code No. U0101: A/T-ECU Time-out

⚠ CAUTION
If diagnosis code U0101 is stored in the engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION
Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Conditions
- After 2 seconds have passed since the ignition switch was turned to "ON" position.
- Battery positive voltage is more than 10 V and is less than 16.5 V.
- After 2 seconds since the battery voltage has reached 10 V or more.

Judgement Criterion
- Unable to receive A/T-ECU signals through the CAN bus line for 4 seconds.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction
- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and A/T-ECU, by malfunction in the power supply system of A/T-ECU, in A/T-ECU itself, in engine-ECU.

Past malfunction
- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and A/T-ECU and malfunction in the power supply system of A/T-ECU. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes stored in each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed harness and connector
- Failed A/T-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnosis Table). After repairing CAN bus line, go to Step 6.

STEP 2. M.U.T.-III diagnosis code

- Confirm whether the diagnosis code is stored in the A/T-ECU.

Q: Is diagnosis code stored?

YES : Perform troubleshooting of A/T (Refer to GROUP 23C – Troubleshooting – Check Chart for Diagnosis Code P.23C-6).

NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code

Check that the other ECU performing CAN communication with A/T-ECU stores diagnosis code No. U0101 [Refer to GROUP 54C – CAN Communication-related Diagnosis Code (U-code) Table].

Q: Is diagnosis code stored?

YES : Go to Step 4.

NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : After replacing A/T-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and A/T-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : Replace the engine-ECU.

NO : Intermittent malfunction in CAN bus line between engine-ECU and A/T-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : Go to Step 1.

NO : Check end.

Code No. U0114: 4WD-ECU Time-out

⚠ CAUTION
If diagnosis code U0114 is stored in the engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION
Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Conditions
- After 2 seconds have passed since the ignition switch was turned to "ON" position.
- Battery positive voltage is more than 10 V and is less than 16.5 V.
- After 2 seconds since the battery voltage has reached 10 V or more.

Judgement Criterion
- Unable to receive 4WD-ECU signals through the CAN bus line for 4 seconds.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction
- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and 4WD-ECU, by malfunction in the power supply system of 4WD-ECU, in 4WD-ECU itself, in engine-ECU.

Past malfunction
- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and 4WD-ECU and malfunction in the power supply system of 4WD-ECU. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes stored in each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION
- Loosens engine output torque restriction.

PROBABLE CAUSES
- Failed harness and connector
- Failed 4WD-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis
- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnosis Table). After repairing CAN bus line, go to Step 6.

STEP 2. M.U.T.-III diagnosis code
- Confirm whether the diagnosis code is stored in the 4WD-ECU.

Q: Is diagnosis code stored?
YES : Perform troubleshooting of 4WD (Refer to GROUP 27C – Troubleshooting – Inspection Chart for Diagnosis Code).
NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code
Check that the other ECU performing CAN communication with 4WD-ECU stores diagnosis code No. U0114 [Refer to GROUP 54C – CAN Communication-related Diagnosis Code (U-code) Table].

Q: Is diagnosis code stored?
YES : Go to Step 4.
NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : After replacing the 4WD-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and 4WD-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : Replace the engine-ECU.

NO : Intermittent malfunction in CAN bus line between engine-ECU and 4WD-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : Go to Step 1.

NO : Check end.

Code No. U0121: ASC-ECU Time-out

⚠ CAUTION

If diagnosis code U0121 is stored in the engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION

Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Conditions

- After 2 seconds have passed since the ignition switch was turned to "ON" position.
- Battery positive voltage is more than 10 V and is less than 16.5 V.
- After 2 seconds since the battery voltage has reached 10 V or more.

Judgement Criterion

- Unable to receive ASC-ECU signals through the CAN bus line for 4 seconds.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction

- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and ASC-ECU, by malfunction in the power supply system of ASC-ECU, in ASC-ECU itself, in engine-ECU.

Past malfunction

- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and ASC-ECU and malfunction in the power supply system of ASC-ECU. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Malfunctions).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes stored in each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed harness and connector
- Failed ASC-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnosis Table). After repairing CAN bus line, go to Step 6.

STEP 2. M.U.T.-III diagnosis code

- Confirm whether the diagnosis code is stored in the ASC-ECU.

Q: Is diagnosis code stored?

YES : Perform troubleshooting of ASC (Refer to GROUP 35C – Troubleshooting – Diagnosis Code Chart).

NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code

Check that the other ECU performing CAN communication with ASC-ECU stores diagnosis code No. U0121 [Refer to GROUP 54C – CAN Communication-related Diagnosis Code (U-code) Table].

Q: Is diagnosis code stored?

YES : Go to Step 4.

NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : After replacing ASC-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ASC-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : After replacing the engine-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ASC-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : Go to Step 1.

NO : Check end.

Code No. U0131: EPS-ECU Time-out

⚠ CAUTION
If diagnosis code U0131 is stored in the engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION
Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Conditions
- After 2 seconds have passed since the ignition switch was turned to "ON" position.
- Battery positive voltage is more than 10 V and is less than 16.5 V.
- After 2 seconds since the battery voltage has reached 10 V or more.

Judgement Criterion
- Unable to receive EPS-ECU signals through the CAN bus line for 4 seconds.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction
- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and EPS-ECU, by malfunction in the power supply system of EPS-ECU, in EPS-ECU itself, in engine-ECU.

Past malfunction
- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and EPS-ECU and malfunction in the power supply system of EPS-ECU. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes stored in each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed harness and connector
- Failed EPS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis
- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnostics Table). After repairing CAN bus line, go to Step 6 .

STEP 2. M.U.T.-III diagnosis code
- Confirm the diagnosis code is stored in the EPS-ECU.

Q: Is diagnosis code stored?
YES : Perform troubleshooting of EPS (Refer to GROUP 37 – Troubleshooting – Diagnosis Code Chart).
NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code
Check that the other ECU performing CAN communication with EPS-ECU stores diagnosis code No. U0131 [Refer to GROUP 54C – CAN-related Diagnosis Code Table].

Q: Is diagnosis code stored?
YES : Go to Step 4.
NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : After replacing EPS-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and EPS-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : Replace engine-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and EPS-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : Go to Step 1.

NO : Check end.

Code No. U0141: ETACS-ECU Time-out

⚠ CAUTION

If diagnosis code U0141 is stored in the engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION

Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Conditions

- After 2 seconds have passed since the ignition switch was turned to "ON" position.
- Battery positive voltage is more than 10 V and is less than 16.5 V.
- After 2 seconds since the battery voltage has reached 10 V or more.

Judgement Criterion

- Unable to receive ETACS-ECU signals through the CAN bus line for 4 seconds.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction

- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and ETACS-ECU, by malfunction in the power supply system of ETACS-ECU, in ETACS-ECU itself, in engine-ECU.

Past malfunction

- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and ETACS-ECU and malfunction in the power supply system of ETACS-ECU. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes stored in each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed harness and connector
- Failed ETACS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnosis Table). After repairing CAN bus line, go to Step 6.

STEP 2. M.U.T.-III diagnosis code

- Confirm whether the diagnosis code is stored in the ETACS-ECU.

Q: Is diagnosis code stored?

YES : Perform troubleshooting of ETACS (Refer to GROUP 54A – ETACS – Troubleshooting – Diagnosis Code Chart).

NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code

Check that the other ECU performing CAN communication with ETACS-ECU stores diagnosis code No. U0141 [Refer to GROUP 54C – CAN Communication-related Diagnosis Code (U-code) Table].

Q: Is diagnosis code stored?

YES : Go to Step 4.

NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : After replacing the ETACS-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ETACS-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : After replacing the engine-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ETACS-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : Go to Step 1.

NO : Check end.

Code No. U0167: KOS-ECU Communication Error

⚠ CAUTION
If diagnosis code U0167 is stored in the engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION
Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Conditions
- After the engine is cranked.
- Ignition switch is "ON" position.

Judgement Criterion
- Unable to receive KOS-ECU signals through the CAN bus line.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction
- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and KOS-ECU, by malfunction in the power supply system of KOS-ECU, in KOS-ECU itself, in engine-ECU.

Past malfunction
- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and KOS-ECU and malfunction in the power supply system of KOS-ECU. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes stored in each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION
- Engine start is prohibited.

PROBABLE CAUSES
- Failed harness and connector
- Failed KOS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis
- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair the CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnosis Table). After repairing the CAN bus line, go to Step 4.

STEP 2. M.U.T.-III diagnosis code
- Confirm whether the diagnosis code is stored in the KOS-ECU.

Q: Is diagnosis code stored?
YES : Perform troubleshooting of KOS-ECU (Refer to GROUP 42B – Troubleshooting – Check Chart for Diagnosis Code).
NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.
1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : After replacing the engine-ECU, go to Step 4.
NO : Intermittent malfunction in CAN bus line between engine-ECU and KOS-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again whether the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?
YES : Go to Step 1.
NO : Check end.

Code No. U0415: ASC-ECU CAN Data Abnormality

⚠ CAUTION
If diagnosis code U0415 is stored in the engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION
Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGEMENT

Check Conditions

- After 5 seconds have passed since the ignition switch was turned to "ON" position.
- While engine running.

Judgement Criterion

- When the communication error is judged between the engine-ECU and the ASC-ECU.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction

- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and ASC-ECU, by malfunction in ASC-ECU signals, in ASC-ECU itself, in engine-ECU.

Past malfunction

- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and ASC-ECU and malfunction in ASC-ECU signals. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes stored in each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION

- Torque requested by active stability control (ASC) is ignored.

PROBABLE CAUSES

- Failed harness and connector
- Signal failure input into engine-ECU sent from ASC-ECU through CAN communication
- Failed ASC-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnostics Table). After repairing CAN bus line, go to Step 6.

STEP 2. M.U.T.-III diagnosis code

- Confirm whether the diagnosis code is stored in the ASC-ECU.

Q: Is diagnosis code stored?

YES : Perform troubleshooting of the active stability control (ASC) system (Refer to GROUP 35C – Troubleshooting – Diagnosis Code Chart).

NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code

Check that the other ECU performing CAN communication with ASC-ECU stores diagnosis code No. U0415 [Refer to GROUP 54C – CAN Communication-related Diagnosis Code (U-code) Table].

Q: Is diagnosis code stored?

YES : Go to Step 4.

NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : After replacing ASC-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ASC-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : After replacing engine-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ASC-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is stored in the engine-ECU.

1. Erase the stored diagnosis code.
2. Ignition switch: LOCK (OFF) → ON
3. Confirm whether the diagnosis code is stored.

Q: Is diagnosis code stored?

YES : Go to Step 1.

NO : Check end.

INSPECTION CHART FOR TROUBLE SYMPTOMS

M1131151504375

Item	Trouble Symptom		Inspection Procedure No.
Communication with M.U.T.-III is impossible	Communication between M.U.T.-III and engine-ECU is not possible.		1
Engine warning lamp	The engine warning lamp does not illuminate right after the ignition switch is turned to "ON".		2
	The engine warning lamp remains illuminating and never goes out.		3
Starting	Starting impossible (No initial combustion)	The starter is not operable.	4
	Starting impossible (Starter operative but no initial combustion)	The starter is operative and cranks the engine, but no initial combustion occurs in the cylinders to start the engine.	5
	Starting impossible (Initial combustion but no complete combustion)	Initial combustion occurs, but the engine stalls soon due to the incomplete combustion.	6
	Engine does not start properly (Long time to start)	The engine starts, but it takes too long for cranking.	
Improper idling	Unstable idling (Rough idling, hunting)	The engine speed is not constant and fluctuates during the idling. Usually, this malfunction can be judged from the shaking tachometer pointer or vibrations transmitted to the steering wheel, shift lever, vehicle body and so on.	7
	Improper idling speed (Too high or too low)	The idling speed is not within the normal range.	
	Engine stalls during idling (Die out)	The engine stalls during the idling in no relation to the vehicle movement.	
Engine stalls	The engine stalls when starting the car (pass out)	The engine stalls when the accelerator pedal is depressed in the idling speed, or during the operation.	8
	Engine stalls at deceleration	The engine stalls at the deceleration.	

Item	Trouble Symptom		Inspection Procedure No.
Driving	Engine does not revolve up	The engine speed does not increase even when the accelerator pedal is depressed.	9
	Hesitation, sag	The response of vehicle speed (engine speed) is delayed when the accelerator pedal is depressed to accelerate vehicle speed, or the vehicle speed (engine speed) is temporarily dropped during the acceleration. This phenomenon is called "hesitation" and a serious hesitation is called "sag".	10
	Stumble	The engine speed increase is delayed when the accelerator pedal is initially depressed at the starting.	
	Poor acceleration	The engine operates smoothly at a constant-speed run, but the vehicle does not accelerate properly as the throttle valve opening changes. In addition, vehicle will not run in the specified maximum speed.	
	Surge	At a constant-speed or acceleration the vehicle is subject to repeated jerking (in terms of the drive speed) in the driving direction.	
	The feeling of impact or vibration when accelerating	The driver feels a sudden impact when the vehicle is accelerated.	11
	The feeling of impact or vibration when decelerating	The driver feels a sudden impact when the vehicle is decelerated.	12
	Knocking	Sharp sound like a hammer striking on the cylinder walls during the driving can be heard and wrongly affects the driving.	13
	Ignition timing deviation	The basic ignition timing is deviated from the datum value.	14
Stopping	Run on (Dieseling)	The engine continues to run after the ignition switch is in "LOCK" (OFF) position.	15
Exhaust gas	Odour, white smoke, black smoke The concentration of CO & HC is high during the idling.	The exhaust has an abnormal odour. Either white or black exhaust gas comes out. The concentration of CO & HC is high during the idling.	16

Item	Trouble Symptom		Inspection Procedure No.
Charging performance	Battery run down	The battery is soon rundown. Or, the charging ability of battery is small.	17
Cooling performance	Overheating	The temperature of engine cooling water is extremely high.	18

PROBLEM SYMPTOMS TABLE

⚠ WARNING

When touching the throttle valve, surely shut off the driving circuits of the throttle valve. In the event that the throttle valve is operated, a finger might be injured as the result of being caught by the throttle valve.

⚠ CAUTION

During troubleshooting if the ignition switch is turned to ON with the connectors, etc. disconnected, some diagnosis code may be saved in other system. After the troubleshooting is completed, always make sure the diagnosis codes of the entire systems. If it is found that some diagnosis codes have been outputted, erase them.

NOTE: When the racing (2,000 to 5,000 r/min or more) continues on the vehicle stopped with no load during the specified time or more, the increase in the engine speed might be limited. This comes from the engine protection and control functions and is not a malfunction.

Inspection Procedure No.	Inspection Item	Reference Page
1	Communication with engine-ECU is not possible	P.13F-154
2	The engine warning lamp does not illuminate right after the ignition switch is turned the ON position	P.13F-156
3	The engine warning lamp remains illuminating and never goes out	P.13F-156
4	Starting impossible (starter not operative)	P.13F-157
5	Starting impossible (Starter operative but no initial combustion)	P.13F-160
6	Starting impossible (Initial combustion but no complete combustion)	P.13F-162
	Improper starting (Long time to start)	
7	Unstable idling (Rough idling, hunting)	P.13F-164
	Improper idling speed (Too high or too low)	
	Engine stalls during idling (Die out)	
8	The engine stalls when starting the car (pass out)	P.13F-166
	The engine stalls when decelerating	
9	Engine does not revolve up	P.13F-167

Inspection Procedure No.	Inspection Item	Reference Page
10	Hesitation, sag	P.13F-168
	Poor acceleration	
	Stumble	
	Surge	
11	The feeling of impact or vibration when accelerating	P.13F-170
12	The feeling of impact or vibration when decelerating	P.13F-171
13	Knocking	P.13F-171
14	Ignition timing deviation	P.13F-172
15	Run on (Dieseling)	P.13F-173
16	Odour, white smoke, black smoke and high-concentration CO/HC during idling	P.13F-173
17	Battery run down	P.13F-175
18	Overheating	P.13F-177
19	Engine-ECU power supply, engine control relay, ignition switch – IG1 system	P.13F-178
20	Fuel pump system	P.13F-180
21	A/C compressor relay system	P.13F-182
22	Ignition circuit system	P.13F-183
23	Engine oil pressure switch system	P.13F-185

SYMPTOM PROCEDURES

Inspection Procedure 1: Communication with Engine-ECU is Not Possible

OPERATION

- Battery voltage is applied to the diagnosis connector terminal.
- The diagnosis connector terminal is earthed to the vehicle body.

COMMENTS ON TROUBLE SYMPTOM

- When the communication between M.U.T.-III and engine-ECU is impossible, it can be suspected that the CAN bus line, power supply circuit of the diagnosis connector, and/or earthing circuit are defective. Communication cannot be achieved either, if a wrong vehicle type is selected on M.U.T.-III.

PROBABLE CAUSES

- Failed diagnosis connector.
- Open/short circuit in the diagnosis connector circuit or loose connector contact.
- Defective CAN communication.
- Defective M.U.T.-III.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check the Vehicle Communication Interface (V.C.I.) operations

- Connect the M.U.T.-III to the diagnosis connector.
- When the power of Vehicle Communication Interface (V.C.I.) is turned to ON, the indicator lamp of the Vehicle Communication Interface (V.C.I.) illuminates in green.

OK: The indicator lamp of the Vehicle Communication Interface (V.C.I.) illuminates in green.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Go to Step 2.

STEP 2. Check battery voltage.

- Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-2).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the battery.

STEP 3. Voltage measurement at diagnosis connector (power supply line).

(1) Check the voltage between the diagnosis connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check of short to earth, and open circuit in MUT line between ETACS-ECU connector and diagnosis connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check of short to earth, and open circuit in +B1 line between battery and ETACS-ECU connector.

Q: Is the check result normal?
YES : Check fuse in the ETACS-ECU, and replace if necessary. If the fuse is normal, replace the ETACS-ECU.
NO : Repair the connector(s) or wiring harness.

STEP 6. Resistance measurement at diagnosis connector (body earth line).

(1) Check the resistance between the diagnosis connector (body earth line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector(s), or check and repair the harness of open circuit and damage in power supply line between diagnosis connector and body earth

STEP 7. Continuity check on ETACS-ECU connectors

(1) Disconnect the connector, and measure at the ETACS-ECU side.
(2) Continuity check between the ETACS-ECU connector (+B1 terminal) and the ETACS-ECU connector (MUT terminal).

OK: Continuity

Q: Is the check result normal?
YES : Go to Step 8.
NO : Check fuse in the ETACS-ECU, and replace if necessary. If the fuse is normal, replace the ETACS-ECU.

STEP 8. Check of harness damage in +B1 line between battery and ETACS-ECU connector.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair the connector(s) or wiring harness.

STEP 9. Check of harness damage in MUT line between ETACS-ECU connector and diagnosis connector.

Q: Is the check result normal?
YES : Refer to the M.U.T.-III reference manual.
NO : Repair the connector(s) or wiring harness.

STEP 10. M.U.T.-III CAN bus diagnosis

- Use M.U.T.-III, perform CAN bus line diagnosis.

Q: Is the check result normal?
YES : Check Inspection Procedure – engine-ECU power supply, engine control relay, ignition switch-IG1 system (Refer to P.13F-178).
NO : Perform troubleshooting for CAN (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnostics Table).

Inspection Procedure 2: The Engine Warning Lamp Does Not Illuminate Right after the Ignition Switch is Turned the ON Position

COMMENTS ON TROUBLE SYMPTOM

- The combination meter illuminates engine warning lamp for 5 seconds just after the ignition switch is in ON position.
- If the engine warning lamp does not illuminate just after the ignition switch is in ON position, the causes of this failure may be the defective engine warning lamp or any open/short circuit in the combination meter, etc.

PROBABLE CAUSES

- Failed engine warning lamp
- Open/short circuit in the combination meter

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. Check the trouble symptom.

Q: Does the trouble symptom persist?
YES : Check combination meter system (Refer to GROUP 54A – Combination Meter – Trouble Symptom Chart).
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Inspection Procedure 3: The Engine Warning Lamp Remains Illuminating and Never Goes Out

COMMENTS ON TROUBLE SYMPTOM

- Failure possibly occurs when engine-ECU detects malfunction, or is possibly caused by short circuit in combination meter circuit, etc.

PROBABLE CAUSE

- Short circuit in the combination meter

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. Check the trouble symptom.

Q: Does the trouble symptom persist?
YES : Check combination meter system (Refer to GROUP 54A – Combination Meter – Trouble System Chart).
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Inspection Procedure 4: Starting Impossible (starter not operative)

OPERATION

- The power source is supplied from the battery to the starter terminal.
- The battery voltage is applied to the starter relay connector terminal.
- When the ignition switch-ST signal is input to the engine-ECU connector terminal ST2, the engine-ECU connector terminal STRL turns ON the power transistor inside the unit, and makes the current flow into the starter relay connector terminal to turn ON the relay.
- When the starter relay is turned ON, the current flows into the starter connector terminal from the starter relay connector terminal to drive the starter motor.

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by malfunction of starter or starter system circuits.

PROBABLE CAUSES

- Failed battery
- Failed OSS-ECU
- Failed starter relay
- Failed starter motor
- Open/short circuit or harness damage in starter system circuit or loose connector contact.
- Failed inhibitor switch
- Failed ETACS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery.

- Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-2).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the battery.

STEP 2. M.U.T.-III data list

- Item 79: Cranking signal

OK:
ON (ignition switch: ST)
OFF (ignition switch: ON)

Q: Is the check result normal?
YES : Go to Step 11.
NO : Go to Step 3.

STEP 3. Voltage measurement at engine-ECU connector (ST2 terminal).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ST
(3) Check the voltage between the engine-ECU connector (ST2 terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 7.
NO : Go to Step 4.

STEP 4. Voltage measurement at ETACS-ECU connector (ST terminal).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ST
(3) Check the voltage between the ETACS-ECU connector (ST terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 5.

STEP 5. Check of short to earth, and open circuit in ST line between OSS-ECU connector and ETACS-ECU connector.

Q: Is the check result normal?
YES : Perform troubleshooting of OSS System (Refer to GROUP 42B – Troubleshooting – Trouble Symptom Chart).
NO : Repair the connector(s) or wiring harness.

STEP 6. Continuity check on ETACS-ECU connectors.

(1) Disconnect the connector, and measure at the ETACS-ECU side.
(2) Continuity check between the ETACS-ECU connector (ST terminal) and the ETACS-ECU connector (ST2 terminal).

OK: Continuity

Q: Is the check result normal?
YES : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in ST2 line between ETACS-ECU connector and engine-ECU connector.
NO : Replace the ETACS-ECU.

STEP 7. Check of harness damage in ST line between OSS-ECU connector and ETACS-ECU connector.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair the connector(s) or wiring harness.

STEP 8. Continuity check on ETACS-ECU connectors.
(1) Disconnect the connector, and measure at the ETACS-ECU side.
(2) Continuity check between the ETACS-ECU connector (ST terminal) and the ETACS-ECU connector (ST2 terminal).

OK: Continuity

Q: Is the check result normal?
YES : Go to Step 9.
NO : Replace the ETACS-ECU.

STEP 9. Check of harness damage in ST2 line between ETACS-ECU connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair the connector(s) or wiring harness.

STEP 10. M.U.T.-III data list
- Item 79: Cranking signal

OK:
ON (ignition switch: ST)
OFF (ignition switch: ON)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 11. Check starter relay itself.
- Check starter relay itself (Refer to GROUP 16 – Starting System – On-vehicle Service – Starter Relay Continuity Check P.16-9).

Q: Is the check result normal?
YES : Go to Step 12.
NO : Replace the starter relay.

STEP 12. Resistance measurement at starter relay connector (body earth line).
(1) Remove relay, and measure at the relay box side.
(2) Check the resistance between the starter relay connector (body earth line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 13.
NO : Repair or replace the connector(s), or check and repair the harness of open circuit and damage in body earth line between starter relay connector and body earth.

STEP 13. Voltage measurement at starter relay connector (STRL line).
(1) Remove relay, and measure at the relay box side.
(2) Transmission: P or N range
(3) Ignition switch: ST
(4) Check the voltage between the starter relay connector (STRL line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 19.
NO : Go to Step 14.

STEP 14. Check inhibitor switch
- Check inhibitor switch (Refer to GROUP 23A – On-vehicle Service – Essential Service – Inhibitor Switch Continuity Check).

Q: Is the check result normal?
YES : Go to Step 15.
NO : Replace the inhibitor switch.

STEP 15. Check of short to earth, and open circuit in STRL line between inhibitor switch connector and starter relay connector.

Q: Is the check result normal?
YES : Go to Step 16.
NO : Repair the connector(s) or wiring harness.

STEP 16. Check of short to earth, and open circuit in STRL line between engine-ECU connector and inhibitor switch connector.

Q: Is the check result normal?
YES : Go to Step 17.
NO : Repair the connector(s) or wiring harness.

STEP 17. Check of short circuit to earth in NTSW line between engine-ECU connector and starter relay connector.

Q: Is the check result normal?
YES : Go to Step 18.
NO : Repair the connector(s) or wiring harness.

STEP 18. M.U.T.-III data list
- Item 102: Starter relay

OK:
ON (ignition switch: ST)
OFF (ignition switch: ON)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 19. Voltage measurement at starter relay connector (power supply line).
(1) Remove relay, and measure at the relay box side.
(2) Check the voltage between the starter relay connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 20.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in body earth line between battery and starter relay connector

STEP 20. Voltage measurement at starter connector (power supply line).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Transmission: P or N range
(3) Ignition switch: ST
(4) Check the voltage between the starter connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 24.
NO : Go to Step 21.

STEP 21. Check of short to earth, and open circuit in power supply line between starter relay connector and starter connector.

Q: Is the check result normal?
YES : Go to Step 22.
NO : Repair the connector(s) or wiring harness.

STEP 22. Check inhibitor switch
- Check inhibitor switch (Refer to GROUP 23C – On-vehicle Service – Essential Service – Inhibitor Switch Continuity Check).

Q: Is the check result normal?
YES : Go to Step 23.
NO : Replace the inhibitor switch.

STEP 23. Check of harness damage in STRL line between inhibitor switch connector and starter relay connector.

Q: Is the check result normal?
YES : Repair or replace the connector(s), or check and repair the harness of damage in STRL line between engine-ECU connector and inhibitor switch connector.
NO : Repair the connector(s) or wiring harness.

STEP 24. Check of harness damage in power supply line between battery and starter relay connector.

Q: Is the check result normal?
YES : Go to Step 25.
NO : Repair the damaged harness wire.

STEP 25. Check of harness damage in power supply line between starter relay connector and starter connector.

Q: Is the check result normal?
YES : Go to Step 26.
NO : Repair the connector(s) or wiring harness.

STEP 26. Voltage measurement at starter terminal (power supply line).

(1) Disconnect the terminal, and measure at the wiring harness side.
(2) Check the voltage between the starter terminal (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 27.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between battery and starter terminal

STEP 27. Check of harness damage in power supply line between battery and starter terminal.

Q: Is the check result normal?
YES : Replace the starter.
NO : Repair the connector(s) or wiring harness.

Inspection Procedure 5: Starting Impossible (Starter Operative but No Initial Combustion)

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by failed ignition circuit, fuel feed and so on.

PROBABLE CAUSES

- Failed battery
- Timing belt broken
- Contamination around the throttle valve
- Failed ignition system
- Failed fuel system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery voltage.

- Measure battery voltage at cranking.

OK: 8 V or more

Q: Is the check result normal?
YES : Go to Step 2.
NO : Battery check (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-2).

STEP 2. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 3.

STEP 3. M.U.T.-III actuator test

- Item 9: Fuel pump

OK: Operating sound of fuel pump can be heard

Q: Is the check result normal?
YES : Go to Step 4.
NO : Check Inspection Procedure – fuel pump system (Refer to P.13F-180).

STEP 4. Check timing belt for breakage.

- Engine: Cranking

OK: Camshaft rotates

Q: Is the check result normal?
YES : Go to Step 5.
NO : Replace the timing belt.

STEP 5. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Clean throttle body (throttle valve portion) (Refer to P.13F-212).

STEP 6. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 2: Crank angle sensor

Q: Is the check result normal?
YES : Go to Step 7.
NO : Check code No. P0335: crank angle sensor system (Refer to P.13F-100).

STEP 7. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Go to Step 8.

NO : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).

STEP 8. Check of harness damage in power supply line between engine control relay connector and No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6 injector connector.

Q: Is the check result normal?

YES : Go to Step 9.

NO : Repair the connector(s) or wiring harness.

STEP 9. Check injector for operating sound.

- Check injector for operating sound at engine cranking (Refer to P.13F-223).

Q: Is operating sound audible?

YES : Go to Step 10.

NO : Check the injector system of the defective cylinder. Check code No. P0261: No. 1 injector circuit low input (Refer to P.13F-73). Check code No. P0262: No. 1 injector circuit high input (Refer to P.13F-74). Check code No. P0264: No. 2 injector circuit low input (Refer to P.13F-75). Check code No. P0265: No. 2 injector circuit high input (Refer to P.13F-76). Check code No. P0267: No. 3 injector circuit low input (Refer to P.13F-77). Check code No. P0268: No. 3 injector circuit high input (Refer to P.13F-79). Check code No. P0270: No. 4 injector circuit low input (Refer to P.13F-80). Check code No. P0271: No. 4 injector circuit high input (Refer to P.13F-81).Check code No. P0273: No. 5 injector circuit low input (Refer to P.13F-82). Check code No. P0274: No. 5 injector circuit high input (Refer to P.13F-83).Check code No. P0276: No. 6 injector circuit low input (Refer to P.13F-84). Check code No. P0277: No. 6 injector circuit high input (Refer to P.13F-85).

STEP 10. Fuel pressure measurement.

- Measure the fuel pressure (Refer to P.13F-213).

Q: Is the check result normal?

YES : Go to Step 11.

NO : Repair.

STEP 11. Replace the engine-ECU.

- After the engine-ECU has been replaced, check for the trouble symptom again.

Q: Does the trouble symptom persist?

YES : Check for foreign matters (water, kerosene, etc.) in fuel and replace if necessary.

NO : Check end.

Inspection Procedure 6: Starting Impossible (Initial Combustion But No Complete Combustion), Improper Starting (Long Time to Start)

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by poor ignition, incorrect air-fuel ratio at cranking, improper fuel pressure and so on.

PROBABLE CAUSES

- Failed battery
- Failed ignition system
- Failed fuel system
- Failed air-fuel ratio control system
- Failed intake air system
- Contamination around the throttle valve
- Timing belt in out of place
- Improper compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery.

- Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-2).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the battery.

STEP 2. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 3.

STEP 3. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor
  e. Item BB: Barometric pressure sensor

Q: Are the check results normal?
YES : Go to Step 4.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 4. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Clean throttle body (throttle valve portion) (Refer to P.13F-212).

STEP 5. M.U.T.-III actuator test

- Item 9: Fuel pump

  OK: Operating sound of fuel pump can be heard.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Check Inspection Procedure – fuel pump system (Refer to P.13F-180).

STEP 6. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair.

STEP 7. Check injector for operating sound.

- Check injector for operating sound at engine cranking (Refer to P.13F-223).

Q: Is operating sound audible?

YES : Go to Step 8.

NO : Check the injector system of the defective cylinder. Check code No. P0261: No. 1 injector circuit low input (Refer to P.13F-73). Check code No. P0262: No. 1 injector circuit high input (Refer to P.13F-74). Check code No. P0264: No. 2 injector circuit low input (Refer to P.13F-75). Check code No. P0265: No. 2 injector circuit high input (Refer to P.13F-76). Check code No. P0267: No. 3 injector circuit low input (Refer to P.13F-77). Check code No. P0268: No. 3 injector circuit high input (Refer to P.13F-79). Check code No. P0270: No. 4 injector circuit low input (Refer to P.13F-80). Check code No. P0271: No. 4 injector circuit high input (Refer to P.13F-81).Check code No. P0273: No. 5 injector circuit low input (Refer to P.13F-82). Check code No. P0274: No. 5 injector circuit high input (Refer to P.13F-83).Check code No. P0276: No. 6 injector circuit low input (Refer to P.13F-84). Check code No. P0277: No. 6 injector circuit high input (Refer to P.13F-85).

STEP 8. Check timing mark on the timing belt.

Q: Is the check result normal?

YES : Go to Step 9.

NO : Align the timing marks.

STEP 9. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Go to Step 10.

NO : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).

STEP 10. Check injector for spray condition.

- Check each injector for spray condition (Refer to P.13F-223).

Q: Is the check result normal?

YES : Go to Step 11.

NO : Replace the injector.

STEP 11. Fuel pressure measurement.

- Fuel pressure measurement (Refer to P.13F-213).

Q: Is the check result normal?

YES : Go to Step 12.

NO : Repair.

STEP 12. Check compression pressure.

- Check the compression pressure (Refer to GROUP 11I – On-vehicle Service – Compression Pressure Check P.11I-12).

Q: Is the check result normal?

YES : Go to Step 13.

NO : Repair.

STEP 13. Replace the engine-ECU.

- After the engine-ECU has been replaced, check for the trouble symptom again.

Q: Does the trouble symptom persist?

YES : Check for foreign matters (water, kerosene, etc.) in fuel and replace if necessary.

NO : Check end.

Inspection Procedure 7: Unstable Idling (Rough Idling, Hunting), Improper Idling Speed (Too High or too Low), Engine Stalls during Idling (Die Out)

COMMENTS ON TROUBLE SYMPTOM

- Probable causes can be widely found in the ignition system, air-fuel ratio control system, throttle valve control system, and fuel system, etc. A sudden engine stall is possibly caused by poor contact in the connectors.

PROBABLE CAUSES

- Failed ignition system
- Failed fuel system
- Failed air-fuel ratio control system
- Failed intake and exhaust air system
- Contamination around the throttle valve
- Timing belt in out of place
- Improper compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor
  e. Item 11: Accelerator pedal position sensor (main)
  f. Item 12: Accelerator pedal position sensor (sub)
  g. Item 13: Throttle position sensor (main)
  h. Item 15: Throttle position sensor (sub)
  i. Item BB: Barometric pressure sensor

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 3. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 83: Power steering fluid pressure switch
  b. Item 87: Neutral switch

Q: Are the check results normal?
YES : Go to Step 4.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 4. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair.

STEP 5. Check timing mark on the timing belt.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Align the timing marks.

STEP 6. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Clean throttle body (throttle valve portion) (Refer to P.13F-212).

STEP 7. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item AC: Right bank oxygen sensor (front)
  b. Item AD: Right bank oxygen sensor (rear)
  c. Item AE: Left bank oxygen sensor (front)
  d. Item AF: Left bank oxygen sensor (rear)

Q: Are the check results normal?
YES : Go to Step 8.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 8. Voltage measurement at engine-ECU connector (ALTG line).

(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idle operation after warm-up
(3) Transmission: P range
(4) Radiator fan: Not operated
(5) Check the voltage between the engine-ECU connector (ALTG line) and body earth.

OK: The voltage increases when the headlamp switch and the rear window defogger switch are turned ON from OFF.

Q: Is the check result normal?
YES : Go to Step 11.
NO : Go to Step 9.

STEP 9. Check of short to power supply, short to earth, open circuit and damage in ALTG line between engine-ECU connector and alternator connector.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair the connector(s) or wiring harness.

STEP 10. Check the trouble symptom.

Q: Does the trouble symptom persist?
YES : Replace the alternator.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 11. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 12.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).

STEP 12. Check purge control solenoid valve itself.

- Check purge control solenoid valve itself (Refer to GROUP 17 – Emission Control – Evaporative Emission Control System – Purge Control Solenoid Valve Check).

Q: Is the check result normal?
YES : Go to Step 13.
NO : Replace the purge control solenoid valve.

STEP 13. Check injector for spray condition.

- Check each injector for spray condition (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 14.
NO : Replace the injector.

STEP 14. Check compression pressure.

- Check the compression pressure (Refer to GROUP 11I – On-vehicle Service – Compression Pressure Check P.11I-12).

Q: Is the check result normal?
YES : Go to Step 15.
NO : Repair.

STEP 15. Replace the engine-ECU.

- After the engine-ECU has been replaced, check for the trouble symptom again.

Q: Does the trouble symptom persist?
YES : Check for foreign matters (water, kerosene, etc.) in fuel and replace if necessary.
NO : Check end.

Inspection Procedure 8: The Engine Stalls when Starting the Car (Pass Out), The Engine Stalls when Decelerating

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by misfire due to failed spark plug, improper air-fuel ratio at accelerator pedal depression and so on when engine stalls at acceleration.
- Failure is possibly caused by an insufficient amount of intake air or improper air-fuel ratio and so on when engine stalls at deceleration.

PROBABLE CAUSES

- Failed ignition system
- Failed intake air system
- Contamination around the throttle valve
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 11: Accelerator pedal position sensor (main)
  b. Item 12: Accelerator pedal position sensor (sub)
  c. Item 13: Throttle position sensor (main)
  d. Item 15: Throttle position sensor (sub)

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 3. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair.

STEP 4. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Clean throttle body (throttle valve portion) (Refer to P.13F-212).

STEP 5. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).

Inspection Procedure 9: Engine Does Not Revolve Up

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by failed electronic-control throttle valve system, fuel system, or ignition system, and so on.

PROBABLE CAUSES

- Failed ignition system
- Failed fuel system
- Failed electronic control throttle valve system
- Timing belt in out of place
- Failed the engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 11: Accelerator pedal position sensor (main)
  b. Item 12: Accelerator pedal position sensor (sub)
  c. Item 13: Throttle position sensor (main)
  d. Item 15: Throttle position sensor (sub)

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 3. Check timing mark on the timing belt.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Align the timing marks.

STEP 4. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).

STEP 5. Fuel pressure measurement.

- Fuel pressure measurement (Refer to P.13F-213).

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Repair.

Inspection Procedure 10: Hesitation, Sag, Poor Acceleration, Stumble, Surge

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by failed ignition system, or improper air-fuel ratio and compression pressure, and so on.

PROBABLE CAUSES

- Failed air-fuel ratio control system
- Failed ignition system
- Failed fuel system
- Failed intake and exhaust air system
- Failed electronic control throttle valve system
- Contamination around the throttle valve
- Improper compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?

YES : Inspection chart for diagnosis code (Refer to P.13F-21).

NO : Go to Step 2.

STEP 2. Check injector for operating sound.

- Check injector for operating sound (Refer to P.13F-223).

Q: Is operating sound audible?

YES : Go to Step 3.

NO : Check the injector system of the defective cylinder. Check code No. P0261: No. 1 injector circuit low input (Refer to P.13F-73). Check code No. P0262: No. 1 injector circuit high input (Refer to P.13F-74). Check code No. P0264: No. 2 injector circuit low input (Refer to P.13F-75). Check code No. P0265: No. 2 injector circuit high input (Refer to P.13F-76). Check code No. P0267: No. 3 injector circuit low input (Refer to P.13F-77). Check code No. P0268: No. 3 injector circuit high input (Refer to P.13F-79). Check code No. P0270: No. 4 injector circuit low input (Refer to P.13F-80). Check code No. P0271: No. 4 injector circuit high input (Refer to P.13F-81).Check code No. P0273: No. 5 injector circuit low input (Refer to P.13F-82). Check code No. P0274: No. 5 injector circuit high input (Refer to P.13F-83).Check code No. P0276: No. 6 injector circuit low input (Refer to P.13F-84). Check code No. P0277: No. 6 injector circuit high input (Refer to P.13F-85).

STEP 3. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 11: Accelerator pedal position sensor (main)
  d. Item 12: Accelerator pedal position sensor (sub)
  e. Item 13: Throttle position sensor (main)
  f. Item 15: Throttle position sensor (sub)
  g. Item BB: Barometric pressure sensor

Q: Are the check results normal?

YES : Go to Step 4.

NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 4. Check purge control solenoid valve itself.

- Check purge control solenoid valve itself (Refer to GROUP 17– Emission Control – Evaporative Emission Control System – Purge Control Solenoid Valve Check).

Q: Is the check result normal?
YES : Go to Step 5.
NO : Replace the purge control solenoid valve.

STEP 5. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item AC: Right bank oxygen sensor (front)
  b. Item AD: Right bank oxygen sensor (rear)
  c. Item AE: Left bank oxygen sensor (front)
  d. Item AF: Left bank oxygen sensor (rear)

Q: Are the check results normal?
YES : Go to Step 6.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 6. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).

STEP 7. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Clean throttle body (throttle valve portion) (Refer to P.13F-212).

STEP 8. Check compression pressure.

- Check the compression pressure (Refer to GROUP 11I – On-vehicle Service – Compression Pressure Check P.11I-12).

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair.

STEP 9. Fuel pressure measurement.

- Fuel pressure measurement (Refer to P.13F-213).

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair.

STEP 10. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 11.
NO : Repair.

STEP 11. Check exhaust leak from exhaust from exhaust manifold.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Repair.

Inspection Procedure 11: The Feeling of Impact or Vibration when Accelerating

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by ignition leak occurring in association with the increase of required voltage by the spark plug at an acceleration and failed electronic-control throttle valve system, and so on.

PROBABLE CAUSES

- Failed ignition system
- Failed electronic control throttle valve system
- Contamination around the throttle valve
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 11: Accelerator pedal position sensor (main)
  b. Item 12: Accelerator pedal position sensor (sub)
  c. Item 13: Throttle position sensor (main)
  d. Item 15: Throttle position sensor (sub)

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 3. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Clean throttle body (throttle valve portion) (Refer to P.13F-212).

STEP 4. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).

Inspection Procedure 12: The Feeling of Impact or Vibration when Decelerating

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by an insufficient amount of intake air due to failed electronic-controlled throttle valve system.

PROBABLE CAUSES

- Failed electronic control throttle valve system
- Contamination around the throttle valve
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 11: Accelerator pedal position sensor (main)
  b. Item 12: Accelerator pedal position sensor (sub)
  c. Item 13: Throttle position sensor (main)
  d. Item 15: Throttle position sensor (sub)

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 3. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Clean throttle body (throttle valve portion) (Refer to P.13F-212).

Inspection Procedure 13: Knocking

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by failed detonation control system and improper thermal value of the spark plug.

PROBABLE CAUSES

- Failed right bank detonation sensor
- Failed left bank detonation sensor
- Failed detonation control system
- Failed spark plug
- Failed ignition system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Check detonation sensor system.
(Refer to Code No.P0327: Right Bank Detonation Sensor Circuit Low Input P.13F-97).
(Refer to Code No.P0328: Right Bank Detonation Sensor Circuit High Input P.13F-98).
(Refer to Code No.P0332: Left Bank Detonation Sensor Circuit Low Input P.13F-99).
(Refer to Code No.P0333: Left Bank Detonation Sensor Circuit High Input P.13F-100).
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).

Inspection Procedure 14: Ignition Timing Deviation

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by failed crank angle sensor and camshaft position sensor or improperly assembled timing belt.

PROBABLE CAUSES

- Failed crank angle sensor
- Failed camshaft position sensor
- Timing belt in out of place
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. Perform output wave pattern measurement at crank angle sensor and camshaft position sensor (Using an oscilloscope).

<Crank angle sensor>

- Use the test harness (MB991709) to connect crank angle sensor connector, and measure at the pick-up harness.
- Engine: Idling
- Transmission: P range
- Check the voltage between the crank angle sensor connector (SGT line) and body earth.

<Camshaft position sensor>

- Use the test harness (MB991709) to connect camshaft position sensor connector, and measure at pick-up harness.
- Engine: Idling
- Transmission: P range
- Check the voltage between the camshaft position sensor connector (SGC line) and body earth.

OK: The timings on the output wave pattern at the both sensors should be the same as the specification in the inspection procedure using an oscilloscope (Refer to P.13F-205).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 4.

STEP 3. Check the trouble symptom.

Q: Does the trouble symptom persist?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. Check crank angle sensor and camshaft position sensor for correct mounting condition.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair.

STEP 5. Check timing mark on the timing belt.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Align the timing marks on timing belt.

STEP 6. Check crank shaft sensing ring.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Replace the crank shaft sensing ring.

STEP 7. Check camshaft position sensing cylinder.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Replace the camshaft position sensing cylinder.

STEP 8. Replace the crank angle sensor.

- After replacing the crank angle sensor check for the trouble symptom again.

Q: Does the trouble symptom persist?
YES : Go to Step 9.
NO : Check end.

STEP 9. Replace the camshaft position sensor.

- After replacing camshaft position sensor check for the trouble symptom again.

Q: Does the trouble symptom persist?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Inspection Procedure 15: Run On (Dieseling)

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by leakage from injectors.

PROBABLE CAUSES

- Failed injector
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check injector for its spray condition.

- Check each injector for spray condition (Refer to P.13F-223).

Q: Does the trouble symptom persist?

YES : Replace the engine-ECU.

NO : Replace the injector.

Inspection Procedure 16: Odour, White Smoke, Black Smoke and High-Concentration CO/HC during Idling

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly caused by improper air-fuel ratio, deteriorated catalyst, and failed ignition system or fuel system, or improper compression pressure, and so on.

PROBABLE CAUSES

- Failed air-fuel ratio control system
- Failed ignition system
- Failed fuel system
- Failed intake and exhaust air system
- Improper compression pressure
- Deteriorated catalyst
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?

YES : Inspection chart for diagnosis code (Refer to P.13F-21).

NO : Go to Step 2.

STEP 2. Check injector for operating sound.

- Check injector for operating sound (Refer to P.13F-223).

Q: Is operating sound audible?

YES : Go to Step 3.

NO : Check the injector system of the defective cylinder. Check code No. P0261: No. 1 injector circuit low input (Refer to P.13F-73). Check code No. P0262: No. 1 injector circuit high input (Refer to P.13F-74). Check code No. P0264: No. 2 injector circuit low input (Refer to P.13F-75). Check code No. P0265: No. 2 injector circuit high input (Refer to P.13F-76). Check code No. P0267: No. 3 injector circuit low input (Refer to P.13F-77). Check code No. P0268: No. 3 injector circuit high input (Refer to P.13F-79). Check code No. P0270: No. 4 injector circuit low input (Refer to P.13F-80). Check code No. P0271: No. 4 injector circuit high input (Refer to P.13F-81).Check code No. P0273: No. 5 injector circuit low input (Refer to P.13F-82). Check code No. P0274: No. 5 injector circuit high input (Refer to P.13F-83).Check code No. P0276: No. 6 injector circuit low input (Refer to P.13F-84). Check code No. P0277: No. 6 injector circuit high input (Refer to P.13F-85).

STEP 3. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor
  e. Item BB: Barometric pressure sensor

Q: Are the check results normal?
YES : Go to Step 4.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 4. Check ignition timing.

- Check ignition timing (Refer to GROUP 11I – On-vehicle Service – Ignition Timing Check P.11I-8).

Q: Is the check result normal?
YES : Go to Step 5.
NO : Check ignition timing deviation (Refer to Inspection Procedure 14 P.13F-172).

STEP 5. Check air intake from intake hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair.

STEP 6. Check exhaust leak from exhaust manifold.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair.

STEP 7. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Clean throttle body (throttle valve portion) (Refer to P.13F-212).

STEP 8. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item AC: Right bank oxygen sensor (front)
  b. Item AD: Right bank oxygen sensor (rear)
  c. Item AE: Left bank oxygen sensor (front)
  d. Item AF: Left bank oxygen sensor (rear)

Q: Are the check results normal?
YES : Go to Step 9.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13F-21).

STEP 9. Check purge control solenoid valve itself.

- Check purge control solenoid valve itself (Refer to GROUP 17– Emission Control – Evaporative Emission Control System – Purge Control Solenoid Valve Check).

Q: Is the check result normal?
YES : Go to Step 10.
NO : Replace the purge control solenoid valve.

STEP 10. Fuel pressure measurement.

- Fuel pressure measurement. (Refer to P.13F-213).

Q: Is the check result normal?
YES : Go to Step 11.
NO : Repair.

STEP 11. Check positive crankcase ventilation valve itself.

- Check positive crankcase ventilation valve itself (Refer to GROUP 17 – Emission Control – Crankcase Emission Control System – Positive Crankcase Ventilation Valve Check).

Q: Is the check result normal?
YES : Go to Step 12.
NO : Replace the positive crankcase ventilation valve.

STEP 12. Visual check of ignition spark.
- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Remove all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 13.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13F-183).

STEP 13. Check compression pressure.
- Check the compression pressure (Refer to GROUP 11I – On-vehicle Service – Compression Pressure Check P.11I-12).

Q: Is the check result normal?
YES : Go to Step 14.
NO : Repair.

STEP 14. Check injector for spray condition.
- Check each injector for spray condition (Refer to P.13F-223).

Q: Is the check result normal?
YES : Go to Step 15.
NO : Replace the injector.

STEP 15. Replace the catalytic converter.
- After replacing catalytic converter check the trouble symptom again.

Q: Does the trouble symptom persist?
YES : Replace the engine-ECU.
NO : Check end.

Inspection Procedure 17: Battery Run Down

COMMENTS ON TROUBLE SYMPTOM
- The exciting currents of the alternator field coil are input into the engine-ECU connector terminal ALTL from the alternator connector terminal.
- The electric generating capacity of the alternator connector terminal is restricted according to the signal from the engine-ECU connector terminal ALTG

COMMENTS ON TROUBLE SYMPTOM
- Failure is possibly caused by failed alternator or alternator control system.

PROBABLE CAUSES
- Failed battery
- Short circuit in alternator G terminal
- Failed alternator
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery.
- Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-2).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the battery.

STEP 2. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 3.

STEP 3. Voltage measurement at alternator connector (ALTL line).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the alternator connector (ALTL line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check of short to earth, and open circuit in ALTL line between engine-ECU connector and alternator connector.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check the trouble symptom.

Q: Does the trouble symptom persist?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. Check of harness damage in ALTL line between engine-ECU connector and alternator connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Voltage measurement at alternator connector (ALTG line).
(1) Disconnect the connector, and measure at the alternator side.
(2) Connect special tool Test Harness (MB991658) to all terminals except the alternator connector (ALTG line).
(3) Ignition switch: ON
(4) Check the voltage between the alternator connector (ALTG line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 8.
NO : Replace the alternator.

STEP 8. Check of short circuit to earth in ALTG line between alternator connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair the connector(s) or wiring harness.

STEP 9. Voltage measurement at engine-ECU connector (ALTG terminal).
(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idle operation after warm-up
(3) Transmission: P range
(4) Cooling fan: Not operated
(5) Check the voltage between the engine-ECU connector (ALTG terminal) and body earth.

OK: The voltage increases when the headlamp switch and the rear window defogger switch are turned ON from OFF.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 5.

Inspection Procedure 18: Overheating

COMMENTS ON TROUBLE SYMPTOM

- Failure is possibly by failed engine cooling system, cooling fan system, or engine coolant temperature sensor, and so on.

PROBABLE CAUSES

- Insufficient amount or deteriorated quality of engine coolant
- Failed cooling fan system
- Failed engine coolant temperature sensor
- Failed thermostat
- Failed water pump
- Failed radiator core
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code stored?
YES : Inspection chart for diagnosis code (Refer to P.13F-21).
NO : Go to Step 2.

STEP 2. Check engine coolant.

NOTE: When the engine coolant level is too low, check for any section that cases leakage and repair, if necessary.

- Check engine coolant (Refer to GROUP 14 – On-vehicle Service – Engine Coolant Leak Check).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace or fill the engine coolant.

STEP 3. M.U.T.-III actuator test

- Item 14: Cooling fan

OK: Fan motor rotates at high speed.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Check fan control relay system (Refer to GROUP 14 – Troubleshooting – Inspection Procedure for Trouble Symptoms – Radiator Fan and Condenser Fan Do Not Operate P.14-3).

STEP 4. M.U.T.-III data list

- Item 6: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120°C

Q: Is the check result normal?
YES : Go to Step 5.
NO : Check engine coolant temperature sensor system (Refer to Code No. P0117: Engine coolant temperature sensor circuit low input P.13F-43, Code No. P0118: Engine coolant temperature sensor circuit high input P.13F-44).

STEP 5. Check thermostat.

- Check thermostat (Refer to GROUP 14 – Thermostat – Inspection P.14-8).

Q: Is the check result normal?
YES : Go to Step 6.
NO : Replace the thermostat.

STEP 6. Check water pump.

- Check water pump (Refer to GROUP 14 – On-vehicle Service – Water Pump Coolant Leak Check).

Q: Is the check result normal?
YES : Replace the radiator.
NO : Replace the water pump.

Inspection Procedure 19: Engine-ECU Power Supply, Engine Control Relay, Ignition Switch-IG1 System

OPERATION

- Battery voltage is applied to the engine control relay power supply line.
- Engine-ECU connector terminal C/R applies current to the engine control relay coil by turning ON the power transistor in the unit in order to turn the relay ON.
- When the engine control relay is turned ON, the battery power will be supplied from the engine control relay connector terminal to the engine-ECU, sensor and actuator.

FUNCTION

- When the ignition switch ON signal is input into the engine-ECU via ETACS-ECU, the engine-ECU turns ON the engine control relay. This causes battery voltage to be supplied to the engine-ECU, sensor and actuator.

PROBABLE CAUSES

- Failed battery
- Failed engine control relay
- Failed OSS-ECU
- Open/short circuit or damage in the engine control relay circuit or loose connector contact.
- Open/short circuit or damage in the engine control relay circuit or loose connector contact.
- Open circuit or damage in the engine-ECU earth circuit or loose connector contact.
- Failed ETACS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery.

- Battery check (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test P.54A-2).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the battery.

STEP 2. Check engine control relay itself.

- Check engine control relay itself (Refer to P.13F-217).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the engine control relay.

STEP 3. Voltage measurement at engine control relay connector (power supply line).

(1) Remove the relay, and measure at the relay box side.
(2) Check the voltage between the engine control relay connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between battery and engine control relay connector.

STEP 4. Voltage measurement at engine-ECU connector (C/R terminal).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the voltage between the engine-ECU connector (C/R terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in C/R line between engine control relay connector and engine-ECU connector.

STEP 5. Voltage measurement at engine-ECU connector (BAT1 terminal).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Short-circuit engine-ECU connector (C/R terminal) to the body earth.
(3) Check the voltage between the engine-ECU connector (BAT1 terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 6.

STEP 6. Check of short to earth, and open circuit in BAT1 line between engine control relay connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Check of harness damage in power supply line between the battery and engine control relay connector.

Q: Is the check result normal?
YES : Repair or replace the connector(s), or check and repair the harness of damage in C/R line between engine control relay connector and engine-ECU connector.
NO : Repair the connector(s) or wiring harness.

STEP 8. Check of damage in BAT1 line between engine-ECU connector and engine control relay connector.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair the connector(s) or wiring harness.

STEP 9. Check of harness damage in power supply line between battery and engine control relay connector.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair the connector(s) or wiring .

STEP 10. Voltage measurement at engine-ECU connector (IGN terminal).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the engine-ECU connector (IGN terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 14.
NO : Go to Step 11.

STEP 11. Voltage measurement at ETACS-ECU connector (IG1 terminal).
(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the ETACS-ECU connector (IG1 terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 13.
NO : Go to Step 12.

STEP 12. Check of short to earth, and open circuit in IG1 line between OSS-ECU connector and ETACS-ECU connector.

Q: Is the check result normal?
YES : Perform troubleshooting of OSS System (Refer to GROUP 42B – Troubleshooting – Trouble Symptom Chart).
NO : Repair the connector(s) or wiring harness.

STEP 13. Continuity check on ETACS-ECU connectors
(1) Disconnect the connector, and measure at the ETACS-ECU side.
(2) Continuity check between the ETACS-ECU connector (IG1 terminal) and the ETACS-ECU connector (IGN terminal).

NOTE: Connect the (+) side of circuit tester to terminal IGN.

OK: Continuity

Q: Is the check result normal?
YES : Repair or replace the connector(s), or check and repair the harness of damage in IGN line between ETACS-ECU connector and engine-ECU connector.
NO : Replace the ETACS-ECU.

STEP 14. Check of harness damage in IGN line between ETACS-ECU connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 15.
NO : Repair the connector(s) or wiring harness.

STEP 15. Continuity check on ETACS-ECU connectors

(1) Disconnect the connector, and measure at the ETACS-ECU side.
(2) Continuity check between the ETACS-ECU connector (IG1 terminal) and the ETACS-ECU connector (IGN terminal).

NOTE: Connect the (+) side of circuit tester to terminal IGN.

OK: Continuity

Q: Is the check result normal?
YES : Go to Step 16.
NO : Replace the ETACS-ECU.

STEP 16. Check of harness damage in IG1 line between OSS-ECU connector and ETACS-ECU connector.

Q: Is the check result normal?
YES : Go to Step 17.
NO : Repair the connector(s) or wiring harness.

STEP 17. Check of open circuit and damage in GNDB, GNDE line between engine-ECU connector and body earth.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Repair the connector(s) or wiring harness.

Inspection Procedure 20: Fuel Pump System

OPERATION

- The fuel pump drive power is supplied from engine control relay connector terminal to fuel pump relay (ETACS-ECU connector terminal F/PB) in the ETACS-ECU.
- The battery voltage is applied by the ignition switch to the fuel pump relay coil (ETACS-ECU connector terminal IG1) in the ETACS-ECU. The engine-ECU connector terminal FP/R turns on the relay by turning ON the power transistor in the unit so as to conduct power to the fuel pump relay coil (via the ETACS-ECU connector terminal FP/R).
- When the fuel pump relay is turned ON, the battery voltage will be supplied from the fuel pump relay (ETACS-ECU connector terminal F/P) to the fuel pump.

FUNCTION

- When the ignition switch ON signal is inputted into the engine-ECU, the engine-ECU turns ON the fuel pump relay. This causes the battery voltage to be supplied to the fuel pump.

PROBABLE CAUSES

- Failed fuel pump relay in the ETACS-ECU
- Failed fuel pump
- Open/short circuit or damage in the fuel pump drive circuit or loose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check fuel pump relay.

- Perform continuity test in fuel pump relay (Refer to P.13F-217).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the ETACS-ECU.

STEP 2. Voltage measurement at engine-ECU connector (FP/R terminal).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the engine-ECU connector (FP/R terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in FP/R line engine-ECU connector and ETACS-ECU connector.

STEP 3. Voltage measurement at ETACS-ECU connector (F/PB terminal).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the ETACS-ECU connector (F/PB terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in F/PB line engine control relay connector and ETACS-ECU connector.

STEP 4. Check fuel pump operations.

- Check fuel pump operations (Refer to P.13F-213).

Q: Is the check result normal?
YES : Go to Step 5.
NO : Replace the fuel pump and gauge assembly.

STEP 5. Resistance measurement at fuel pump connector (body earth line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the resistance between the fuel pump connector (body earth line) and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector(s), or check and repair the harness of open circuit and damage in body earth line fuel pump connector and body earth.

STEP 6. Voltage measurement at fuel pump connector (F/P line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the fuel pump connector (F/P line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector(s), or check and repair the harness of short circuit to earth, and open circuit in F/P line fuel pump connector and body earth.

STEP 7. Check of harness damage in FP/R line between engine-ECU connector and ETACS-ECU connector.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair the connector(s) or wiring harness.

STEP 8. Check of harness damage in F/PB line between engine control relay connector and ETACS-ECU connector.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair the connector(s) or wiring harness.

STEP 9. Check of harness damage in F/P line between ETACS-ECU connector and fuel pump connector.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair the connector(s) or wiring harness.

STEP 10. M.U.T.-III actuator test

- Refer to Actuator Test Reference Table P.13F-197.
  a. Item 9: Fuel pump

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Inspection Procedure 21: A/C Compressor Relay System

OPERATION

- Battery voltage is applied to the A/C compressor relay connector terminals.
- Engine-ECU connector terminal AC/R applies current to the A/C compressor relay coil by turning ON the power transistor in the unit in order to turn the relay ON.
- When the A/C compressor relay turns ON, battery voltage is supplied by the A/C compressor relay connector terminal to the A/C compressor connector terminal.

FUNCTION

- When the A/C switch ON signal is input into the engine-ECU, the engine-ECU turns ON the A/C compressor relay. This causes battery voltage to be supplied to the A/C compressor and the magnet latch actuates.

PROBABLE CAUSES

- Failed A/C compressor relay
- Failed A/C compressor
- Open/short circuit or damage in the A/C compressor relay circuit or loose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check A/C compressor relay itself.

- Check A/C compressor relay itself (Refer to GROUP 55 – On-vehicle Service – Relay Check P.55-2).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the A/C compressor relay.

STEP 2. Voltage measurement at A/C compressor relay connector (power supply line).

(1) Remove the relay, and measure at the relay box side.
(2) Check the voltage between the A/C compressor relay connector (power supply line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between battery and A/C compressor relay connector.

STEP 3. Check of harness damage in power supply line between battery and A/C compressor relay connector.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the connector(s) or wiring harness.

STEP 4. Voltage measurement at engine-ECU connector (AC/R terminal).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Check the voltage between the engine-ECU connector (AC/R terminal) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in AC/R line between A/C compressor relay connector and engine-ECU connector.

STEP 5. Check of harness damage in AC/R line between A/C compressor relay connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the connector(s) or wiring harness.

STEP 6. Check of short to earth, open circuit and damage in power supply line between A/C compressor relay connector and A/C compressor connector.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Check A/C compressor clutch operating conditions.

- Disconnect engine-ECU connector, and short-circuit engine-ECU connector (AC/R terminal) to the body earth.

OK: A/C compressor clutch operates.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Replace the A/C compressor assembly.

Inspection Procedure 22: Ignition Circuit System

OPERATION

- The battery voltage is applied from the engine control relay connector terminal to the ignition coil connector terminal and is earthed to the vehicle body via the ignition coil connector terminal.
- A power voltage of 12 V is applied to the ignition coil connector terminal from the engine-ECU connector terminals CIL1, CIL2, CIL3, CIL4, CIL5 and CIL6.

FUNCTION

- When the engine-ECU turn the power transistor in the unit to OFF, the battery voltage is applied to the power transistor in the ignition coil, resulting that the power transistor is ON. And, when the engine-ECU turns the power transistor in the unit to ON, the power transistor in the ignition coil will be turned OFF.
- When the power transistor in the ignition coil is turned to ON with any signal from the engine-ECU, the primary voltage will be applied through the ignition coil. When the power transistor in the ignition coil is turned OFF, the primary current is blocked and high voltage is generated in the secondary coil.

PROBABLE CAUSES

- Failed spark plug
- Failed ignition coil
- Open/short circuit or harness damage in ignition system circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service – Spark Plug Check and Cleaning P.16-18).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the spark plug.

STEP 3. Check ignition coil itself.

- Check ignition coil itself (Refer to GROUP 16 – Ignition System – On-vehicle Service – Ignition Coil Check P.16-18).

Q: Is the check result normal?
YES : Go to Step 4.
NO : Replace the ignition coil.

STEP 4. Voltage measurement at No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6 ignition coil connector (power supply line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6 ignition coil connector (power supply line) and body earth.

OK: System voltage

Q: Are the check results normal?
YES : Go to Step 5.
NO : Repair or replace the connector(s), or check and repair the harness of short to earth, and open circuit in power supply line between engine control relay connector and No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6 ignition coil connector.

STEP 5. Resistance measurement at No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6 ignition coil connector (body earth line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Measure the resistance between the No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6 ignition coil connector (body earth line) and body earth.

OK: Continuity (2 Ω or less)

Q: Are the check results normal?
YES : Go to Step 6.
NO : Repair or replace the connector(s), or check and repair the harness of open circuit and damage in body earth line between No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6 ignition coil connector and body earth.

STEP 6. Check of short to earth, open circuit and damage in CIL1, CIL2, CIL3, CIL4, CIL5, CIL6 line between No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6 ignition coil connector and engine-ECU connector.

Q: Are the check results normal?
YES : Go to Step 7.
NO : Repair the connector(s) or wiring harness.

STEP 7. Check of harness damage in CIL1, CIL2, CIL3, CIL4, CIL5, CIL6 line between engine control relay connector and No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6 ignition coil connector.

Q: Are the check results normal?
YES : Go to Step 8.
NO : Repair the connector(s) or wiring harness.

STEP 8. Check the trouble symptom.

Q: Does the trouble symptom persist?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Inspection Procedure 23: Engine Oil Pressure Switch System

OPERATION

- Battery voltage is applied to the oil pressure switch connector terminal from the engine-ECU connector terminal OPSW.

FUNCTION

- Detect the engine oil pressure conditions and enter the result into the engine-ECU. After starting the engine if the oil pressure rises to higher than the given pressure, the engine oil pressure switch turns OFF. Under this condition the engine-ECU sends the command of turning off the oil warning lamp to the combination meter via CAN.

PROBABLE CAUSES

- Failed engine oil pressure switch
- Open/short circuit or damage in the oil pressure switch circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Voltage measurement at oil pressure switch connector (OPSW line).

(1) Disconnect the connector, and measure at the wiring harness side.
(2) Ignition switch: ON
(3) Check the voltage between the oil pressure switch connector (OPSW line) and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Go to Step 2.

STEP 2. Check of short to earth, and open circuit in OPSW line between oil pressure switch connector and engine-ECU connector.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. M.U.T.-III data list

- Refer to Data List Reference Table P.13F-186.
  a. Item 90: Oil pressure switch

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 4. Voltage measurement at engine-ECU connector (OPSW terminal).

(1) Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
(2) Engine: Idling
(3) Check the voltage between the engine-ECU connector (OPSW terminal) and body earth.

OK:
1 V or less (ignition switch: ON)
System voltage (during idling)

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 5.

STEP 5. Check of harness damage in OPSW line between oil pressure switch connector and engine-ECU connector.

Q: Is the check result normal?
YES : Replace the oil pressure switch.
NO : Repair the connector(s) or wiring harness.

DATA LIST REFERENCE TABLE

M1131152005600

Item No.	Inspection Item	Inspection condition		Normal condition
1	Battery voltage	Ignition switch: ON		System voltage
2	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare engine speed on tachometer with the value displayed on M.U.T.-III	Matched
		Engine: Idle operation	Engine coolant temperature: –20°C	1,300 – 1,500 r/min
			Engine coolant temperature: 0°C	1,200 – 1,400 r/min
			Engine coolant temperature: 20°C	1,200 – 1,400 r/min
			Engine coolant temperature: 40°C	1,000 – 1,200 r/min
			Engine coolant temperature: 80°C	550 – 750 r/min
3	Target idling speed	Engine: Idle operation	Engine coolant temperature: –20°C	1,300 – 1,500 r/min
			Engine coolant temperature: 0°C	1,200 – 1,400 r/min
			Engine coolant temperature: 20°C	1,200 – 1,400 r/min
			Engine coolant temperature: 40°C	1,000 – 1,200 r/min
			Engine coolant temperature: 80°C	550 – 750 r/min
4	Vehicle speed signal	Running at 40 km/h		Approximately 40 km/h
5	Intake air temperature sensor	Ignition switch: ON or engine running	Intake air temperature: –20°C	–20°C
			Intake air temperature: 0°C	0°C
			Intake air temperature: 20°C	20°C
			Intake air temperature: 40°C	40°C
			Intake air temperature: 80°C	80°C

Item No.	Inspection Item	Inspection condition		Normal condition
6	Engine coolant temperature sensor	Ignition switch: ON or engine running	Engine coolant temperature: –20°C	–20°C
			Engine coolant temperature: 0°C	0°C
			Engine coolant temperature: 20°C	20°C
			Engine coolant temperature: 40°C	40°C
			Engine coolant temperature: 80°C	80°C
8	Manifold absolute pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa
			Altitude: 600 m	95 kPa
			Altitude: 1,200 m	88 kPa
			Altitude: 1,800 m	81 kPa
		Set the vehicle to the pre-inspection condition	Idle operation	16 – 36 kPa
			Excessive acceleration	Varies depending on the negative pressure at the inlet manifold
10	Air flow sensor *1	Set the vehicle to the pre-inspection condition	Idle operation	800 – 1,200 mV
			2,500 r/min	1,100 – 1,500 mV
			Acceleration	Varies depending on the acceleration
11	Accelerator pedal position sensor (main)	Ignition switch: ON	Release the accelerator pedal	900 – 1,100 mV
			Depress the accelerator pedal	Increases in response to the pedal depression stroke
			Depress the accelerator pedal fully	4,000 mV or more
12	Accelerator pedal position sensor (sub)	Ignition switch: ON	Release the accelerator pedal	400 – 600 mV
			Depress the accelerator pedal	Increases in response to the pedal depression stroke
			Depress the accelerator pedal fully	2,000 mV or more

Item No.	Inspection Item	Inspection condition		Normal condition
13	Throttle position sensor (main)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors • Ignition switch: ON (engine stopped)	Fully close the throttle valve with your finger	300 – 700 mV
			Fully open the throttle valve with your finger	4,000 mV or more
		Engine: Idle operation after warm-up	No load	500 – 660 mV
			A/C switch: OFF → ON	Voltage rises
			Transmission: N → D range	
15	Throttle position sensor (sub)	• Remove the intake air hose at the throttle body. • Disconnect the connector of the electronic-controlled throttle valve • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors • Ignition switch: ON (engine stopped)	Fully close the throttle valve with your finger	4,000 mV or more
			Fully open the throttle valve with your finger	1,000 mV or less
16	Ignition advance (right bank)	• Engine: After warm-up • Install timing light (for use to measure actual ignition timing)	Idle operation	2 – 18 °CA (BTDC)
			2,500 r/min	31 – 43 °CA (BTDC)

Item No.	Inspection Item	Inspection condition		Normal condition
17	Injector drive time*2	Engine: cranking	When engine coolant temperature is 0°C	80 – 120 ms
			When engine coolant temperature is 20°C	30 – 50 ms
			When engine coolant temperature is 80°C	8 – 16 ms
		Set the vehicle to the pre-inspection condition	Engine is idling	1.5 – 3.5 ms
			2,500 r/min	1.2 – 3.2 ms
			Suddenly depress the accelerator pedal	Increases
21	Electric power steering current value	• Engine: Idle operation after warm-up • Turn the steering wheel to the left and right with a vehicle stationary.		Approximately 110 A or less
31	Exhaust gas recirculation valve	Set the vehicle to the pre-inspection condition	Engine is idling	1 – 8 STEP
			2,500 r/min	1 – 8 STEP
		Under the high load operation		Increased
74	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	ON
			Brake pedal: Released	OFF
76	A/C switch	Engine: Idle operation after warm-up	A/C switch: OFF	OFF
			A/C switch: ON	ON (when the compressor clutch is operated)
79	Cranking signal (Ignition switch: ST)	Ignition switch: ON	Engine: Stopped	OFF
			Engine: Cranking	ON
83	Power steering fluid pressure switch	Engine: Idle operation after warm-up	When steering wheel is stationary	OFF
			When steering wheel is operated	ON
84	Idling switch	Ignition switch: ON	Depress the accelerator pedal	OFF
			Release the accelerator pedal	ON
85	Ignition switch: IG	Ignition switch: ON		ON
87	Neutral switch	Ignition switch: ON	Selector lever: N	ON
			Selector lever: Other than N	OFF

Item No.	Inspection Item	Inspection condition		Normal condition
89	Normally closed brake switch	Ignition switch: ON	Depress the brake pedal	ON
			Release the brake pedal	OFF
90	Oil pressure switch	Ignition switch: ON		ON
		Engine: Idle operation after warm-up		OFF
93	A/C compressor relay	Engine: Idle operation after warm-up	A/C switch: OFF	OFF
			A/C switch: ON	ON (when the compressor clutch is operated)
95	Engine control relay	Ignition switch: ON		ON
96	Throttle valve control servo relay	Ignition switch: ON		ON
97	Fuel pump relay	Ignition switch: ON		OFF
		Engine: Idle operation		ON
98	Oil feeder control valve	Engine: After warm-up	Engine is idling	OFF
			5,000 r/min	ON
AA	Air flow sensor*1	Set the vehicle to the pre-inspection condition	Idle operation	2.0 – 6.0 g/s
			2,500 r/min	6.0 – 14.0 g/s
			Acceleration	Varies depending on the acceleration
AB	Throttle position sensor (main)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors • Ignition switch: ON (engine stopped)	Fully close the throttle valve with your finger	6 – 14 %
			Fully open the throttle valve with your finger	80 – 100 %

Item No.	Inspection Item	Inspection condition		Normal condition
AC	Right bank oxygen sensor (front)	Engine: After warm-up (leaner by deceleration, richer acceleration)	Excessive deceleration from 4,000 r/min	0.2 V or less → 0.6 to 1.0 V (after few seconds)
			At excessive acceleration	0.6 – 1.0 V
		Engine: After warm-up (use oxygen sensor signals, check the air-fuel ratio and the conditions under the control of the engine-ECU)	Idle operation	0.4 V or less ⇔ 0.6 to 1.0 V (varies)
			2,500 r/min	
AD	Right bank oxygen sensor (rear)	• Transmission: 2nd • The engine speed is maintained to 3,500 r/min or more during an accelerated driving with the throttle full-open		0.6 – 1.0 V
AE	Left bank oxygen sensor (front)	Engine: After warm-up (leaner by deceleration, richer acceleration)	Excessive deceleration from 4,000 r/min	0.2 V or less → 0.6 to 1.0 V (after few seconds)
			At excessive acceleration	0.6 – 1.0 V
		Engine: After warm-up (use oxygen sensor signals, check the air-fuel ratio and the conditions under the control of the engine-ECU)	Idle operation	0.4 V or less ⇔ 0.6 to 1.0 V (varies)
			2,500 r/min	
AF	Left bank oxygen sensor (rear)	• Transmission: 2nd • The engine speed is maintained to 3,500 r/min or more during an accelerated driving with the throttle full-open		0.6 – 1.0 V
BB	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa
			Altitude: 600 m	95 kPa
			Altitude: 1,200 m	88 kPa
			Altitude: 1,800 m	81 kPa

Item No.	Inspection Item	Inspection condition		Normal condition
BC	Throttle position sensor (relative value)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors • Ignition switch: ON (engine stopped)	Fully close the throttle valve with your finger	0 – 5 %
			Fully open the throttle valve with your finger	88 – 100 %
BD	Throttle position sensor (sub)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors • Ignition switch: ON (engine stopped)	Fully close the throttle valve with your finger	6 – 14 %
			Fully open the throttle valve with your finger	80 – 100 %
BE	Accelerator pedal position sensor (main)	Ignition switch: ON	Release the accelerator pedal	18 – 22 %
			Depress the accelerator pedal	Increases in response to the pedal depression stroke
			Depress the accelerator pedal fully	80 % or more

Item No.	Inspection Item	Inspection condition		Normal condition
BF	Accelerator pedal position sensor (sub)	Ignition switch: ON	Release the accelerator pedal	8 – 12 %
			Depress the accelerator pedal	Increases in response to the pedal depression stroke
			Depress the accelerator pedal fully	40 % or more
DD	Accelerator pedal position sensor (relative value)	Ignition switch: ON	Release the accelerator pedal	0 – 5 %
			Depress the accelerator pedal	Increases in response to the pedal depression stroke
			Depress the accelerator pedal fully	95 – 100 %
102	Starter relay	Ignition switch: ON		OFF
		Engine: Cranking		ON
113	Spark advance (left bank)	• Engine: after warm up • Timing light is set (to check actual ignition timing) • Transmission: P range	Engine: Idle operation	2 – 18 °CA (BTDC)
			2,500 r/min	31 – 43 °CA (BTDC)

*NOTE: *1: On the new vehicle (mileage: 500 km or less), air flow sensor output value may be higher by approximately 10 %.*

*NOTE: *2: On the new vehicle (mileage: 500 km or less), injector drive time may be longer by approximately 10 %.*

Engine-ECU monitoring items

- This monitor item includes many useful items for understanding the engine conditions controlled by the engine-ECU.
- However, it is hard to show the definite specification of each item, since its value may vary to a large extent with a little difference in the measuring conditions, environment, and changes with the lapse of time, etc. on the objective vehicle. Therefore, this document will describe only the check conditions, display range, and behaviour of numeric values.

Item No.	Inspection item	M.U.T.-III display descriptions	Standards at each check	Display range, and numeric value
14	Throttle position sensor (main) learning value	• The following shows learning values of throttle valve opening angle at idling.	Ignition switch: ON	500 – 2,000 mV
26	Long term fuel trim (right bank)	• Indicates the right bank long-term air-fuel ratio feedback amount. • The negative side shows a reduction in the injection amount, while the positive side shows an increase.	Engine: After warm-up, 2,500 r/min without any load (under the air-fuel ratio feedback control)	–12.5 to 12.5 %
27	Long term fuel trim (left bank)	• Indicates the left bank long-term air-fuel ratio feedback amount. • The negative side shows a reduction in the injection amount, while the positive side shows an increase.	Engine: After warm-up, 2,500 r/min without any load (under the air-fuel ratio feedback control)	–12.5 to 12.5 %
28	Short term fuel trim (right bank)	• Indicates the right bank short-term air-fuel ratio feedback amount. • The negative side shows a reduction in the injection amount, while the positive side shows an increase.	Engine: After warm-up, 2,500 r/min without any load (under the air-fuel ratio feedback control)	–25.0 to 25.0 %
29	Short term fuel trim (left bank)	• Indicates the left bank short-term air-fuel ratio feedback amount. • The negative side shows a reduction in the injection amount, while the positive side shows an increase.	Engine: After warm-up, 2,500 r/min without any load (under the air-fuel ratio feedback control)	–25.0 to 25.0 %
32	Detonation retard (right bank)	• Indicates the ignition timing retardation angle that is controlled by the detonation sensor output.	Engine: Excessive acceleration after warm-up	Retards depending on the degree (angle) of acceleration

Item No.	Inspection item	M.U.T.-III display descriptions	Standards at each check	Display range, and numeric value
33	Detonation control learned value (right bank)	• Indicates the learning value to compensate for the ignition timing that is controlled by the detonation sensor output. • 0 % side is retardation, and 100 % side is advance.	Ignition switch: ON	0 – 100 %
47	Fan motor duty	• Indicates the fan duty ratio electric cooling fan.	• Engine: After warm-up • A/C switch: ON (when the compressor is active)	0 – 100 %
49	Purge control solenoid valve duty	• Indicates the duty ratio for the purge control solenoid valve.	Engine: After warm-up (when 1 minute has elapsed)	1 % or more
58	Throttle valve control servo	• Indicates the target opening angle of throttle valve.	Engine: After warm-up	0 – 100 %
59	Throttle valve control servo target value	• Indicates the target opening angle of throttle valve.	Engine: After warm-up	0 – 5.0 V
68	Idle speed control learned value (A/C OFF)	• Indicates the learning value to compensate for the opening angle of idling speed control (opening angle of throttle valve). • The negative side shows "close" side, while the positive side shows "open" side.	Ignition switch: ON	–1 to 2.4 L/s
69	Idle speed control learned value (A/C ON)	• Indicates the learning value to compensate for the opening angle of idling speed control (opening angle of throttle valve) with the air conditioner turned ON. • The negative side shows "close" side, while the positive side shows "open" side.	Ignition switch: ON	–1 to 2.4 L/s
72	Absolute load value	• Indicates the size of engine load value.	Engine: After warm-up	0 – 100 %
73	Calculated load value	• Indicates the size of engine load value.	Engine: After warm-up	0 – 100 %
BA	Exhaust gas recirculation servo (target)	• Indicates the target opening angle of exhaust gas recirculation servo.	Engine: After warm-up	0 – 100 %

Item No.	Inspection item	M.U.T.-III display descriptions	Standards at each check	Display range, and numeric value
105	Fuel system status (right bank)	• Indicates the right bank air-fuel ratio feedback control conditions. OL: Open loop CL: Closed loop OL: DRV: Open loop depending on the drive conditions OL: SYS: Open loop due to system anomaly. CL: HO2S: Closed loop only for the right bank oxygen sensor (front) (right bank oxygen sensor (rear) anomaly)	Engine: After warm-up	Varies depending on the drive conditions
106	Fuel system status (left bank)	• Indicates the left bank air-fuel ratio feedback control conditions. OL: Open loop CL: Closed loop OL: DRV: Open loop depending on the drive conditions OL: SYS: Open loop due to system anomaly. CL: HO2S: Closed loop only for the left bank oxygen sensor (front) (left bank oxygen sensor (rear) anomaly)	Engine: After warm-up	Varies depending on the drive conditions
114	Detonation retard (left bank)	• Indicates the ignition timing retardation angle that is controlled by the detonation sensor output.	Engine: Excessive acceleration after warm-up	Retards depending on the degree (angle) of acceleration
115	Detonation control learned value (left bank)	• Indicates the learning value to compensate for the ignition timing that is controlled by the detonation sensor output. • 0 % side is retardation, and 100 % side is advance.	Ignition switch: ON	0 – 100 %

ACTUATOR TEST REFERENCE TABLE

M1131152503632

Item No.	Inspection Item	Drive content	Inspection condition	Normal condition
1	Injectors	Specified injector is stopped	Engine: warm up, idle (cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idle condition is changed by stopping selected cylinder: this can cause an unstable condition and the engine may stall.
9	Fuel pump	Drive fuel pump to circulate fuel	• Ignition switch: ON • Check for pump operating noise near fuel tank	Operating noise audible
10	Purge control solenoid valve	Switch solenoid valve from OFF to ON	Ignition switch: ON	When the valve is actuated, operating noise is audible
14	Cooling fan motor	Actuate the fan motor	Ignition switch: ON	Fan motor rotates at high speed
16	A/C compressor relay	Switch the A/C compressor relay from OFF to ON	Ignition switch: ON	The operating sound of A/C compressor is audible
17	Oil feeder control valve	Switch the oil feeder control valve from OFF to ON	Engine: warm up, idle	When the valve is actuated, operating noise is audible

CHECK AT THE ECU TERMINALS

M1131153502579

Disconnect the engine-ECU connectors, and connect check harness special tool MB992110 between the engine-ECU connectors.

1. Measure the voltage between each check harness connector terminal and check harness connector earth terminal (GNDB or GNDE).
2. Connect a needle-nosed wire probe to a voltmeter probe.
3. Referring to the check sheet, insert the micromini probe into the check harness connector and measure the voltage.

   NOTE:
   1. *You may find it convenient to pull out the engine-ECU to make it easier to reach the connector terminals.*
   2. *The chart procedures do not have the particular order.*

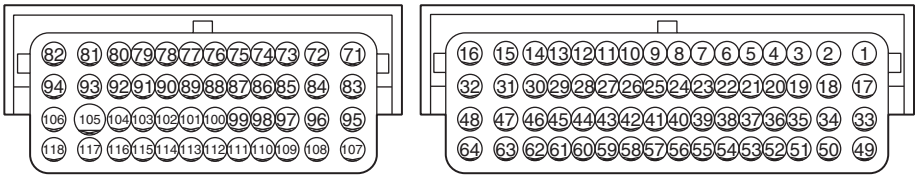
⚠ CAUTION

Short-circuiting the positive (+) probe between a connector terminal and earth could damage the vehicle wiring, the sensor, engine-ECU or all of them. Be careful to prevent this!

4. If voltmeter shows any division from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
5. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

TERMINAL VOLTAGE CHECK CHART

Special Tool Check Harness (MB992110) Connector Terminal Arrangement



AK502614AO

Terminal No.	Terminal code	Inspection Item	Check condition (Engine condition)	Normal condition
1	OCV	Oil feeder control valve	Engine: Idling operation after warm-up	System voltage
			Engine: 5,000 r/min	1 V or less → 4.0 – 10 V*(After a few seconds pass)
2	INJ1	No. 1 injector	Engine: While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 9 – 14 V*, it is slightly reduced temporarily.
3	INJ2	No. 2 injector		
18	INJ3	No. 3 injector		
19	INJ4	No. 4 injector		
50	INJ5	No. 5 injector		
51	INJ6	No. 6 injector		
4	CIL1	Ignition coil No. 1	Engine: 3,000 r/min	0.3 – 3.0 V*
5	CIL2	Ignition coil No. 2		
20	CIL3	Ignition coil No. 3		
21	CIL4	Ignition coil No. 4		
52	CIL5	Ignition coil No. 5		
53	CIL6	Ignition coil No. 6		
6	NTSW	Starter active signal	Engine: Cranking	System voltage
			Engine: Idling	1.0 V or less
7	OFRE	Right bank oxygen sensor (front) offset voltage	Ignition switch: ON	0.4 – 0.6 V
8	SGT	Crank angle sensor	Engine: Cranking	0.4 – 4.0 V*
			Engine: Idle operation	2.0 – 3.0 V*
9	5V	Sensor impressed voltage	Ignition switch: ON	System voltage

Terminal No.	Terminal code	Inspection Item	Check condition (Engine condition)		Normal condition
10	TPSM	Throttle position sensor (main)	• Remove the intake air hose at the throttle body. • Disconnect the connector of the electronic-controlled throttle valve. • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors. • Ignition switch: ON (engine stopped)	Fully close the throttle valve with your finger.	0.3 – 0.7 V
				Fully open the throttle valve with your finger.	4.0 V or more
11	TPSS	Throttle position sensor (sub)	• Remove the intake air hose at the throttle body. • Disconnect the connector of the electronic-controlled throttle valve. • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors. • Ignition switch: ON (engine stopped)	Fully close the throttle valve with your finger.	4.0 V or more
				Fully open the throttle valve with your finger.	1.0 V or less
12	TPS5	Applied voltage to the throttle position sensor	Ignition switch: ON		4.9 – 5.1 V
14	SGC	Camshaft position sensor	Engine: Cranking		0.4 – 4.0 V*
			Engine: Idle operation		2.5 – 3.9 V*
15	ETV+	Throttle valve control servo (+)	• Ignition switch: ON • Accelerator pedal: fully opened → fully closed		Decreases slightly (Approximately 2 V) from the battery voltage
16	ETV–	Throttle valve control servo (–)	• Ignition switch: ON • Accelerator pedal: fully closed → fully opened		Decreases slightly (Approximately 2 V) from the battery voltage

Terminal No.	Terminal code	Inspection Item	Check condition (Engine condition)		Normal condition
22	O2FR	Right bank oxygen sensor (front)	Engine: Maintain 2,500 r/min after warm-up		0.5 ⇔ 1.4 V (repeat the alteration)
26	WTS	Engine coolant temperature sensor	Ignition switch: ON	When engine coolant temperature is –20°C	3.9 – 4.5 V
				When engine coolant temperature is 0°C	3.2 – 3.8 V
				When engine coolant temperature is 20°C	2.3 – 2.9 V
				When engine coolant temperature is 40°C	1.3 – 1.9 V
				When engine coolant temperature is 60°C	0.7 – 1.3 V
				When engine coolant temperature is 80°C	0.3 – 0.9 V
31	EGRA	Exhaust gas recirculation valve (A)	Ignition switch: OFF → ON		To initialise, energise exhaust gas recirculation valve for three seconds and de-energise it
32	EGRB	Exhaust gas recirculation valve (B)			
47	EGRC	Exhaust gas recirculation valve (C)			
48	EGRD	Exhaust gas recirculation valve (D)			
33	OHFR	Right bank oxygen sensor (front) heater	Engine: Idling operation after warm-up (after 15 seconds has elapsed)		9 – 11 V*
			Under the high load operation		9 – 11 V* → System voltage
34	OHFL	Left bank oxygen sensor (front) heater	Engine: Idling operation after warm-up (after 15 seconds has elapsed)		9 – 11 V*
			Under the high load operation		9 – 11 V* → System voltage
35	OHRL	Left bank oxygen sensor (rear) heater	Engine: Idling operation after warm-up (after 15 seconds has elapsed)		1.0 V or less
			Under the high load operation		System voltage

Terminal No.	Terminal code	Inspection Item	Check condition (Engine condition)		Normal condition
36	OPSW	Engine oil pressure switch	Ignition switch: ON		1.0 V or less
			Engine: Idle operation		System voltage
37	PURG	Purge control solenoid valve	Ignition switch: ON		System voltage
			Engine: 2,500 r/min after warm-up (with 4 minutes after the engine starting sequence is completed)		Voltage decreases
40	O2RL	Left bank oxygen sensor (rear)	• Transmission: 2nd • The engine speed is maintained to 3,500 r/min or more during an accelerated driving with the throttle full-open		1.0 – 1.5 V
41	ORLE	Left bank oxygen sensor (rear) offset voltage	Ignition switch: ON		0.4 – 0.6 V
44	MAP5	Applied voltage to the manifold absolute pressure sensor	Ignition switch: ON		4.9 – 5.1 V
45	MAP	Manifold absolute pressure sensor	Ignition switch: ON	At 0 m altitude	3.8 – 4.2 V
				At 600 m altitude	3.5 – 3.9 V
				At 1,200 m altitude	3.3 – 3.7 V
				At 1,800 m altitude	3.0 – 3.4 V
			Engine: Idle operation after warm-up		0.6 – 1.4 V
			Engine: While the engine is idling after warm-up, quickly depress the accelerator pedal		Varies depending on the negative pressure at the inlet manifold
49	OHRR	Right bank oxygen sensor (rear) heater	Engine: Idling operation after warm-up (after 15 seconds has elapsed)		1.0 V or less
			Under the high load operation		System voltage
54	O2RR	Right bank oxygen sensor (front)	• Transmission: 2nd • The engine speed is maintained to 3,500 r/min or more during an accelerated driving with the throttle full-open		1.0 – 1.5 V
55	ORRE	Right bank oxygen sensor (front) offset voltage	Ignition switch: ON		0.4 – 0.6 V
57	O2FL	Left bank oxygen sensor (front) offset voltage	Engine: Maintain 2,500 r/min after warm-up		0.5 ⇔ 1.4 V (repeat the alteration)
58	OFLE	Left bank oxygen sensor (front) offset voltage	Ignition switch: ON		0.4 – 0.6 V

Terminal No.	Terminal code	Inspection Item	Check condition (Engine condition)		Normal condition
60	ALTG	Alternator G terminal	• Engine: Idle operation after warm-up • Radiator fan: Non-operation • Head lamp switch: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON		Voltage rises
61	ALTF	Alternator FR terminal	• Engine: Idle operation after warm-up • Radiator fan: Non-operation • Head lamp switch: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON		Voltage decreases
62	ALTL	Alternator L terminal	Ignition switch: ON		0.5 – 2.0 V
			Engine: Idle operation		System voltage
72	RSB	Power supply voltage applied to throttle valve control servo	Ignition switch: ON		System voltage
73	C/R	Engine control relay	Ignition switch: LOCK (OFF)		System voltage
			Ignition switch: ON		1.0 V or less
74	APSM	Accelerator pedal position sensor (main)	Ignition switch: ON	Release the accelerator pedal	0.9 – 1.1 V
				Depress the accelerator pedal fully	4.0 V or more
75	APS5	Applied voltage to the accelerator pedal position sensor (main)	Ignition switch: ON		4.9 – 5.1 V
77	APSS	Accelerator pedal position sensor (sub)	Ignition switch: ON	Release the accelerator pedal.	0.4 – 0.6 V
				Depress the accelerator pedal fully	2.0 V or more
78	5VV	Applied voltage to the accelerator pedal position sensor (sub)	Ignition switch: ON		4.9 – 5.1 V
82	BAT1	Power supply	Ignition switch: ON		System voltage
84	C/RL	Throttle valve control servo relay	Ignition switch: ON → LOCK (OFF)		1.0 V or less → System voltage → 1.0 V or less
87	AFS	Air flow sensor	Engine: Gradually increase the speed		Voltage increase in response to revving

Terminal No.	Terminal code	Inspection Item	Check condition (Engine condition)		Normal condition
89	ATS	Intake air temperature sensor	Ignition switch: ON	When the intake air temperature is –20°C	3.8 – 4.4 V
				When the intake air temperature is 0°C	3.2 – 3.8 V
				When the intake air temperature is 20°C	2.3 – 2.9 V
				When the intake air temperature is 40°C	1.5 – 2.1 V
				When the intake air temperature is 60°C	0.8 – 1.4 V
				When the intake air temperature is 80°C	0.4 – 1.0 V
92	IGN	Ignition switch – IG	Ignition switch: ON		System voltage
96	FP/R	Fuel pump relay	Ignition switch: ON		System voltage
			Engine: Idle operation		1.0 V or less
102	AC/R	A/C compressor relay	• Engine: Idle operation • A/C switch: OFF → ON (when the compressor is active)		System voltage → 1.0 V or less
104	BACK	Backup power supply	Ignition switch: LOCK (OFF)		System voltage
105	ST	Ignition switch – ST	Engine: Cranking		8 V or more
106	STRL	Starter relay	Engine: Cranking		System voltage
			Engine: Idle operation		1.0 V or less

*NOTE: *: The shown voltage is the average value where an analogue voltmeter is used (because a digital voltmeter may not be able to indicate the average voltage stably).*

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

Turn the ignition switch to "LOCK" (OFF) position.

1. Disconnect the engine-ECU connector.
2. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

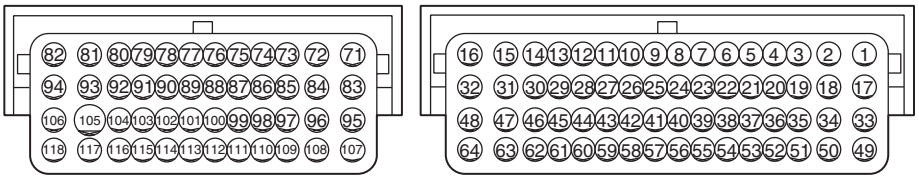
   NOTE:
   1. *When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.*
   2. *Checking need not be carried out in the order given in the chart.*

⚠ CAUTION

If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine-ECU and/or ohmmeter. Be careful to prevent this!

3. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and the repair or replace.
4. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-ECU Harness Side Connector



AK502911BA

Terminal No.	Terminal code	Inspection Item	Standard value, normal condition (Check condition)
1 – 82	DCV – BAT1	Oil feeder control valve	6.9 – 7.9 Ω (at 20°C)
15 – 16	ETV+ – ETV-	Throttle valve control servo	0.3 – 80 Ω (at 20°C)
26 – 27	WTS – WTSE	Engine coolant temperature sensor	14 – 17 kΩ (at –20°C)
			[5.1 – 6.5 kΩ (at 0°C)]*
			2.1 – 2.7 kΩ (at 20°C)
			[0.9 – 1.3 kΩ (at 40°C)]*
			[0.48 – 0.68 kΩ (at 60°C)]*
			0.26 – 0.36 kΩ (at 80°C)
31 – 82	EGRA – BAT1	Exhaust gas recirculation valve (A)	20 – 24 Ω (at 20°C)
32 – 82	EGRB – BAT1	Exhaust gas recirculation valve (B)	
47 – 82	EGRC – BAT1	Exhaust gas recirculation valve (C)	
48 – 82	EGRD – BAT1	Exhaust gas recirculation valve (D)	
33 – 82	OHFR – BAT1	Right bank oxygen sensor (front) heater	4.5 – 8.0 Ω (at 20°C)
34 – 82	OHFL – BAT1	Left bank oxygen sensor (front) heater	4.5 – 8.0 Ω (at 20°C)
35 – 82	OHRL – BAT1	Left bank oxygen sensor (rear) heater	11 – 18 Ω (at 20°C)
37 – 82	PURG – BAT1	Purge control solenoid valve	22 – 26 Ω (at 20°C)
49 – 82	OHRR – BAT1	Right bank oxygen sensor (rear) heater	11 – 18 Ω (at 20°C)

Terminal No.	Terminal code	Inspection Item	Standard value, normal condition (Check condition)
71 – body earth	RSG – body earth	ECU earth	Continuity (2 Ω or less)
81 – body earth	GNDB – body earth		
83 – body earth	RSH – body earth		
93 – body earth	GNDE – body earth		
88 – 89	AFSE – ATS	Intake air temperature sensor	13 – 17 kΩ (at –20°C)
			5.3 – 6.7 kΩ (at 0°C)
			2.3 – 3.0 kΩ (at 20°C)
			0.30 – 0.45 kΩ (at 80°C)

NOTE: [*]: The value in square brackets is only advisory.

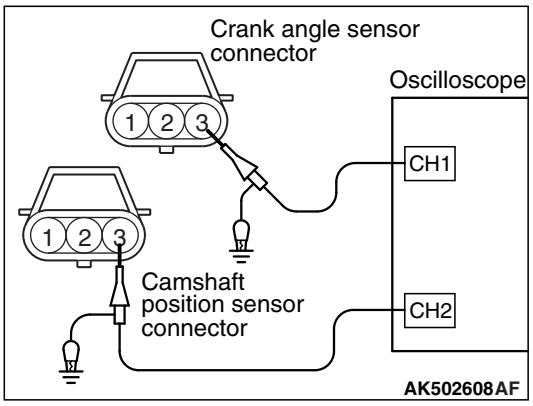
INSPECTION PROCEDURE USING AN OSCILLOSCOPE

M1131154503508

The output signals of the sensors and the conditions of the actuation signals of the actuators can be inspected visually by observing the waveforms on the oscilloscope.

Camshaft position sensor and Crank angle sensor

Measurement Method



1. Disconnect the camshaft position sensor connector and connect the special tool test harness (MB991709) in between (All terminals should be connected).
2. Connect the oscilloscope special patterns pickup to camshaft position sensor terminal No. 3.
3. Disconnect the crank angle sensor connector and connect the special tool test harness (MB991709) in between (All terminals should be connected).
4. Connect the oscilloscope special patterns pickup to crank angle sensor terminal No. 3.

Alternate Method (Test harness not available)

1. Disconnect the engine-ECU connector and connect the special tool power plant ECU check harness (MB992110) in between.
2. Connect the oscilloscope special pattern pickup to engine-ECU terminal SGC (when checking the camshaft position sensor signal wave pattern).
3. Connect the oscilloscope special pattern pickup to engine-ECU terminal SGT (when checking the crank angle sensor signal wave pattern).

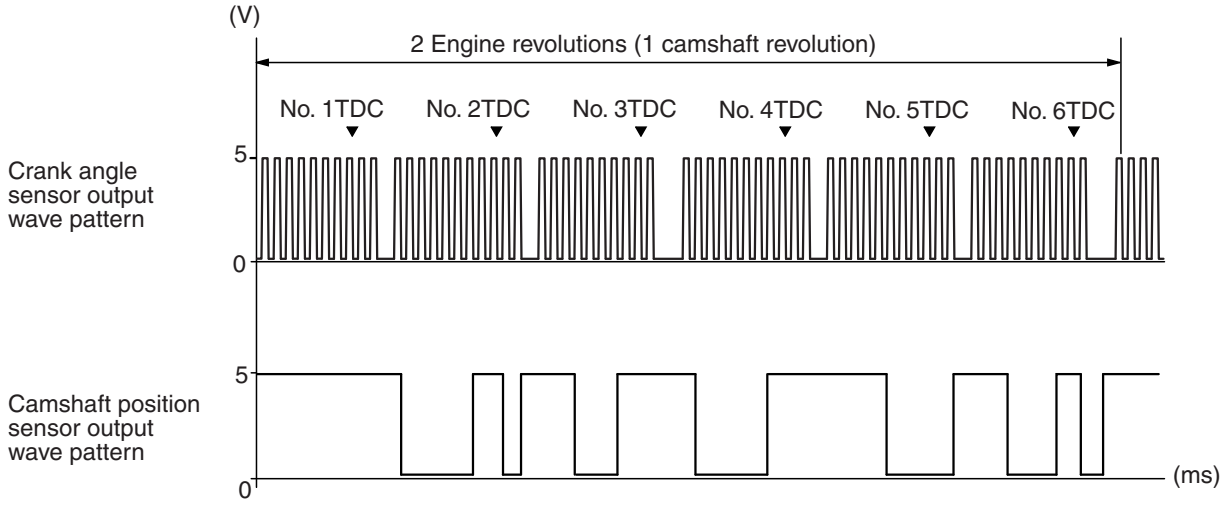
Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	Low

Function	Special patterns
Pattern selector	Display
Engine	Idle

Standard wave pattern



TDC: Top dead centre

AK602760AB

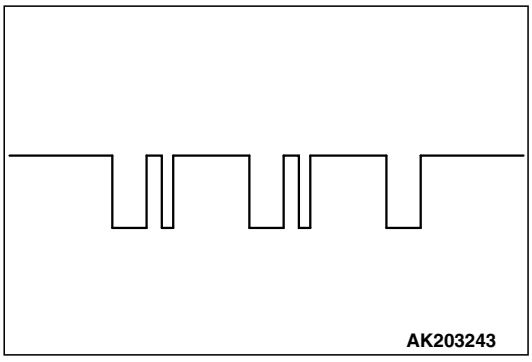
Description of Wave Patterns

- The camshaft position sensor serves as to detect the compression top dead centre of each cylinder. By observing this signal simultaneously with other control signals, it is possible to identify each cylinder.
- The crank angle sensor is used to detect the crank angle of each cylinder. While the engine revolves for two cycles, 72 pieces of crank angle sensor High signal (including any missing) will be outputted.

Wave Pattern Observation Points

- Verify that the wave pattern is shortened as the engine speed rises.

Examples of Abnormal Wave Pattern



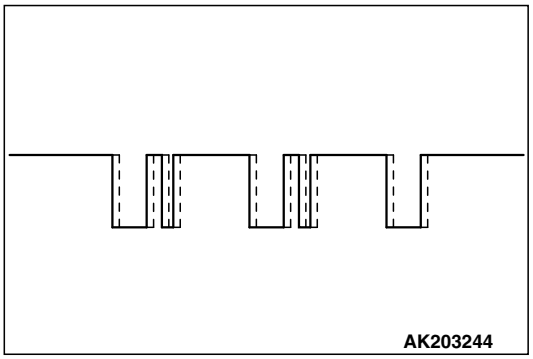
Example 1

Wave pattern characteristics

- Rectangular wave will be outputted while the engine is not started.

Cause of problem

- Failed sensor interface



Example 2

Wave pattern characteristics

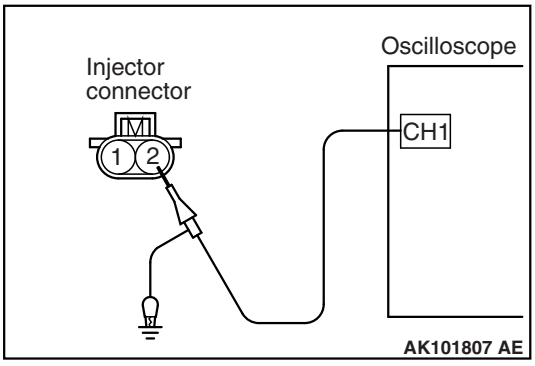
- Wave pattern is displaced in the forward or backward direction.

Cause of problem

- Loose timing belt
- Abnormal sensing section

Injector

Measurement Method



1. Disconnect the injector connector and insert the special tool test harness (MB991658) in-between the separated connectors. (Always mate all the terminals.)
2. Connect the oscilloscope probe to terminal No. 2 of the injector connector.

Alternate Method (Measure at the engine-ECU)

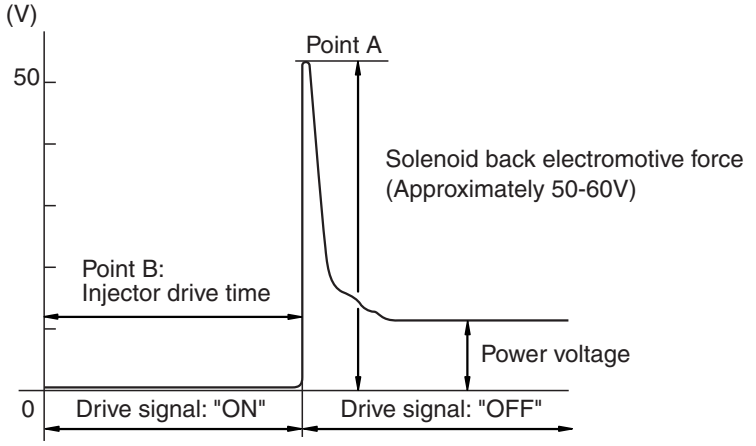
1. Connect the oscilloscope special patterns pickup to engine-ECU terminal INJ1 (when checking the No. 1 cylinder).
2. Connect the oscilloscope special patterns pickup to engine-ECU terminal INJ2 (when checking the No. 2 cylinder).
3. Connect the oscilloscope special patterns pickup to engine-ECU terminal INJ3 (when checking the No. 3 cylinder).
4. Connect the oscilloscope special patterns pickup to engine-ECU terminal INJ4 (when checking the No. 4 cylinder).
5. Connect the oscilloscope special patterns pickup to engine-ECU terminal INJ5 (when checking the No. 5 cylinder).
6. Connect the oscilloscope special patterns pickup to engine-ECU terminal INJ6 (when checking the No. 6 cylinder).

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine	Idle

Standard wave pattern



AK602761AB

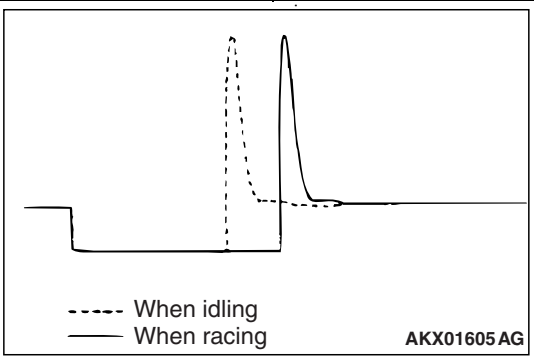
Description of Wave Patterns

- Normally the supply voltage is applied, but, if any signal is received from the engine-ECU, the voltage falls to near 0 V as long as the drive signal continues.
- When the signal from the engine-ECU is stopped, a peak voltage resulting from the counter electromotive force of coil appears and the original supply voltage restores.
- Injector operation time: Fuel injection period determined by the engine-ECU according to various sensor output values. Injector operation time = Effective injection period + Invalid injection period (invalid injection period: used to compensate for the delayed operation due to decrease in the supplied voltage)
- Solenoid back electromotive force: When the signal from the engine-ECU is OFF, the injector coil can generate a solenoid back electromotive force (Approximately 50 to 60 V).
- Power supply voltage: While there is no signal from the engine-ECU, the supply voltage is applied. If this supply voltage is low, the invalid injection period gets longer, and the drive period gets longer as well.

Wave Pattern Observation Points

- Point A: The level of solenoid back electromotive force:

Solenoid back electromotive force is low or doesn't appear at all.	Short-circuit in the injector solenoid



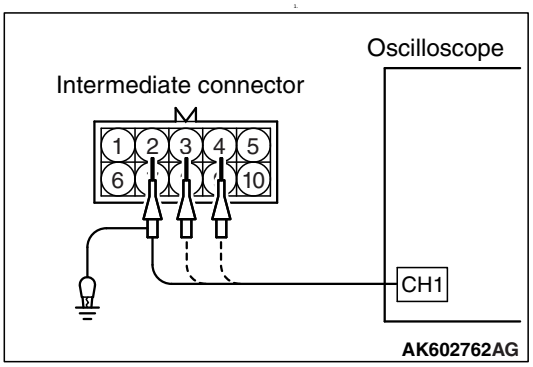
Point B: Injector operation time

Operation time	Consistent with the displayed time on M.U.T.-III.
Force an excessive acceleration.	The drive period will once extend greatly, then will be settled to that corresponding to the engine speed.

Ignition coil (power transistor control signal)

Measurement Method

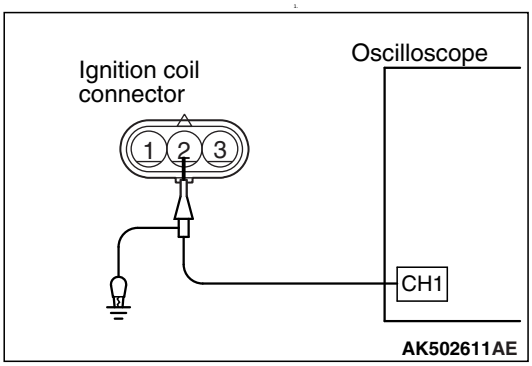
Measure at the right bank (number 1, 3, 5 cylinders)



Disconnect the intermediate connector, and connect the test harness special tool (MB991658) between the separated connectors.

2. Connect the oscilloscope probe to each intermediate connector terminal to analyze each cylinder:
   - Intermediate connector (CIL1 line) for the number 1 cylinder.
   - Intermediate connector (CIL3 line) for the number 3 cylinder.
   - Intermediate connector (CIL5 line) for the number 5 cylinder.

Measure at the left bank (number 2, 4, 6 cylinders)



Disconnect the ignition coil connector, and connect the test harness special tool (MB991658) between the separated connectors. (All terminals should be connected.)

2. Connect the oscilloscope probe to each ignition coil connector terminal No. 2.

Alternate Method (Measure at the engine-ECU)

1. Connect the oscilloscope probe to engine-ECU terminal CIL1 (when checking the No. 1 cylinder).
2. Connect the oscilloscope probe to engine-ECU terminal CIL2 (when checking the No. 2 cylinder).
3. Connect the oscilloscope probe to engine-ECU terminal CIL3 (when checking the No. 3 cylinder).
4. Connect the oscilloscope probe to engine-ECU terminal CIL4 (when checking the No. 4 cylinder).
5. Connect the oscilloscope probe to engine-ECU terminal CIL5 (when checking the No. 5 cylinder).
6. Connect the oscilloscope probe to engine-ECU terminal CIL6 (when checking the No. 6 cylinder).

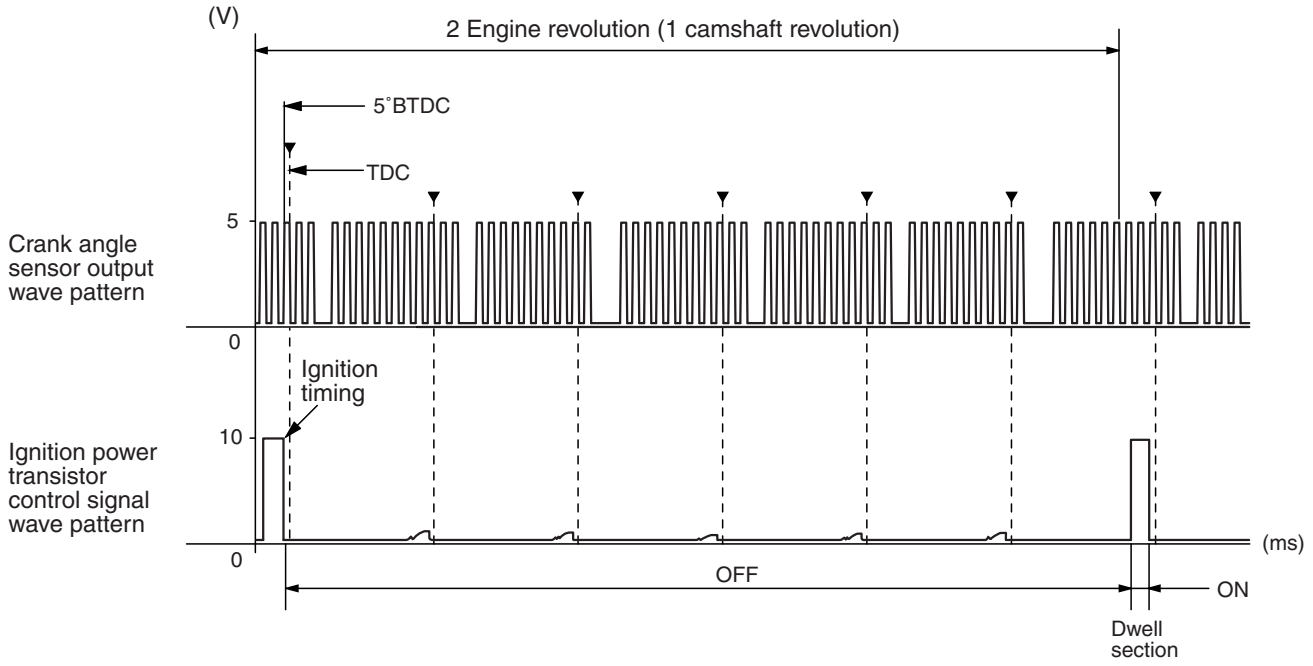
Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	Low

Function	Special patterns
Pattern selector	Display
Engine	Idle

Standard wave pattern



AK602763AB

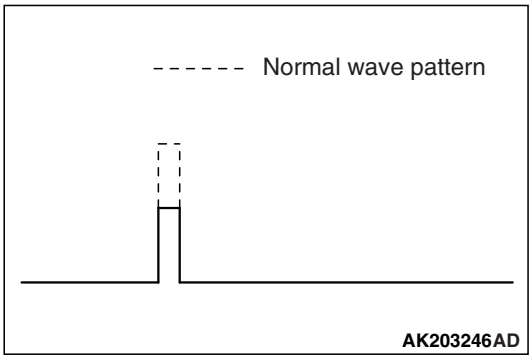
Description of Wave Patterns

- Power transistor ON condition:
  An interval when the power transistor is ON and the primary side of ignition coil is conducted (referred to as "dwell interval") This conduction period gets longer if the battery voltage is low or vice versa so that the primary voltage at ignition can be controlled to a constant level.
- Power transistor OFF condition:
  This interval corresponds to when the power transistor is OFF and the power transistor drive signal is not outputted from the engine-ECU.

Wave Pattern Observation Points

- Verify that the power transistor control signal (ignition timing) advances as the engine speed increases.

Examples of Abnormal Wave Pattern



Wave pattern characteristics

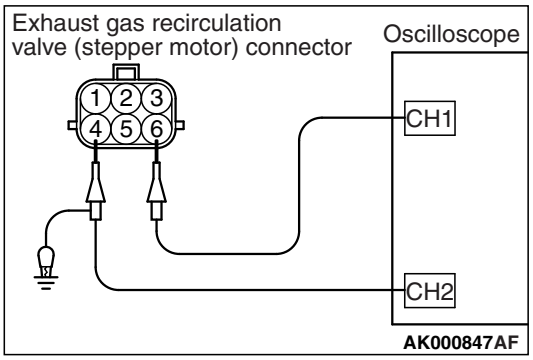
- The voltage is low.

Cause of problem

- Open-circuit in the ignition primary circuit.

EXHAUST GAS RECIRCULATION VALVE (STEPPER MOTOR)

Measurement Method



1. Disconnect the exhaust gas recirculation valve connector and insert the special tool test harness (MB991658) in-between the separated connectors. (Always mate all the terminals.)
2. Connect the oscilloscope probe of each channel to either combination of terminal No. 1 and No. 3 or terminal No. 4 and No. 6 of the exhaust gas recirculation valve connector.

Alternate Method (Measure at the engine-ECU)

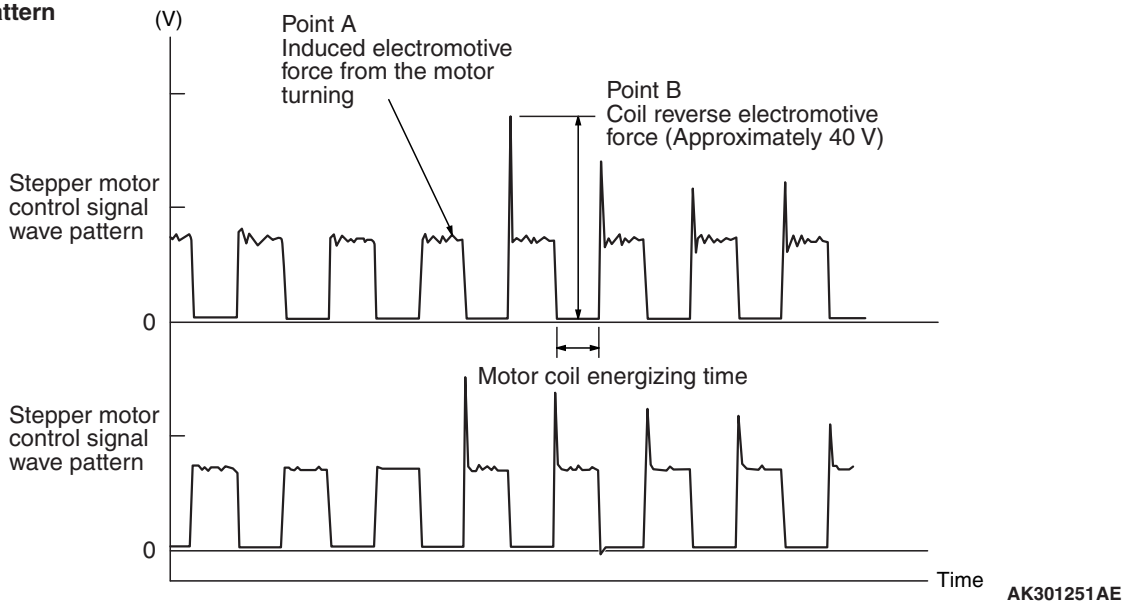
1. Disconnect the engine-ECU connector and connect the special tool Power plant ECU check harness (MB992110) in between.
2. Connect the oscilloscope probe to engine-ECU terminal EGRA, connection terminal EGRB, connection terminal EGRC and connection terminal EGRD respectively.

Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine	Ignition switch: OFF → ON

Standard wave pattern



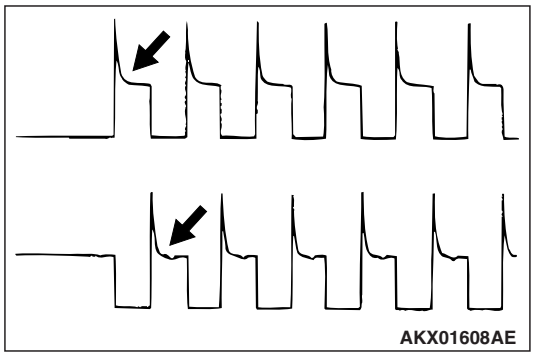
Description of Wave Patterns

- A wave pattern momentarily appears at acceleration.
- When the signal from the engine-ECU is turned OFF, a peak voltage resulting from the counter electromotive force of motor coil appears.In addition, the wave pattern will be disturbed by an inductive electromotive force generated as the motor revolves.

Wave Pattern Observation Points

- Verify that the standard wave patter appears when the stepper motor operating conditions are met.

Examples of Abnormal Wave Pattern



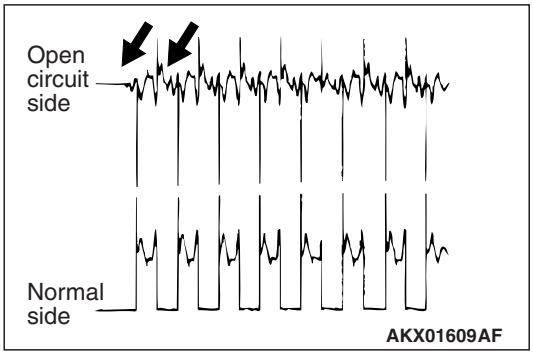
Example 1

Wave pattern characteristics

- Induced electromotive force from the motor revolution does not appear, or is very small.
- Coil's counter electromotive force does not appear, or is very small.

Cause of problem

- Faulty motor operation (motor is not revolving)
- Short-circuit in the coil



Example 2

Wave pattern characteristics

- The motor coil is not conducted (voltage does not fall to 0 V), or the waveform of the induced electromotive force is slightly different from the standard one.

Cause of problem

- Open-circuit in the line between the stepper motor and engine-ECU.

ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

M1131001002606

⚠ *WARNING*

When touching the throttle valve, surely shut off the driving circuits of the throttle valve. In the event that the throttle valve is operated, a finger might be injured as the result of being caught by the throttle valve.

⚠ CAUTION

When throttle body is cleaned, use the M.U.T.-III to initialise the learning value (Refer to GROUP 00, Precautions Before Service – Initialisation Procedure for Learning Value in MPI Engine P.00-7).

1. Disconnect the electronic-controlled throttle valve connector.
2. Remove the air intake hose from the throttle body.
3. Remove the throttle body assembly.

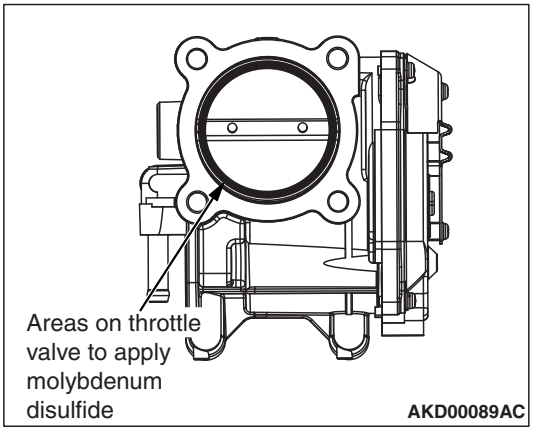
⚠ CAUTION

Do not spray the cleaning fluid directly to the throttle valve.

4. Spray the cleaning fluid on a clean cloth.

⚠ CAUTION

- **Make sure the cleaning fluid does not enter motor and sensor through the shaft.**
- **Be careful not to rub off the molybden applied around the throttle valve shaft.**



5. Wipe off the dirt around the throttle valve with the cloth sprayed with cleaning fluid.
6. Install the throttle body assembly.
7. Attach the air intake hose.
8. Connect the electronic-controlled throttle valve connector.

HOW TO REDUCE PRESSURIZED FUEL LINES

M1131000902866

The service procedure is the same as the vehicles with 4B1 engine (Refer to GROUP 13A – On-vehicle Service, How To Reduce Pressurized Fuel Lines).

FUEL TANK PUMP OPERATION CHECK

M1131002003107

The service procedure is the same as the vehicles with 4B1 engine (Refer to GROUP 13A – On-vehicle Service, Fuel Tank Pump Operation Check).

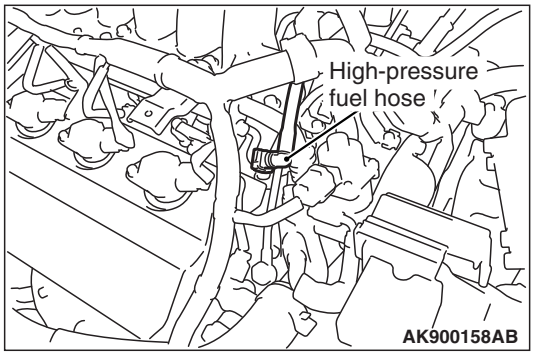
FUEL PRESSURE TEST

M1131001903077

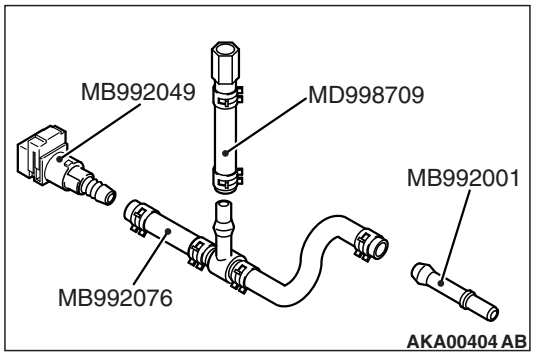
1. Release residual pressure from the fuel pipe line to prevent fuel gush out (Refer to P.13F-213).

⚠ CAUTION

Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

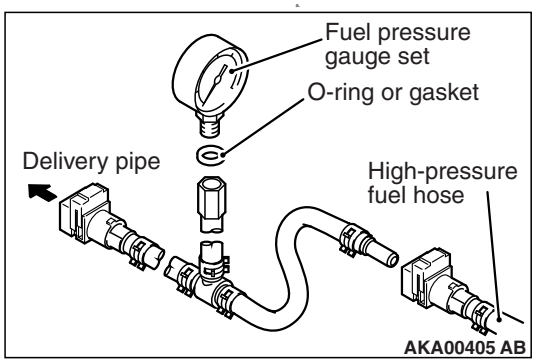


2. Disconnect the high-pressure fuel hose at the delivery pipe side.



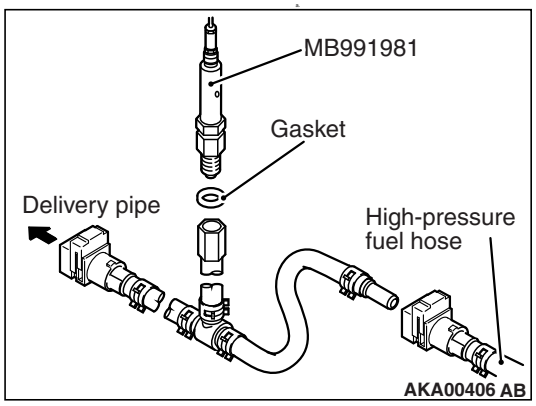
3. Assemble the special tool called injector test set (MB992076) as shown in the figure.
   (1) Remove the injector installation adapter from the hose. Remove another hose together with the adapter and remove the adopter from the remaining hose.
   (2) To the hose ends from which each adapter is removed, attach the special tool quick connector (MB992049) and special tool hose adapter (MB992001).
   (3) Remove the nipple of the bolt of the special tool hose adapter (MD998709).
   (4) Install the special tool prepared in the procedure (3) to the nipple that was removed together with hose in the procedure (1)
4. Attach the special tool between the delivery pipe and fuel pipe pressure hose.

<Where the fuel pressure gauge is used>



Attach the fuel pressure gauge on the special tool for measuring the fuel pressure via an appropriate O-ring or gasket.

<Where the fuel pressure gauge set is used>



a. Attach the special tool fuel pressure gauge set (MB991981) on the special tool for measuring the fuel pressure via an appropriate gasket.
b. Connect the leads from the fuel pressure gauge set to the power supply (cigarette lighter socket) and special tool vehicle communication interface (V.C.I.) (MB991824).

⚠ CAUTION

Connection and disconnection of M.U.T.-III should be always performed with the ignition switch turned to the LOCK (OFF) position.

5. Connect the M.U.T.-III to the diagnosis connector.
6. Turn the ignition switch to the ON position. (But do not start the engine.)
7. Select "Item No. 09" of the M.U.T.-III actuator test to drive the fuel pump. Verify there is no leakage from each section with the fuel pressure being applied.
8. Finish the actuator test or turn the ignition switch to the LOCK (OFF) position.
9. Start the engine and run at idle.
10. Measure the fuel pressure while the engine is running at idle.

    Standard value: Approximately 324 kPa
11. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
12. If any of fuel pressure measured in steps 10 and 11 is out of specification, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure is too low. • Fuel pressure drops after racing.	Clogged fuel filter	Replace the fuel filter.
	Fuel leaking to the return side due to poor seating of the fuel regulator valve in the fuel pressure regulator or the settled spring.	Replace fuel pressure regulator
	Low fuel pump delivery pressure	Replace fuel pump.
Fuel pressure is too high.	Binding valve in fuel pressure regulator	Replace fuel pressure regulator

13. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky injector	Replace injector.
	Leaky fuel regulator valve seat	Replace fuel pressure regulator
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump is held open	Replace fuel pump.

14. Release residual pressure from the fuel pipe line.

⚠ CAUTION

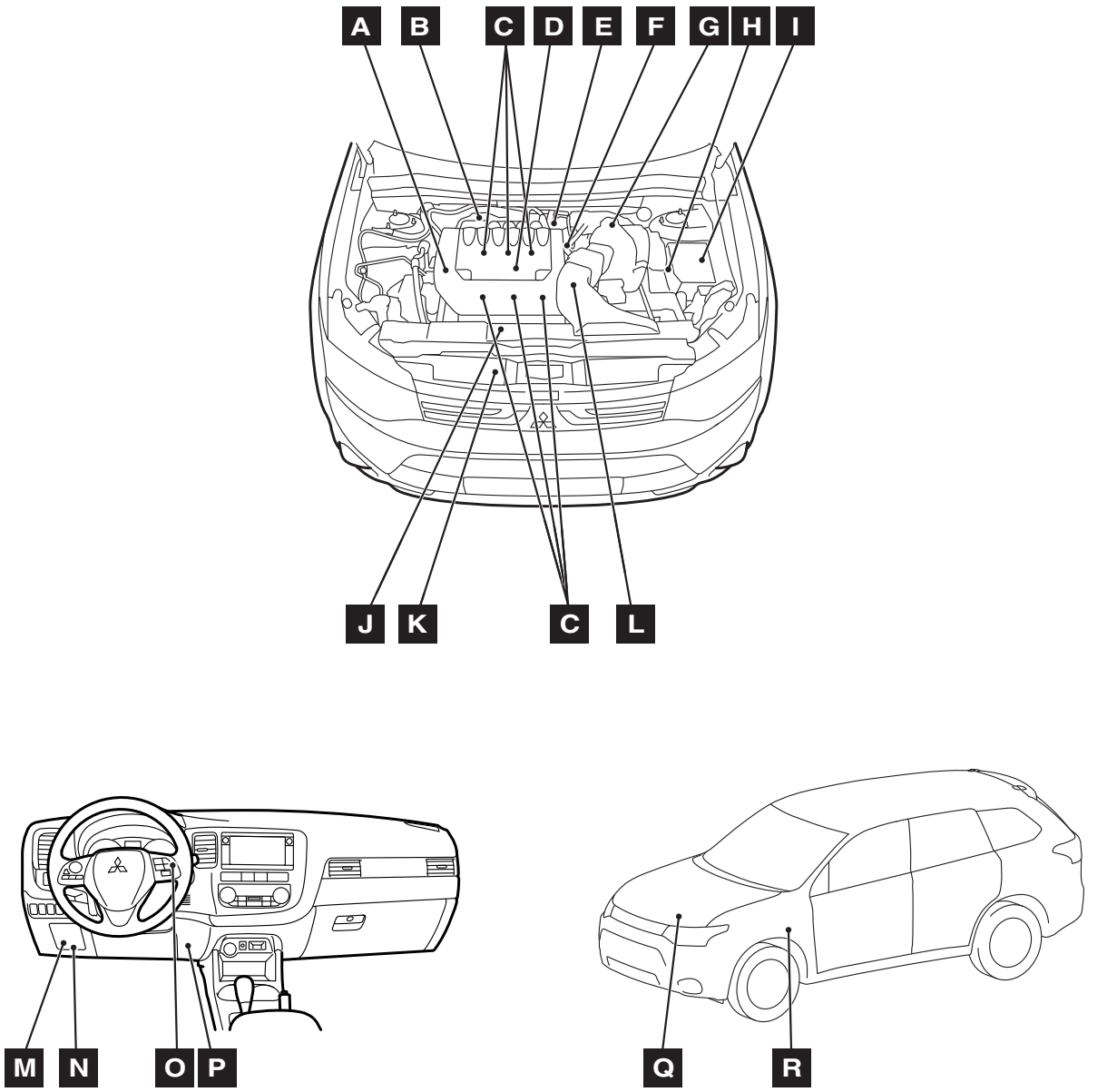
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

15. Remove the special tool from delivery pipe.
16. Replace high-pressure fuel hose to delivery pipe.
17. Check for any fuel leaks by following the procedure in step 7.
18. Disconnect the M.U.T.-III.

COMPONENT LOCATION

M1131002103977

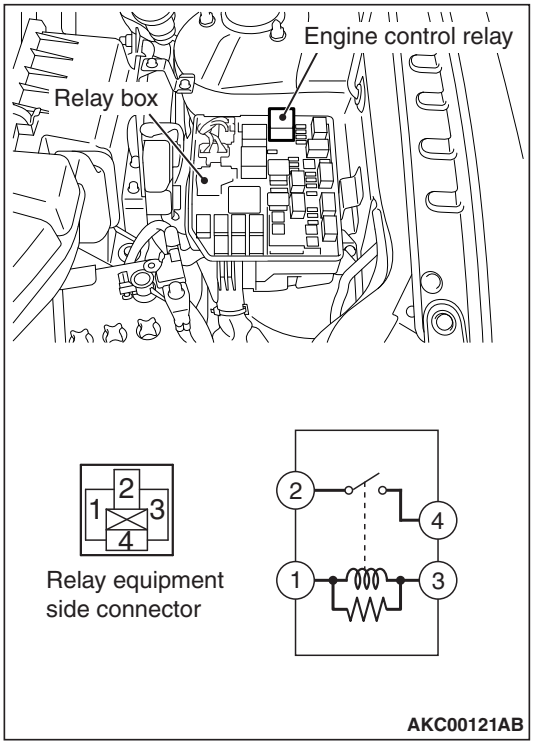
Name	Symbol	Name	Symbol
A/C compressor relay	I	Ignition coil (with the built-in power transistor)	C
Accelerator pedal position sensor	P	Injector	C
Air flow sensor (with intake air temperature sensor)	G	Left bank detonation sensor	D
Camshaft position sensor	F	Left bank oxygen sensor (front)	J
Crank angle sensor	A	Left bank oxygen sensor (rear)	Q
Diagnosis connector	N	Manifold absolute pressure sensor	B
Exhaust gas recirculation valve	F	Oil feeder control valve	F
Electronic-controlled throttle valve (throttle position sensor and throttle valve control servo)	F	Purge control solenoid valve	E
Engine control relay	I	Right bank detonation sensor	D
Engine coolant temperature sensor	F	Right bank oxygen sensor (front)	R
Engine-ECU	H	Right bank oxygen sensor (rear)	R
Engine oil pressure switch	K	Starter relay	I
Engine warning lamp	O	Throttle valve control servo relay	I
ETACS-ECU (fuel pump relay)	M		



AKD00149 AB

ENGINE CONTROL RELAY CONTINUITY CHECK

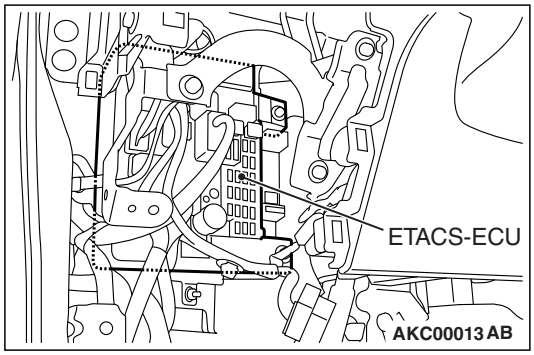
M1131050002125

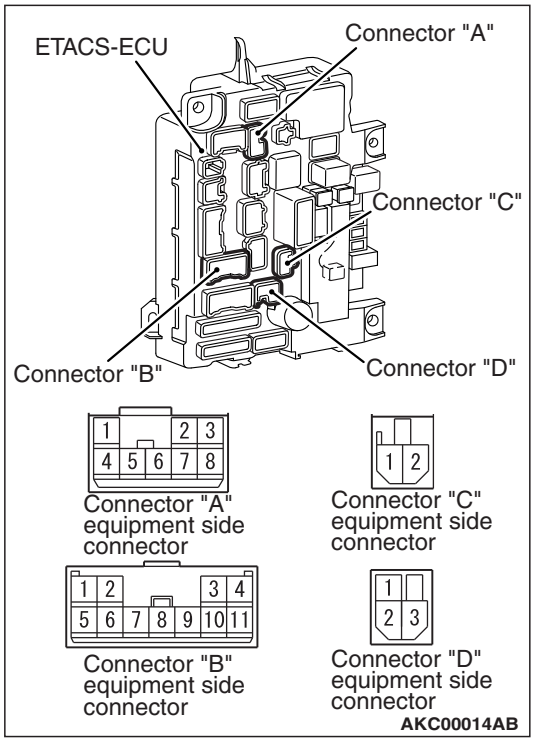


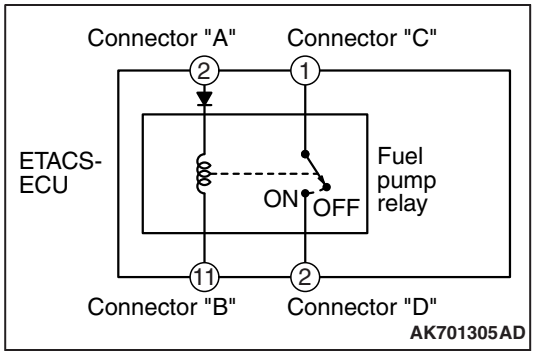
Tester connection terminal	Battery voltage	Normal condition
1 – 3	No voltage	Continuity
2 – 4	No voltage	No continuity
	Voltage (Connect positive (+) terminal of battery to terminal No. 3 and negative (–) terminal of battery to terminal No. 1.)	Continuity (2 Ω or less)

FUEL PUMP RELAY CONTINUITY CHECK

M1131033002207



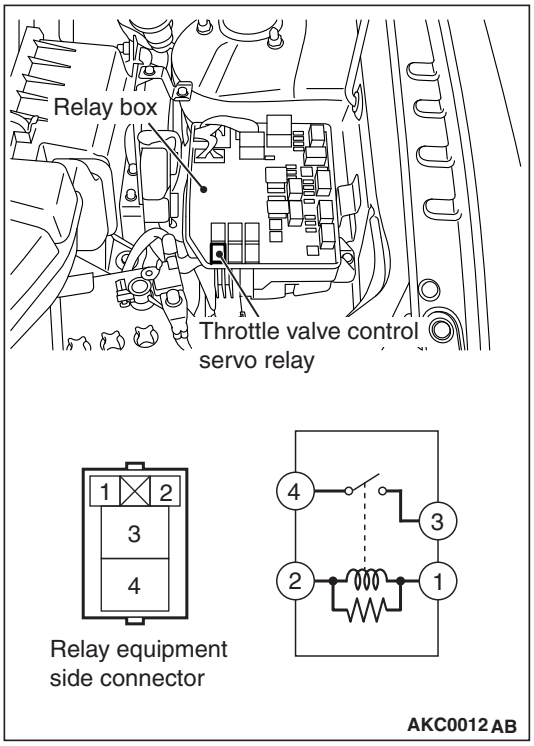




Tester connection terminal	Battery voltage	Normal condition
Connector "C" terminal No. 1 – Connector "D" terminal No. 2	No voltage	No continuity
	Voltage (Connect the (+) terminal of battery to terminal No. 2 of connector "A" and the (–) terminal to terminal No. 11 of connector "B".)	Continuity (2 Ω or less)

THROTTLE VALVE CONTROL SERVO RELAY CONTINUITY CHECK

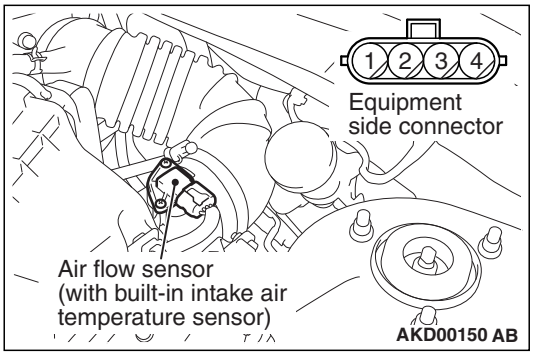
M1131053501148



Tester connection terminal	Battery voltage	Normal condition
1 – 2	No voltage	Continuity
3 – 4	No voltage	No continuity
	Voltage (Connect the positive (+) terminal of battery to terminal No. 2 and the negative (–) terminal to terminal No. 1.)	Continuity (2 Ω or less)

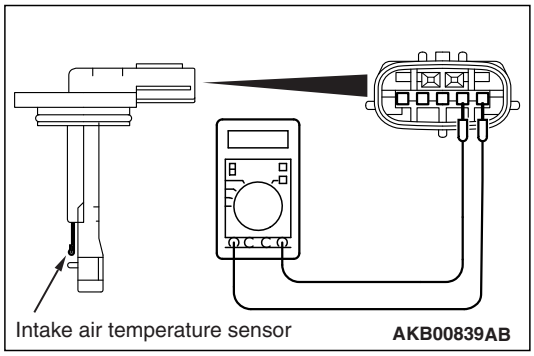
INTAKE AIR TEMPERATURE SENSOR CHECK

M1131002802445



1. Disconnect the air flow sensor connector.
2. Measure the resistance between terminals No. 1 and No.4 of the air flow sensor connector.

   Standard value:
   13 – 17 kΩ (at –20°C)
   5.3 – 6.7 kΩ (at 0°C)
   2.3 – 3.0 kΩ (at 20°C)
   0.30 – 0.45 kΩ (at 80°C)



3. Measure resistance while heating the sensor using a hair drier.

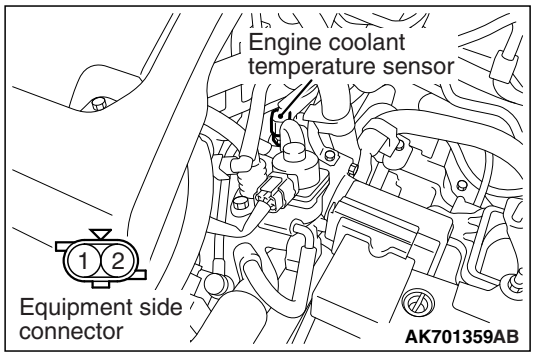
   Normal condition:

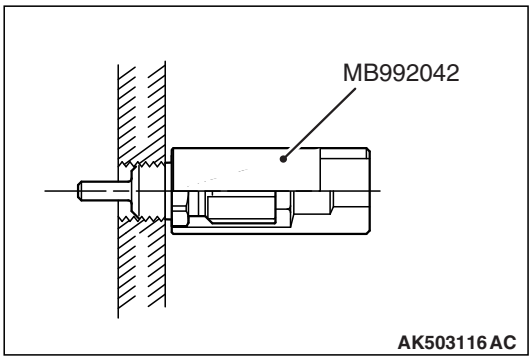
Temperature (°C)	Resistance (kΩ)
Higher	Smaller

4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.

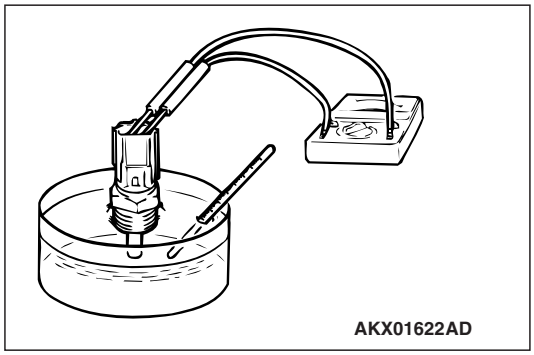
ENGINE COOLANT TEMPERATURE SENSOR CHECK

M1131003102450





1. Remove the engine coolant temperature sensor using the special tool engine coolant temperature sensor wrench (MB992042).

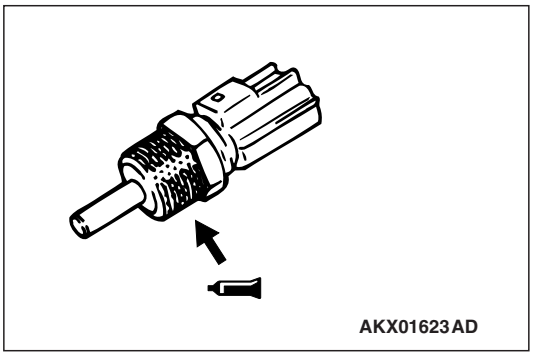


2. With temperature sensing portion of the engine coolant temperature sensor immersed in the hot water, measure the resistance between connector terminals.

   Standard value:
   14 – 17 kΩ (at –20°C)
   [5.1 – 6.5 kΩ (at 0°C)]
   2.1 – 2.7 kΩ (at 20°C)
   [0.9 – 1.3 kΩ (at 40°C)]
   [0.48 – 0.68 kΩ (at 60°C)]
   0.26 – 0.36 kΩ (at 80°C)

   NOTE: The value in square brackets is only advisory.

3. If the resistance deviates from the standard value greatly, replace the sensor.



4. Apply the sealant over the screw sections on the engine coolant temperature sensor.

   Specified sealant: Loctite 262, THREEBOND 1324N or equivalent

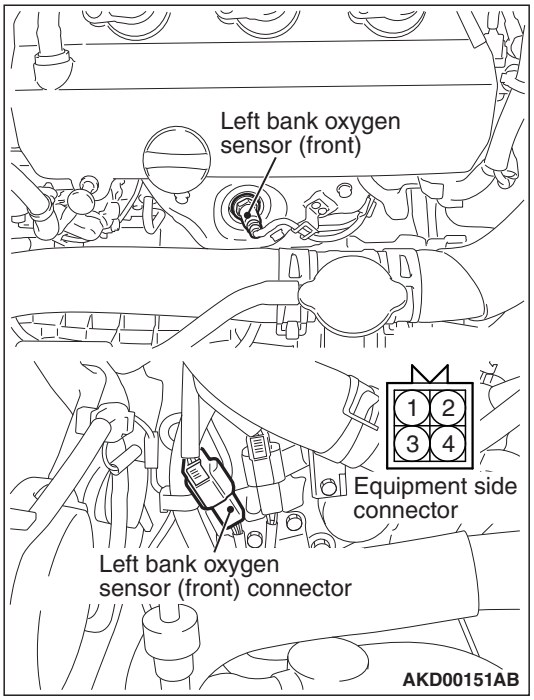
5. With the special tool engine coolant temperature sensor wrench (MB992042) tighten the engine coolant temperature sensor to the specified torque.

   Tightening torque: 30 ± 9 N·m

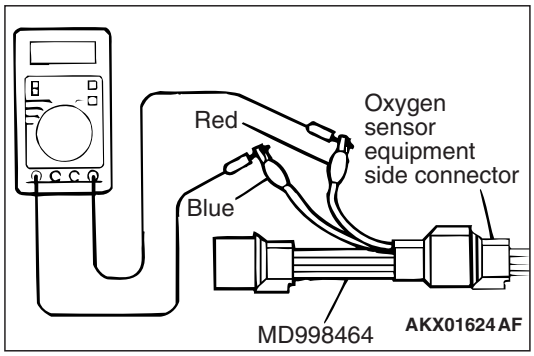
OXYGEN SENSOR CHECK

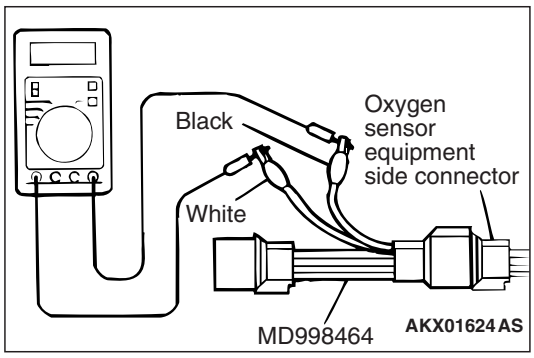
M1131005004035

Left bank oxygen sensor (front)



1. Disconnect the oxygen sensor connector and connect the special tool test harness (MD998464) to the connector on the oxygen sensor side.





2. Measure the resistance between terminal No. 1 and No. 3 of the oxygen sensor connector.

   Standard value: 4.5 – 8.0 Ω (at 20°C)

3. If the resistance deviates from the standard value, replace the oxygen sensor.
4. Warm up the engine until the engine coolant temperature is 80°C or higher.
5. Perform a tracing for 5 minutes or more with the engine speed of 2,000 r/min.
6. Connect the digital voltmeter between terminal No. 2 and No. 4.
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

   Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air-fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

⚠ CAUTION

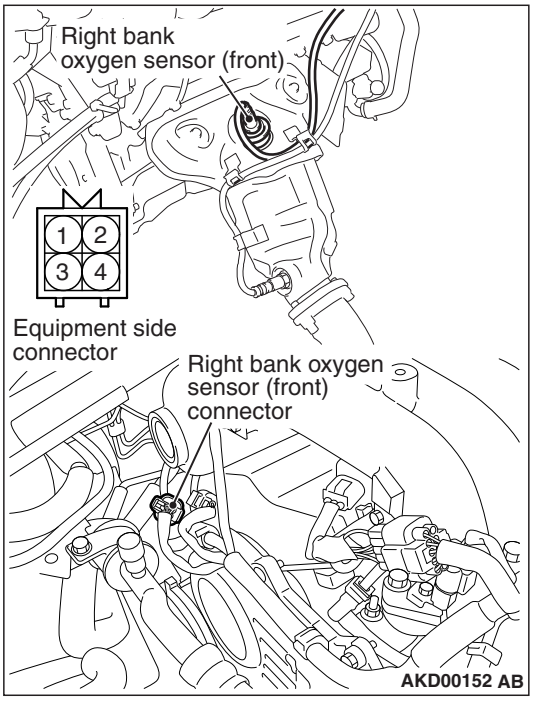
- **Be very careful when connecting the jumper wire, or incorrect connection can damage the oxygen sensor.**
- **Exercise sufficient care so as not to apply voltage exceeding 8 V onto the oxygen sensor heater; otherwise the heater may be damaged.**

NOTE: If the temperature of sensing area does not reach the high temperature (of approximately 400°C or more) even though the oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air-fuel ratio.
Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 and No. 3 of the oxygen sensor with the (+) and (–) terminals of 8 V power supply respectively, then check the voltage again.

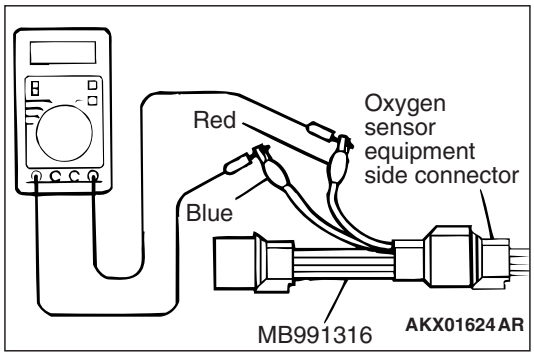
8. If the voltage deviates from the standard value, replace the oxygen sensor.

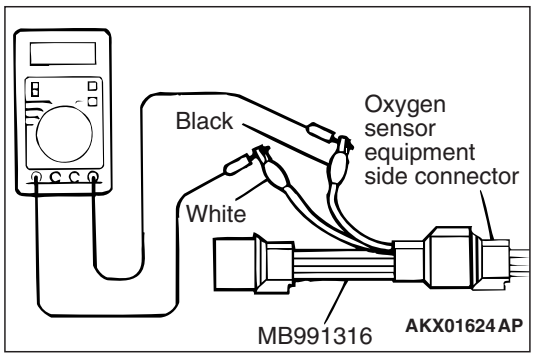
NOTE: For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler P.15-13.

Right bank oxygen sensor (front)



1. Disconnect the oxygen sensor connector and connect the special tool test harness (MB991316) to the connector on the oxygen sensor side.





2. Measure the resistance between terminal No. 1 and No. 3 of the oxygen sensor connector.

   Standard value: 4.5 – 8.0 Ω (at 20°C)

3. If the resistance deviates from the standard value, replace the oxygen sensor.
4. Warm up the engine until the engine coolant temperature is 80°C or higher.
5. Perform a tracing for 5 minutes or more with the engine speed of 2,000 r/min.
6. Connect the digital voltmeter between terminal No. 2 and No. 4.
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

   Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air-fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

⚠ CAUTION

- **Be very careful when connecting the jumper wire, or incorrect connection can damage the oxygen sensor.**
- **Exercise sufficient care so as not to apply voltage exceeding 8 V onto the oxygen sensor heater; otherwise the heater may be damaged.**

NOTE: If the temperature of sensing area does not reach the high temperature (of approximately 400°C or more) even though the oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air-fuel ratio.
Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 and No. 3 of the oxygen sensor with the (+) and (–) terminals of 8 V power supply respectively, then check the voltage again.

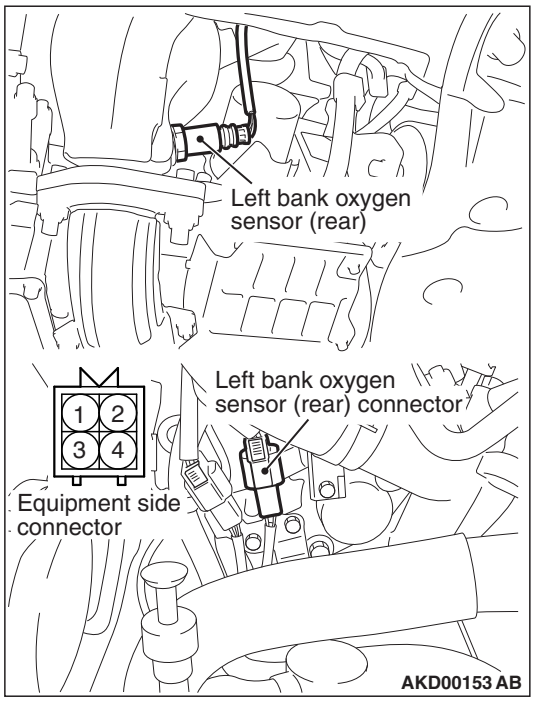
8. If the voltage deviates from the standard value, replace the oxygen sensor.

NOTE: For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler P.15-13.

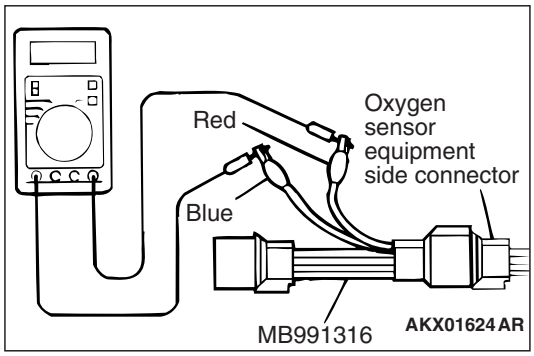
Left bank oxygen sensor (rear)

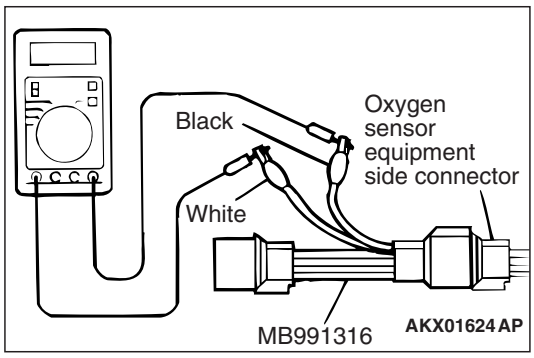
⚠ CAUTION

Drive test must be performed, while two persons are onboard, in a place where a full-throttle accelerating drive can be attempted safely.



1. Disconnect the oxygen sensor connector and connect the special tool test harness (MB991316) to the connector on the oxygen sensor side.





2. Measure the resistance between terminal No. 1 and No. 3 of the oxygen sensor connector.

   Standard value: 11 – 18 Ω (at 20°C)

3. If the resistance deviates from the standard value, replace the oxygen sensor.
4. Warm up the engine until the engine coolant temperature is 80°C or higher.
5. Drive at 50km/h or more for 10 minutes.
6. Connect the digital voltmeter between terminal No. 2 and No. 4.
7. Measure the output voltage of the oxygen sensor under the following driving.
   - Transmission: 2nd
   - Drive with wide open throttle
   - Engine: 3,500 r/min or more

   Standard value:

Oxygen sensor output voltage	Remarks
0.6 – 1.0 V	High load operation makes air/fuel ratio richer and normal oxygen sensor also can output voltage of 0.6 – 1.0 V

NOTE: If the temperature of sensing area does not reach the high temperature (of approximately 400°C or more) even though the oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air-fuel ratio.

NOTE: When the vehicle is driven with high loads, the temperature of the sensing area of the oxygen sensor is sufficiently high. Thus, it is not necessary to apply the voltage to the heater.

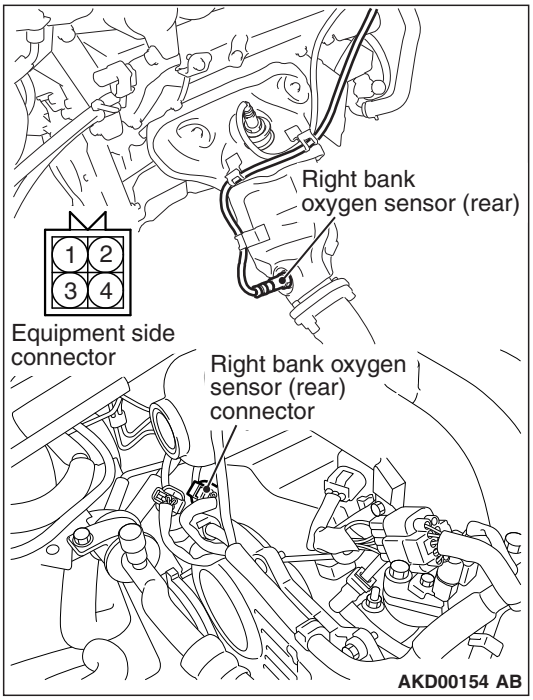
8. If the voltage deviates from the standard value, replace the oxygen sensor.

NOTE: For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler P.15-13.

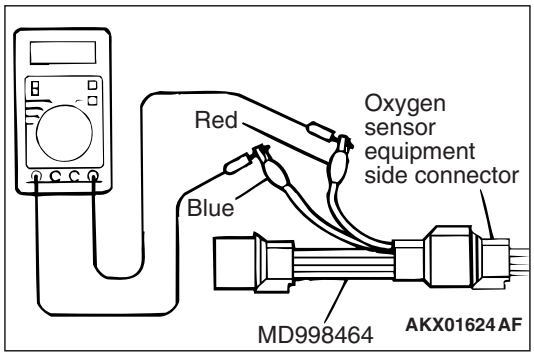
Right bank oxygen sensor (rear)

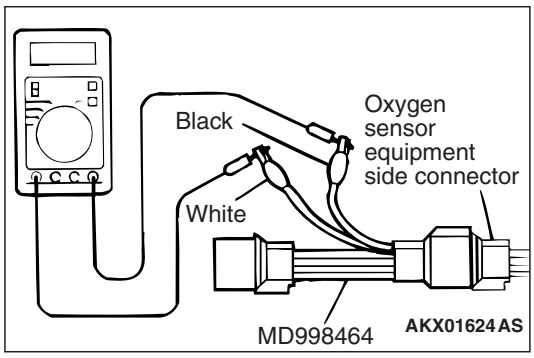
⚠ CAUTION

Drive test must be performed, while two persons are onboard, in a place where a full-throttle accelerating drive can be attempted safely.



1. Disconnect the oxygen sensor connector and connect the special tool test harness (MD998464) to the connector on the oxygen sensor side.





2. Measure the resistance between terminal No. 1 and No. 3 of the oxygen sensor connector.

   Standard value: 11 – 18 Ω (at 20°C)

3. If the resistance deviates from the standard value, replace the oxygen sensor.
4. Warm up the engine until the engine coolant temperature is 80°C or higher.
5. Drive at 50km/h or more for 10 minutes.
6. Connect the digital voltmeter between terminal No. 2 and No. 4.
7. Measure the output voltage of the oxygen sensor under the following driving.
   - Transmission: 2nd
   - Drive with wide open throttle
   - Engine: 3,500 r/min or more

   Standard value:

Oxygen sensor output voltage	Remarks
0.6 – 1.0 V	High load operation makes air/fuel ratio richer and normal oxygen sensor also can output voltage of 0.6 – 1.0 V

NOTE: If the temperature of sensing area does not reach the high temperature (of approximately 400℃ or more) even though the oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air-fuel ratio.

NOTE: When the vehicle is driven with high loads, the temperature of the sensing area of the oxygen sensor is sufficiently high. Thus, it is not necessary to apply the voltage to the heater.

8. If the voltage deviates from the standard value, replace the oxygen sensor.

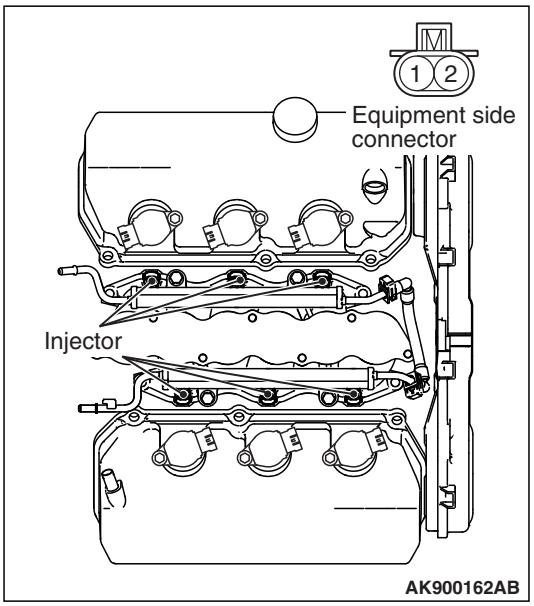
NOTE: For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler P.15-13.

INJECTOR CHECK

M1131005203069

CHECK THE OPERATION SOUND

⚠ CAUTION



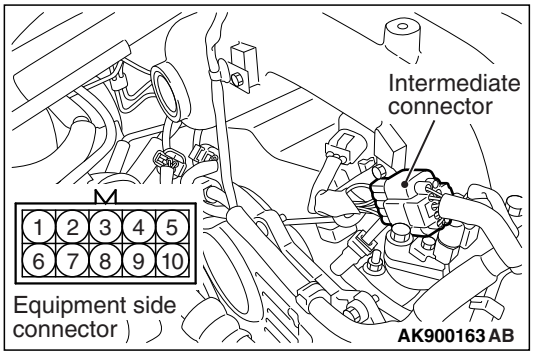
Beware that, even if the injector to be checked is not operating, the operation sound of other injectors may be heard.

1. Use a stethoscope to listen to the operation sound (ticks) from the injectors while the engine is idling or cranking.
2. Verify that the operation sound increases with the higher engine speed.

NOTE: If the operating sound cannot be heard, inspect the injector actuation circuit.

MEASUREMENT OF RESISTANCE BETWEEN TERMINALS

Right bank side (No. 1, 3, 5 injector)



1. Disconnect the intermediate connector.
2. Measure the resistance between the injector intermediate connector terminals.

INJECTOR No.	MEASUREMENT TERMINAL	RESISTANCE
No. 1	6 – 7	10.5 – 13.5 Ω (at 20°C)
No. 3	6 – 8	
No. 5	6 – 9	

3. Connect the injector intermediate connector.

Left bank side (No. 2, 4, 6 injector)

1. Disconnect the injector connector.
2. Measure the resistance between terminals.

   Standard value: 10.5 – 13.5 Ω (at 20°C)

3. If the resistance is deviates from the standard value, replace the injector.

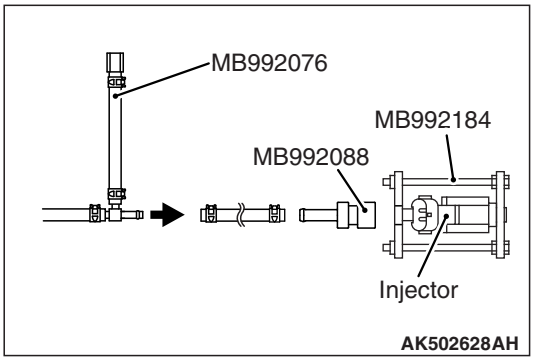
CHECK THE INJECTION CONDITION

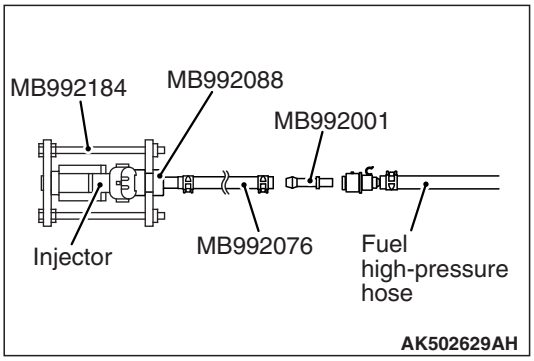
1. Release the residual pressure in the fuel pipe line to prevent the fuel from running out (Refer to P.13F-213).

⚠ CAUTION

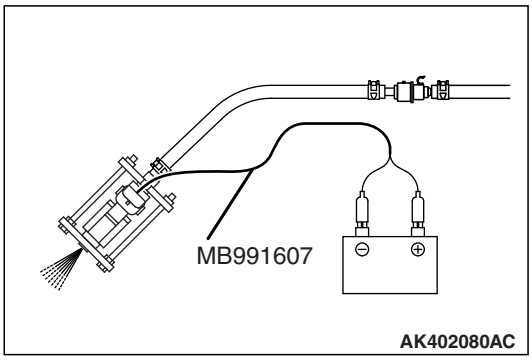
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

2. Disconnect the high-pressure fuel hose at the delivery pipe side.
3. Remove the injector.





4. Prepare the special tool called injector test set (MB992076) as shown in the figure.
   (1) Disconnect the injector mounting hose.
   (2) Remove the adapter for mounting injector and attach the special tool Injector test nipple (MB992088) instead.
   (3) After attaching the injector on the special tool Injector test nipple (MB992088), secure it with the special tool injector holder (MB992184).
5. Mount the injector test set (MB992076) prepared with the special tool hose adapter (MB992001) onto the high-pressure fuel hose.
6. Connect the M.U.T.-III to the diagnosis connector.
7. Turn the ignition switch to the ON position. (But do not start the engine.)
8. Select "Item No. 9" of the M.U.T.-III actuator test to drive the fuel pump.



9. Connect the special tool Injector test harness (MB991607) between the injector and battery to drive the injector.

10.Check each injector for spray conditions. The condition can be considered satisfactory unless it is extremely poor.
11.Stop the actuation of the injector, and check for leakage from the injector nozzle.

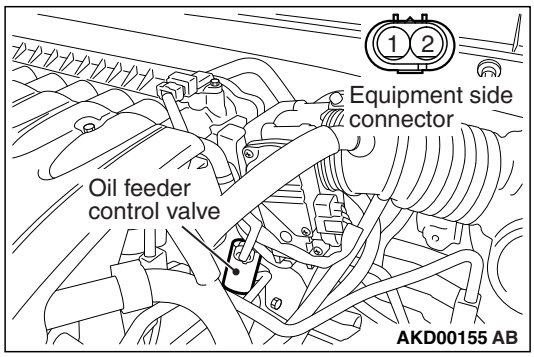
Standard value: 1 drop or less per minute

12.After turning the ignition switch to the "LOCK" (OFF) position, remove the M.U.T.-III.
13.Actuate the injector until it does not spray fuel any longer, then drain the fuel inside the special tool.
14.Remove the special tool.
15.When the spray condition is extremely poor or any fuel leaks from the injector nozzle, replace the injector.
16.Replace the injector and high-pressure fuel hose in the original places.

OIL FEEDER CONTROL VALVE CHECK

M1131053800481

OPERATION CHECK



1. Disconnect the oil feeder control valve connector.
2. Make sure that the oil feeder control valve generates a tick sound when the battery voltage is applied between the connector terminals at the oil feeder control valve side.

⚠ CAUTION
To prevent the coil from burning, keep the duration of the voltage application as short as possible.

Resistance between terminals

1. Disconnect the oil feeder control valve connector.
2. Measure the resistance between the terminals of the connector at the oil feeder control valve.

Standard value: 6.9 – 7.9 Ω (at 20°C)

3. If the resistance deviates from the standard value, replace oil feeder control valve.

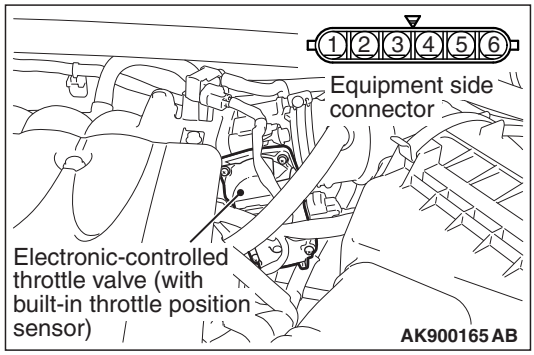
THROTTLE VALVE CONTROL SERVO CHECK

M1131051001727

OPERATION CHECK

1. Remove the air intake hose from the throttle body assembly.
2. Turn the ignition switch to the ON position.
3. Verify that the throttle valve opens or closes according to the accelerator pedal operated.

CHECK THE COIL RESISTANCE



1. Disconnect the electronic-controlled throttle valve connector.
2. Measure the resistance between terminal No.1 and No.2 of the electronic-controlled throttle valve connector.

Standard value: 0.3 – 100 Ω (at 20°C)

NOTE: If the measured resistance deviates from the standard value, fully open the throttle valve with your finger more than five times, then check the result again.
If the throttle valve control serve is not used for an extended period of time, the resistance may be increased as a result of internal forming of oxide film. Therefore, it means that the oxide film can be removed through a self cleaning capability of the throttle valve control servo, if forcibly moved.

3. If the resistance deviates from the standard value, replace the throttle body assembly.

INJECTOR

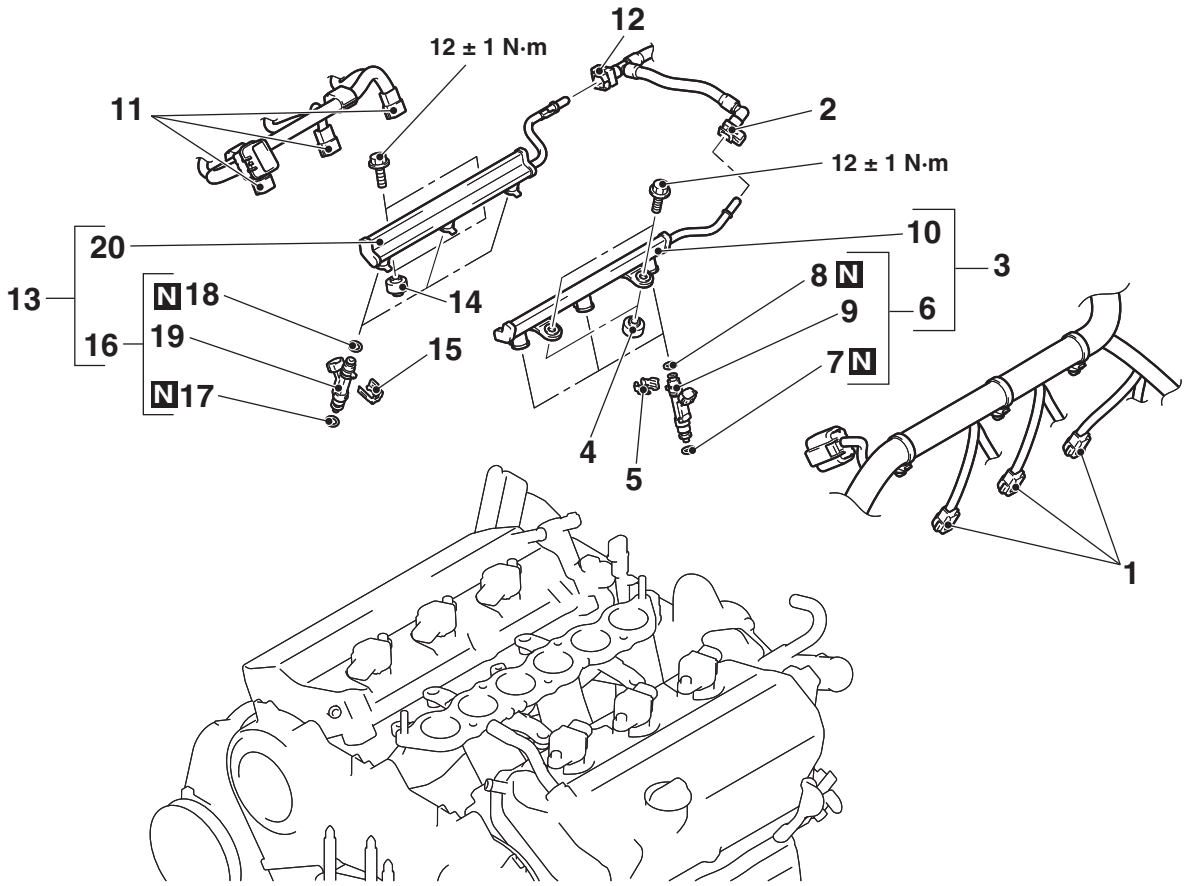
REMOVAL AND INSTALLATION

M1131007104027

⚠ CAUTION

When the fuel injector is replaced, initialise the learned value using M.U.T.-III (Refer to GROUP 00 – Precautions before Service, Initialisation Procedure for Learning Value in MPI Engine P.00-7).

Pre-removal Operation	Post-installation Operation
• How to Reduce Pressurized Fuel Lines (Refer to P.13F-213). • Air Intake Plenum Removal (Refer to GROUP 15 – Air Intake Plenum P.15-3).	• Air Intake Plenum Installation (Refer to GROUP 15 – Air Intake Plenum P.15-3). • Fuel Leak Check.



ACA01453AC

Removal steps

		1.	Fuel injector connector connection
<<A>>	>>F<<	2.	Fuel high-pressure hose connection
<<B>>	>>E<<	3.	Fuel delivery pipe and fuel injector assembly
		4.	Insulator
	>>D<<	5.	Fuel injector support
	>>C<<	6.	Fuel injector assembly
	>>B<<	7.	O-ring
	>>A<<	8.	O-ring
		9.	Fuel injector
		10.	Fuel delivery pipe

Removal steps (Continued)

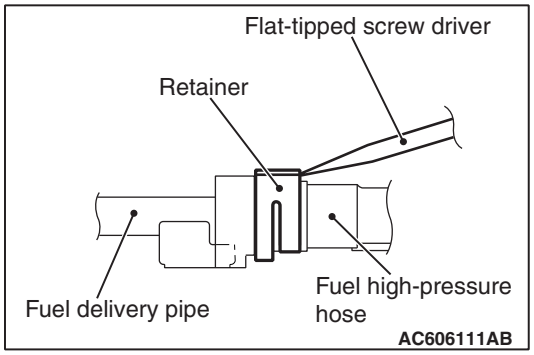
		11.	Fuel injector connector connection
<<A>>	>>F<<	12.	Fuel-high pressure hose connection
<<B>>	>>E<<	13.	Fuel delivery pipe and fuel injector assembly
		14.	Insulator
	>>D<<	15.	Fuel injector support
	>>C<<	16.	Fuel injector assembly
	>>B<<	17.	O-ring
	>>A<<	18.	O-ring
		19.	Fuel injector
		20.	Fuel delivery pipe

REMOVAL SERVICE POINTS

<<A>> FUEL HIGH-PRESSURE HOSE DISCONNECTION

⚠ CAUTION

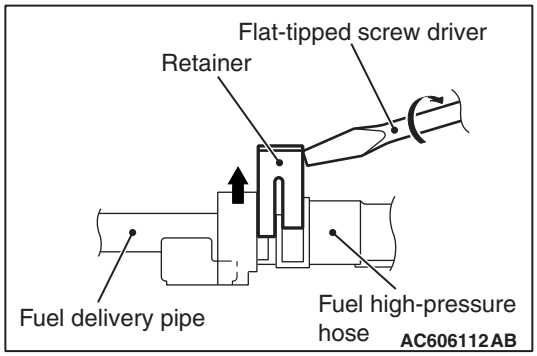
Do not kink the fuel high-pressure hose as it is made of plastics.



1. Insert a flat-tipped screwdriver (6 mm wide and 1 mm thick) into the retainer of the fuel high-pressure hose connector.

⚠ CAUTION

When pushing up the retainer of the fuel high-pressure hose connector, pay attention to avoid damage to the retainer.



2. Turn the flat-tipped screwdriver inserted into the retainer by 90 degrees to push up the retainer and unlock the fuel high-pressure hose connector.

<<B>> FUEL DELIVERY PIPE AND FUEL INJECTOR ASSEMBLY REMOVAL

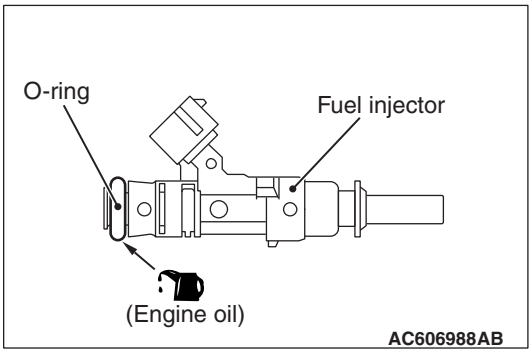
⚠ CAUTION

Do not drop the fuel injector.

Remove the fuel delivery pipe with the fuel injectors attached to it.

INSTALLATION SERVICE POINTS

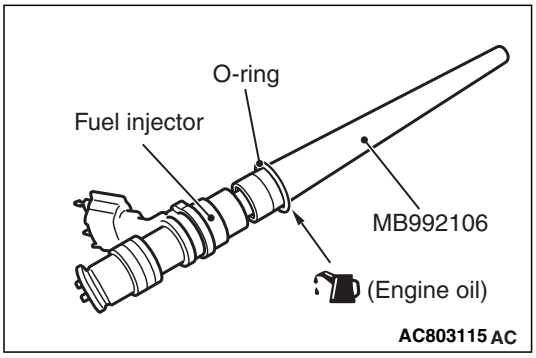
>>A<< O-RING INSTALLATION



1. Apply a small amount of new engine oil to the O-ring.
2. While turning the fuel injector to right and left, install the O-ring to the fuel injector with care to avoid damage to the O-ring.

>>B<< O-RING INSTALLATION

1. Apply a small amount of new engine oil to the O-ring.



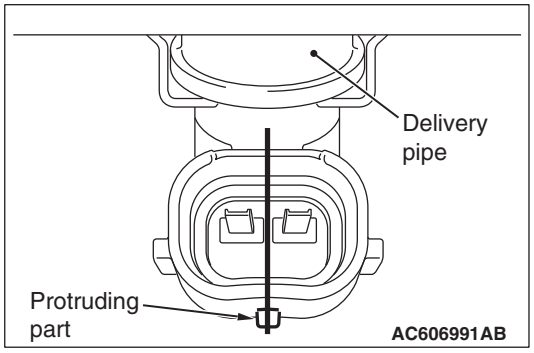
2. Using special tool O-ring installer (MB992106), install the fuel injector paying attention to avoid damage to the O-ring.

>>C<< FUEL INJECTOR ASSEMBLY INSTALLATION

⚠ CAUTION

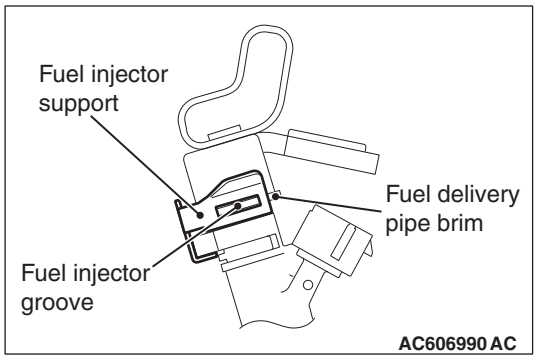
When applying the engine oil, make sure not to allow the engine oil to enter the fuel delivery pipe inside.

1. Apply a small amount of new engine oil to the O-ring.



2. Turning the fuel injector assembly to right and left, install it to the fuel delivery pipe with care not to damage the O-ring. After the installation, check for its smooth rotation. At this time, check that the projection part of the fuel injector assembly is in the centre.
3. If the rotation is not smooth, the O-ring may be caught. Remove the fuel injector assembly and check the O-ring for damage. After this, re-insert it to the fuel delivery pipe and check for its smooth rotation.

>>D<< FUEL INJECTOR SUPPORT INSTALLATION



Install the fuel injector support to the fuel injector groove and fuel delivery pipe brim, and fix the fuel injector assembly and fuel delivery pipe.

>>E<< FUEL DELIVERY PIPE AND FUEL INJECTOR ASSEMBLY INSTALLATION

⚠ CAUTION

When applying the engine oil, make sure not to allow the engine oil to enter the inlet manifold inside.

1. Apply a small amount of new engine oil to the O-ring at the end of fuel injector assembly.

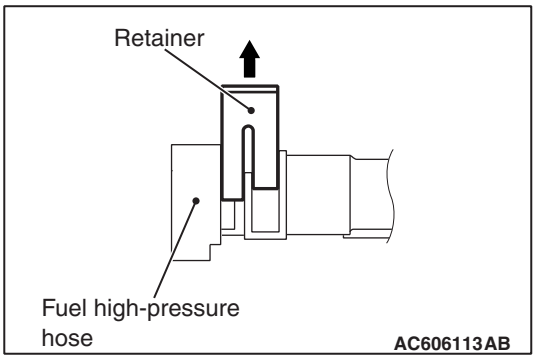
⚠ CAUTION

When installing the fuel delivery pipe and fuel injector assembly to the inlet manifold, pay attention to avoid damage to the O-ring at the end of the fuel injector assembly.

2. Install the fuel delivery pipe and fuel injector assembly to the inlet manifold.
3. Tighten the mounting bolts of the fuel delivery pipe to the specified torque.

Tightening torque: 12 ± 1 N·m

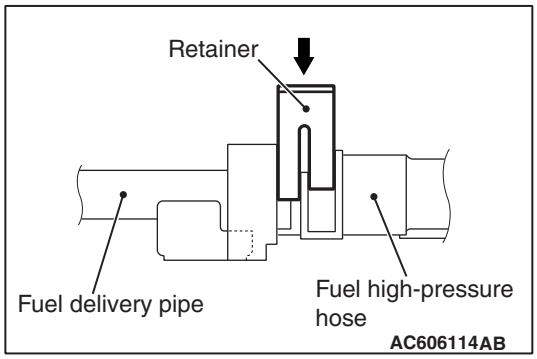
>>F<< FUEL HIGH-PRESSURE HOSE CONNECTION



1. Pull up the retainer of fuel high-pressure hose to unlock before installing.

⚠ CAUTION

- **When pushing in the retainer of the fuel high-pressure hose connector, pay attention to avoid damage to the retainer.**
- **After the installation of the fuel high-pressure hose, slightly pull the fuel high-pressure hose to check that it is connected securely. At this time, also check that there is approximately 1 mm play.**



2. Install the fuel high-pressure hose to the fuel delivery pipe securely and push in the retainer of the fuel high-pressure hose connector to lock the fuel high-pressure hose and fuel delivery pipe.

THROTTLE BODY ASSEMBLY

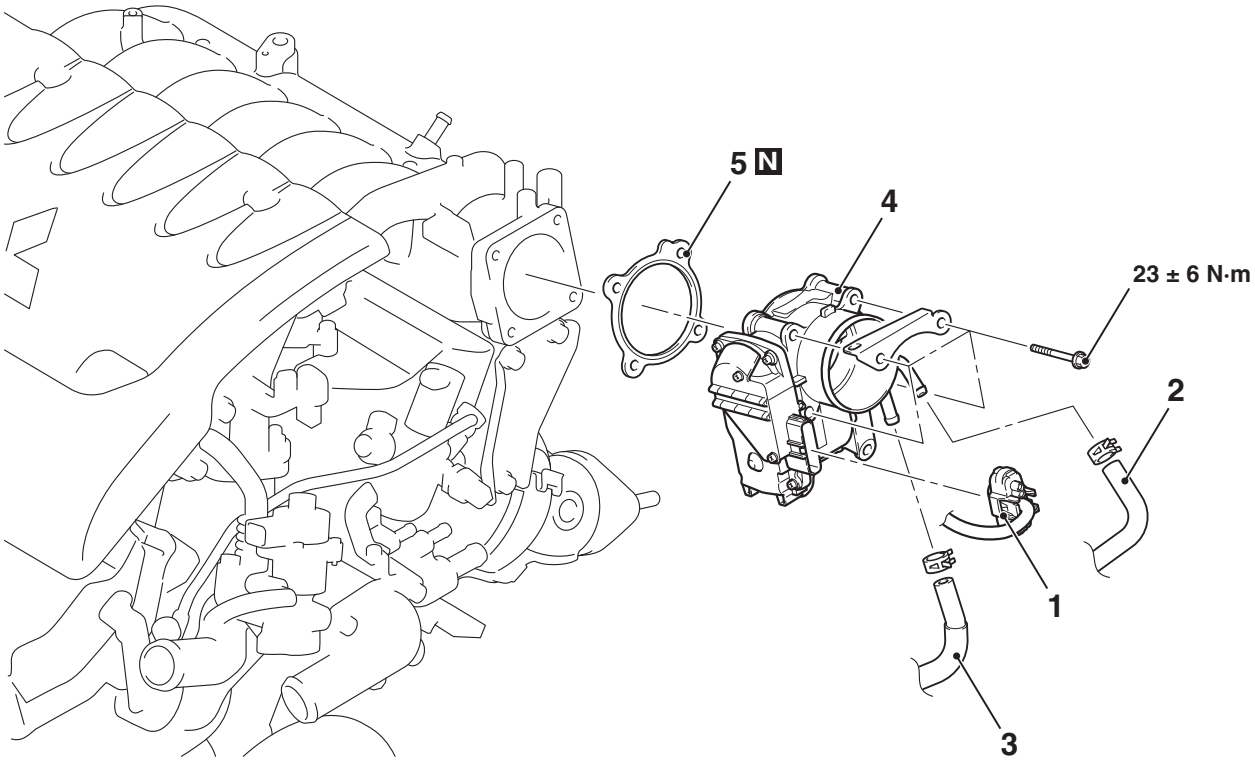
REMOVAL AND INSTALLATION

M1131007702915

⚠ CAUTION

- **When the throttle body assembly is replaced, initialise the learned value using M.U.T.-III (Refer to GROUP 00 – Precautions before Service, Initialisation Procedure for Learning Value in MPI Engine P.00-7).**
- **Never loosen the screw fixing the throttle body assembly resin cover. If the screw is loosened, the sensor incorporated in the resin cover is misaligned and the throttle body assembly does not work normally.**

Pre-removal Operation	Post-installation Operation
• Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6). • Air Cleaner Intake Hose Removal (Refer to GROUP 15 – Air Cleaner P.15-11).	• Air Cleaner Intake Hose Installation (Refer to GROUP 15 – Air Cleaner P.15-11). • Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6).



AC809028AB

Removal steps

>>B<< • Initialisation procedure (Installation only)
1. Electronic control throttle valve connector connection
2. Water hose connection

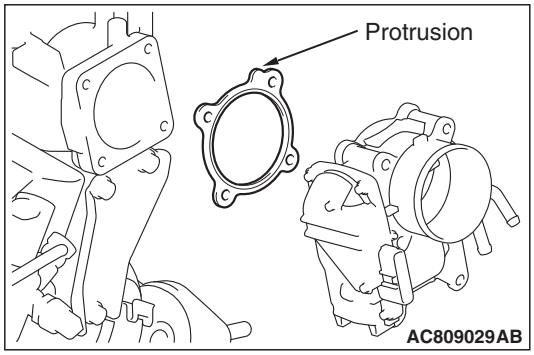
Removal steps (Continued)

3. Water hose connection
4. Throttle body stay
5. Throttle body assembly

>>A<< 6. Throttle body gasket

INSTALLATION SERVICE POINTS

>>A<< THROTTLE BODY GASKET INSTALLATION



Install the throttle body gasket as its protrusion is in the direction shown.

>>B<< INITIALISATION PROCEDURE

Turn the ignition switch to the "ON" position and then to "LOCK" (OFF) position and hold it for at least 10 seconds.

ENGINE-ECU

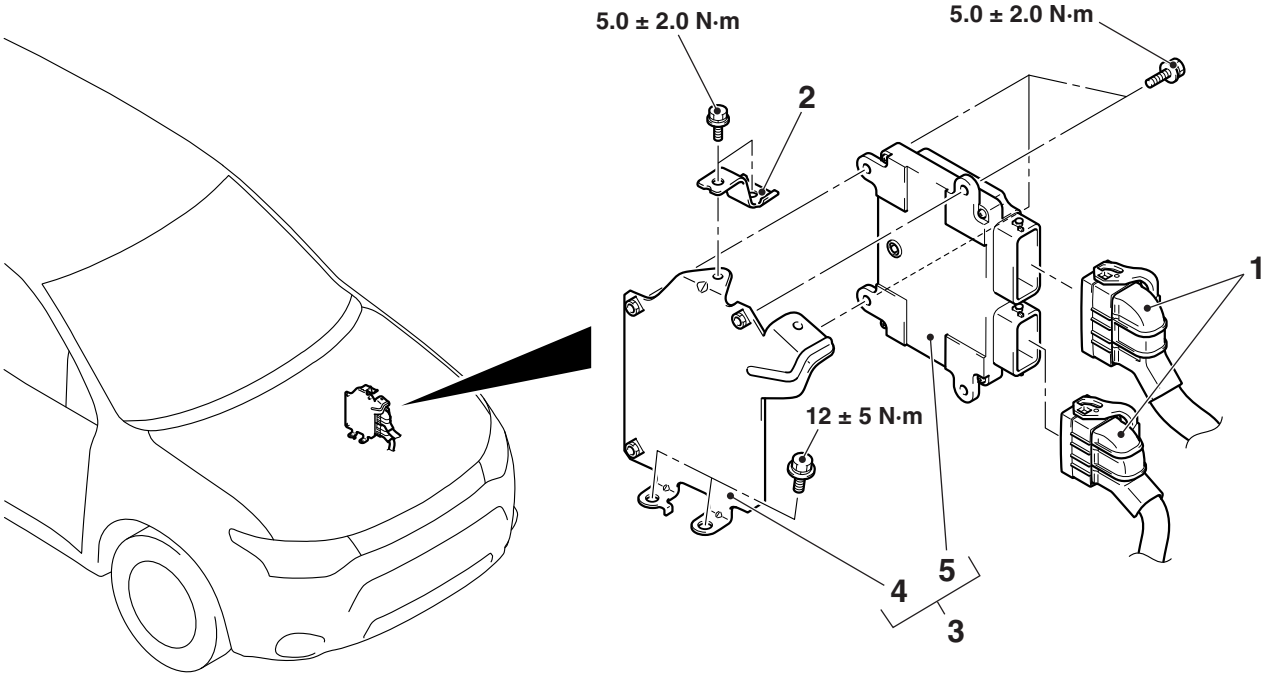
REMOVAL AND INSTALLATION

M1131033802355

⚠ CAUTION

- **If the engine-ECU is replaced, another ECU related to KOS system should not be replaced together. If at least two ECUs needs to be replaced, replace one ECU and then register its ID with M.U.T.-III. Then proceed to the replacement of the other ECU.**
- **If the engine-ECU is replaced, perform the coding for it.**
- **If the engine-ECU is replaced, use M.U.T.-III to write the Chassis No.**
- **After the engine-ECU replacement, idling speed may be unstable because the MPI engine learning is not completed. To make it stable, let the system learn the idling (Refer to GROUP 00 – Precautions before Service, Learning Procedure for Idling in MPI Engine P.00-7).**

Pre-removal and post-installation operation
- Air Cleaner Assembly Removal and Installation (Refer to GROUP 15 – Air Cleaner P.15-11) .



ACB05832AB

Removal steps

>>A<<
- Initialisation operation <only at installation>

1. Engine-ECU connector connection
2. Engine-ECU stay
3. Engine-ECU and engine-ECU bracket
4. Engine-ECU bracket
5. Engine-ECU

INSTALLATION SERVICE POINTS

>>A<< INITIALISATION OPERATION

Turn the ignition switch to the "ON" position and then to "LOCK" (OFF) position and hold it for at least 10 seconds.

GROUP 14

ENGINE COOLING

CONTENTS

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SERVICE SPECIFICATIONS. 14-2

LUBRICANT. 14-2

TROUBLESHOOTING 14-3
- INSPECTION CHART FOR TROUBLE SYMPTOMS 14-3
- SYMPTOM PROCEDURES 14-3

ON-VEHICLE SERVICE. 14-6
- ENGINE COOLANT CHANGE 14-6
- COOLING FAN RELAY CONTINUITY CHECK. 14-6

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WATER PUMP 14-9
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WATER HOSE AND WATER PIPE . . 14-10
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RADIATOR 14-13
- REMOVAL AND INSTALLATION 14-13

GENERAL INFORMATION

M1142000100103

The service contents below have been added due to the introduction of 6B3 engine.
For the items other than described below, refer to the service publications for vehicles with 4B1 engine.

- Trouble symptom procedures.
- Engine coolant quantity.
- How to change engine coolant.
- Component service procedures.

SERVICE SPECIFICATIONS

M1141000302304

Item		Standard value
Thermostat	Valve opening temperature of thermostat °C	82 ± 1.5
	Full-opening temperature of thermostat °C	95
	Valve lift mm	9.0 or more

LUBRICANT

M1141000402248

Item	Specified coolant	Quantity L
Engine coolant	MITSUBISHI MOTORS GENUINE SUPER LONG LIFE COOLANT PREMIUM or equivalent*	10.0 (including 0.65 in the radiator condense tank)

*NOTE: *similar high quality ethylene glycol based non-silicate, non-amine, non-nitrate and non-borate coolant with long life hybrid organic acid technology.*

TROUBLESHOOTING

INSPECTION CHART FOR TROUBLE SYMPTOMS

M1141005601158

Trouble symptom	No.	Reference page
Radiator fan and condenser fan do not operate	1	P.14-3

SYMPTOM PROCEDURES

Inspection Procedure 1: Radiator Fan and Condenser Fan do not Operate

OPERATION

- Based on the signal from the engine coolant temperature sensor and the output shaft speed sensor signal (vehicle speed signal) from the A/T-ECU, and the A/C switch signal from the A/C-ECU, the engine-ECU sends the radiator fan and condenser fan control signal to the ETACS-ECU via CAN bus line.
- Based on the radiator fan and condenser fan control signal from the engine-ECU, the ETACS-ECU turns ON/OFF the radiator fan relay, condenser fan relay, and the fan control relay to control the rotation of the radiator fan motor and condenser fan motor.

TECHNICAL DESCRIPTION

- If the radiator fan and condenser fan do not operate, the radiator fan motor, the condenser fan motor, the radiator fan relay, the condenser fan relay, the fan control relay, the ETACS-ECU may be defective.
- The CAN bus line, ETACS-ECU, A/T system, A/C system, or MPI system may also be defective.

PROBABLE CAUSES

- Malfunction of CAN bus system.
- Damaged harness or connector.
- Malfunction of the MPI system.
- Malfunction of the A/T system.
- Malfunction of the A/C system.
- Malfunction of fusible link SBF3.
- Malfunction of fusible link SBF4.
- Malfunction of radiator fan relay.
- Malfunction of condenser fan relay.
- Malfunction of fan control relay.
- Malfunction of radiator fan motor.
- Malfunction of condenser fan motor.
- Malfunction of engine compartment relay box.
- Malfunction of ETACS-ECU.
- Malfunction of engine-ECU.

DIAGNOSIS PROCEDURE

⚠ CAUTION

- **If there is any problem in the CAN bus lines, an incorrect diagnosis code may be stored. Prior to this diagnosis, diagnose the CAN bus lines.**
- **Before replacing the ECU, ensure that the CAN bus lines is normal.**

STEP 1. Check the CAN bus system diagnosis.

Using M.U.T.-III, perform CAN bus diagnosis (Refer to GROUP 54C – Explanation About The M.U.T-III CAN Bus Diagnostics).

Q: Is the check result satisfactory?

YES : Go to Step 2.

NO : Repair the CAN bus lines (Refer to GROUP 54C – Troubleshooting, CAN Bus Diagnostic Table). Then go to Step 24.

STEP 2. Check the MPI system actuator test.

Using M.U.T.-III to check the MPI system actuator test (Refer to GROUP 13F – Troubleshooting, Actuator Test Reference Table P.13F-197).

- Item 14: Cooling fan motor

Q: Is the check result normal?

YES : Go to Step 23.

NO : Go to Step 3.

STEP 3. Check the MPI system diagnosis code.
Using M.U.T.-III, perform MPI system diagnosis code (Refer to GROUP 13F – Troubleshooting, Diagnosis Function P.13F-10).

Q: Is any diagnosis code stored?
YES : Repair the MPI system (Refer to GROUP 13F – Troubleshooting, Inspection Chart for Diagnosis Code P.13F-21). Then go to Step 24.
NO : Go to Step 4.

STEP 4. Check the A/T system diagnosis code.
Using M.U.T.-III, perform A/T system diagnosis code (Refer to GROUP 23C – Troubleshooting, Diagnosis Function P.23C-6).

Q: Is any diagnosis code stored?
YES : Repair the A/T system (Refer to GROUP 23C – Troubleshooting, Diagnosis Code Chart P.23C-6). Then go to Step 24.
NO : Go to Step 5.

STEP 5. Check the A/C system diagnosis code.
Using M.U.T.-III, check A/C system diagnosis code (Refer to GROUP 55 – Troubleshooting, Diagnosis Function).

Q: Is any diagnosis code stored?
YES : Repair the A/C system (Refer to GROUP 55 – Troubleshooting, Diagnosis Code Chart). Then go to Step 24.
NO : Go to Step 6.

STEP 6. Check the ETACS system diagnosis code.
Using M.U.T.-III, check ETACS system diagnosis code (Refer to GROUP 54A – ETACS, Troubleshooting, Diagnosis Function).

Q: Is any diagnosis code stored?
YES : Repair the ETACS system (Refer to GROUP 54A – ETACS, Troubleshooting, Diagnosis Code Chart). Then go to Step 24.
NO : Go to Step 7.

STEP 7. Check the radiator fan relay, the condenser fan relay, and the fan control relay.
Refer to P.14-6.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Replace the damaged relay. Then go to Step 24.

STEP 8. Check the radiator fan motor and the condenser fan motor.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Replace the damaged fan motor (Refer to P.14-13). Then go to Step 24.

STEP 9. Check of short to power supply, short to earth, open circuit and harness damage in power supply line between fusible link (SBF4) and radiator fan relay connector.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair the connector(s) or wiring harness. Then go to Step 24.

STEP 10. Check of short to power supply, short to earth, open circuit and harness damage in power supply line between fusible link (SBF3) and condenser fan relay connector.

Q: Is the check result normal?
YES : Go to Step 11.
NO : Repair the connector(s) or wiring harness. Then go to Step 24.

STEP 11. Check of short to power supply, short to earth, open circuit and harness damage in power supply line between fusible link (SBF3) and fan control relay connector.

Q: Is the check result normal?
YES : Go to Step 12.
NO : Repair the connector(s) or wiring harness. Then go to Step 24.

STEP 12. Check of short to power supply, short to earth, open circuit and harness damage in power supply line between radiator fan relay connector and radiator fan motor connector.

Q: Is the check result normal?
YES : Go to Step 13.
NO : Repair the connector(s) or wiring harness. Then go to Step 24.

STEP 13. Check of short to power supply, short to earth, open circuit and harness damage in power supply line between radiator fan motor connector and fan control relay connector.

Q: Is the check result normal?
YES : Go to Step 14.
NO : Repair the connector(s) or wiring harness. Then go to Step 24.

STEP 14. Check of short to power supply, short to earth, open circuit and harness damage in power supply line between condenser fan relay connector and condenser fan motor connector.

Q: Is the check result normal?
YES : Go to Step 15.
NO : Repair the connector(s) or wiring harness. Then go to Step 24.

STEP 15. Check of short to power supply, short to earth, open circuit and harness damage in power supply and control line between fan control relay connector and condenser fan relay connector.

Q: Is the check result normal?
YES : Go to Step 16.
NO : Repair the connector(s) or wiring harness. Then go to Step 24.

STEP 16. Check of short to power supply, short to earth, open circuit and harness damage in body earth line between fan control relay and body earth.

Q: Is the check result normal?
YES : Go to Step 17.
NO : Repair the connector(s) or wiring harness. Then go to Step 24.

STEP 17. Check of short to power supply, short to earth, open circuit and harness damage in body earth line between condenser fan motor connector and body earth.

Q: Is the check result normal?
YES : Go to Step 18.
NO : Repair the connector(s) or wiring harness. Then go to Step 24.

STEP 18. Check of short to power supply, short to earth, open circuit and harness damage in F/LO line between radiator fan relay connector and ETACS-ECU connector.

Q: Is the check result normal?
YES : Go to Step 19.
NO : Repair the connector(s) or wiring harness. Then go to Step 24.

STEP 19. Check of short to power supply, short to earth, open circuit and harness damage in F/HI line between condenser fan relay connector and ETACS-ECU connector.

Q: Is the check result normal?
YES : Go to Step 20.
NO : Repair the connector(s) or wiring harness. Then go to Step 24.

STEP 20. Check the fusible link SBF3 and SBF4.

Q: Is the check result normal?
YES : Go to Step 21.
NO : Replace the damaged fusible link. Then go to Step 24.

STEP 21. Check the ETACS system diagnosis code.
Using M.U.T.-III, check ETACS system diagnosis code (Refer to GROUP 54A – ETACS, Troubleshooting, Diagnosis Function).

Q: Is any diagnosis code stored?
YES : Replace the ETACS-ECU (Refer to GROUP 54A – ETACS, ETACS-ECU). Then go to Step 24.
NO : Go to Step 22.

STEP 22. Check the MPI system actuator test.
Using M.U.T.-III to check the MPI system actuator test (Refer to GROUP 13F – Troubleshooting, Actuator Test Reference Table P.13F-197).
- Item 14: Cooling fan motor

Q: Is the check result normal?
YES : Go to Step 23.
NO : Replace the engine-ECU (Refer to GROUP 13F – Engine-ECU P.13F-232). Then go to Step 24.

STEP 23. Check the symptoms.

Q: Does the radiator fan and condenser fan operate normal?
YES : It can be assumed that this malfunction is intermittent (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points, How to Cope with Intermittent Malfunction).
NO : Replace the engine-ECU (Refer to GROUP 13F – Engine-ECU P.13F-232). Then go to Step 24.

STEP 24. Check the symptoms.

Q: Does the radiator fan and condenser fan operate normal?
YES : The procedure is complete.
NO : Return to Step 1.

ON-VEHICLE SERVICE

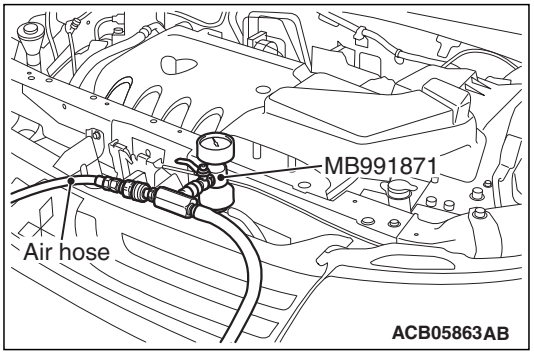
ENGINE COOLANT CHANGE

M1141001201448

1. Remove the engine room under cover front A. (Refer to GROUP 51 – Under Cover.)

⚠ WARNING
Hot steam may escape when the radiator cap is opened. Open with caution. Place rag over the cap and twist it anticlockwise slightly to release the pressure. Wait until the hot steam is released, and then remove the cap by turning it anticlockwise gradually.

2. Drain the water from the radiator, heater core and engine after unplugging the radiator drain plug and removing the radiator cap.
3. Drain the coolant after unplugging the radiator condenser tank.
4. After draining the coolant, clean the path of the coolant by injecting water into the radiator from the radiator cap area.
5. Securely tighten the drain plug of the radiator.
6. Assemble the radiator condenser tank.



7. Using the LLC changer (Special tool: MB991870), refill the engine coolant up to the top of the radiator port.

Coolant: MITSUBISHI MOTORS GENUINE SUPER LONG LIFE COOLANT PREMIUM
Quantity: Approximately 10.0 dm^3
(Including 0.65 dm^3 in the radiator condense tank)

8. Tighten the radiator cap securely.
9. Remove the radiator condenser tank cap, and add the engine coolant up to the "FULL" line of the level gauge.
10. Turn OFF the air conditioner switch, start the engine to warm it up until the cooling fan works.
    NOTE: This is necessary to open the thermostat fully.
11. Rev the engine several times and then stop it. Check that there are no coolant leaks.
12. Remove the radiator cap with the engine cool, and then refill the engine coolant up to the top of the radiator port.
13. Tighten the radiator cap securely.
14. Remove the radiator condenser tank cap, and add the engine coolant up to the "FULL" line of the level gauge.
15. Install the engine compartment under cover front A. (Refer to GROUP 51 – Under Cover.)

COOLING FAN RELAY CONTINUITY CHECK

M1141006201915

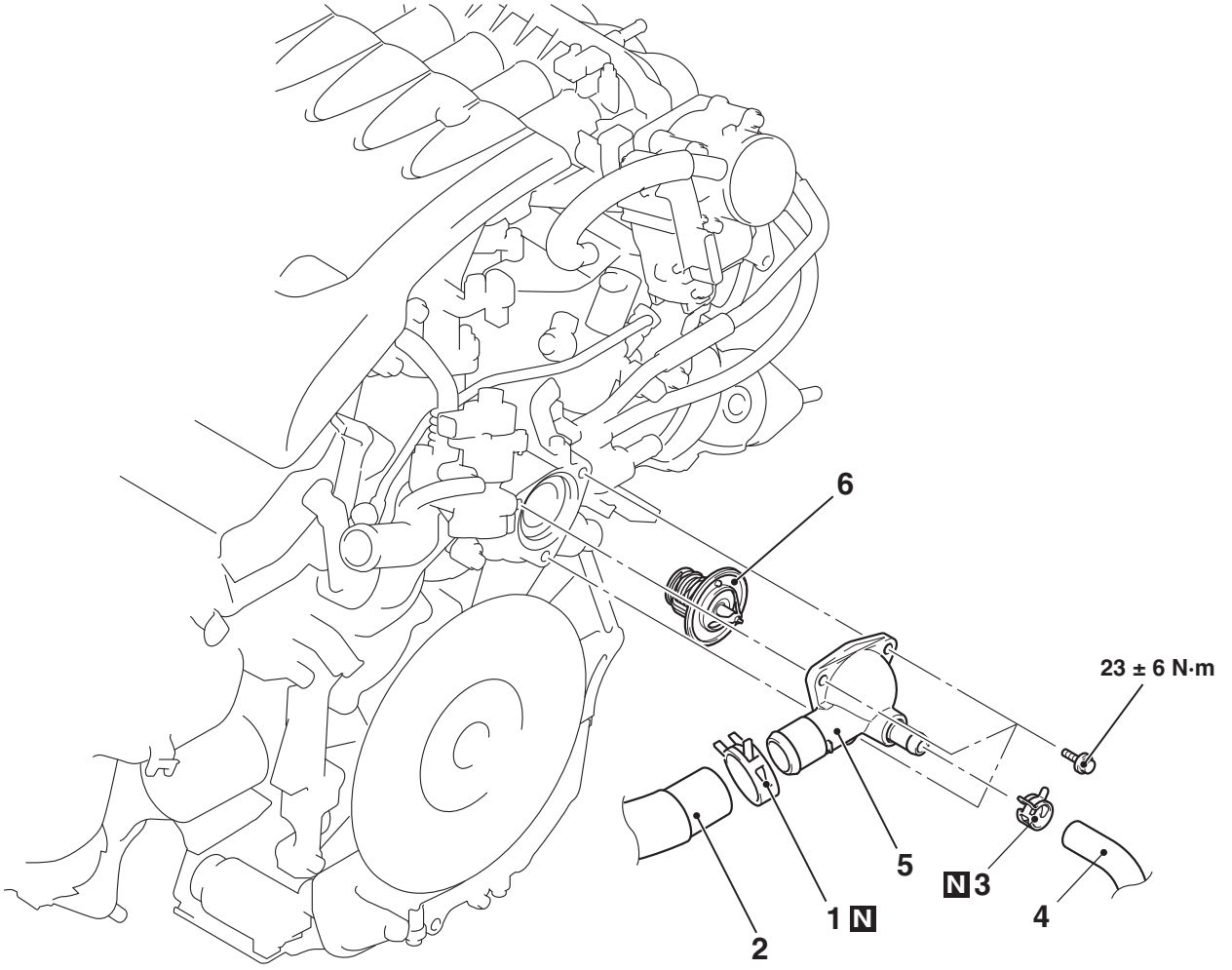
Same as for vehicles with 4N1 engine.

THERMOSTAT

REMOVAL AND INSTALLATION

M1141002403300

Pre-removal Operation	Post-installation Operation
• Engine Coolant Draining (Refer to P.14-6). • Air Cleaner Assembly Removal (Refer to GROUP 15 – Air Cleaner P.15-11). • Battery and Battery Tray Removal (Refer to GROUP 54A – Battery).	• Battery and Battery Tray Installation (Refer to GROUP 54A – Battery). • Air Cleaner Assembly Installation (Refer to GROUP 15 – Air Cleaner P.15-11). • Engine Coolant Refilling (Refer to P.14-6).



ACD00144AB

Removal steps

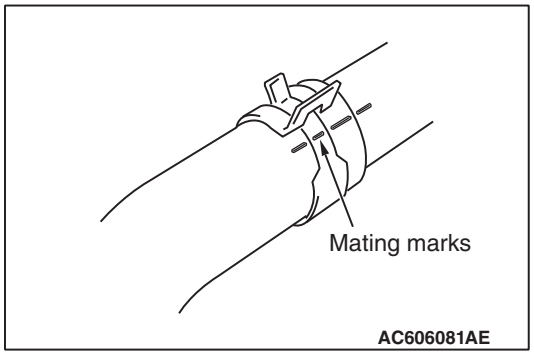
<<A>> >>B<< 1. Hose clip
<<A>> >>B<< 2. Radiator lower hose connection
<<A>> >>B<< 3. Hose clip

Removal steps (Continued)

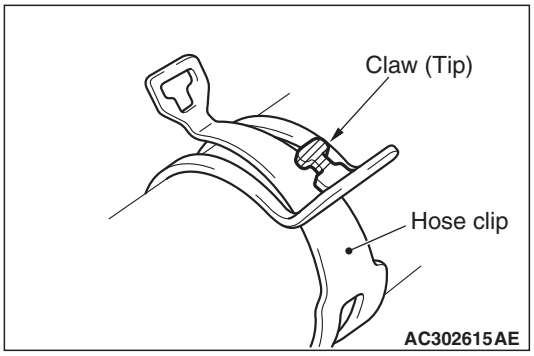
<<A>> >>B<< 4. Water return hose
5. Water inlet fitting
>>A<< 6. Thermostat

REMOVAL SERVICE POINT

<<A>> HOSE CLIP/RADIATOR LOWER HOSE DISCONNECTION



1. Make mating marks on the radiator lower hose and the hose clip as shown to install them in the original position.



2. Break off the tip of hose clip claw and spread out the hose clip, then disconnect the radiator lower hose.

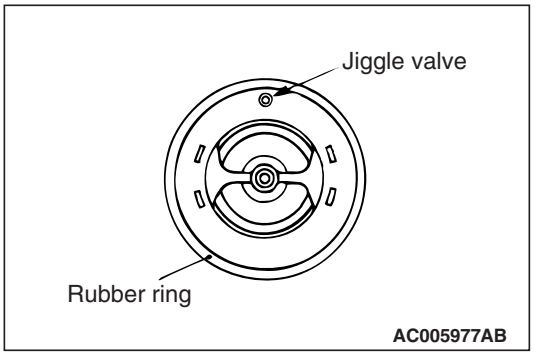
   NOTE: If there is a hose clip claw, the hose clip cannot spread to capacity because the claw contacts the hose clip.

INSTALLATION SERVICE POINTS

>>A<< THERMOSTAT INSTALLATION

⚠ CAUTION

Avoid adhesion of grease to the rubber ring of the thermostat. If the rubber ring is damaged, replace the thermostat.



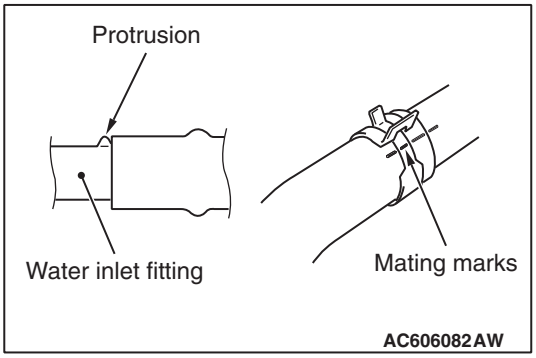
Install the thermostat with care to avoid peeling or damage to the rubber ring. When installing the thermostat, face the jiggle valve of the thermostat upward.

>>B<< RADIATOR LOWER HOSE/HOSE CLIP CONNECTION

⚠ CAUTION

Never reuse the hose clip whose claw is broken off to prevent the rusting.

1. Make mating mark on a new hose clip in the same position as the remove one.

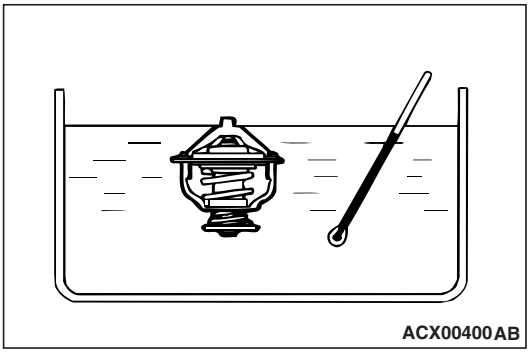


2. Insert the radiator lower hose until the protrusion of the water inlet fitting.
3. Align the mating marks on the radiator lower hose and hose clip.
4. Remove the hose clip claw and shorten the hose clip, then install the radiator lower hose.

INSPECTION

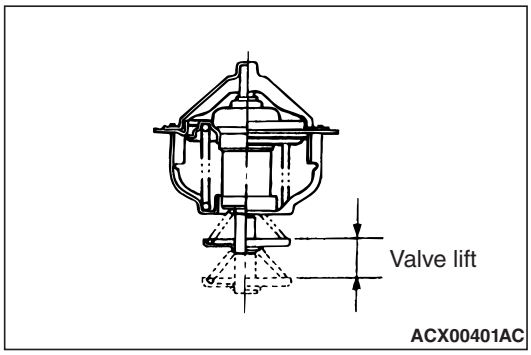
M1141002502014

THERMOSTAT CHECK



1. Immerse the thermostat in water, and heat the water while stirring. Check the thermostat valve opening temperature.

   Standard value:
   82 ± 1.5°C



2. Check that the amount of valve lift is at the standard value when the water is at the full-opening temperature.

NOTE: Measure the valve height when the thermostat is fully closed, and use this measurement to compare the valve height when the thermostat is fully open.

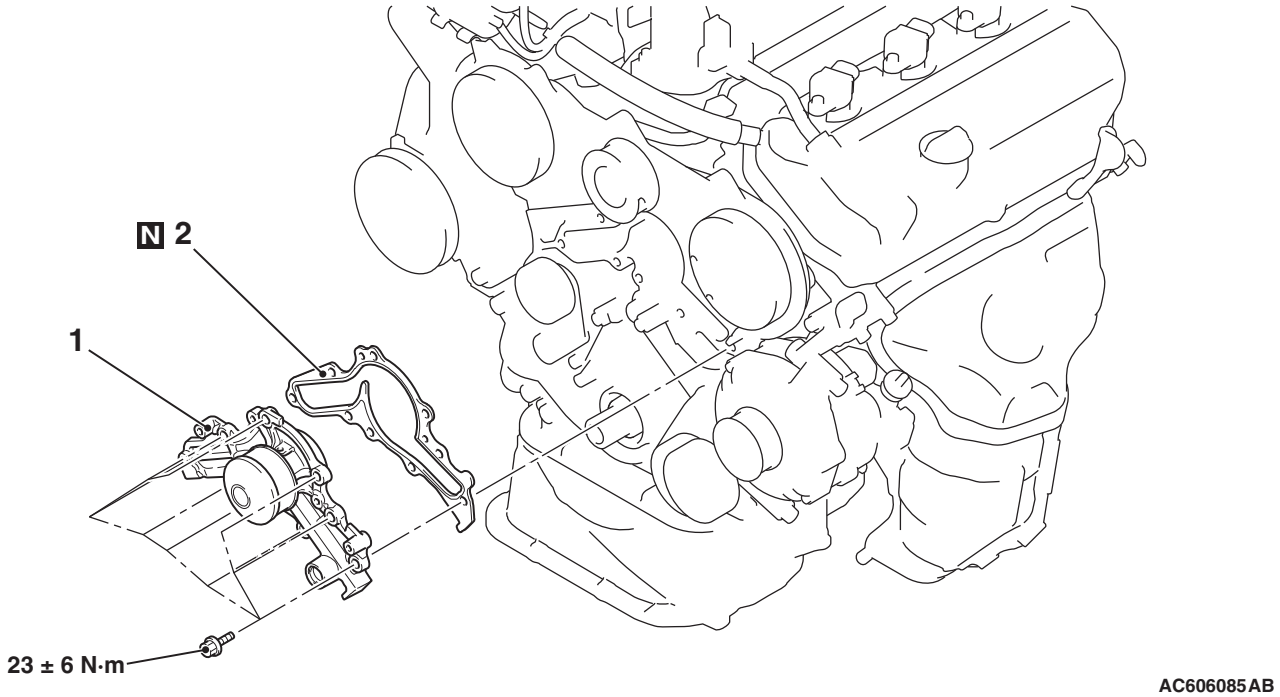
Standard value:
Full-opening temperature: 95°C
Amount of valve lift:
9.0 mm or more

WATER PUMP

REMOVAL AND INSTALLATION

M1141002703055

Pre-removal Operation	Post-installation Operation
• Engine Coolant Draining (Refer to P.14-6). • Timing Belt Removal (Refer to GROUP 11I – Timing Belt P.11I-40).	• Timing Belt Installation (Refer to GROUP 11I – Timing Belt P.11I-40). • Engine Coolant Refilling (Refer to P.14-6).



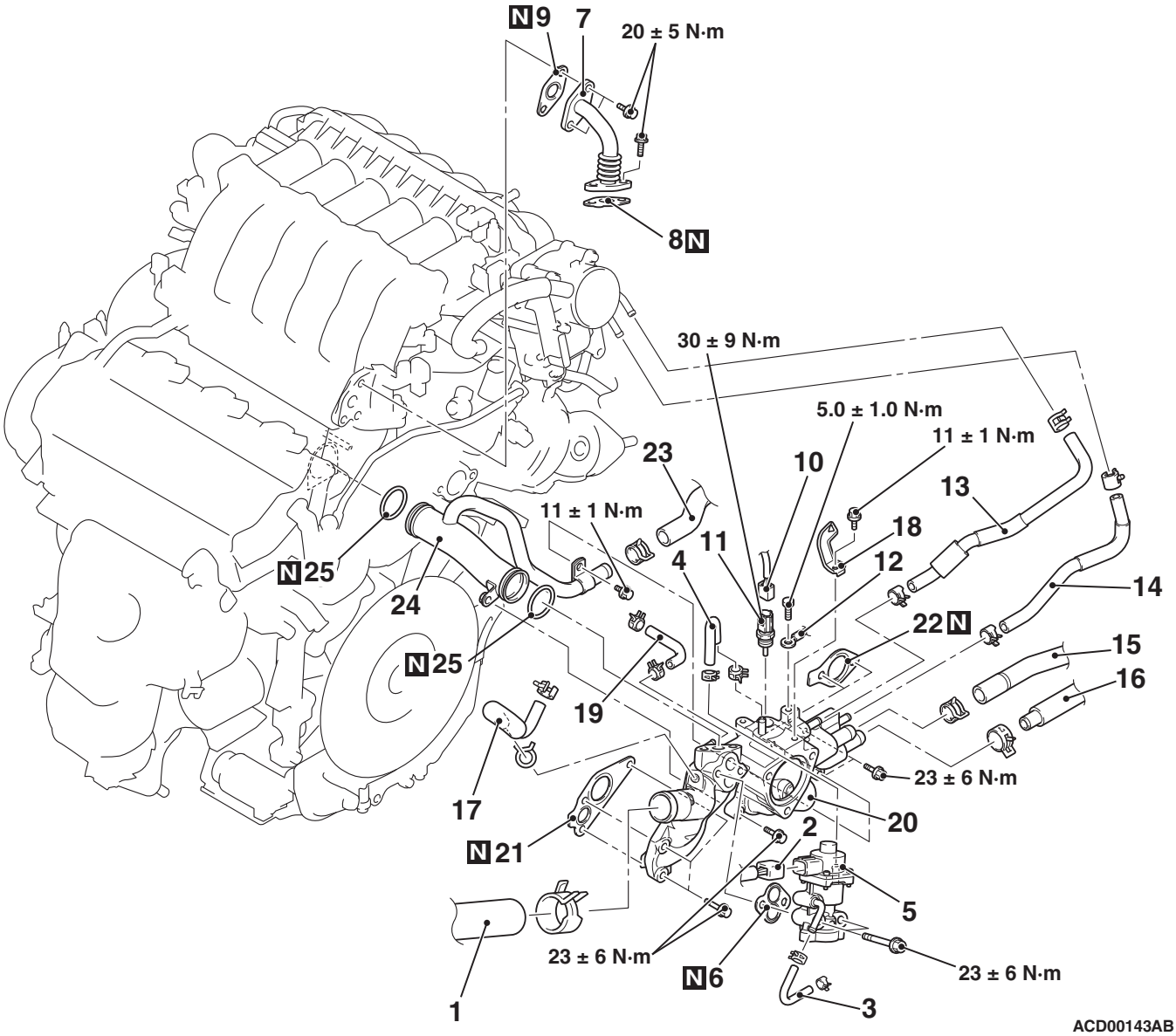
Removal steps
1. Water pump
2. Water pump gasket

WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

M1141003304558

Pre-removal operation	Post-installation operation
• Engine Coolant Draining (Refer to P.14-6). • Air Cleaner Assembly Removal (Refer to GROUP 15 – Air Cleaner P.15-11). • Battery and Battery Tray Removal (Refer to GROUP 54A – Battery). • Thermostat Removal (Refer to P.14-7).	• Thermostat Installation (Refer to P.14-7). • Battery and Battery Tray Installation (Refer to GROUP 54A – Battery). • Air Cleaner Assembly Installation (Refer to GROUP 15 – Air Cleaner P.15-11). • Engine Coolant Refilling (Refer to P.14-6).



Removal steps

<<A>> >>D<< 1. Radiator upper hose connection
2. EGR valve connector
3. EGR water hose
4. EGR water hose
5. EGR valve
6. EGR valve gasket
7. EGR pipe
8. EGR pipe gasket

Removal steps (Continued)

9. EGR pipe gasket
10. Engine coolant temperature sensor connector

<<B>> >>C<< 11. Engine coolant temperature sensor
12. Earth cable connection
13. Water hose
14. Water hose

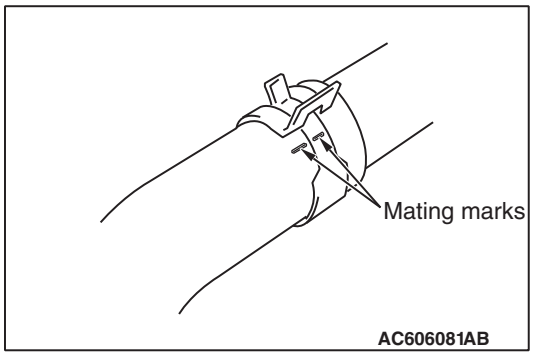
Removal steps (Continued)

15. Water feed hose A connection
16. Heater hose A connection
17. Water hose
18. Harness bracket
    - Oil pipe clamp bolt (Refer to GROUP 11I – Cylinder Head Gasket P.11I-36).
19. Water hose

<<C>> >>B<< 20. Thermostat housing
>>B<< 21. Thermostat housing gasket
>>B<< 22. Thermostat housing gasket
23. Heater hose C connection
24. Water inlet pipe
>>A<< 25. O-ring

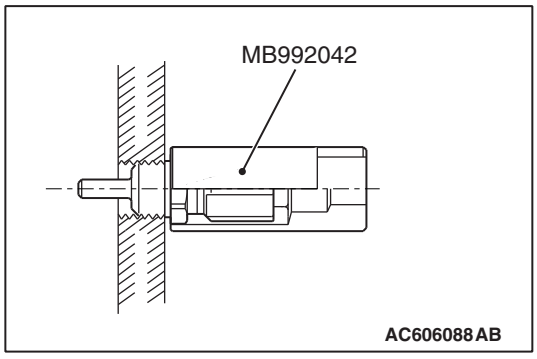
REMOVAL SERVICE POINTS

<<A>> RADIATOR UPPER HOSE DISCONNECTION



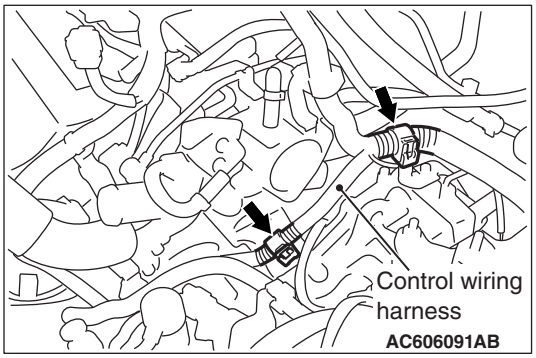
Make mating marks on the radiator upper hose and the hose clamp. Disconnect the radiator upper hose.

<<B>> ENGINE COOLANT TEMPERATURE SENSOR REMOVAL



Use special tool engine coolant temperature sensor wrench (MB992042) to remove the engine coolant temperature sensor.

<<C>> THERMOSTAT HOUSING REMOVAL

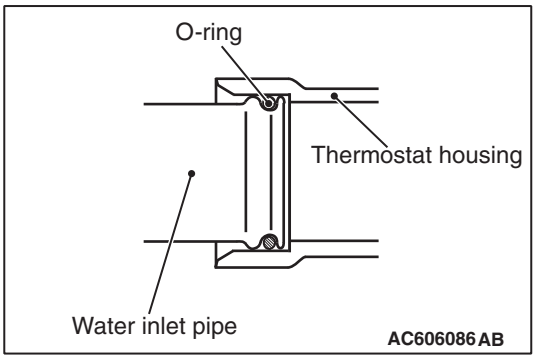


Remove the two control wiring harness clamps, and remove the thermostat housing.

INSTALLATION SERVICE POINTS

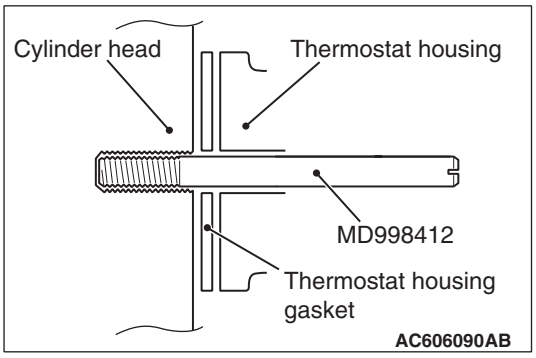
>>A<< O-RING INSTALLATION

⚠ CAUTION
Do not allow engine oil or other grease to adhere to the O-ring



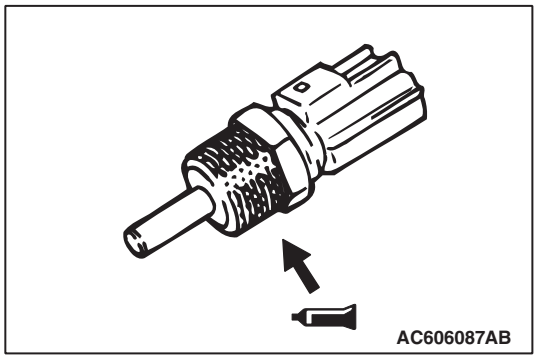
Fit the O-ring in the water inlet pipe groove, wet the O-ring circumference or the pipe mounting area inner wall, and then insert the O-ring.

>>B<< THERMOSTAT HOUSING GASKET/THERMOSTAT HOUSING INSTALLATION



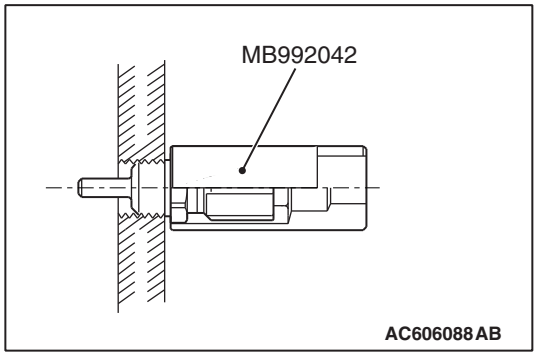
Using the special tool guide (MD998412), install the thermostat housing while supporting the thermostat housing gasket.

>>C<< ENGINE COOLANT TEMPERATURE SENSOR INSTALLATION



1. Apply the specified sealant to the thread of the engine coolant temperature sensor.

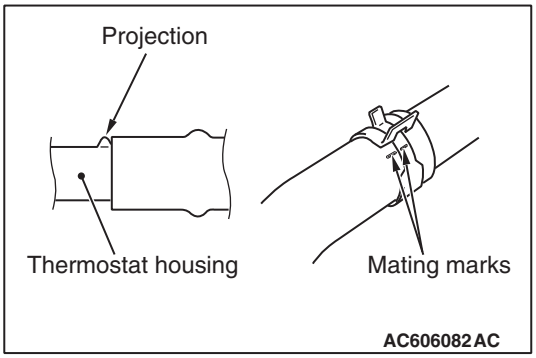
   Specified Sealant: Three bond 1324N, Loctite 262 or equivalent



2. Use special tool water temp sensor wrench (MB992042) to tighten the engine coolant temperature sensor to the specified torque.

   Tightening torque: 30 ± 9 N·m

>>D<< RADIATOR UPPER HOSE INSTALLATION



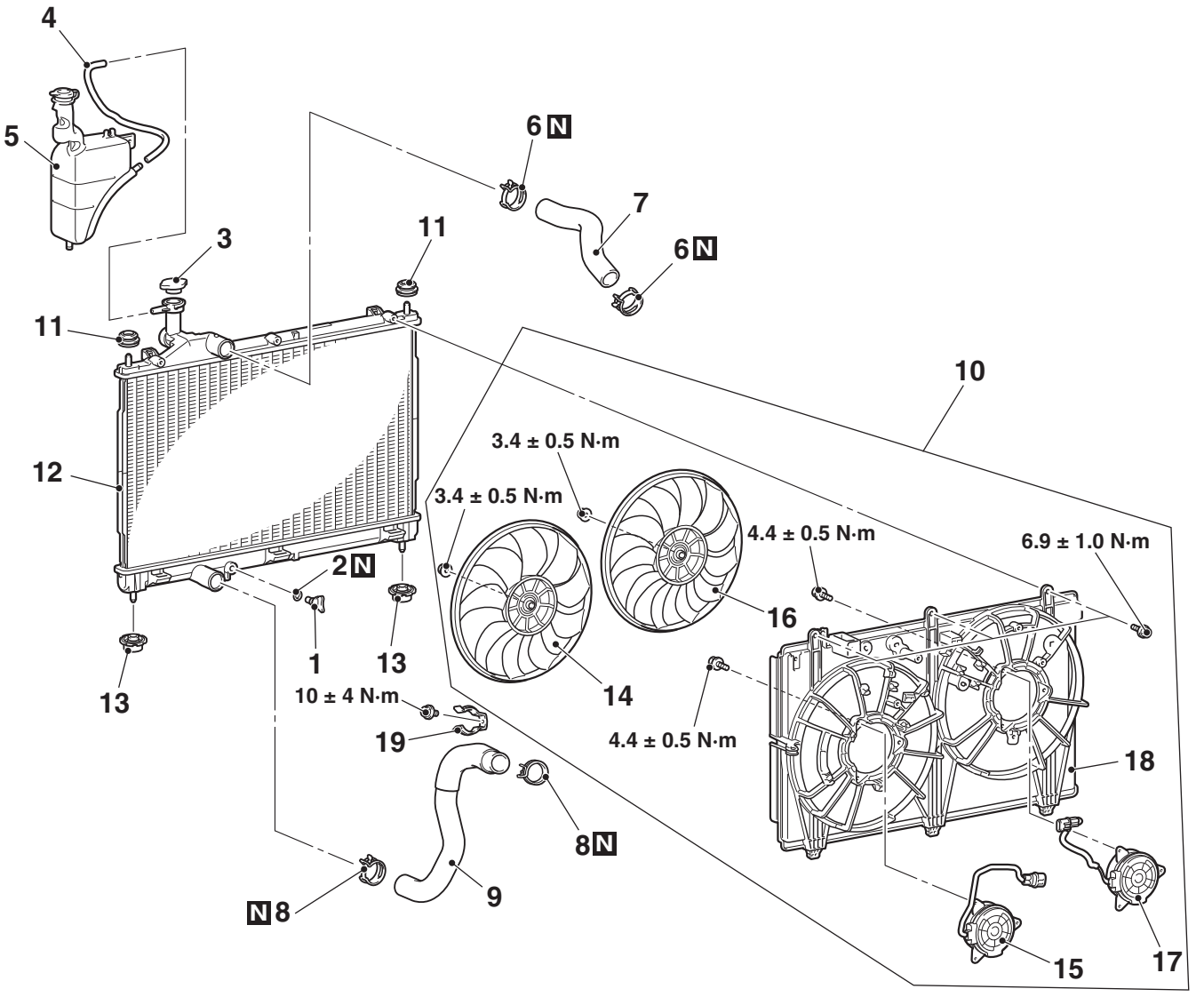
1. Insert radiator upper hose as far as the projection of the thermostat housing.
2. Align the mating marks on the radiator upper hose and hose clamp, and then connect the radiator upper hose.

RADIATOR

REMOVAL AND INSTALLATION

M1141001504095

Pre-removal Operation	Post-installation Operation
• Front under cover panel and front extension under cover panel removal (Refer to GROUP 51 – Under Cover). • Engine coolant draining (Refer to P.14-6). • Air cleaner intake duct and air cleaner assembly removal (Refer to GROUP 15 – Air Cleaner P.15-11). • Headlamp support upper panel cover (Refer to GROUP 51, Radiator Grille)	• Headlamp support upper panel cover (Refer to GROUP 51, Radiator Grille) • Air cleaner intake duct and air cleaner assembly installation (Refer to GROUP 15 – Air Cleaner P.15-11). • Engine coolant refilling (Refer to P.14-6). • Front under cover panel and front extension under cover panel installation (Refer to GROUP 51 – Under Cover).



Removal steps

1. Radiator drain plug
2. O-ring
3. Radiator cap
4. Radiator condenser tank hose
5. Radiator condenser tank

<<A>> >>A<< 6. Hose clip

<<A>> >>A<< 7. Radiator upper hose

<<A>> >>A<< 8. Hose clip

Removal steps (Continued)

<<A>> >>A<< 9. Radiator lower hose
- Radiator fan motor connector connection
- Condenser fan motor connector connection

10. Fan, fan motor and fan shroud assembly

Removal steps (Continued)

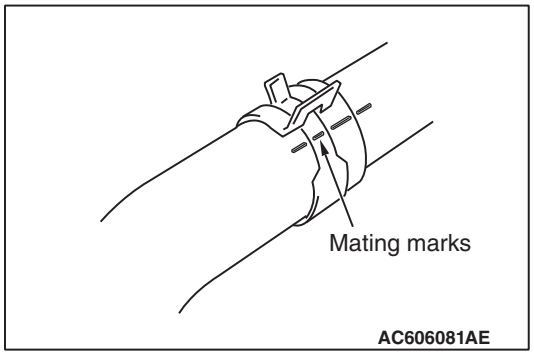
- Front end upper bar assembly (Refer to GROUP 42A – Loose Panel)

11. Support upper insulator
- Condenser assembly (Refer to GROUP 55 – Condenser Assembly)

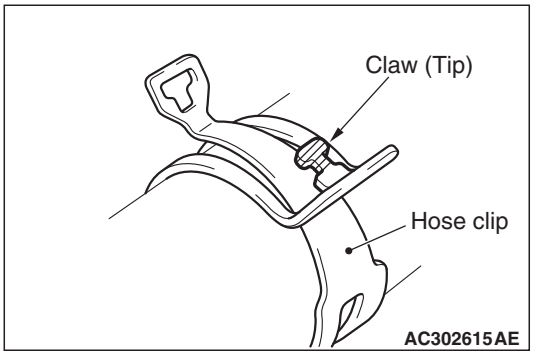
12. Radiator assembly
13. Support lower insulator
14. Radiator fan
15. Radiator fan motor
16. Condenser fan
17. Condenser fan motor
18. Fan shroud
19. Radiator hose support

REMOVAL SERVICE POINT

<<A>> HOSE CLIP/RADIATOR HOSE REMOVAL



1. Make mating marks on the radiator hose and the hose clip as shown to install them in the original position.



2. Break off the tip of hose clip claw and spread out the hose clip, then disconnect the radiator hose.

   NOTE: If there is a hose clip claw, the hose clip cannot spread to capacity because the claw contacts the hose clip.

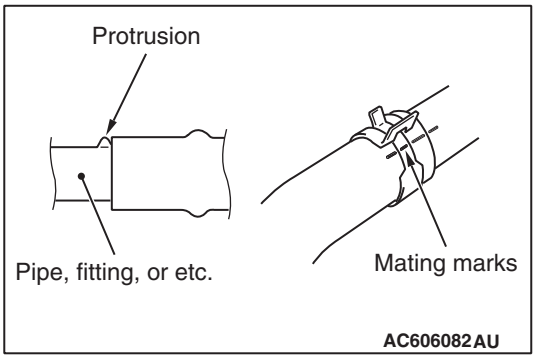
INSTALLATION SERVICE POINT

>>A<< RADIATOR HOSE/HOSE CLIP CONNECTION

⚠ CAUTION

Never reuse the hose clip whose claw is broken off to prevent the rusting.

1. Make mating mark on a new hose clip in the same position as the remove one.



2. Insert the radiator hose until the protrusion of the pipe.
3. Align the mating marks on the radiator hose and hose clip.
4. Remove the hose clip claw and shorten the hose clip, then install the radiator hose.

GROUP 15

INTAKE AND EXHAUST

CONTENTS

GENERAL INFORMATION 15-2

SERVICE SPECIFICATIONS. 15-2

AIR INTAKE PLENUM. 15-3
REMOVAL AND INSTALLATION 15-3

INLET MANIFOLD 15-5
REMOVAL AND INSTALLATION 15-5

EXHAUST MANIFOLD 15-8
REMOVAL AND INSTALLATION 15-8
INSPECTION. 15-10

AIR CLEANER 15-11
REMOVAL AND INSTALLATION 15-11

EXHAUST PIPE AND MAIN MUFFLER 15-13
REMOVAL AND INSTALLATION 15-13

GENERAL INFORMATION

M1151000102293

The intake and exhaust system components for vehicles with 6B3 engine have been added.

SERVICE SPECIFICATIONS

M1151000302305

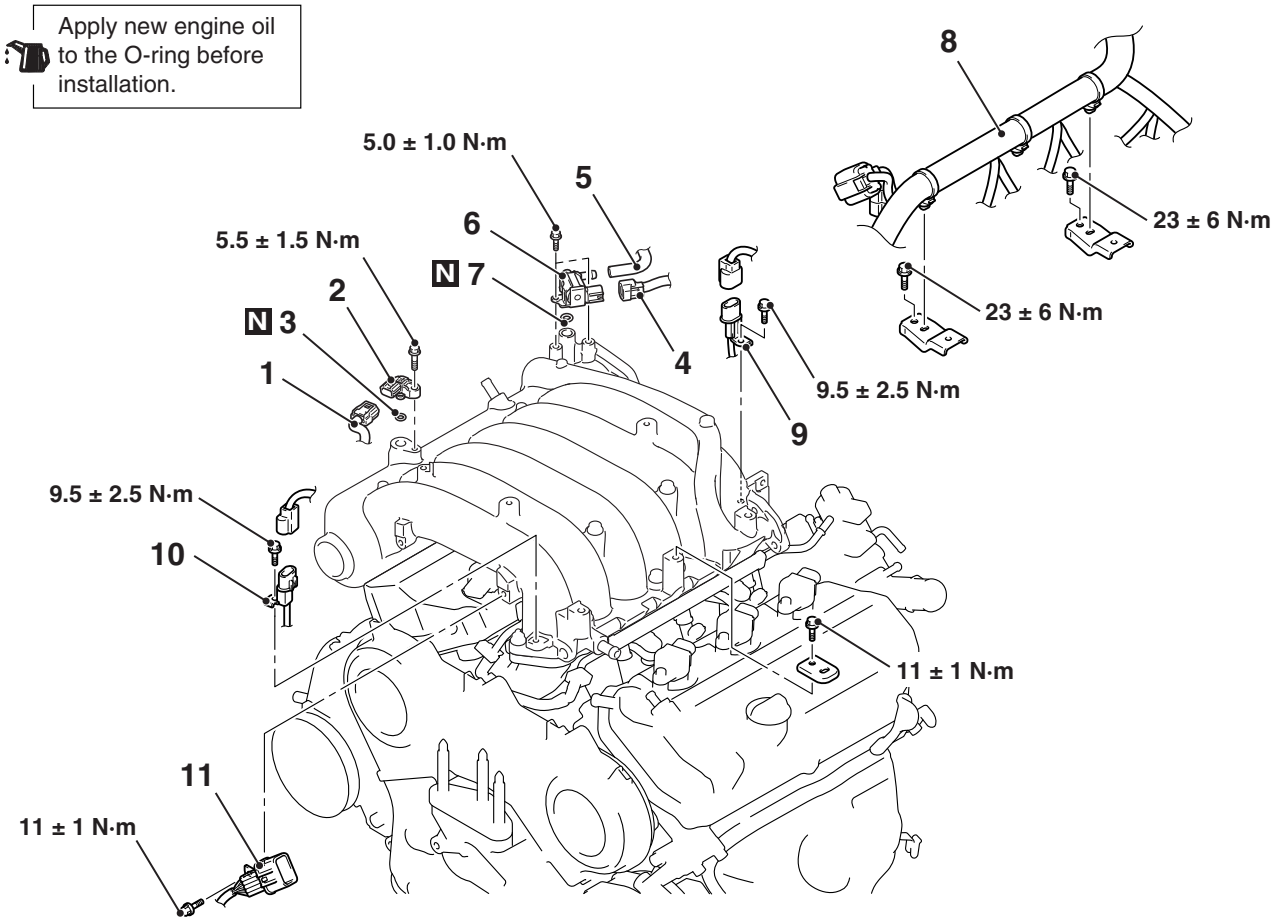
Item	Standard value	Limit
Inlet manifold distortion of the installation surface mm	0.15 or less	0.20
Exhaust manifold distortion of the installation surface mm	0.5 or less	0.7

AIR INTAKE PLENUM

REMOVAL AND INSTALLATION

M1151002700615

Pre-removal Operation	Post-installation Operation
• Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Change P.14-6). • Engine Cover Removal (Refer to GROUP 16 – Ignition System, Ignition coil P.16-19). • Air Cleaner Assembly Removal (Refer to P.15-11). • Throttle Body Assembly Removal (Refer to GROUP 13F – Throttle Body Assembly P.13F-230).	• Throttle Body Assembly Installation (Refer to GROUP 13F – Throttle Body Assembly P.13F-230). • Air Cleaner Assembly Installation (Refer to P.15-11). • Engine Cover Installation (Refer to GROUP 16 – Ignition System, Ignition coil P.16-19). • Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Change P.14-6).



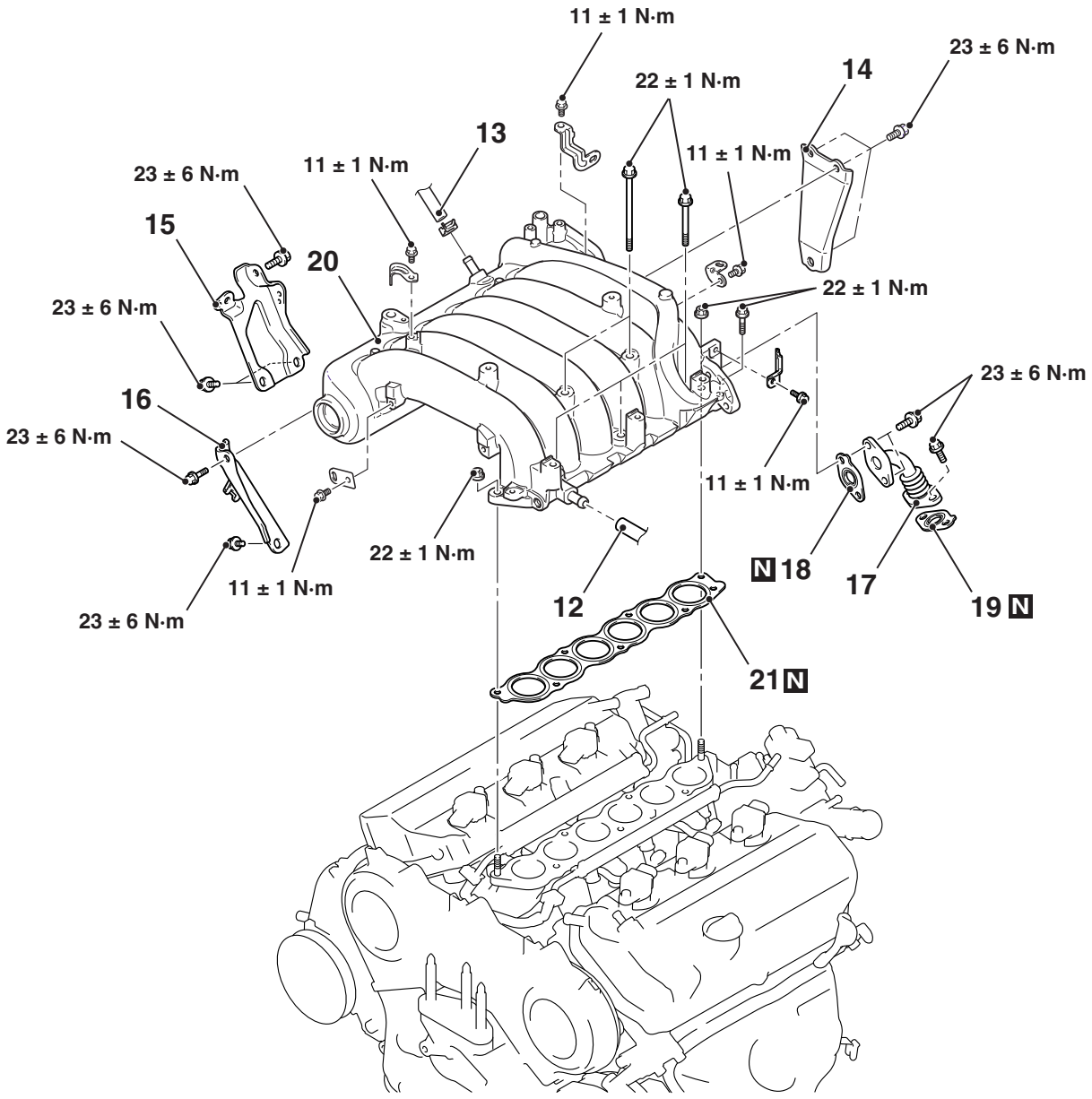
AC809104AB

Removal steps

1. Manifold absolute pressure sensor connector
>>A<< 2. Manifold absolute pressure sensor
3. O-ring
4. Purge control solenoid valve connector
5. Purge hose connection
6. Purge control solenoid valve
7. O-ring

Removal steps (Continued)

8. Control wiring harness connection
9. Right bank detonation sensor connector
10. Left bank detonation sensor connector
11. Control wiring harness and injector wiring harness combination connector



Removal steps

12. PCV hose connection
13. Brake booster vacuum hose connection
14. Throttle body stay
15. Air intake plenum stay (rear)
16. Air intake plenum stay (front)
17. EGR valve pipe
18. EGR valve pipe gasket
19. EGR valve pipe gasket
20. Air intake plenum
21. Air intake plenum gasket

INSTALLATION SERVICE POINT

>>A<< MANIFOLD ABSOLUTE PRESSURE SENSOR INSTALLATION

⚠ CAUTION

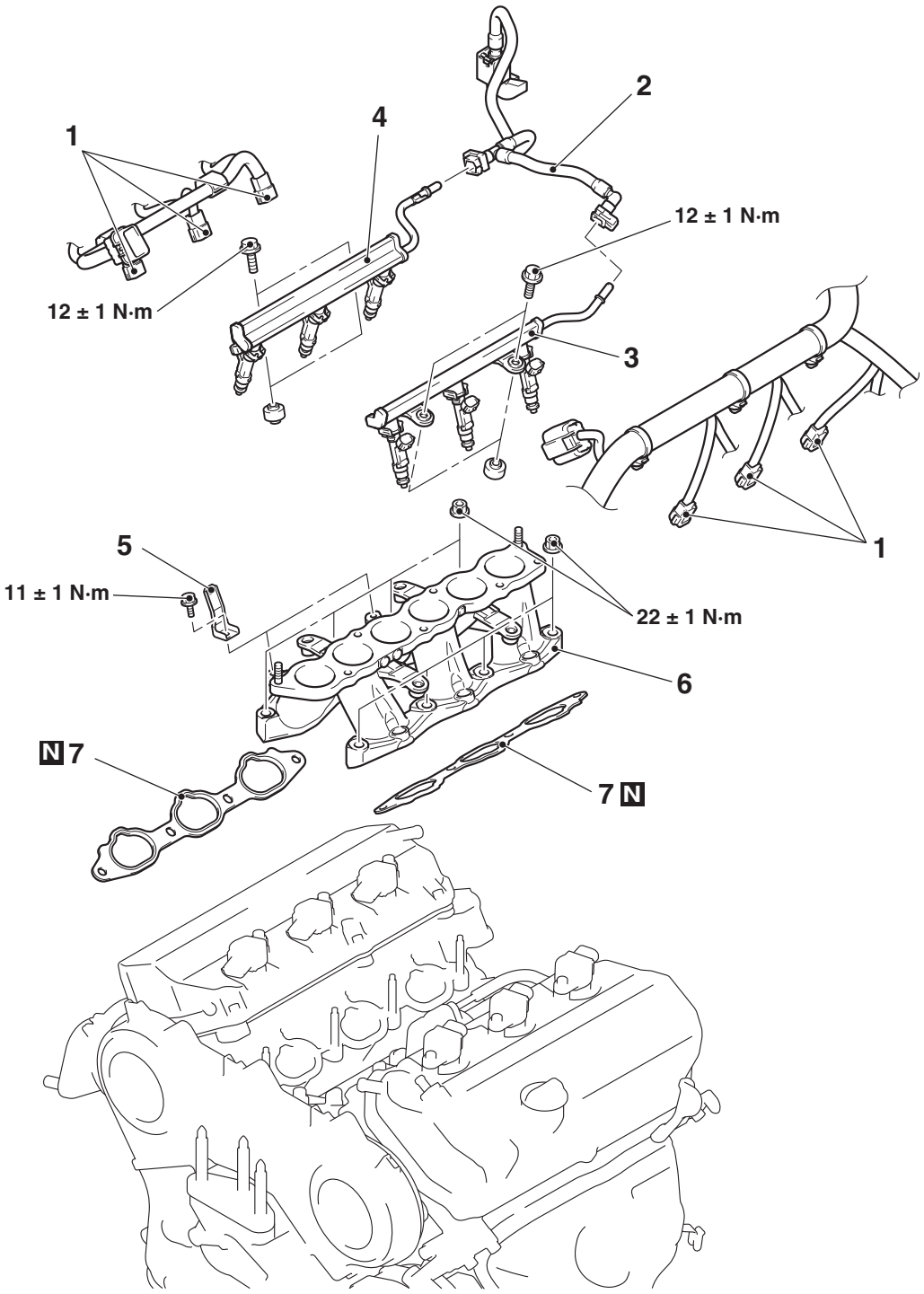
- **Install the manifold absolute pressure sensor, taking care not to give a shock to it.**
- **Do not use a manifold absolute pressure sensor that has fallen down.**

INLET MANIFOLD

REMOVAL AND INSTALLATION

M1151003004990

Pre-removal Operation	Post-installation Operation
• Fuel Discharge Prevention (Refer to GROUP 13F – On-vehicle Service, How to Reduce Pressurized Fuel Lines P.13F-213). • Air Intake Plenum Removal (Refer to P.15-3).	• Air Intake Plenum Installation (Refer to P.15-3). • Fuel Leakage Inspection.



ACA02243AC

Removal steps

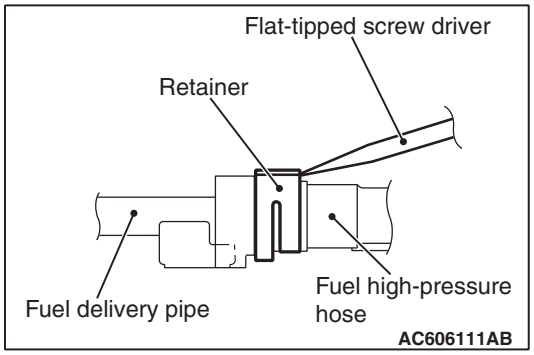
		1.	Fuel injector connector connection
<<**A**>>	>>**C**<<	2.	Fuel high-pressure hose connection
<<**B**>>	>>**B**<<	3.	Fuel delivery pipe and fuel injector assembly
<<**B**>>	>>**B**<<	3.	Fuel delivery pipe and fuel injector assembly
		5.	Harness bracket
	>>**A**<<	6.	Inlet manifold
		7.	Inlet manifold gasket

REMOVAL SERVICE POINTS

<<A>> FUEL HIGH-PRESSURE HOSE DISCONNECTION

⚠ CAUTION

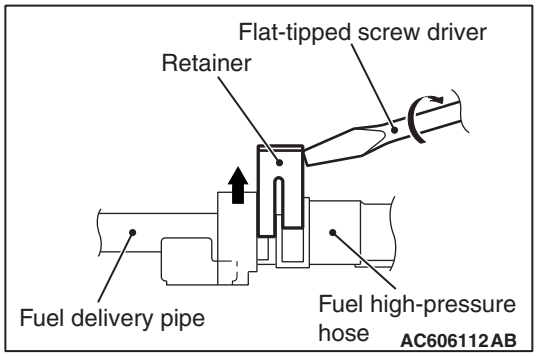
Do not kink the fuel high-pressure hose as it is made of plastics.



1. Insert a flat-tipped screwdriver (6 mm wide and 1 mm thick) into the retainer of the fuel high-pressure hose connector.

⚠ CAUTION

When pushing up the retainer of the fuel high-pressure hose connector, pay attention to avoid damage to the retainer.



2. Turn the flat-tipped screwdriver inserted into the retainer by 90 degrees to push up the retainer and unlock the fuel high-pressure hose connector.

<<B>> FUEL DELIVERY PIPE AND FUEL INJECTOR ASSEMBLY REMOVAL

⚠ CAUTION

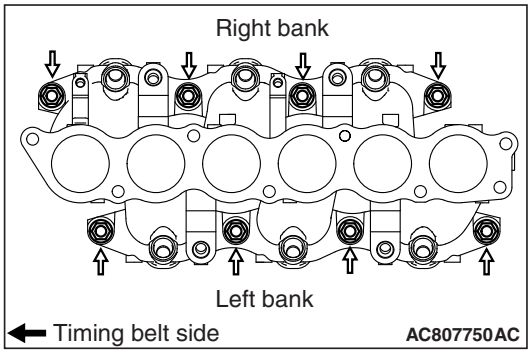
Do not drop the fuel injector.

Remove the fuel delivery pipe with the fuel injectors attached to it.

INSTALLATION SERVICE POINTS

>>A<< INLET MANIFOLD INSTALLATION

1. Coat the inlet manifold mounting studs with engine oil.



2. Tighten the inlet manifold mounting nuts by the following procedure.

Order	Mounting nuts	Tightening torque
1st	Left bank nuts	6.5 ± 1.5 N·m
2nd	Right bank nuts	22 ± 1 N·m
3rd	Left bank nuts	22 ± 1 N·m
4th	Right bank nuts	22 ± 1 N·m
5th	Left bank nuts	22 ± 1 N·m

>>B<< FUEL DELIVERY PIPE AND FUEL INJECTOR ASSEMBLY INSTALLATION

⚠ CAUTION

When applying the engine oil, make sure not to allow the engine oil to enter the inlet manifold inside.

1. Apply a small amount of new engine oil to the O-ring at the end of fuel injector assembly.

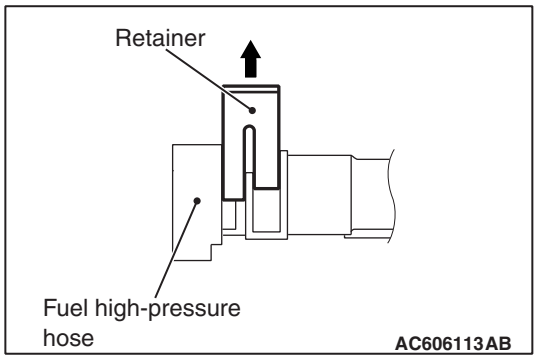
⚠ CAUTION

When installing the fuel delivery pipe and fuel injector assembly to the inlet manifold, pay attention to avoid damage to the O-ring at the end of the fuel injector assembly.

2. Install the fuel delivery pipe and fuel injector assembly to the inlet manifold.
3. Tighten the mounting bolts of the fuel delivery pipe to the specified torque.

   Tightening torque: 12 ± 1 N·m

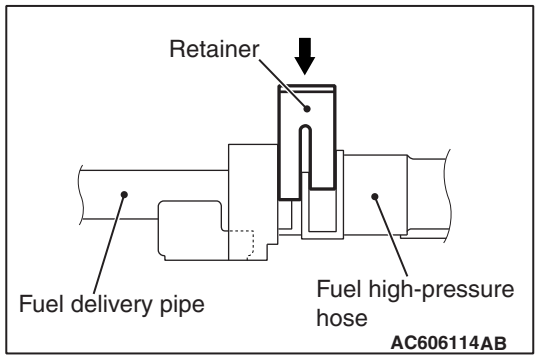
>>C<< FUEL HIGH-PRESSURE HOSE CONNECTION



1. Pull up the retainer of fuel high-pressure hose to unlock before installing.

⚠ CAUTION

- **When pushing in the retainer of the fuel high-pressure hose connector, pay attention to avoid damage to the retainer.**
- **After the installation of the fuel high-pressure hose, slightly pull the fuel high-pressure hose to check that it is connected securely. At this time, also check that there is approximately 1 mm play.**



2. Install the fuel high-pressure hose to the fuel delivery pipe securely and push in the retainer of the fuel high-pressure hose connector to lock the fuel high-pressure hose and fuel delivery pipe.

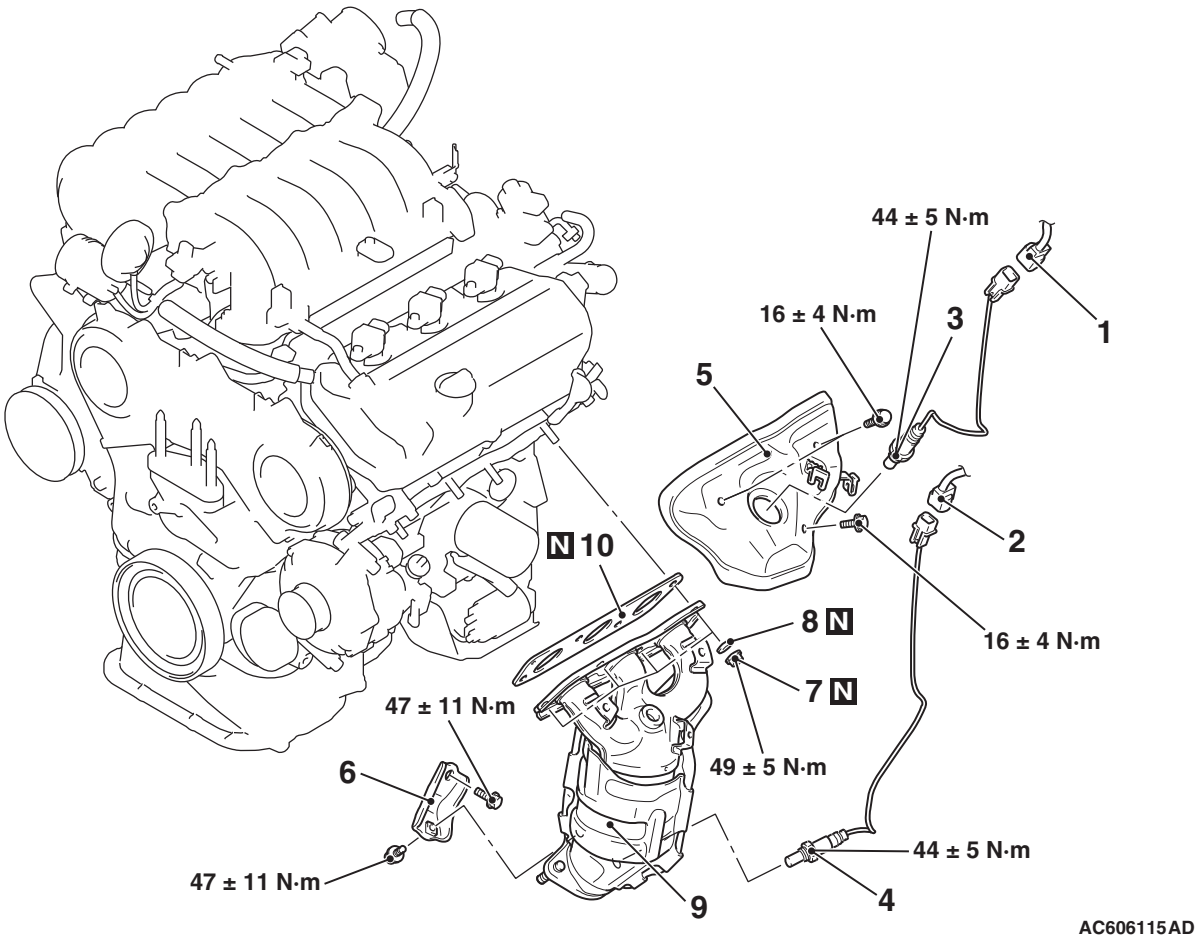
EXHAUST MANIFOLD

REMOVAL AND INSTALLATION

M1151003303255

<LEFT BANK>

Pre-removal operation	Post-installation operation
• Air Cleaner Intake Duct Removal (Refer to P.15-11). • Engine Room Under Cover Front B Removal (Refer to GROUP 51 – Under Cover). • Front Exhaust Pipe Removal (Refer to P.15-13).	• Front Exhaust Pipe Installation (Refer to P.15-13). • Engine Room Under Cover Front B Installation (Refer to GROUP 51 – Under Cover). • Air Cleaner Intake Duct Installation (Refer to P.15-11).



Removal steps

1. Left bank oxygen sensor (Front) connector connection
2. Left bank oxygen sensor (Rear) connector connection

<<**A**>> >>**B**<< 3. Left bank oxygen sensor (Front)

<<**B**>> >>**A**<< 4. Left bank oxygen sensor (Rear)

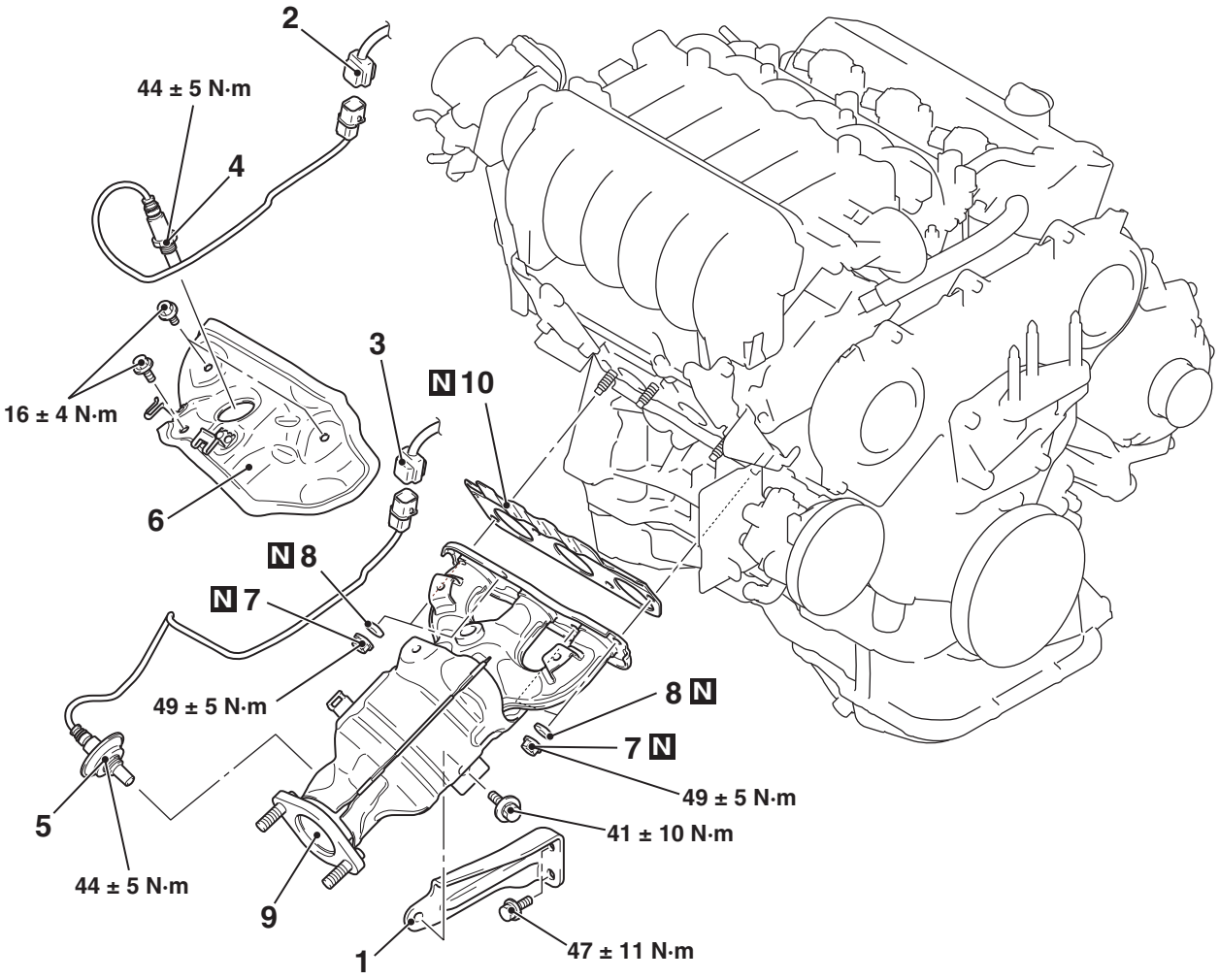
5. Heat protector

Removal steps (Continued)

6. Left exhaust manifold bracket
7. Exhaust manifold nut
8. Exhaust manifold washer
9. Exhaust manifold
10. Exhaust manifold gasket

<RIGHT BANK>

Pre-removal operation	Post-installation operation
• Air Cleaner Cover and Air Cleaner Intake Duct Removal <6B3> (Refer to P.15-11). • Battery and Battery Tray Removal (Refer to GROUP 54A – Battery). • Engine Room Under Cover Front B Removal (Refer to GROUP 51 – Under Cover). • Front Exhaust Pipe, Front Exhaust Pipe (RH), Centre Exhaust Pipe and Front Floor Front Panel Heat Protector Removal <6B3> (Refer to P.15-13).	• Front Exhaust Pipe, Front Exhaust Pipe (RH), Centre Exhaust Pipe and Front Floor Front Panel Heat Protector Installation <6B3> (Refer to P.15-13). • Engine Room Under Cover Front B Installation (Refer to GROUP 51 – Under Cover). • Battery and Battery Tray Installation (Refer to GROUP 54A – Battery). • Air Cleaner Cover and Air Cleaner Intake Duct Installation <6B3> (Refer to P.15-11).



AC708988AB

Removal steps

1. Right exhaust manifold bracket
2. Right bank oxygen sensor (Front) connector connection
3. Right bank oxygen sensor (Rear) connector connection

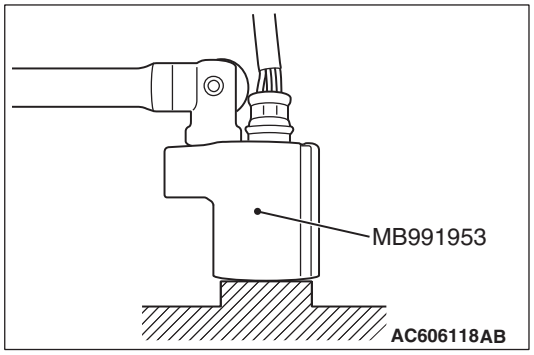
<<A>> >>B<< 4. Right bank oxygen sensor (Front)

Removal steps (Continued)

<<B>> >>A<< 5. Right bank oxygen sensor (Rear)
6. Heat protector
7. Exhaust manifold nut
8. Exhaust manifold washer
9. Exhaust manifold
10. Exhaust manifold gasket

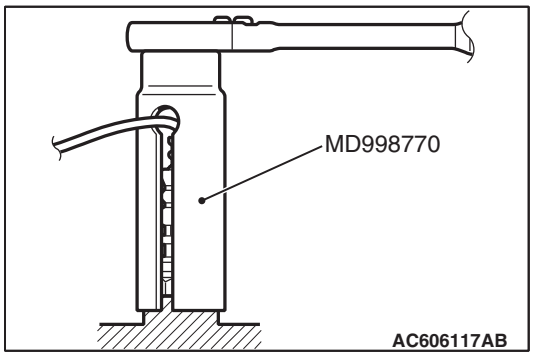
REMOVAL SERVICE POINTS

<<A>> LEFT BANK OXYGEN SENSOR (FRONT) / RIGHT BANK OXYGEN SENSOR (FRONT) REMOVAL



Use special tool oxygen sensor wrench (MB991953) to remove the oxygen sensor.

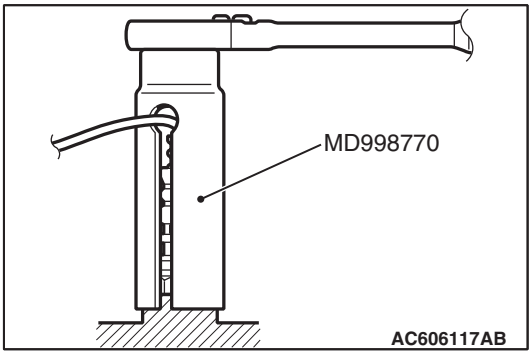
<<B>> LEFT BANK OXYGEN SENSOR (REAR) / RIGHT BANK OXYGEN SENSOR (REAR) REMOVAL



Use special tool oxygen sensor wrench (MD998770) to remove the oxygen sensor.

INSTALLATION SERVICE POINTS

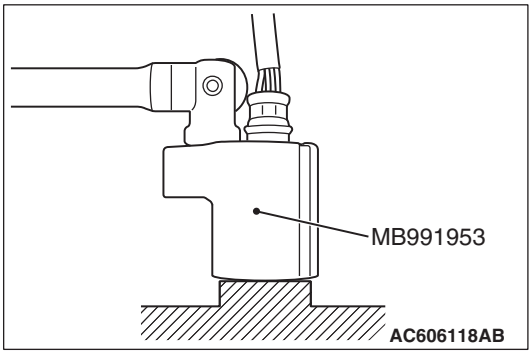
>>A<< RIGHT BANK OXYGEN SENSOR (REAR) / LEFT BANK OXYGEN SENSOR (REAR) INSTALLATION



Tighten the oxygen sensor to the specified torque by using special tool oxygen sensor wrench (MD998770).

Tightening torque: 44 ± 5 N·m

>>B<< RIGHT BANK OXYGEN SENSOR (FRONT) / LEFT BANK OXYGEN SENSOR (FRONT) INSTALLATION



Tighten the oxygen sensor to the specified torque by using special tool oxygen sensor wrench (MB991953).

Tightening torque: 44 ± 5 N·m

INSPECTION

M1151003401591

EXHAUST MANIFOLD CHECK

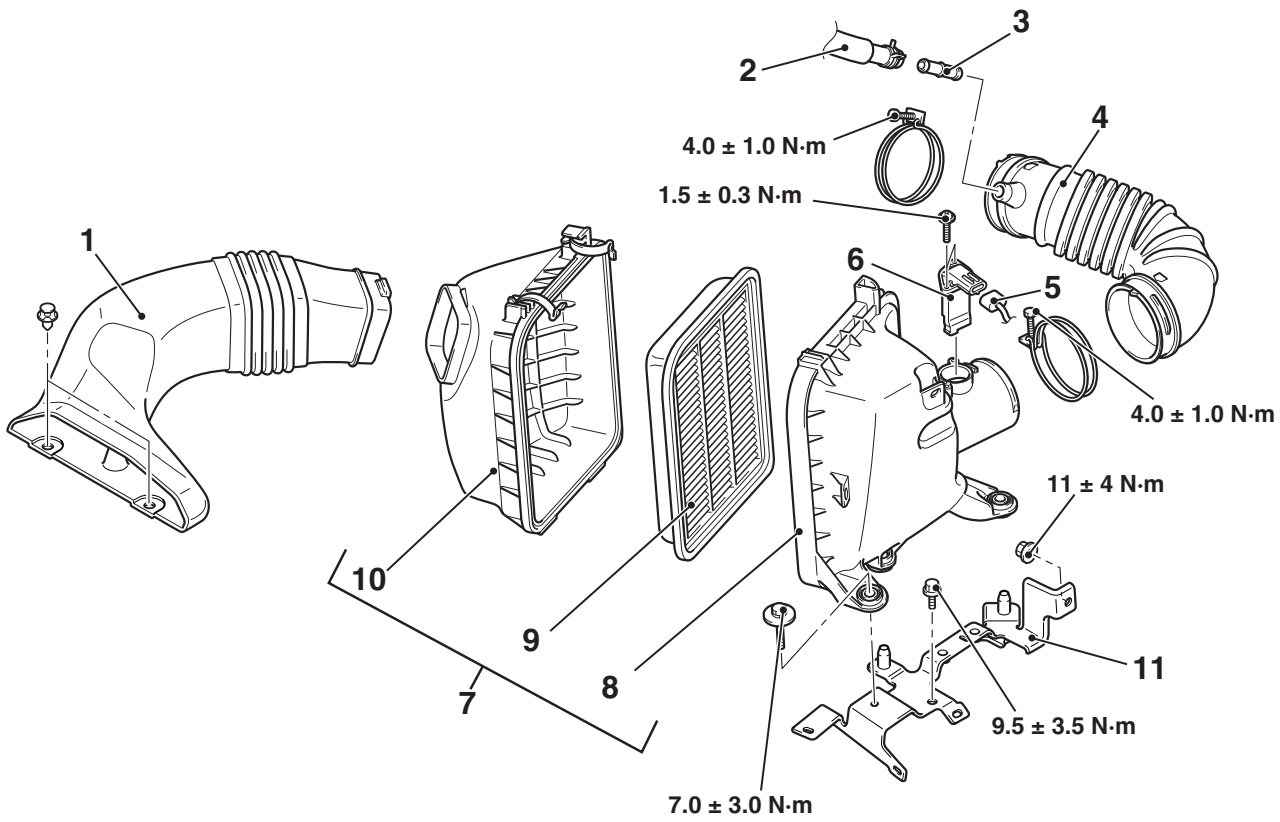
1. Check the exhaust manifold for damage and cracks, and replace it if necessary.
2. Using a straight edge and a thickness gauge, check for distortion of the cylinder head installation surface. If it exceeds the limit value, replace it.

   Standard value: 0.5 mm or less
   Limit: 0.7 mm

AIR CLEANER

REMOVAL AND INSTALLATION

M1151002103690



ACD00118AB

Removal steps

1. Air cleaner intake duct
2. Breather hose connection

>>C<< 3. Nipple

>>B<< 4. Air cleaner intake hose

5. Air flow sensor connector connection

>>A<< 6. Air flow sensor

7. Air cleaner assembly
8. Air cleaner cover
9. Air cleaner element
10. Air cleaner body
    - Engine-ECU (Refer to GROUP 13F – Engine-ECU P.13F-232).
11. Air cleaner bracket

INSTALLATION SERVICE POINTS

>>A<< AIR FLOW SENSOR INSTALLATION

1. Install the air flow sensor to the air cleaner cover with care not to damage the O-ring.

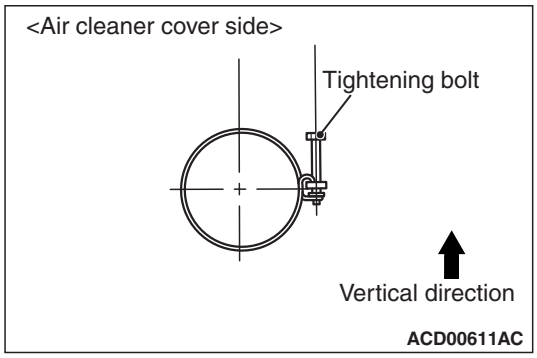
⚠ CAUTION

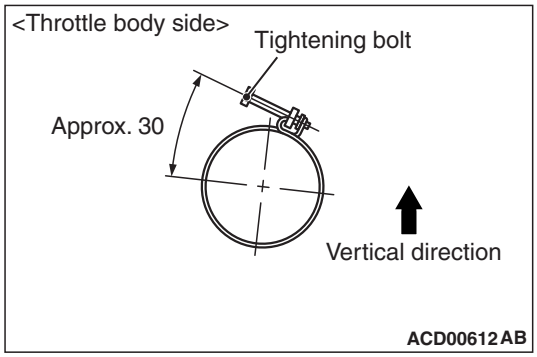
Do not over-tighten. If the mounting screw is over-tightened, the air cleaner cover can be damaged.

2. Tighten the mounting screws to the specified torque.

Tightening torque: 1.5 ± 0.3 N·m

>>B<< AIR CLEANER INTAKE HOSE INSTALLATION





1. Install the hose clamps with the tightening bolt at the position shown in the figure.
2. Check that the tip of tightening bolt does not interfere with the surrounding components.

>>C<< NIPPLE INSTALLATION

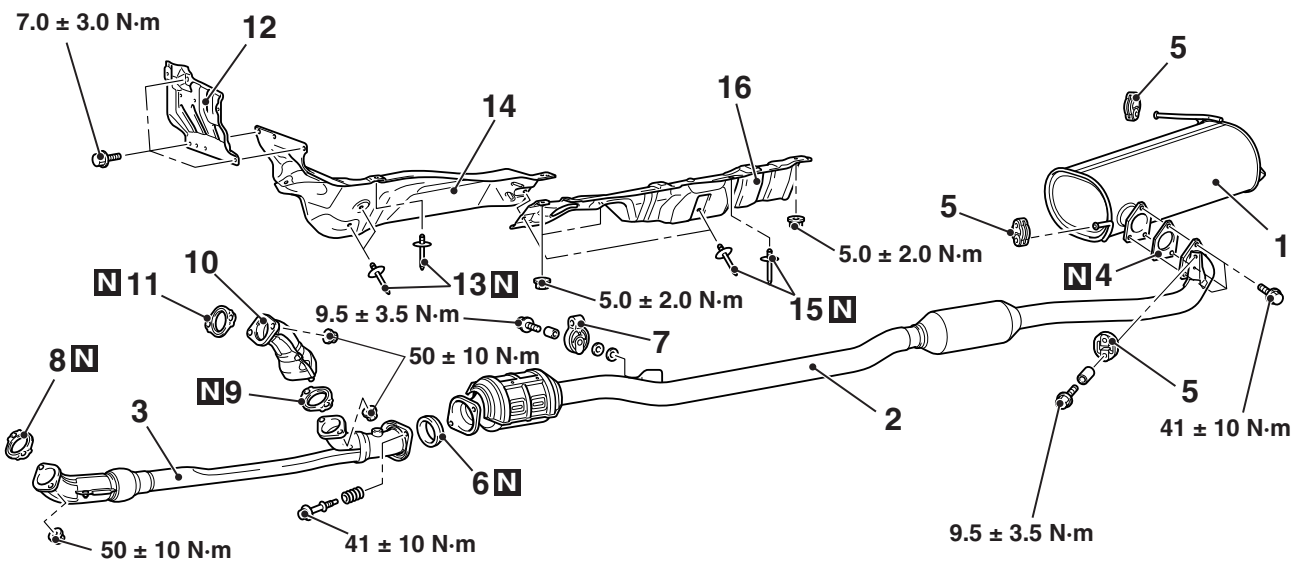
⚠ CAUTION

Securely install the nipple to the air cleaner intake hose.

EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

M1151008703719



ACD00105AB

Exhaust main muffler and rear floor panel heat protector removal steps

1. Exhaust main muffler
4. Exhaust pipe gasket
5. Exhaust muffler hanger

Centre exhaust pipe and front floor panel rear heat protector removal steps

2. Centre exhaust pipe
4. Exhaust pipe gasket
6. Seal ring
7. Exhaust muffler hanger

<<A>> >>A<< 15. Rivet

16. Front floor rear panel heat protector

Front exhaust pipe and front floor panel front heat protector removal steps

3. Front exhaust pipe
6. Seal ring
8. Exhaust pipe gasket
9. Exhaust pipe gasket
10. Front exhaust pipe (RH)
11. Exhaust pipe gasket
12. Dash panel heat protector

<<A>> >>A<< 13. Rivet

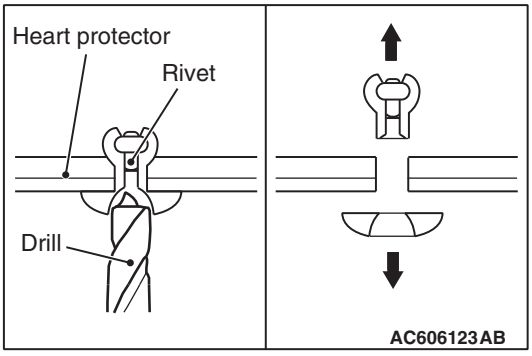
14. Front floor front panel heat protector

REMOVAL SERVICE POINTS

<<A>> RIVET REdMOVAL

⚠ CAUTION

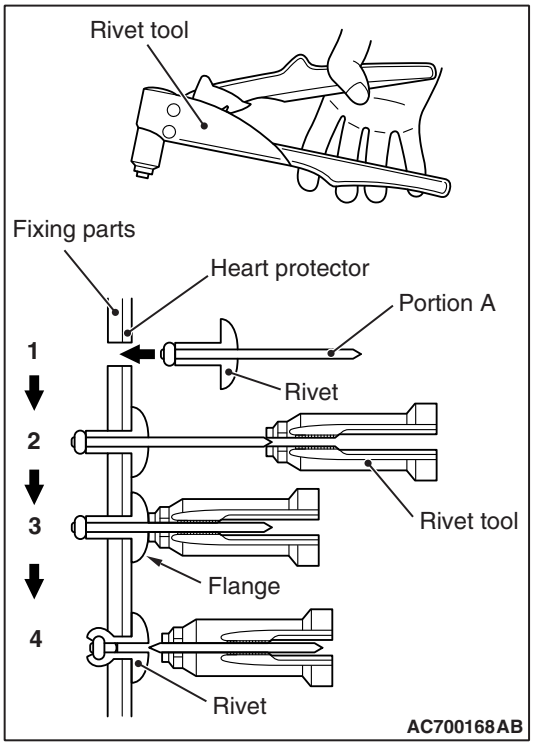
Be careful not to damage the heat protector with the drill.



Use a drill (6.0 mm) to make a hole in the rivet to break it, and then remove the rivet.

INSTALLATION SERVICE POINT

>>A<< RIVET INSTALLATION



Use a rivet tool shown in the illustration to connect the parts with rivets by the following procedures.

1. Insert the rivet into a corresponding location.
2. Set the rivet tool at a portion A of rivet.
3. While pushing the flange surface of the rivet onto parts to be fixed with the rivet tool, press the handle of the tool.
4. Thin part of portion A of the rivet will be cut off and the parts is fixed in position.

GROUP 16

ENGINE ELECTRICAL

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CHARGING SYSTEM

GENERAL INFORMATION

M1161000102313

The service procedures below have been added due to the introduction of 6B3 engine. The service procedures are basically the same as those of the conventional vehicle to which 4B1 engine is mounted.

SYSTEM DIAGRAM

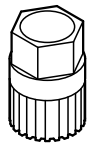
Same as vehicles with 4B1 engine.

ALTERNATOR SPECIFICATION

Item	6B3
Type	Battery voltage sensing
Rated output V/A	12/120
Voltage regulator	Electronic built-in type

SPECIAL TOOL

M1161000601326

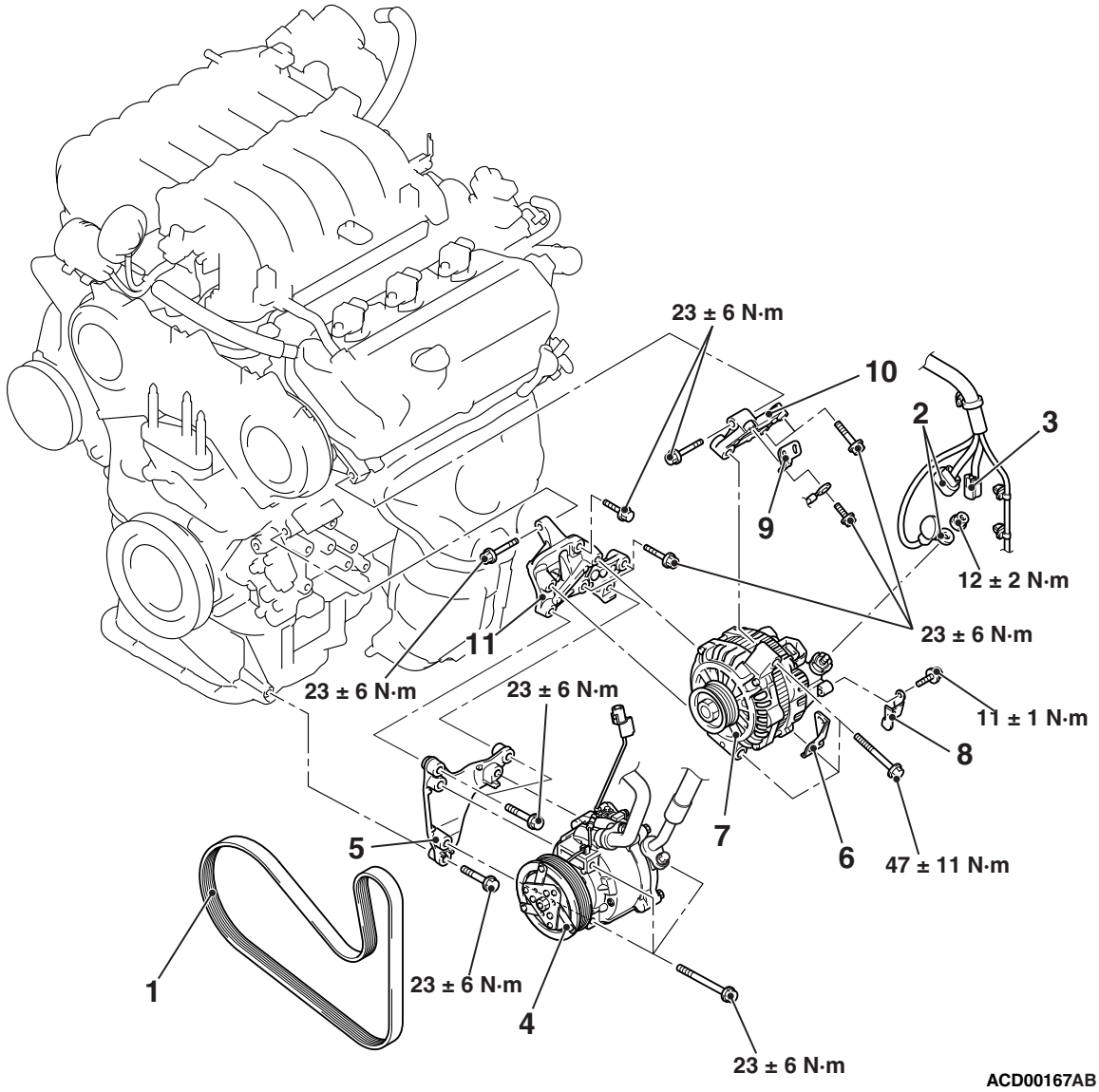
Tool	Number	Name	Use
 MB992226	MB992226	Serration socket	Removal and installation of alternator's one way clutch

ALTERNATOR ASSEMBLY

REMOVAL AND INSTALLATION

M1161001404089

Pre-removal Operation	Post-installation Operation
• Engine Room Under Cover Front A and Engine Room Side Cover (RH) Removal (Refer to GROUP 51– Under Cover).	• Alternator Drive Belt Tension Check (Refer to GROUP 11C – On-vehicle Service, Drive Belt Tension Check). • Engine Room Under Cover Front A and Engine Room Side Cover (RH) Installation (Refer to GROUP 51 – Under Cover).



Removal steps

<<**A**>>
1. Alternator drive belt
2. Alternator connector and terminal connection
3. A/C compressor and clutch assembly connector connection

<<**B**>>
4. A/C compressor and clutch assembly
5. Compressor bracket

Removal steps (Continued)

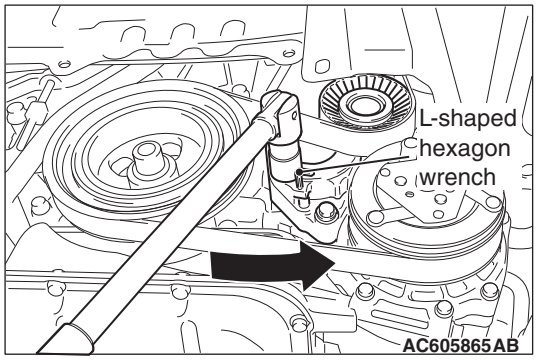
<<**C**>> >>**A**<<
6. Harness bracket
7. Alternator assembly
8. Harness bracket
9. Earth cable connection
10. Alternator upper bracket
11. Alternator lower bracket

REMOVAL SERVICE POINTS

<<A>> ALTERNATOR DRIVE BELT REMOVAL

⚠ CAUTION

When the alternator drive belt is reused, draw an arrow indicating the rotating direction on the back of the alternator drive belt using chalk to install the same direction.



1. Turn the alternator drive belt auto-tensioner to anti-clockwise, and insert the L-shaped hexagon wrench to the alternator drive belt auto-tensioner hole in order to fix the alternator drive belt auto-tensioner.
2. Remove the alternator drive belt.

<<B>> A/C COMPRESSOR AND CLUTCH ASSEMBLY REMOVAL

1. Remove the A/C compressor and clutch assembly from the A/C compressor bracket with the hose still attached.
2. Place the removed A/C compressor and clutch assembly where it will not be a hindrance when removing and installing the alternator assembly, and secure it with a cord or wire.

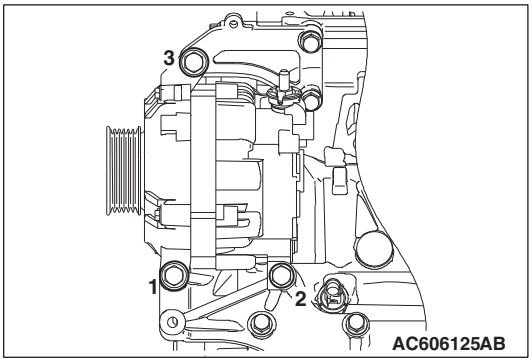
<<C>> ALTERNATOR ASSEMBLY REMOVAL

Move the A/C compressor and clutch assembly to one side, and then remove the alternator assembly from under the vehicle.

INSTALLATION SERVICE POINT

>>A<< ALTERNATOR ASSEMBLY INSTALLATION

1. Temporarily tighten the alternator assembly to the alternator bracket.

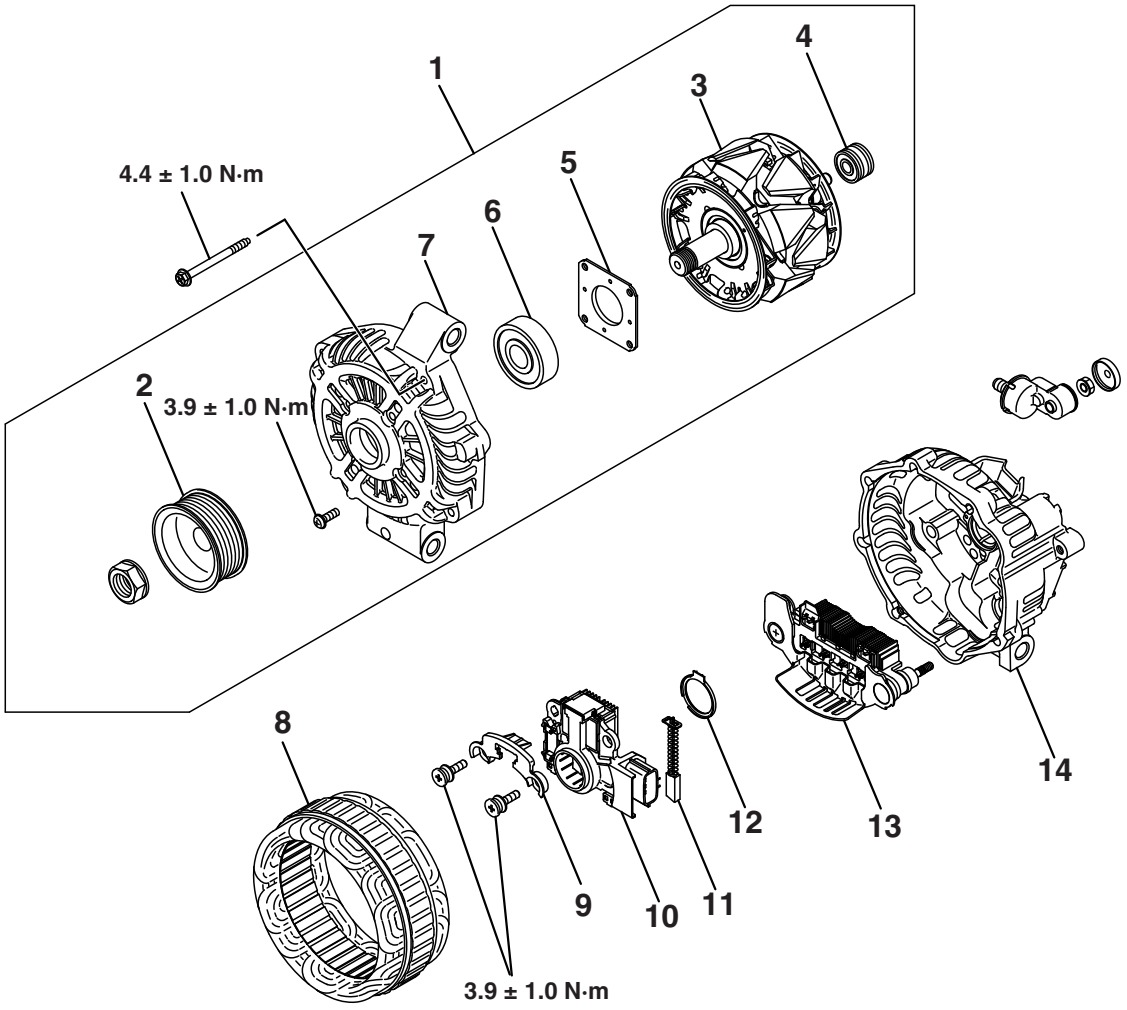


2. In accordance with the tightening order shown in the illustration, tighten the installation bolts for the alternator bracket to the specified torque.

Tightening torque: 47 ± 11 N·m

DISASSEMBLY AND REASSEMBLY

M1161001601222



AK702167AC

Disassembly steps

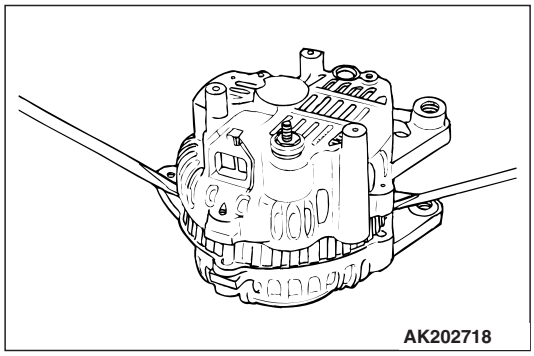
<<**A**>> 1. Front bracket assembly
<<**B**>> 2. Alternator pulley
3. Rotor
4. Rear bearing
5. Bearing retainer
6. Front bearing
>>**B**<< 7. Front bracket

Disassembly steps (Continued)

<<**C**>> 8. Stator
9. Plate
<<**C**>> >>**A**<< 10. Regulator assembly
11. Brush
12. Rubber packing
13. Rectifier
14. Rear bracket

DISASSEMBLY SERVICE POINTS

<<A>> FRONT BRACKET ASSEMBLY REMOVAL

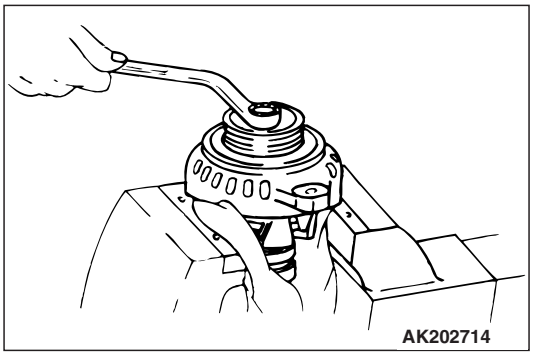


⚠ CAUTION

Do not insert the screwdriver blades too deep. Doing so could damage the stator coil.

Insert the blades of screwdrivers between the front bracket assembly and stator core, and pry and separate them with the screwdrivers.

<<B>> ALTERNATOR PULLEY REMOVAL

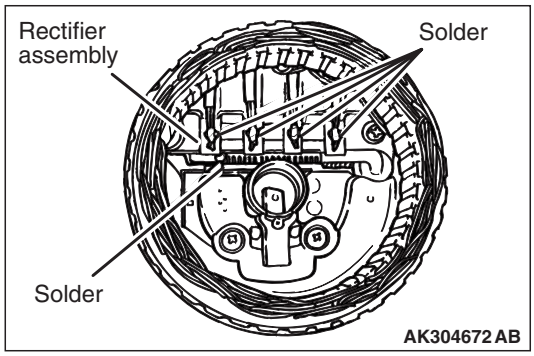


⚠ CAUTION

Perform operation carefully not to damage the rotor.

Clamp the rotor in a vise with the pulley facing up to remove the pulley.

<<C>> STATOR / REGULATOR ASSEMBLY REMOVAL



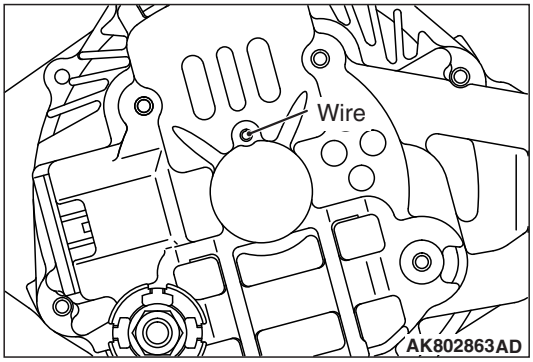
⚠ CAUTION

- **Use a 180 – 250 W soldering iron, and finish unsoldering within four seconds. Diodes will be damaged by heat if unsoldering time is too long.**
- **Avoid applying undue force to the diode leads.**

1. Unsolder the stator leads from the main diode of the rectifier assembly when the stator is removed.
2. When removing the rectifier assembly from the regulator assembly, undo the soldered points on the rectifier assembly.

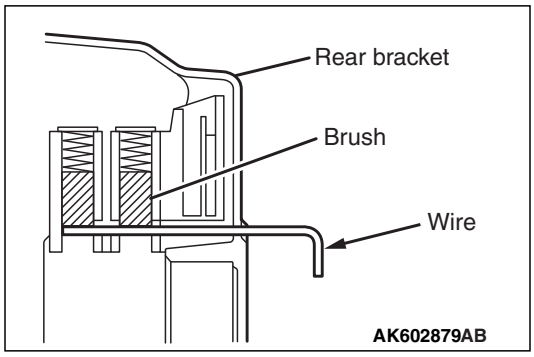
REASSEMBLY SERVICE POINTS

>>A<< REGULATOR ASSEMBLY INSTALLATION

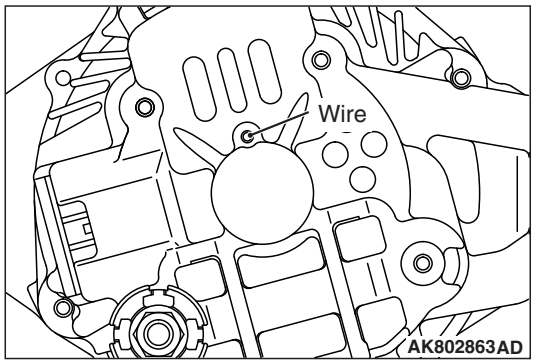


After installing the regulator assembly, insert a piece of wire through the hole in the rear bracket while pressing the brush to keep the brush against movement.

NOTE: Unless inserting the wire to fix the brush, the rotor installation is difficult.



>>B<< FRONT BRACKET ASSEMBLY INSTALLATION

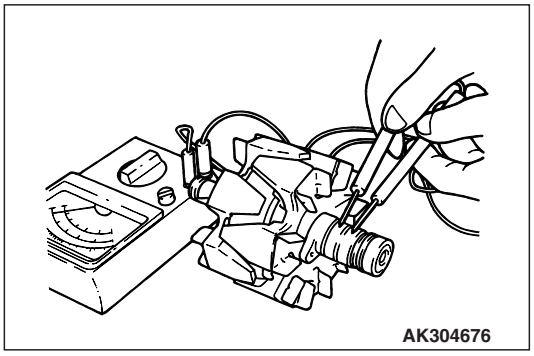


After installing the rotor, remove the wire used to secure the brush.

INSPECTION

M1161001700970

ROTOR

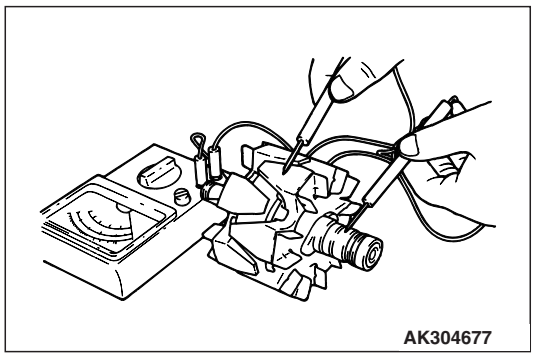


1. Measure the resistance between the two slip rings of the rotor coil to check the continuity between them.

   Replace the rotor if the resistance is not within the standard value range.

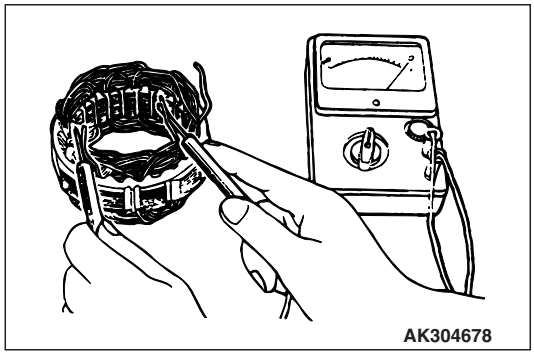
   Standard value: 2.1 – 2.4 Ω

2. Check the continuity between the slip rings and core.



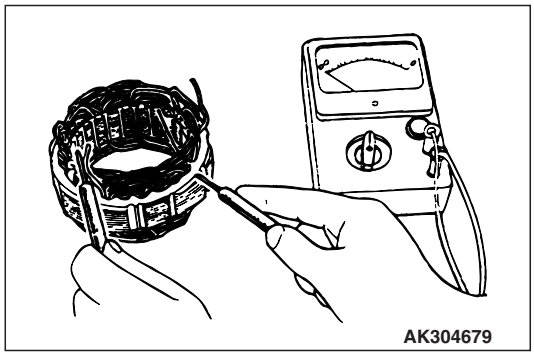
3. If continuity is present, replace the rotor.

STATOR



1. Check the continuity between coil leads.

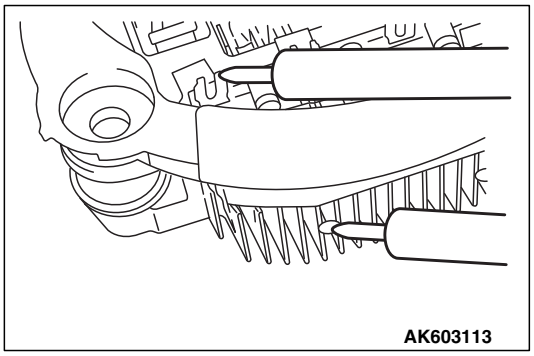
   If there is no continuity, replace the stator.



2. Check the continuity between coil and core.

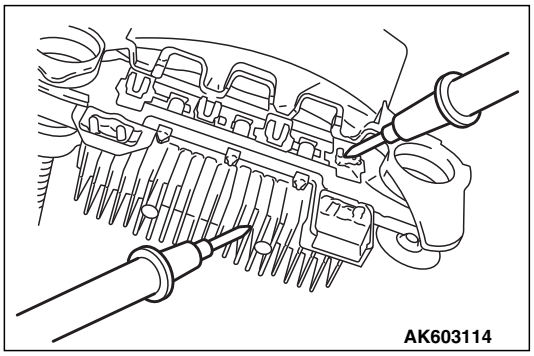
   If there is continuity, replace the stator.

RECTIFIER ASSEMBLY



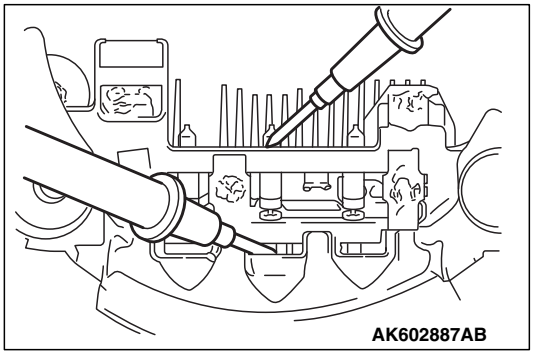
1. Check the condition of the (+) heat sink by checking the continuity between the (+) heat sink and each of the stator coil lead connecting terminals.

   If the continuity is present for both terminals, or if no continuity is present for both terminals, the diode is shorted. Replace the rectifier assembly.



2. Check the condition of the (–) heat sink by checking the continuity between the (–) heat sink and each of the stator coil lead connecting terminals.

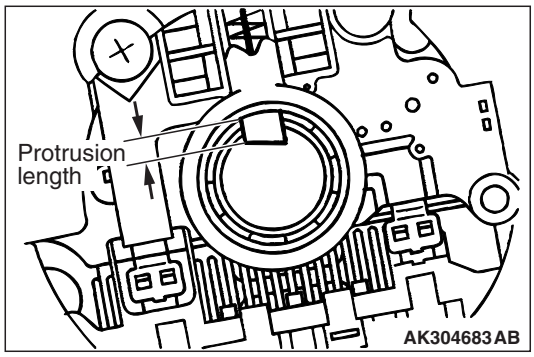
   If the continuity is present for both terminals, or if no continuity is present for both terminals, the diode is shorted. Replace the rectifier assembly.



3. Diode Trio Test: Check three diodes for continuity by connecting an ammeter to both ends of each diode.

   If there is no continuity in both directions, diode is faulty and heatsink assembly must be replaced.

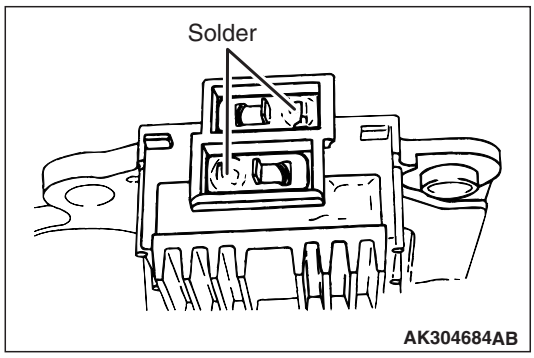
BRUSH



1. Measure the length of the protrusion of the brush. Replace the brush if the protrusion length is shorter than the limit.

   Limit: 2 mm minimum

2. Unsolder the lead of the brush. The brush will come out, becoming ready for removal.



3. Install a new brush by pushing it into the holder as shown in the drawing and soldering the lead.

STARTING SYSTEM

GENERAL INFORMATION

M1162000101357

The service procedures below have been added due to the introduction of 6B3 engine.

STARTER MOTOR SPECIFICATIONS

Item	6B3
Type	Reduction drive with planetary gear
Rated output kW/V	1.4/12
Number of pinion teeth	8

SERVICE SPECIFICATIONS

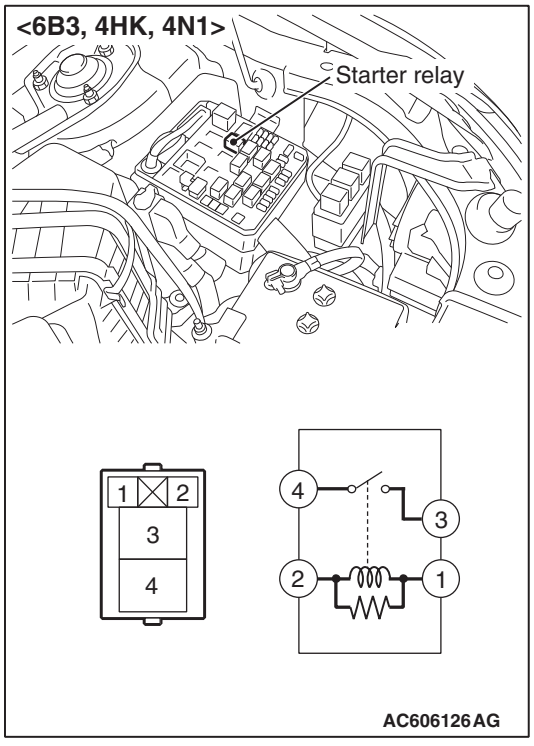
M1162000300767

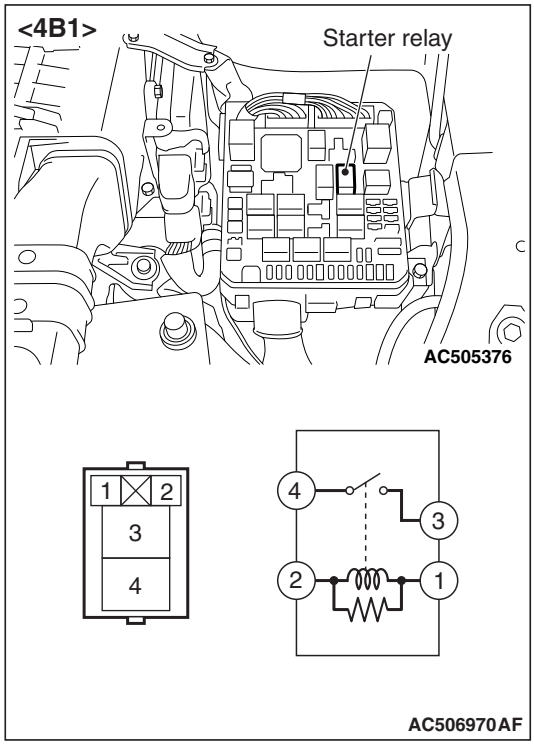
Item	Standard value	Limit
Pinion gap mm	0.5 – 2.0	–

ON-VEHICLE SERVICE

STARTER RELAY CONTINUITY CHECK

M1162001401146





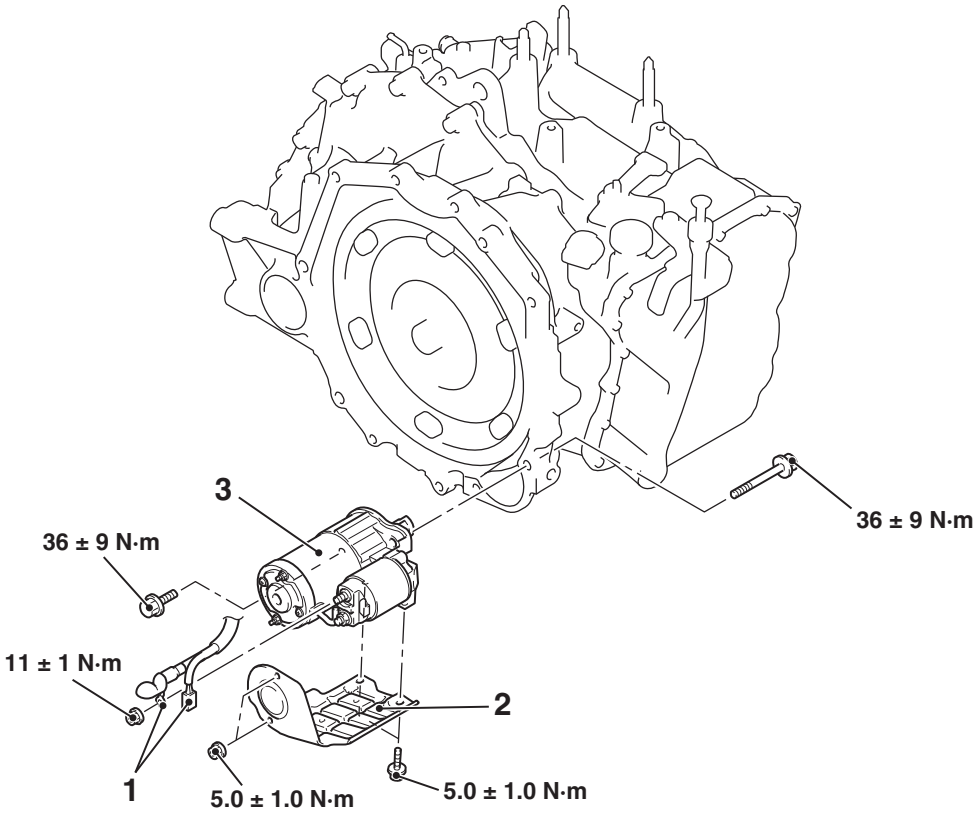
Battery voltage	Terminal No. to be connected to tester	Continuity test results
Not applied	3 – 4	Open circuit
Connect terminal No.1 to battery (–) terminal. Connect terminal No.2 to battery (+) terminal.	3 – 4	Continuity (less than 2 Ω)

STARTER MOTOR ASSEMBLY

REMOVAL AND INSTALLATION

M1162001003401

Pre-removal and Post-installation Operation
- Engine Room Under Cover Front A Removal and Installation (Refer to GROUP 51 – Under Cover).



Removal steps
1. Starter connector and terminal connection
2. Starter cover
<<A>> 3. Starter assembly

REMOVAL SERVICE POINT

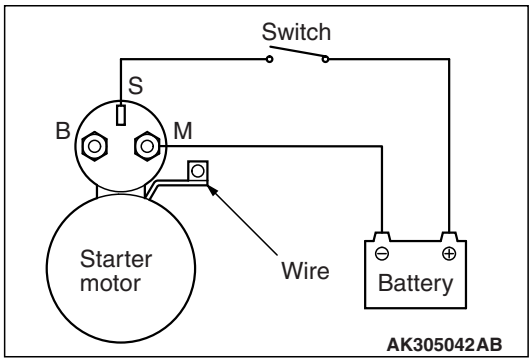
<<A>> STARTER ASSEMBLY REMOVAL

Remove the starter assembly from under the vehicle.

STARTER MOTOR ASSEMBLY INSPECTION

M1162001101361

PINION GAP ADJUSTMENT

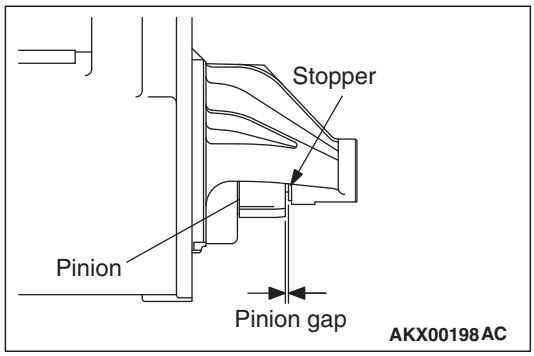


1. Disconnect the field coil wire from the M-terminal of the magnetic switch.
2. Connect a 12-volt battery between the S-terminal and M-terminal.

⚠ CAUTION

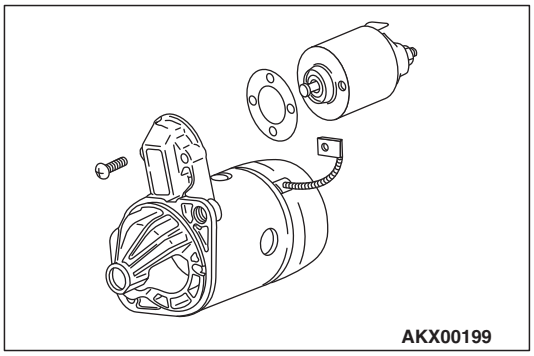
This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.

3. Set the switch to "ON", and the pinion will move out.



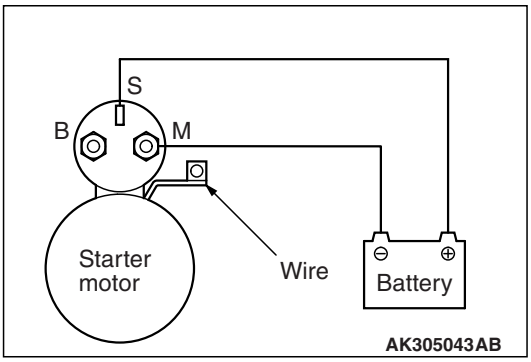
4. Check the pinion-to-stopper clearance (pinion gap) with a feeler gauge.

   Standard value: 0.5 – 2.0 mm



5. If the pinion gap is out of specification, adjust by adding or removing gasket(s) between the magnetic switch and front bracket.

MAGNETIC SWITCH PULL-IN TEST



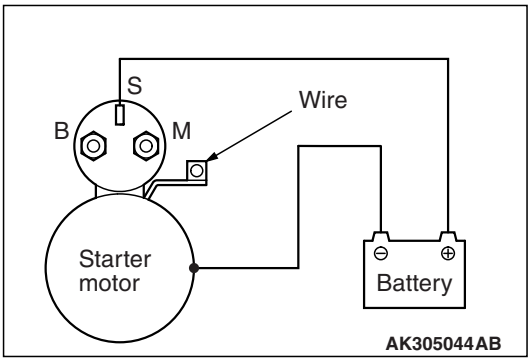
1. Disconnect the field coil wire from the M-terminal of the magnetic switch.

⚠ CAUTION

This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.

2. Connect a 12-volt battery between the S-terminal and M-terminal.
3. If the pinion moves out, the pull-in coil is good. If it doesn't, replace the magnetic switch.

MAGNETIC SWITCH HOLD-IN TEST



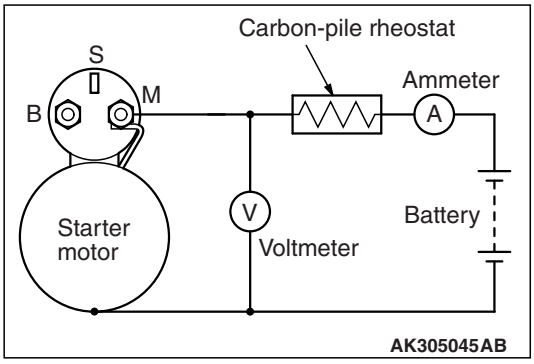
1. Disconnect the field coil wire from the M-terminal of the magnetic switch.

⚠ CAUTION

This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.

2. Connect a 12-volt battery between the S-terminal and body.
3. Manually pull out the pinion as far as the pinion stopper position.
4. If the pinion remains out, everything is in order. If the pinion moves in, the hold-in circuit is open. Replace the magnetic switch.

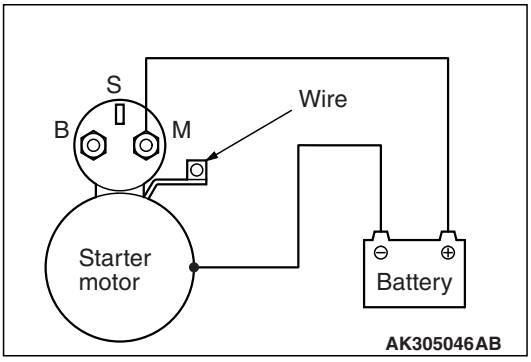
FREE RUNNING TEST



1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to the starter motor as follows:
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostat in series between the battery (+) terminal and starter motor terminal.
3. Connect a voltmeter (15-volt scale) across the starter motor.
4. Rotate the rheostat to full-resistance position.
5. Connect the battery cable from the battery (–) terminal to the starter motor body.
6. Adjust the rheostat until the battery voltage shown on the voltmeter is 11 V.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

   Current: maximum 90 Amps

MAGNETIC SWITCH RETURN TEST



1. Disconnect the field coil wire from the M-terminal of the magnetic switch.

⚠ CAUTION

This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.

2. Connect a 12-volt battery between the M-terminal and body.

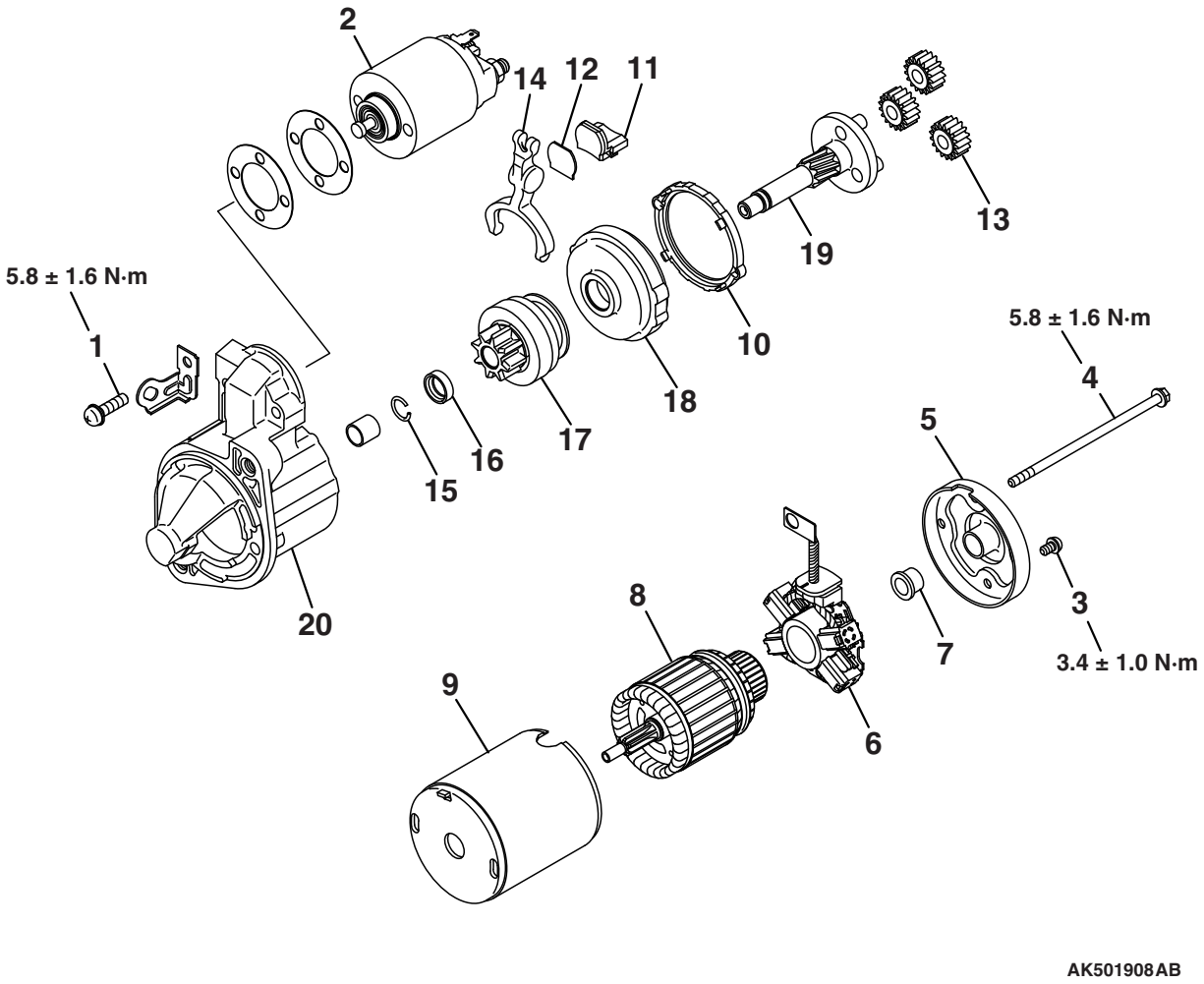
⚠ WARNING

Be careful not to get your fingers caught when pulling out the pinion.

3. Pull the pinion out and release. If the pinion quickly returns to its original position, everything is operating properly. If it doesn't, replace the magnetic switch.

DISASSEMBLY AND REASSEMBLY

M1162001201056



AK501908AB

Disassembly steps

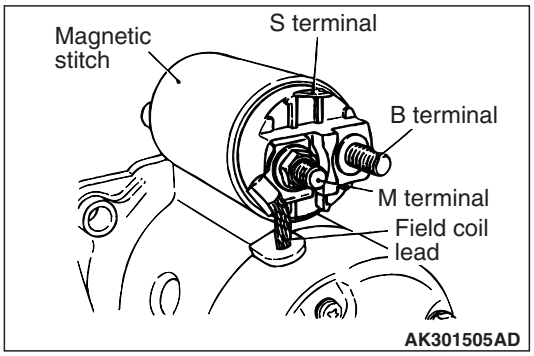
1. Screw
<<**A**>> 2. Magnetic switch
3. Screw
4. Bolt
5. Rear bracket
6. Brush holder
7. Rear bearing
8. Armature
9. Yoke assembly
10. Packing A

Disassembly steps (Continued)

11. Packing B
12. Plate
13. Planetary gear
14. Lever
<<**B**>> >>**A**<< 15. Snap ring
<<**B**>> >>**A**<< 16. Stop ring
17. Overrunning clutch
18. Internal gear
19. Planetary gear shaft
20. Front bracket

DISASSEMBLY SERVICE POINTS

<<A>> MAGNETIC SWITCH REMOVAL

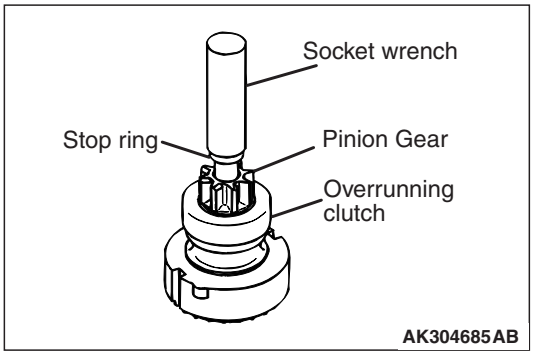


⚠ CAUTION

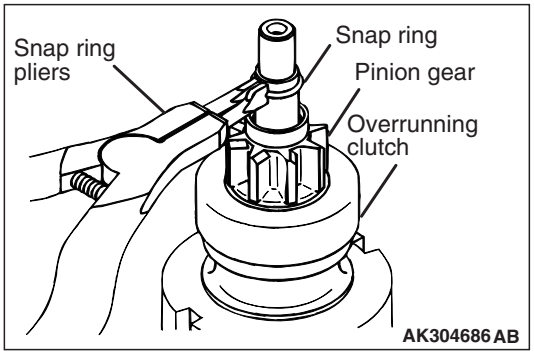
Do not clamp the yoke assembly with a vise.

Disconnect the lead from the M terminal of the magnetic switch.

<<B>> SNAP RING/STOP RING REMOVAL



1. Apply a long socket wrench of an appropriate size to the stop ring and strike the wrench to drive out the stop ring toward the pinion gear side.



2. Remove the snap ring with snap ring pliers, then remove the stop ring and overrunning clutch.

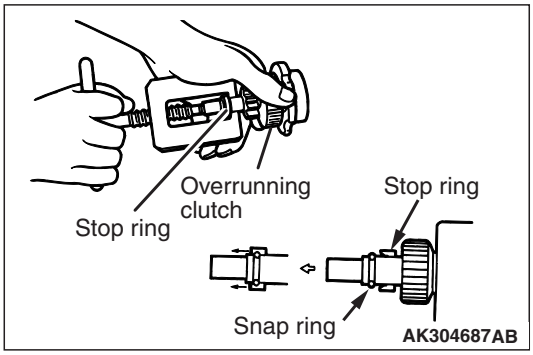
STARTER MOTOR PARTS CLEANING

Never clean in a solvent such starter motor parts as the magnetic switch, brush holder, and armature. If they are soaked in a solvent, their insulation could be impaired. When these parts require cleaning, wipe off contamination with cloth.

1. Never soak the drive unit in a solvent. If it is washed in a solvent, the grease having been packed in the overrunning clutch at the factory will be washed out.
2. Wipe the drive unit with cloth if it requires cleaning.

REASSEMBLY SERVICE POINTS

>>A<< STOP RING/SNAP RING INSTALLATION

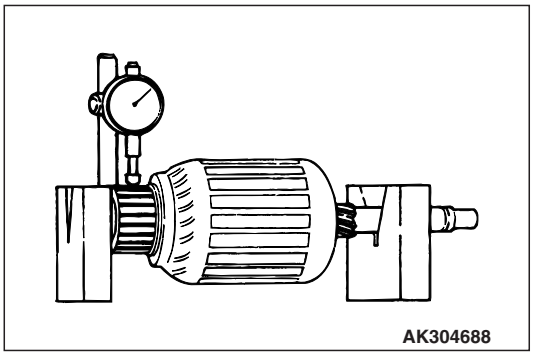


Use a suitable puller to pull the stop ring until it gets over the snap ring.

INSPECTION

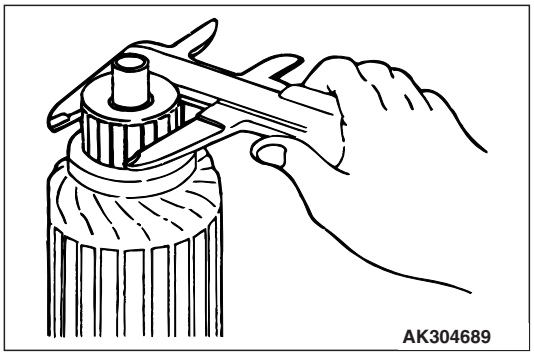
M1162001300793

COMMUTATOR

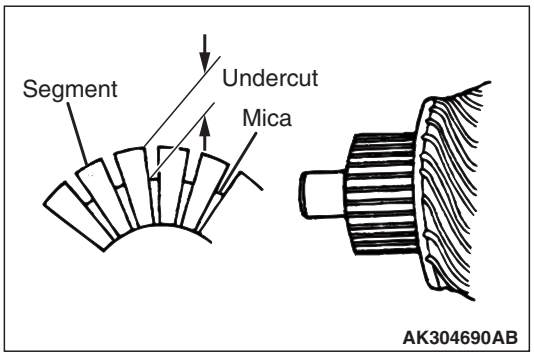


1. Support the armature with a pair of V block and turn it to measure the runout of the surface not rubbed by the brushes using a dial gauge.

   Standard value: 0.05 mm or less
   Limit: 0.1 mm

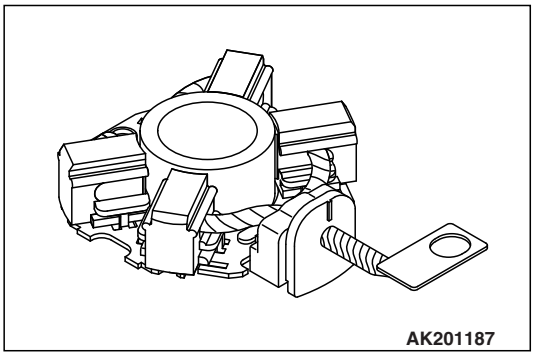


2. Measure the diameter of the commutator.
   Standard value: 29.4 mm
   Limit: 28.8 mm



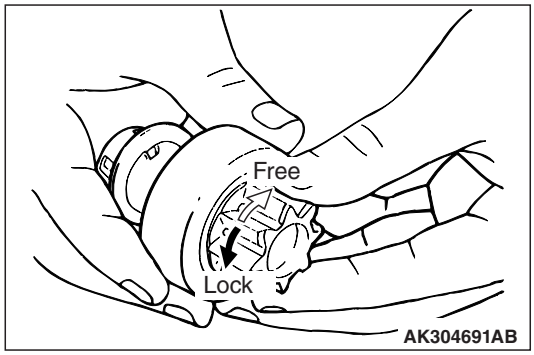
3. Measure the depth of the undercut between segments.
   Standard value: 0.5 mm
   Limit: 0.2 mm

BRUSH HOLDER



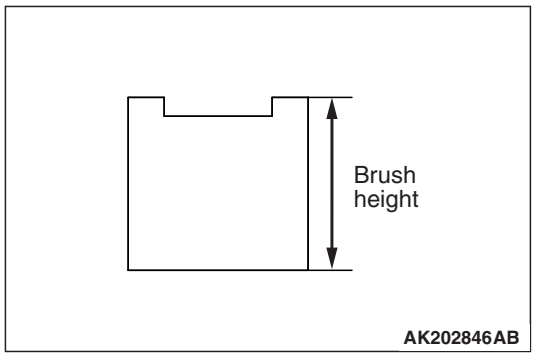
Push the brush into the brush holder to make sure that the spring is working on the brush.
If the spring is not working, replace the brush holder.

OVERRUNNING CLUTCH



1. Make sure that the pinion cannot be turned anti-clockwise and can be turned clockwise freely.
2. Check the pinion for abnormal ware and damage.

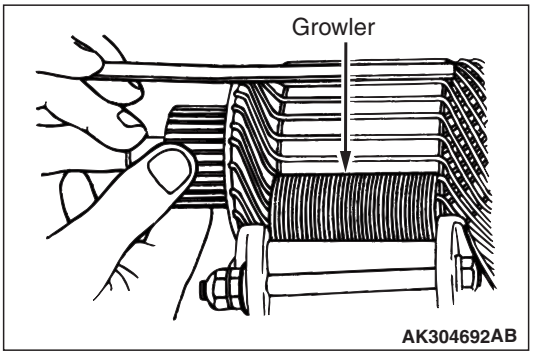
BRUSHES



1. Check the commutator contacting surface of each brush for abnormal roughness. Also check the height of the brush. Replace the brush holder if the height is lower than the limit.
   Limit: 7.0 mm
2. When the contact surface of the brush is rectified or the brush holder is replaced, recondition the contact surface with sandpaper wrapped around the commutator.

ARMATURE COIL

1. Check the armature coil for short circuit as follows.

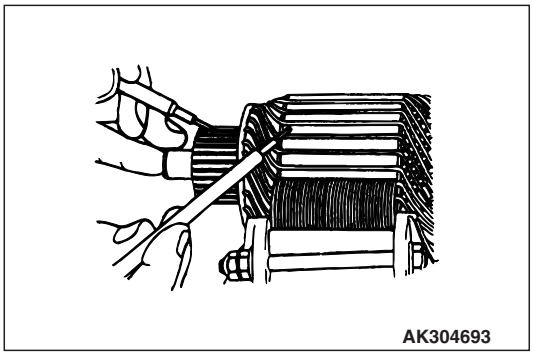


2. Set the armature in a growler.

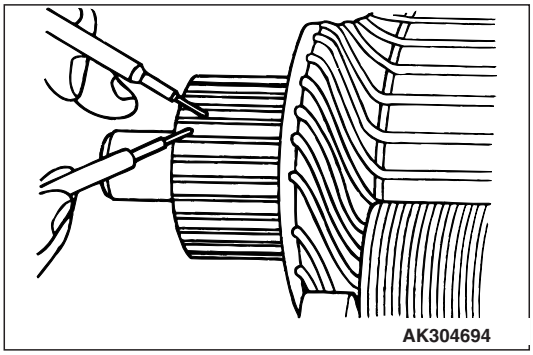
⚠ CAUTION

Clean the surface of the armature thoroughly before performing the test.

3. While holding a thin strip of iron against the armature in parallel with its axis, turn the armature slowly. The armature is normal if the iron strip is not attracted to the armature or it does not vibrate.



4. Check the insulation between commutator segments and armature coils. The armature coils are properly insulated if no continuity is present.



5. Check continuity between a segment and another. There is no open circuit in the tested coil if there is continuity.

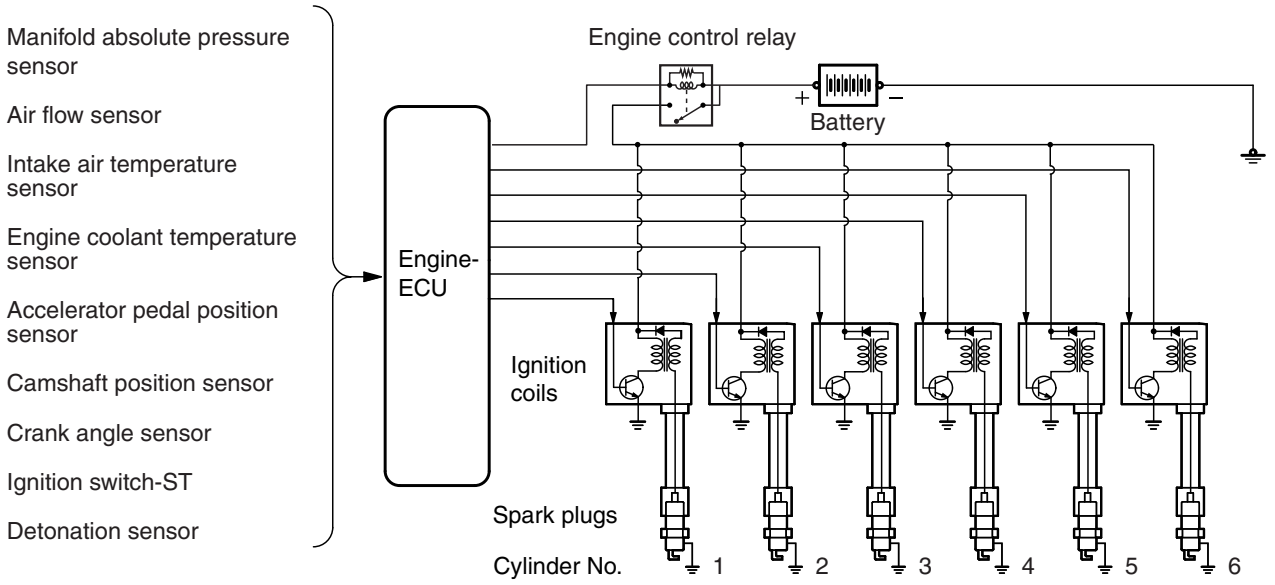
IGNITION SYSTEM

GENERAL INFORMATION

M1163000102096

The service procedures below have been added due to the introduction of 6B3 engine.

SYSTEM DIAGRAM



AK603514AB

- This system is equipped with six ignition coils with built-in power transistors for each of the cylinders.
- The engine-ECU turns the power transistors inside the ignition coils alternately on and off. This causes the primary currents in the ignition coils to be alternately interrupted and allowed to flow to fire the cylinders in the order 1-2-3-4-5-6.

IGNITION COIL SPECIFICATION

Item	6B3
Type	Molded 6-coil

SPARK PLUG SPECIFICATIONS

Item	6B3
NGK	DILKR7C11

SERVICE SPECIFICATIONS

M1163000301763

SPARK PLUG

Item	Standard value	Limit
Spark plug gap mm	1.0 – 1.1	1.3

ON-VEHICLE SERVICE

IGNITION COIL CHECK

M1163001201651

The service procedures are basically the same as those of the conventional vehicle to which 4B1 engine is mounted.

SPARK PLUG CHECK AND CLEANING

M1163004303017

The spark plug has been added due to introduction of 6B3 engine. The service procedures are basically the same as those of the conventional vehicle to which 4B1 engine is mounted.

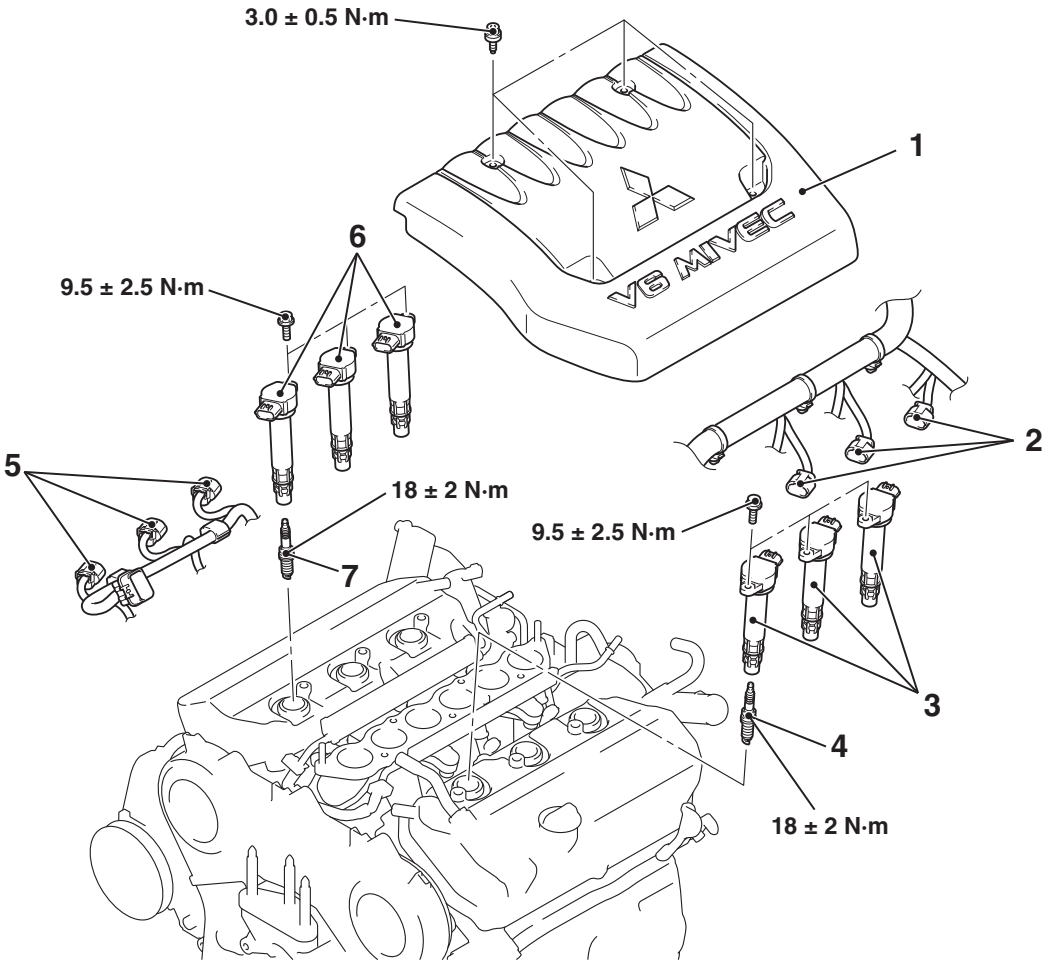
Standard value, limit:

Manufacturer	Type	Standard value (mm)	Limit (mm)
NGK	DILKR7C11	1.0 – 1.1	1.3

IGNITION COIL

REMOVAL AND INSTALLATION

M1163004002381



AC606128AB

Removal steps <Left bank>

1. Engine cover
2. Ignition coil connector connection
3. Ignition coil
4. Spark plug

Removal steps <Right bank>

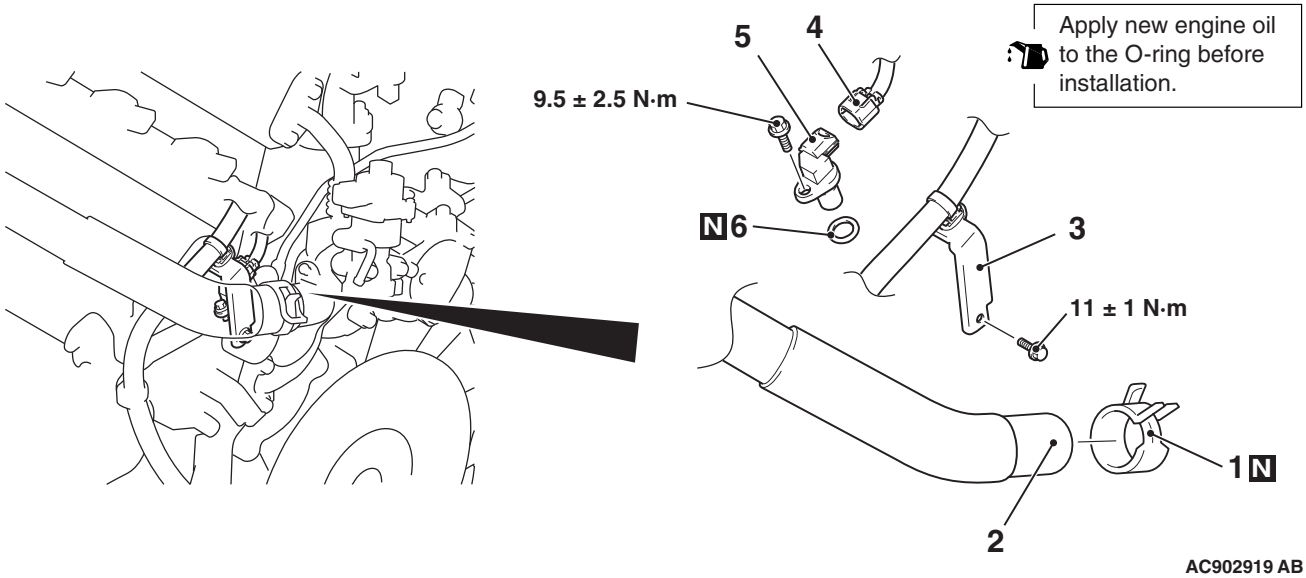
1. Engine cover
- Air intake plenum (Refer to GROUP 15 – Air Intake Plenum P.15-3)
5. Ignition coil connector connection
6. Ignition coil
7. Spark plug

CAMSHAFT POSITION SENSOR

REMOVAL AND INSTALLATION

M1163003402234

Pre-removal Operation	Post-installation Operation
• Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6). • Battery and Battery Tray Removal (Refer to GROUP 54A – Battery).	• Battery and Battery Tray Installation (Refer to GROUP 54A – Battery). • Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6).

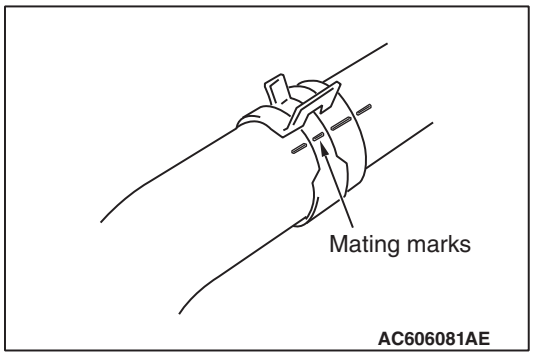


Removal steps

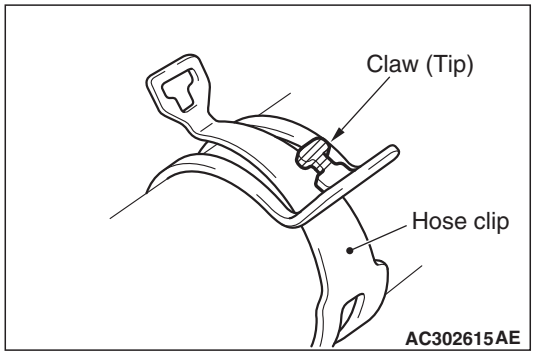
<<A>> >>A<< 1. Hose clip
<<A>> >>A<< 2. Radiator upper hose connection
3. Harness bracket
4. Camshaft position sensor connector connection
5. Camshaft position sensor
6. O-ring

REMOVAL SERVICE POINT

<<A>> HOSE CLIP/RADIATOR UPPER HOSE DISCONNECTION



1. Make mating marks on the radiator upper hose and the hose clip as shown to install them in the original position.

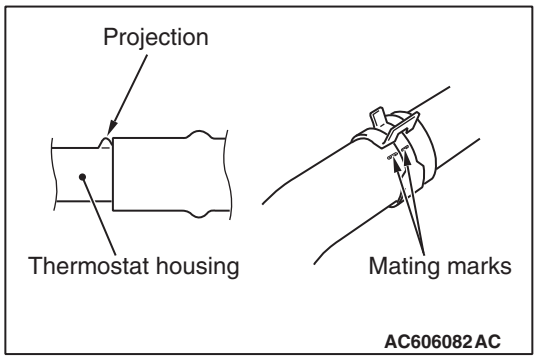


2. Break off the tip of hose clip claw and spread out the hose clip, then disconnect the radiator upper hose.

NOTE: If there is a hose clip claw, the hose clip cannot spread to capacity because the claw contacts the hose clip.

INSTALLATION SERVICE POINT

>>A<< RADIATOR UPPER HOSE/HOSE CLIP INSTALLATION

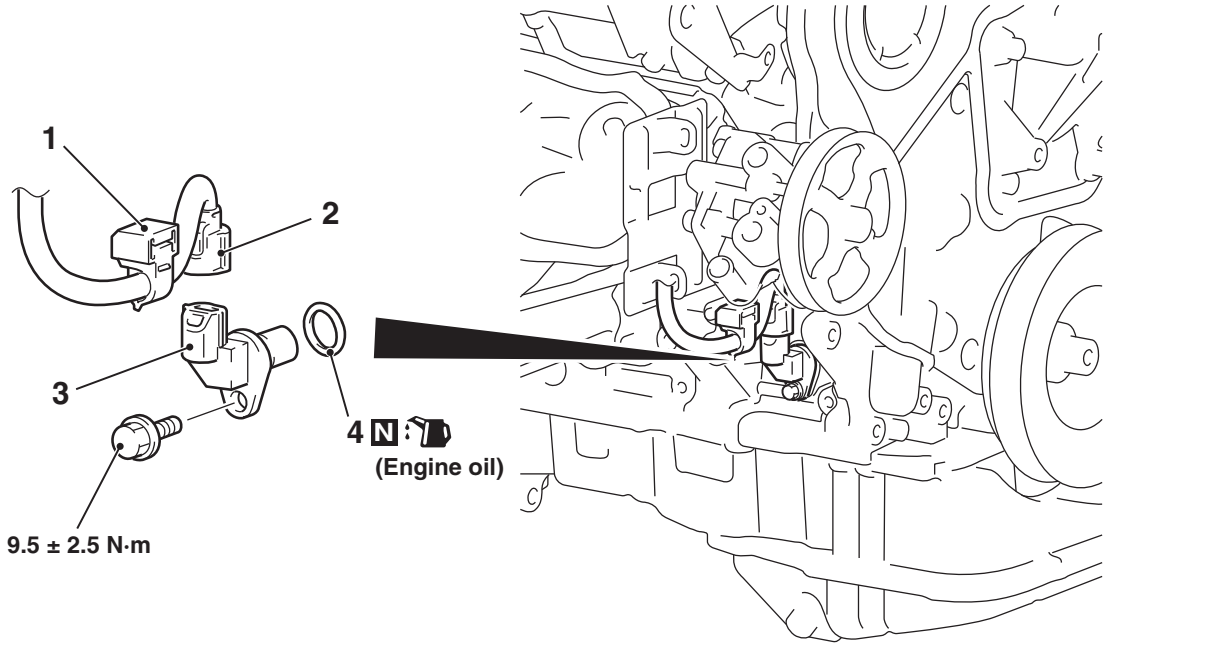


1. Insert radiator upper hose as far as the projection of the thermostat housing.
2. Align the mating marks on the radiator upper hose and hose clip.
3. Remove the hose clip claw and shorten the hose clip, then install the radiator upper hose.

CRANK ANGLE SENSOR

REMOVAL AND INSTALLATION

M1163004801782



Removal steps

1. Harness clamp
2. Crank angle sensor connector connection

Removal steps (Continued)

3. Crank angle sensor
4. O-ring

DETONATION SENSOR

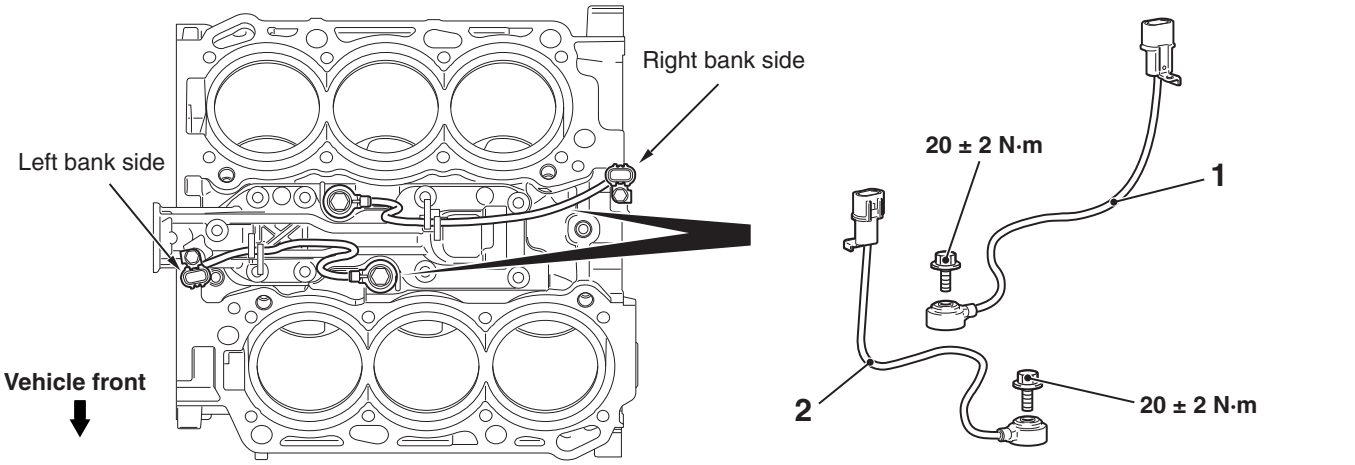
REMOVAL AND INSTALLATION

M1163002802972

⚠ CAUTION

- **When the detonation sensor is replaced, initialise the learned value using M.U.T.-III (Refer to GROUP 00 – Precautions before Service, Initialisation Procedure for Learning Value in MPI Engine P.00-7).**
- **Do not drop or hit the detonation sensor against other components. Internal damage may result, and the detonation sensor will need to be replaced.**

Pre-removal and Post-installation Operation
- Inlet Manifold Removal and Installation (Refer to GROUP 15 – Inlet Manifold P.15-5).



AC606131AB

Removal steps
1. Right bank detonation sensor
2. Left bank detonation sensor

GROUP 17

ENGINE AND EMISSION CONTROL

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ENGINE CONTROL

GENERAL INFORMATION

M1171000101634

The service procedure is basically the same as for vehicles with 4B1 engine.

CRUISE CONTROL

GENERAL INFORMATION

M1172000101875

The service procedure is basically the same as for vehicles with 4B1 engine.

EMISSION CONTROL <MPI>

GENERAL INFORMATION

M1173000102194

OUTLINE OF CHANGE

The service procedures have been added due to introduction of 6B3 engine. The following change is made. The other service procedures are the same as those of the conventional vehicle to which 4B1 engine is mounted.

Items	Name	Specification
Emission reduction control system	Exhaust gas recirculation system • Exhaust gas recirculation valve	Equipped Stepper motor type (Purpose: NOx reduction)

SERVICE SPECIFICATION(S)

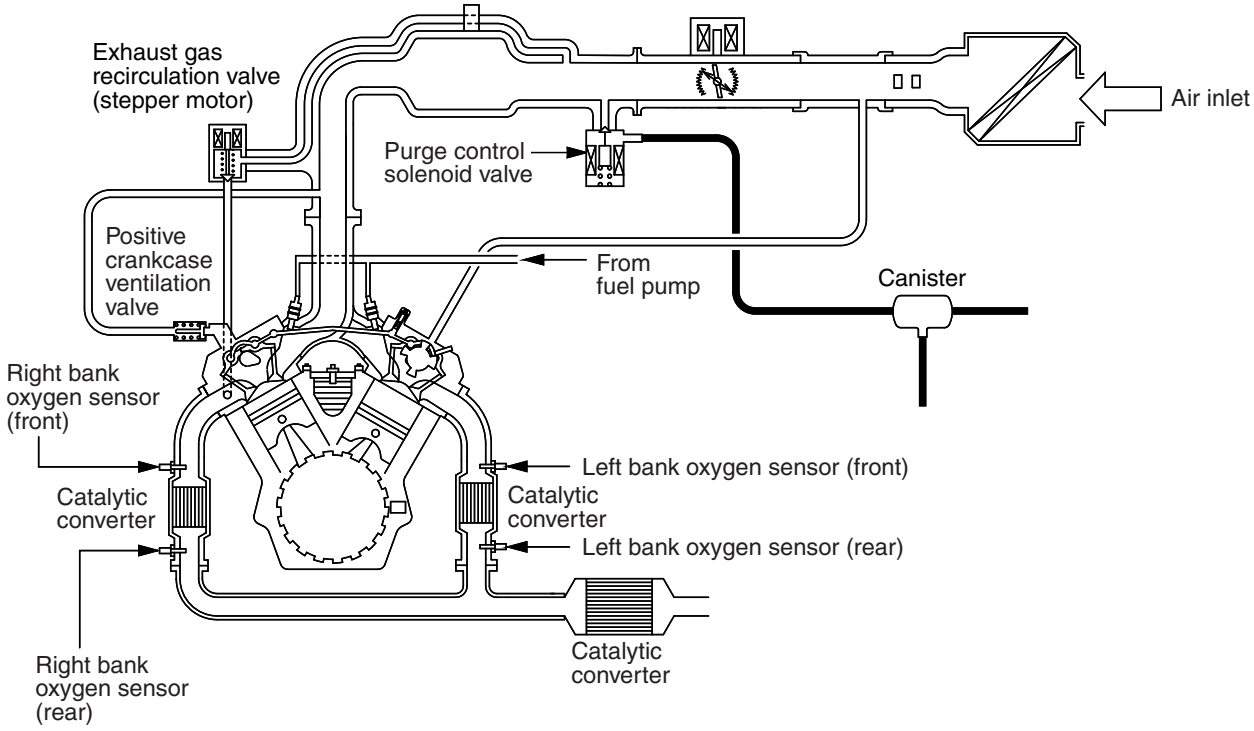
M1173000301689

Item	Standard value
Exhaust gas recirculation valve (stepper motor) coil resistance (at 20°C) Ω	20 – 24

VACUUM HOSE

VACUUM HOSE PIPING DIAGRAM

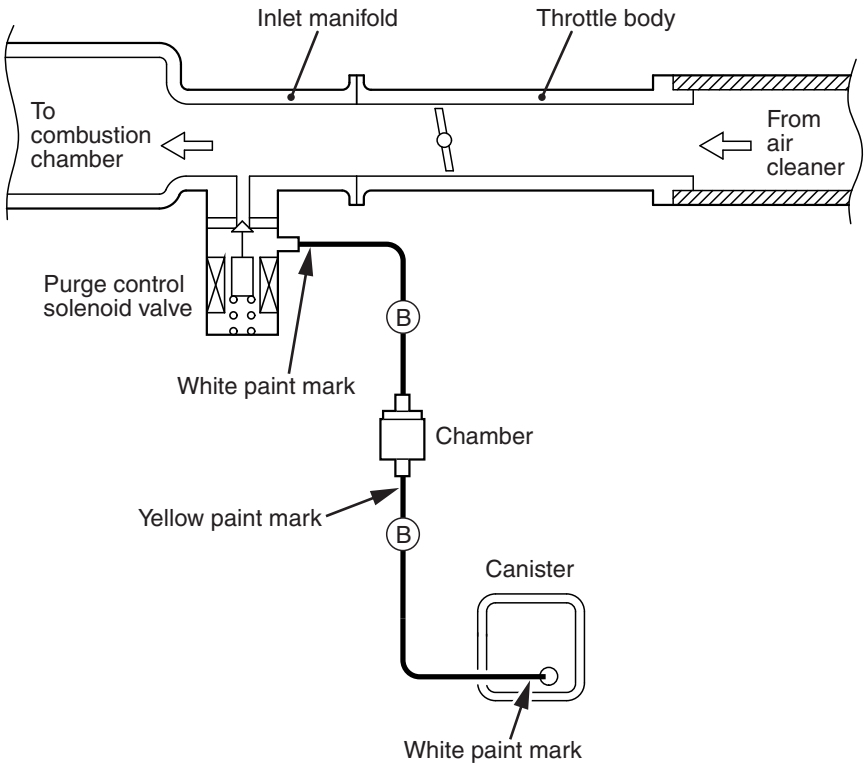
M1173000902372



AKD00115AB

VACUUM CIRCUIT DIAGRAM

M1173007101705



Vacuum hose colour
B: Black

AK900119AB

VACUUM HOSE CHECK

M1173007301129

1. Using the vacuum circuit diagram as a guide, check to be sure that the vacuum hoses are correctly connected.
2. Check the connection condition of the vacuum hoses which can be removed, loosened, clogged possibly. And then check whether there are no folded and damaged vacuum hoses.

VACUUM HOSE INSTALLATION

M1173007200765

1. When connecting the vacuum hoses, they should be securely inserted onto the nipples.
2. Connect the hoses correctly, using the vacuum circuit diagram as a guide.

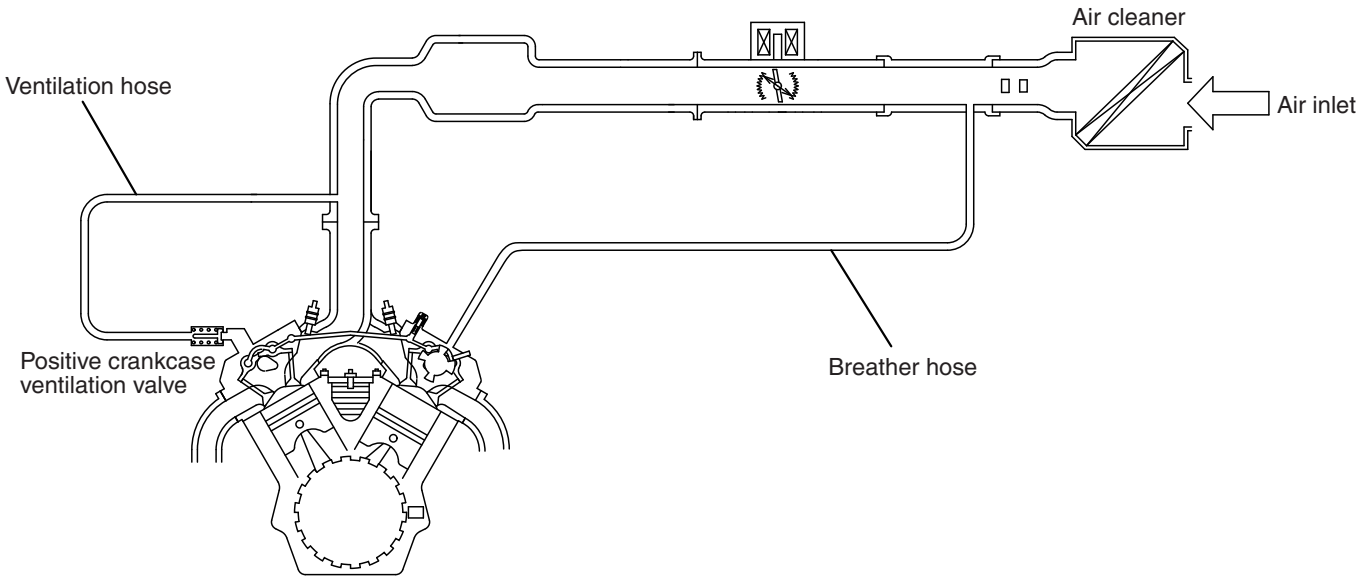
CRANKCASE EMISSION CONTROL SYSTEM

GENERAL INFORMATION (CRANKCASE EMISSION CONTROL SYSTEM)

M1173005001821

The service procedures have been added due to introduction of 6B3 engine. The other service procedures are basically the same as those of the conventional vehicle to which 4B1 engine is mounted.

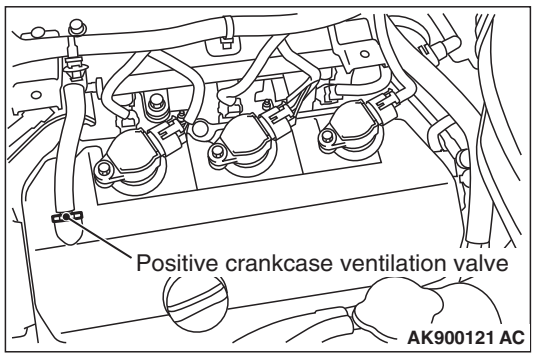
SYSTEM DIAGRAM



AK900120AB

COMPONENT LOCATION (CRANKCASE EMISSION CONTROL SYSTEM)

M1173007401308



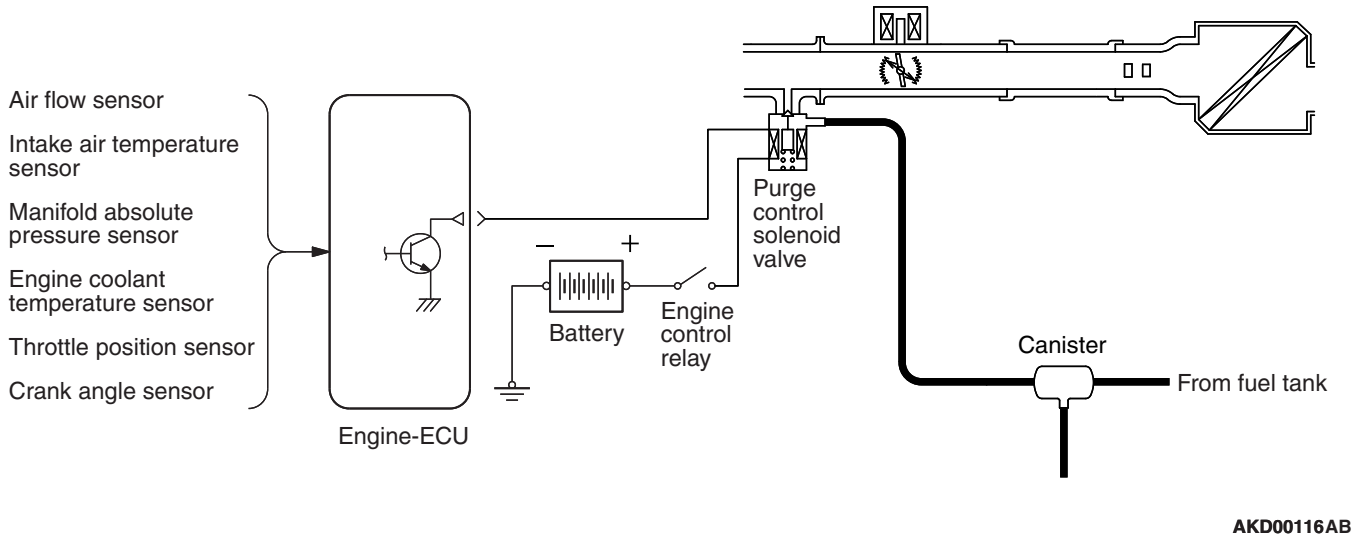
EVAPORATIVE EMISSION CONTROL SYSTEM

GENERAL INFORMATION (EVAPORATIVE EMISSION CONTROL SYSTEM)

M1173005102144

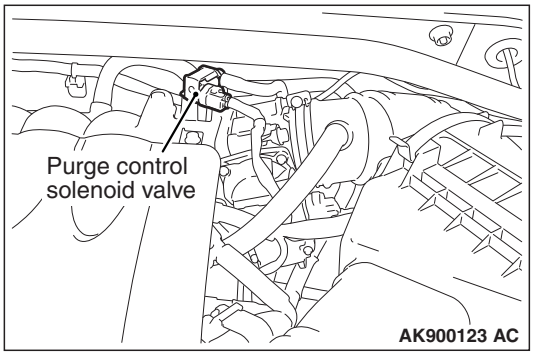
The service procedures have been added due to introduction of 6B3 engine. The other service procedures are basically the same as those of the conventional vehicle to which 4B1 engine is mounted.

SYSTEM DIAGRAM



COMPONENT LOCATION (EVAPORATIVE EMISSION CONTROL SYSTEM)

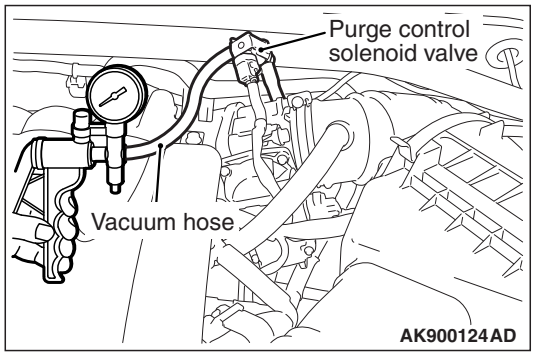
M1173007501242



PURGE CONTROL SYSTEM CHECK

M1173001401924

1. Remove the purge control solenoid valve from the inlet manifold, and cover the installation hole with tape and so on.



2. Connect the hand vacuum pump with the removed purge control solenoid valve.

3. When the engine is cold or hot, apply a vacuum of 53 kPa, and check the condition of the vacuum.

When engine is cold
(Engine coolant temperature: 40°C or less)

Engine condition	Normal condition
At idle	Vacuum is maintained.

When engine is hot
(Engine coolant temperature: 80°C or higher)

Engine condition	Normal condition
At idle (after 4 minutes have passed since the engine was started)	Vacuum will leak.

REMOVAL AND INSTALLATION

M1173004201725

The service procedure is basically the same as for vehicles with 4B1 engine.

EXHAUST GAS RECIRCULATION (EGR) VALVE

GENERAL INFORMATION (EXHAUST GAS RECIRCULATION SYSTEM)

M1173005201580

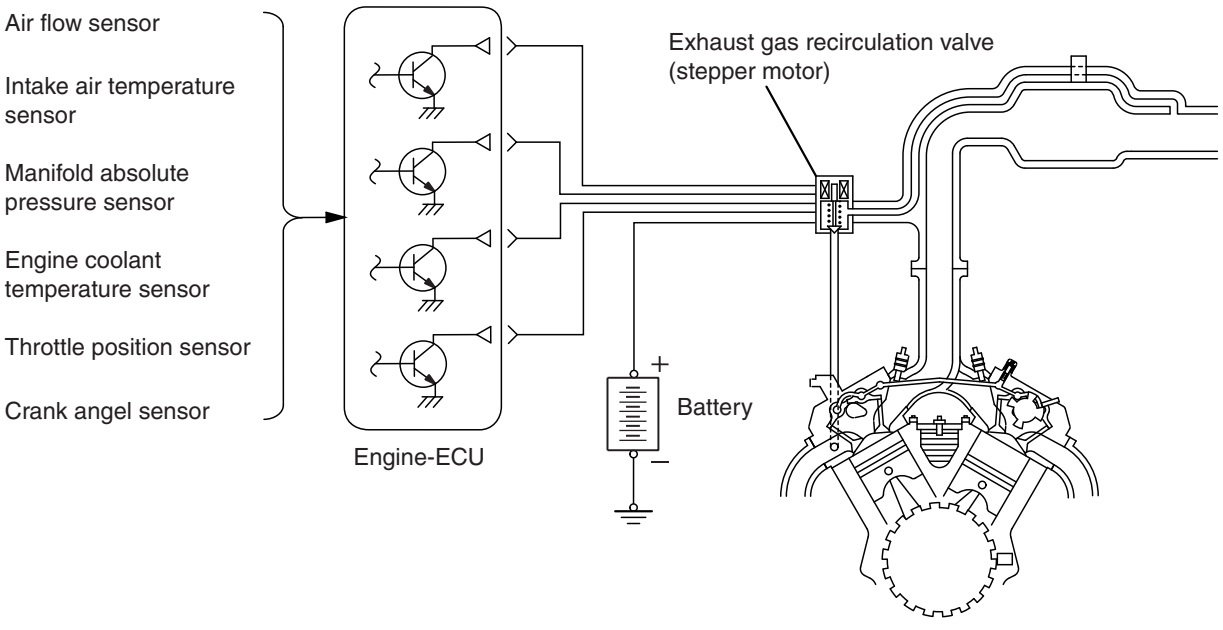
The exhaust gas recirculation system lowers the nitrogen oxide (NOx) emission level.
When the air/fuel mixture combustion temperature is high, a large quantity of nitrogen oxides (NOx) is generated in the combustion chamber.
Therefore, this system recirculates part of emission gas from the exhaust port of the cylinder head to the combustion chamber through the inlet manifold to decrease the air/fuel mixture combustion temperature, resulting in reduction of NOx.
The exhaust gas recirculation flow rate is controlled by the exhaust gas recirculation valve so as not to decrease the driveability.

OPERATION

The exhaust gas recirculation valve is being closed and does not recirculate exhaust gases under one of the following conditions.
Otherwise, the exhaust gas recirculation valve is opened and recirculates exhaust gases.

- The engine coolant temperature is low.
- The engine is at idle.
- The throttle valve is widely opened.

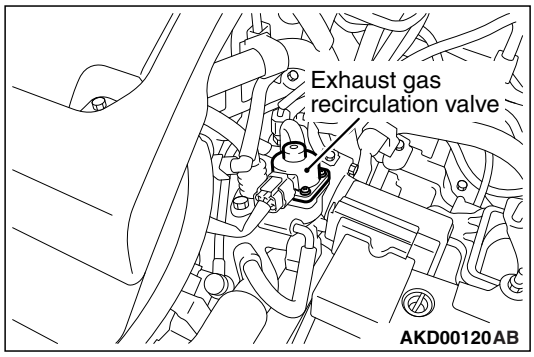
SYSTEM DIAGRAM



AK900125AB

COMPONENT LOCATION (EXHAUST GAS RECIRCULATION SYSTEM)

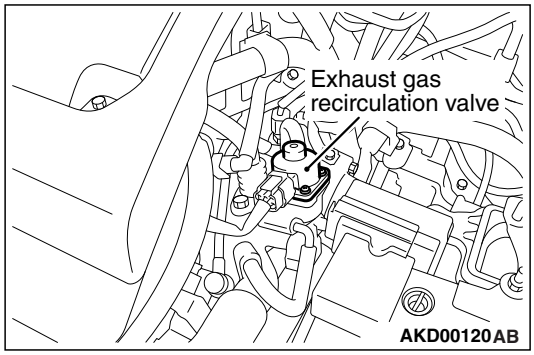
M1173007601023



EXHAUST GAS RECIRCULATION VALVE (STEPPER MOTOR) CHECK

M1173050200996

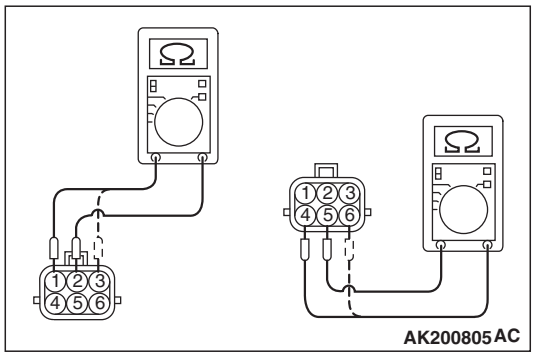
CHECKING THE OPERATION SOUND



1. Check that the operation sound of the stepper motor can be heard from the exhaust gas recirculation valve when the ignition switch is turned ON (without starting the engine).
2. If the operation sound cannot be heard, inspect the drive circuit of the stepper motor.

NOTE: If the circuit is normal, either the stepper motor or the engine-ECU may have failed.

CHECKING THE COIL RESISTANCE



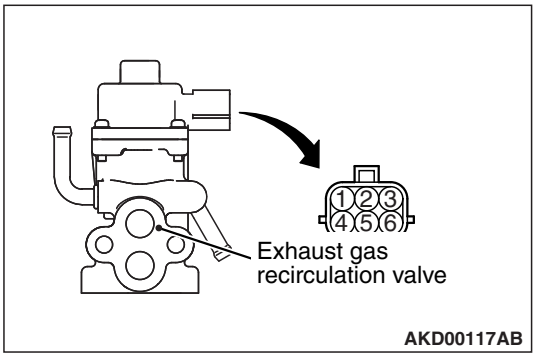
1. Remove the exhaust gas recirculation valve.
2. Measure the resistance between terminal No. 2 and either terminal No. 1 or terminal No. 3 of the connector at the exhaust gas recirculation valve.

   Standard value: 20 – 24 Ω (at 20°C)
3. Measure the resistance between terminal No. 5 and either terminal No. 6 or terminal No. 4 of the connector at the exhaust gas recirculation valve.

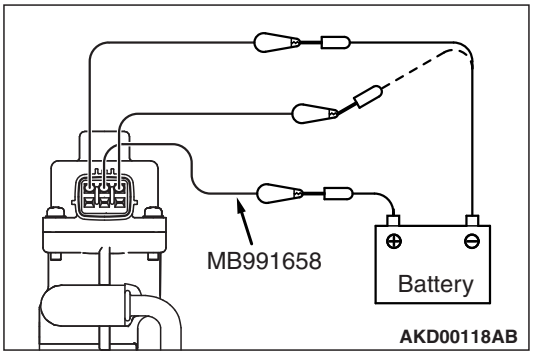
   Standard value: 20 – 24 Ω (at 20°C)
4. If the voltage deviates from the standard value, replace the exhaust gas recirculation valve.

NOTE: For removal and installation of the exhaust gas recirculation valve (Refer to P.17-10).

OPERATION CHECK



1. Remove the exhaust gas recirculation valve.
2. Attach a special tool test harness (MB991658) to the connector at the exhaust gas recirculation valve.



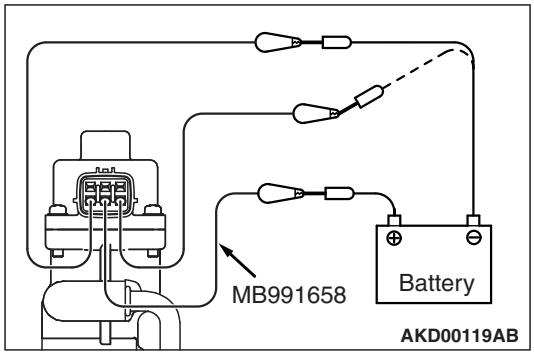
⚠ CAUTION
Connecting battery voltage to the exhaust gas recirculation valve for a long term could damage the coil.

3. Connect the positive (+) terminal of the battery to terminal No. 2.

4. Connect terminals No. 1 and No. 3 to the negative (–) terminal of the battery, in order to test whether the stepper motor vibrates (with a slight shudder), indicating that the stepper motor is operating.

⚠ CAUTION

Connecting battery voltage to the exhaust gas recirculation valve for a long term could damage the coil.



5. Connect the positive (+) terminal of the battery to terminal No. 5.
6. Connect terminals No. 4 and No. 6 to the negative (–) terminal of the battery, in order to test whether the stepper motor vibrates (with a slight shudder), indicating that the stepper motor is operating.
7. If a vibration can be felt during the test, the stepper motor is normal.
8. Install the exhaust gas recirculation valve (Refer to P.17-10).

CLEANING THE EXHAUST GAS RECIRCULATION VALVE

⚠ CAUTION

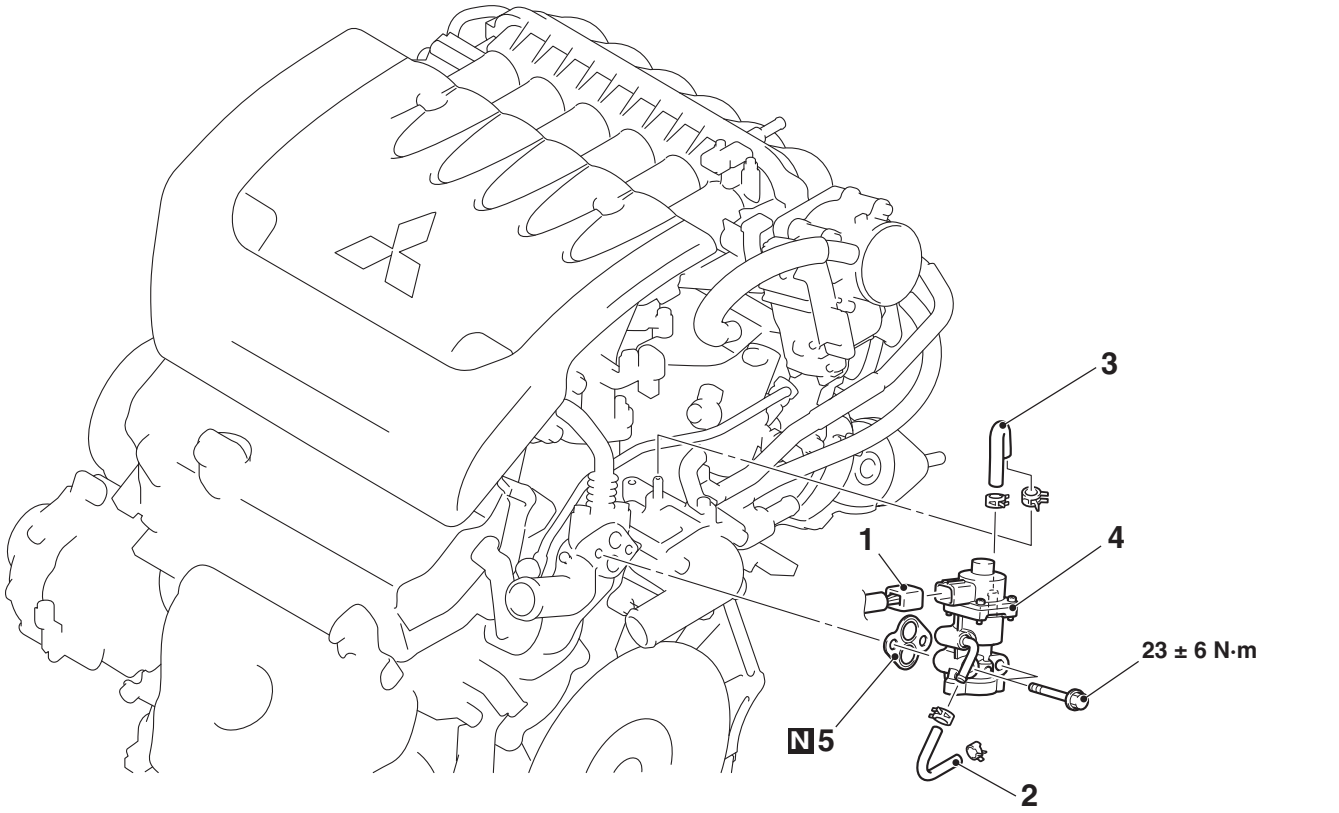
Do not use a solvent or detergent, which could enter the motor and cause it to malfunction.

1. Remove the exhaust gas recirculation valve and check that the exhaust gas recirculation valve is not stuck or clogged with carbon deposits. Use a wire brush to clean the valve if necessary.
2. Install the exhaust gas recirculation valve (Refer to P.17-10).

REMOVAL AND INSTALLATION

M1173010501587

Pre-removal Operation	Post-installation Operation
• Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6). • Air Cleaner Intake Hose and Air Cleaner Assembly Removal (Refer to GROUP 15 – Air Cleaner P.15-11).	• Air Cleaner Intake Hose and Air Cleaner Assembly Installation (Refer to GROUP 15 – Air Cleaner P.15-11). • Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement P.14-6).

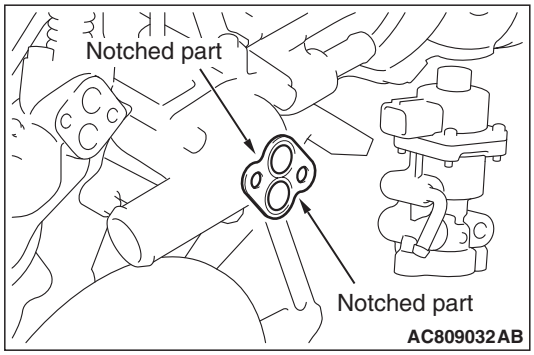


Removal steps

1. EGR valve connector connection
2. Water hose
3. Water hose
4. EGR valve
>>A<< 5. EGR valve gasket

INSTALLATION SERVICE POINT

>>A<< EGR VALVE GASKET INSTALLATION



Install the EGR valve gasket as shown in the illustration.

CATALYTIC CONVERTER

REMOVAL AND INSTALLATION

M1173003901969

The catalytic converter is integrated with the exhaust manifold and centre exhaust pipe. The removal and installation is the same as exhaust manifold (Refer to GROUP 15 – Exhaust Manifold P.15-8) and centre exhaust pipe (Refer to GROUP 15 – Exhaust Pipe and Main Muffler P.15-13).

GROUP 23

AUTOMATIC TRANSMISSION (FF)

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AUTOMATIC TRANSMISSION (FF) 23C

AUTOMATIC TRANSMISSION OVERHAUL 23D

NOTES

GROUP 23C

AUTOMATIC TRANSMISSION (FF)

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- A/T FLUID CHANGE 23C-15

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TRANSFER ASSEMBLY 23C-20
- REMOVAL AND INSTALLATION 23C-20

A/T FLUID COOLER LINE 23C-21
- REMOVAL AND INSTALLATION 23C-21

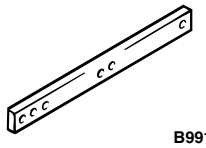
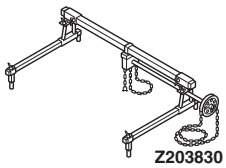
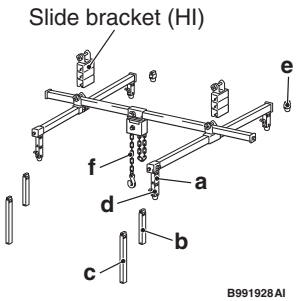
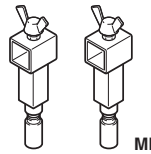
GENERAL INFORMATION

M1231000100894

The service procedures below have been added due to the introduction of 6B3 engine. The other service procedures are the same as vehicles with 4N1 engine.

SPECIAL TOOLS

M1231000601159

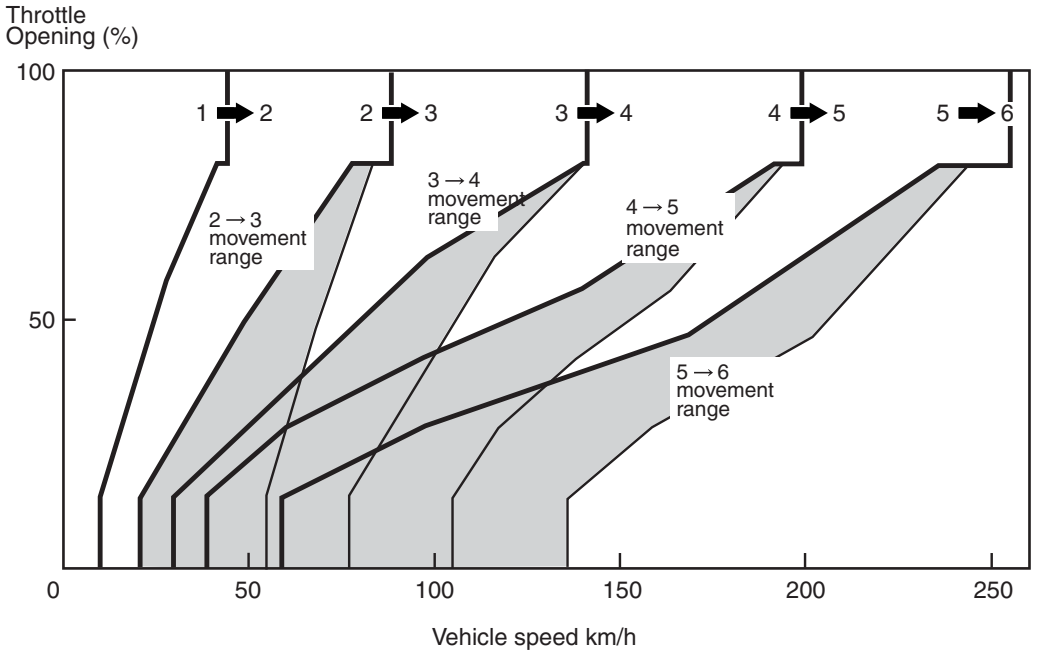
Tool	Number	name	Use
 MB992208	MB992208	Engine hanger plate A	Supporting the engine assembly during removal and installation of the transmission assembly
 B991454	MB991454	Engine hanger balancer	When the engine hanger is used: Supporting the engine assembly during removal and installation of the transmission assembly *NOTE: Special tool MB991454 is a part of engine hanger attachment set MB991453.*
 B991527	MB991527	Hanger	
 Z203830	MB991895	Engine hanger	
 B991928AI	MB991928 a: MB991929 b: MB991930 c: MB991931 d: MB991932 e: MB991933 f: MB991934	Engine hanger a: Joint (50) x 2 b: Joint (90) x 2 c: Joint (140) x 2 d: Foot (standard) x 4 e: Foot (short) x 2 f: Chain and fork assembly	
 MB992906	MB992906	Engine hanger attachment	

TROUBLESHOOTING

SHIFT PATTERN

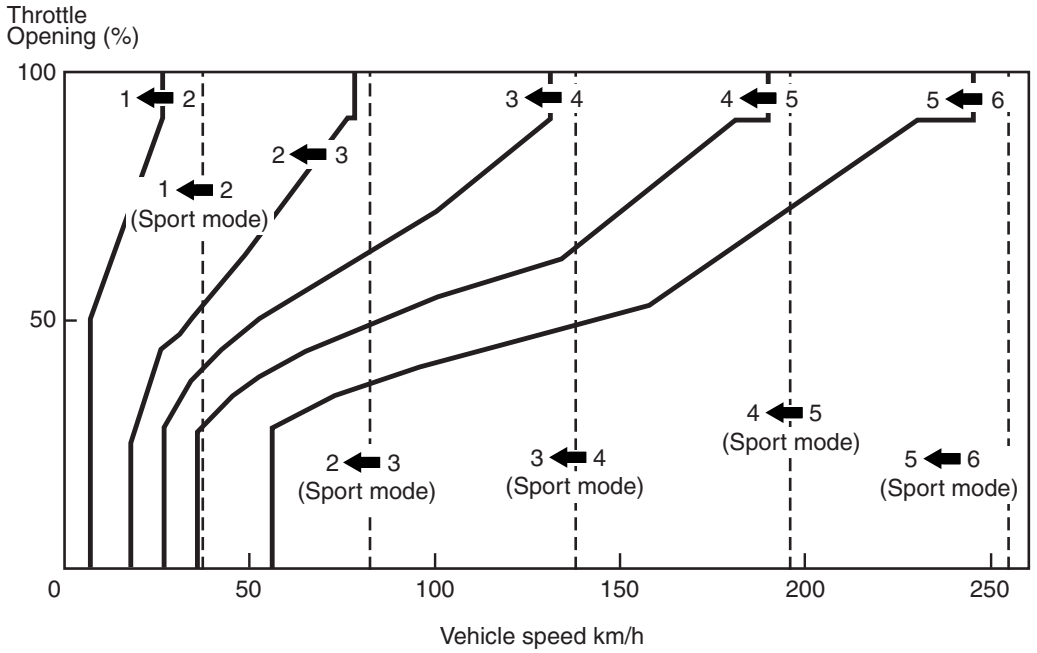
M1231028400664

UPSHIFT PATTERN



ACD01165AB

DOWNSHIFT PATTERN

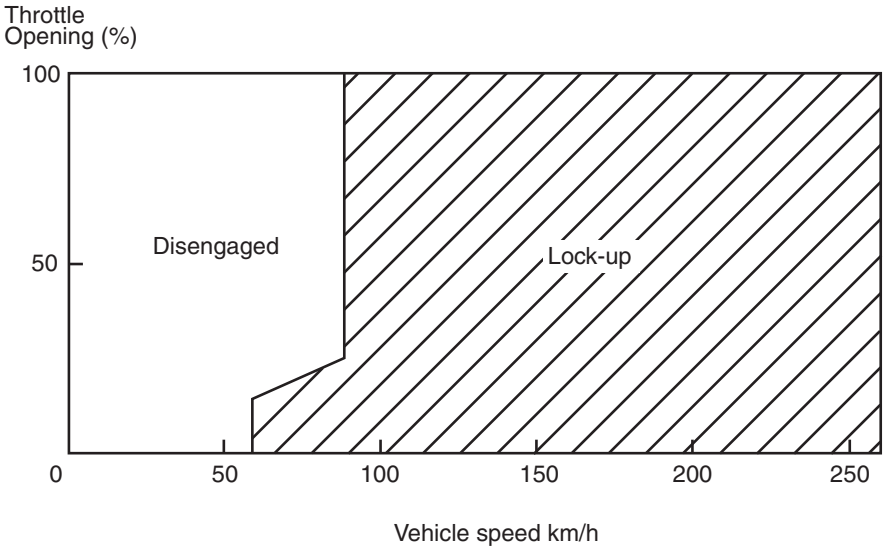


ACD01166AB

DAMPER CLUTCH CONTROL

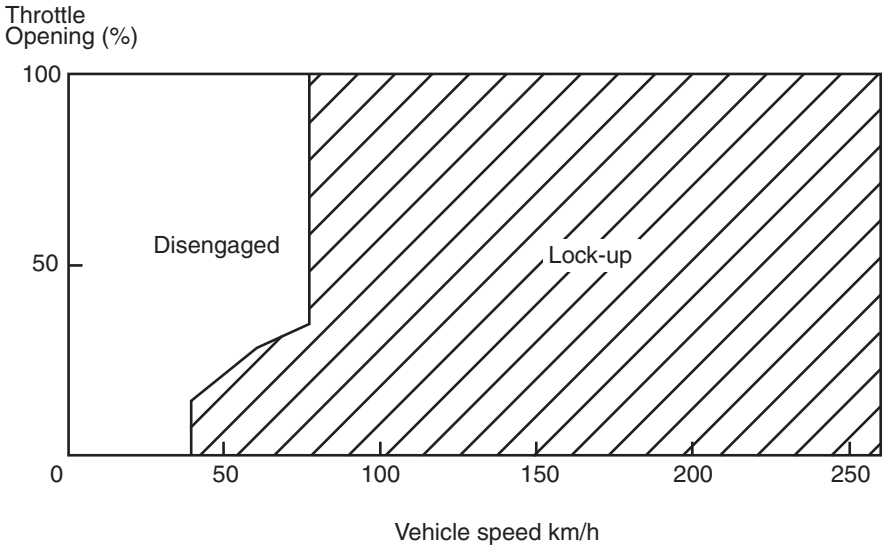
M1231021300417

In 6th range



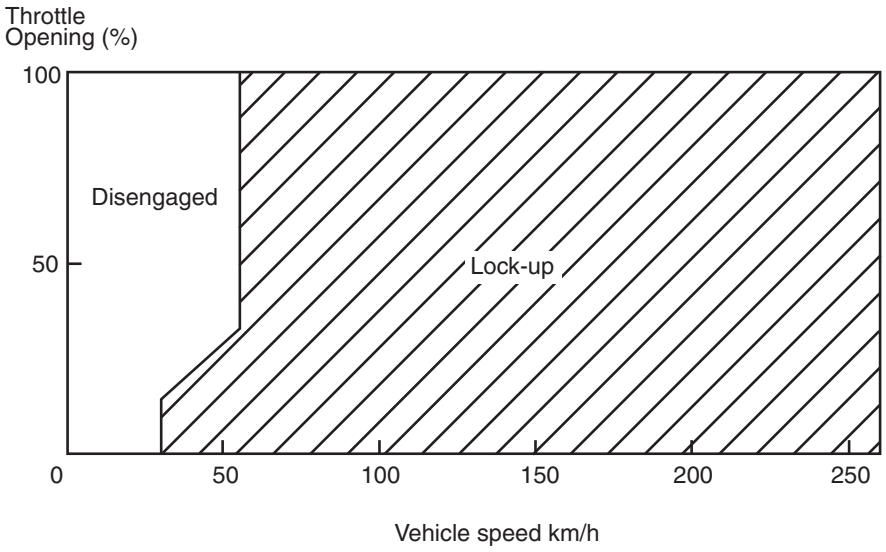
ACD01167AB

In 5th range



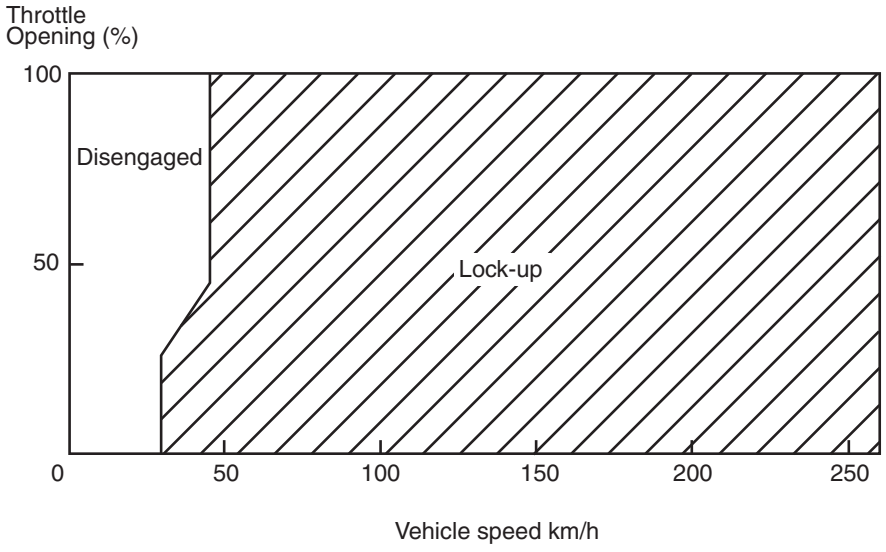
ACD01168AB

In 4th range



ACD01169AB

In 3rd range



ACD01170AB

CHECK CHART FOR DIAGNOSIS CODES

M1231007901021

The numbers of some diagnosis codes have been renewed.

The diagnosis codes listed below have been discontinued.

- P0703: Stoplight switch malfunction
- P0743: Lock-up and Low-reverse brake linear solenoid valve system
- P0748: Line pressure linear solenoid valve system
- P0753: Low clutch linear solenoid valve system
- P0758: 2-6 brake linear solenoid valve system
- P0763: 3-5 reverse clutch linear solenoid valve system
- P0768: High clutch linear solenoid valve system
- P1731: 1st engine brake detection
- P1753: Low clutch shift solenoid valve system
- P1758: Low-reverse brake shift solenoid valve system

⚠ CAUTION

During diagnosis, a diagnosis code associated with other system may be set when the ignition switch is turned on with connector(s) disconnected. On completion, confirm all systems for diagnosis code(s). If diagnosis code(s) are set, erase them all.

Diagnosis code No.	Diagnosis item		Reference page
P0962	Line pressure linear solenoid valve system	Short circuit	P.23C-7
P0963		Open circuit	
P0973	Low clutch linear solenoid valve system	Short circuit	P.23C-8
P0974		Open circuit	
P0976	2-6 brake linear solenoid valve system	Short circuit	P.23C-9
P0977		Open circuit	
P0979	3-5 reverse clutch linear solenoid valve system	Short circuit	P.23C-10
P0980		Open circuit	
P0982	High clutch linear solenoid valve system	Short circuit	P.23C-11
P0983		Open circuit	
P0998	Low clutch shift solenoid valve system	Short circuit	P.23C-12
P0999		Open circuit	
P099B	Low-reverse brake shift solenoid valve system	Short circuit	P.23C-13
P099C		Open circuit	
P2763	Lock-up and Low-reverse brake linear solenoid valve system	Open circuit	P.23C-14
P2764		Short circuit	

DIAGNOSIS CODE PROCEDURES

Code No. P0962: Line Pressure Linear Solenoid Valve System (Short circuit)
Code No. P0963: Line Pressure Linear Solenoid Valve System (Open circuit)

DIAGNOSIS CODE SET CONDITIONS

- With the ignition switch ON, an abnormal value equivalent to short circuit is detected in the solenoid control current for 1 second. <P0962>
- With the ignition switch ON, an abnormal value equivalent to open circuit is detected in the solenoid control current for 5 seconds. <P0963>

PROBABLE CAUSES

- Malfunction of the line pressure linear solenoid valve system circuit
- Damaged harness or connector
- Malfunction of the A/T-ECU
- Malfunction of the line pressure linear solenoid valve (valve body assembly)

DIAGNOSIS PROCEDURE

STEP 1. Check the A/T-ECU terminal voltage.
[A/T-ECU connector (harness side, connected)]
Measure the voltage between the PLLS terminal and body earth.

- While driving: 300 Hz
- Other than above: 0 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 2.

STEP 2. Check for continuity in PLLS line between the A/T-ECU connector and A/T control solenoid valve assembly connector.
When the continuity check result is OK, check that the wiring harness is not shorted to the body and other wiring harness.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check the line pressure linear solenoid.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check for continuity in signal line between the A/T control solenoid valve assembly connector and the line pressure linear solenoid valve connector.

Q: Is the check result satisfactory?
YES : Replace the valve body assembly.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the failure section.

STEP 6. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Replace the A/T-ECU.
NO : Repair or replace the failure section.

STEP 7. Erase the diagnosis code, and drive the vehicle for a while.
Check that the normal code is displayed.

Q: Is the check result normal?
YES : The procedure is complete.
NO : Return to Step 1.

Code No. P0973: Low Clutch Linear Solenoid Valve System (Short circuit)
Code No. P0974: Low Clutch Linear Solenoid Valve System (Open circuit)

DIAGNOSIS CODE SET CONDITIONS

- During 1st gear driving or 4th gear driving, an abnormal value equivalent to short circuit is detected in the solenoid control current for 1 second. <P0973>
- During 1st gear driving or 4th gear driving, an abnormal value equivalent to open circuit is detected in the solenoid control current for 5 seconds. <P0974>

PROBABLE CAUSES

- Malfunction of the low clutch linear solenoid valve system circuit
- Damaged harness or connector
- Malfunction of the A/T-ECU
- Malfunction of the low clutch linear solenoid valve (valve body assembly)

DIAGNOSIS PROCEDURE

STEP 1. Check the A/T-ECU terminal voltage.
[A/T-ECU connector (harness side, connected)]
Measure the voltage between the LOLS terminal and body earth.

- Low clutch engaged: 300 Hz
- Other than above: 0 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 2.

STEP 2. Check for continuity in LOLS line between the A/T-ECU connector and A/T control solenoid valve assembly connector.
When the continuity check result is OK, check that the wiring harness is not shorted to the body and other wiring harness.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check the low clutch linear solenoid.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check for continuity in signal line between the A/T control solenoid valve assembly connector and the low clutch linear solenoid valve connector.

Q: Is the check result satisfactory?
YES : Replace the valve body assembly.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the failure section.

STEP 6. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Replace the A/T-ECU.
NO : Repair or replace the failure section.

STEP 7. Erase the diagnosis code, and drive the vehicle for a while.
Check that the normal code is displayed.

Q: Is the check result normal?
YES : The procedure is complete.
NO : Return to Step 1.

Code No. P0976: 2-6 Brake Linear Solenoid Valve System (Short circuit)
Code No. P0977: 2-6 Brake Linear Solenoid Valve System (Open circuit)

DIAGNOSIS CODE SET CONDITIONS

- During 2nd or 6th gear driving, an abnormal value equivalent to short circuit is detected in the solenoid control current for 1 second. <P0976>
- During 2nd or 6th gear driving, an abnormal value equivalent to open circuit is detected in the solenoid control current for 5 seconds. <P0977>

PROBABLE CAUSES

- Malfunction of the 2-6 brake linear solenoid valve system circuit
- Damaged harness or connector
- Malfunction of the A/T-ECU
- Malfunction of the 2-6 brake linear solenoid valve (valve body assembly)

DIAGNOSIS PROCEDURE

STEP 1. Check the A/T-ECU terminal voltage.
[A/T-ECU connector (vehicle side, connected)]
Measure the voltage between the 26LS terminal and body earth.

- 2-6 brake engaged (2nd and 6th gear): 300 Hz
- Other than above: 0 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 2.

STEP 2. Check for continuity in 26LS line between the A/T-ECU connector and A/T control solenoid valve assembly connector.
When the continuity check result is OK, check that the wiring harness is not shorted to the body and other wiring harness.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check the 2-6 brake linear solenoid.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check for continuity in signal line between the A/T control solenoid valve assembly connector and the 2-6 brake linear solenoid valve connector.

Q: Is the check result satisfactory?
YES : Replace the valve body assembly.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the failure section.

STEP 6. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Replace the A/T-ECU.
NO : Repair or replace the failure section.

STEP 7. Erase the diagnosis code, and drive the vehicle for a while.
Check that the normal code is displayed.

Q: Is the check result normal?
YES : The procedure is complete.
NO : Return to Step 1.

Code No. P0979: 3-5 Reverse Clutch Linear Solenoid Valve System (Short circuit)
Code No. P0980: 3-5 Reverse Clutch Linear Solenoid Valve System (Open circuit)

DIAGNOSIS CODE SET CONDITIONS

- During the 1st, 2nd, 4th, and 6th gear driving, an abnormal value equivalent to short circuit is detected in the solenoid control current for 1 second. <P0979>
- During the 1st, 2nd, 4th, and 6th gear driving, an abnormal value equivalent to open circuit is detected in the solenoid control current for 5 seconds. <P0980>

PROBABLE CAUSES

- Malfunction of the 3-5 reverse clutch linear solenoid valve system circuit
- Damaged harness or connector
- Malfunction of the A/T-ECU
- Malfunction of the 3-5 reverse clutch linear solenoid valve (valve body assembly)

DIAGNOSIS PROCEDURE

STEP 1. Check the A/T-ECU terminal voltage.
[A/T-ECU connector (harness side, connected)]
Measure the voltage between 35LS terminal and body earth.

- When 3-5 reverse clutch engaged. (3rd, 5th, and reverse): 0 V
- Other than above: 300 Hz

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 2.

STEP 2. Check for continuity in 35LS line between the A/T-ECU connector and A/T control solenoid valve assembly connector.
When the continuity check result is OK, check that the wiring harness is not shorted to the body and other wiring harness.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check the 3-5 reverse clutch linear solenoid.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check for continuity in signal line between the A/T control solenoid valve assembly connector and the 3-5 reverse clutch linear solenoid valve connector.

Q: Is the check result satisfactory?
YES : Replace the valve body assembly.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the failure section.

STEP 6. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Replace the A/T-ECU.
NO : Repair or replace the failure section.

STEP 7. Erase the diagnosis code, and drive the vehicle for a while.
Check that the normal code is displayed.

Q: Is the check result normal?
YES : The procedure is complete.
NO : Return to Step 1.

Code No. P0982: High Clutch Linear Solenoid Valve System (Short circuit)
Code No. P0983: High Clutch Linear Solenoid Valve System (Open circuit)

DIAGNOSIS CODE SET CONDITIONS

- During 1st to 3rd gear driving, an abnormal value equivalent to short circuit is detected in the solenoid control current for 1 second. <P0982>
- During 1st to 3rd gear driving, an abnormal value equivalent to open circuit is detected in the solenoid control current for 5 seconds. <P0983>

PROBABLE CAUSES

- Malfunction of the high clutch linear solenoid valve system circuit
- Damaged harness or connector
- Malfunction of the A/T-ECU
- Malfunction of the high clutch linear solenoid valve (valve body assembly)

DIAGNOSIS PROCEDURE

STEP 1. Check the A/T-ECU terminal voltage.
[A/T-ECU connector (harness side, connected)]
Measure the voltage between the HCLS terminal and body earth.

- High clutch engaged: 0 V
- Other than above: 300 Hz

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 2.

STEP 2. Check for continuity in HCLS line between the A/T-ECU connector and A/T control solenoid valve assembly connector.
When the continuity check result is OK, check that the wiring harness is not shorted to the body and other wiring harness.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check the high clutch linear solenoid.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check for continuity in signal line between the A/T control solenoid valve assembly connector and the high clutch linear solenoid valve connector.

Q: Is the check result satisfactory?
YES : Replace the valve body assembly.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the failure section.

STEP 6. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Replace the A/T-ECU.
NO : Repair or replace the failure section.

STEP 7. Erase the diagnosis code, and drive the vehicle for a while.
Check that the normal code is displayed.

Q: Is the check result normal?
YES : The procedure is complete.
NO : Return to Step 1.

Code No. P0998: Low Clutch Shift Solenoid Valve System (Short circuit)
Code No. P0999: Low Clutch Shift Solenoid Valve System (Open circuit)

DIAGNOSIS CODE SET CONDITIONS

- During the 5th to 6th driving, and with the lock-up function deactivated, a short circuit is detected for 0.5 second. <P0998>
- During 1st to 4th driving, and with the lock-up function deactivated, an open circuit is detected for 0.5 second. <P0999>

PROBABLE CAUSES

- Malfunction of the low clutch shift solenoid valve system circuit
- Damaged harness or connector
- Malfunction of the A/T-ECU
- Malfunction of the low clutch shift solenoid valve (valve body Assembly)

DIAGNOSIS PROCEDURE

STEP 1. Check the A/T-ECU terminal voltage.
[A/T-ECU connector (harness side, connected)]
Measure the voltage between LCSS terminal and body earth.

- 5th and 6th: System voltage
- Other than above: 0 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 2.

STEP 2. Check for continuity in LCSS line between the A/T-ECU connector and the A/T control solenoid valve assembly.
When the continuity check result is OK, check that the wiring harness is not shorted to the body and other wiring harness.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check the low clutch shift solenoid.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check for continuity in signal line between the A/T control solenoid valve assembly connector and the low clutch shift solenoid valve connector.

Q: Is the check result satisfactory?
YES : Replace the valve body assembly.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the failure section.

STEP 6. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Replace the A/T-ECU.
NO : Repair or replace the failure section.

STEP 7. Erase the diagnosis code, and drive the vehicle for a while.
Check that the normal code is displayed.

Q: Is the check result normal?
YES : The procedure is complete.
NO : Return to Step 1.

Code No. P099B: Low-Reverse Brake Shift Solenoid Valve System (Short circuit)
Code No. P099C: Low-Reverse Brake Shift Solenoid Valve System (Open circuit)

DIAGNOSIS CODE SET CONDITIONS

- When the battery voltage is 2 V or more, the short circuit is detected for 0.5 second. <P099B>
- When the battery voltage is 2 V or more, the open circuit is detected for 0.5 second. <P099C>

PROBABLE CAUSES

- Malfunction of the low-reverse brake shift solenoid valve system circuit
- Damaged harness or connector
- Malfunction of the A/T-ECU
- Malfunction of the low-reverse brake shift solenoid valve (valve body assembly)

DIAGNOSIS PROCEDURE

STEP 1. Check the A/T-ECU terminal voltage.
[A/T-ECU connector (harness side, connected)]
Measure the voltage between the LRSS terminal and body earth.

- Reverse and 1st coast: System voltage
- Other than above: 0 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 2.

STEP 2. Check for continuity in LRSS line between the A/T-ECU connector and the A/T control solenoid valve assembly.
When the continuity check result is OK, check that the wiring harness is not shorted to the body and other wiring harness.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check the low-reverse brake shift solenoid.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check for continuity in signal line between the A/T control solenoid valve assembly connector and the low-reverse brake shift solenoid valve connector.

Q: Is the check result satisfactory?
YES : Replace the valve body assembly.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the failure section.

STEP 6. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Replace the A/T-ECU.
NO : Repair or replace the failure section.

STEP 7. Erase the diagnosis code, and drive the vehicle for a while.
Check that the normal code is displayed.

Q: Is the check result normal?
YES : The procedure is complete.
NO : Return to Step 1.

Code No. P2763: Lock-up and Low-reverse Brake Linear Solenoid Valve System (Open circuit)
Code No. P2764: Lock-up and Low-reverse Brake Linear Solenoid Valve System (Short circuit)

DIAGNOSIS CODE SET CONDITIONS

- During 1st driving or 2nd to 6th lock-up operation, an abnormal value equivalent to open circuit is detected in the solenoid control current for 5 seconds. <P2763>
- During 1st driving or 2nd to 6th lock-up operation, an abnormal value equivalent to short circuit is detected in the solenoid control current for 1 second. <P2764>

PROBABLE CAUSES

- Malfunction of the lock-up and low-reverse brake linear solenoid valve system circuit
- Damaged harness or connector
- Malfunction of the A/T-ECU
- Malfunction of the lock-up and low-reverse brake linear solenoid valve (valve body assembly)

DIAGNOSIS PROCEDURE

STEP 1. Check the A/T-ECU terminal voltage.
[A/T-ECU connector (harness side, connected)]
Measure the voltage between the LULS terminal and body earth.

- Lock-up released: 0 V
- Lock-up engaged: 300 Hz

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 2.

STEP 2. Check for continuity in LULS line between the A/T-ECU connector and A/T control solenoid valve assembly connector.
When the continuity check result is OK, check that the wiring harness is not shorted to the body and other wiring harness.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the connector(s) or wiring harness.

STEP 3. Check the lock-up and low-reverse brake linear solenoid.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check for continuity in signal line between the A/T control solenoid valve assembly connector and the lock-up and low-reverse brake linear solenoid valve connector.

Q: Is the check result satisfactory?
YES : Replace the valve body assembly.
NO : Repair the connector(s) or wiring harness.

STEP 5. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the failure section.

STEP 6. Check the A/T-ECU and A/T control solenoid valve assembly connector pin terminals and the connection status.

Q: Is the check result normal?
YES : Replace the A/T-ECU.
NO : Repair or replace the failure section.

STEP 7. Erase the diagnosis code, and drive the vehicle for a while.
Check that the normal code is displayed.

Q: Is the check result normal?
YES : The procedure is complete.
NO : Return to Step 1.

DATA LIST REFERENCE TABLE

M1231008100898

The other information is the same as before.

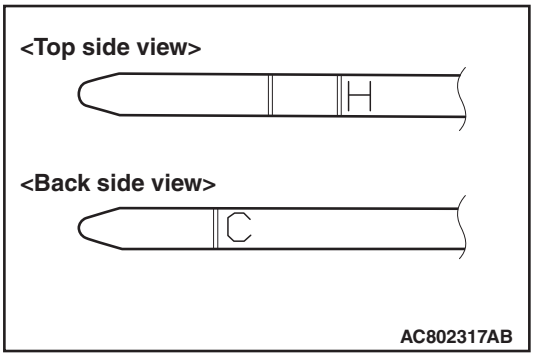
Item No.	Inspection item	Inspection requirement		Normal condition
3	Input shaft speed sensor signal	Gear range: 4th gear	Driving at constant speed of 60 km/h	1,700 – 2,000 r/min
13	Input shaft speed sensor	Gear range: 4th gear	Driving at constant speed of 60 km/h	1,700 – 2,000 r/min

ON-VEHICLE SERVICE

ESSENTIAL SERVICE

A/T FLUID CHECK

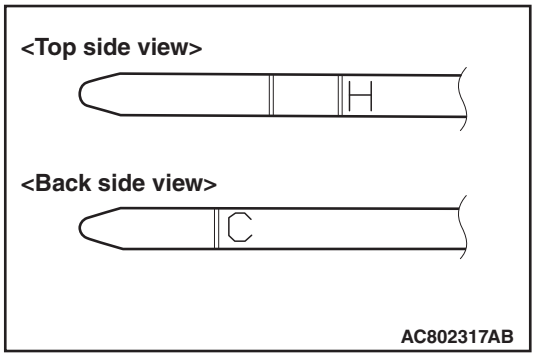
M1231000900685



The service procedures are the same as for vehicles with 4N1 engine. Note that the oil level gauge is different from that for 4N1 engine.

A/T FLUID CHANGE

M1231001000715



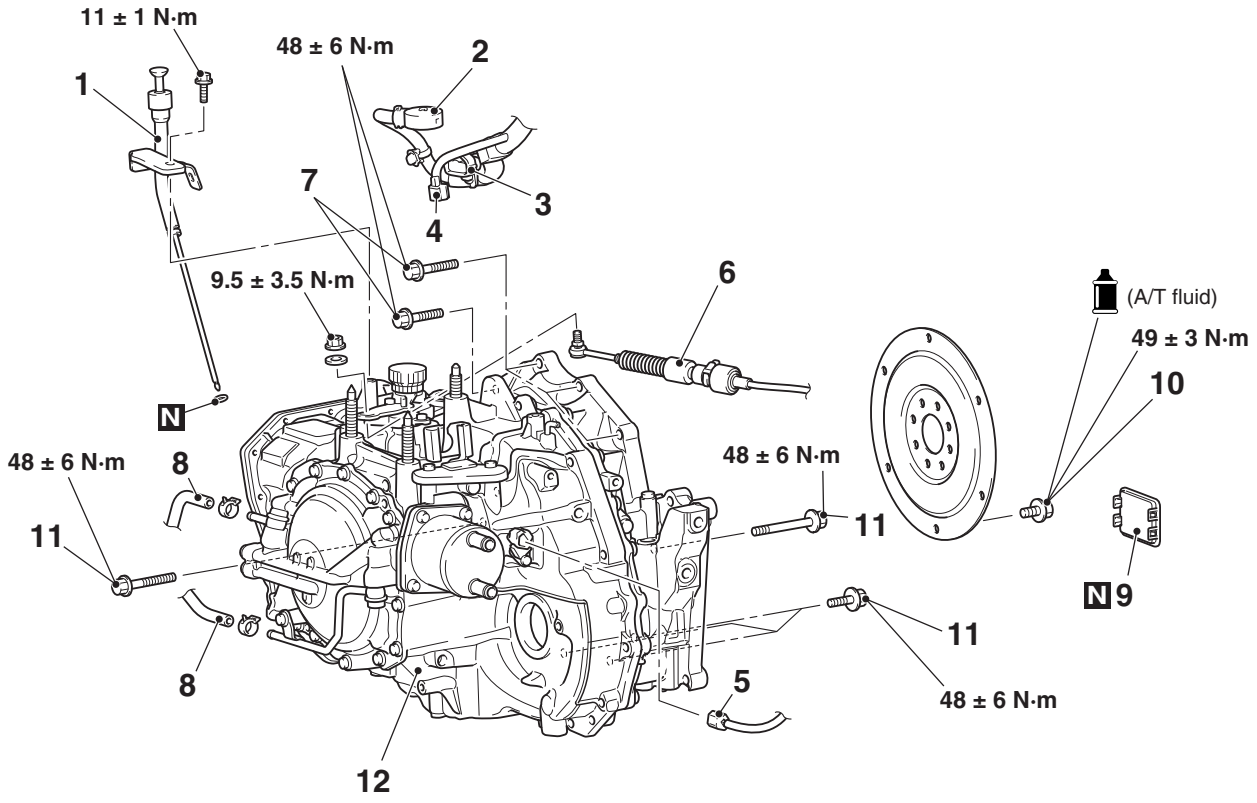
The service procedures are the same as for vehicles with 4N1 engine. Note that the oil level gauge is different from that for 4N1 engine.

TRANSMISSION ASSEMBLY

REMOVAL AND INSTALLATION

M1231005701689

Pre-removal operation	Post-installation operation
• Engine Room Under Cover A and Side Cover Removal. • A/T Fluid Draining (Refer to P.23C-15). • Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service P.14-6). • Air Cleaner Bracket Removal (Refer to GROUP 15 – Air Cleaner P.15-11). • Battery and Battery Tray Removal. • Engine-ECU Removal (Refer to GROUP 13F – Engine-ECU P.13F-232). • Driveshaft Removal (Refer to GROUP 26 – Driveshaft Assembly P.26-2).	• Driveshaft Installation (Refer to GROUP 26 – Driveshaft Assembly P.26-2). • Engine-ECU installation (Refer to GROUP 13F – Engine-ECU P.13F-232). • Battery and battery tray installation. • Air Cleaner Assembly Installation (Refer to GROUP 15 – Air Cleaner P.15-11). • Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service P.14-6). • A/T Fluid Refilling (Refer to P.23C-15). • Engine Room Under Cover A and Side Cover Installation.



ACD00433AB

Removal steps

1. Oil filler tube assembly
2. A/T control solenoid valve assembly connector
3. Inhibitor switch connector
4. Input shaft speed sensor connector
5. Output shaft speed sensor connector

>>**B**<< 6. Transmission control cable connection (transmission side)

<<**A**>> 7. Transmission assembly upper part coupling bolt

Removal steps (Continued)

- Starter mounting bolt (Refer to GROUP 16 – Starter Motor Assembly P.16-10.)
- Transfer assembly (Refer to P.23C-20.)

8. A/T fluid cooler hose assembly connection

- Water return hose A, Water tube assembly, Water feed hose (Refer to P.23C-21.)
- Heater piping hose assembly connection (Refer to GROUP 55 – Heater Hose P.55-3.)

Removal steps (Continued)

9. Cover

<<B>> 10. Torque converter and drive plate coupling bolt
- Air intake plenum (Refer to GROUP15 – Air Intake Plenum P.15-3.)
- Front suspension crossmember (Refer to GROUP 32 – Crossmember P.32-3.)
- While supporting the engine and transmission assembly with a garage jack.
- Transmission mounting bracket

<<C>>
- Engine assembly holding

11. Transmission assembly lower part coupling bolt

>>A<< 12. Transmission assembly

REMOVAL SERVICE POINTS

<<A>> TRANSMISSION ASSEMBLY UPPER PART COUPLING BOLT REMOVAL

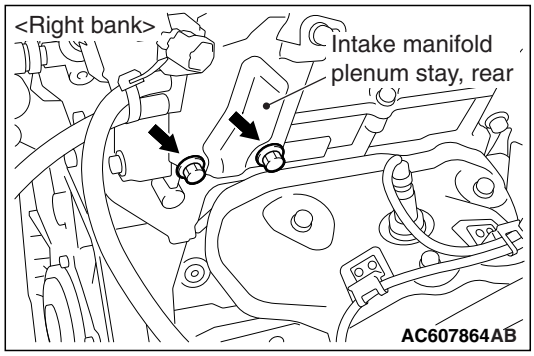
Only loosen the bolts from the engine and transmission assembly (do not remove).

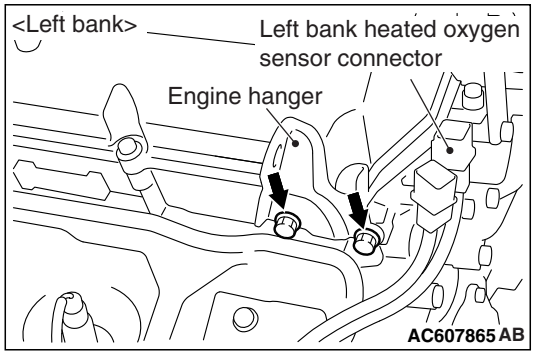
<<B>> TORQUE CONVERTER AND DRIVE PLATE COUPLING BOLT REMOVAL

1. Remove the coupling bolts while turning the crankshaft.
2. Fully push the torque converter into the transmission side so that it does not remain on the engine side.

<<C>> ENGINE ASSEMBLY HOLDING

⚠ CAUTION



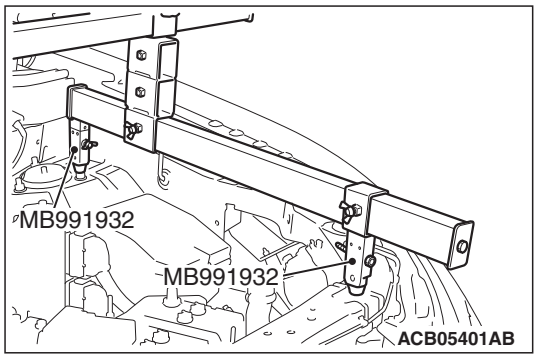


The engine hanger plate (special tool: MB992208)should be secured by tightening bolts with the engine hanger plate to the specified torque (If the other bolts are used, the engine assembly may fall down when it is raised.)

Tightening torque: 22 ± 4 N·m

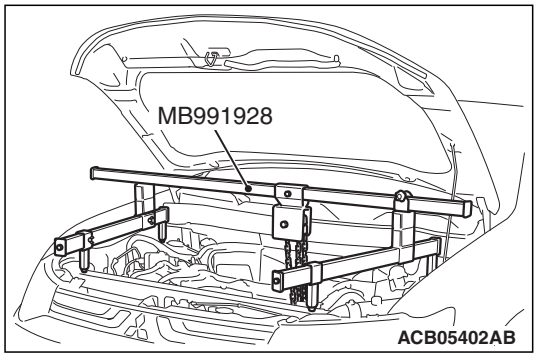
1. Remove the air intake plenum stay, rear on the right bank and the engine hanger on the left bank, and then install the engine hanger plate (Special tool: MB992208) to the place.

2. <When engine hanger (Special tool: MB991928) is used>
   (1) Assemble the engine hanger (special tool: MB991928). (Set the components below to the base hanger.)
- Slide bracket (HI)
- Foot x 4 (standard) (MB991932)



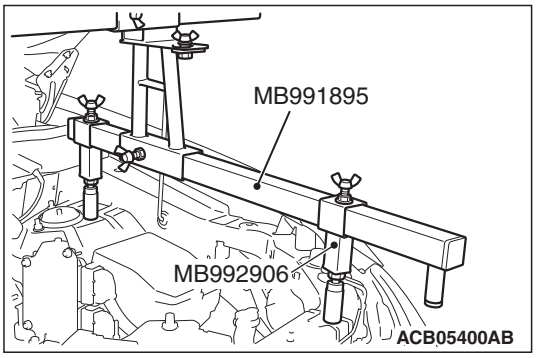
   (2) Set the foot of the special tool as shown in the figure.

NOTE: Adjust the engine hanger balance by sliding the slide bracket (HI).



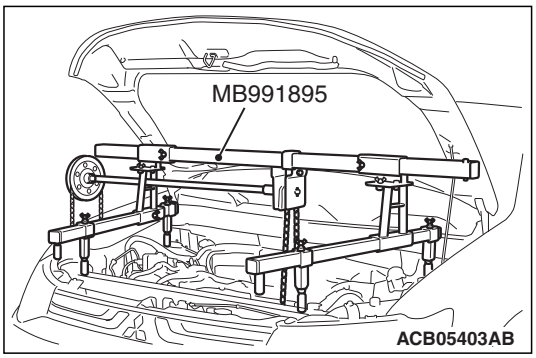
   (3) Connect the engine hanger (Special tool: MB991928) to the engine hanger (special tool: MB991527). Remove the garage jack and then remove the transmission assembly upper part coupling bolts that have been loosened previously.

3. <When engine hanger (Special tool: MB991895) and engine hanger attachment (Special tool: MB992906) are used>



   (1) Set the foot of engine hanger (special tool: MB991895) as shown in the figure.

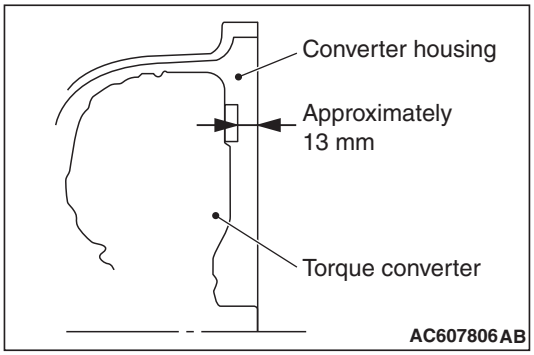
NOTE: Slide the front foot of engine hanger (special tool:MB991895) to balance the engine hanger.



   (2) Connect the engine hanger (Special tool: MB991895) to the engine hanger (special tool: MB991527). Remove the garage jack and then remove the transmission assembly upper part coupling bolts that have been loosened previously.

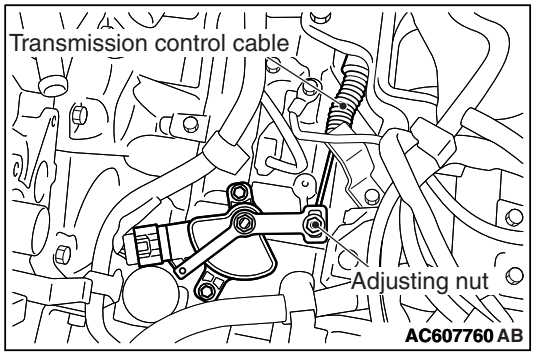
INSTALLATION SERVICE POINTS

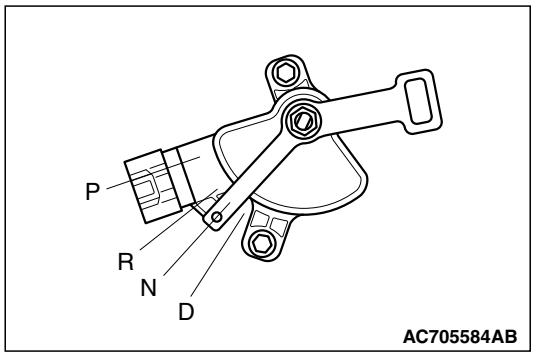
>>A<< TRANSMISSION ASSEMBLY INSTALLATION



Fully push the torque converter into the transmission side, and then assemble the transmission assembly to the engine.

>>B<< TRANSMISSION CONTROL CABLE (TRANSMISSION SIDE) INSTALLATION





1. Move the selector lever and manual control lever to the "N" position.
2. Use the adjusting nut to tighten the transmission control cable to the specified torque.

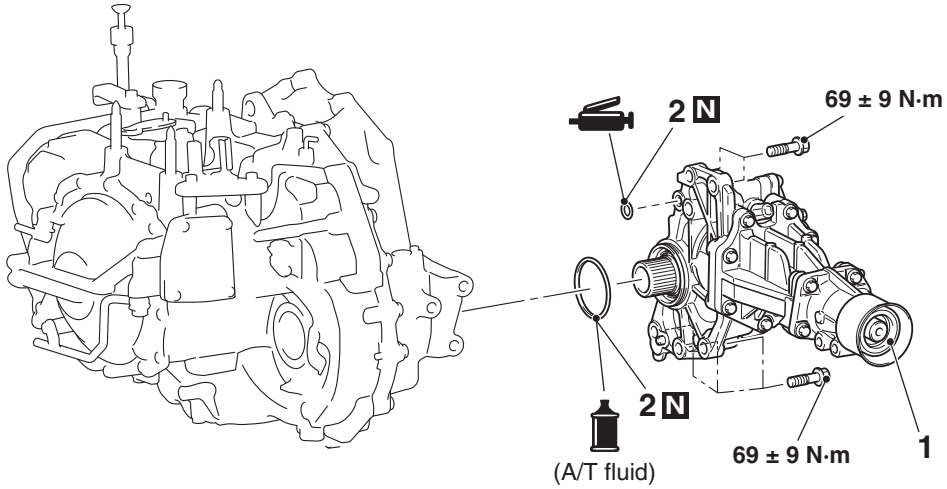
Tightening torque: 9.5 ± 3.5 N·m

TRANSFER ASSEMBLY

REMOVAL AND INSTALLATION

M1231006000646

Pre-removal and post-installation operation
- Engine Room Under Cover Removal and Installation.
- A/T Fluid Draining and Refilling (Refer to P.23C-15.)
- Transfer Oil Draining and Refilling.
- Front Exhaust Pipe Removal and Installation (Refer to GROUP 15 – Exhaust Pipe and Main Muffler P.15-13.)
- Propeller Shaft Removal and Installation.
- Engine Roll Stopper Rod Assembly Removal and Installation.
- Drive shaft <RH> removal and installation (Refer to GROUP 26 – Drive Shaft Assembly P.26-2.)



ACD00434AB

Removal steps

<<A>> 1. Transfer assembly
2. O-ring

REMOVAL SERVICE POINT

<<A>> TRANSFER ASSEMBLY REMOVAL

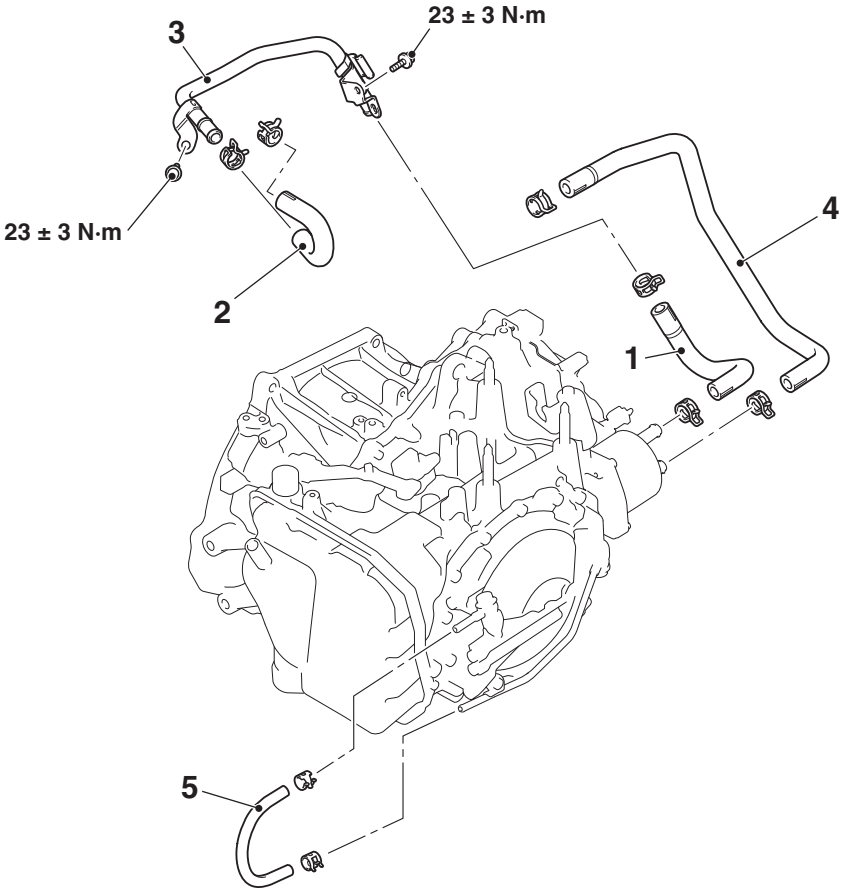
Move the engine and transmission assembly toward the front of the vehicle to make a gap between the engine/transmission assembly and the crossmember. Pull out the transfer assembly through this gap.

A/T FLUID COOLER LINE

REMOVAL AND INSTALLATION

M1231036800203

Pre-removal and post-installation operation
- Engine room under cover front A, engine room side cover removal and installation.
- Engine coolant draining and refilling (Refer to GROUP 14 – On-vehicle Service – Engine Coolant Replacement P.14-6.)
- A/T fluid draining and refilling (Refer to P.23C-15.)



ACD00338AB

Removal steps
1. Water return hose A
2. Water return hose B
3. Water tube assembly

Removal steps (Continued)
4. Water feed hose
5. A/T fluid cooler hose

NOTES

GROUP 23D

AUTOMATIC TRANSMISSION OVERHAUL

CONTENTS

GENERAL INFORMATION 23D-2
GENERAL SPECIFICATIONS 23D-2
TORQUE SPECIFICATIONS 23D-3
TRANSMISSION 23D-4
DISASSEMBLY AND REASSEMBLY 23D-4

GENERAL INFORMATION

M1233000101989

OUTLINE OF CHANGE

Due to the addition of 6B31 engine, the automatic transmission has been added. The service procedures are the same as W6AJA transmission.

TRANSMISSION MODEL

Transmission model	Engine model	Vehicle model
W6AJA-1-E1ZA	6B31-SOHC	GF4W

GENERAL SPECIFICATIONS

M1233000201663

Item		Specifications
Transmission model		W6AJA
Torque converter	Type	3-element with damper clutch
	Stall torque ratio	1.96
	Lock-up	Present
Transmission type		Electronically controlled 6-speed full-automatic
Gear ratio	1st	4.199
	2nd	2.405
	3rd	1.583
	4th	1.161
	5th	0.855
	6th	0.685
	Reverse	3.457
Final gear ratio		3.360
Transfer type		Constant mesh type full-time 4WD
Transfer gear ratio		0.425

TORQUE SPECIFICATIONS

M1233023101902

Transmission

Item	N·m
Output gear set mounting bolt	41 ± 1
Side cover mounting bolt	27 ± 2
Pawl shaft plate mounting bolt	7.9
Oil strainer mounting bolt	9.4
Oil pump assembly mounting bolt	21
Converter housing mounting bolt	47 ± 2
ATF adjusting bolt	7.4 ± 2.4
Detent spring mounting bolt	4.9
Oil temperature sensor	7.9
Control valve assembly mounting bolt	7.9
Control valve cover mounting bolt	9.0 ± 0.9
Cooler tube eye bolt	33 ± 3
Cooler tube mounting bolt	22 ± 1
Baffle plate mounting bolt	6.6 ± 1.0
Pressure test port bolt	7.4
Water-cooled A/T fluid cooler mounting bolt	4.3 ± 0.6
Manual control lever mounting nut	22 ± 3
Inhibitor switch mounting bolt	5.9
Turbine sensor	5.9
Speed sensor	5.9
Control cable bracket mounting bolt	23 ± 3
Oil filler tube mounting bolt	11 ± 1
Harness bracket mounting bolt	23 ± 3
Corrugate clamp bracket mounting bolt	23 ± 3
Corrugate clamp bracket mounting bolt	47 ± 18
Flange bolt	47 ± 18
Roll rod adapter bracket mounting bolt	90 ± 10

Transfer

Item	N·m
Transfer mounting bolt	69 ± 9

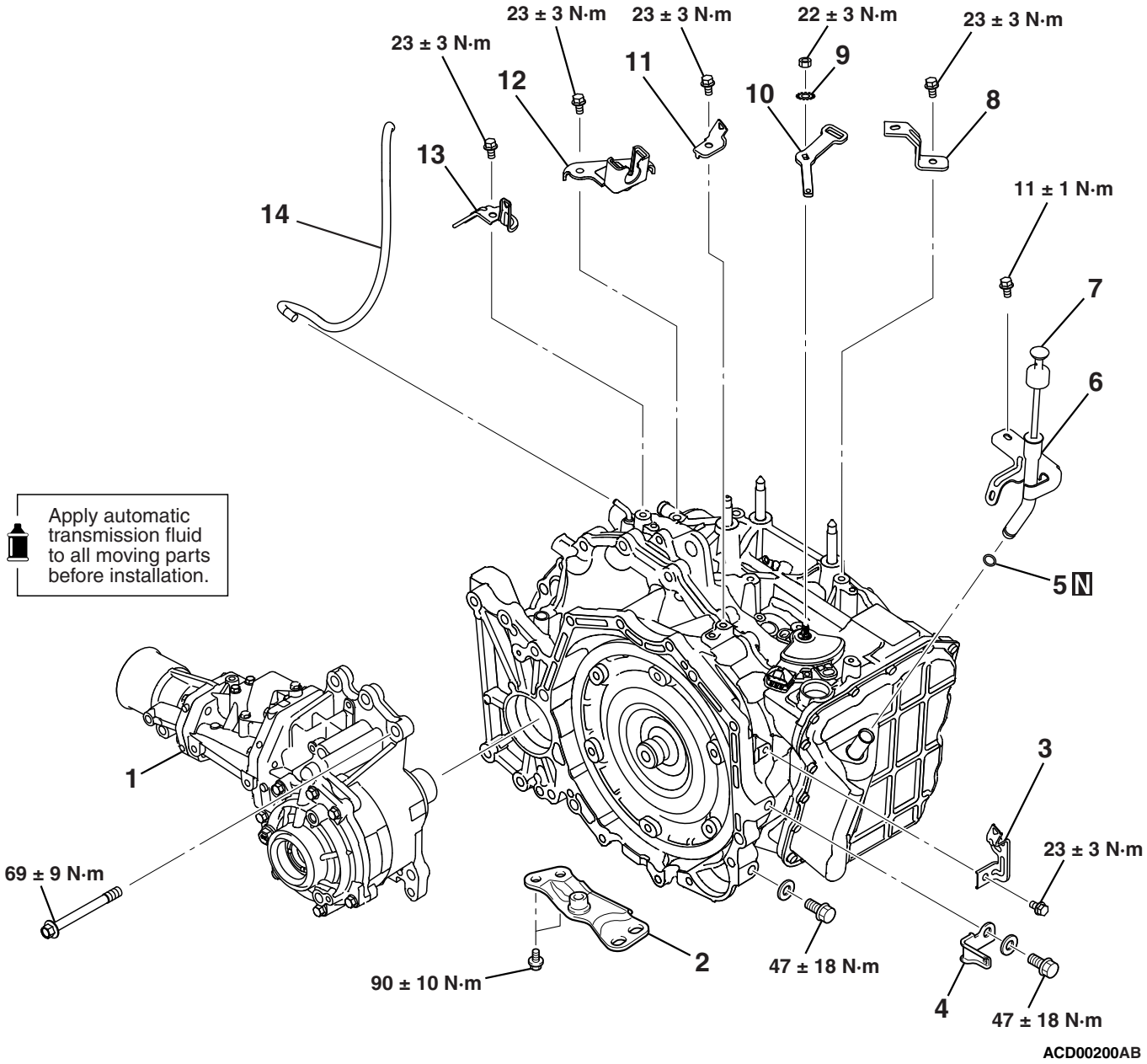
TRANSMISSION

DISASSEMBLY AND REASSEMBLY

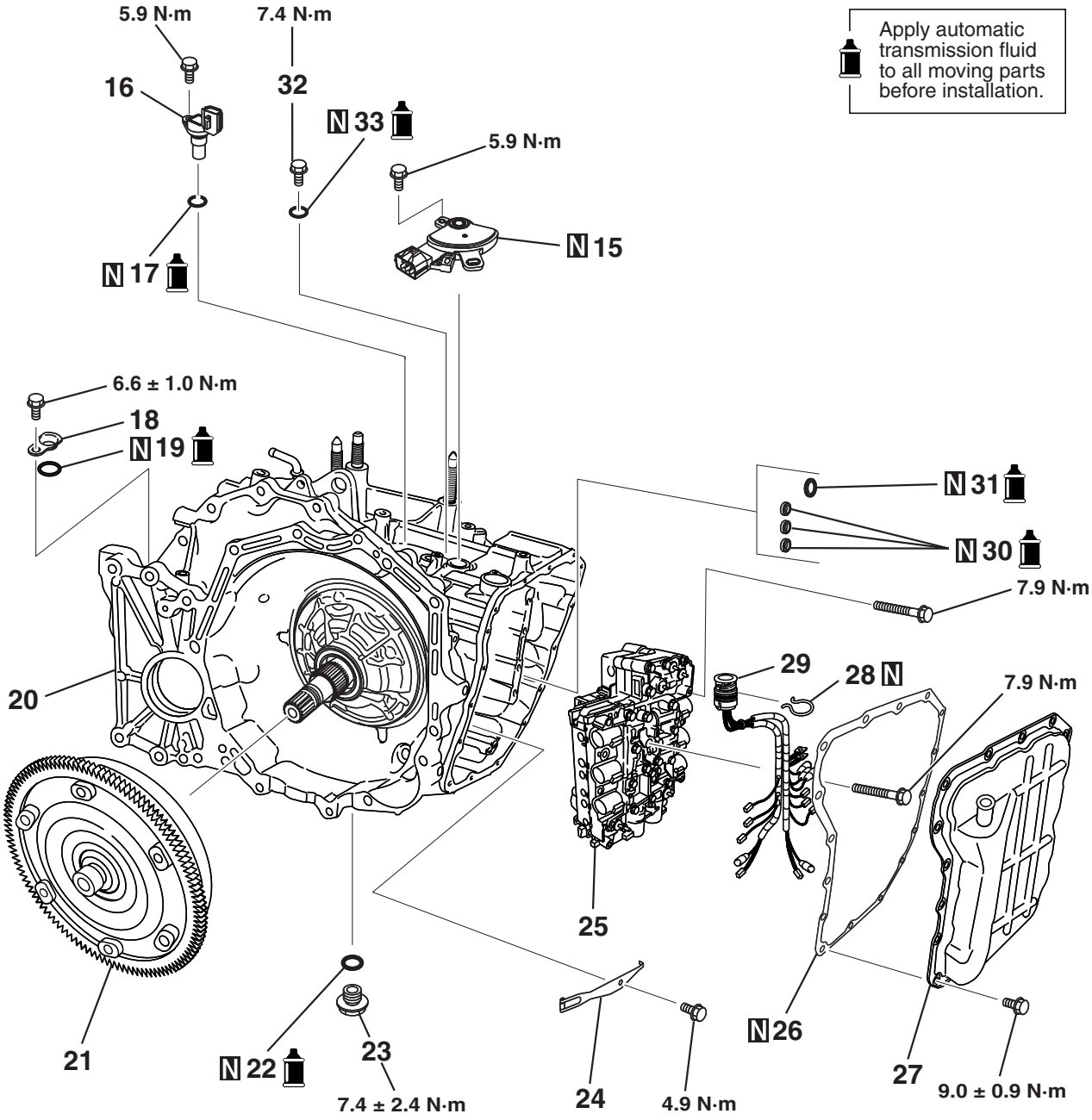
M1233001002201

⚠ CAUTION

- **Use a fluid of the designated brand for ATF (automatic transmission fluid). Use of ATF not specified by the manufacturer can affect driveability and the durability of the automatic transmission, and can even lead to damage to the transmission.**
- **Perform disassembly work in a clean, dustproof room.**
- **Wash sand and mud adhering to the outside of the transmission well using steam or washing oil outside a dustproof room before disassembly to prevent them from entering the inside during disassembly and assembly. (Do not blow steam in the inside of the transmission or wash rubber-made parts with washing oil)**
- **Pull out the torque converter from the transmission after it is cleaned and drain ATF.**
- **During the disassembly and assembly work, always use bare hands or vinyl gloves.**
- **Do not touch internal parts with your hands which touched the outside of the transmission.(Wash your hands before touching internal parts)**
- **Use paper towels instead of cotton gloves and shop towels to prevent entry of lint.**
- **Check the normal condition before performing disassembly and assembly work.**
- **Do not reuse drained ATF.**

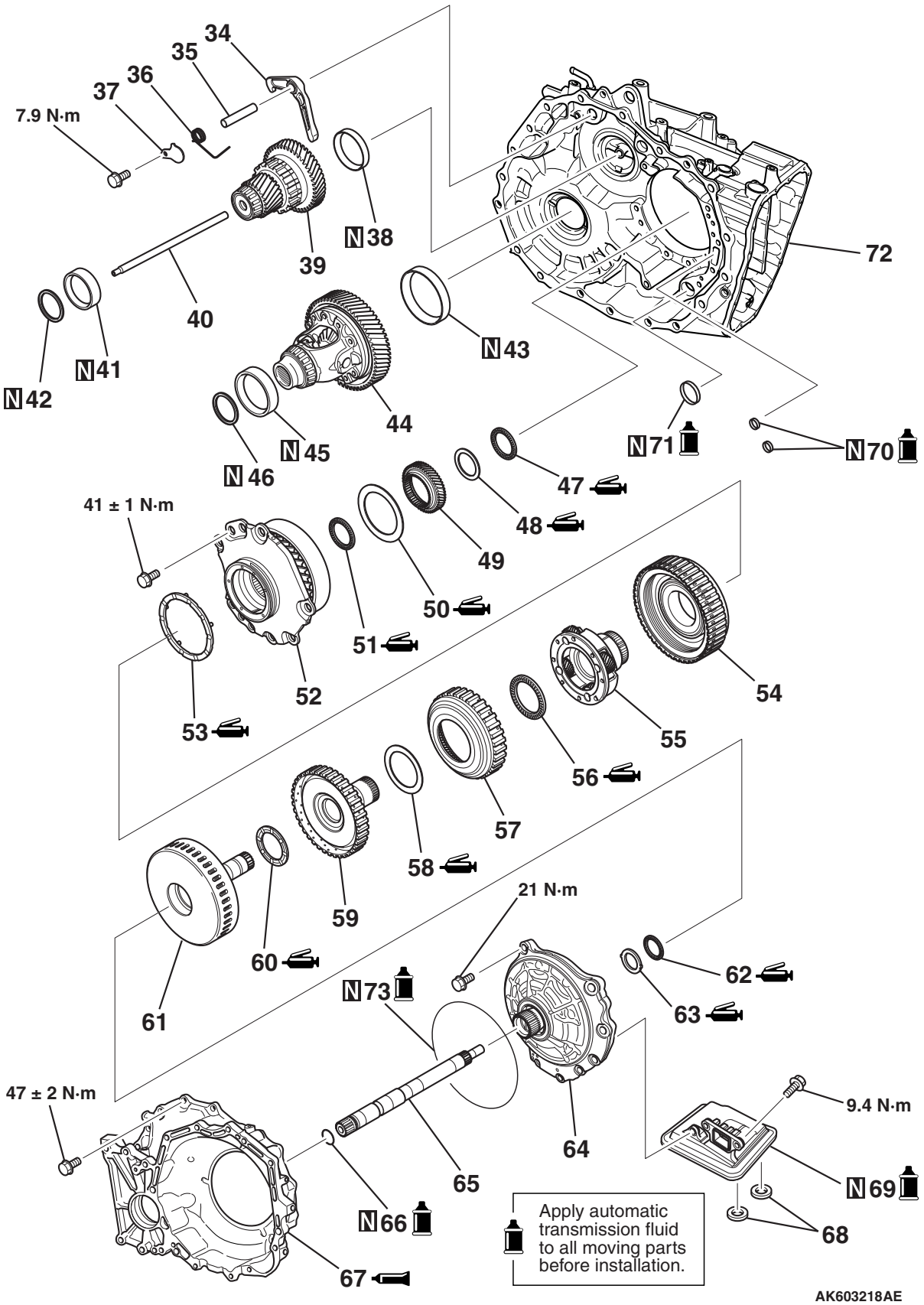


1. Transfer assembly
2. Roll rod adapter bracket
3. Corrugate clamp bracket
4. Corrugate clamp bracket
5. O-ring
6. Oil filler tube
7. Oil level gauge
8. Harness bracket
9. Spring washer
10. Manual control lever
11. Corrugate clamp bracket
12. Control cable bracket
13. Corrugate clamp bracket
14. Breather hose



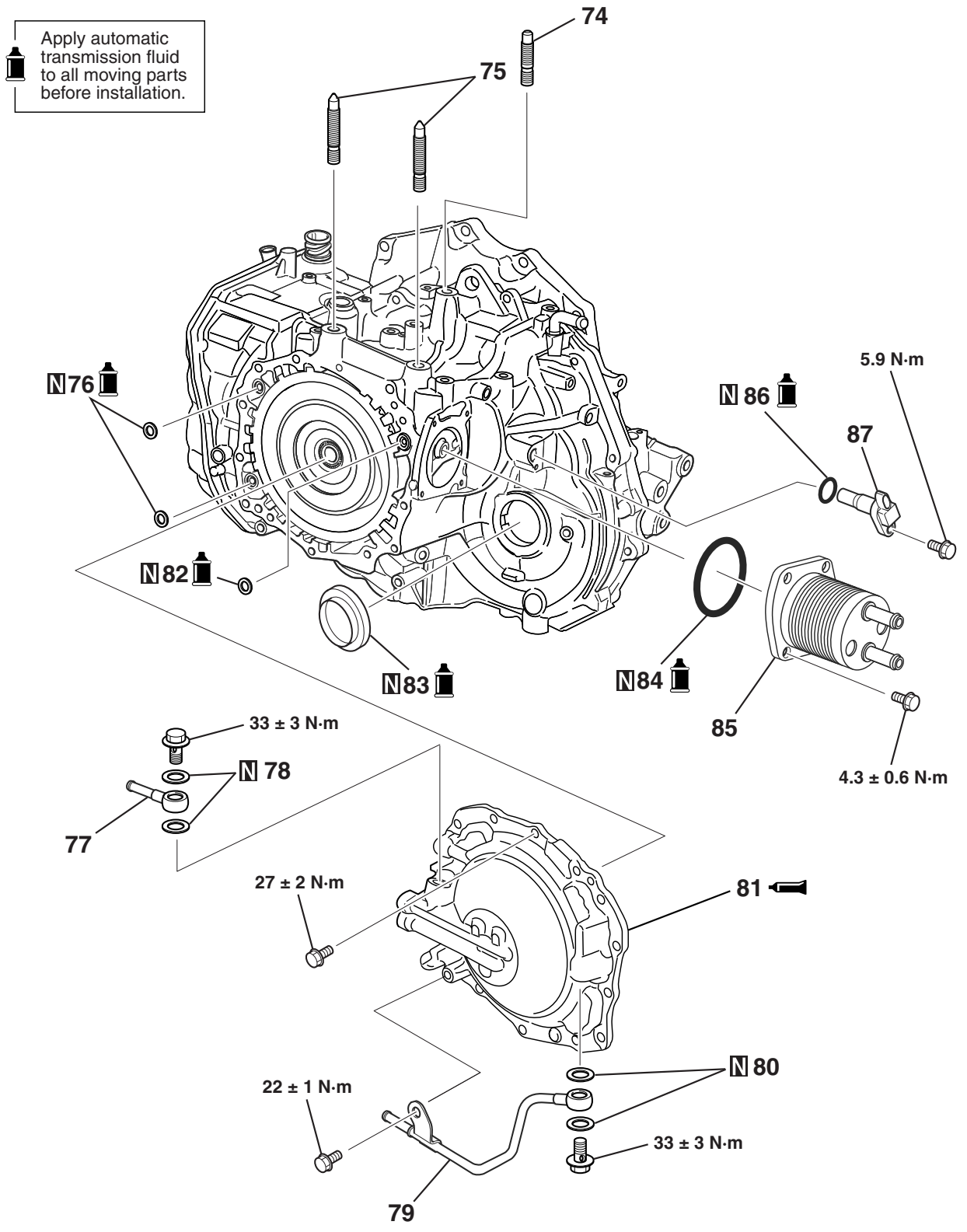
AK603216AE

15. Inhibitor switch
16. Turbine sensor
17. O-ring
18. Baffle plate
19. O-ring
20. Transmission assembly
21. Torque converter
22. O-ring
23. ATF adjusting bolt
24. Detent spring
25. Control valve assembly
26. Control valve cover gasket
27. Control valve cover
28. Snap ring
29. Terminal assembly
30. Lip seal
31. Lip seal
32. Pressure test port bolt
33. O-ring



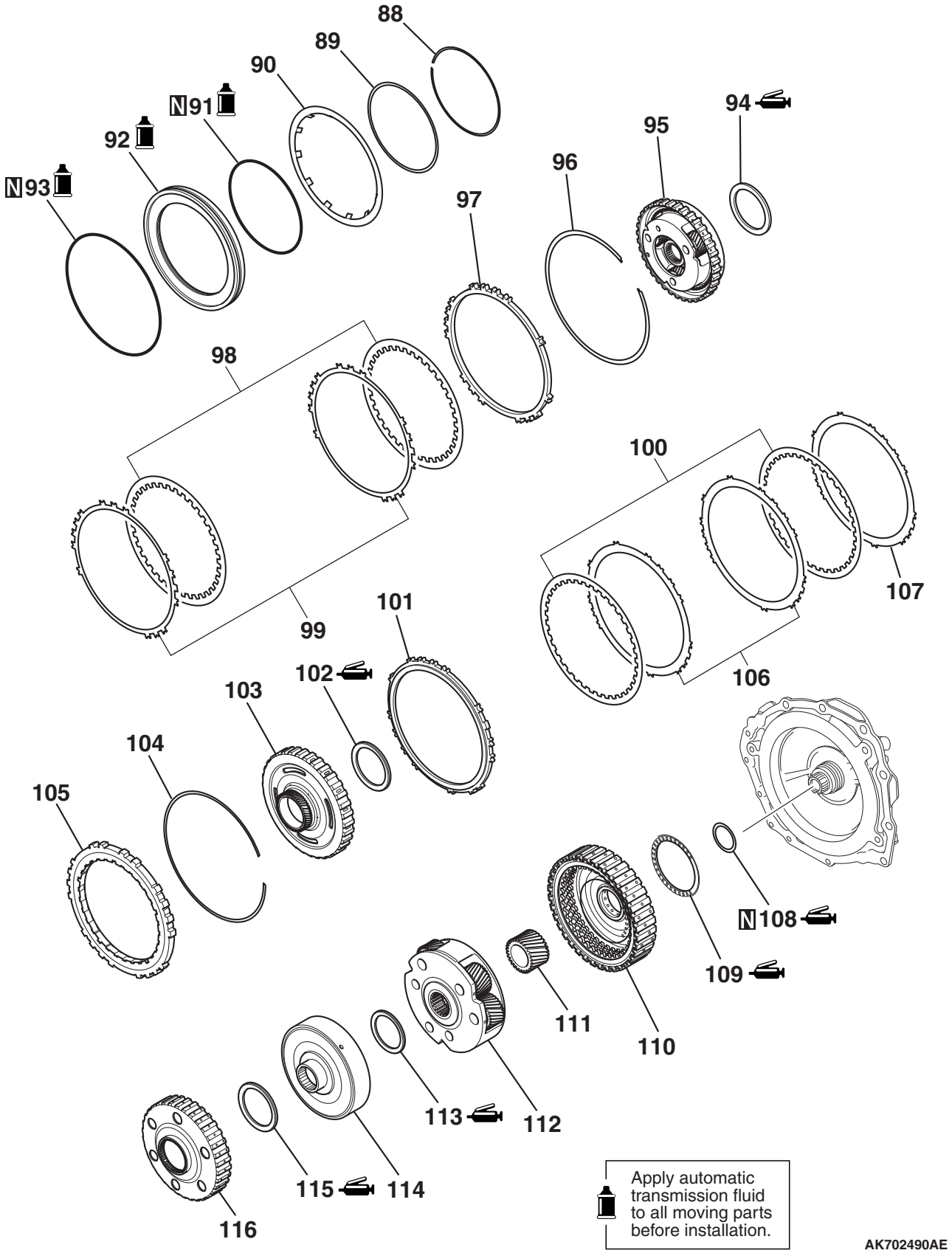
34. Parking pawl
35. Parking pawl shaft
36. Return spring
37. Pawl shaft plate
38. Outer race
39. Reduction gear assembly
40. Reduction gear lubrication tube
41. Outer race

42. Reduction gear taper bearing shim
43. Outer race
44. Differential assembly
45. Outer race
46. Differential taper bearing shim
47. Needle bearing
48. Bearing race
49. RR sun gear (front side)
50. Bearing race
51. Needle bearing
52. Output gear set
53. Thrust washer
54. Low clutch assembly
55. FR carrier
56. Needle bearing
57. FR internal gear
58. Needle bearing
59. FR sun gear
60. Needle bearing
61. 3-5 Reverse clutch assembly
62. Needle bearing
63. Bearing race
64. Oil pump assembly
65. Input shaft
66. O-ring
67. Converter housing
68. Magnet
69. Oil strainer
70. O-ring
71. O-ring
72. Transmission case
73. O-ring



AK603219AE

74. Stud bolt
75. Stud bolt
76. O-ring
77. Cooler tube (IN)
78. Washer
79. Cooler tube (OUT)
80. Washer
81. Side cover
82. O-ring
83. Side oil seal
84. O-ring
85. Water cooled A/T fluid cooler
86. O-ring
87. Speed sensor



88. Snap ring
89. Diaphragm spring retainer
90. Diaphragm spring
91. D-ring
92. Low-reverse brake piston
93. D-ring
94. Needle bearing
95. RR carrier assembly

96. Snap ring
97. Retaining plate
98. Drive plate
99. Driven plate
100. Drive plate
101. Retaining plate
102. Needle bearing
103. RR sun gear (rear side)
104. Snap ring
105. One-way clutch
106. Driven plate
107. Retaining plate
108. Spacer
109. Needle bearing
110. High clutch assembly
111. Reduction sun gear
112. Reduction carrier
113. Needle bearing
114. Reduction internal gear assembly
115. Needle bearing
116. High clutch hub

NOTES

GROUP 26

FRONT AXLE

CONTENTS

GENERAL INFORMATION 26-2

DRIVESHAFT ASSEMBLY 26-2

REMOVAL AND INSTALLATION 26-2

DISASSEMBLY AND REASSEMBLY 26-4

EBJ BOOT REPLACEMENT 26-4

GENERAL INFORMATION

M1262000100038

The service contents below have been added or changed due to the introduction of 6B3 engine.

- A heat protector has been added under the drive shaft assembly (LH).
- The quantities of the grease filled in the PTJ boot and the EBJ boot, the installation position of a dynamic damper, the distance between the PTJ boot bands have been specified.

DRIVESHAFT ASSEMBLY

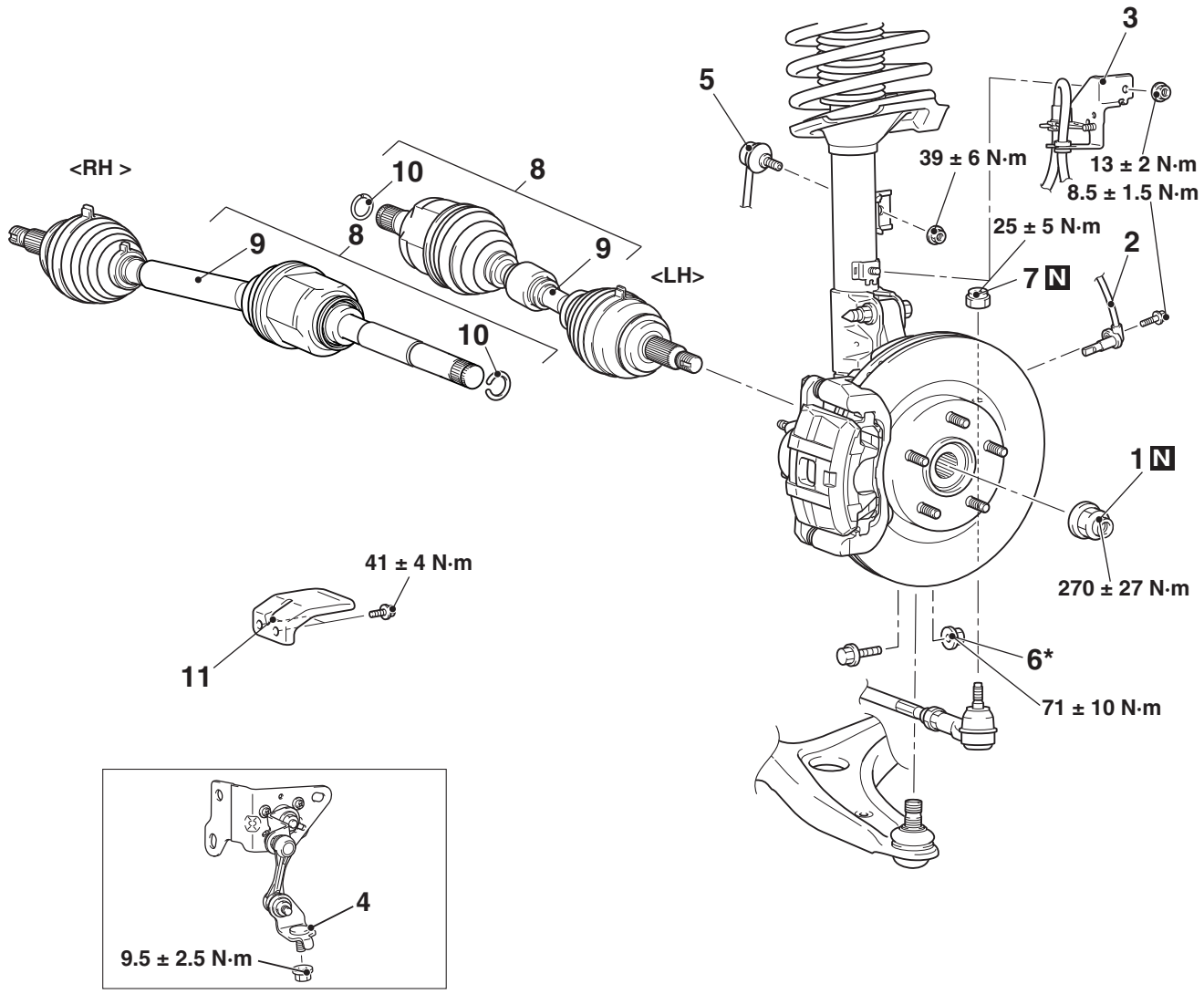
REMOVAL AND INSTALLATION

M1261003502577

⚠ CAUTION

- **The wheel speed detection magnetic encoder collects metallic particles easily, because it is magnetised. Make sure that the magnetic encoder should not collect metallic particles. Check that there is not any trouble prior to reassembling it.**
- **When removing and installing the driveshaft assembly, make sure that the wheel speed detection magnetic encoder (integrated with the inner oil seal) does not contact with surrounding parts to avoid damage.**
- **When removing and installing the front wheel speed sensor, make sure that the pole piece at the end does not contact with surrounding parts to avoid damage.**
- **The parts indicated by * are the nuts with friction coefficient stabilizer. In removal, ensure there is no damage, clean dust and soiling from the bearing and thread surfaces, and tighten them to the specified torque.**

Pre-removal operation	Post-installation operation
• Engine Room Under Cover Removal (Refer to GROUP 51, Under Cover). • Automatic Transmission fluid draining (Refer to GROUP 23C, On-vehicle Service, Automatic Transmission Fluid Change P.23C-15).	• Using your fingers, press the ball joint dust cover to check for a crack or damage. • Engine Room Under Cover Installation (Refer to GROUP 51, Under Cover). • Automatic Transmission fluid refilling (Refer to GROUP 23C, On-vehicle Service, Automatic Transmission Fluid Change P.23C-15). • Check the beam direction of the headlamp (Low beam) (Refer to GROUP 54A – Headlamp Aiming).



ACD00195AB

Removal steps

<<**A**>> >>**C**<< 1. Driveshaft nut
2. Front wheel speed sensor
3. Brake hose bracket
4. Front height sensor to lower arm connection <Vehicles with discharge headlamp>

<<**B**>> >>**B**<< 5. Stabilizer link connection
6. Nut (lower arm ball joint connection)

Removal steps (Continued)

<<**C**>> 7. Self-locking nut (tie-rod end connection)

<<**D**>> >>**A**<< 8. Driveshaft assembly
9. Driveshaft
10. Circlip
11. Heat protector

NOTE: The removal and service points are the same as before.

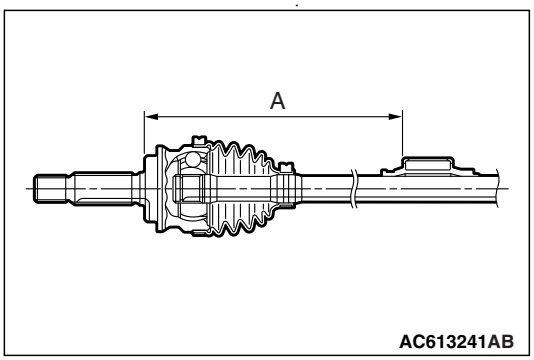
DISASSEMBLY AND REASSEMBLY

The following item has been added.
Note that the disassembly procedures and the service points other than described below are the same as before.

- Quantity of the grease filled in PTJ boot.

NOTE: When using the repair kit grease, fill the half of the grease into the joint and the other half into the boot as a guideline, and consume the grease completely.

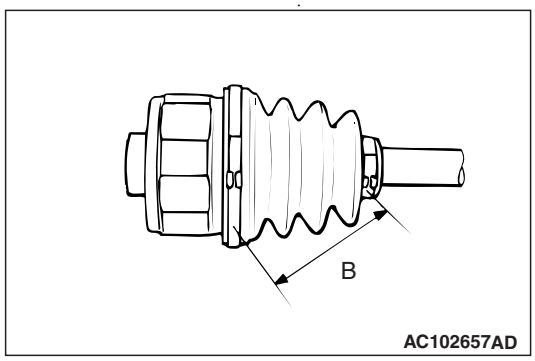
Application amount:
PTJ Boot : 245 ± 10 g



Installation position of the left dynamic damper ("A" shown in the figure)

NOTE: Removal of the dynamic damper is the same as for vehicles with 4N1 engine.

Standard value: 231 ± 7 mm



Distance between the PTJ boot bands ("B" shown in the figure)

Standard value: 95 ± 3 mm

M1261003702913

EBJ BOOT REPLACEMENT

M1261007500540

The quantity of the grease filled in the EBJ boot is as follows:
For the contents other than described, refer to the service publications for conventional models.

Application amount: 140 ± 10 g

GROUP 32

POWER PLANT MOUNT

CONTENTS

GENERAL INFORMATION 32-2

ENGINE MOUNTING 32-2

REMOVAL AND INSTALLATION 32-2

CROSSMEMBER 32-3

REMOVAL AND INSTALLATION 32-3

GENERAL INFORMATION

M1321000101990

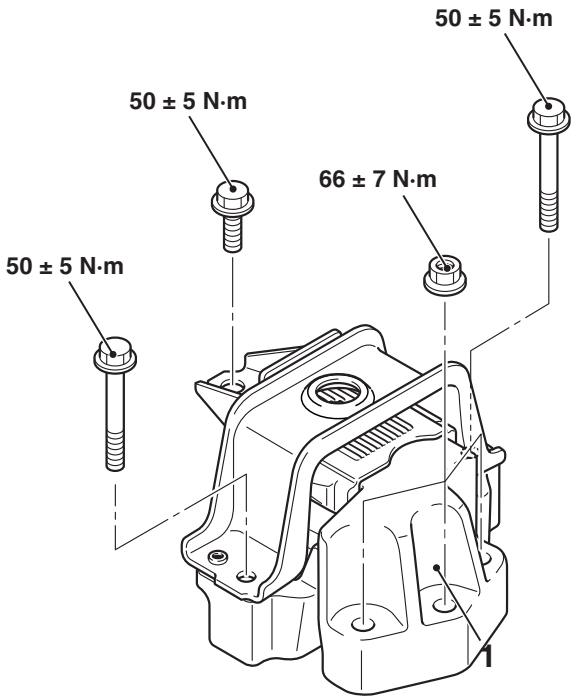
The service contents below have been added or changed due to the introduction of 6B3 engine.

- An engine mounting bracket for 6B3 engine has been added.
- A heat protector has been added over the steering gear and linkage assembly.

ENGINE MOUNTING

REMOVAL AND INSTALLATION

M1321001103502



ACD00206AB

Removal

<<**A**>> >>**A**<< 1. Engine mounting bracket

NOTE: The removal and service points are the same as before.

CROSSMEMBER

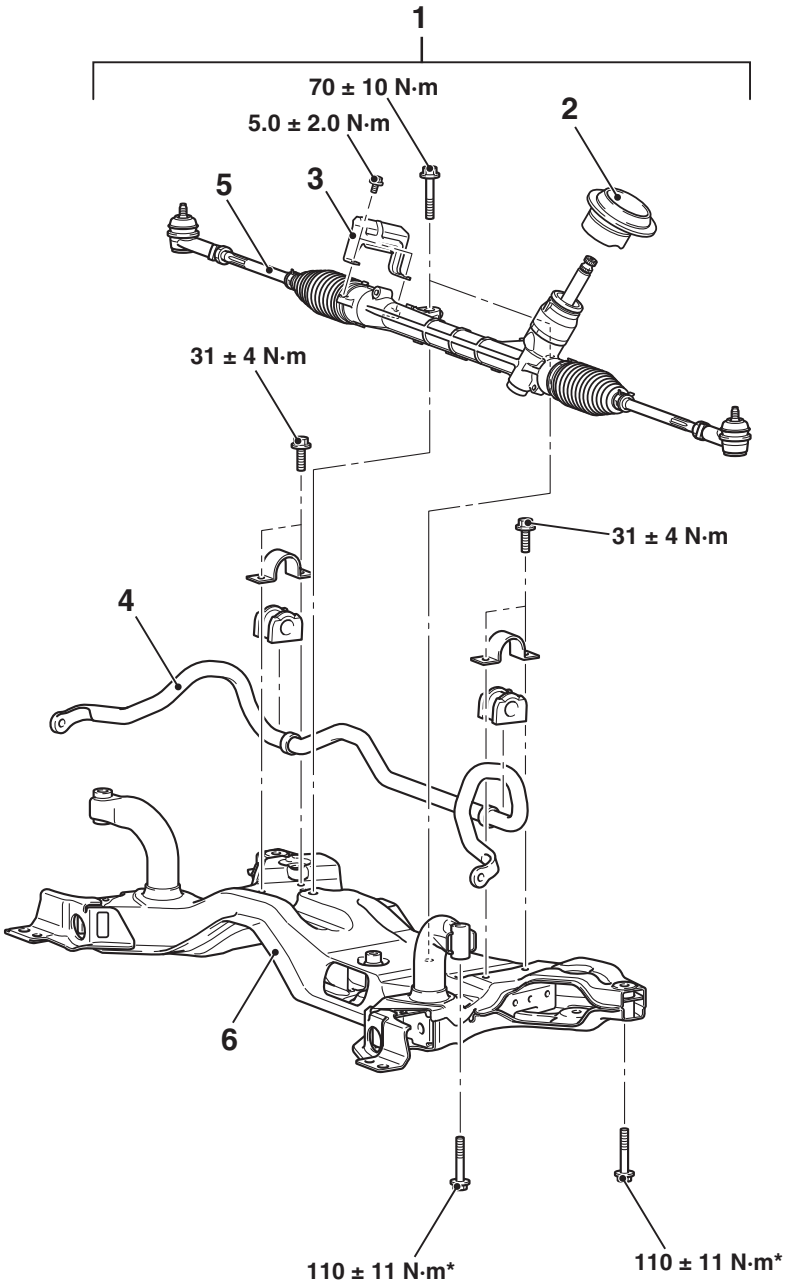
REMOVAL AND INSTALLATION

M1321003202405

⚠ CAUTION

- **Before removing the driver's air bag module and steering wheel assembly, always refer to GROUP 52B – Service Precautions, Driver's Air Bag Module and Clock Spring. Also, set the front wheels so that they are facing straight forward, and remove the ignition key. If you fail to do this, the SRS clock spring will be damaged, causing the SRS (air bag) to be inoperative and serious injury.**
- **The parts indicated by * are the bolts with friction coefficient stabilizer. In removal, ensure there is no damage, clean dust and soiling from the bearing and thread surfaces, and tighten them to the specified torque.**
- **After the installation, perform a calibration for the ASC-ECU to learn the steering wheel sensor neutral point. (Refer to GROUP 35C – On-vehicle Service, Steering Wheel Sensor Calibration).**

Pre-removal Operation	Post-installation Operation
• Steering Wheel Assembly Removal (Refer to GROUP 52B – Driver's Air Bag Module and Clock Spring). • Engine Roll Stopper Rod Assembly Removal. • Lower Arm Assembly Removal (Refer to GROUP 33 – Lower Arm). • Front Floor Backbone Brace Removal (Refer to GROUP 42A – Loose Panel).	• Front Floor Backbone Brace Installation (Refer to GROUP 42A – Loose Panel). • Lower Arm Assembly Installation (Refer to GROUP 33 – Lower Arm). • Engine Roll Rod Assembly Installation. • Steering Wheel Assembly Installation (Refer to GROUP 52B – Driver's Air Bag Module and Clock Spring). • Checking Steering Wheel Position with Wheels Straight Ahead. • Wheel Alignment Check and Adjustment (Refer to GROUP 33, On-vehicle Service - Front Wheel Alignment Check and Adjustment).



ACD00212AC

Removal steps

- Steering column bolt (Steering column shaft assembly and steering gear & linkage connection) (Refer to GROUP 37 – Steering Shaft).
- Self-locking nut (Tie-rod end and knuckle connection) (Refer to GROUP 26 – Front Axle Hub Assembly).
- Stabilizer link and stabilizer bar connection nut (Refer to GROUP 33 – Stabilizer Bar).

<<**A**>>

>>**A**<<

Removal steps (Continued)

- Front end side panel mounting bolt (Refer to GROUP 42A – Loose Panel).

1. Front suspension crossmember assembly
2. Joint cover grommet
3. Heat protector
4. Stabilizer bar (Refer to GROUP 33 – Stabilizer Bar).
5. Steering gear and linkage assembly
6. Front suspension crossmember

NOTE: The removal and service points are the same as before.

GROUP 35A

SERVICE BRAKES

CONTENTS

GENERAL INFORMATION 35A-2

MASTER CYLINDER ASSEMBLY AND BRAKE BOOSTER ASSEMBLY. 35A-2

REMOVAL AND INSTALLATION 35A-2

GENERAL INFORMATION

M1351000102156

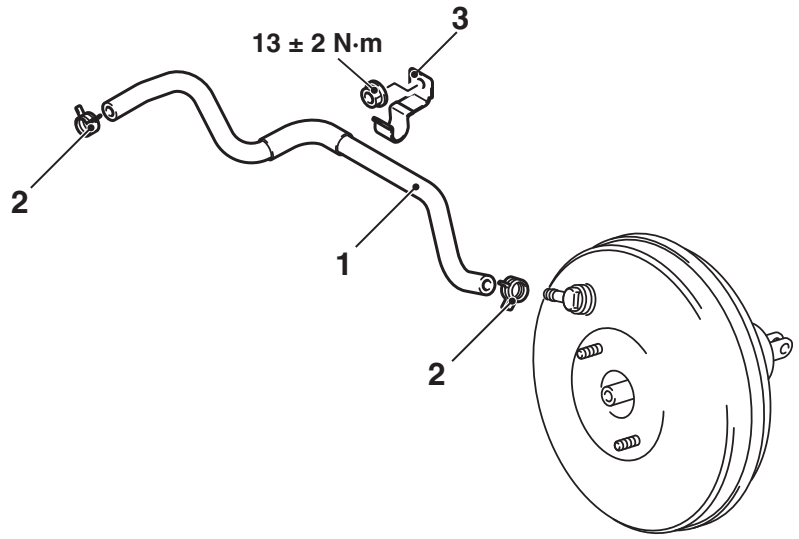
The vacuum hose service procedure for vehicles with 6B3 engine has been established.

MASTER CYLINDER ASSEMBLY AND BRAKE BOOSTER ASSEMBLY

REMOVAL AND INSTALLATION

M1351003703451

<VACUUM HOSE AND VACUUM PIPE>



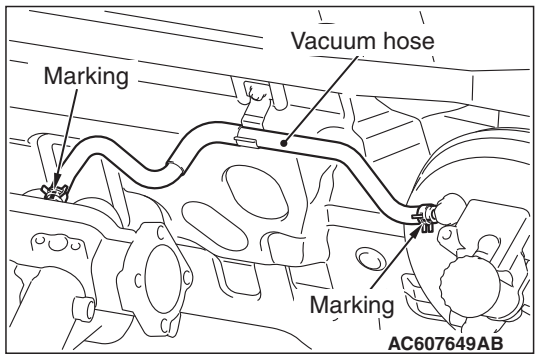
ACD00208AB

Removal steps

>>**A**<< 1. Vacuum hose
2. Hose clip
3. Clamp

INSTALLATION SERVICE POINTS

>>A<< VACUUM HOSE INSTALLATION



Align the mark as shown in the figure to assemble the vacuum hose.

GROUP 51

EXTERIOR

CONTENTS

GENERAL INFORMATION 51-2

MARK 51-2

REMOVAL AND INSTALLATION 51-2

GENERAL INFORMATION

M1511029400514

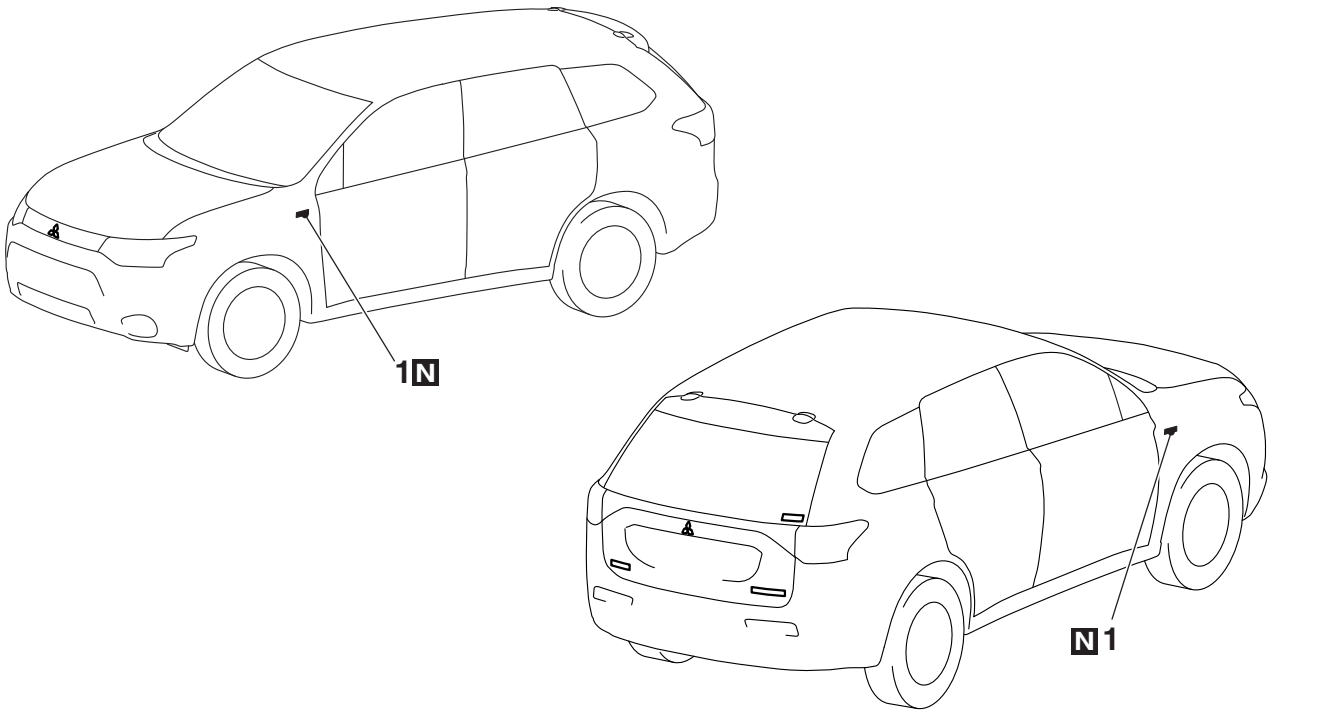
OUTLINE OF CHANGES

The V6 mark has been added to the fender panel.

MARK

REMOVAL AND INSTALLATION

M1511011803992



ACB05807AF

>>A<< 1. V6 mark

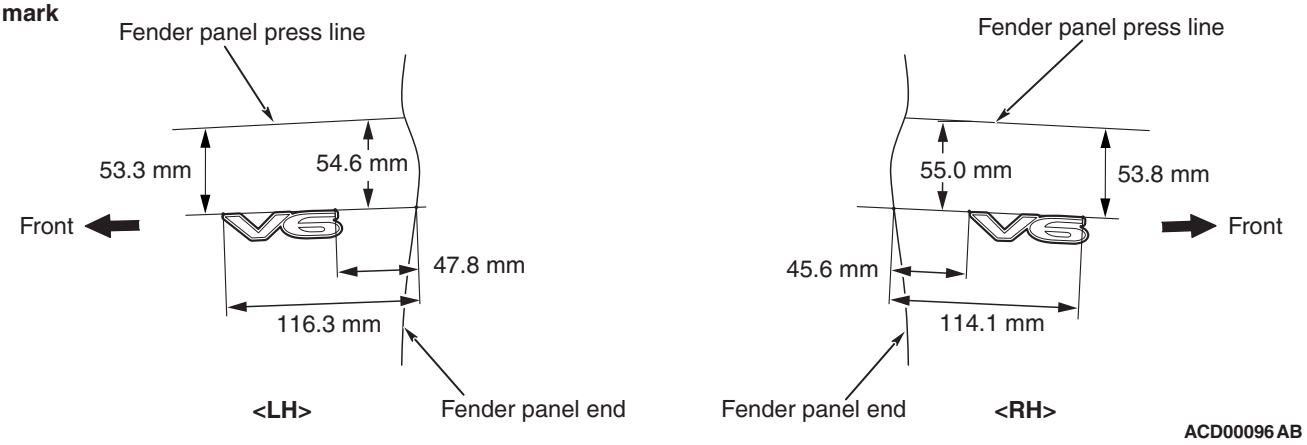
INSTALLATION SERVICE POINT

>>A<< MARK APPLICATION

1. Installation position

   Attach each mark to the position shown in the illustration.

1. V6 mark



2. Installation procedure
   (1) Use Parts Cleaner (MZ100387 or equivalent) to clean the mark installation surfaces on the body.

⚠ CAUTION

When attaching the marks, the ambient temperature should be 20 – 38°C and the air should be completely free of dust. If the ambient temperature is lower than 20°C, the marks and the places on the vehicle body where the marks are to be attached should be heated to 20 – 30°C.

   (2) Peel off the protection sheet on the back of the marks to paste it on the installation position.

NOTES

GROUP 54A

CHASSIS ELECTRICAL

CONTENTS

GENERAL INFORMATION 54A-2

BATTERY 54A-2

ON-VEHICLE SERVICE 54A-2

CHARGING 54A-2

BATTERY TEST 54A-2

GENERAL INFORMATION

M1541000100818

OUTLINE OF CHANGE

Due to the addition of 3.0 L engine, the service procedure has been established.The other service procedures are the same as before.

BATTERY

ON-VEHICLE SERVICE

CHARGING

M1541001102301

⚠ CAUTION

- **The battery plugs should be removed during charging.**
- **The battery electrolyte level may rise and overflow from the battery during charging.**
- **Explosions may occur if the battery is brought close to naked flames during charging.**
- **Be careful to avoid tasks that might produce sparks or other danger while the battery is charging.**
- **After charging is complete, reinstall the battery plugs, pour water over the battery to rinse away any sulphuric acid, and let the battery stand to dry.**
- **Charge the battery in a well-ventilated location.**
- **Do not let the battery electrolyte temperature rise above approximately 45°C (approximately 55°C during rapid charging).**

1. Remove the battery from the vehicle.
2. The normal charging current is a value in amperes which is 1/10th of the battery capacity. If the battery needs to be charged rapidly because of reasons such as time limitations, the maximum charging current for rapid charging is the battery capacity expressed as an ampere value.

Battery type	Capacity (5-hour rate)	Normal charging current	Rapid charging current
80D26L	55 Ah	5.5 A	55 A

Determine when charging is finished.

When the specific gravity of the battery electrolyte is constantly within 1.220 – 1.290 for a continuous period of one hour or more.

BATTERY TEST

M1541001202416

TEST STEPS

STEP 1. Battery no-load voltage check

(1) Illuminate the headlamp for 15 seconds.
(2) Turn off the headlamp and then leave it for about 2 minutes to stabilise the battery voltage.
(3) Remove the battery cable.
(4) Measure the battery no-load voltage.

OK: 12.4 V or more (Specific gravity 1.240)

Q: Does the measured voltage correspond with this range?
YES : Go to Step 3.
NO : Go to Step 2.

STEP 2. Battery charging

Recharge the battery at 5A (constant-current charging). (Refer to Table 1.)

Q: Is the battery no-load voltage normal value (12.4 V or more)?
YES : Go to Step 3.
NO : Replace the battery.

STEP 3. Load test check

(1) Connect the battery tester to battery.
(2) Feed a load current through the battery. (Refer to Table 1).
(3) Measure the battery voltage after 15 seconds and then eliminate a load current.
(4) Compare the measured voltage to the specified lowest voltage. (Refer to Table 2).

Q: Is the measured voltage higher than the lowest voltage?
YES : The battery is normal.
NO : Replace the battery.

(TABLE 1)

Battery type	**Charging time when fully discharged [5A constant current charging] (H)**	**Load current (A)**
80D26L	11	290

(TABLE 2)

Outside air temperature (°C)	21 or more	16 to 20	10 to 15	4 to 9	–1 to 3	–7 to –2	–12 to –8	–18 to –13
Minimum voltage (V)	9.6	9.5	9.4	9.3	9.1	8.9	8.7	8.5

NOTES

GROUP 55

HEATER, AIR CONDITIONER AND VENTILATION

CONTENTS

GENERAL INFORMATION 55-2

ON-VEHICLE SERVICE. 55-2
RELAY CHECK. 55-2
IDLE-UP INSPECTION. 55-2

HEATER HOSE 55-3
REMOVAL AND INSTALLATION 55-3

COMPRESSOR ASSEMBLY 55-4
REMOVAL AND INSTALLATION 55-4
DISASSEMBLY AND REASSEMBLY 55-5

REFRIGERANT LINE 55-8
REMOVAL AND INSTALLATION 55-8

GENERAL INFORMATION

M1551000101113

OUTLINE OF CHANGE

Due to the addition of 3.0 L engine, the service procedure has been added.

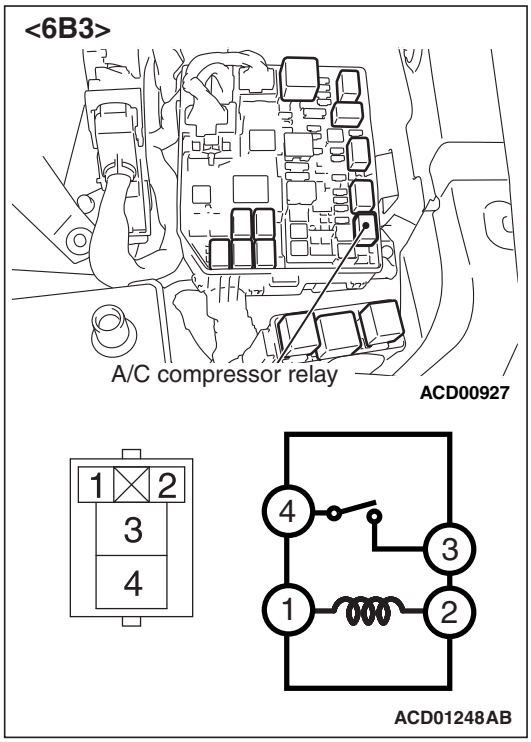
- The heater line configuration has been changed.
- An A/C compressor assembly has been changed.
- The refrigerant line configuration has been changed.

ON-VEHICLE SERVICE

RELAY CHECK

M1552008801647

A/C COMPRESSOR RELAY CONTINUITY CHECK



Battery voltage	Checking terminal	Normal condition
Not applied	3 – 4	No continuity
• Connect terminal 2 to the positive battery terminal • Connect terminal 1 to the negative battery terminal		Continuity exists (2 Ω or less)

IDLE-UP INSPECTION

M1552001602139

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Check that the idling speed is within the standard value range.

   Standard value:
   600 ± 100 r/min

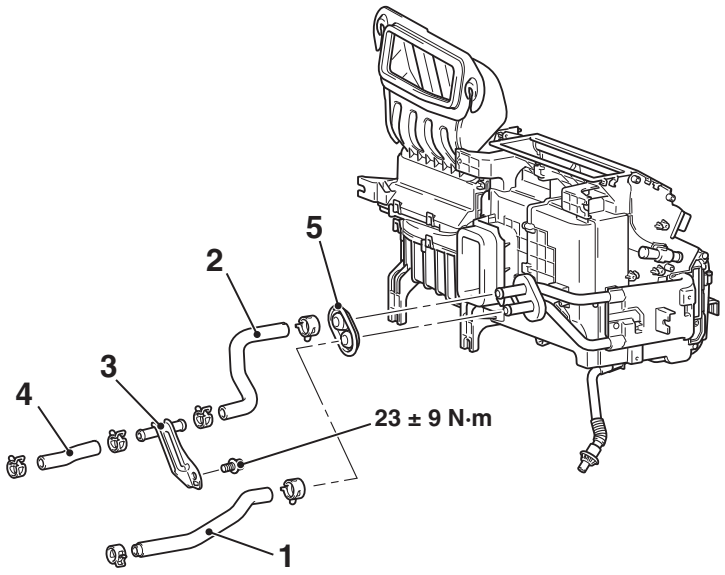
   NOTE: The idling speed is controlled by the ISC system automatically, so does not require adjustment.
3. Operate the air conditioner by turning on the A/C switch. Then check that the idling speed is within the standard value range.

   Standard value:
   760 r/min

HEATER HOSE

REMOVAL AND INSTALLATION

M1551007700340



ACC07813AB

Heater piping hose removal steps

1. Heater piping hose A
2. Heater piping hose B
3. Heater piping hose assembly

Heater piping hose removal steps (Continued)

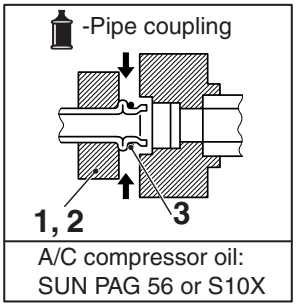
4. Heater piping hose C
5. Grommet

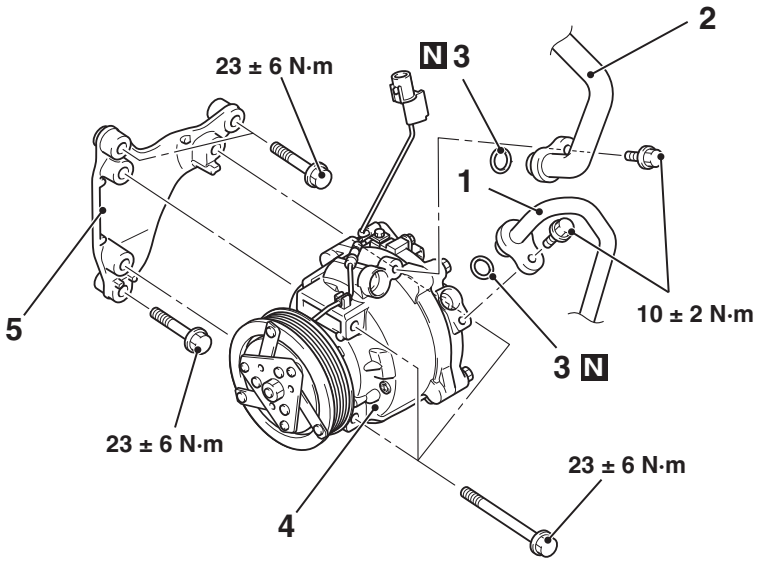
COMPRESSOR ASSEMBLY

REMOVAL AND INSTALLATION

M1552004403933

Pre-removal operation	Post-installation Operation
• Discharging refrigerant (Refer to) • Engine room under cover front B and engine room side cover removal (Refer to GROUP 51, Under cover). • Alternator drive belt removal (Refer to GROUP 11I Crankshaft pulley P.11I-17)	• Alternator drive belt installation (Refer to GROUP 11I Crankshaft pulley P.11I-17) • Alternator drive belt tension check and adjustment (Refer to GROUP 11I, Drive Belt tension Check P.11I-8). • Engine room under cover front B and engine room side cover installation (Refer to GROUP 51, Under Cover). • Charging refrigerant (Refer to)





ACC07814 AB

		Removal steps
<<A>>	1.	Discharge flexible hose connection
<<A>>	2.	Suction flexible hose connection
	3.	O-ring
<<B>> >>A<<	4.	A/C compressor and clutch assembly
	5.	A/C compressor bracket

NOTE: The service points which are not described are the same as before.

REMOVAL SERVICE POINTS

<<A>> DISCHARGE FLEXIBLE HOSE/SUCTION FLEXIBLE HOSE DISCONNECTION

⚠ CAUTION

Use the plug which is not breathable because A/C compressor oil or receiver have high hygroscopicity.

Plug the hose nipple removed to prevent the entry of dust and dirt.

<<B>> A/C COMPRESSOR AND CLUTCH ASSEMBLY REMOVAL

Be careful not to spill the A/C compressor oil and remove the A/C compressor.

INSTALLATION SERVICE POINT

>>A<< A/C COMPRESSOR AND CLUTCH ASSEMBLY INSTALLATION

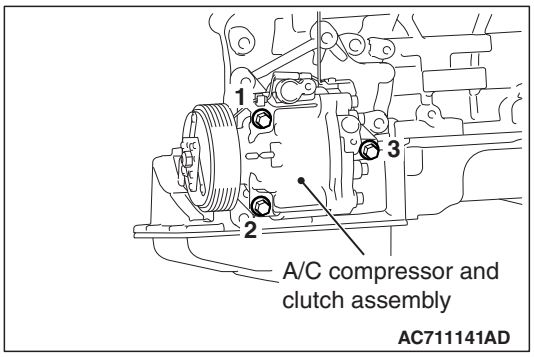
If a new compressor is installed, first adjust the amount of oil according to the procedures described below, and then install the compressor.

1. Measure the amount X mL of oil within the removed compressor.
2. Drain (from the new compressor) the amount of oil calculated according to the following formula, and then install the new compressor.

   New compressor oil amount = 70mL

   70 mL – X mL = Y mL

NOTE: Y mL indicates the amount of oil in the refrigerant line, the condenser, the evaporator, etc.

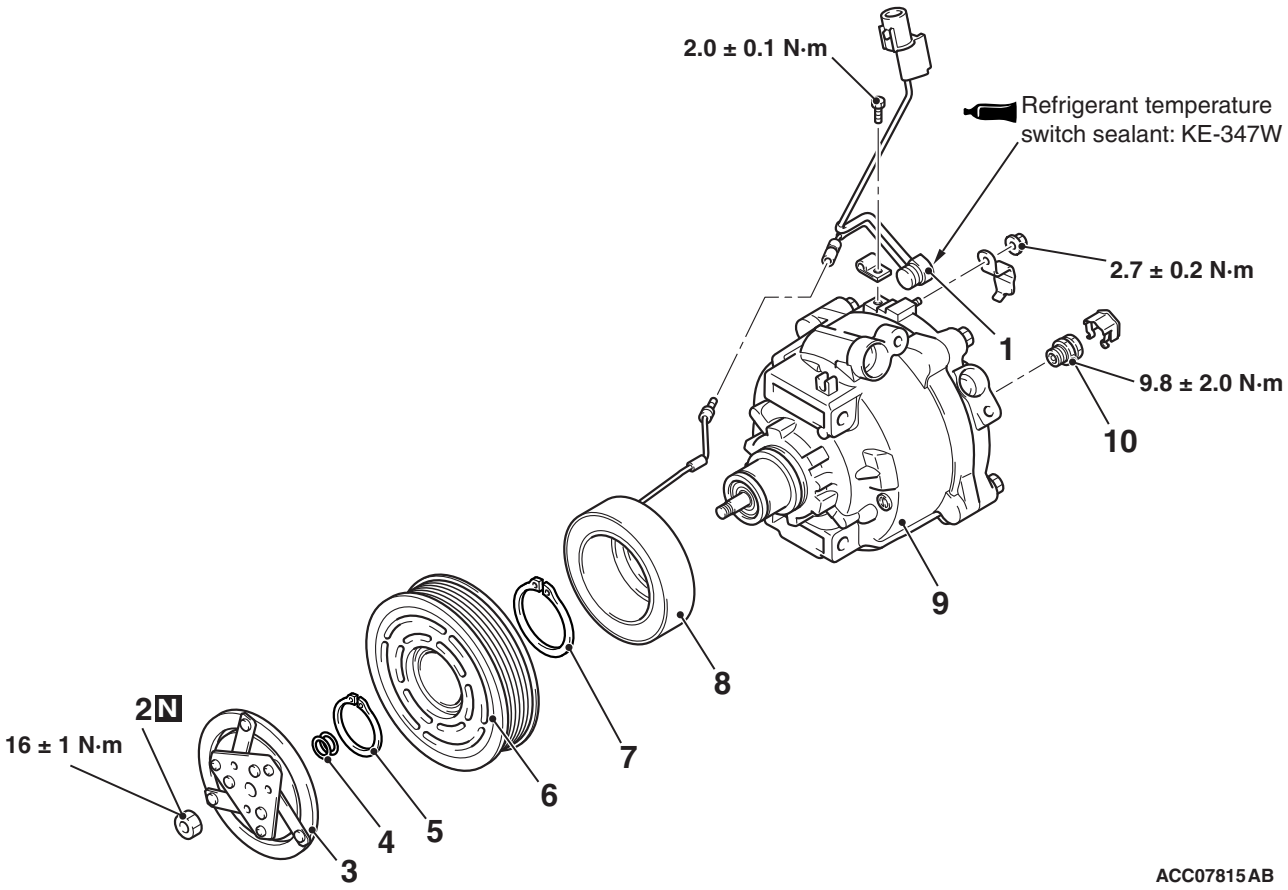


3. Tighten A/C compressor assembly mounting bolts to the specified torque in the order of number shown in the figure.

Tightening torque: 23 ± 6 N·m

DISASSEMBLY AND REASSEMBLY

M1552004603744



Refrigerant temperature switch disassembly steps

1. Refrigerant temperature switch

A/C compressor clutch disassembly steps

>>F<< • Air gap adjustment

<<A>> >>E<< 2. Self-locking nut

3. Armature

4. Shim

A/C compressor clutch disassembly steps (Continued)

>>D<< 5. Snap ring

<<B>> >>C<< 6. Rotor

7. Snap ring

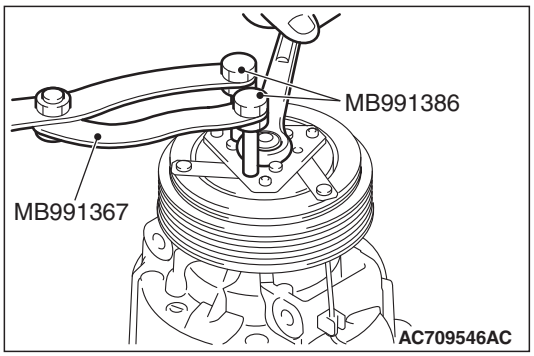
>>B<< 8. A/C compressor coil

9. A/C compressor

>>A<< 10. A/C compressor high pressure relief valve

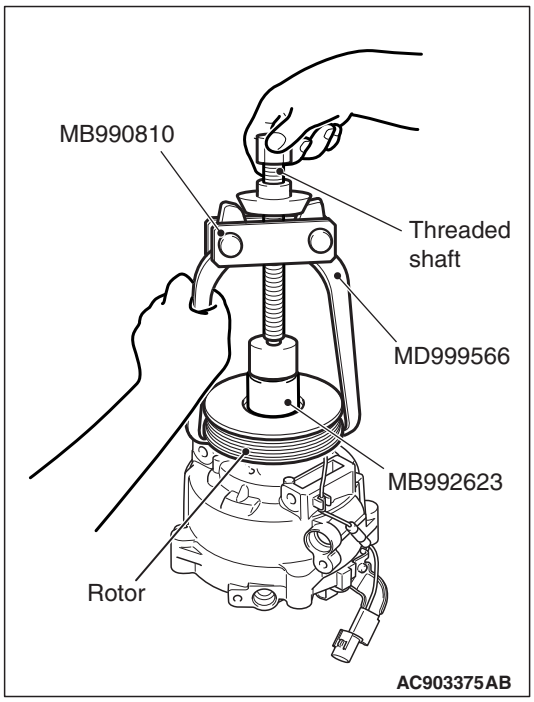
DISASSEMBLY SERVICE POINTS

<<A>> SELF-LOCKING NUT REMOVAL



Use the special tools below to remove the self-locking nut.

<<B>> ROTOR REMOVAL



⚠ CAUTION

- **Be sure to use the guide (MB992623) when the side bearing puller (MB990810) is used to prevent the damage of A/C compressor.**
- **If the threaded shaft of side bearing puller (MB990810) is turned than necessary, the rotor may be distorted. Therefore, turn the threaded shaft lightly only by hand without using any tools.**

Rotor can be removed by hand, but if it is difficult to remove it, use the guide (MB992623) and the side bearing puller (MB990810) as shown.

REASSEMBLY SERVICE POINTS

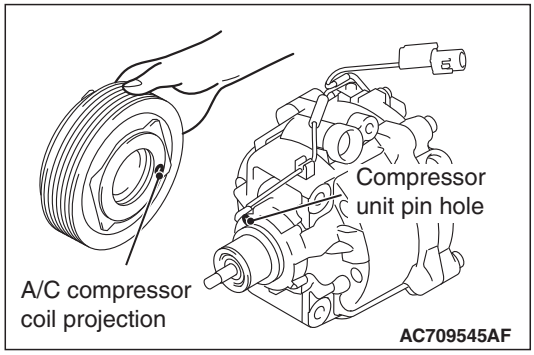
>>A<< A/C COMPRESSOR HIGH PRESSURE RELIEF VALVE INSTALLATION

⚠ CAUTION

Be careful not to damage the O-ring when installing the high-pressure relief valve. Apply the specified refrigerating machine oil the high-pressure relief valve mounting hole before installation

Check that O-ring is installed to the high-pressure relief and use the adjust torque wrench to install the high-pressure relief valve to the main body of the compressor.

>>B<< A/C COMPRESSOR COIL ATTACHMENT

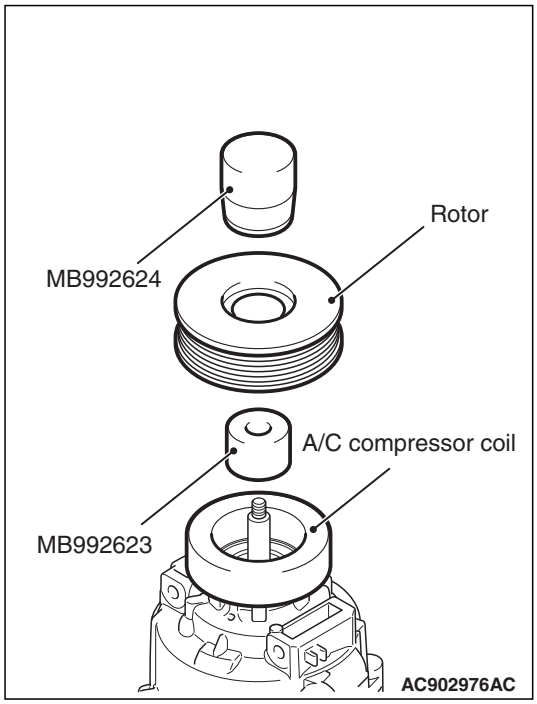


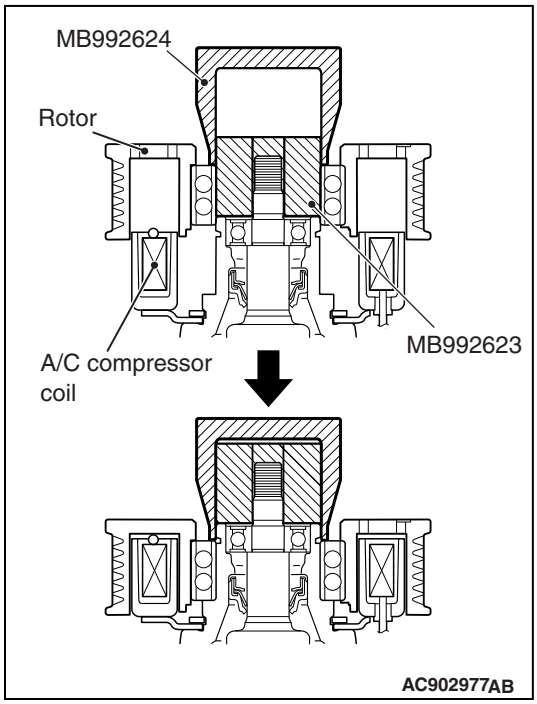
Line up the pin hole on the compressor unit with the A/C compressor coil projection and attach.

>>C<< ROTOR INSTALLATION

⚠ CAUTION

If the outer wheel side of rotor is pushed, an abnormal noise can be generated because the inside of rotor is damaged, therefore, always push the inner wheel side.

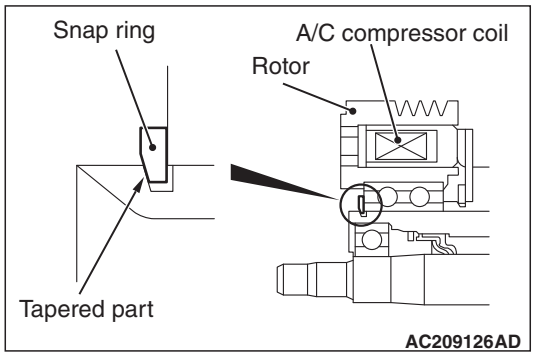




Install the rotor while pushing the inner wheel side slowly using the pusher (MB992624) and guide (MB992623).

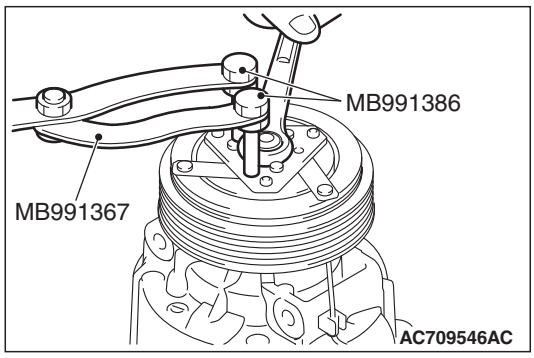
NOTE: Insert the rotor in a direction perpendicular to the A/C compressor.

>>D<< SNAP RING INSTALLATION



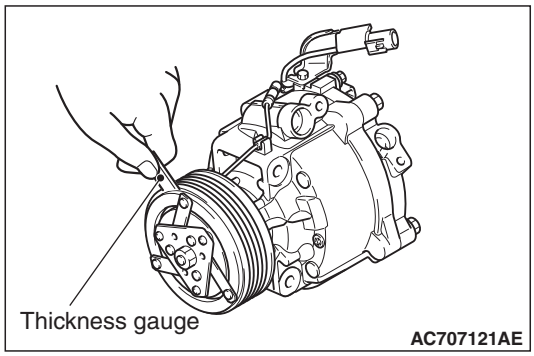
Using snap ring pliers, fit the snap ring so that the snap ring's tapered part is on the outside.

>>E<< SELF-LOCKING NUT INSTALLATION



Using a special tool, as when removing the nut, secure the armature and tighten the self-locking nut.

>>F<< AIR GAP ADJUSTMENT



Check whether or not the air gap of the clutch is within the standard value.

Standard value:
0.25 – 0.45 mm

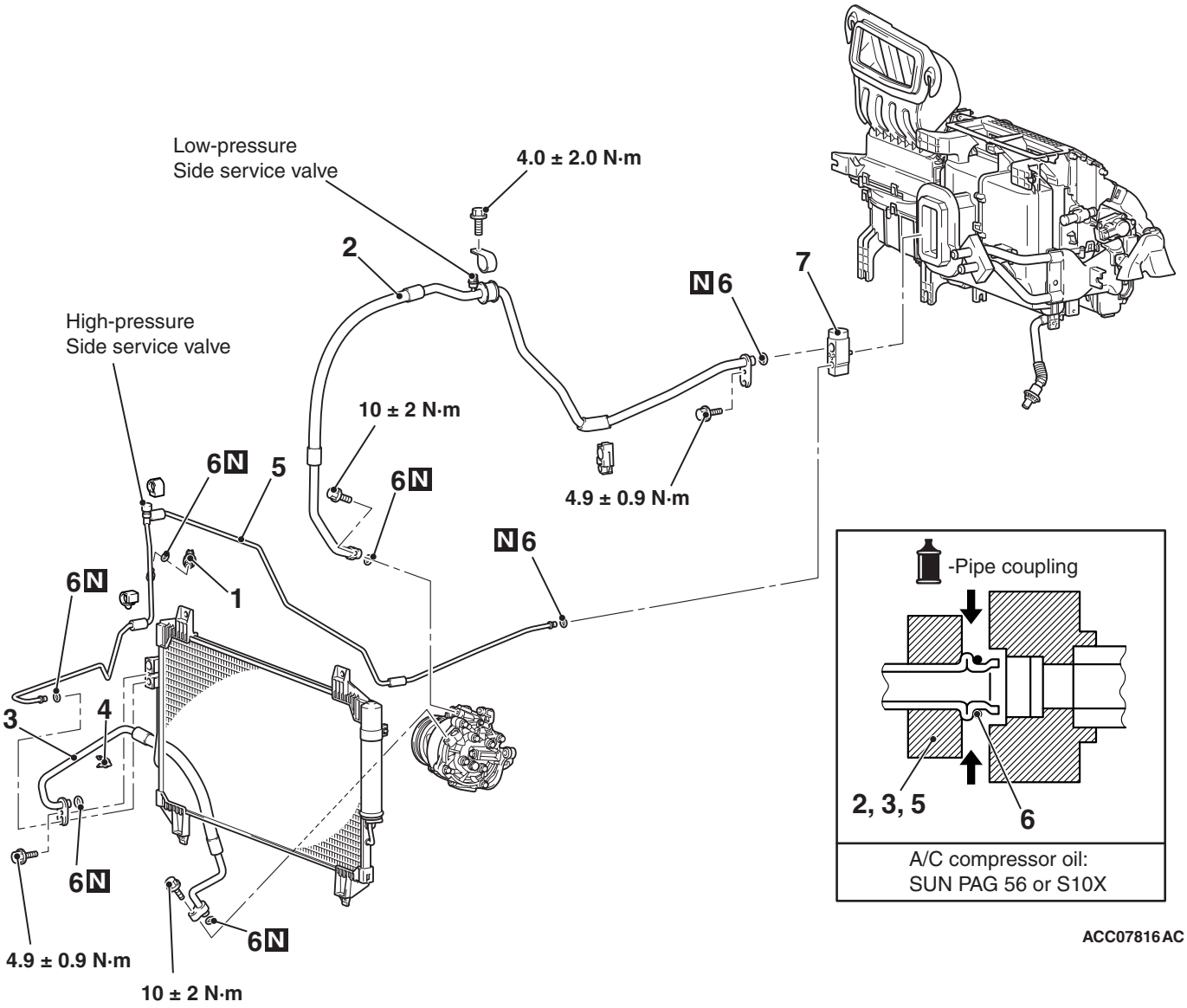
NOTE: If there is a deviation of the air gap from the standard value, make the necessary adjustment by adjusting the number of shims.

REFRIGERANT LINE

REMOVAL AND INSTALLATION

M1552006403092

Pre-removal and Post-installation Operation
Discharging and Recharging refrigerant (Refer to).



A/C pressure sensor removal steps

<<A>> 1. A/C pressure sensor
<<A>> 6. O-ring

A/C compressor suction hose removal steps

- Dash panel heat protector (Refer to GROUP 42A, Loose Panel).

<<A>> 2. A/C compressor suction hose
<<A>> 6. O-ring

Liquid pipe and A/C compressor discharge hose removal steps

- Air Cleaner Intake Duct Removal and Installation (Refer to GROUP 15 – Air Cleaner P.15-11)
- Headlamp support panel cover Removal and Installation (Refer to GROUP 51, Front Bumper and Radiator Grille).

<<A>> >>A<< 3. A/C compressor discharge hose
<<A>> 6. O-ring
4. Clamp
<<A>> 5. Liquid pipe
<<A>> 6. O-ring

Expansion valve removal steps

- Dash panel heat protector (Refer to GROUP 42A, Loose Panel).

<<A>> 2. A/C compressor suction hose connection (at heater assembly side)
<<A>> 6. O-ring
<<A>> 5. Liquid pipe connection (at heater assembly side)
<<A>> 6. O-ring
<<A>> 7. Expansion valve

REMOVAL SERVICE POINT

<<A>> HOSE AND PIPE REMOVAL

⚠ CAUTION

Use the plug which is not breathable because A/C compressor oil or receiver have high hygroscopicity.

Plug the nipple of condenser, compressor, and expansion valve to prevent the entry of dust and dirt.

INSTALLATION SERVICE POINT

>>A<< A/C COMPRESSOR DISCHARGE HOSE INSTALLATION

Assemble the clamp into the condenser assembly, and then assemble the A/C condenser discharge hose into the clamp.

NOTES

GROUP 70

COMPONENT LOCATIONS

CONTENTS

RELAY 70-2

SENSOR. 70-3

SOLENOID AND SOLENOID VALVE 70-6

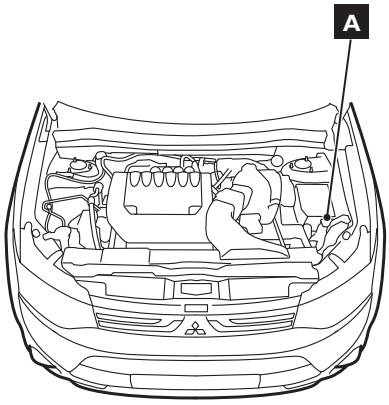
EARTH CABLE. 70-7

EARTH 70-8

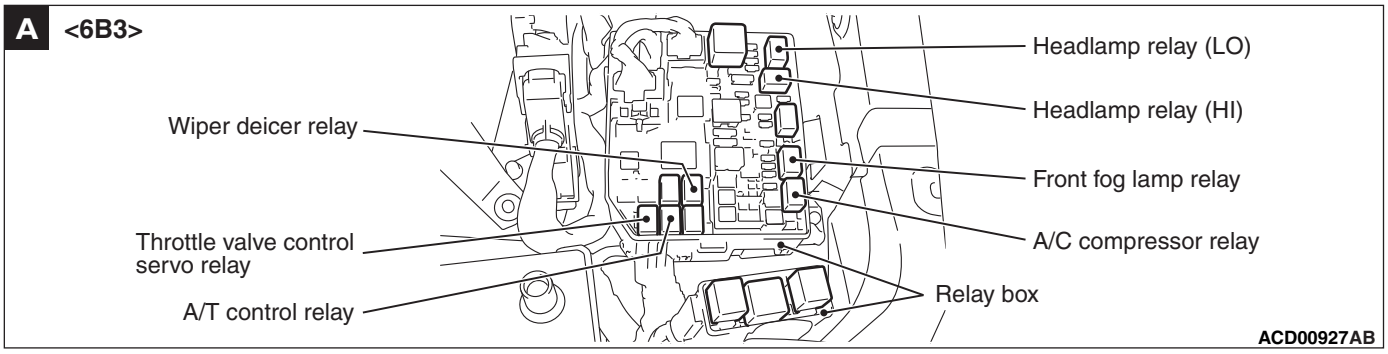
RELAY

M1701000402570

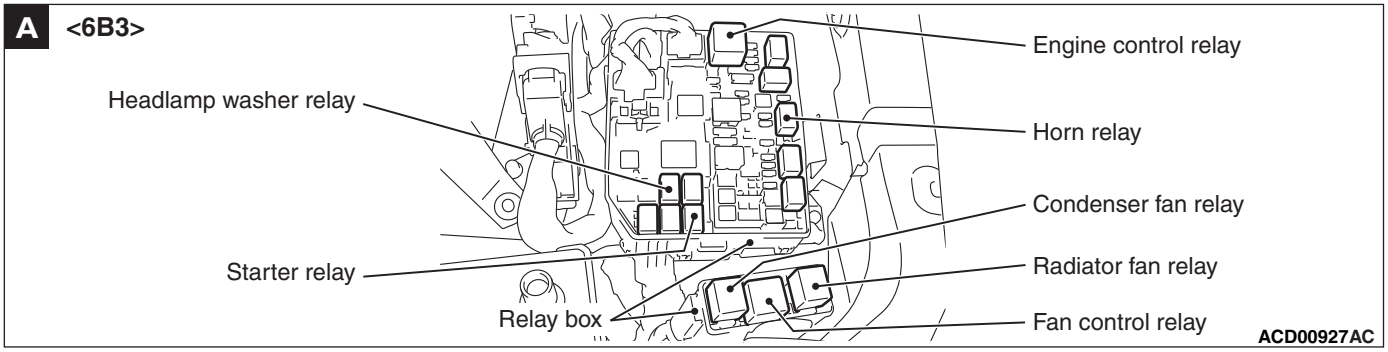
Name	Symbol	Name	Symbol
A/C compressor relay <6B3>	A	Headlamp washer relay <6B3>	A
Condenser fan relay <6B3>	A	Horn relay <6B3>	A
Engine control relay <6B3>	A	Radiator fan relay <6B3>	A
Fan control relay <6B3>	A	Starter relay <6B3>	A
Front fog lamp relay <6B3>	A	Throttle valve control servo relay <6B3>	A
Headlamp relay (HI) <6B3>	A	Wiper deicer relay <6B3>	A
Headlamp relay (LO) <6B3>	A		



ACD00774AB



ACD00927AB

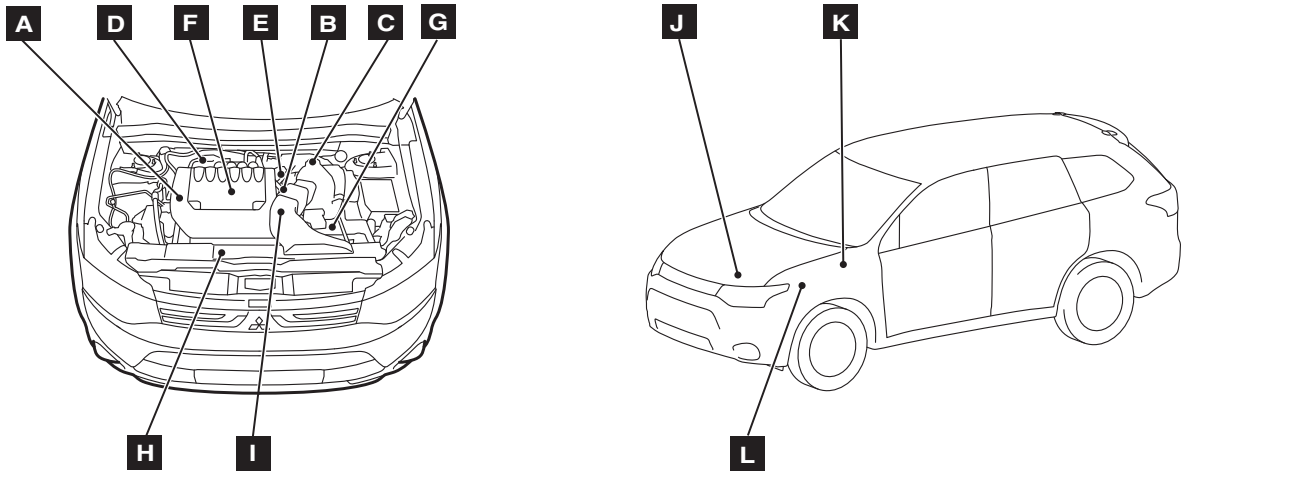


ACD00927AC

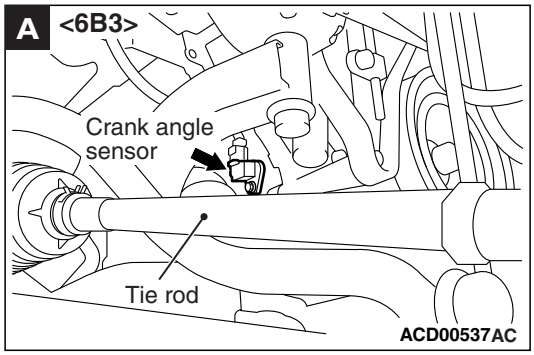
SENSOR

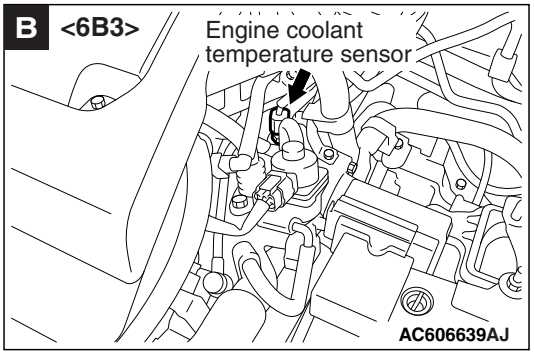
M1701000603618

Name	Symbol	Name	Symbol
Air flow sensor <6B3>	C	Left bank oxygen sensor (front) <6B3>	H
Camshaft position sensor <6B3>	I	Left bank oxygen sensor (rear) <6B3>	J
Crank angle sensor <6B3>	A	Manifold absolute pressure sensor <6B3>	D
Electronic-controlled throttle valve (incorporating throttle position sensor) <6B3>	E	Output shaft speed sensor <6B3>	L
Engine coolant temperature sensor <6B3>	B	Right bank detonation sensor <6B3>	F
Input shaft speed sensor <6B3>	G	Right bank oxygen sensor (front) <6B3>	K
Left bank detonation sensor <6B3>	F	Right bank oxygen sensor (rear) <6B3>	K

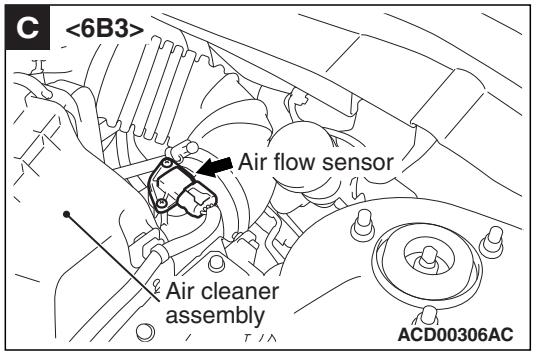


ACD01503AB

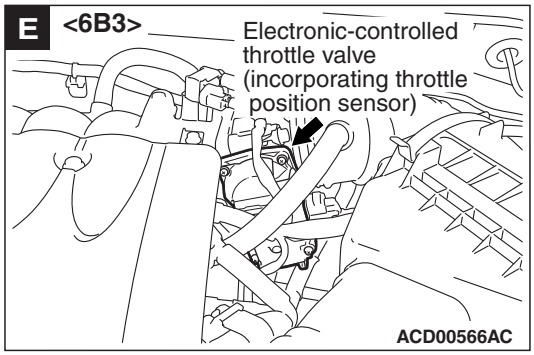




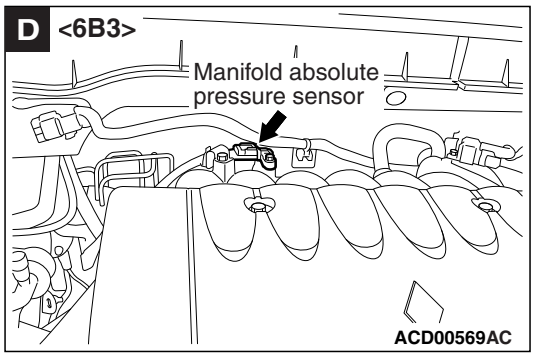
C <6B3>



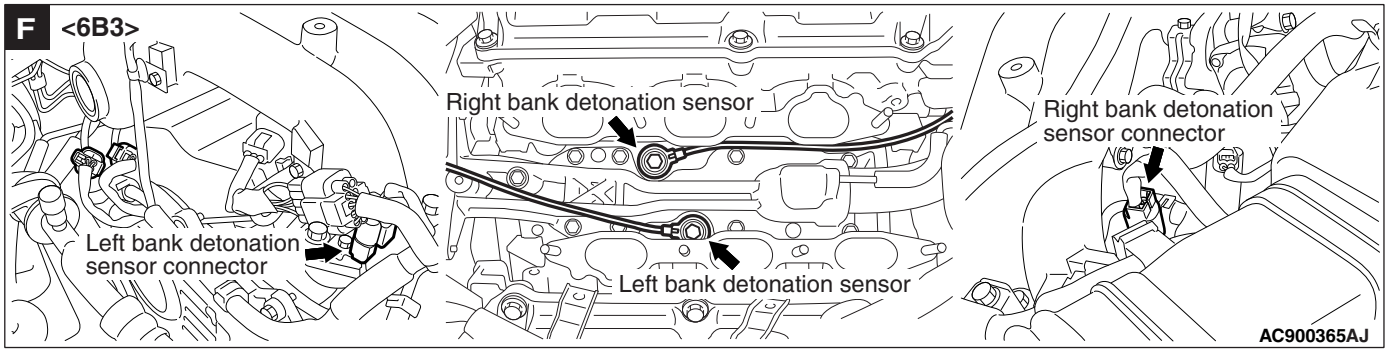
E <6B3>



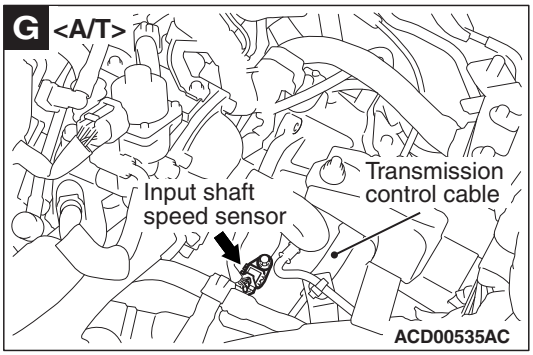
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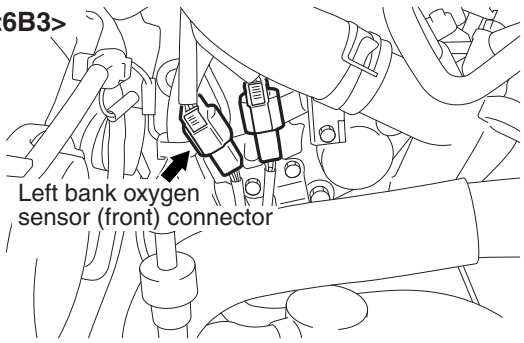
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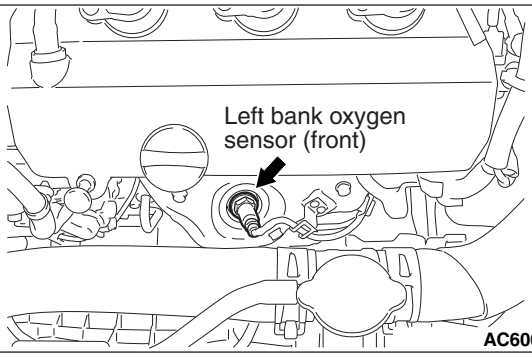


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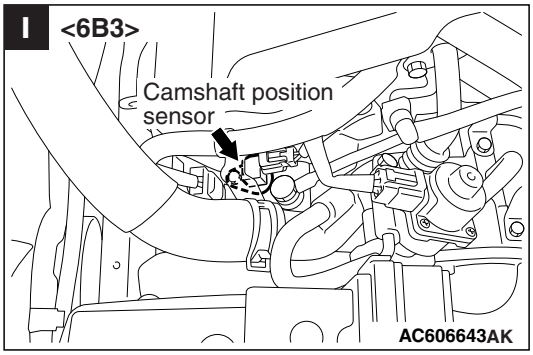


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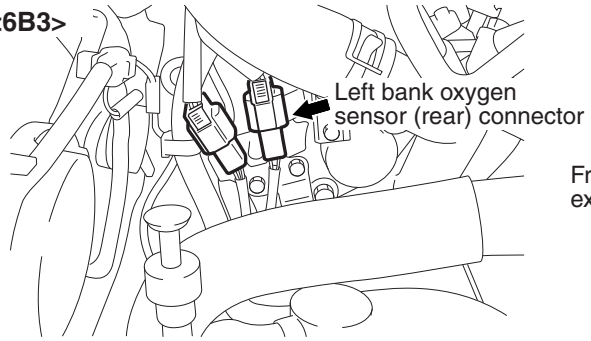


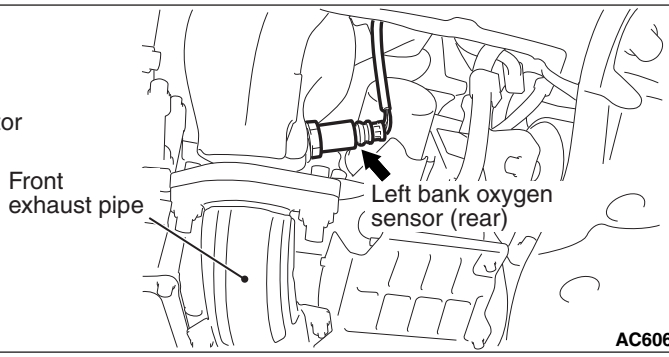


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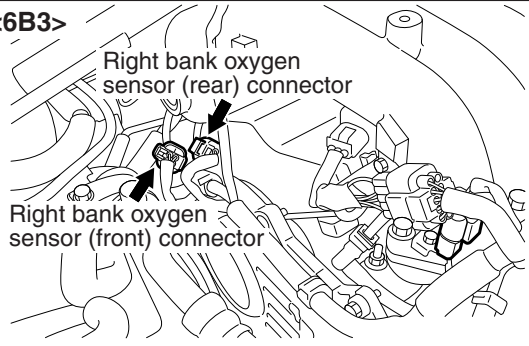


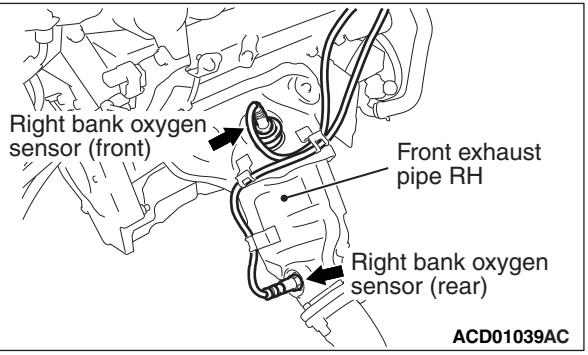
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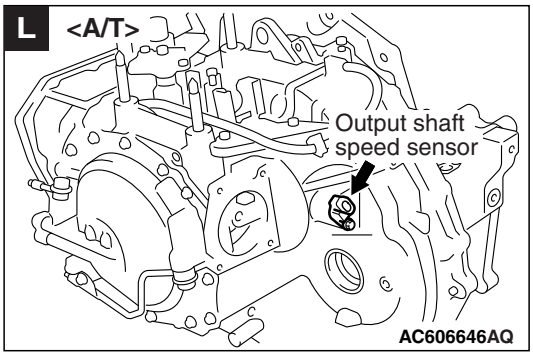




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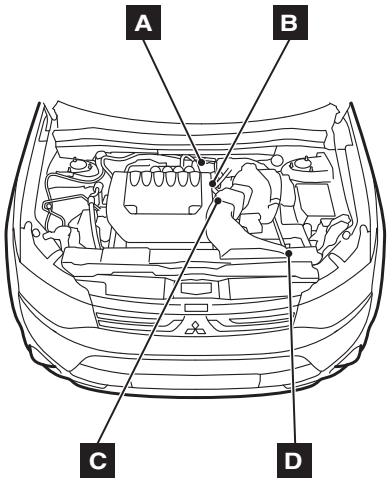




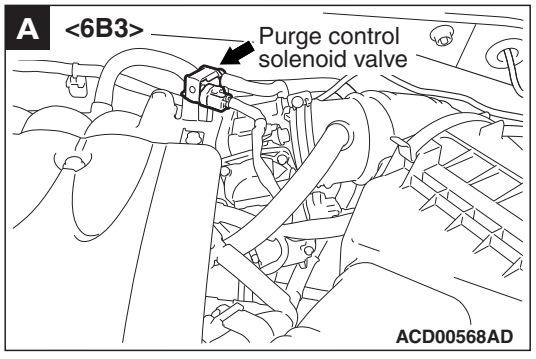
SOLENOID AND SOLENOID VALVE

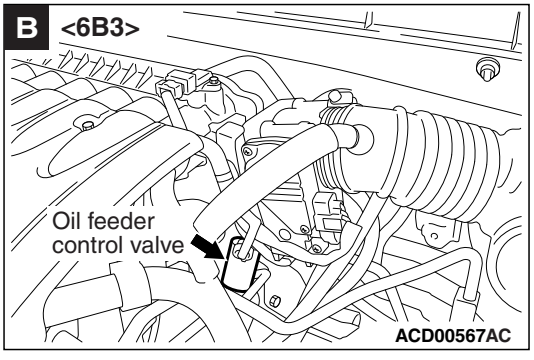
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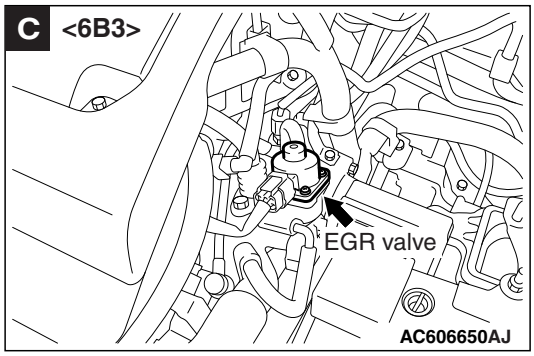
Name	Symbol	Name	Symbol
A/T control solenoid valve assembly <6B3>	D	Oil feeder control valve <6B3>	B
EGR valve <6B3>	C	Purge control solenoid valve <6B3>	A

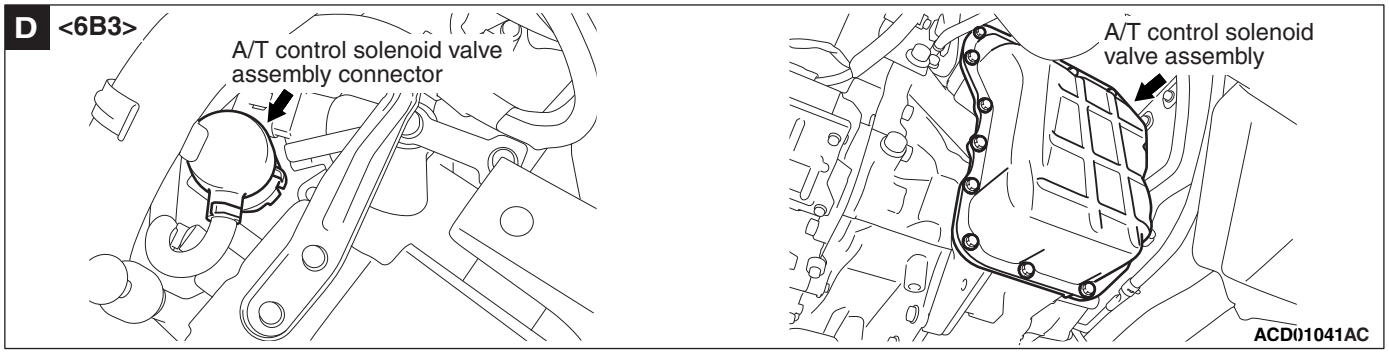


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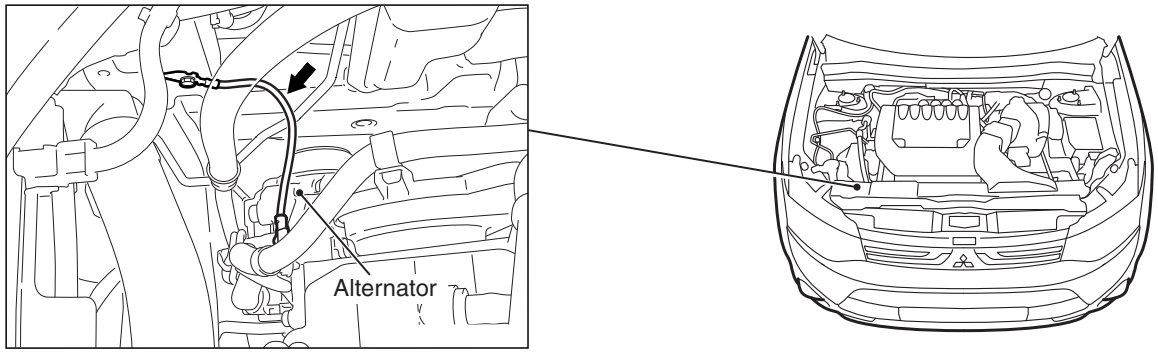




EARTH CABLE

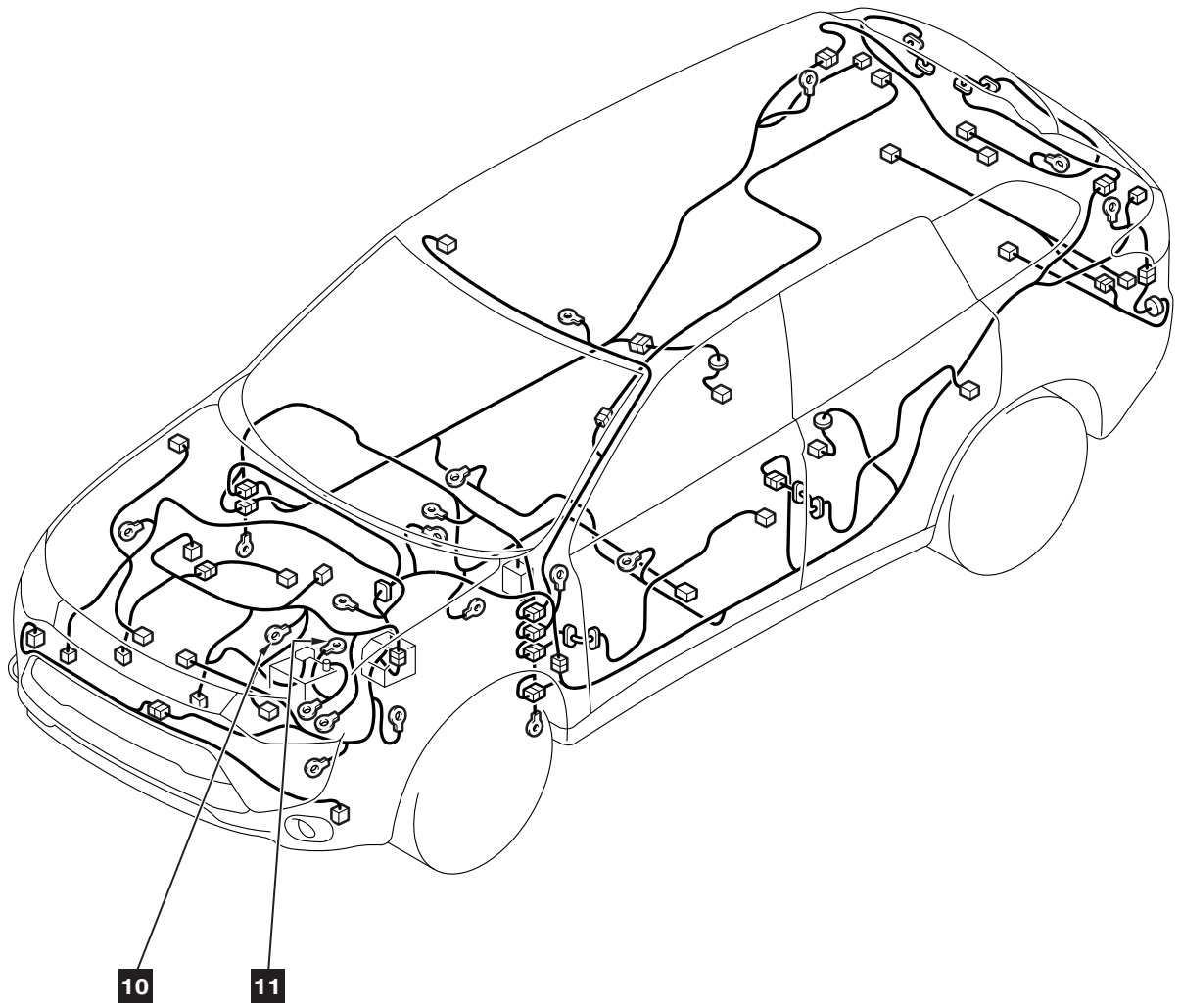
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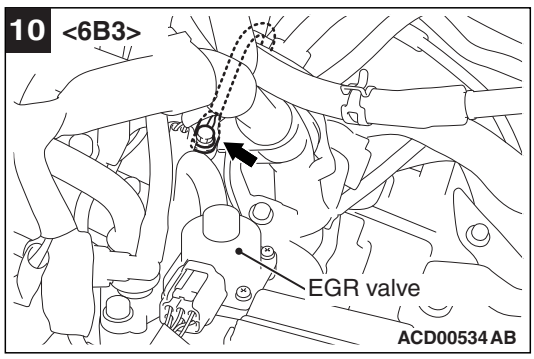
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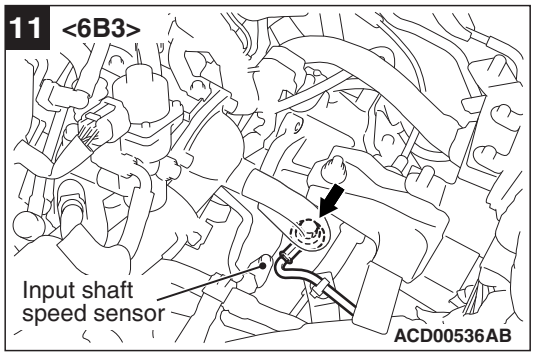
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ACD01254AD

NOTE: Same earth numbers are used in the circuit diagram.





GROUP 80

CONFIGURATION DIAGRAMS

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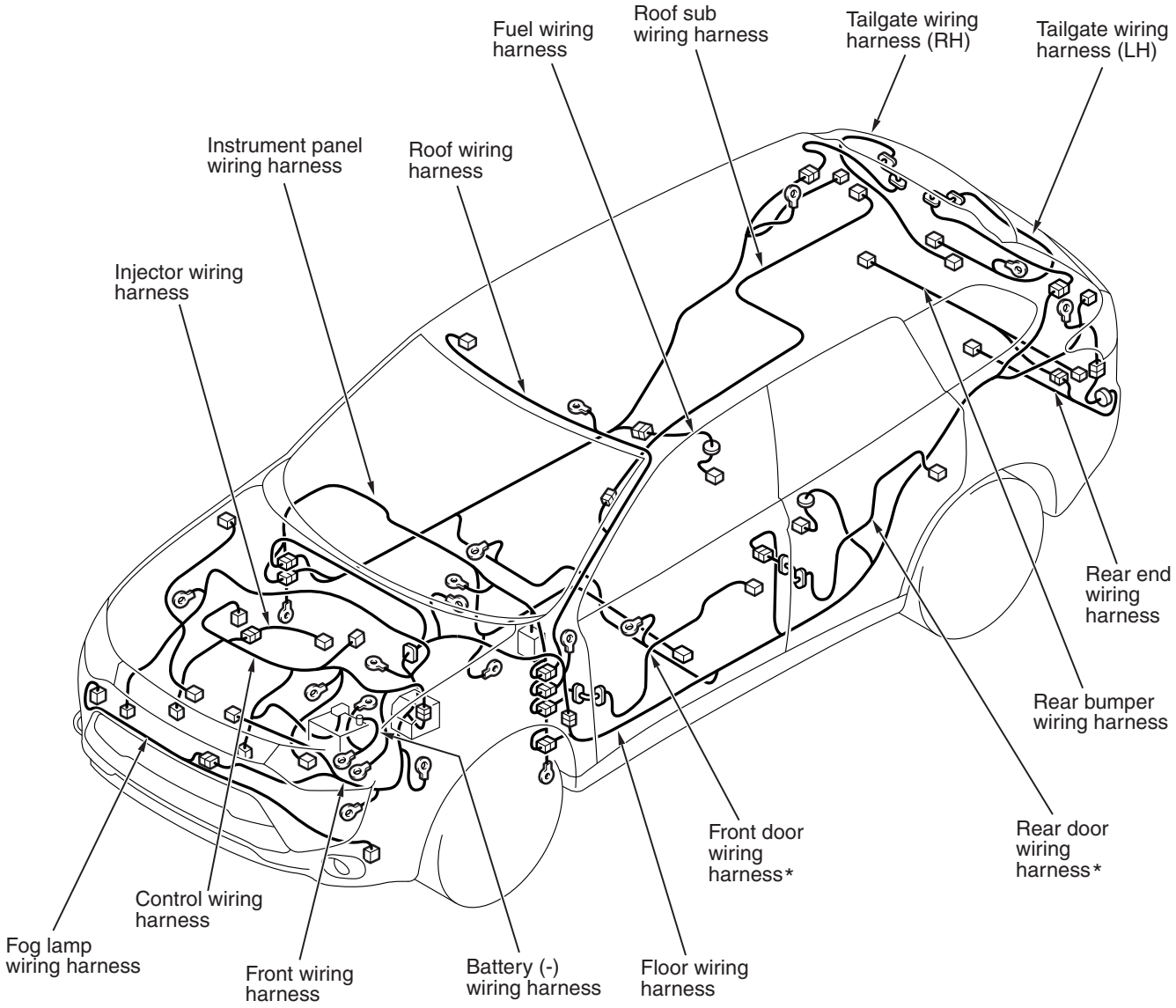
OVERALL CONFIGURATION DIAGRAM <6B3>. 80-2

ENGINE COMPARTMENT <6B3>. . . 80-3

ENGINE AND TRANSMISSION <6B3> 80-5

OVERALL CONFIGURATION DIAGRAM <6B3>

M1801000104389



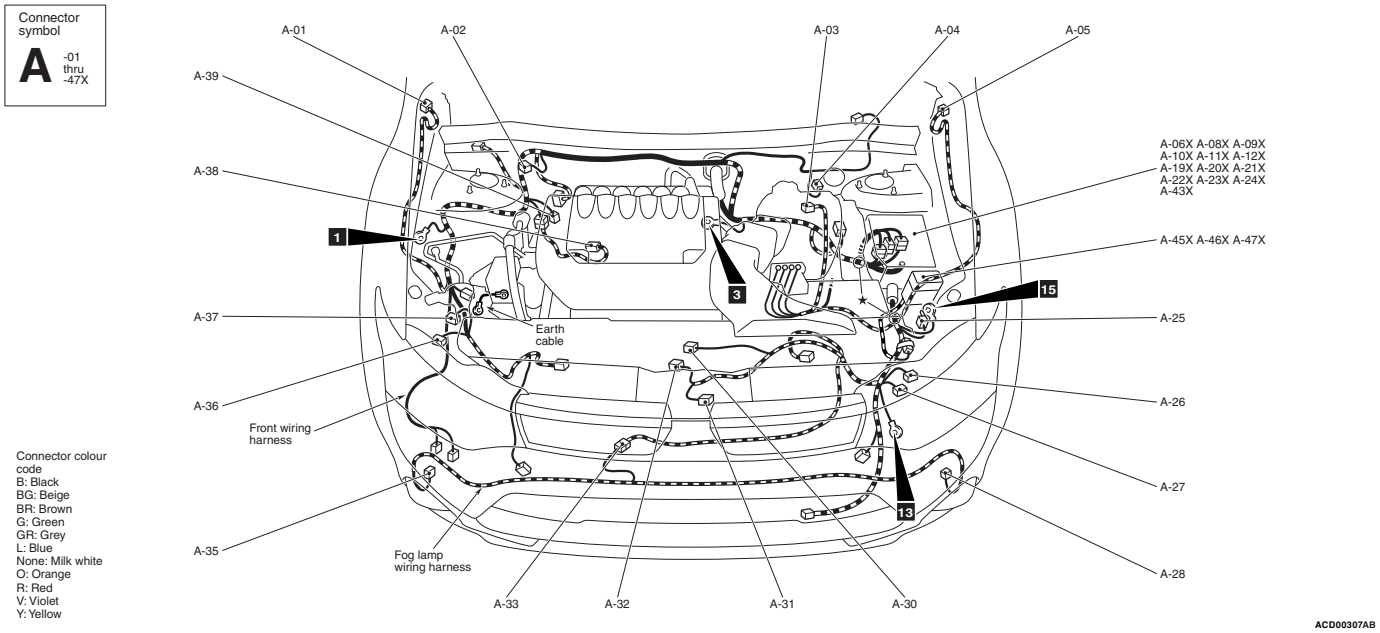
ACD01254AC

NOTE:

1. *This illustration shows only major wiring harnesses.*
2. **: also equipped at the right side.*

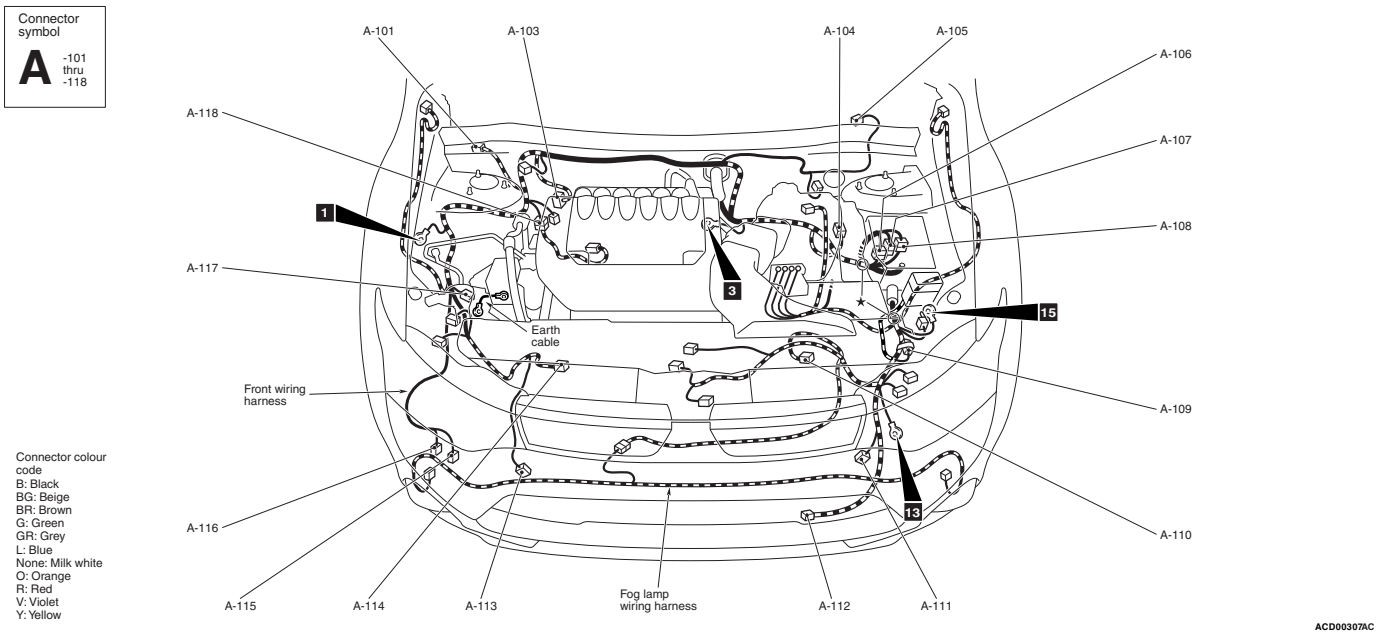
ENGINE COMPARTMENT <6B3>

M1801000309559



A-01	(2-B)	Side turn-signal lamp (RH)
A-02	(4-B)	No connection
A-03	(4-B)	Air flow sensor
A-04	(2-B)	Brake fluid level switch
A-05	(2-B)	Side turn-signal lamp (LH)
A-06X	(4)	Throttle valve control servo relay
A-08X	(4)	Starter relay
A-09X	(4)	No connection
A-10X	(4)	No connection
A-11X	(4)	Headlamp washer relay
A-12X	(4)	Wiper deicer relay
A-19X	(4)	Engine control relay
A-20X	(4)	A/C compressor relay
A-21X	(4)	Front fog lamp relay
A-22X	(4)	Horn relay
A-23X	(4)	Headlamp relay (HI)
A-24X	(4)	Headlamp relay (LO)
A-25	(6-GR)	Earth J/C (Front)
A-26	(8-B)	Headlamp assembly (LH)
A-27	(6-GR)	Headlamp assembly (LH)
A-28	(2-B)	Front fog lamp (LH)
A-30	(2-B)	No connection
A-31	(2-B)	Condenser fan motor
A-32	(2-B)	Radiator fan motor
A-33	(4-B)	Front wiring harness and fog lamp wiring harness combination
A-35	(2-B)	Front fog lamp (RH)
A-36	(8-B)	Headlamp assembly (RH)
A-37	(6-GR)	Headlamp assembly (RH)
A-38	(3-B)	Front height sensor <Vehicles with headlamp automatic levelling system>
A-39	(2-B)	Front wheel speed sensor (RH)
A-43X	(4)	A/T control relay
A-45X	(4)	Condenser fan relay
A-46X	(5)	Fan control relay
A-47X	(4)	Radiator fan relay

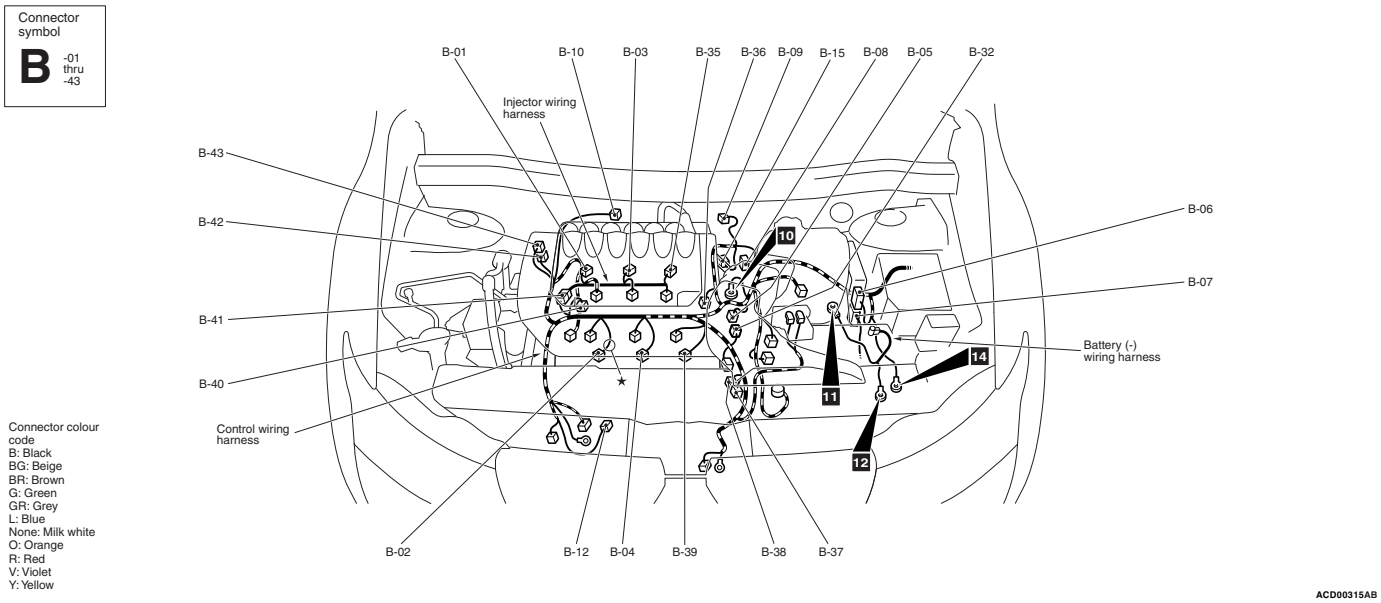
ENGINE COMPARTMENT <6B3> (CONTINUED)



A-101 (2-B) Wiper deicer
A-103 (38-B) ASC-ECU
A-104 (2-B) Front wheel speed sensor (LH)
A-105 (5-GR) Windshield wiper motor
A-106 (14-L) Front wiring harness and control wiring harness combination (integrated in relay box)
A-107 (22) Front wiring harness and control wiring harness combination (integrated in relay box)
A-108 (18-GR) Front wiring harness and control wiring harness combination (integrated in relay box)
A-109 (4-B) Spare connector (for trailer harness)
A-110 (2-Y) Front impact sensor (LH)
A-111 (1-B) Horn (LO)
A-112 (2-B) Ambient temperature sensor
A-113 (1-B) Horn (HI)
A-114 (2-Y) Front impact sensor (RH)
A-115 (2-GR) Headlamp washer motor
A-116 (2-B) Washer motor
A-117 (3-B) A/C pressure sensor
A-118 (3-GR) Front wiring harness and front height sensor sub wiring harness combination <Vehicles with headlamp automatic levelling system>

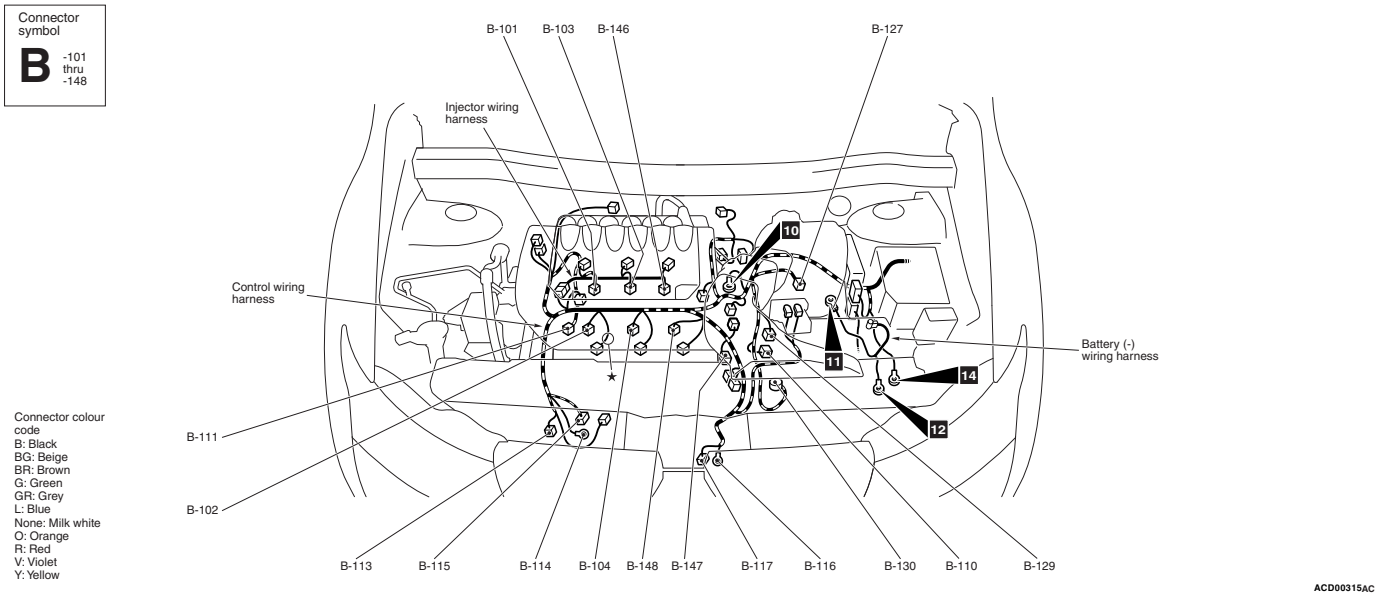
ENGINE AND TRANSMISSION <6B3>

M1801000405286



B-01	(3-B)	No.1 ignition coil
B-02	(3-B)	No.2 ignition coil
B-03	(3-B)	No.3 ignition coil
B-04	(3-B)	No.4 ignition coil
B-05	(2-B)	Engine coolant temperature sensor
B-06	(64-GR)	Engine-ECU
B-07	(48-GR)	Engine-ECU
B-08	(6-B)	Electronic-controlled throttle valve
B-09	(2-B)	Purge control solenoid valve
B-10	(3-B)	Manifold absolute pressure sensor
B-12	(1-L)	Engine oil pressure switch
B-15	(2-B)	Oil feeder control valve
B-32	(6-GR)	EGR valve
B-35	(3-B)	No.5 ignition coil
B-36	(2-B)	Right bank detonation sensor
B-37	(4-B)	Left bank oxygen sensor (Front)
B-38	(4-GR)	Left bank oxygen sensor (Rear)
B-39	(3-B)	No.6 ignition coil
B-40	(2-B)	Left bank detonation sensor
B-41	(10-B)	Control wiring harness and injector wiring harness combination
B-42	(4-B)	Right bank oxygen sensor (Rear)
B-43	(4-GR)	Right bank oxygen sensor (Front)

ENGINE AND TRANSMISSION <6B3> (CONTINUED)



B-101 (2-GR) No.1 injector
B-102 (2-GR) No.2 injector
B-103 (2-GR) No.3 injector
B-104 (2-GR) No.4 injector
B-110 (10-B) Inhibitor switch
B-111 (3-GR) Crank angle sensor
B-113 (1-B) A/C compressor assembly
B-114 (1) Alternator
B-115 (4-GR) Alternator
B-116 (1) Starter
B-117 (1-B) Starter
B-127 (3-B) Output shaft speed sensor
B-129 (3-B) Input shaft speed sensor
B-130 (22-B) A/T control solenoid valve assembly
B-146 (2-GR) No.5 injector
B-147 (3-GR) Camshaft position sensor
B-148 (2-GR) No.6 injector

GROUP 90

CIRCUIT DIAGRAMS

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CENTRALIZED JUNCTION

M1901000304539

FUSIBLE LINK AND FUSE

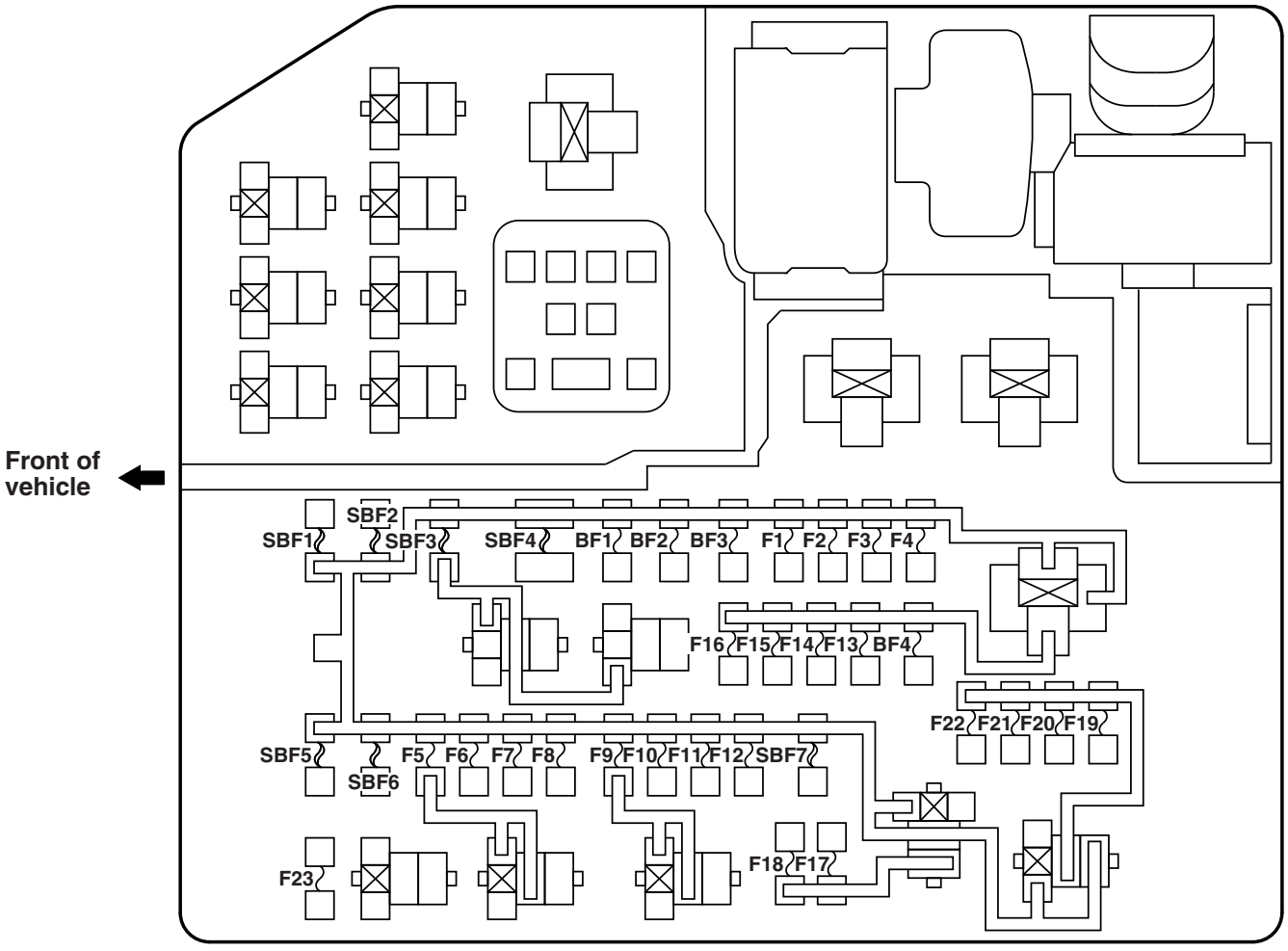
ENGINE COMPARTMENT <4B1, 4J1, 6B3>

No.	Power supply circuit	Name	Rated capacity (A)	Housing colour	Load circuit
SBF1	Fusible link No.4 in engine compartment	Fusible link	30	Pink	Condenser fan motor <6B3>, condenser fan relay <6B3> and fan control relay <6B3>
SBF2			30	Pink	Starter
SBF3			30	Pink	Condenser fan motor <4B1, 4J1>, condenser fan relay <4B1, 4J1> and fan control relay <4B1, 4J1>
SBF4			40	Green	Radiator fan motor and radiator fan relay
SBF5			40	Green	ABS-ECU and ASC-ECU
SBF6			40	Green	Valve lift control relay and Valve lift-ECU
SBF7			30	Pink	ABS-ECU, ASC-ECU and DC/DC converter (powertrain)
BF1		Fuse	30	Green	Electric tailgate control unit
BF2			30	Green	Audio amplifier
BF3			30	Green	Fuse No.17 to 19 in passenger compartment and DC/DC converter (entertainment)
BF4	Engine control relay		–	–	–
F1	Fusible link No.4 in engine compartment		20	Yellow	A/T-ECU, CVT-ECU, input shaft speed sensor <A/T>, output shaft speed sensor <A/T>, primary pulley speed sensor <CVT> and secondary pulley speed sensor <CVT>
F2			15	Blue	Wiper deicer
F3			–	–	–
F4			10	Red	Daytime running lamp and daytime running lamp relay
F5			15	Blue	Front fog lamp (LH, RH) and front fog lamp relay
F6			10	Red	A/C compressor assembly and A/C compressor relay
F7			20	Yellow	Headlamp washer motor and headlamp washer relay
F8			20	Yellow	Security alarm horn and security alarm horn relay

No.	Power supply circuit	Name	Rated capacity (A)	Housing colour	Load circuit
F9	Fusible link No.4 in engine compartment	Fuse	10	Red	Horn and horn relay
F10			15	Blue	Engine-ECU
F11			7.5	Brown	Alternator
F12			7.5	Brown	Engine-ECU
F13	Engine control relay		20	Yellow	<4B1, 4J1> Air flow sensor, AS&G-ECU, engine-ECU, inlet oil feeder control valve, No.1 to 4 injector, oxygen sensor (front), oxygen sensor (rear), purge control solenoid valve, throttle valve control servo relay, valve lift-ECU and vehicle speed sensor
					<6B3> Air flow sensor, engine-ECU, EGR valve, left bank oxygen sensor (front), left bank oxygen sensor (rear), No.1 to 6 injector, oil feeder control valve, purge control solenoid valve, right bank oxygen sensor (front), right bank oxygen sensor (rear) and throttle valve control servo relay
F14			15	Blue	Fuel pump and gauge unit (main)
F15			10	Red	No.1 to 4 ignition coil <4B1, 4J1>, No.1 to 6 ignition coil <6B3>
F16			–	–	–
F17	Headlamp relay (HI)		10	Red	Headlamp assembly (LH)
F18			10	Red	Headlamp assembly (RH)
F19	Headlamp relay (LO)		20	Yellow	Headlamp assembly (LH) <Discharge type>
F20			20	Yellow	Headlamp assembly (RH) <Discharge type>
F21			10	Red	Headlamp assembly (LH, RH) and headlamp manual levelling switch
F22			10	Red	Headlamp assembly (RH)
F23			7.5	Brown	Battery current sensor
1	Battery/Alternator	Fusible link	140	–	Fusible link No.5/Fusible link No.2 to 4
2	Battery/Fusible link No.1 in engine compartment		80	–	ETACS-ECU, fusible link No.1 and fuse No.4, 8 to 16, 20, 25 and fusible link No.24 in passenger compartment and ETACS-ECU (ACC relay 3)
3			80	–	EPS-ECU and fuse No.F23 in engine compartment

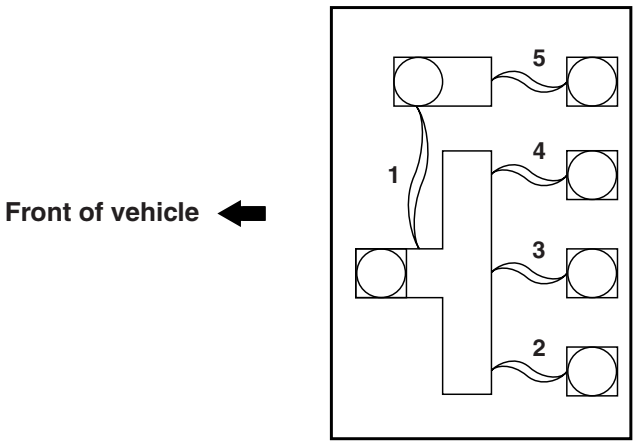
No.	Power supply circuit	Name	Rated capacity (A)	Housing colour	Load circuit
4	Battery/Fusible link No.1 in engine compartment	Fusible link	120 <Except for 4J1> 175 <4J1>	–	Fusible link No.SBF1 to SBF7, BF1 to BF3, F1, F2, F4 to F15 and F17 to F22 in engine compartment, engine control relay, headlamp relay (LO) and headlamp relay (HI)
5	Fusible link No.1 in engine compartment/Alternator		80	–	Fusible link No.2 and fuse No.3, 5 to 7 and 21 to 23 in passenger compartment and ETACS-ECU (ACC relay 2, blower relay and rear window defogger relay)

Relay box



ACB06030AB

Fusible link box connected directly to battery positive terminal



AC506810AZ

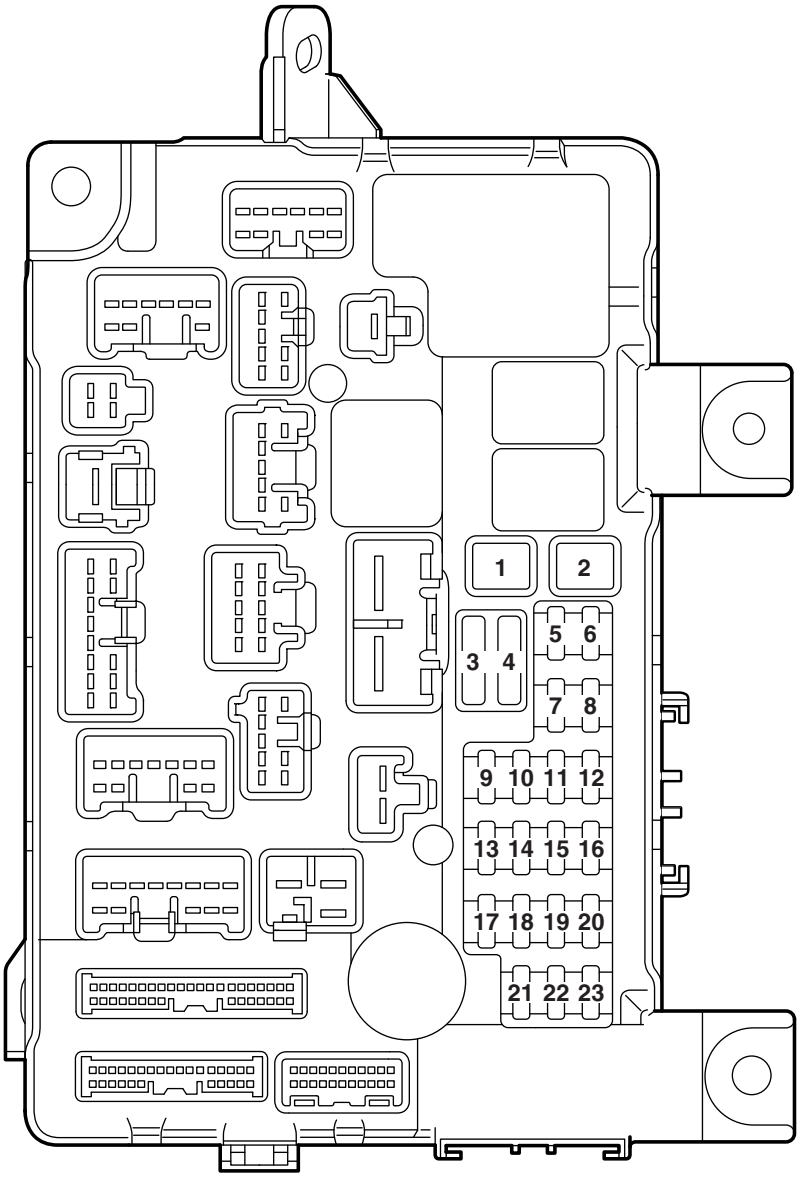
PASSENGER COMPARTMENT

No.	Power supply circuit	Name	Rated capacity (A)	Housing colour	Load circuit
1	Fusible link No.2 in engine compartment <4B1, 4J1, 6B3> Fusible link No.12 in engine compartment <4N1>	Fusible link	30	Pink	Front power window motor (LH, RH), power window main switch and rear power window motor (LH, RH)
2	Fusible link No.5 in engine compartment <4B1, 4J1, 6B3> Fusible link No.10 in engine compartment <4N1>		30	Pink	Fuse No.21 in passenger compartment and rear window defogger
3		Fuse	30	Green	Blower motor
4	ETACS-ECU (ACC relay 3)		30	Green	ETACS-ECU, ETACS-ECU (rear window washer relay, windshield washer relay, windshield wiper automatic stop relay, windshield wiper speed switching relay), washer motor and windshield wiper motor
5	Fusible link No.5 in engine compartment <4B1, 4J1, 6B3> Fusible link No.10 in engine compartment <4N1>		20	Yellow	ETACS-ECU (dead lock relay, door lock relay, door mirror fold relay, door mirror unfold relay, door unlock relay, driver's door unlock relay, tailgate unlock relay <Vehicles without KOS>), door mirror assembly (LH, RH), front door lock actuator (LH, RH), rear door lock actuator (LH, RH) and tailgate door lock actuator

No.	Power supply circuit	Name	Rated capacity (A)	Housing colour	Load circuit
6	Fusible link No.5 in engine compartment <4B1, 4J1, 6B3> Fusible link No.10 in engine compartment <4N1>	Fuse	10	Red	Rear fog lamp
7			15	Blue	–
8	ETACS-ECU (ACC relay 3)		15	Blue	ETACS-ECU, ETACS-ECU (rear wiper relay) and rear wiper motor
9	Fusible link No.2 in engine compartment <4B1, 4J1, 6B3> Fusible link No.12 in engine compartment <4N1>		20	Yellow	Sunroof motor assembly
10			10	Red	AS&G-ECU <M/T>, electric steering lock, engine switch, ignition switch circuit and OSS-ECU
11			10	Red	Diagnosis connector
12			15	Blue	ETACS-ECU (turn-signal lamp control circuit)
13			10	Red	4WD-ECU
14			15	Blue	ETACS-ECU (stop lamp control circuit), OSS-ECU and spare connector (for switch box)
15	ETACS-ECU (IG1 relay)		10	Red	4WD-ECU, ABS-ECU, ACC/FCM-ECU, A/T control relay, ASC-ECU, AS&G-ECU, column switch, combination meter, corner sensor/back sensor-ECU, CVT control relay, DC/DC converter (powertrain), electric tailgate control unit, engine-ECU <4N1>, EPS-ECU, hazard indicator assembly, heated seat relay, KOS-ECU, heater controller assembly (A/C-ECU), PTC heater relay 1, PTC heater relay 2, PTC heater relay 3, selector lever assembly, sonar switch, steering wheel sensor and sunroof motor assembly
16			7.5	Brown	SRS-ECU

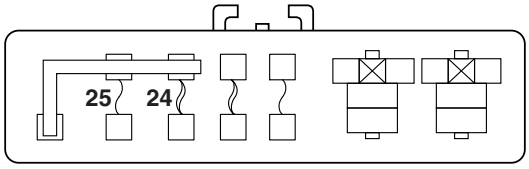
No.	Power supply circuit	Name	Rated capacity (A)	Housing colour	Load circuit
17	Fuse No.BF3 in engine compartment	Fuse	15	Blue	<Vehicles without AS&G system> CAN box unit, DAB tuner, hands free-ECU, multivision display, radio and CD player, rear display unit, spare connector (for audio) and spare connector (for rear display)
					<Vehicles with AS&G system> –
18			7.5	Brown	Column switch, combination meter, ETACS-ECU (ignition control circuit, power window relay), electric tailgate control unit, heater controller assembly (A/C-ECU), KOS-ECU, lighting control sensor, OSS-ECU, security alarm sensor and security alarm siren
19			15	Blue	Combination meter, ETACS-ECU (interior lamp control circuit) and hazard indicator assembly
20	ETACS-ECU (IG1 relay)		7.5	Brown	A/T-ECU, back-up lamp, CVT-ECU, ETACS-ECU and spare connector (for switch box)
21	ETACS-ECU (Rear window defogger relay)		7.5	Brown	Door mirror assembly (LH, RH) and wiper deicer relay
22	ETACS-ECU (ACC relay 2)		10	Red	<Vehicles without AS&G system> CAN box unit, door mirror assembly (LH, RH), multivision display, radio and CD player, rear display unit, selector lever assembly, spare connector (for audio), spare connector (for rear display) and steering lock solenoid
					<Vehicles with AS&G system> DC/DC converter (entertainment), door mirror assembly (LH, RH), selector lever assembly and steering lock solenoid
23			15	Blue	Accessory socket and cigarette lighter
24	Fusible link No.2 in engine compartment <4B1, 4J1, 6B3> Fusible link No.12 in engine compartment <4N1>	Fusible link	30	Pink	Power seat assembly
25		Fuse	30	Green	Heated seat (LH, RH) and heated seat switch

ETACS-ECU



ACB04404AC

Relay box connected directly to ETACS-ECU



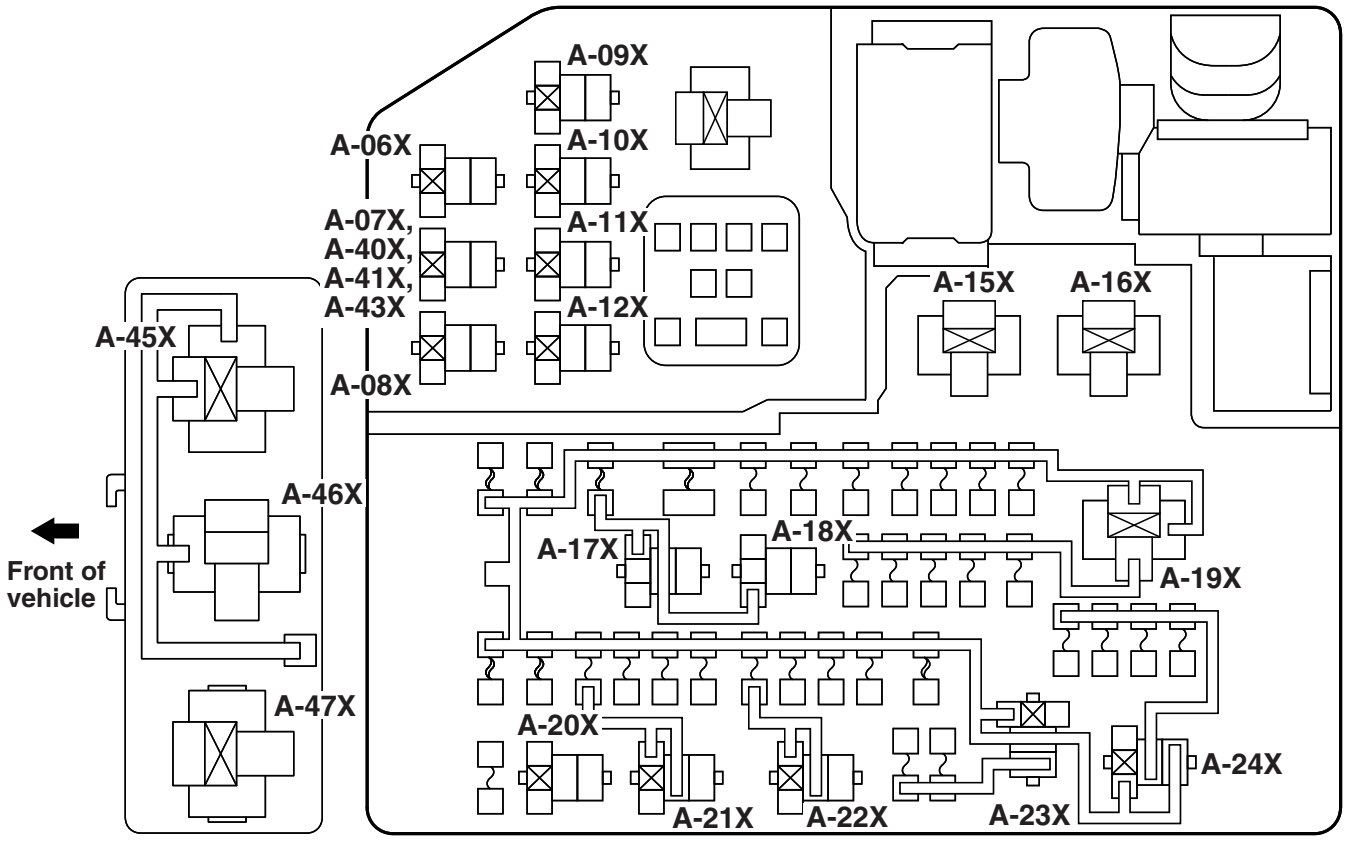
ACB04405AB

CENTRALIZED RELAY

CENTRALIZED RELAY <4B1, 4J1, 6B3>

Connector No.	Name	Connector No.	Name
A-06X	Throttle valve control servo relay	A-20X	A/C compressor relay
A-07X	CVT control relay <Vehicles without AS&G system>	A-21X	Front fog lamp relay
A-08X	Starter relay	A-22X	Horn relay
A-09X	Security alarm relay <Vehicles without security alarm sensor>	A-23X	Headlamp relay (HI)
A-10X	Daytime running lamp relay	A-24X	Headlamp relay (LO)
A-11X	Headlamp washer relay	A-40X	Starter cut relay <Vehicles with AS&G system (M/T)>
A-12X	Wiper deicer relay	A-41X	Electric oil pump relay <Vehicles with AS&G system (CVT)>
A-15X	Valve lift control relay <4J1>	A-43X	A/T control relay
A-16X	Radiator fan relay <4B1, 4J1>	A-45X	Condenser fan relay <6B3>
A-17X	Condenser fan relay <4B1, 4J1>	A-46X	Fan control relay <6B3>
A-18X	Fan control relay <4B1, 4J1>	A-47X	Radiator fan relay <6B3>
A-19X	Engine control relay		

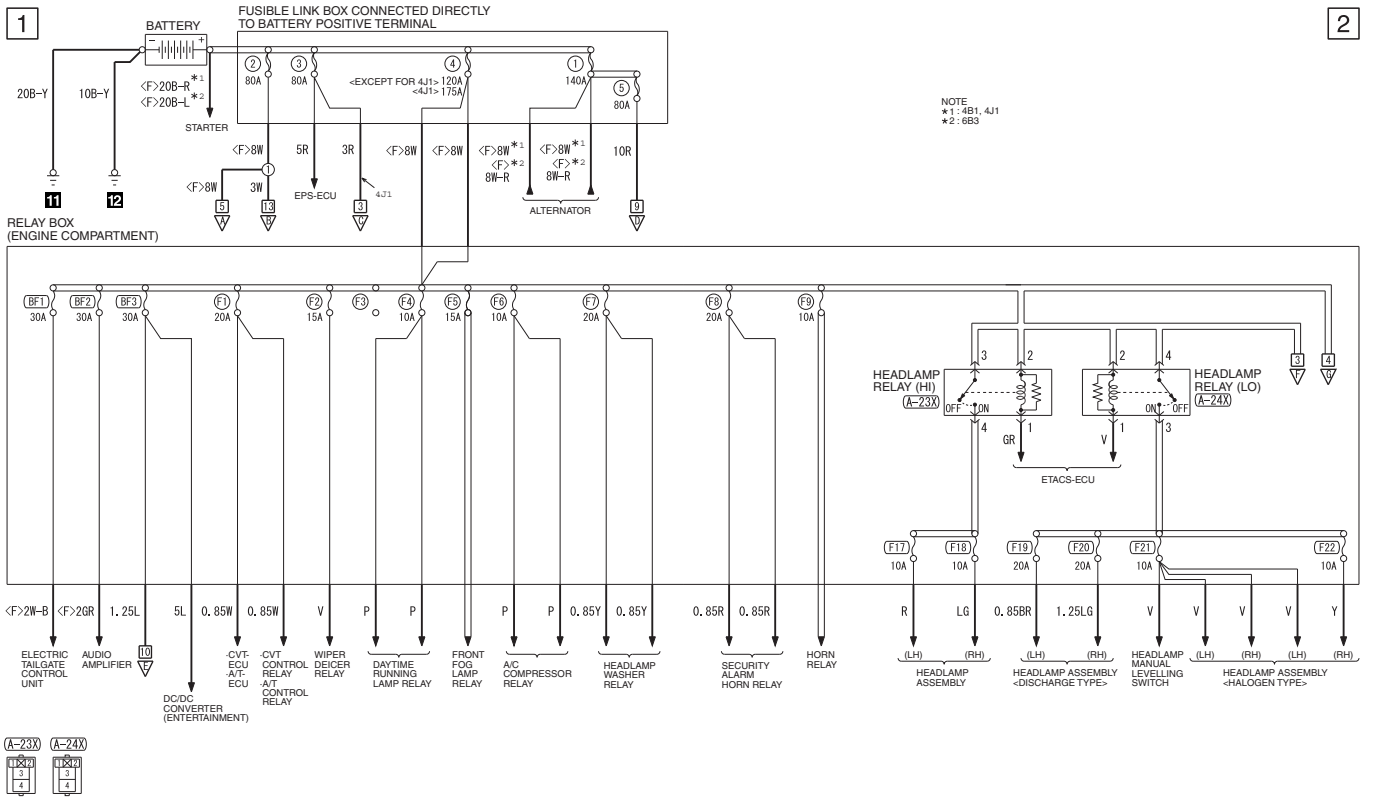
Relay box in engine compartment



ACC01753AE

POWER DISTRIBUTION SYSTEM <4B1, 4J1, 6B3>

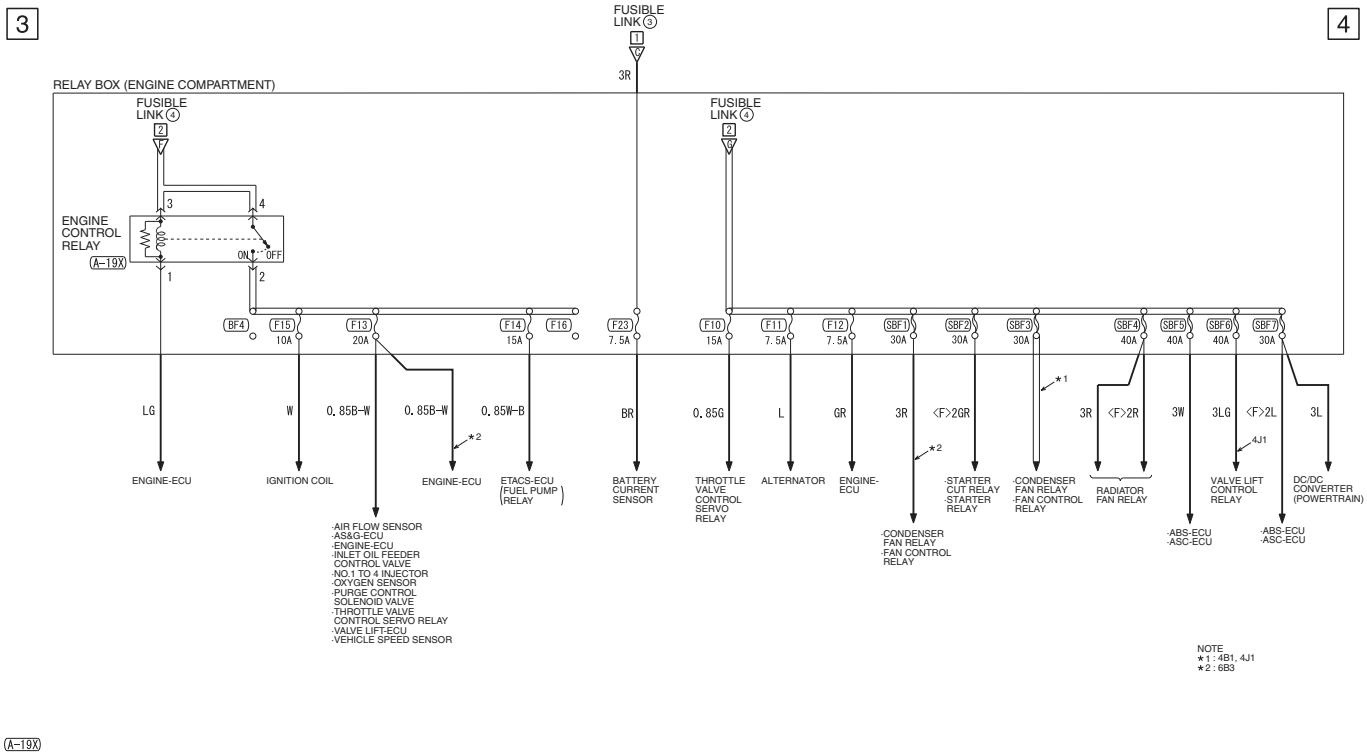
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Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU01E05AC

POWER DISTRIBUTION SYSTEM <4B1, 4J1, 6B3> (CONTINUED)

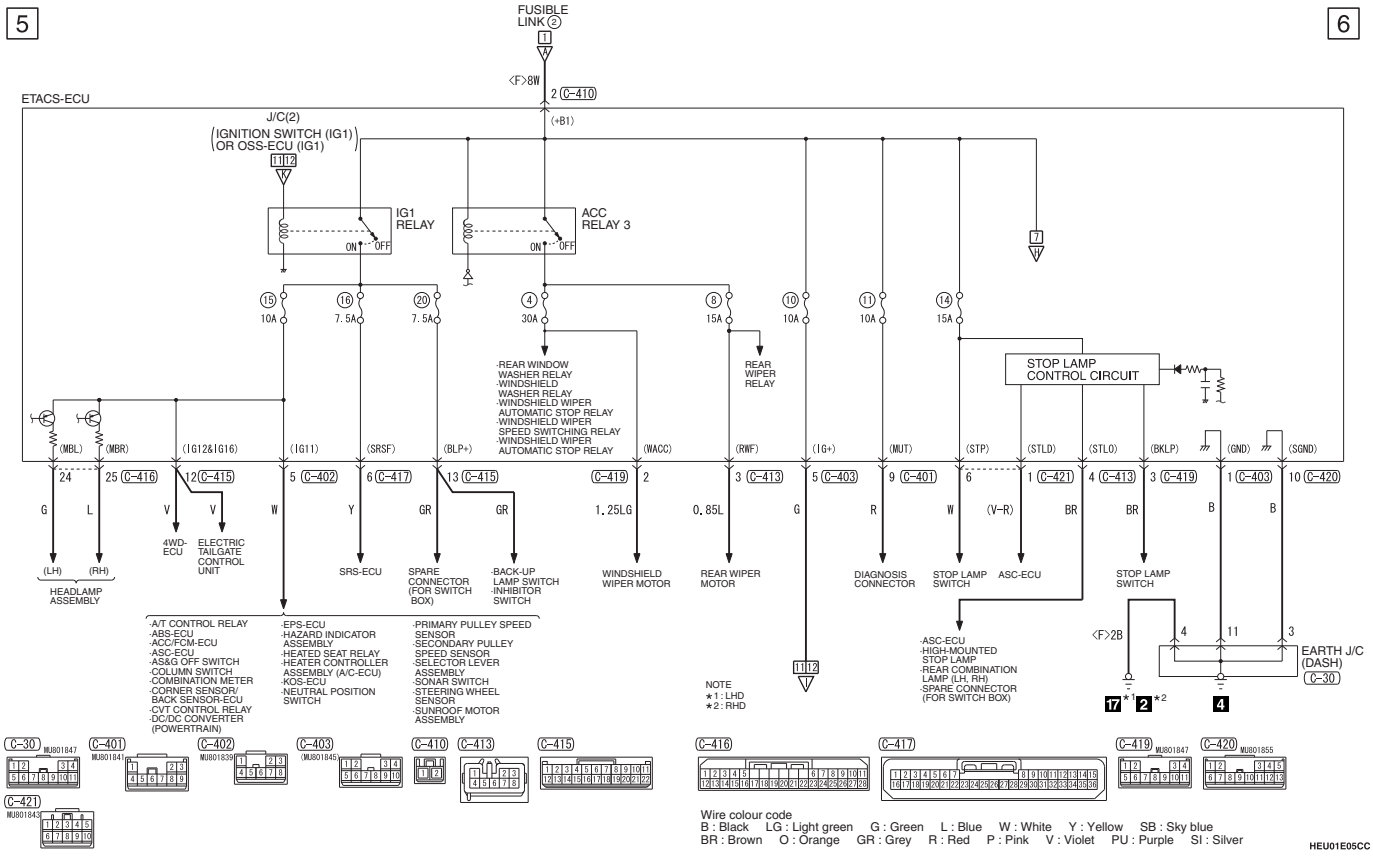




Wire colour code
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BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

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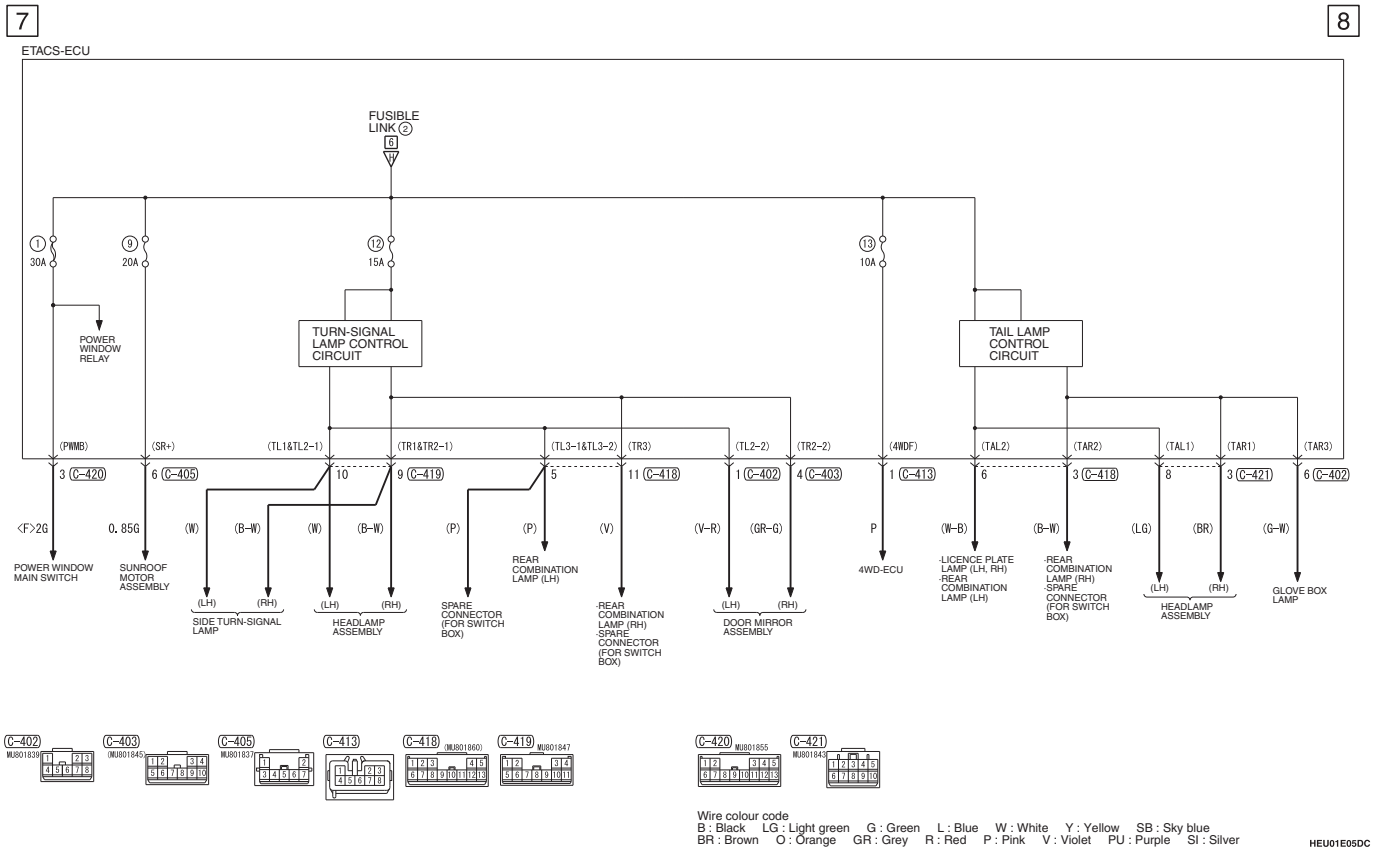
POWER DISTRIBUTION SYSTEM <4B1, 4J1, 6B3> (CONTINUED)



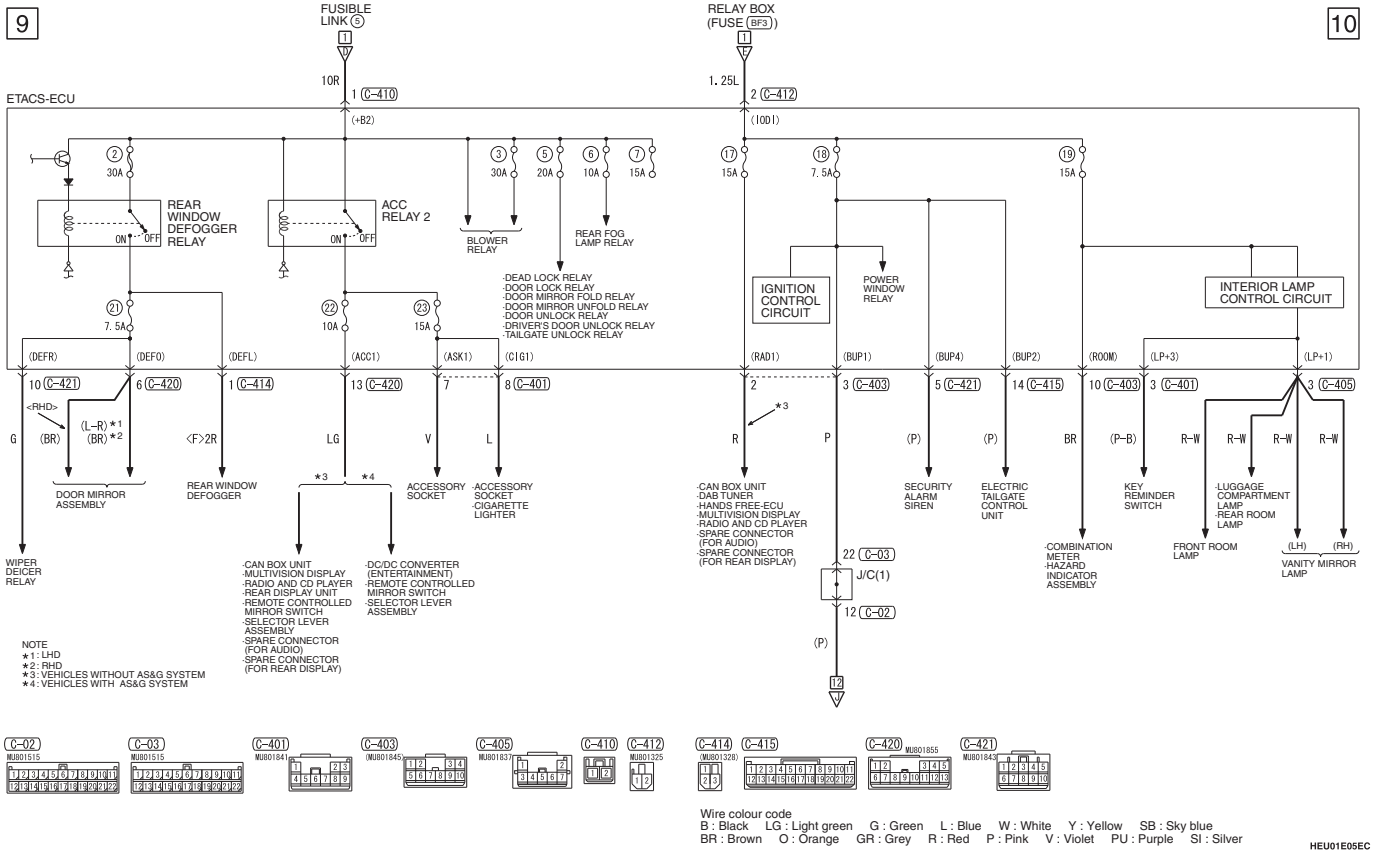
Wire colour code
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BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU01E05CC

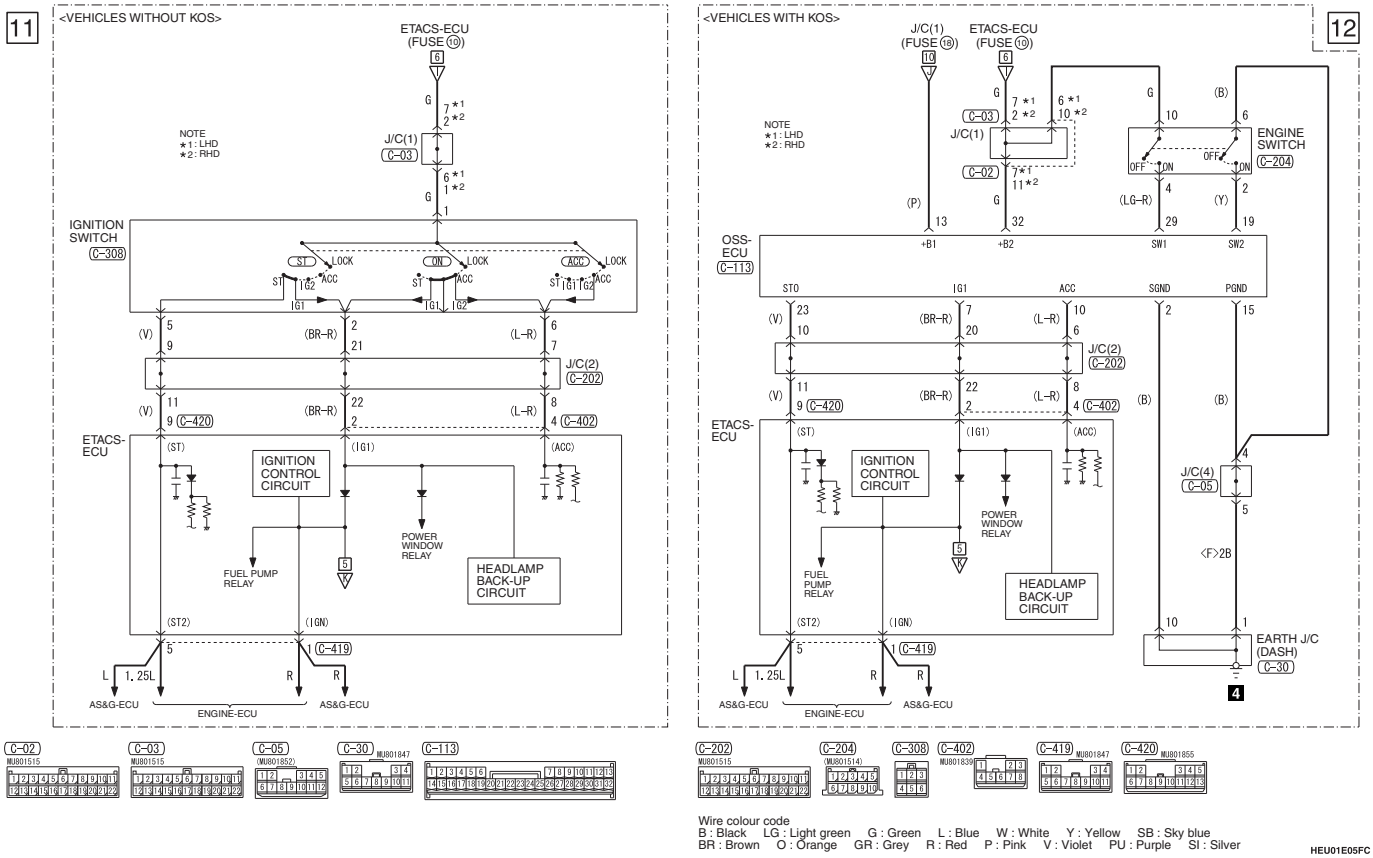
POWER DISTRIBUTION SYSTEM <4B1, 4J1, 6B3> (CONTINUED)



POWER DISTRIBUTION SYSTEM <4B1, 4J1, 6B3> (CONTINUED)



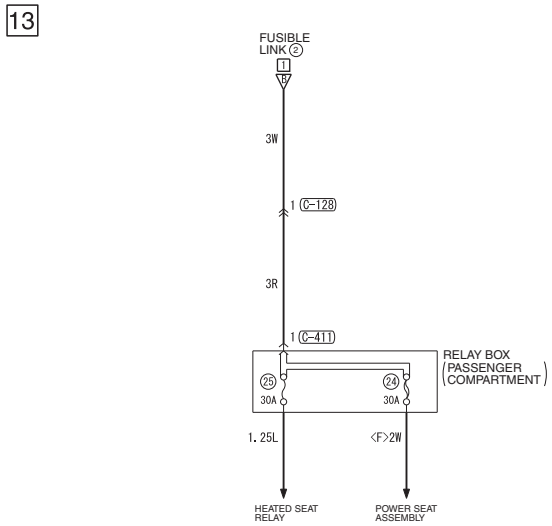
POWER DISTRIBUTION SYSTEM <4B1, 4J1, 6B3> (CONTINUED)



Wire colour code
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BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU01E05FC

POWER DISTRIBUTION SYSTEM <4B1, 4J1, 6B3> (CONTINUED)



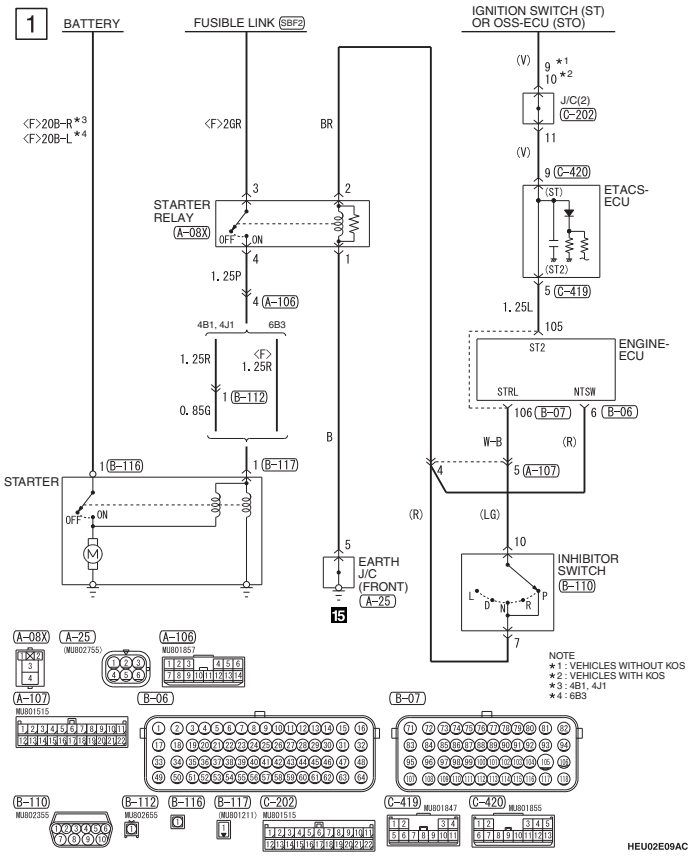
C-128 C-411

Wire colour code
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HEU01E05GC

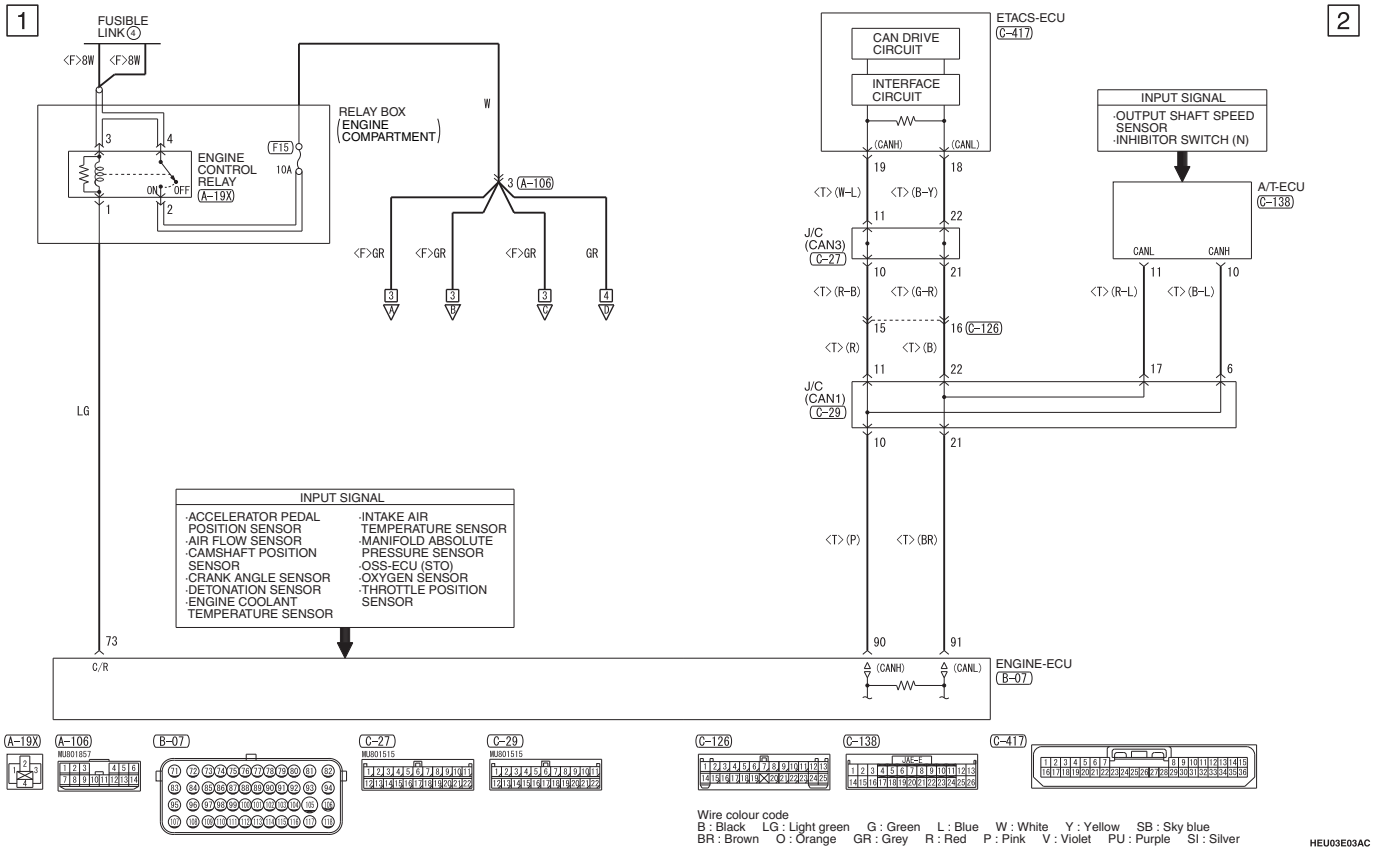
STARTING SYSTEM <6B3, 4B1, 4J1-CVT (VEHICLES WITHOUT AS&G SYSTEM)>

M1901000507253

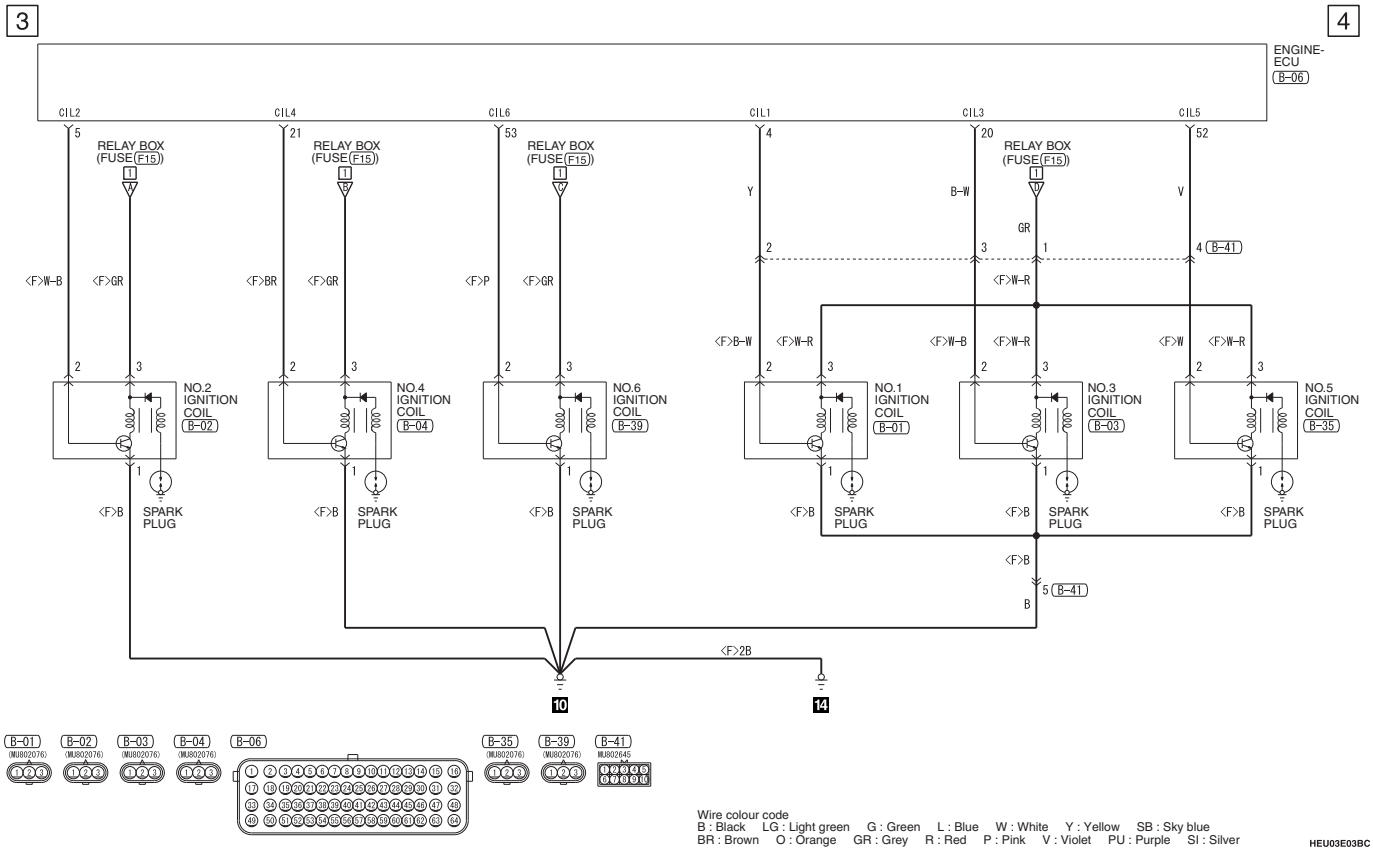


IGNITION SYSTEM <6B3>

M1901000606417



IGNITION SYSTEM <6B3> (CONTINUED)

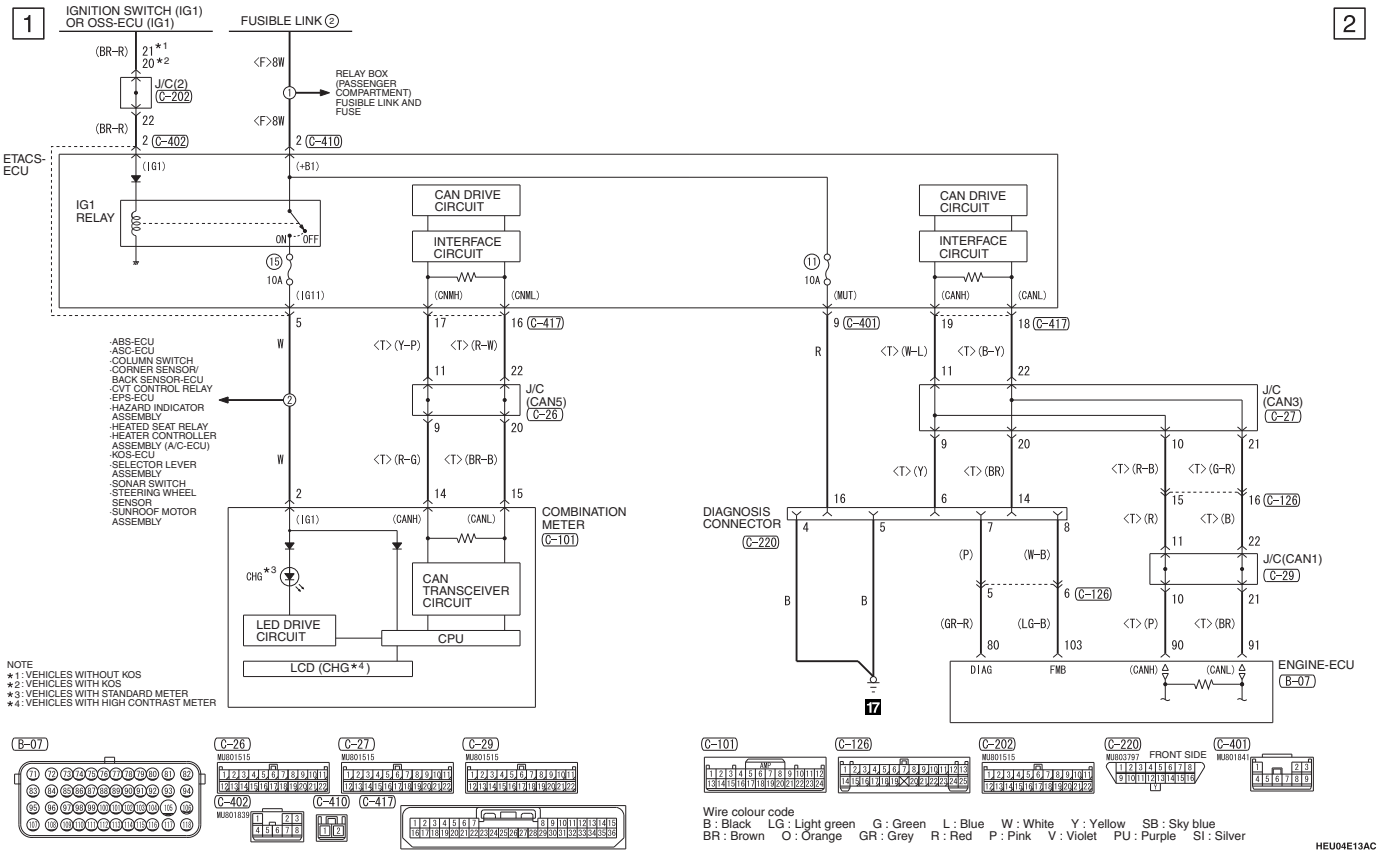


Wire colour code
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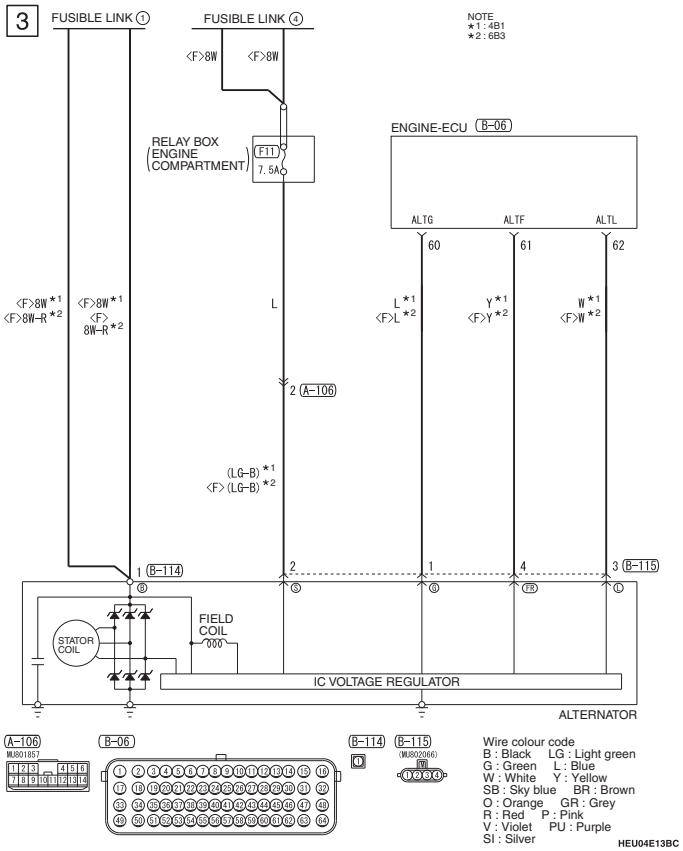
HEU03E03BC

CHARGING SYSTEM <4B1, 6B3 (LHD)>

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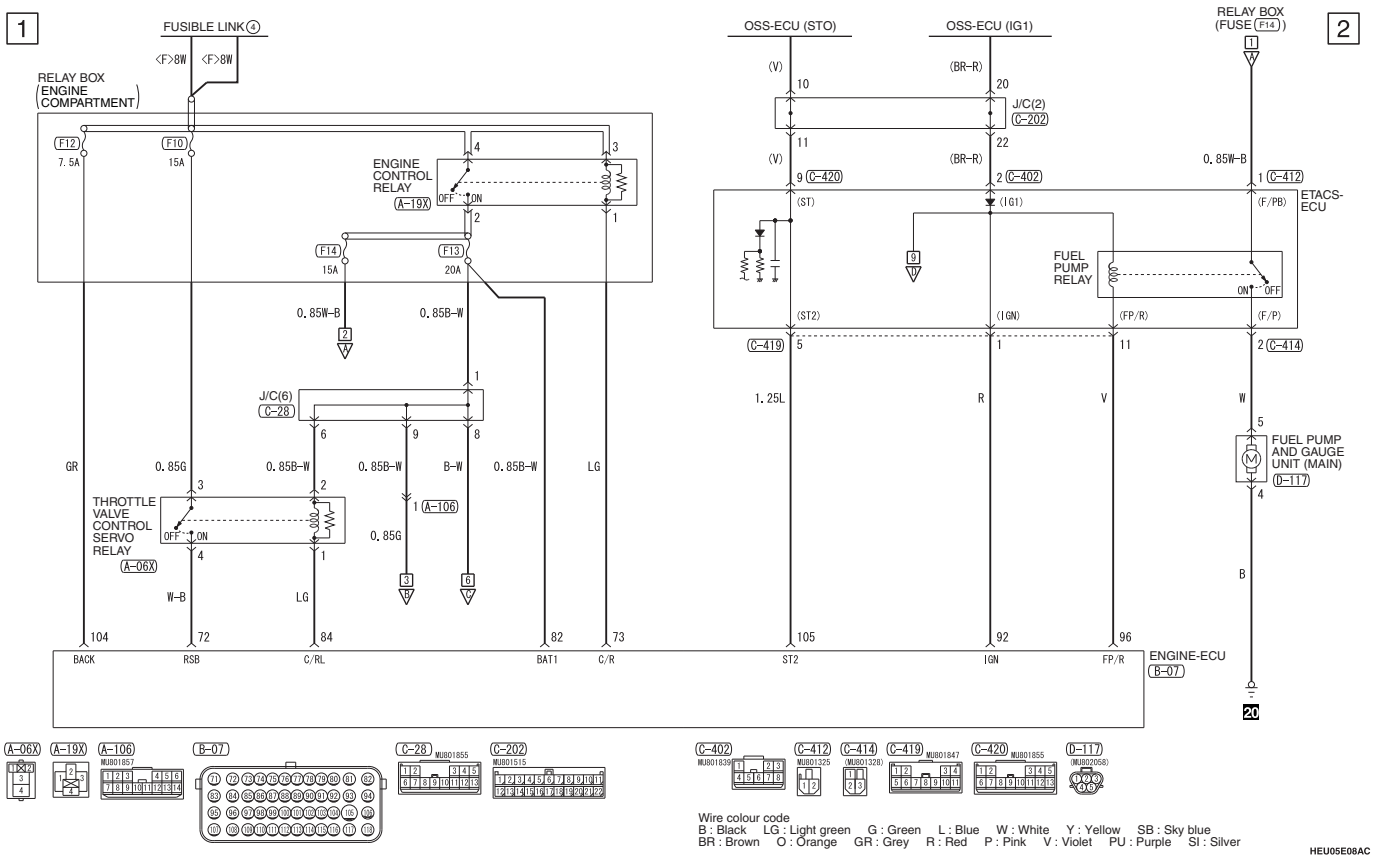


CHARGING SYSTEM <4B1, 6B3 (LHD)>(CONTINUED)



ENGINE CONTROL SYSTEM <6B3>

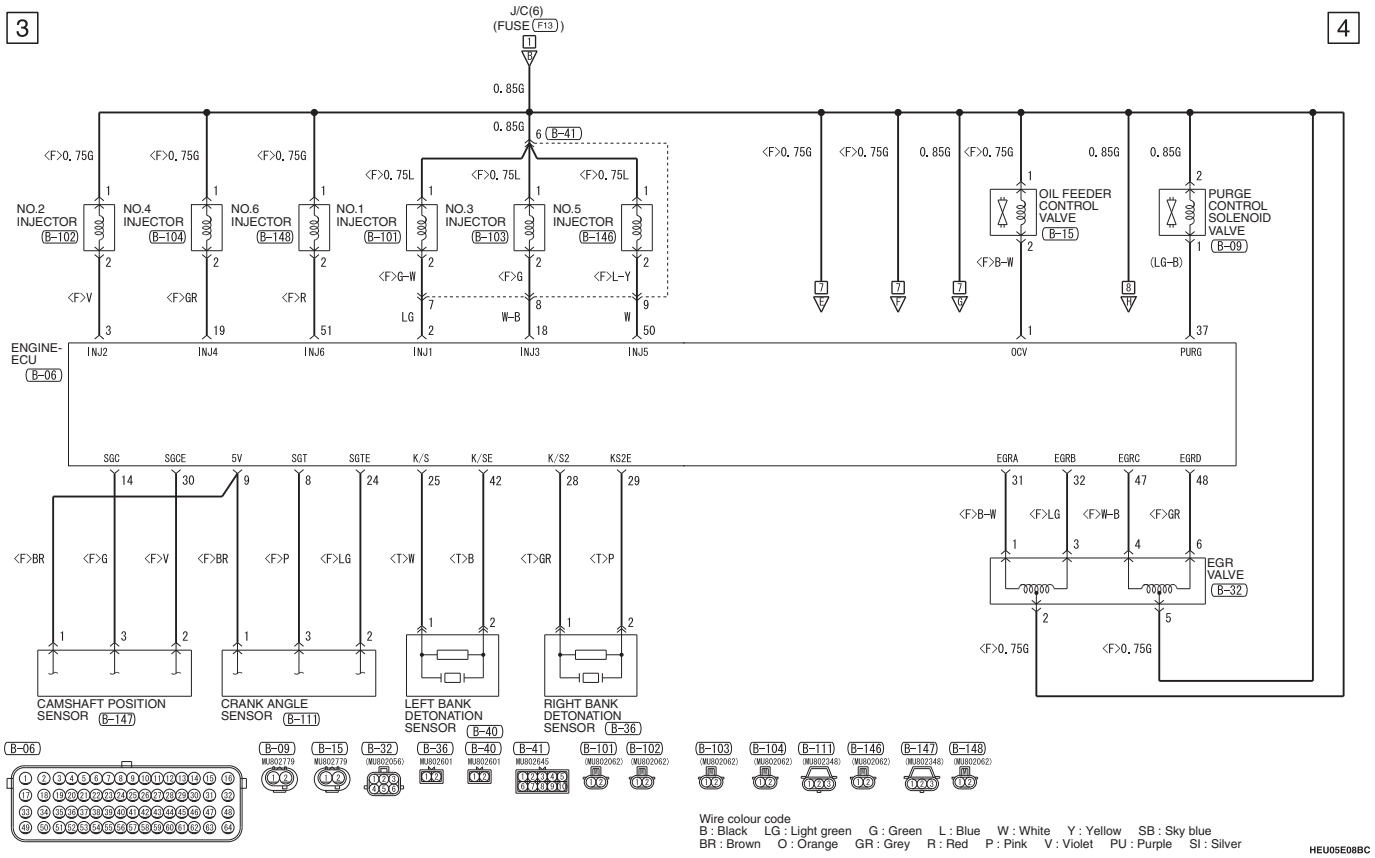
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Wire colour code
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HEU05E08AC

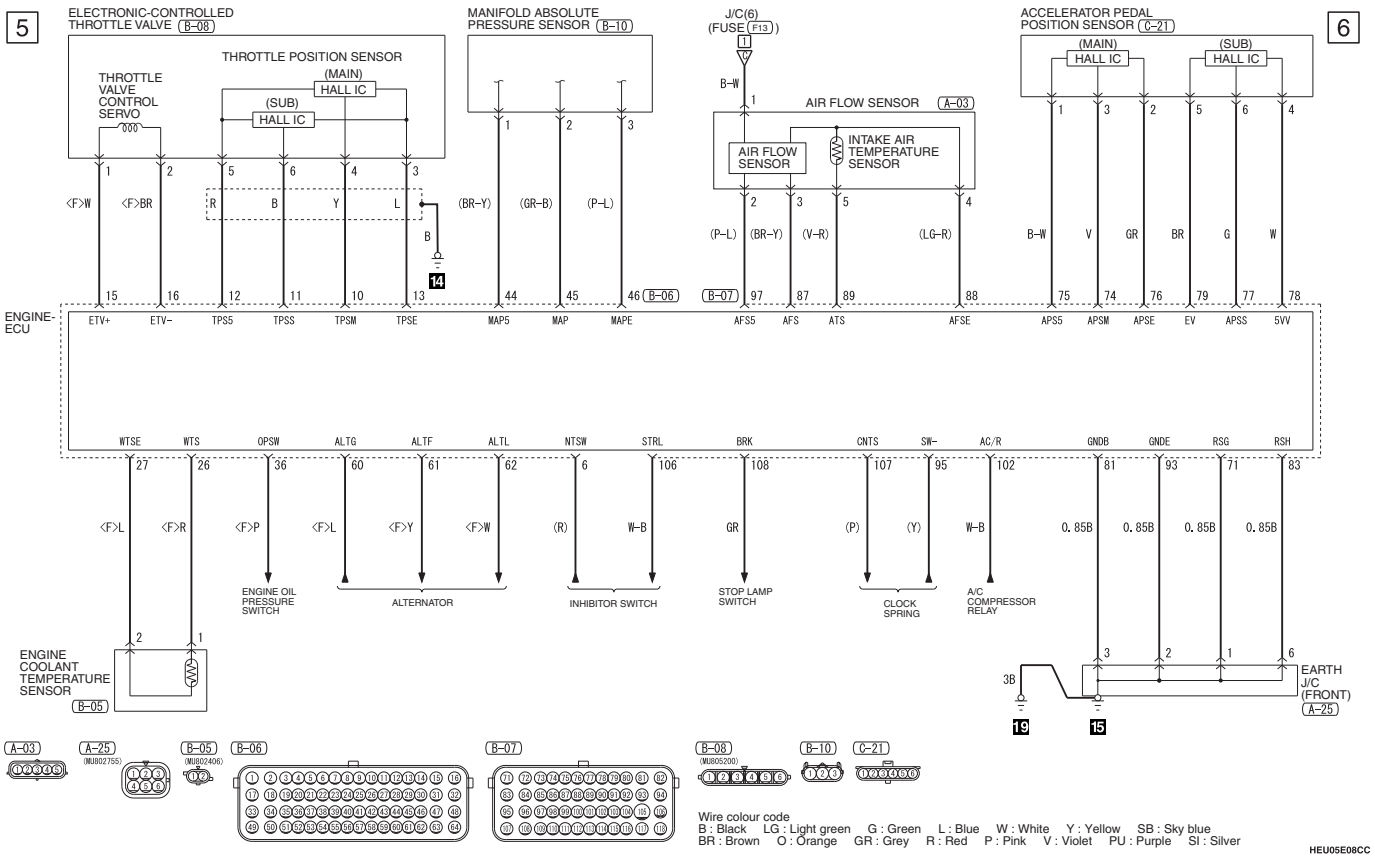
ENGINE CONTROL SYSTEM <6B3> (CONTINUED)



Wire colour code
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HEU05E08BC

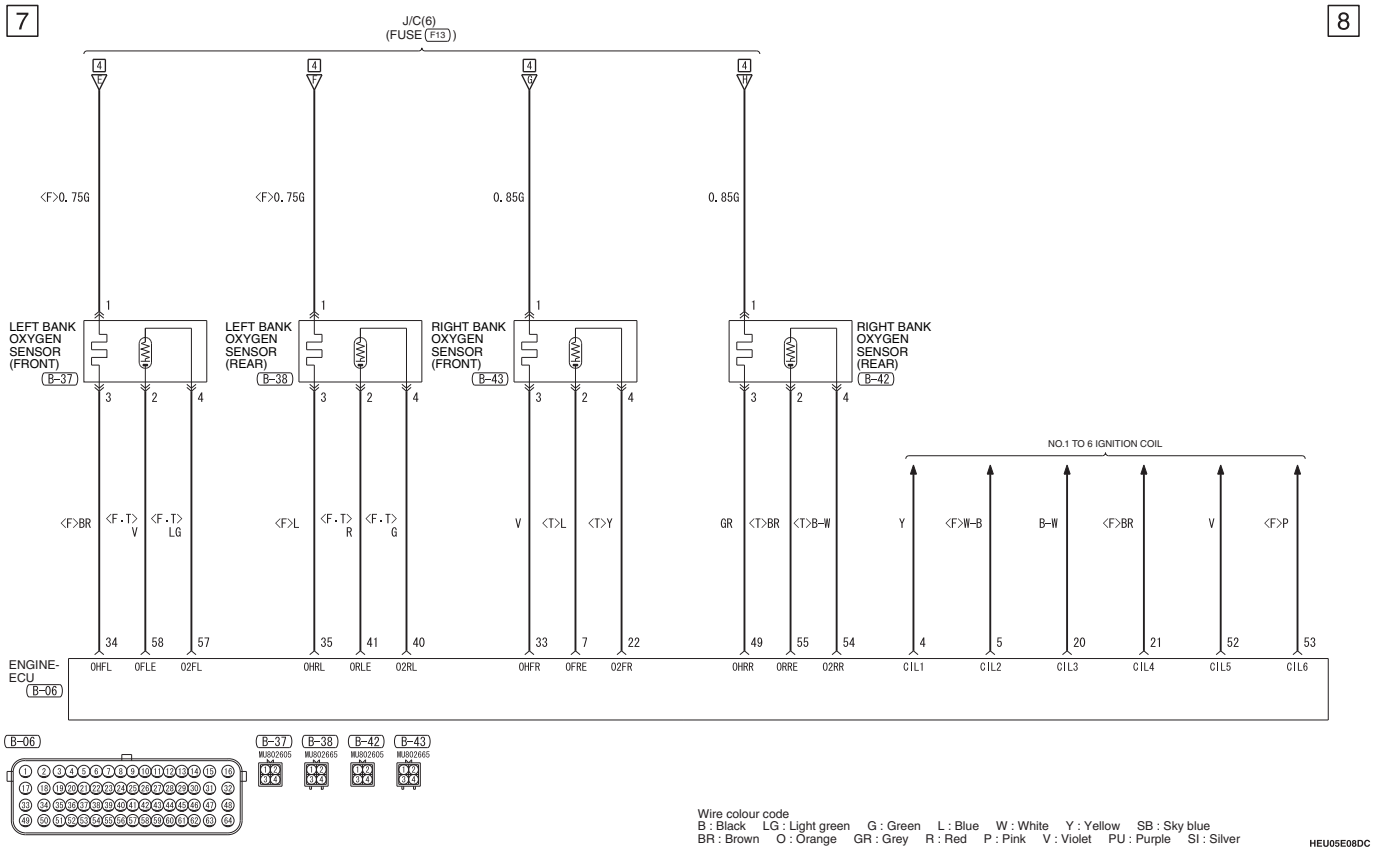
ENGINE CONTROL SYSTEM <6B3> (CONTINUED)



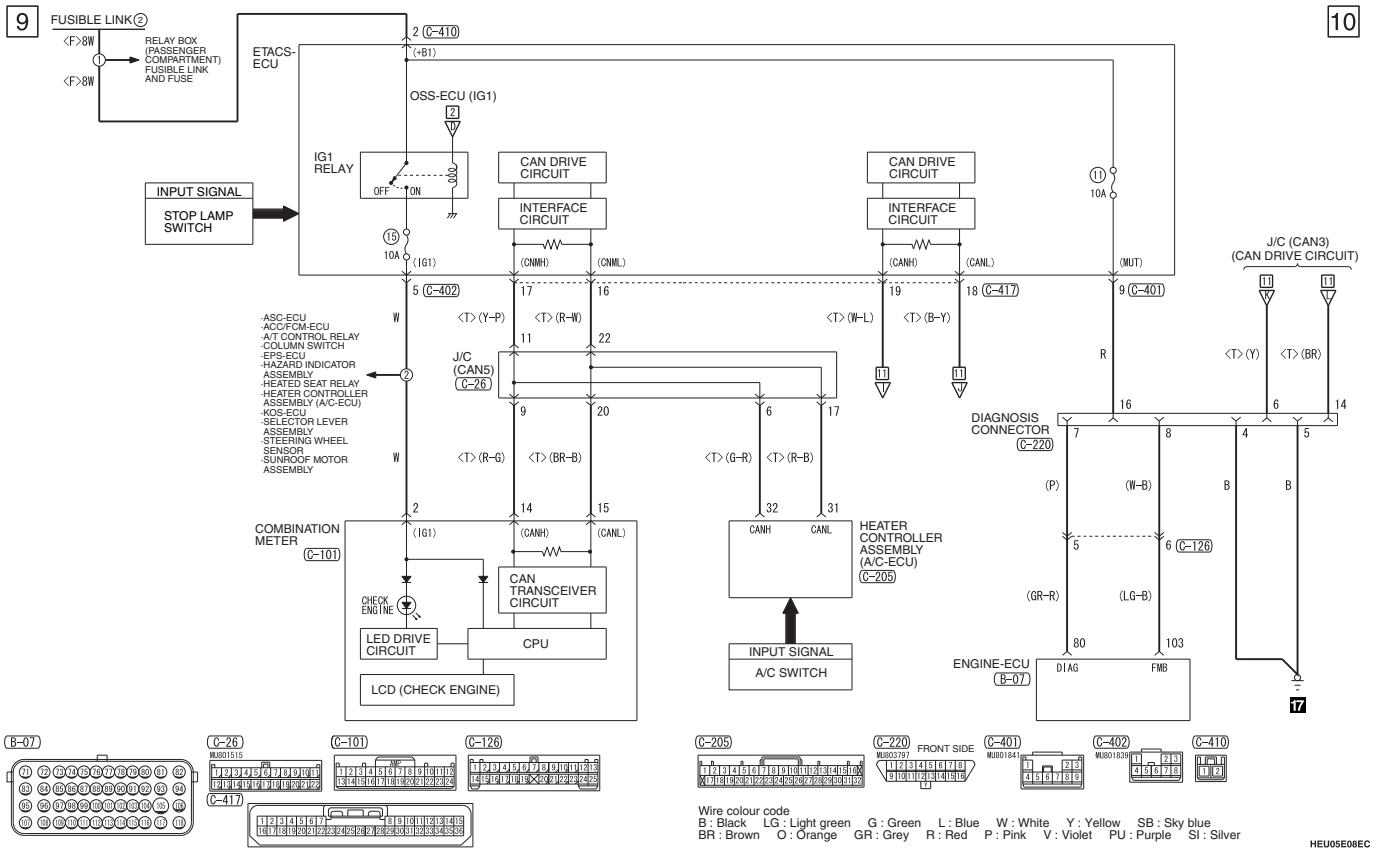
Wire colour code
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HEU05E08CC

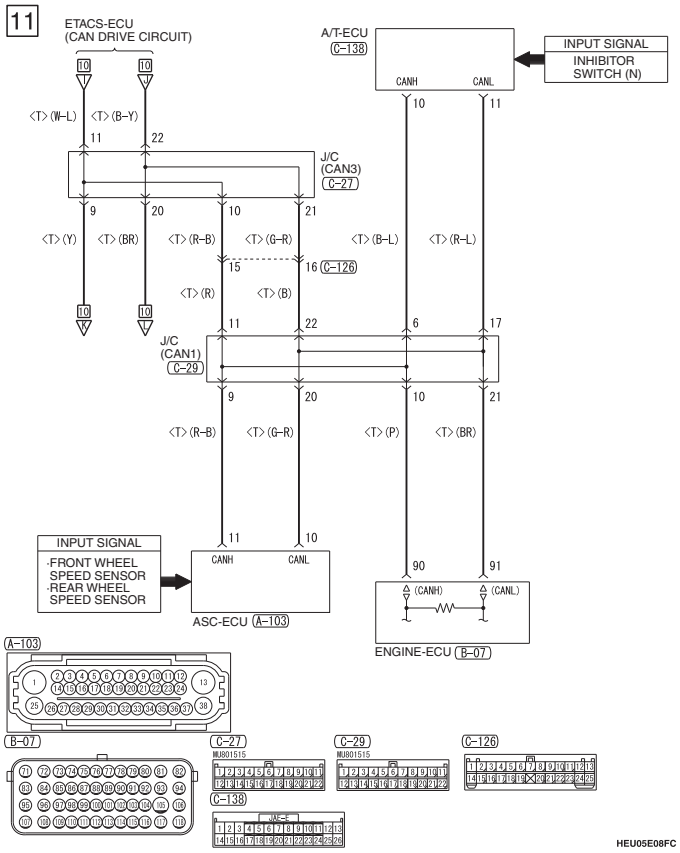
ENGINE CONTROL SYSTEM <6B3> (CONTINUED)



ENGINE CONTROL SYSTEM <6B3> (CONTINUED)

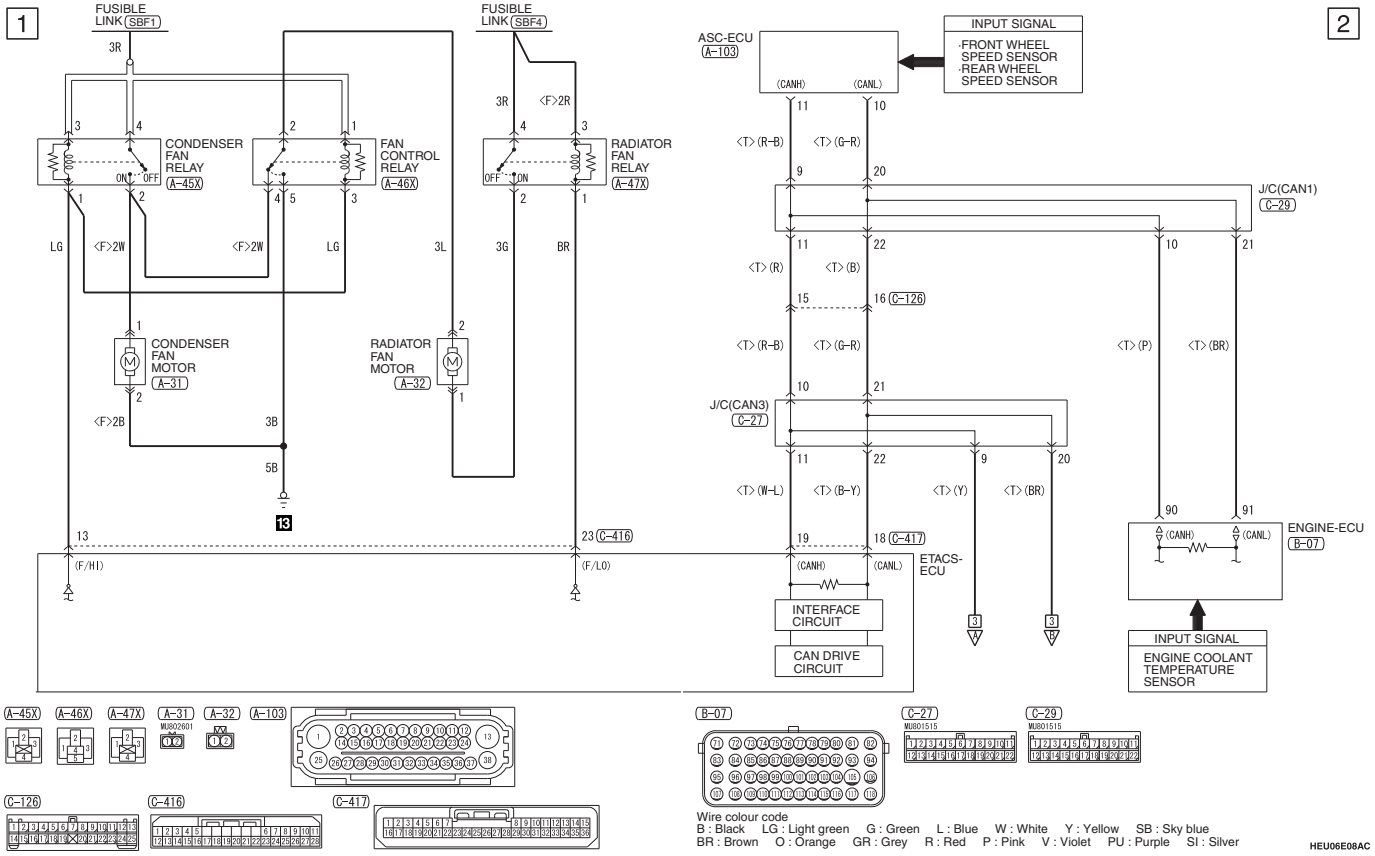


ENGINE CONTROL SYSTEM <6B3> (CONTINUED)



COOLING SYSTEM <6B3>

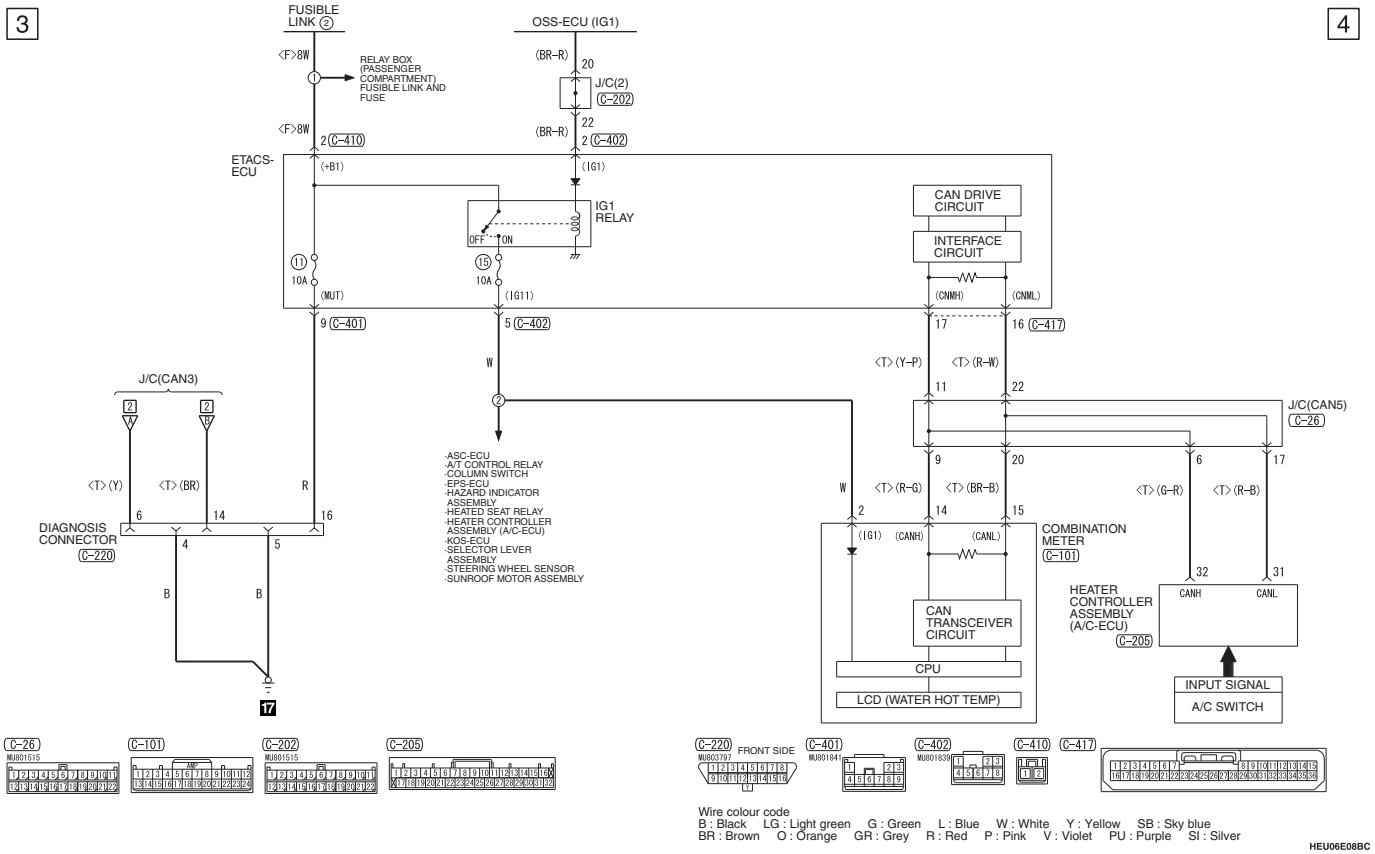
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Wire colour code
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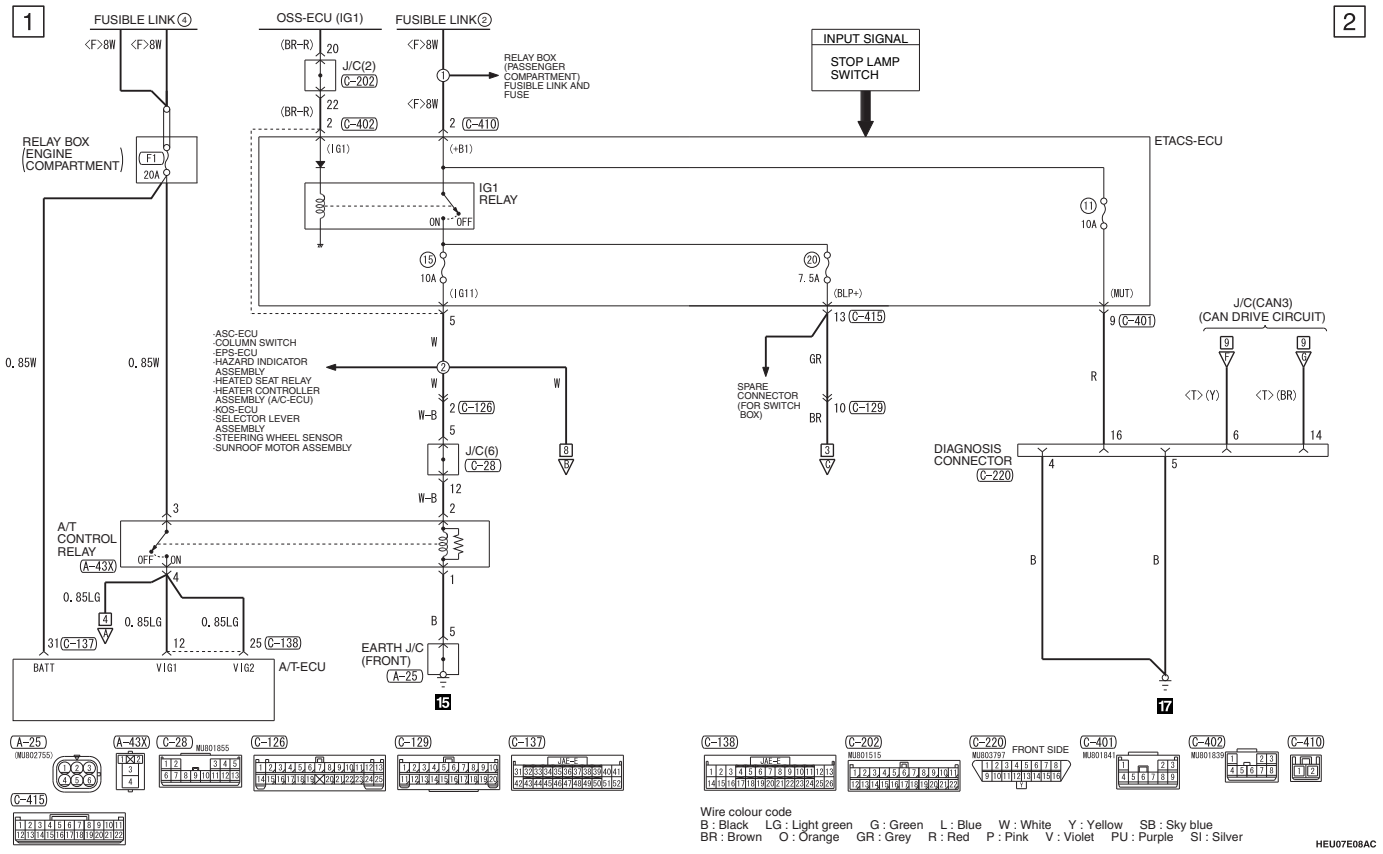
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COOLING SYSTEM <6B3> (CONTINUED)



A/T <6B3>

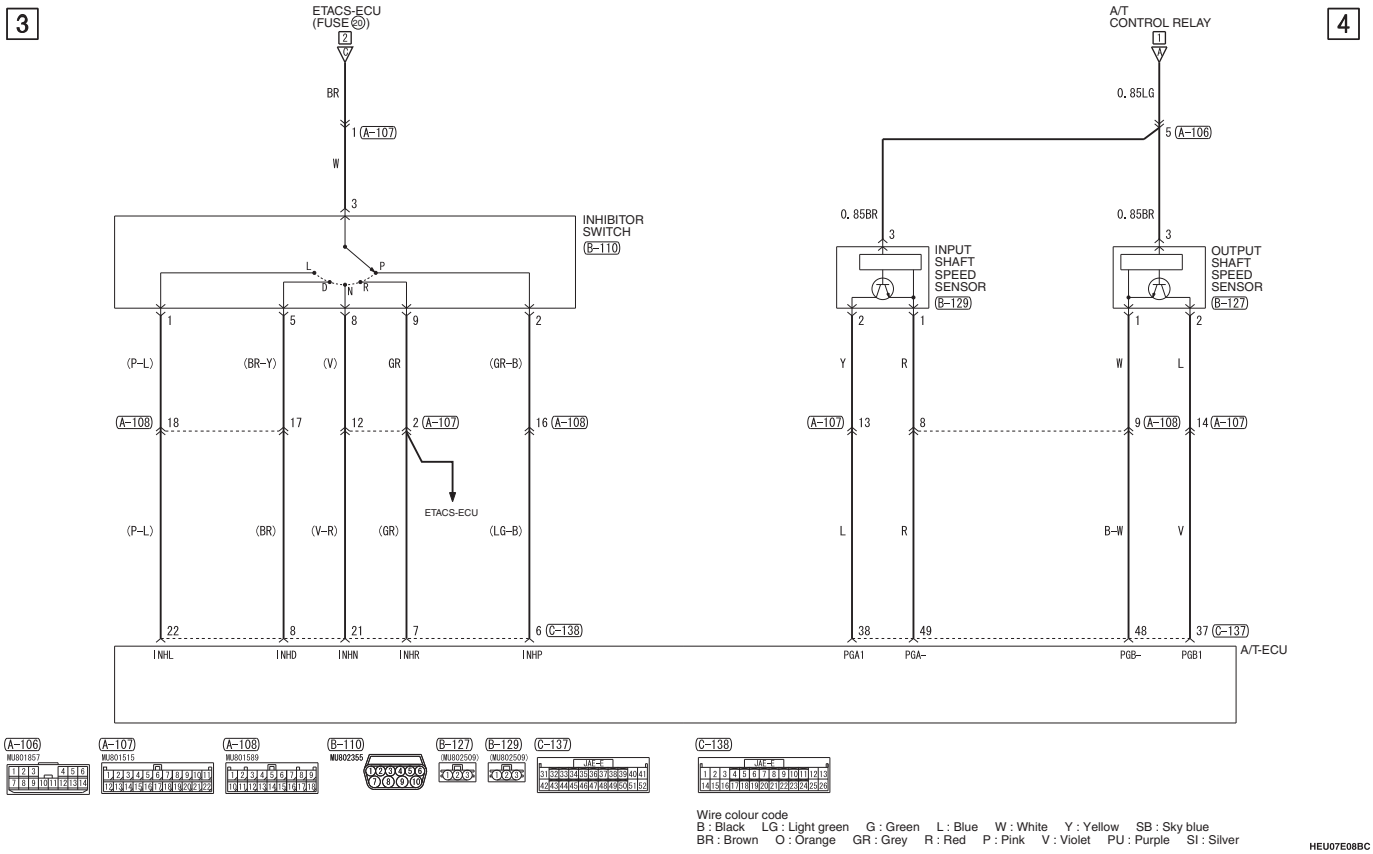
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Wire colour code
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HEU07E08AC

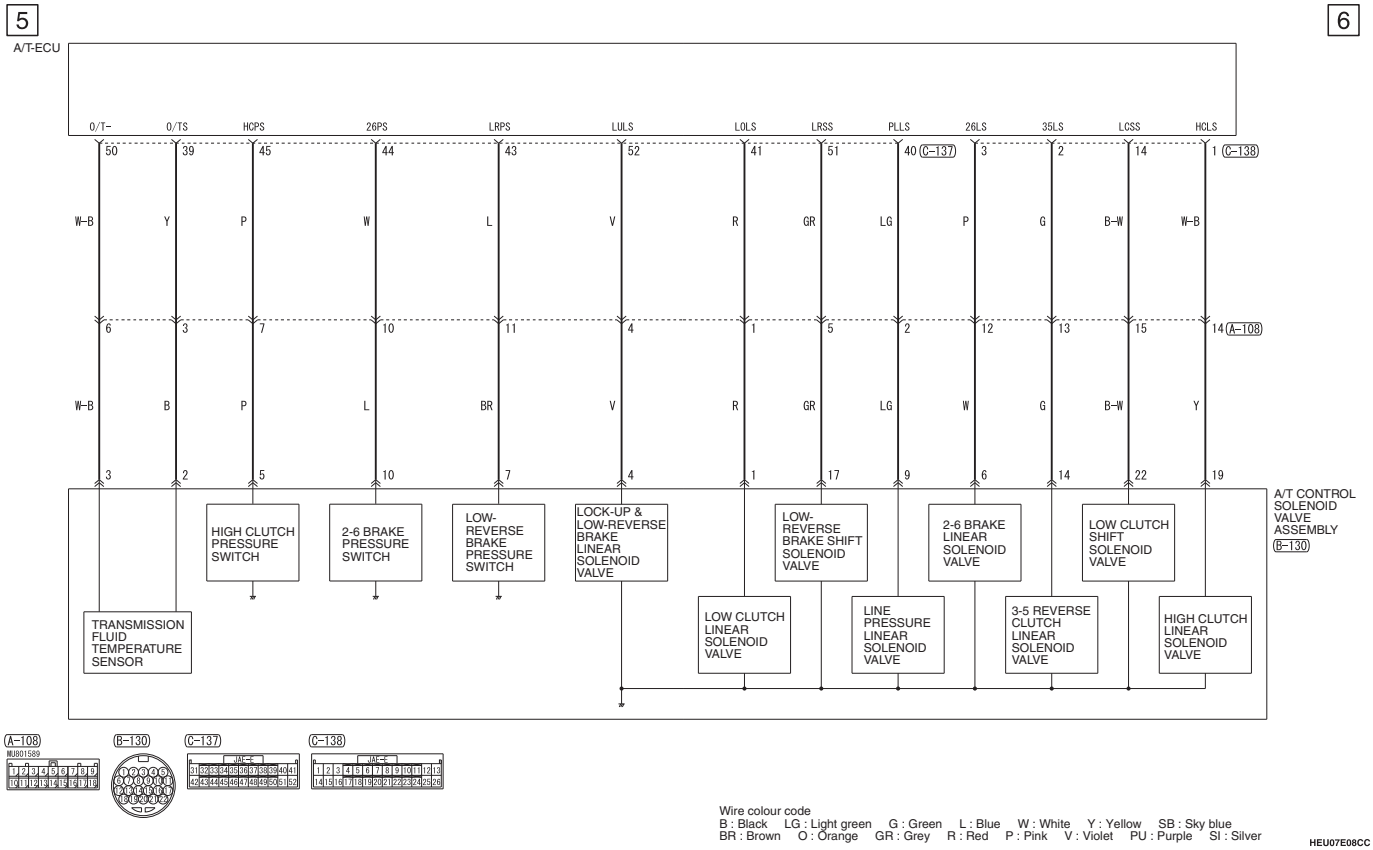
A/T <6B3> (CONTINUED)



Wire colour code
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HEU07E08BC

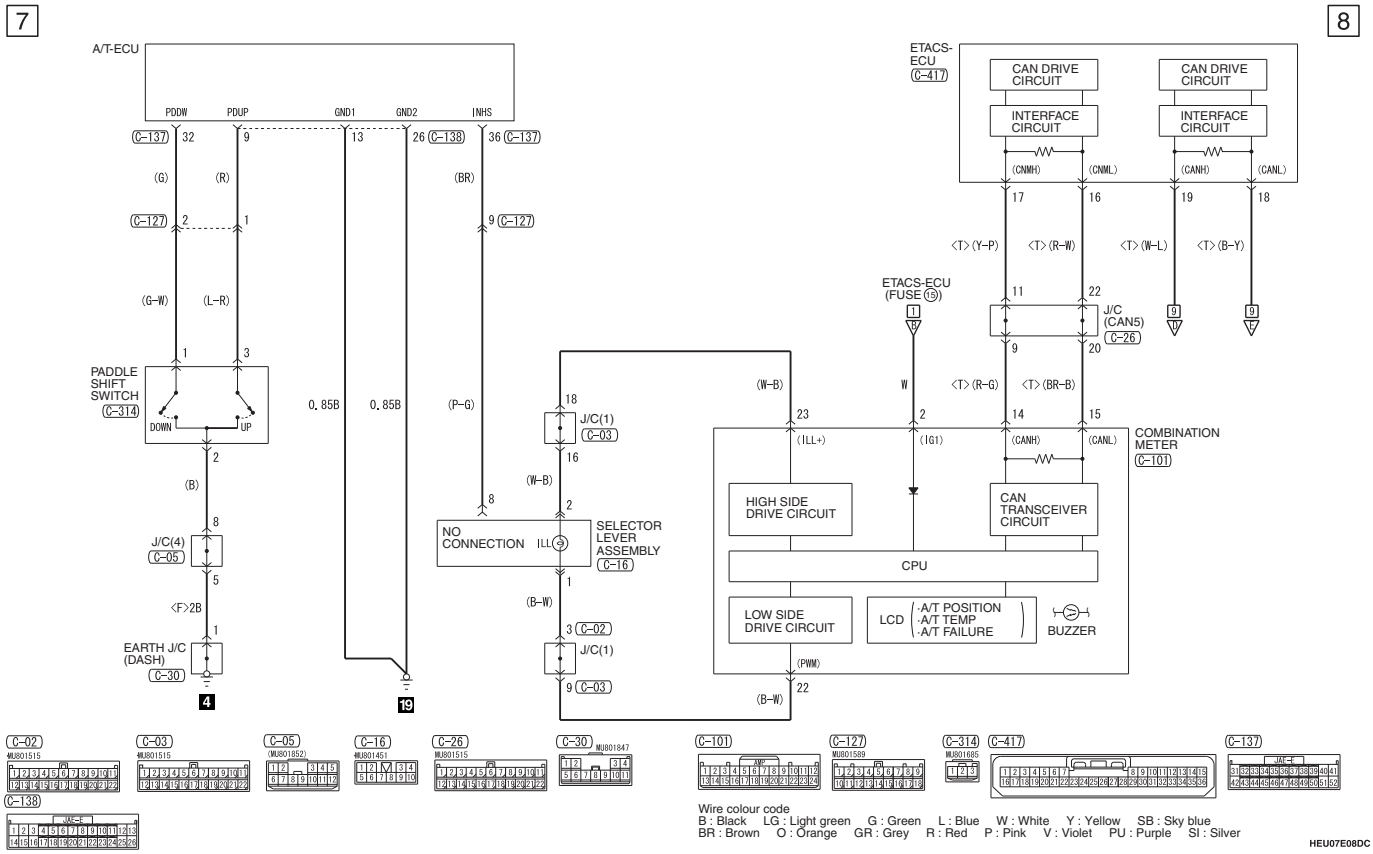
A/T <6B3> (CONTINUED)



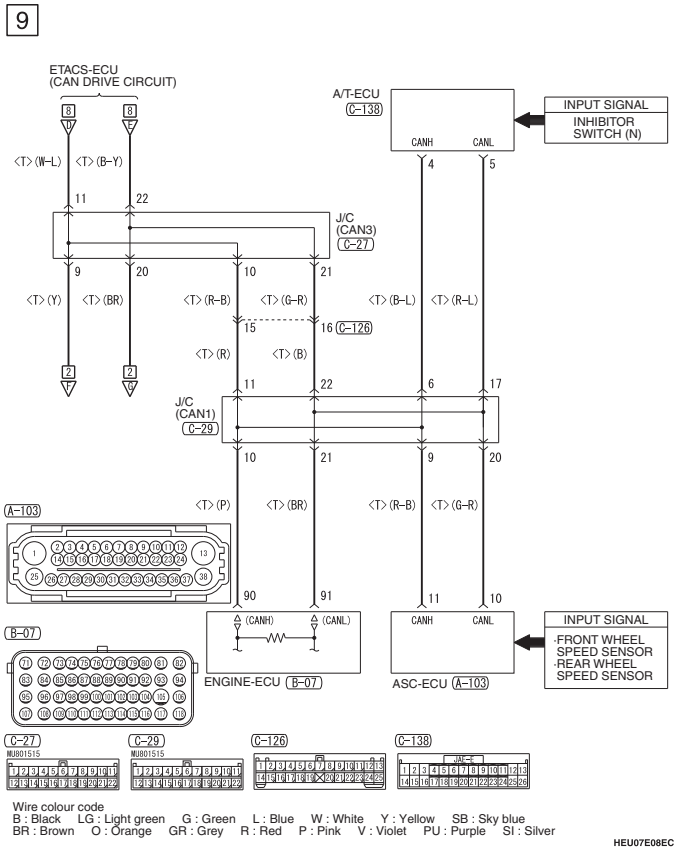
Wire colour code
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A/T <6B3> (CONTINUED)

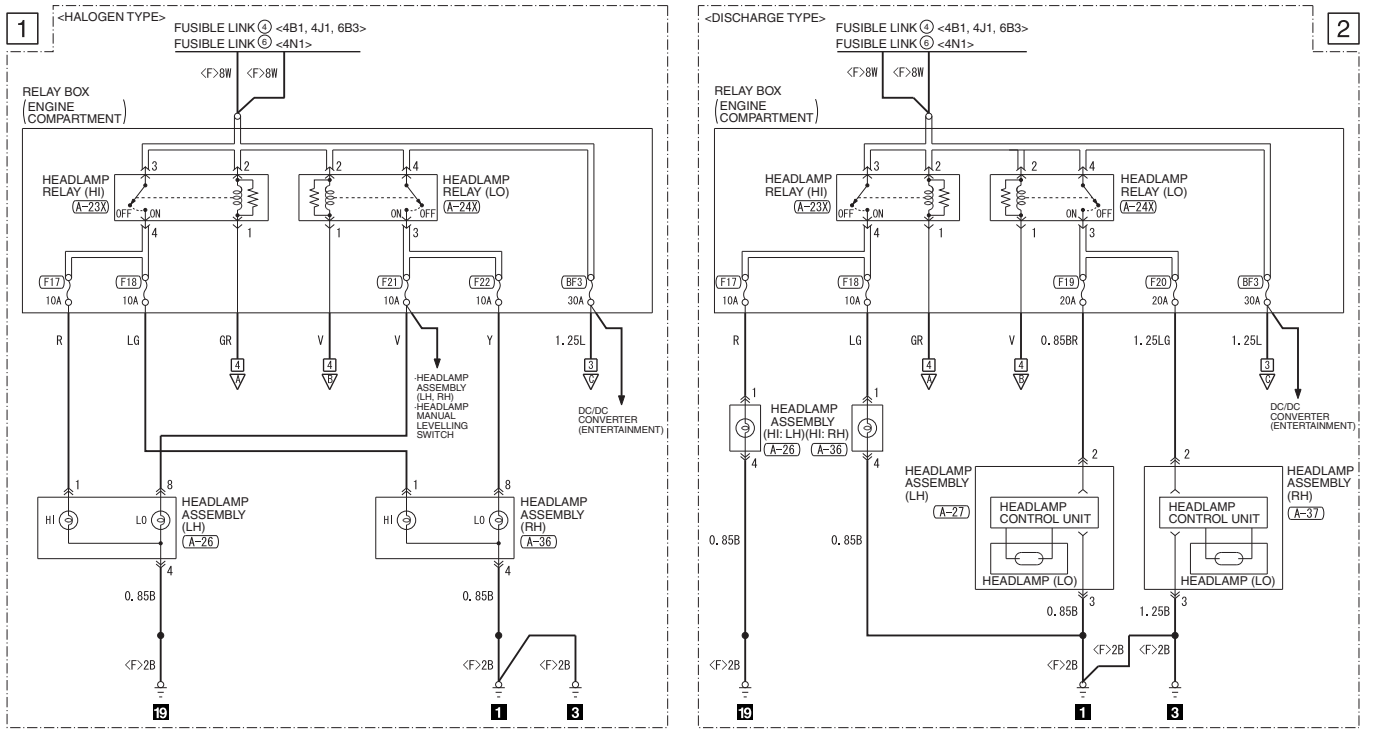


A/T <6B3> (CONTINUED)



HEADLAMP <LHD>

M1901001508389

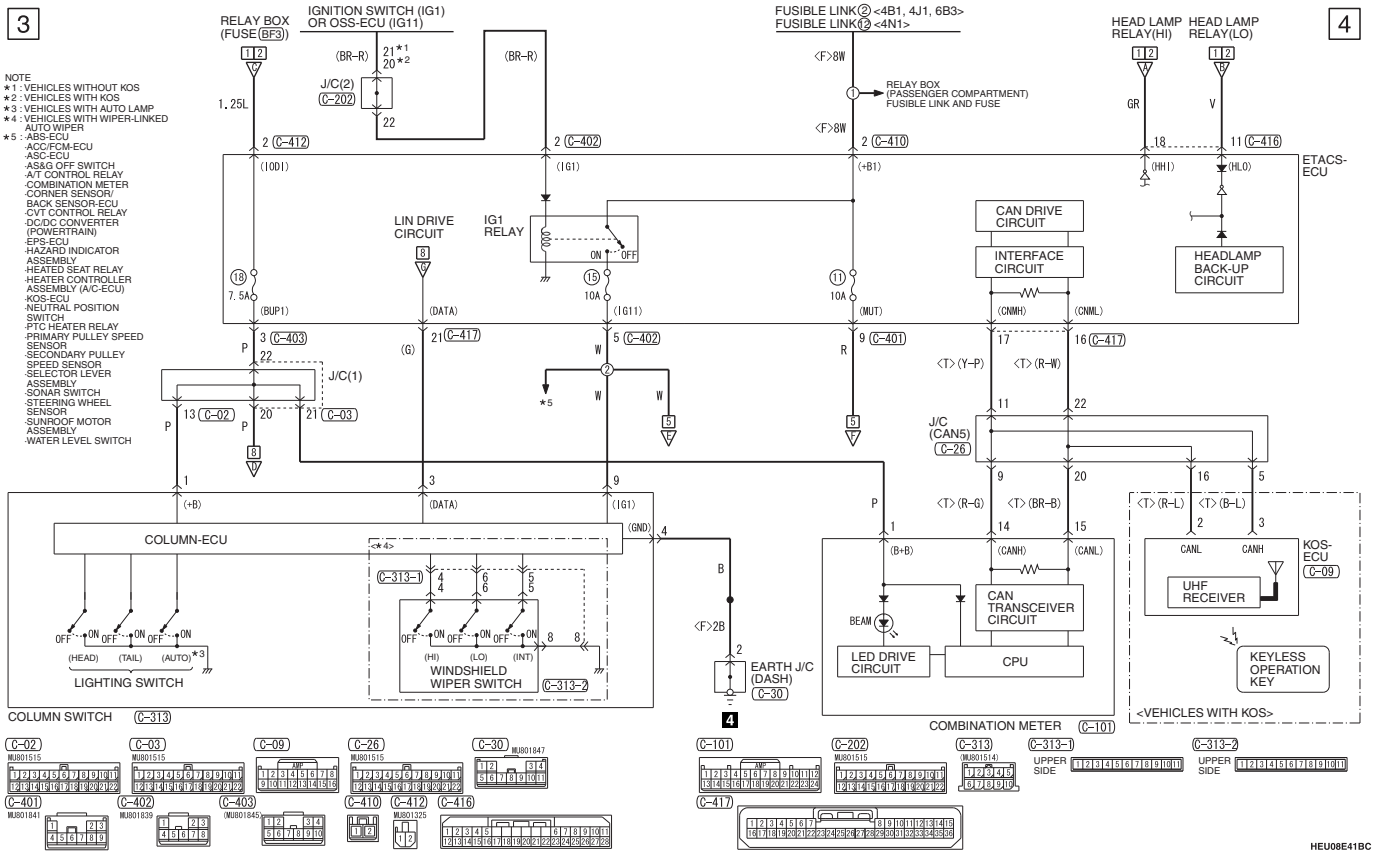




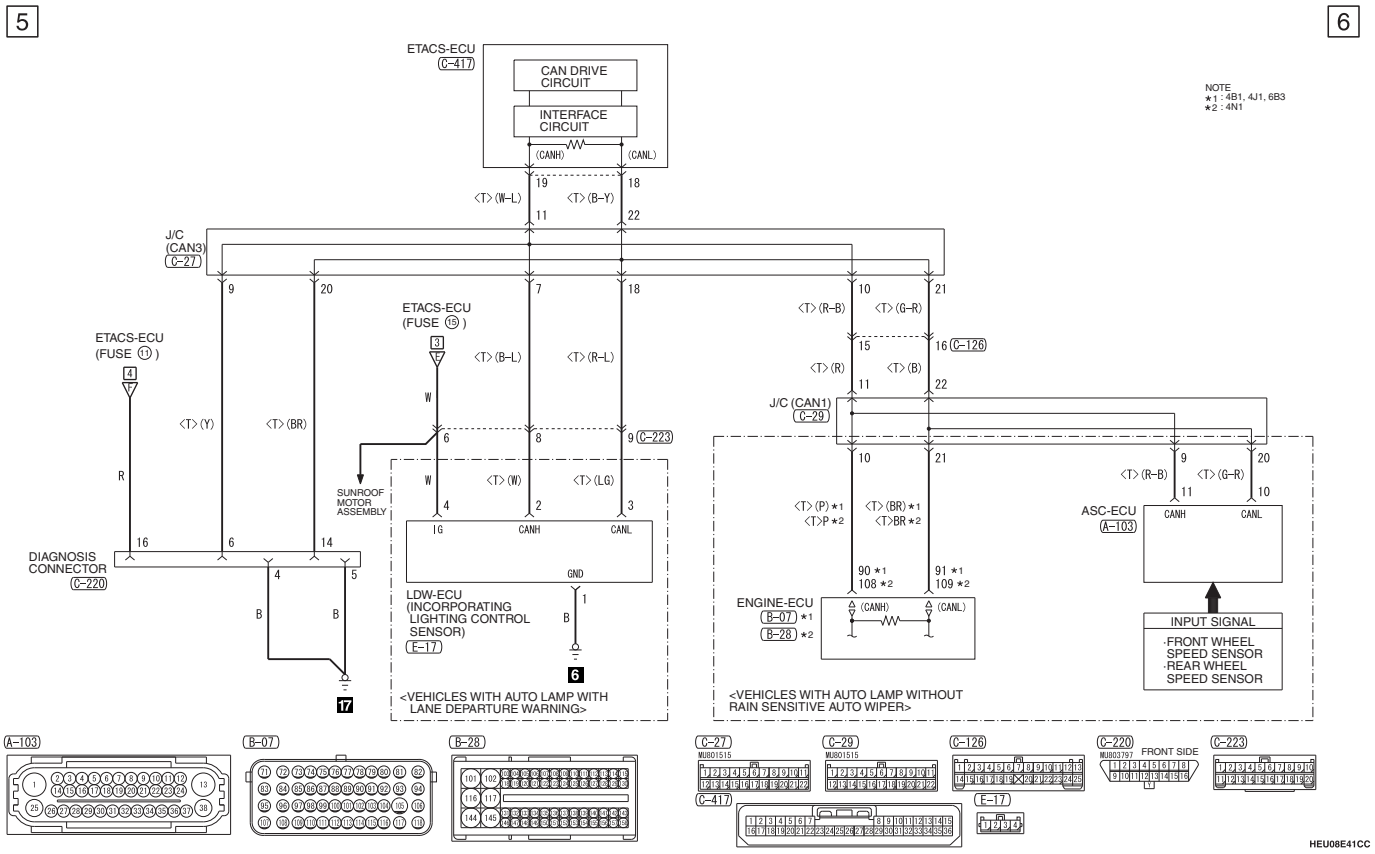
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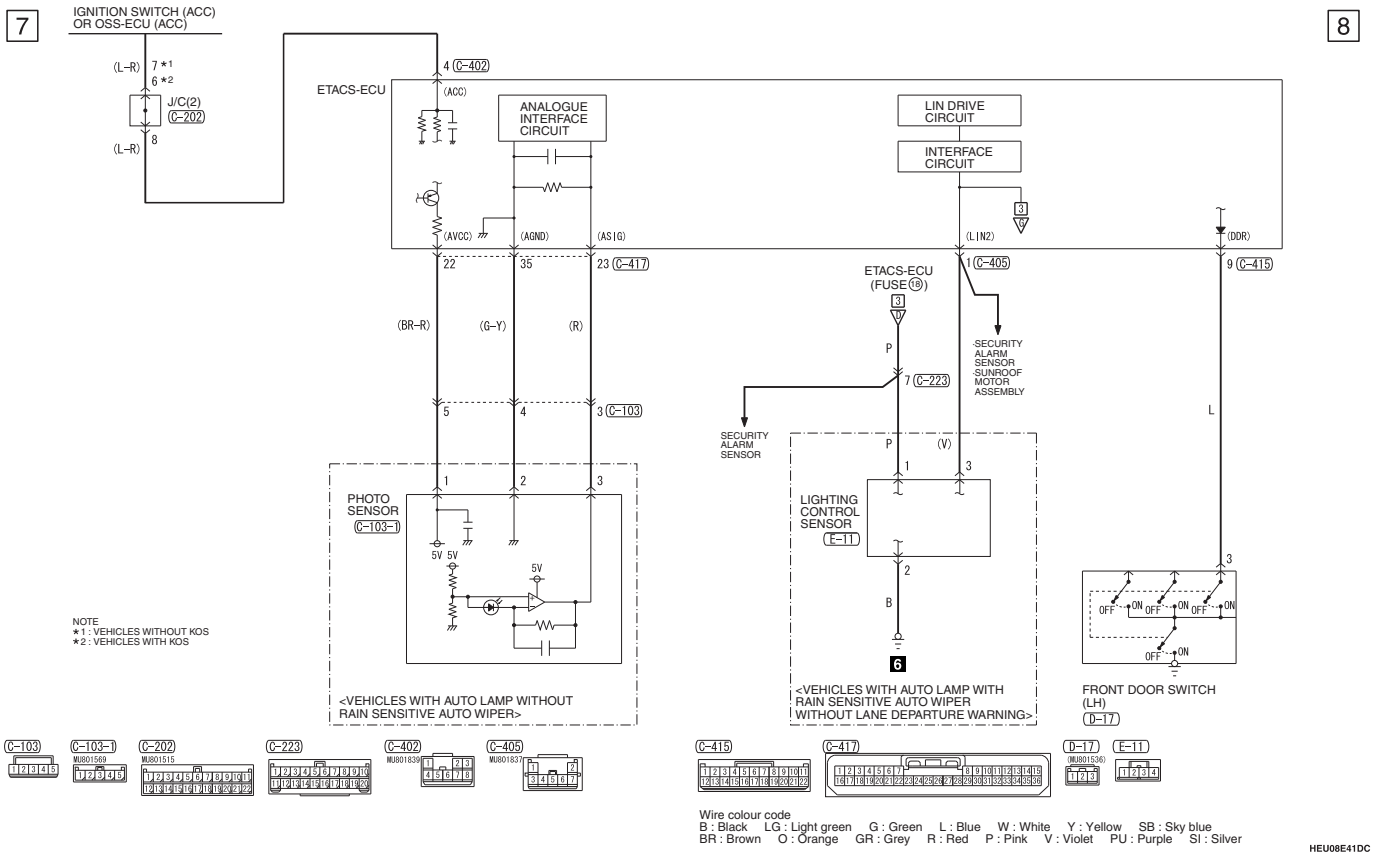
HEADLAMP <LHD> (CONTINUED)



HEADLAMP <LHD> (CONTINUED)



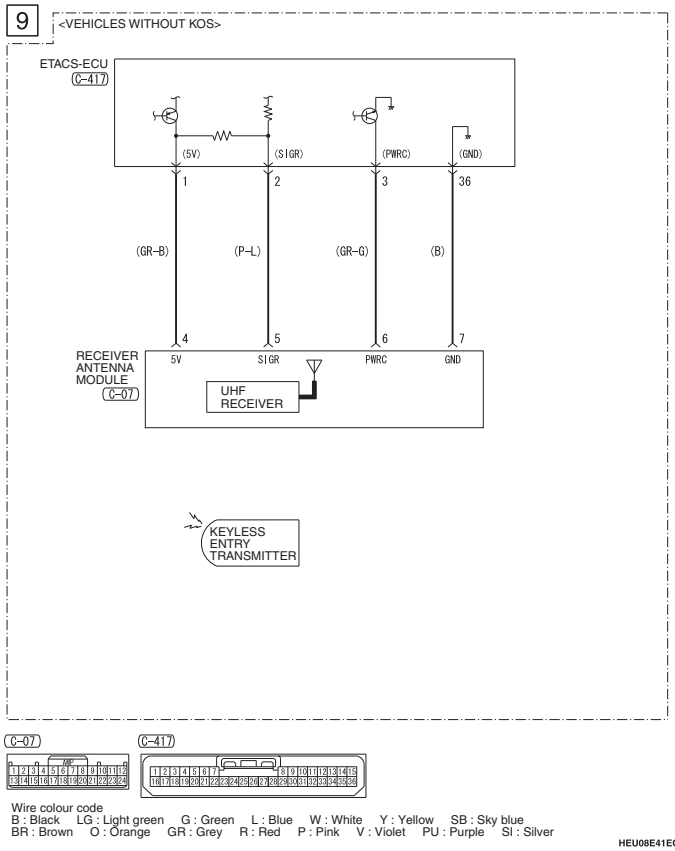
HEADLAMP <LHD> (CONTINUED)



Wire colour code
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HEU08E41DC

HEADLAMP <LHD> (CONTINUED)

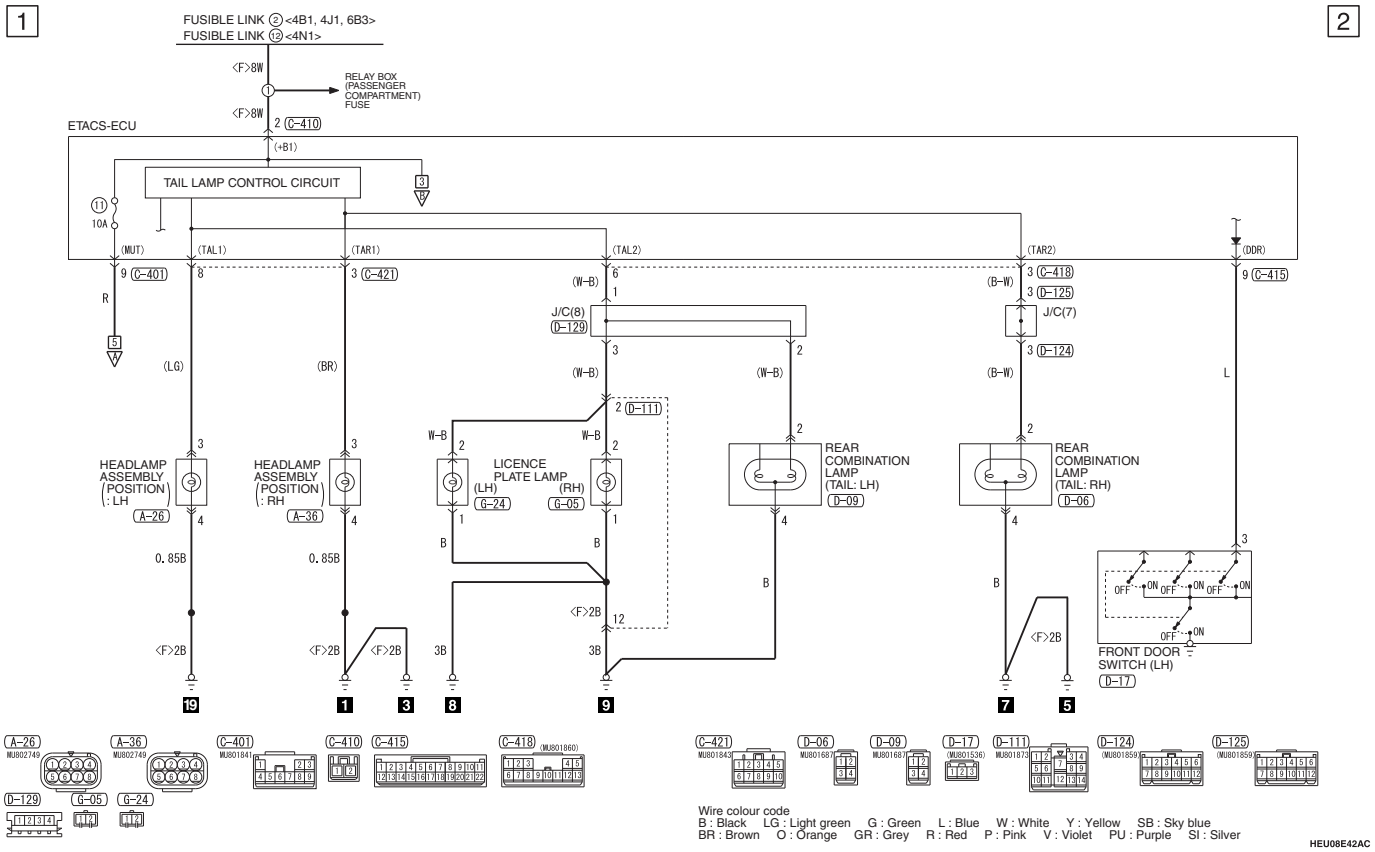


Wire colour code
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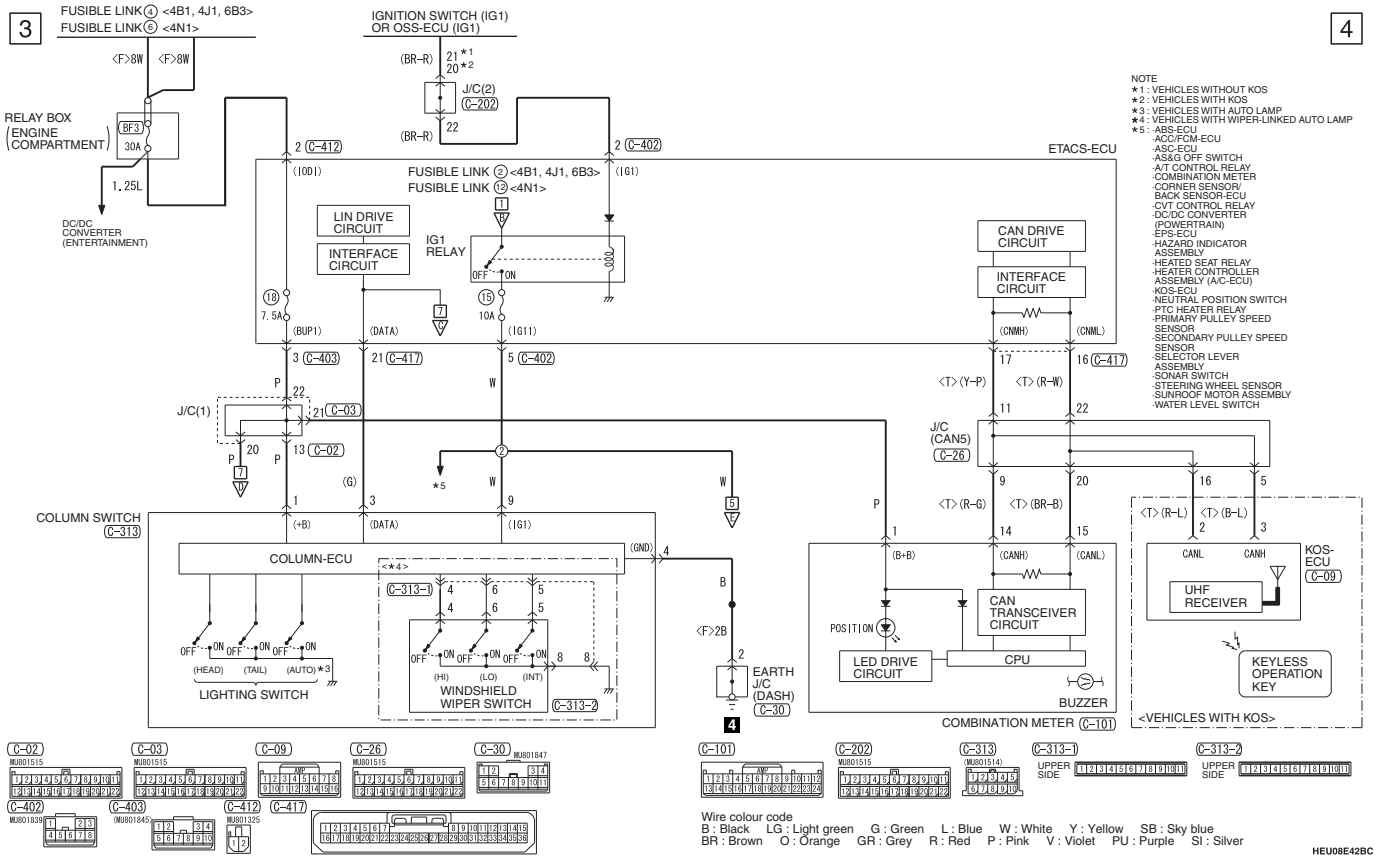
HEU08E41EC

TAIL LAMP, POSITION LAMP, LICENCE PLATE LAMP AND LAMP REMINDER BUZZER <LHD>

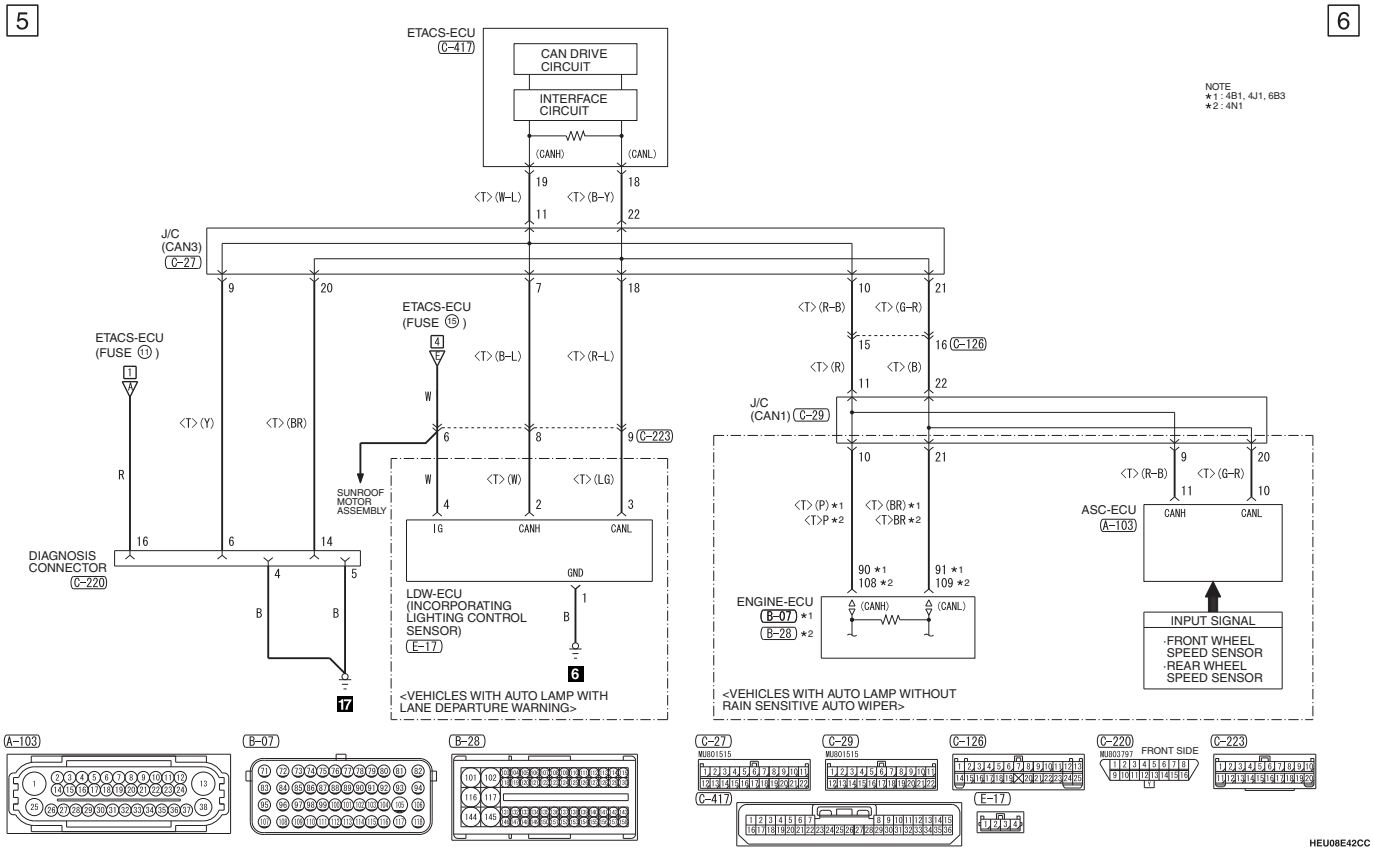
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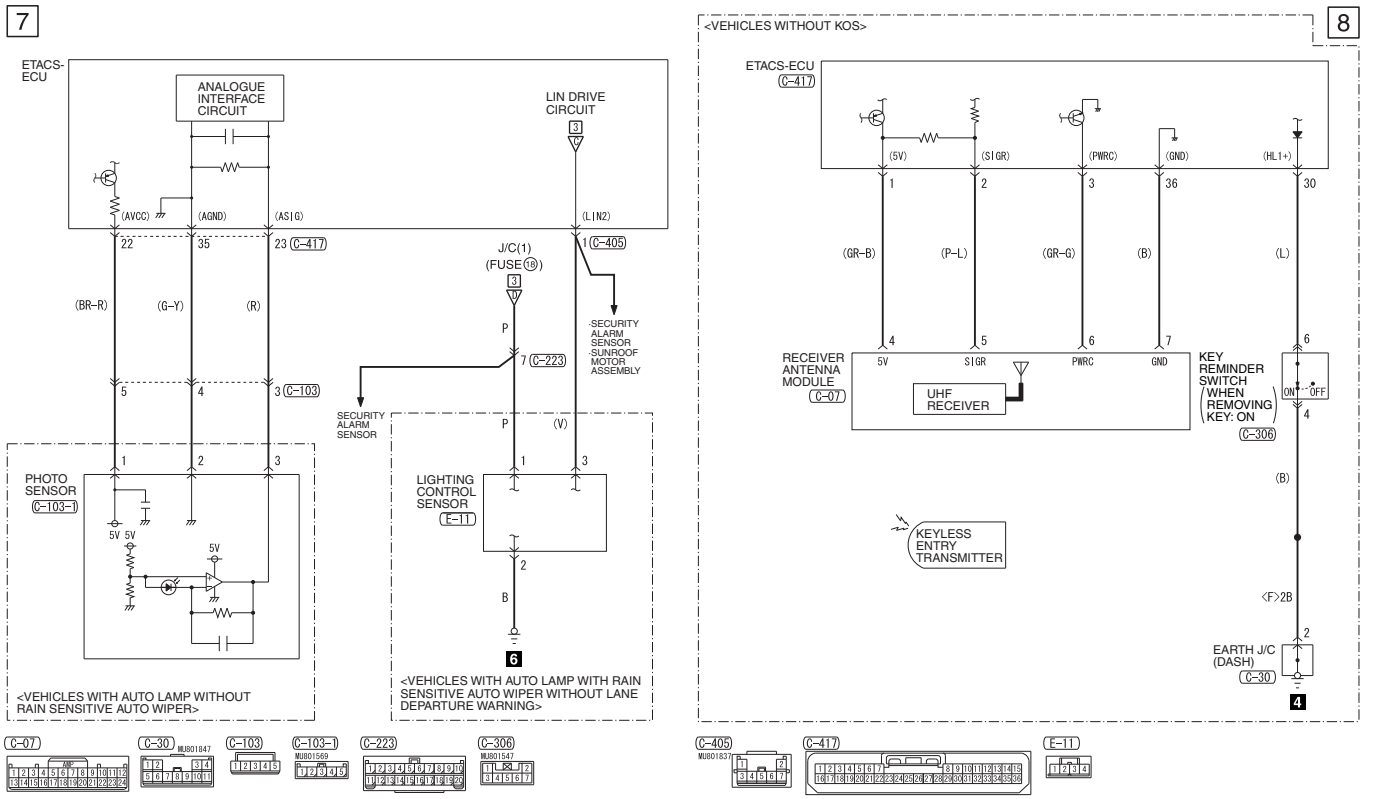
TAIL LAMP, POSITION LAMP, LICENCE PLATE LAMP AND LAMP REMINDER BUZZER <LHD> (CONTINUED)



TAIL LAMP, POSITION LAMP, LICENCE PLATE LAMP AND LAMP REMINDER BUZZER <LHD> (CONTINUED)



TAIL LAMP, POSITION LAMP, LICENCE PLATE LAMP AND LAMP REMINDER BUZZER <LHD> (CONTINUED)

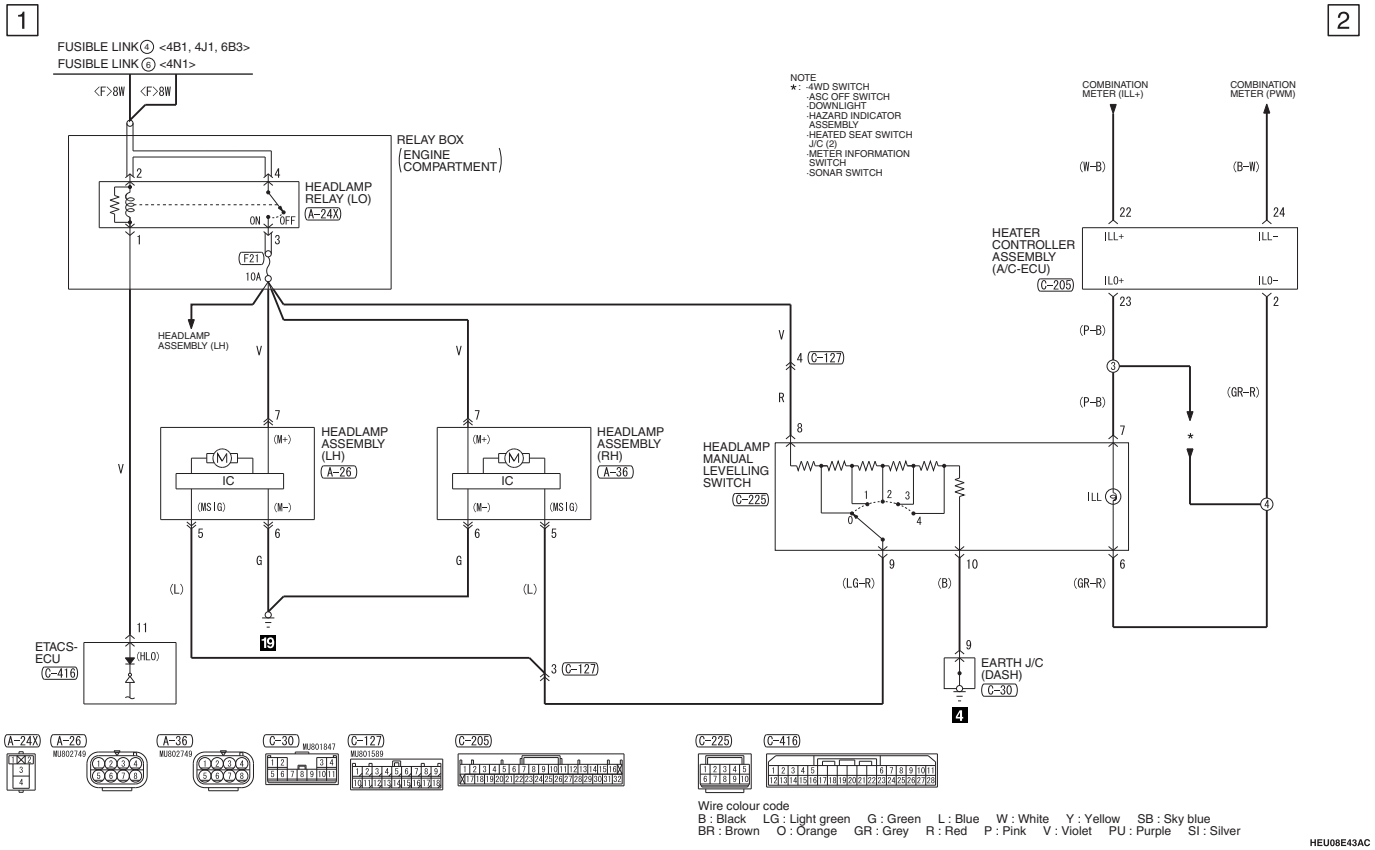


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU08E42DC

HEADLAMP MANUAL LEVELLING SYSTEM

M1901025301612

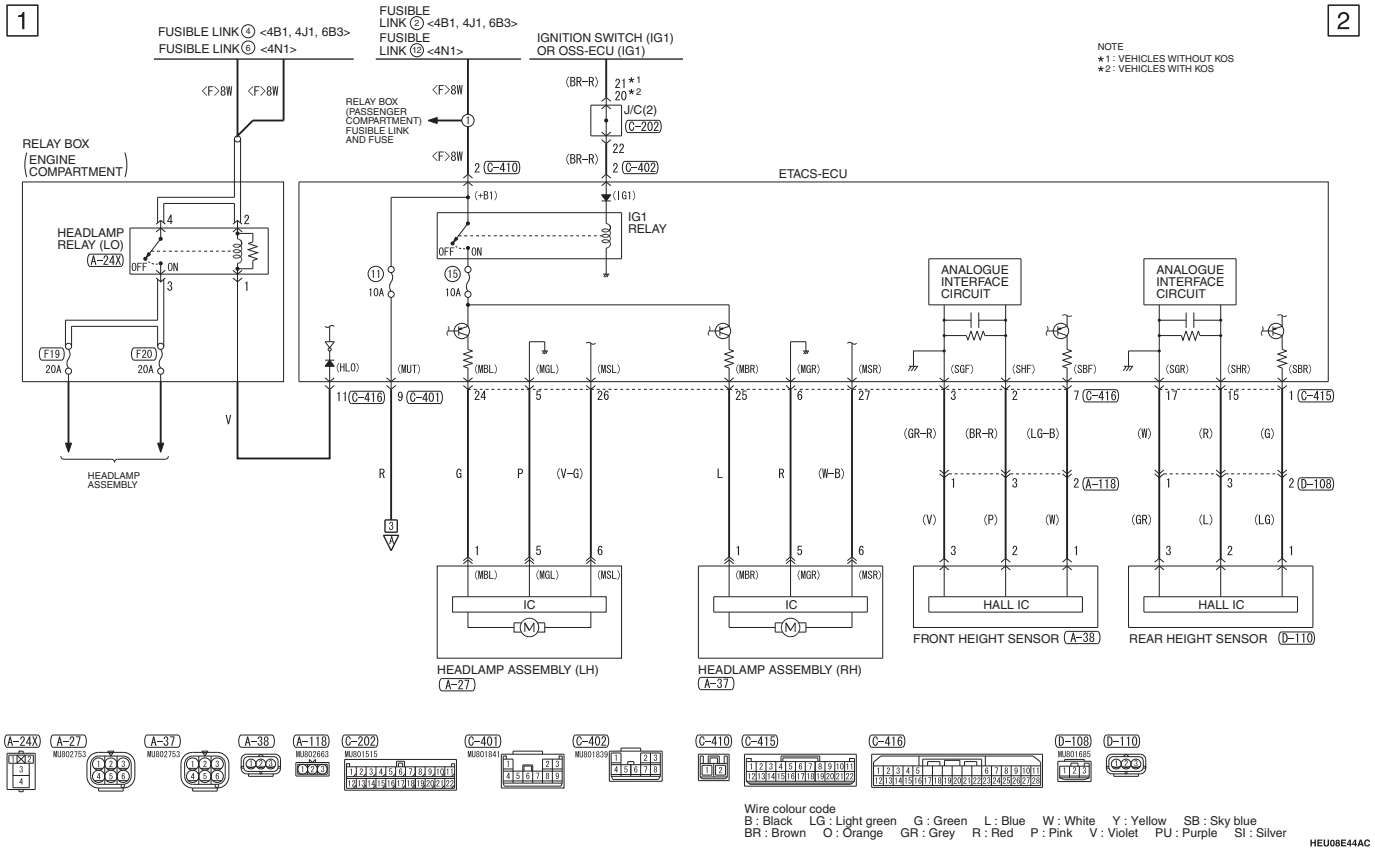


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

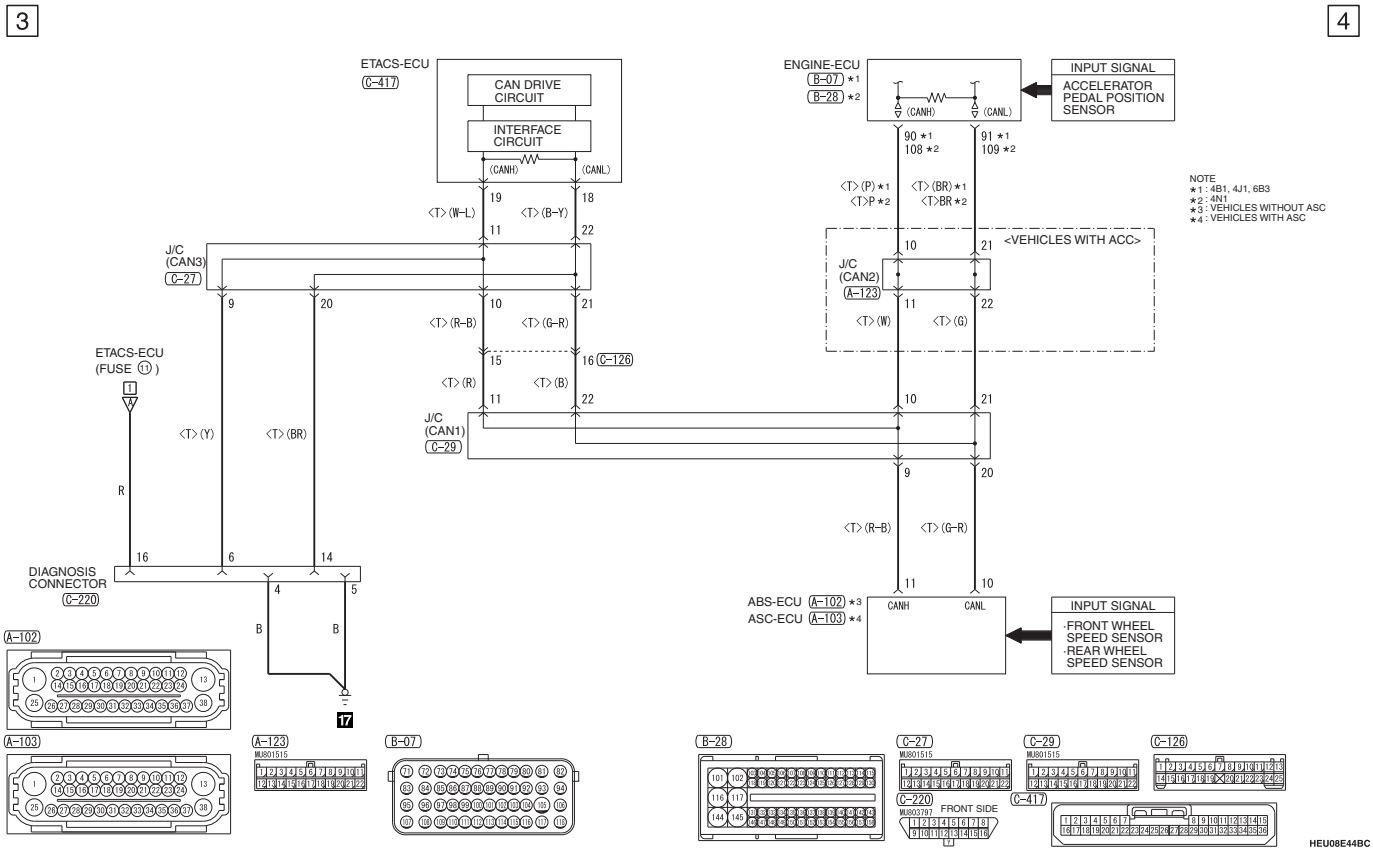
HEU08E43AC

HEADLAMP AUTOMATIC LEVELLING SYSTEM <LHD>

M1901025401642

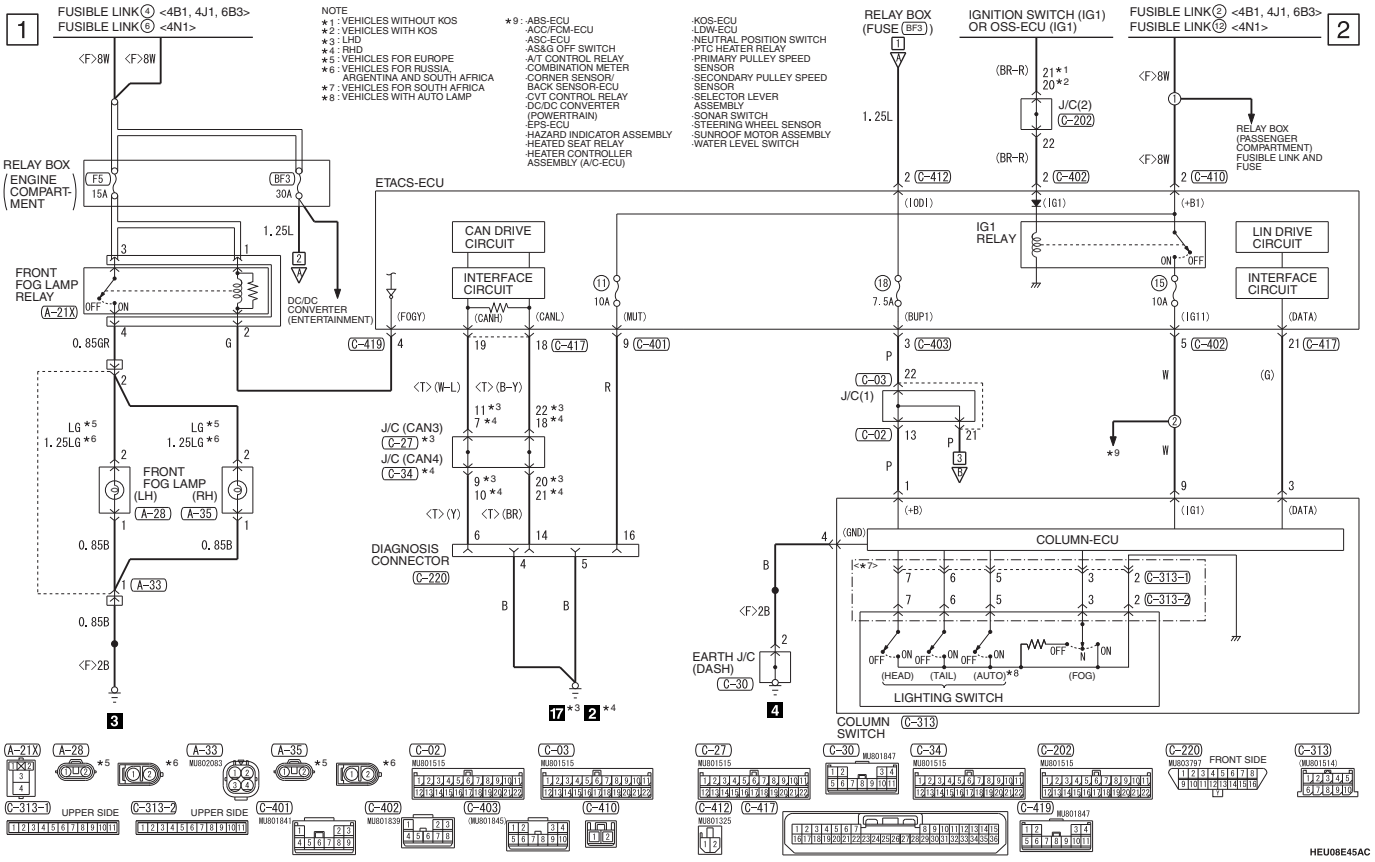


HEADLAMP AUTOMATIC LEVELLING SYSTEM <LHD> (CONTINUED)



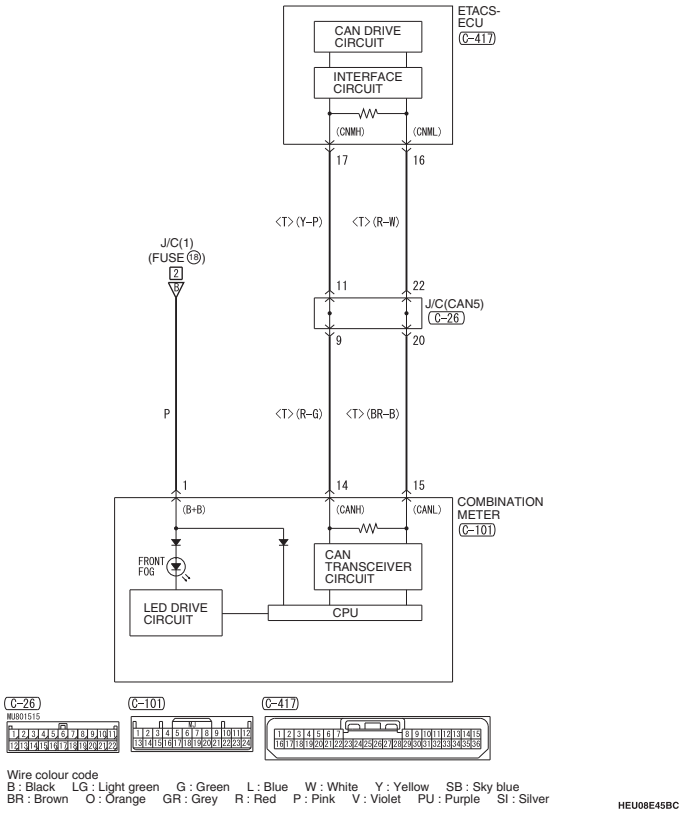
FRONT FOG LAMP

M1901011903071



FRONT FOG LAMP (CONTINUED)

3

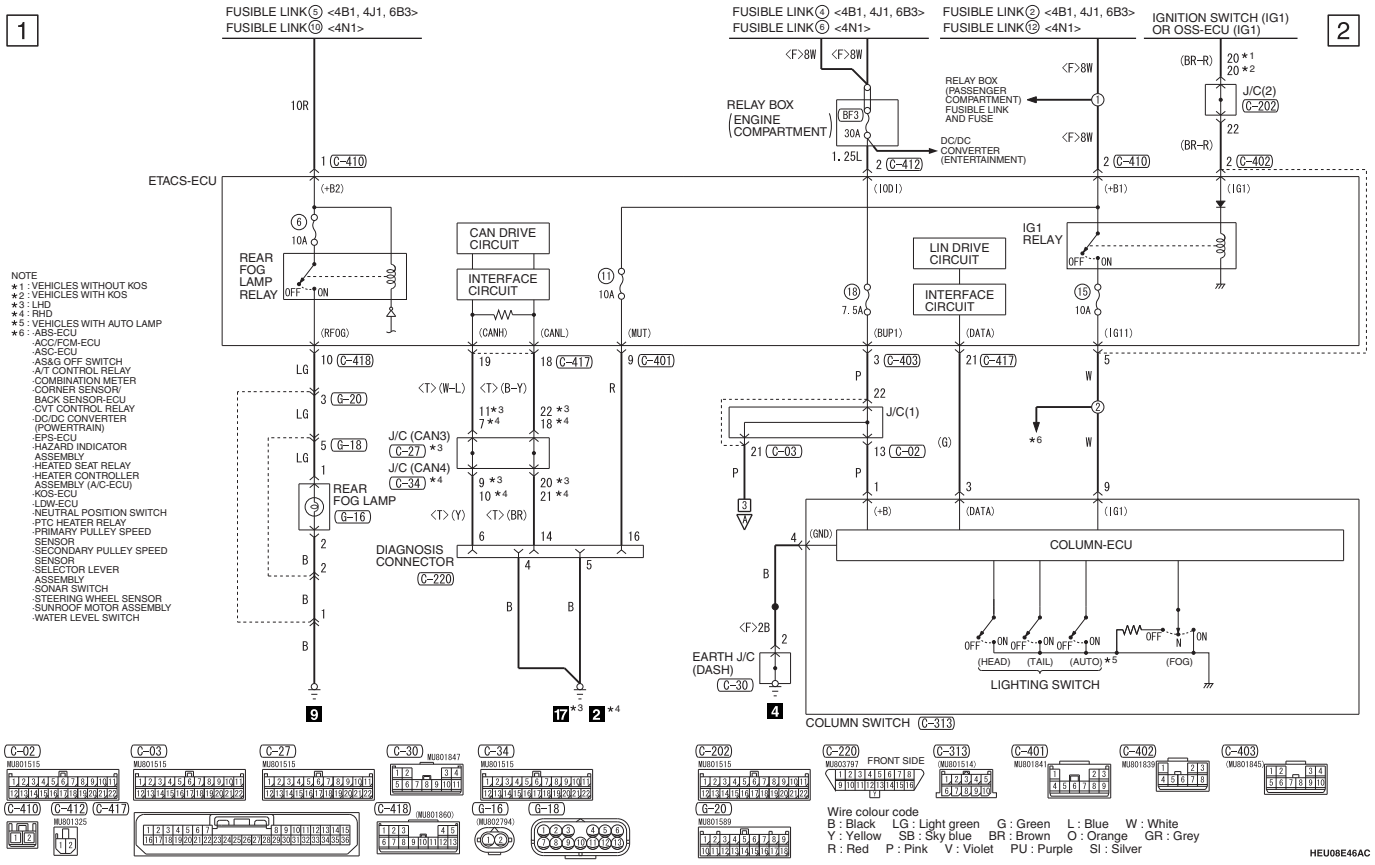


Wire colour code
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BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU08E45BC

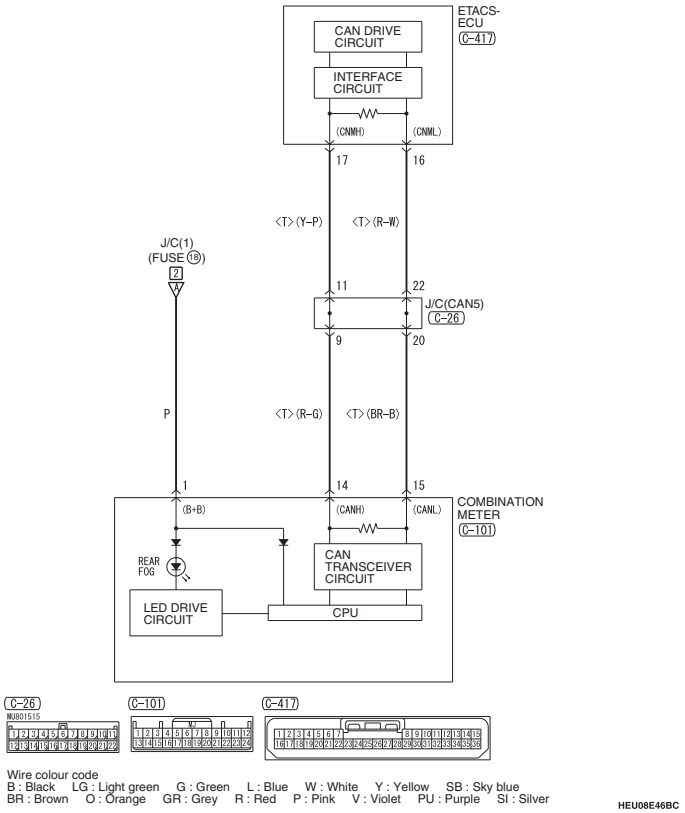
REAR FOG LAMP

M1901012002283



REAR FOG LAMP (CONTINUED)

3

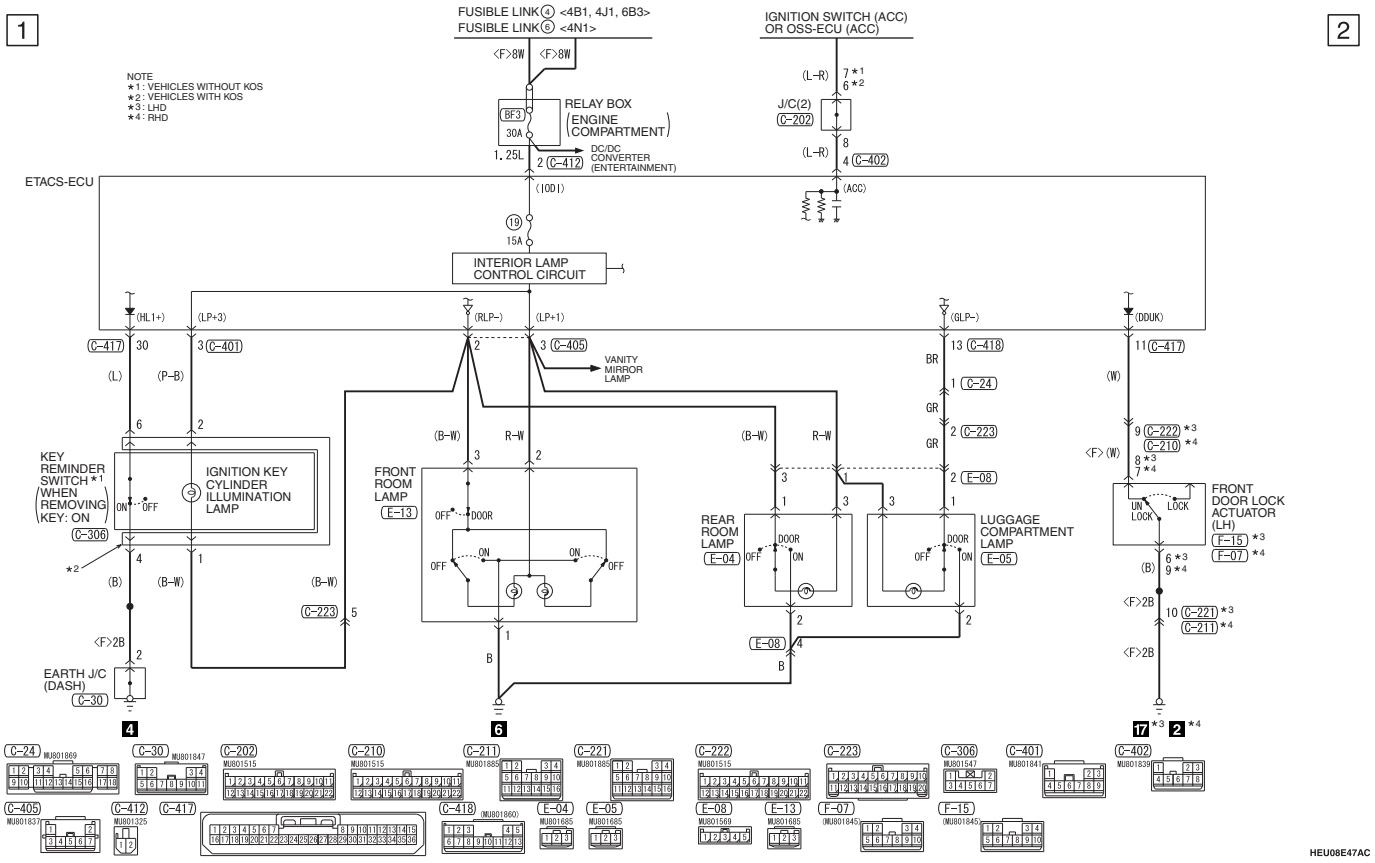


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU08E46BC

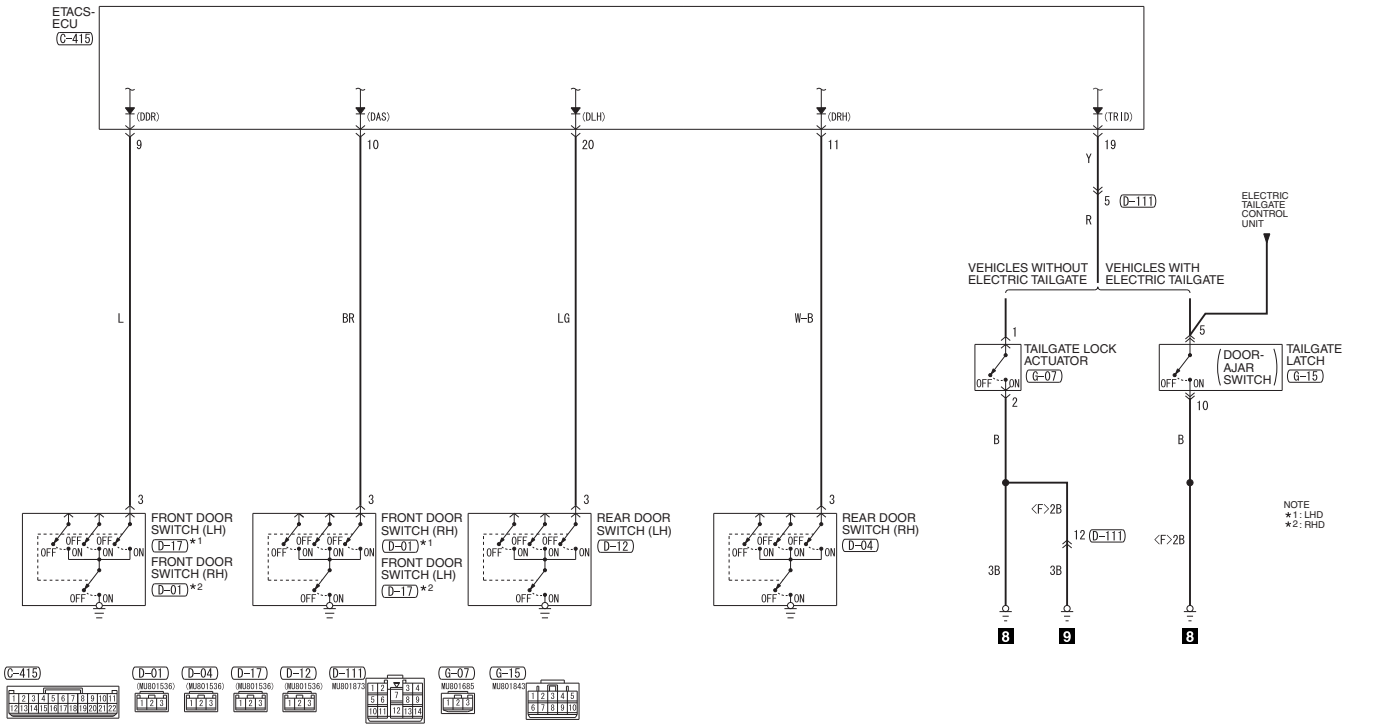
ROOM LAMP, LUGGAGE COMPARTMENT LAMP AND IGNITION KEY CYLINDER ILLUMINATION LAMP

M1901017301543



ROOM LAMP, LUGGAGE COMPARTMENT LAMP AND IGNITION KEY CYLINDER ILLUMINATION LAMP (CONTINUED)

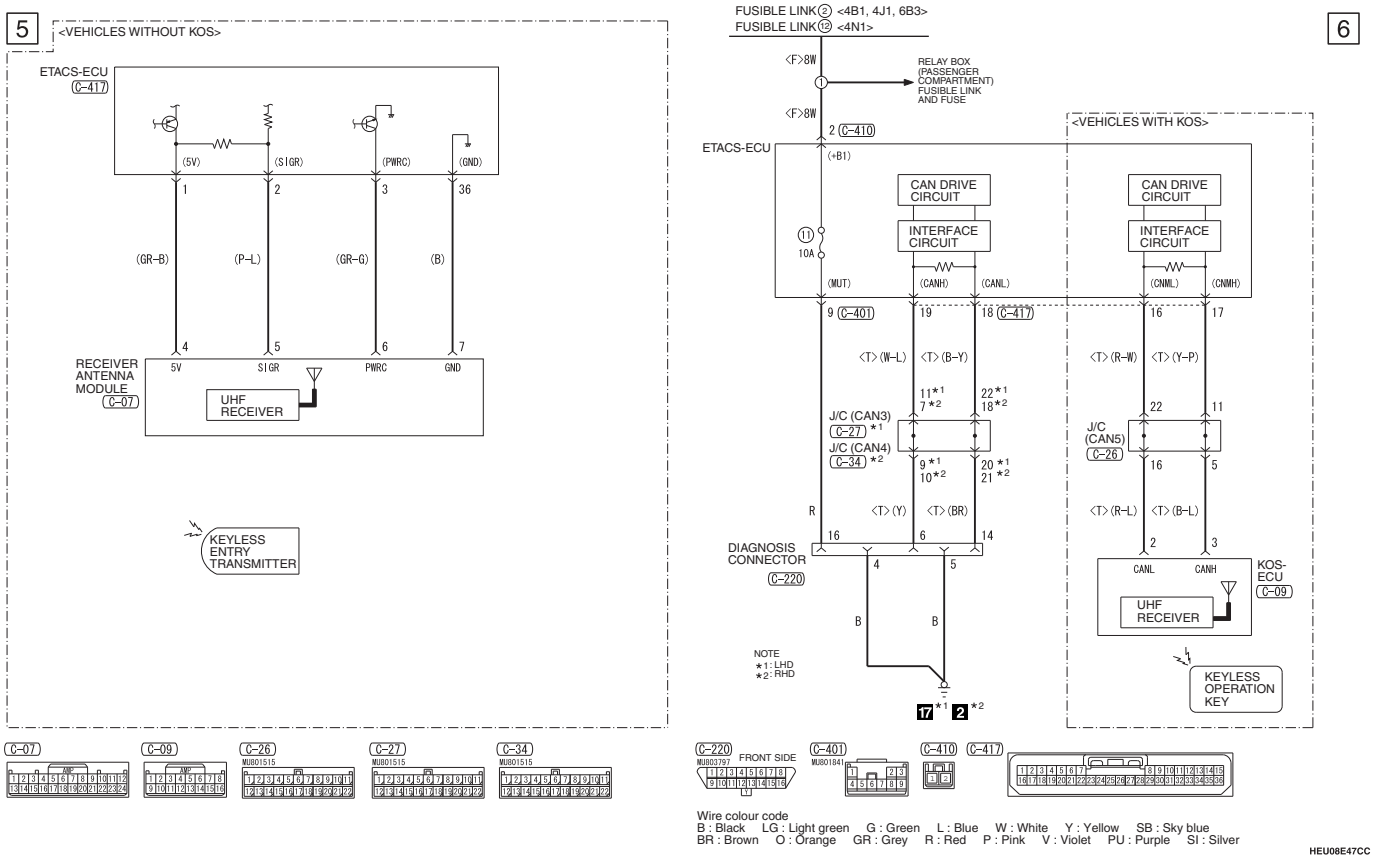
3 4



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU08E47BC

ROOM LAMP, LUGGAGE COMPARTMENT LAMP AND IGNITION KEY CYLINDER ILLUMINATION LAMP (CONTINUED)

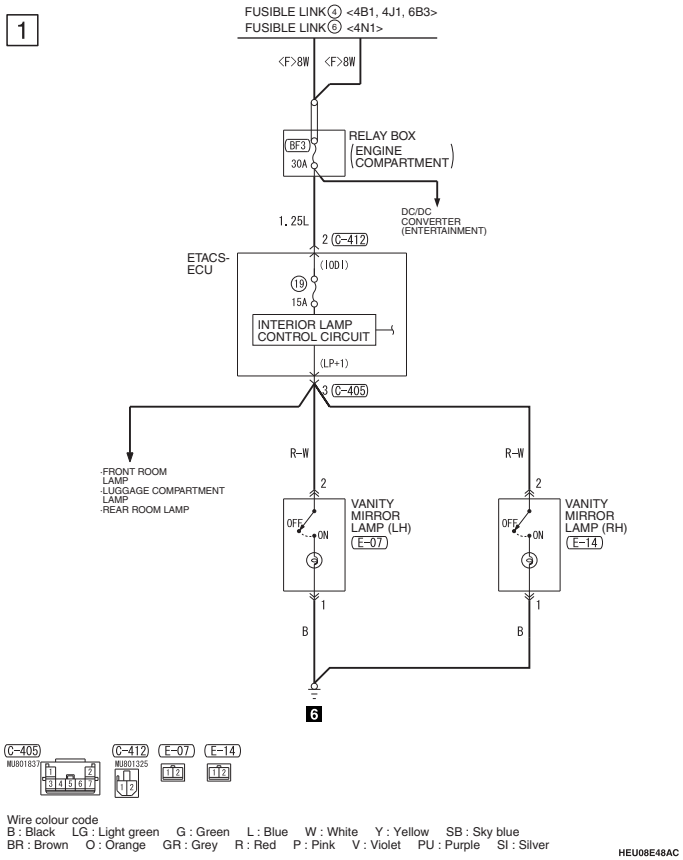


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU08E47CC

VANITY MIRROR LAMP

M1901002401492

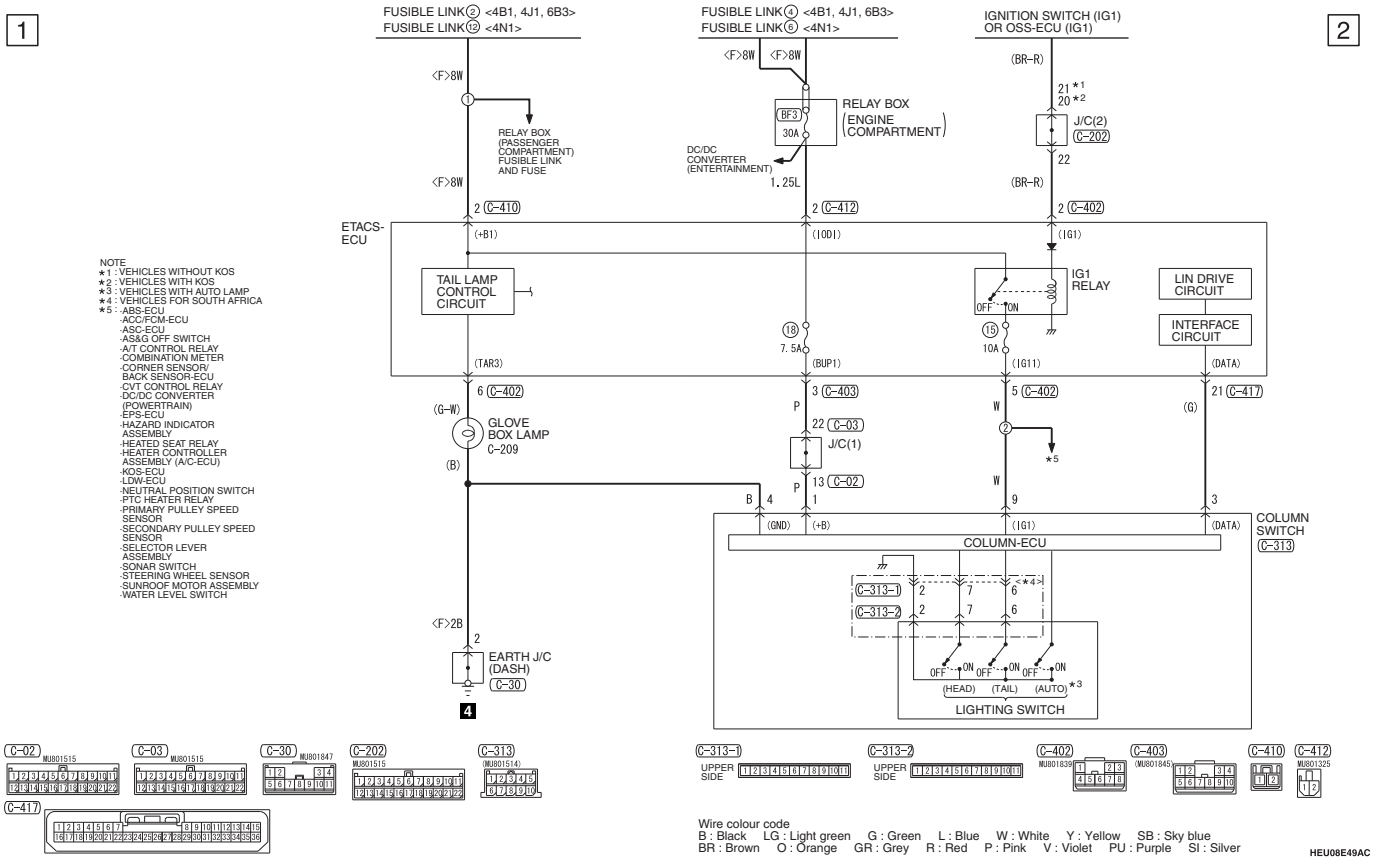


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU08E48AC

GLOVE BOX LAMP

M1901002202350

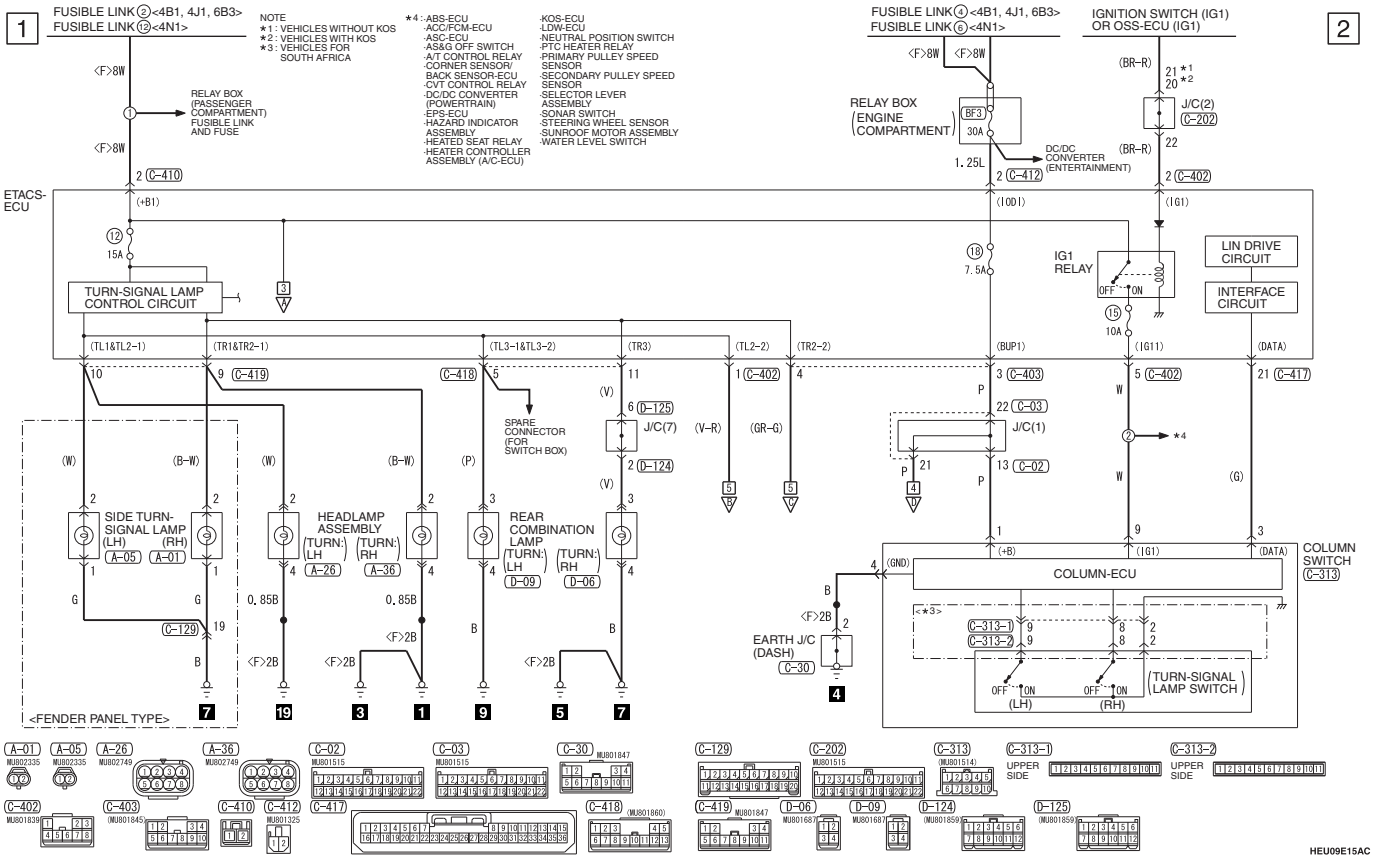


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

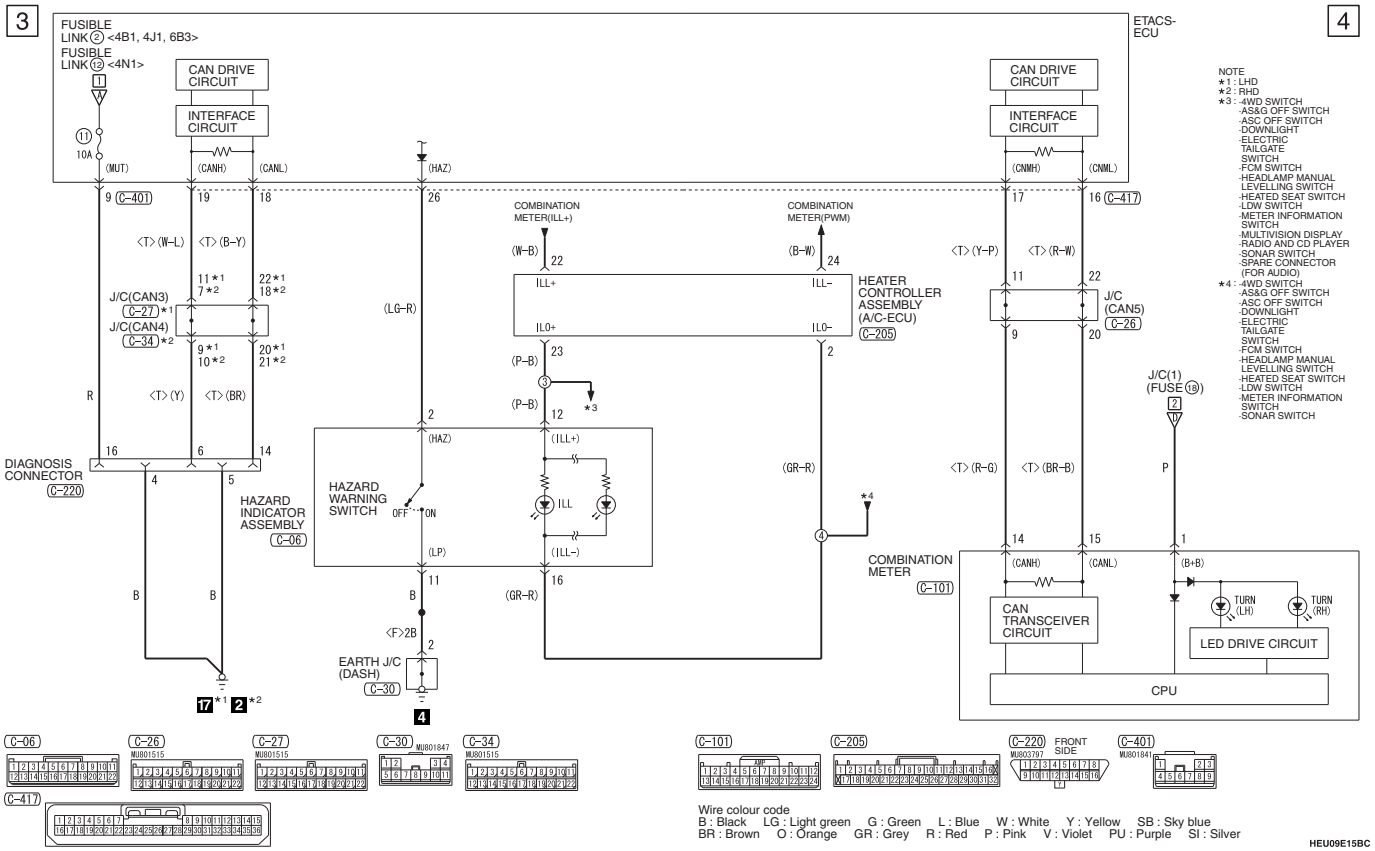
HEU08E49AC

TURN-SIGNAL LAMP AND HAZARD WARNING LAMP

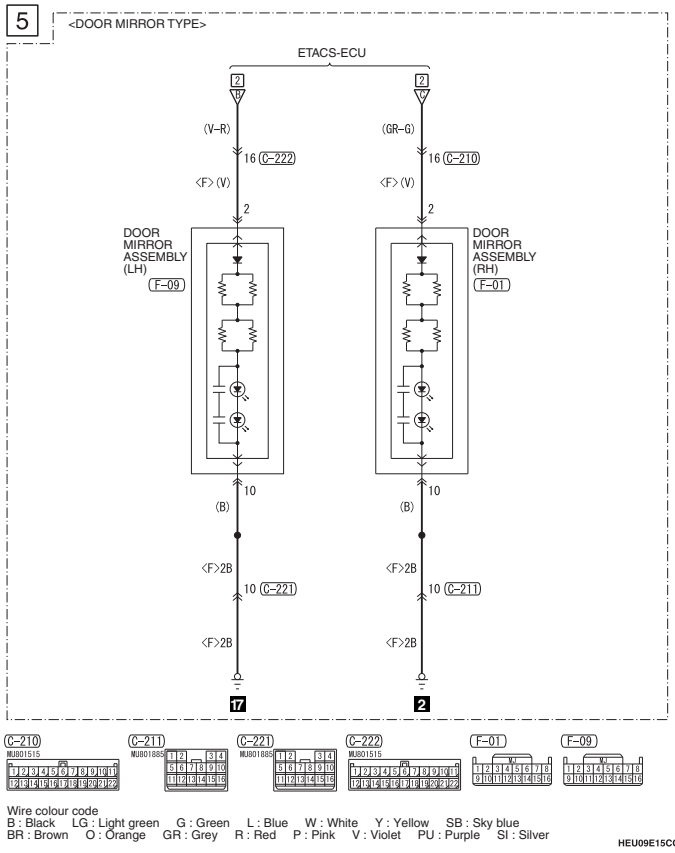
M1901002905637



TURN-SIGNAL LAMP AND HAZARD WARNING LAMP (CONTINUED)

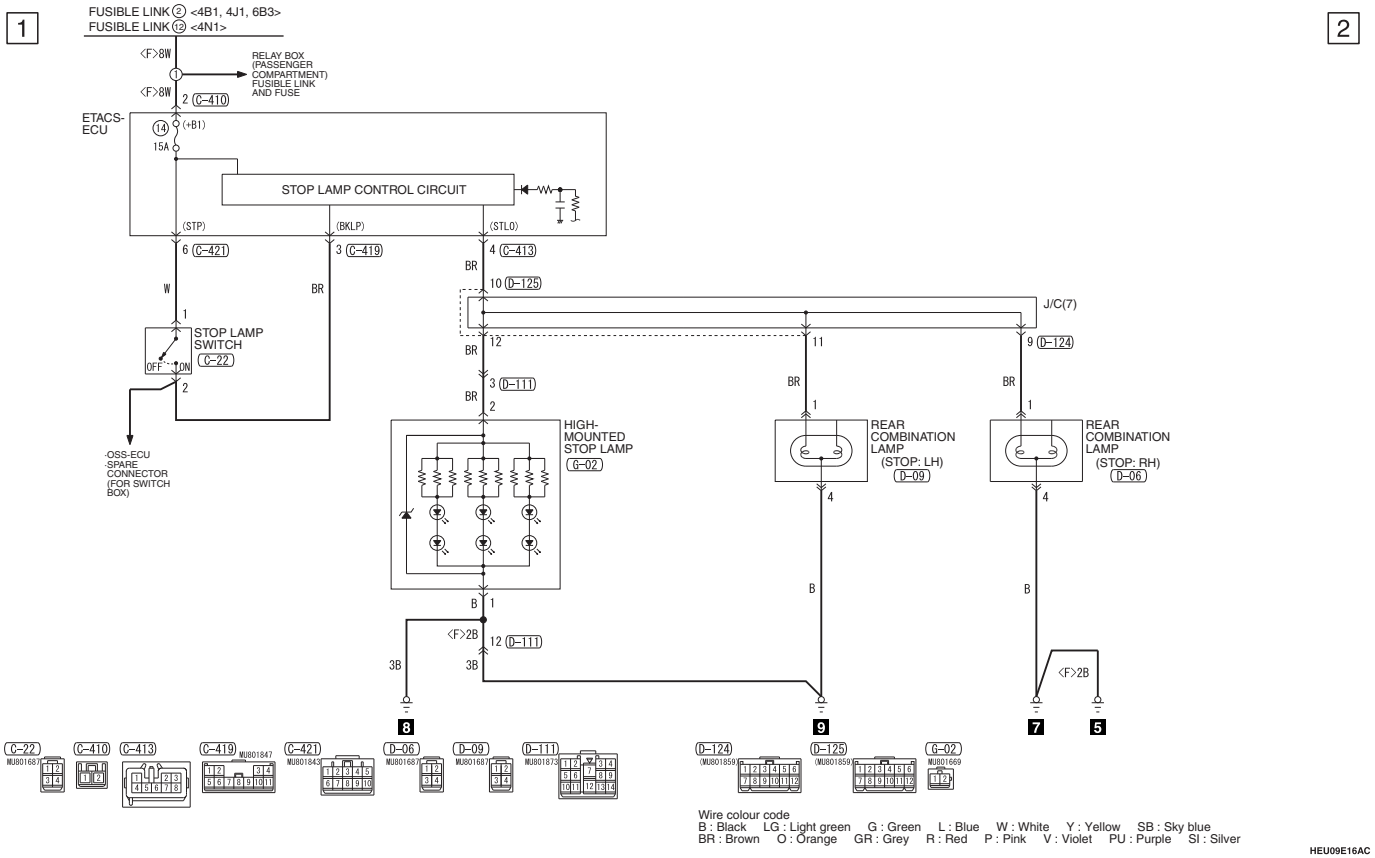


TURN-SIGNAL LAMP AND HAZARD WARNING LAMP (CONTINUED)



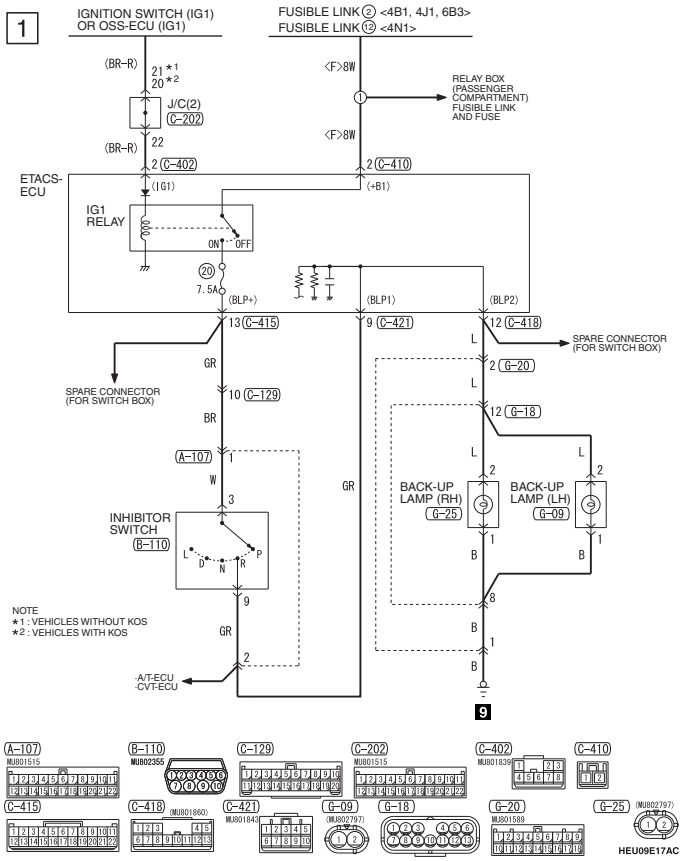
STOP LAMP

M1901003004902



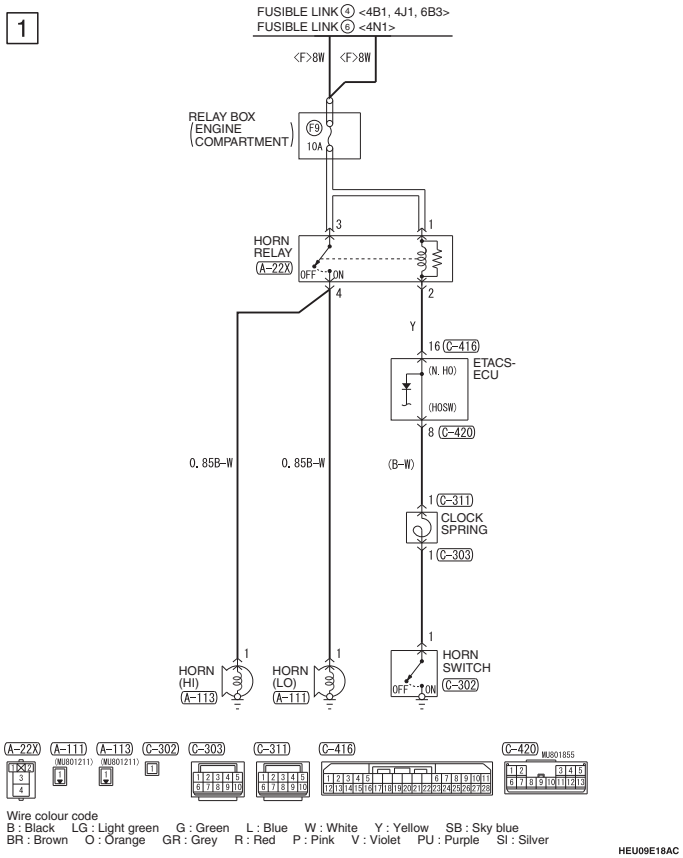
BACK-UP LAMP <CVT, A/T>

M1901003106284



HORN

M1901003303278

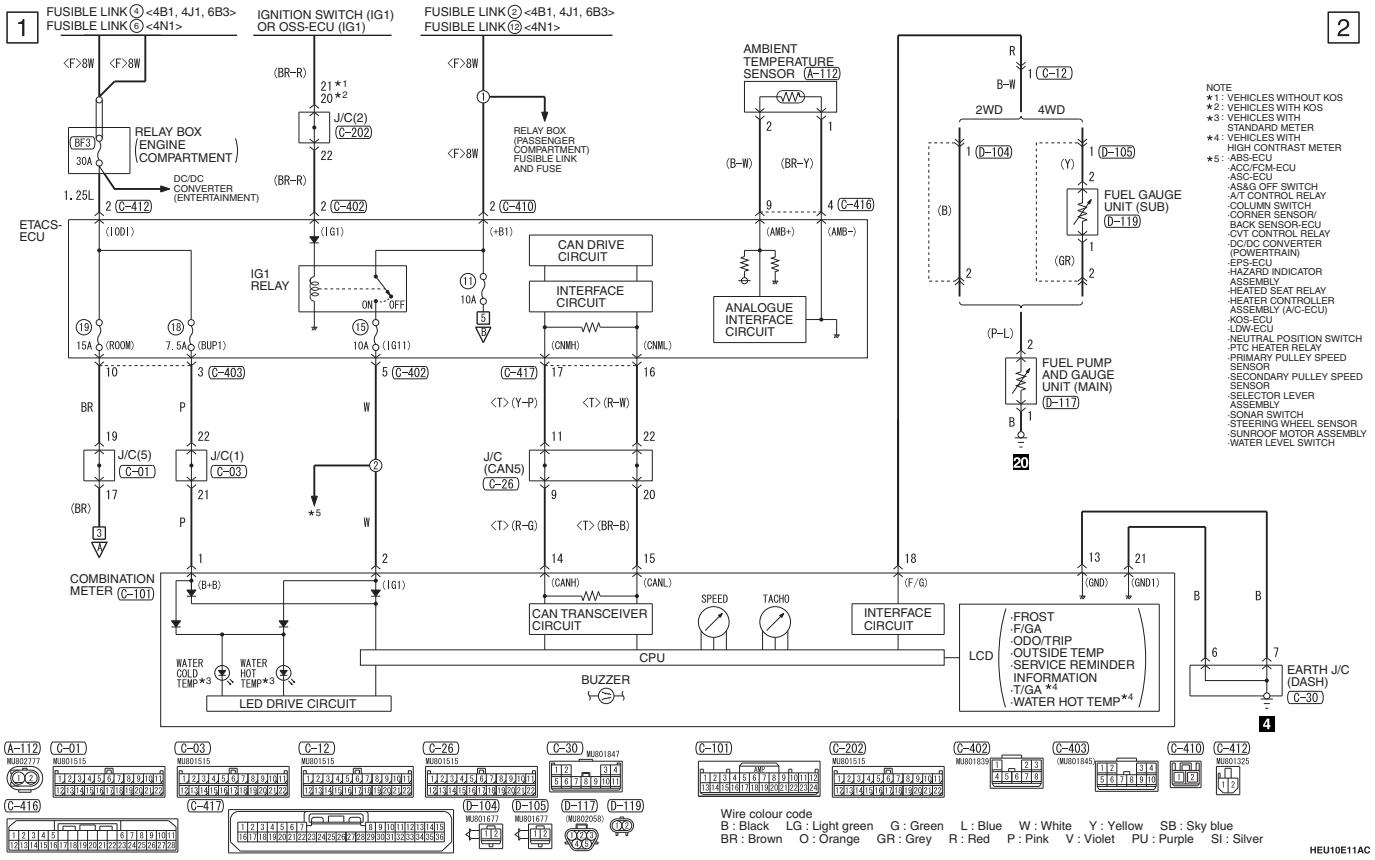


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

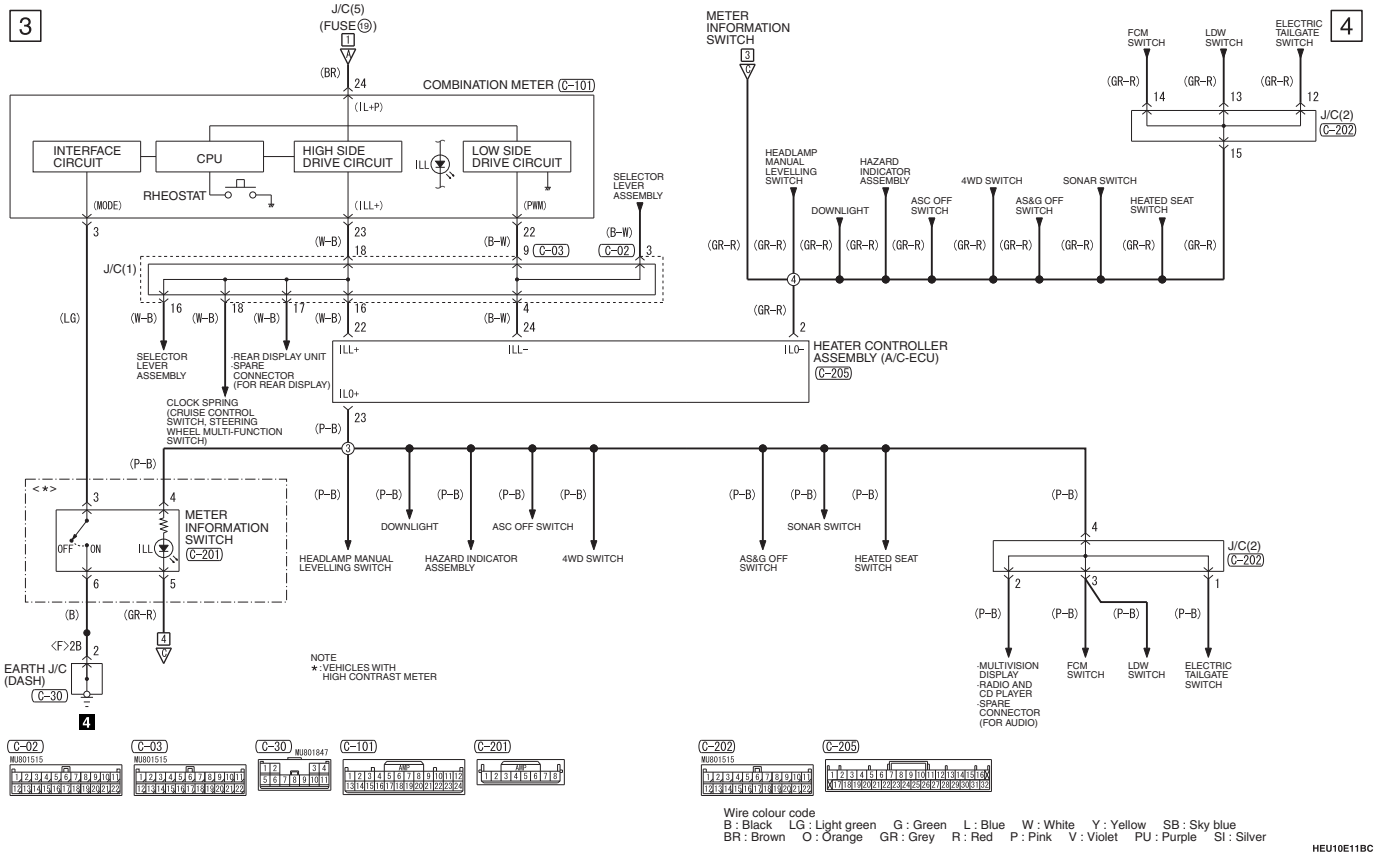
HEU09E18AC

METER AND GAUGE <LHD>

M1901003507616



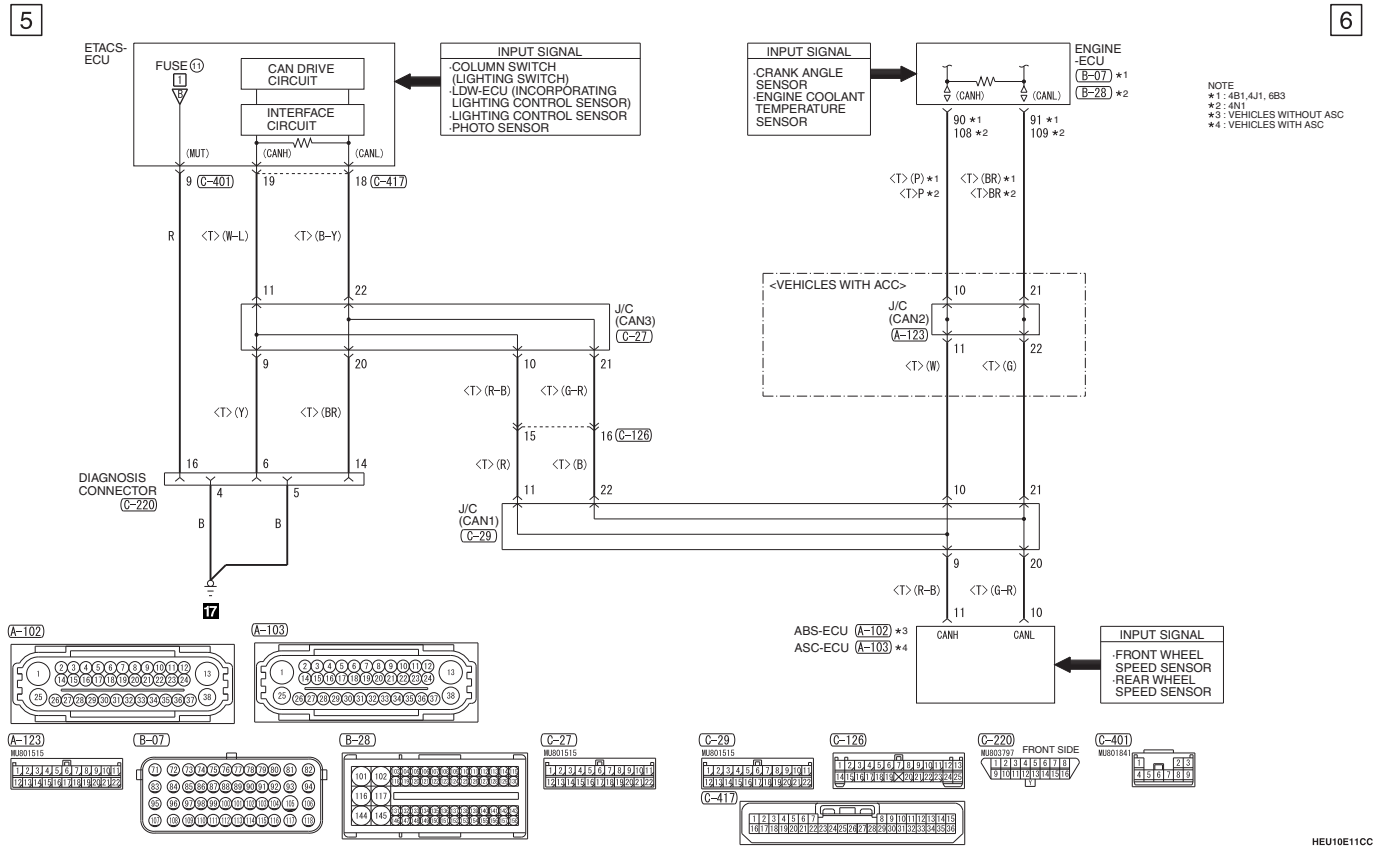
METER AND GAUGE <LHD> (CONTINUED)



Wire colour code
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BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU10E11BC

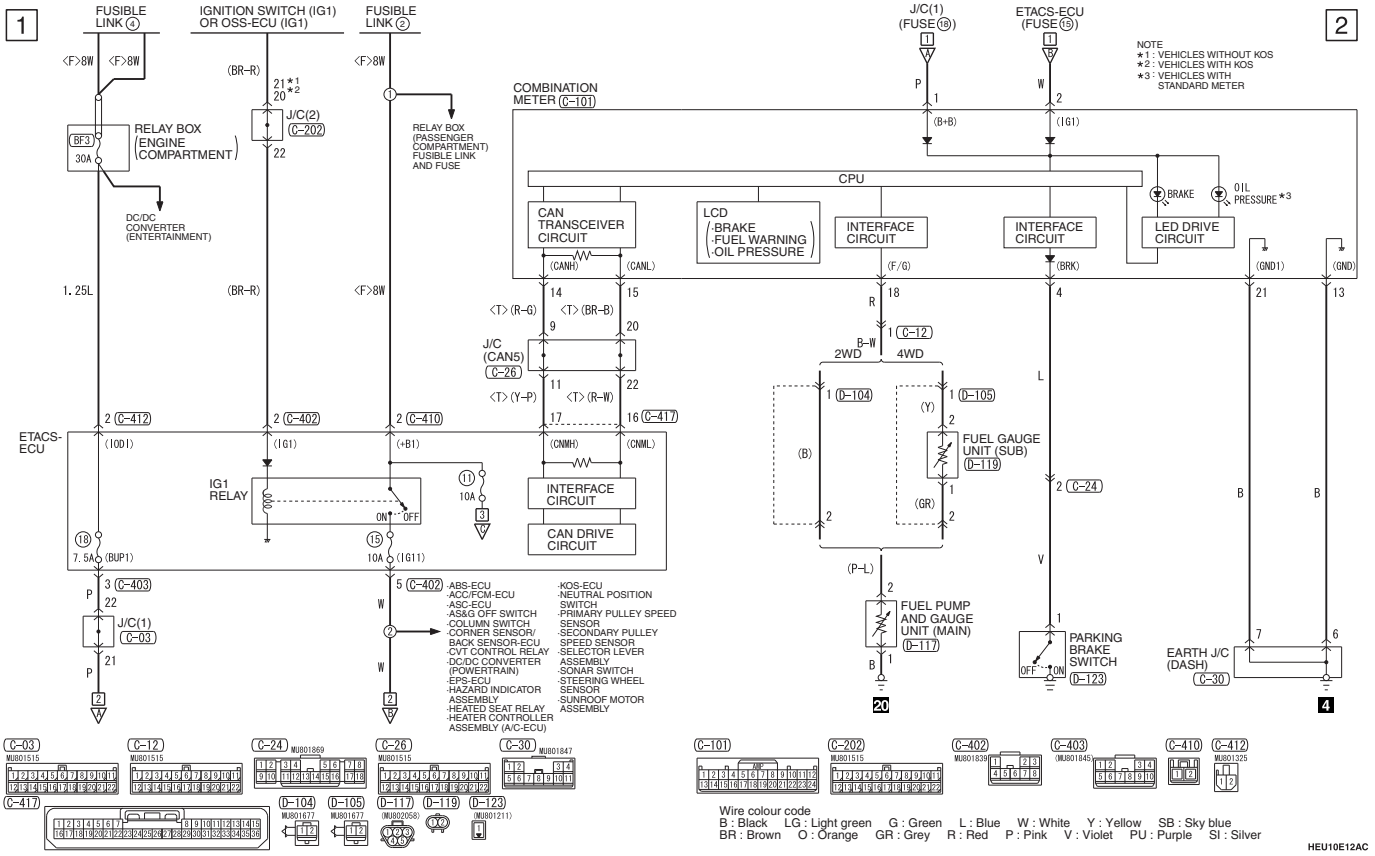
METER AND GAUGE <LHD> (CONTINUED)



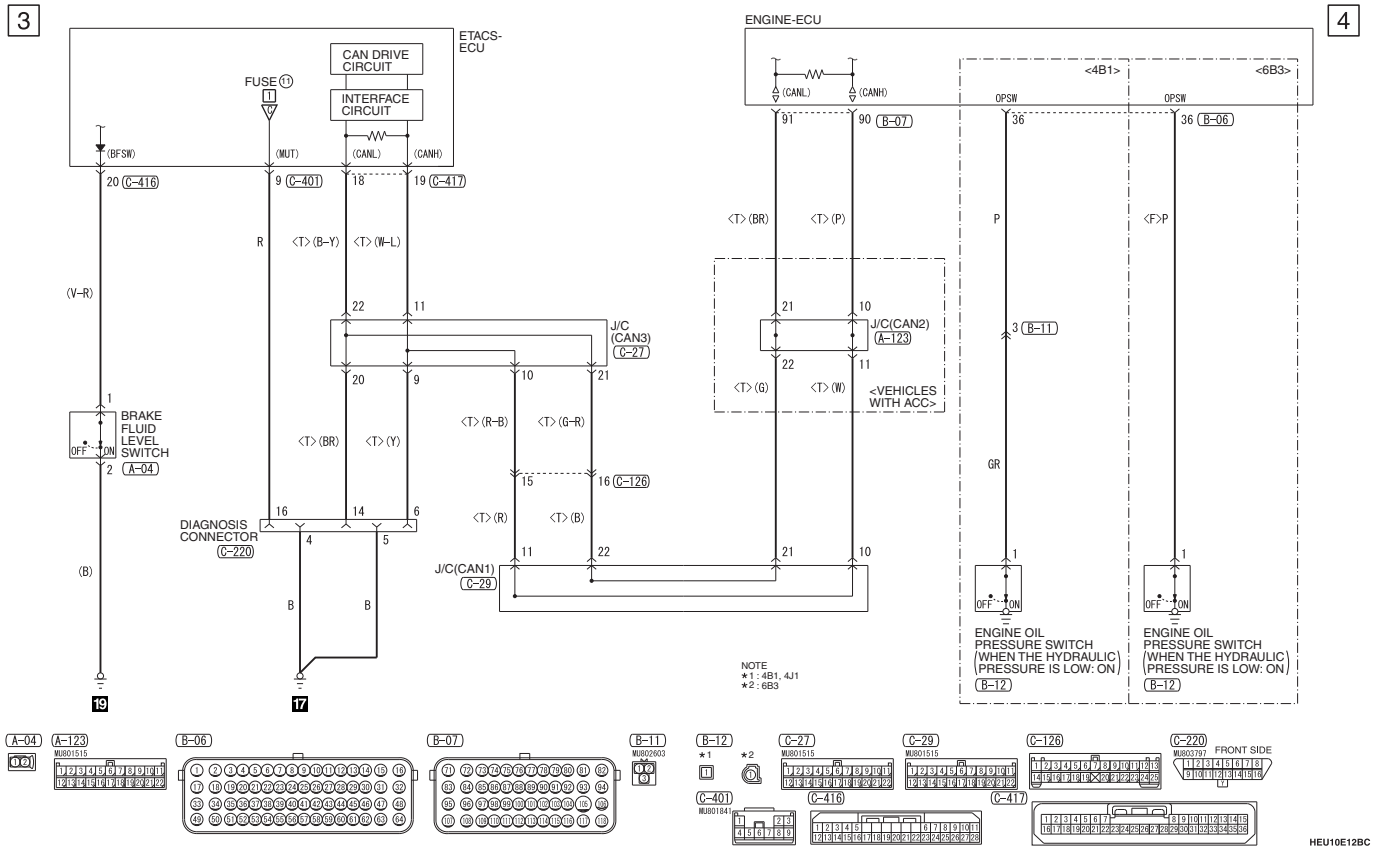
HEU10E11CC

FUEL WARNING LAMP, OIL PRESSURE WARNING LAMP AND BRAKE WARNING LAMP <4B1, 4J1, 6B3 (LHD)>

M1901018702042

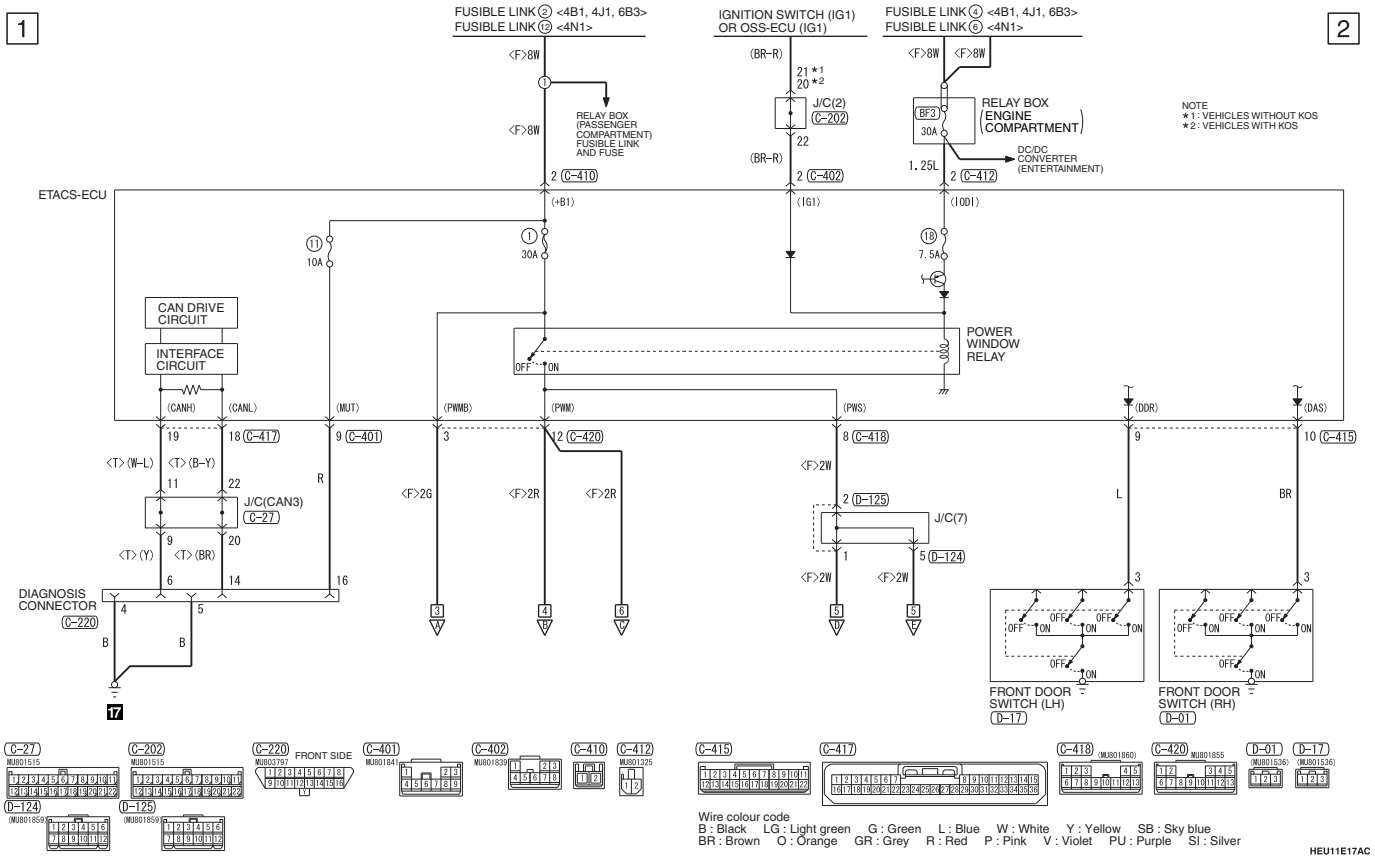


FUEL WARNING LAMP, OIL PRESSURE WARNING LAMP AND BRAKE WARNING LAMP <4B1, 4J1, 6B3 (LHD)> (CONTINUED)

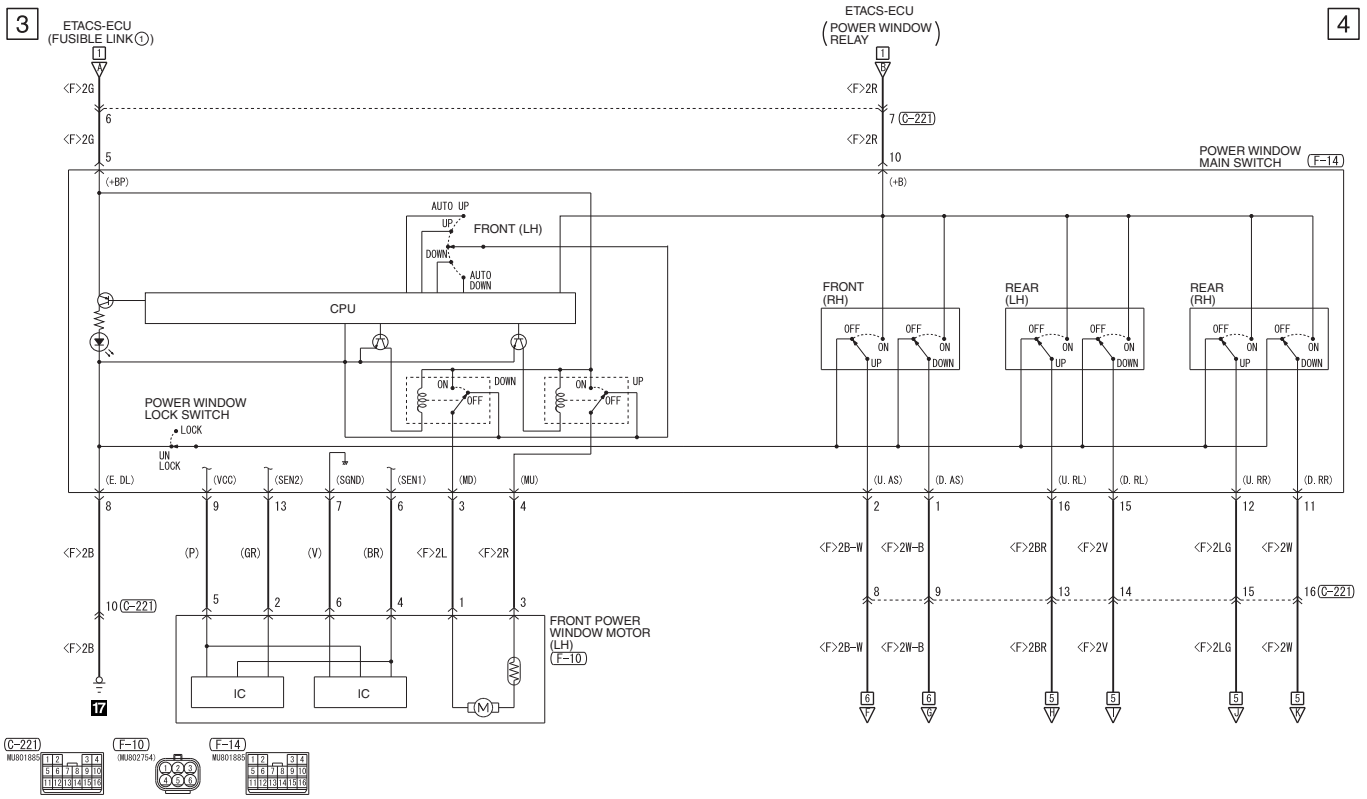


POWER WINDOWS <LHD>

M1901004606185



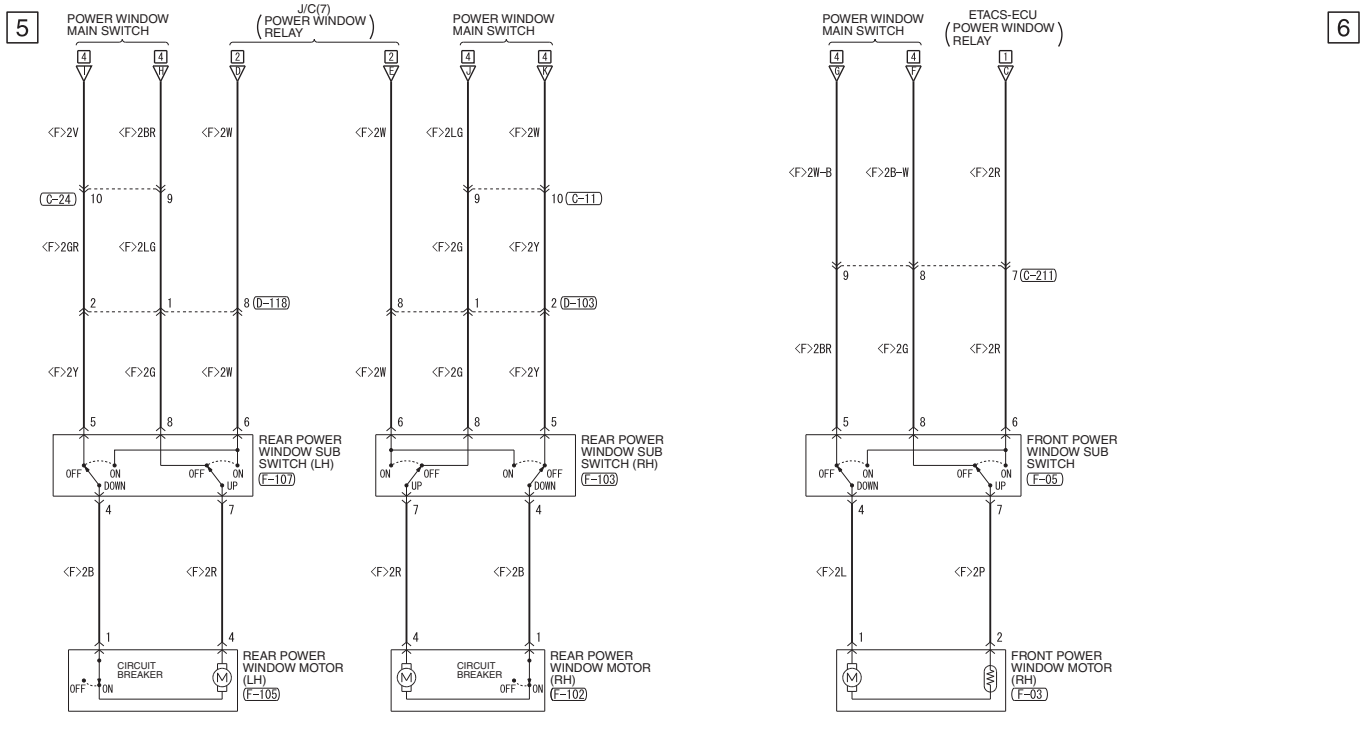
POWER WINDOWS <LHD> (CONTINUED)



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU11E17BC

POWER WINDOWS <LHD> (CONTINUED)

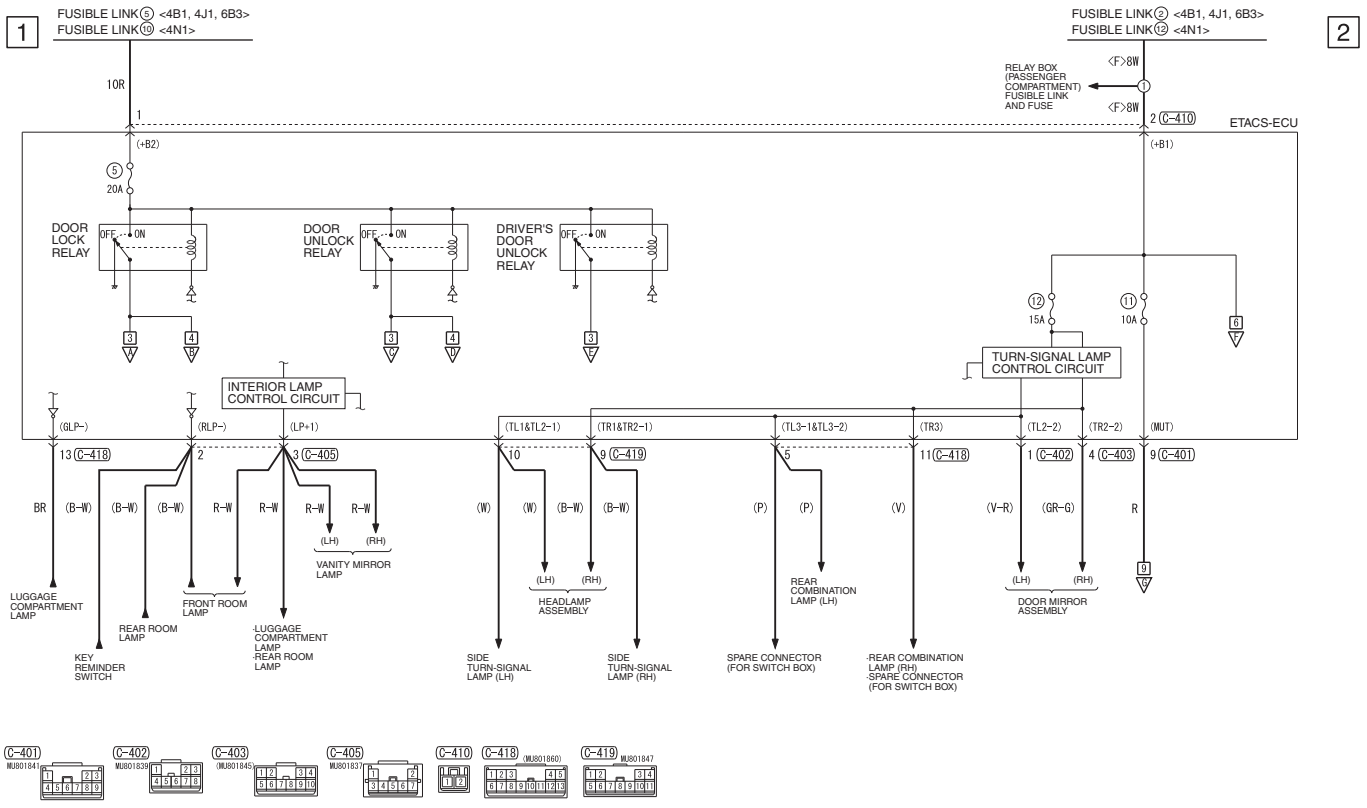


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU11E17CC

CENTRAL DOOR LOCKING SYSTEM <VEHICLES WITH KOS (LHD)>

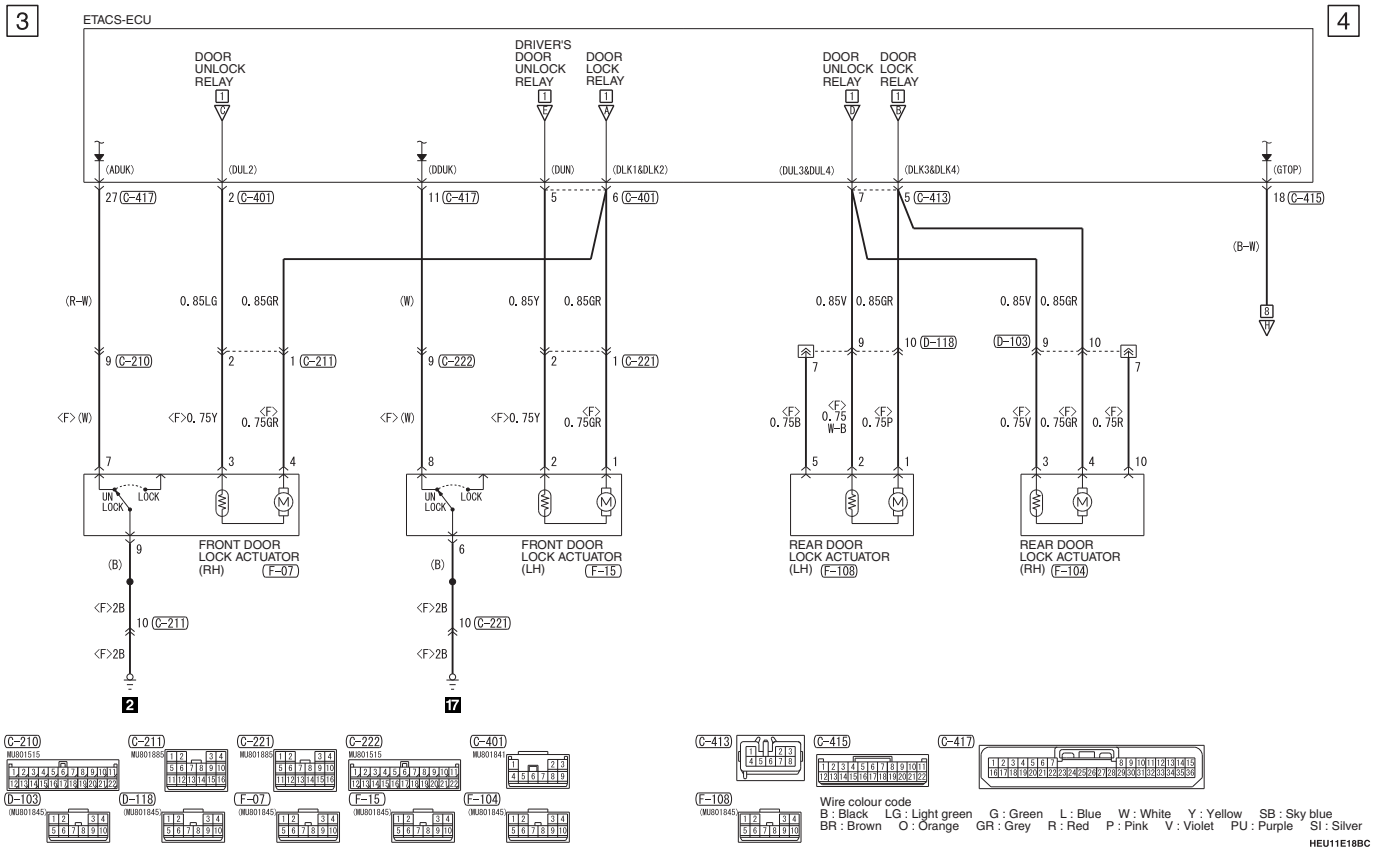
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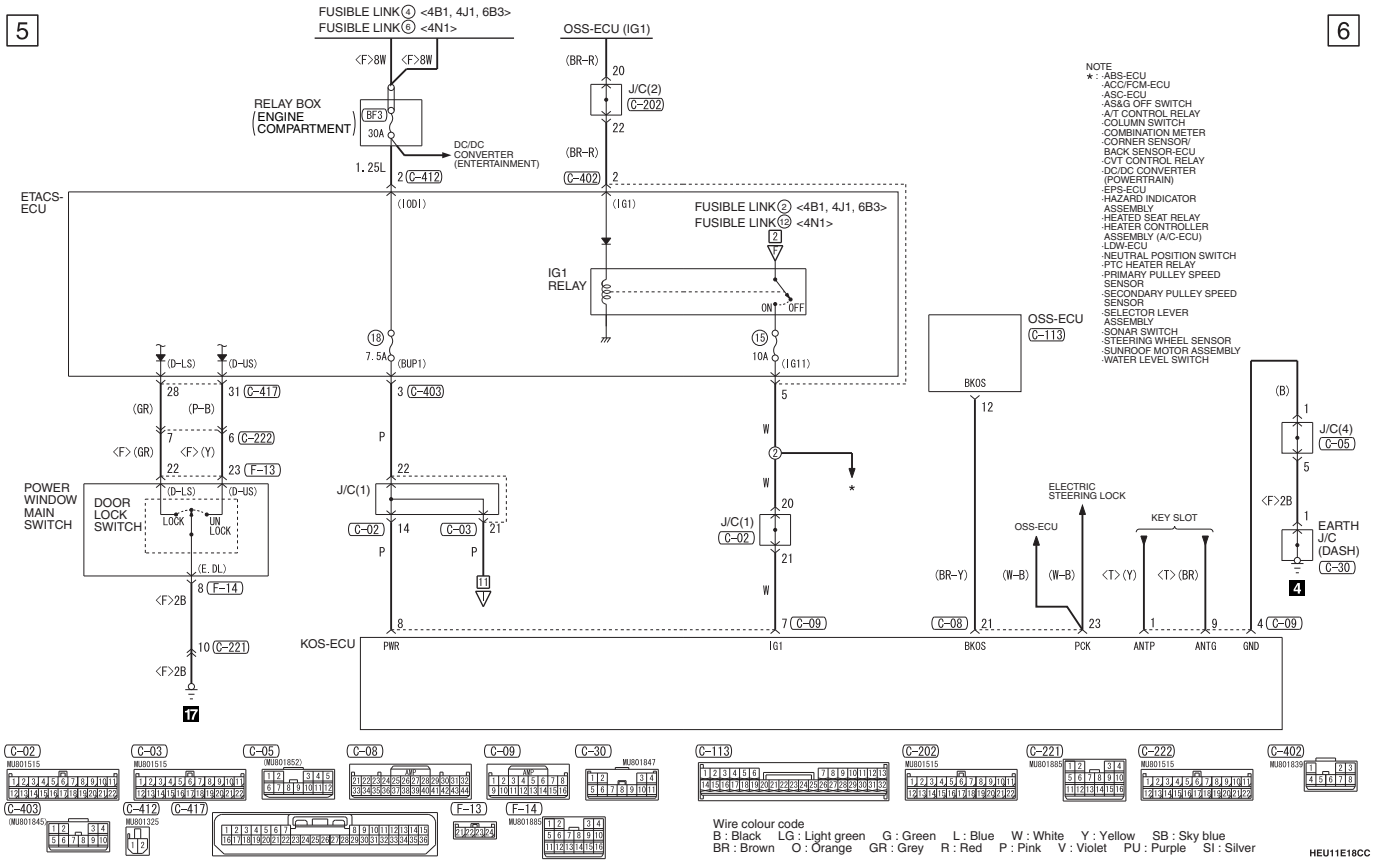
Wire colour code
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HEU11E18AC

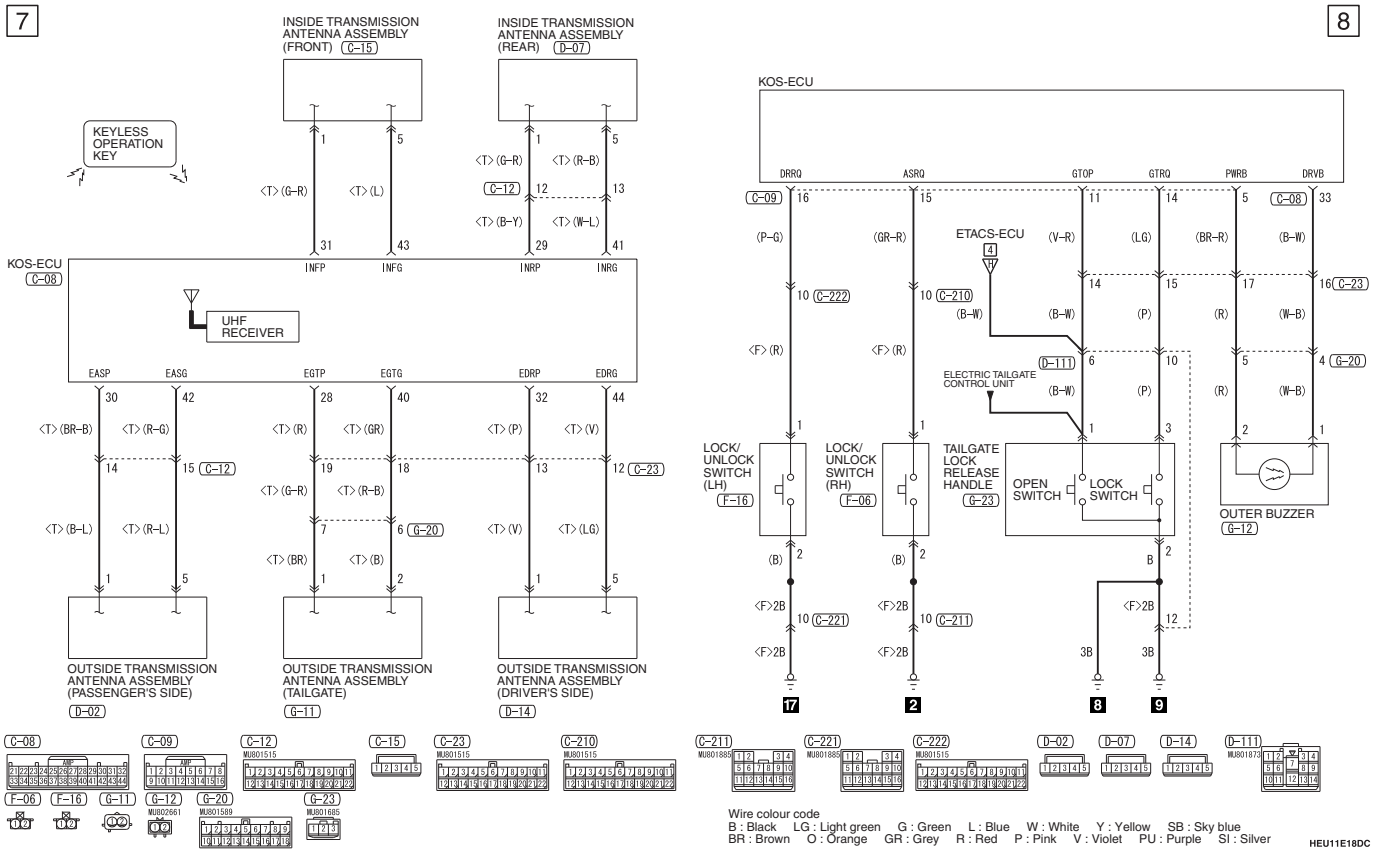
CENTRAL DOOR LOCKING SYSTEM <VEHICLES WITH KOS (LHD)> (CONTINUED)



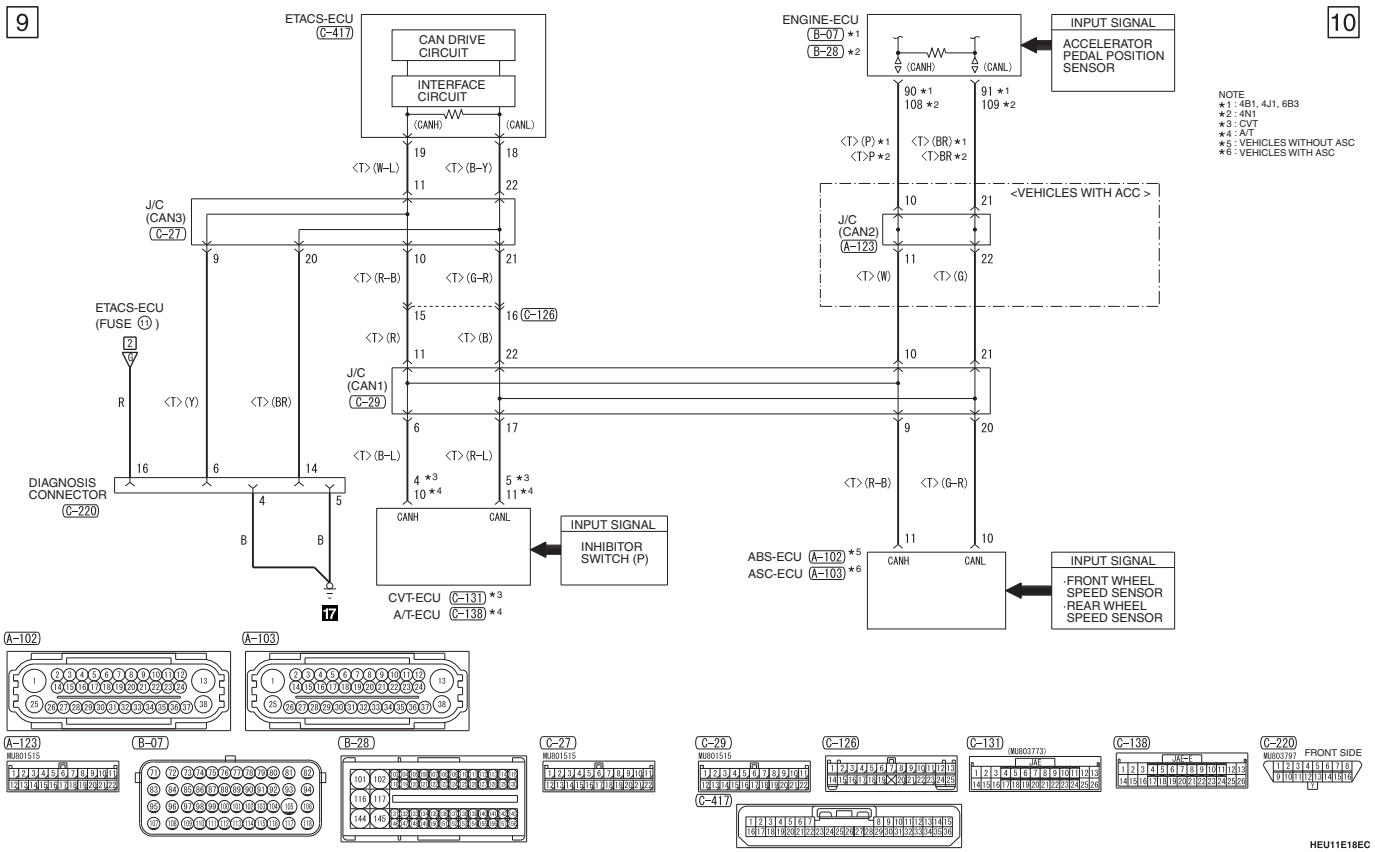
CENTRAL DOOR LOCKING SYSTEM <VEHICLES WITH KOS (LHD)> (CONTINUED)



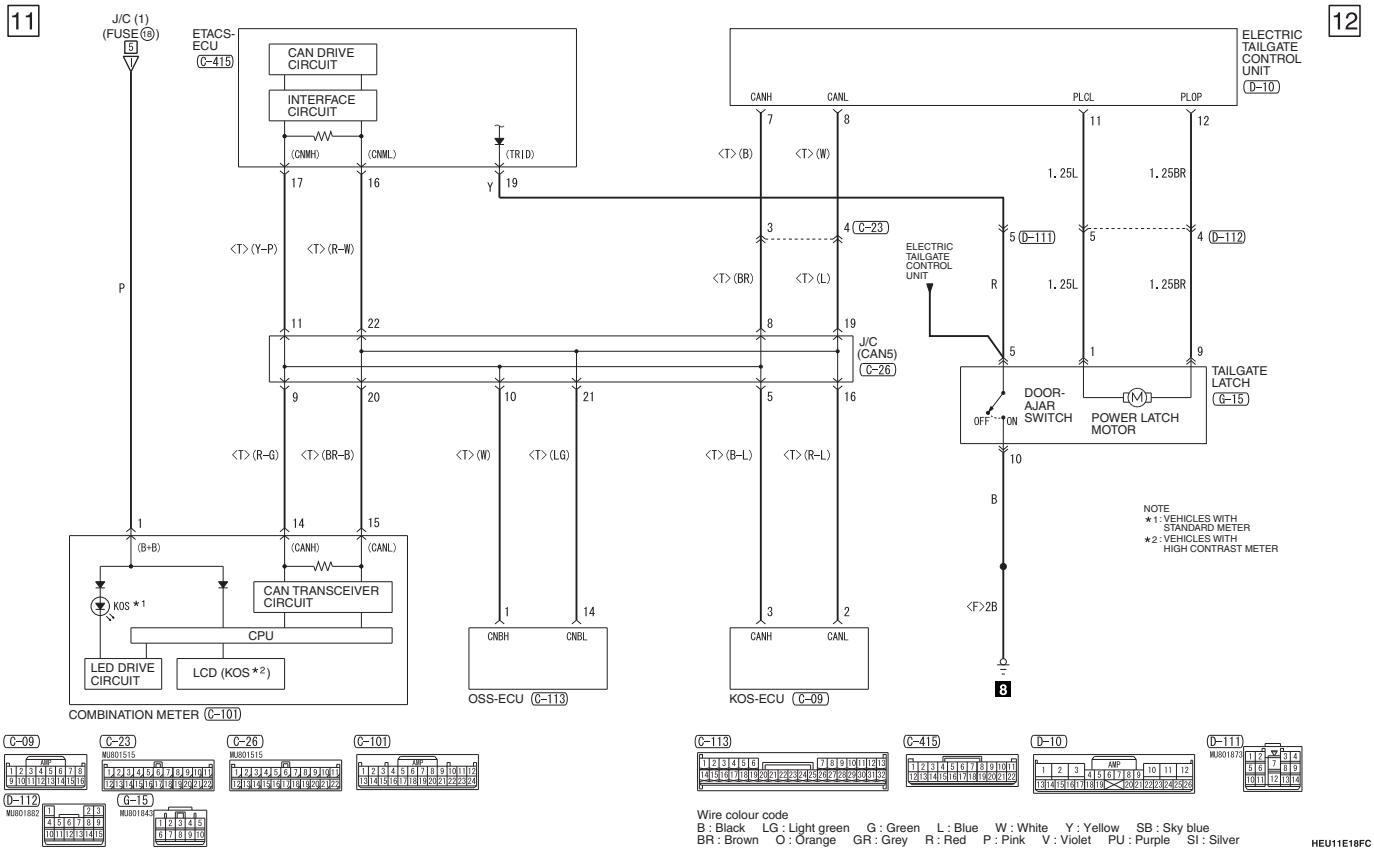
CENTRAL DOOR LOCKING SYSTEM <VEHICLES WITH KOS (LHD)> (CONTINUED)



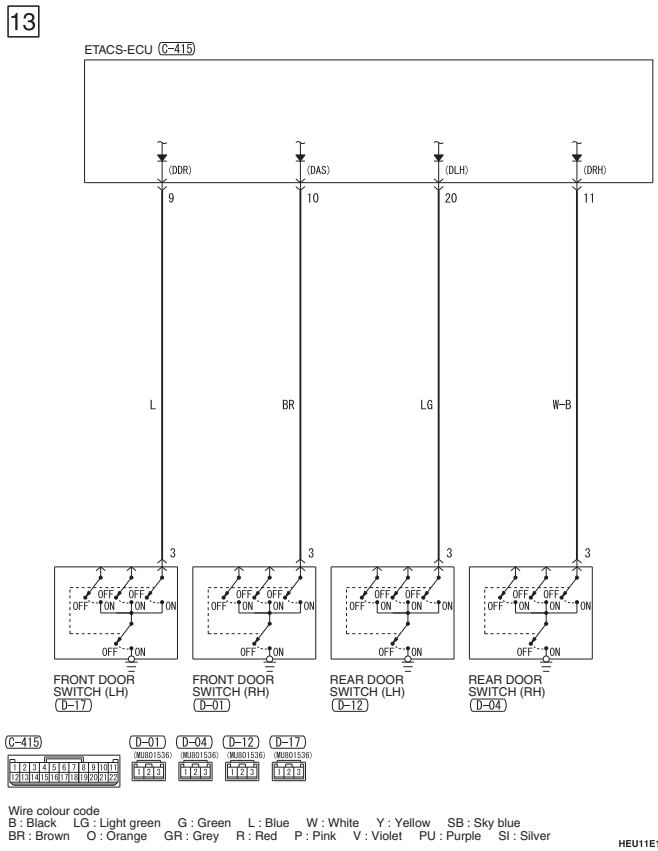
CENTRAL DOOR LOCKING SYSTEM <VEHICLES WITH KOS (LHD)> (CONTINUED)



CENTRAL DOOR LOCKING SYSTEM <VEHICLES WITH KOS (LHD)> (CONTINUED)

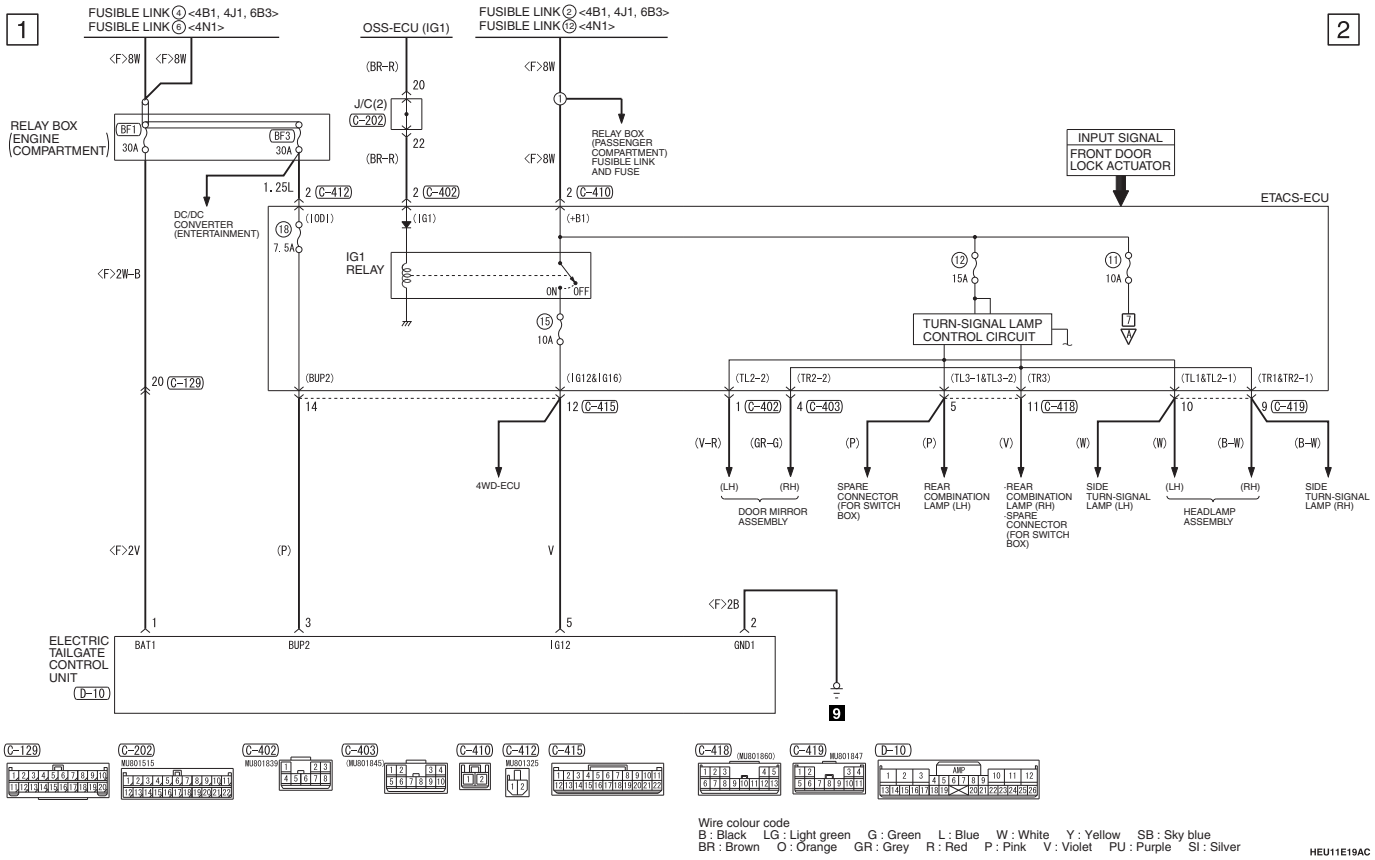


CENTRAL DOOR LOCKING SYSTEM <VEHICLES WITH KOS (LHD)> (CONTINUED)



ELECTRIC TAILGATE <LHD>

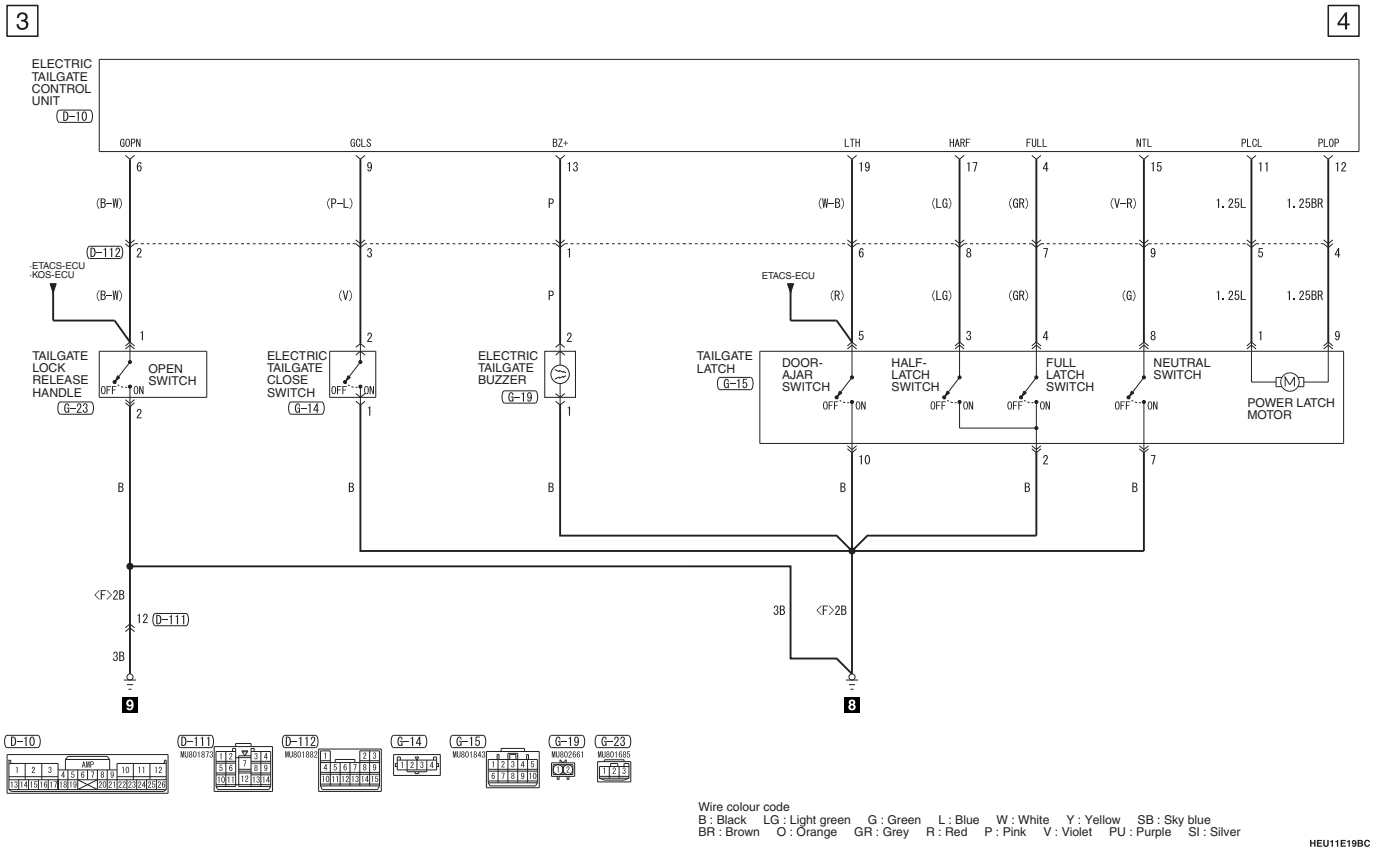
M1901023800210



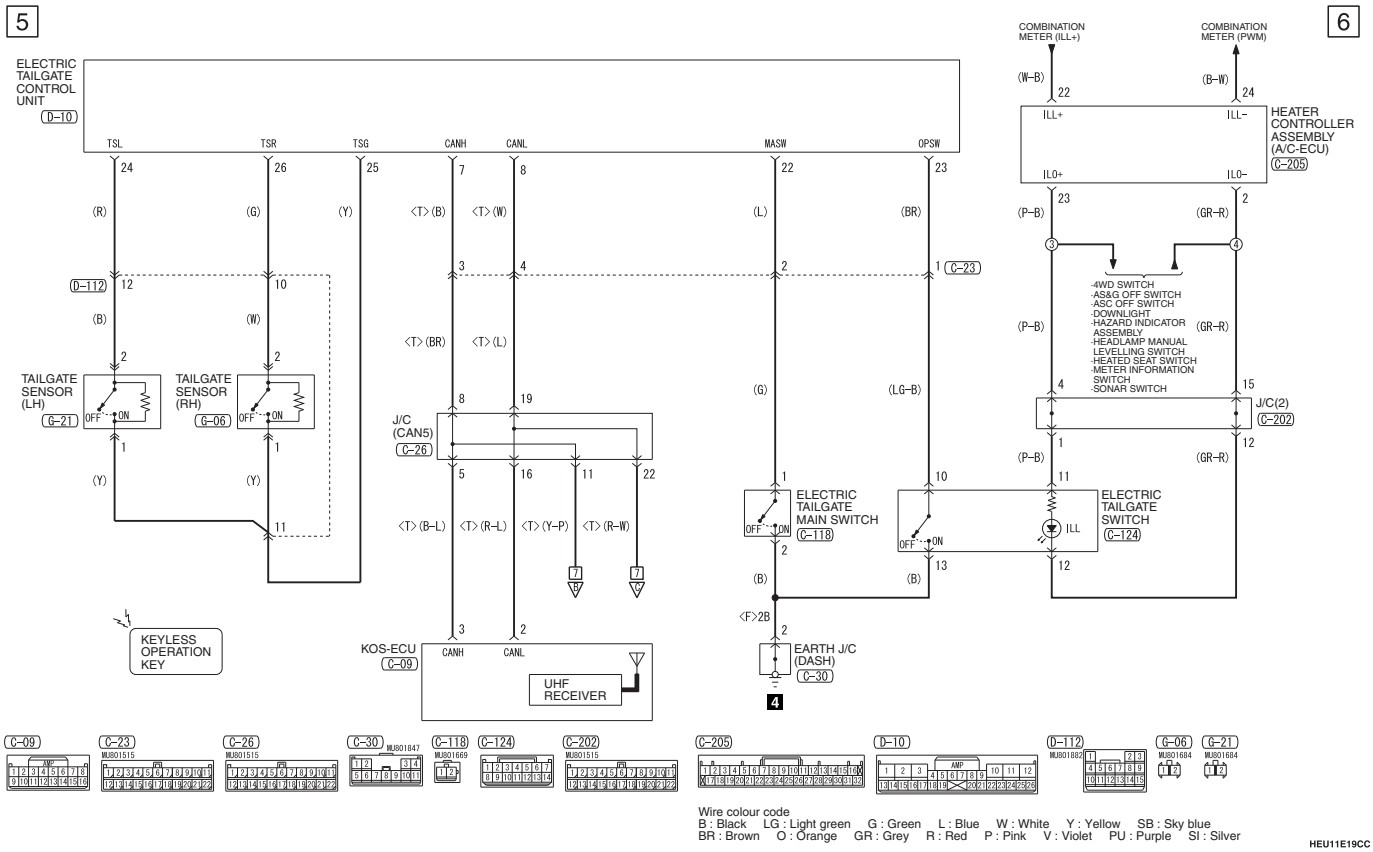
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU11E19AC

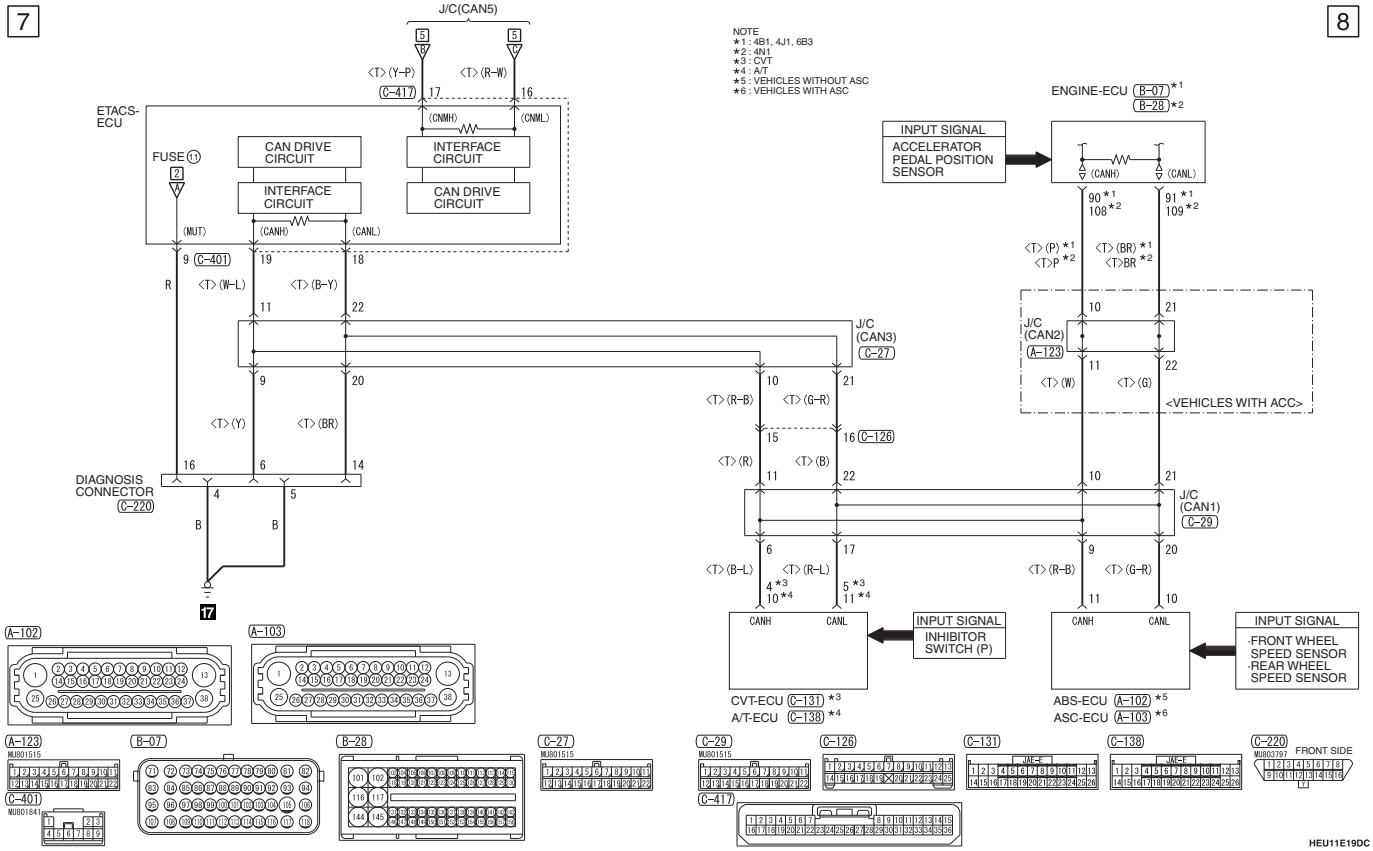
ELECTRIC TAILGATE <LHD> (CONTINUED)



ELECTRIC TAILGATE <LHD> (CONTINUED)

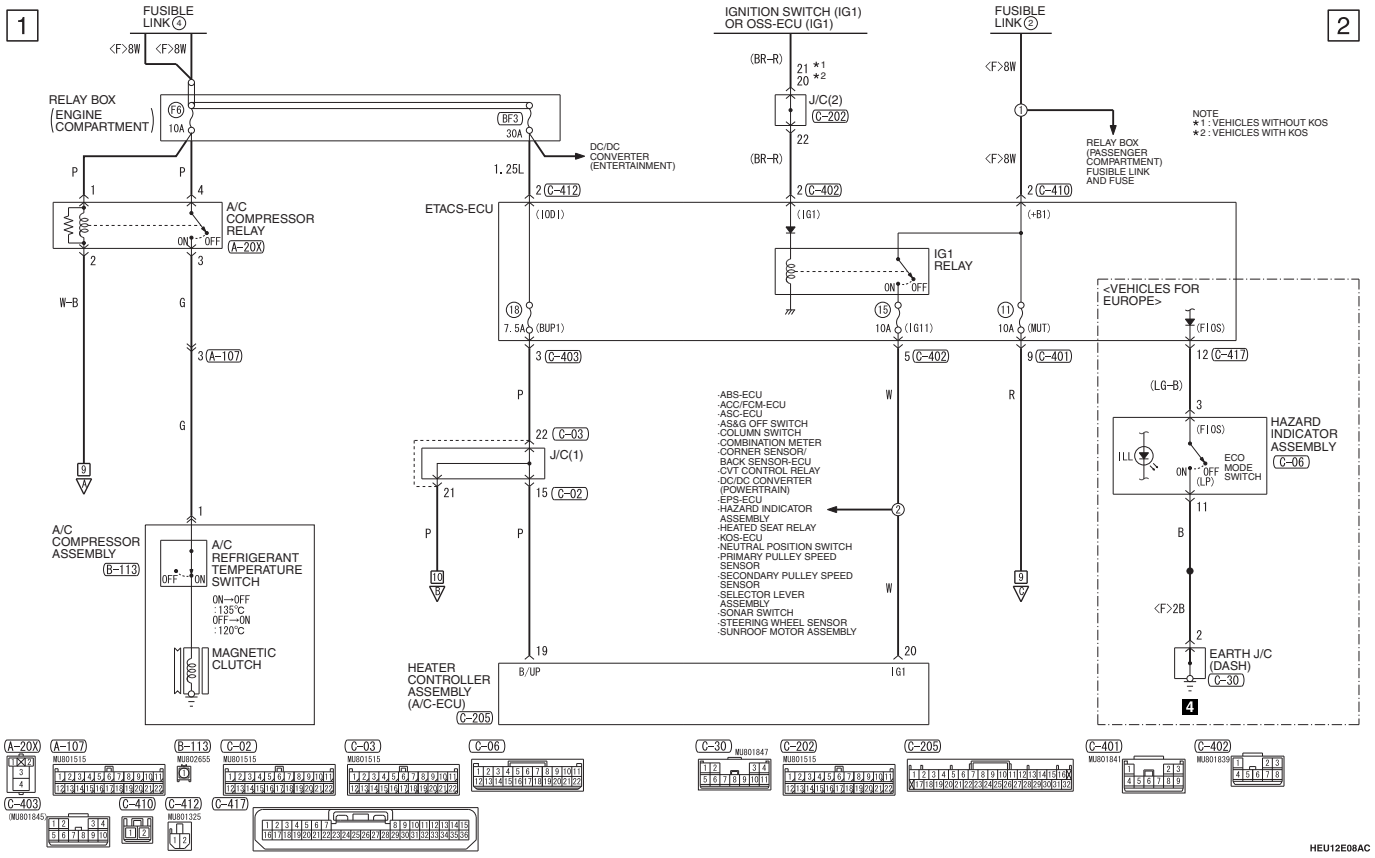


ELECTRIC TAILGATE <LHD> (CONTINUED)



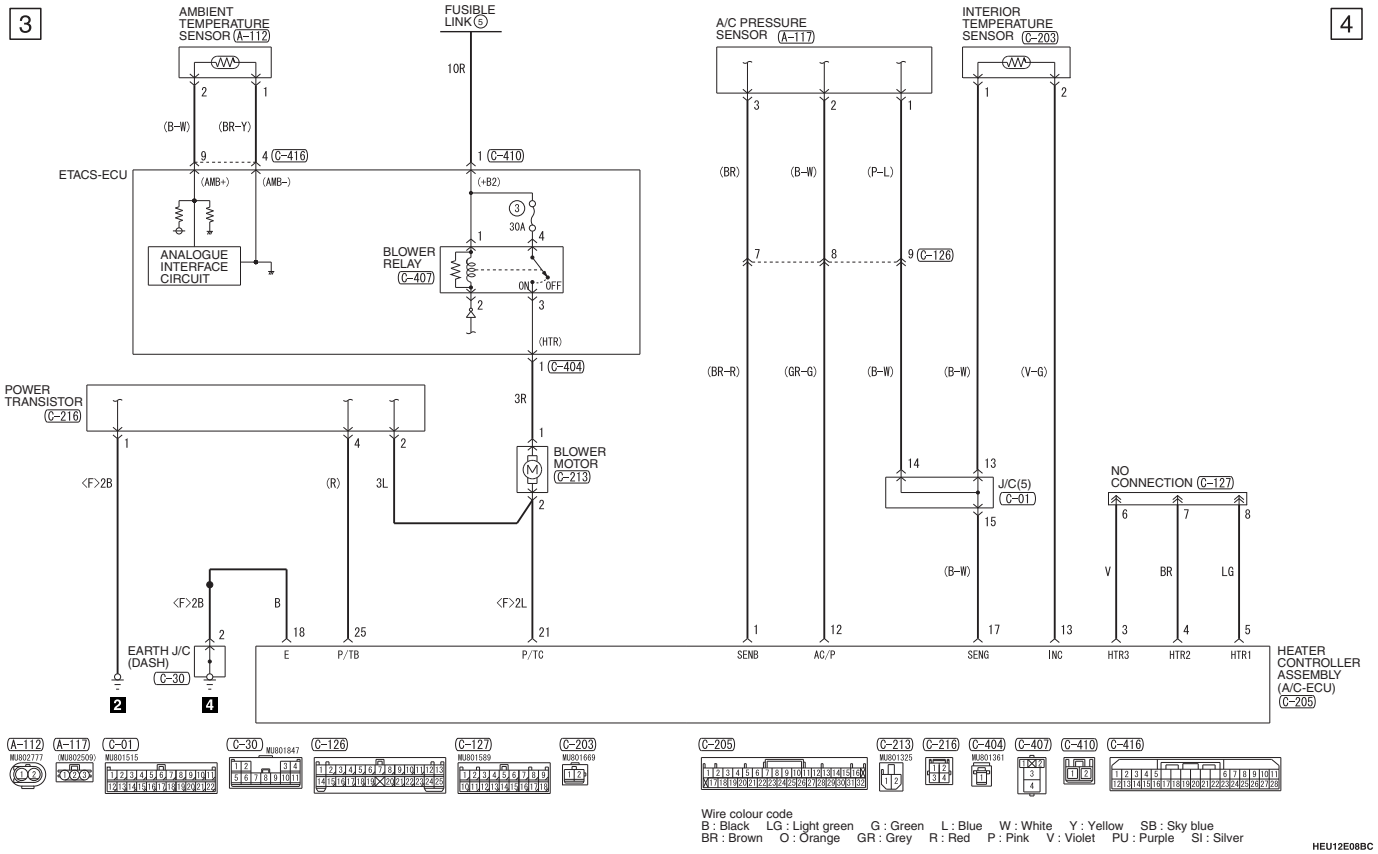
AIR CONDITIONER <4B1, 4J1, 6B3 (LHD)>

M1901032101892

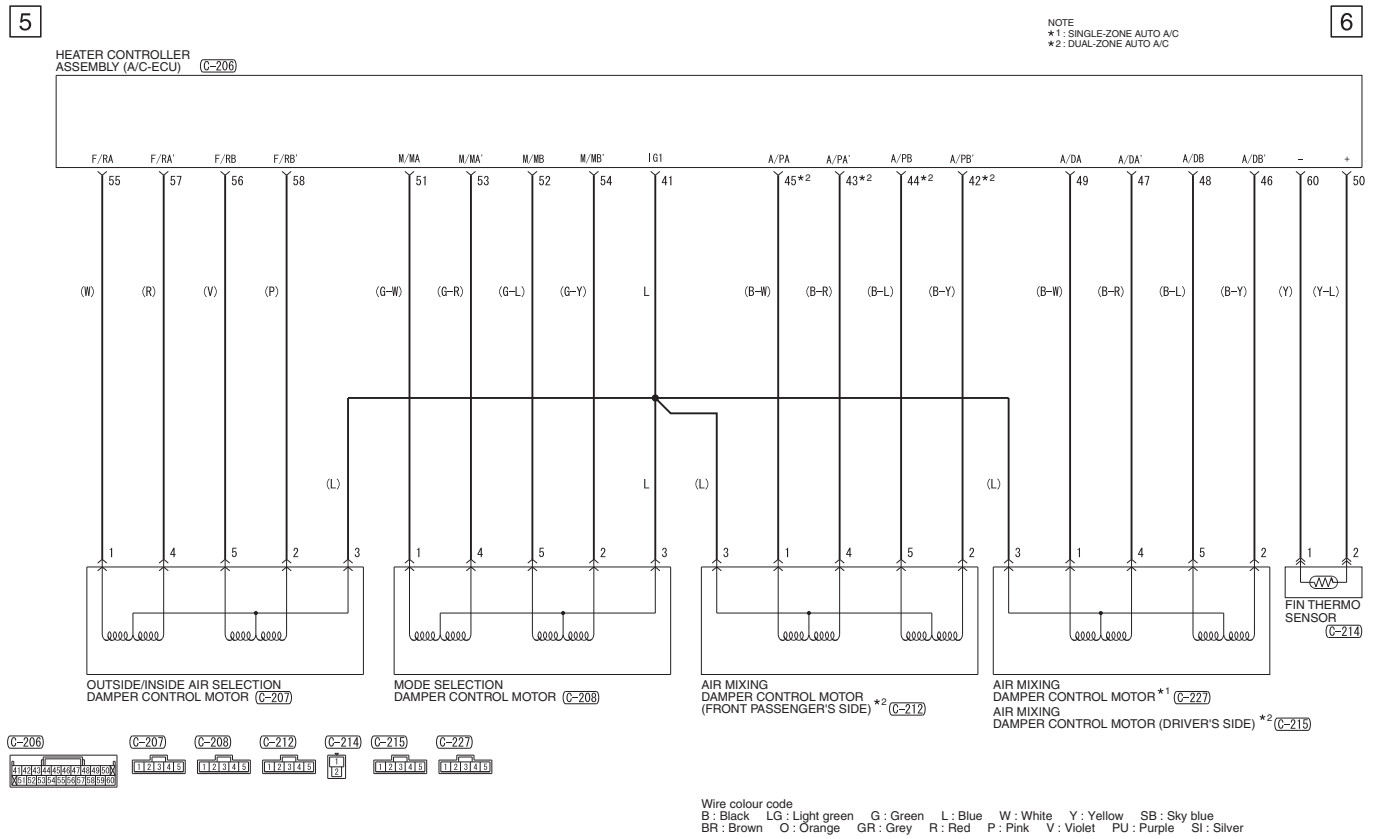


HEU12E08AC

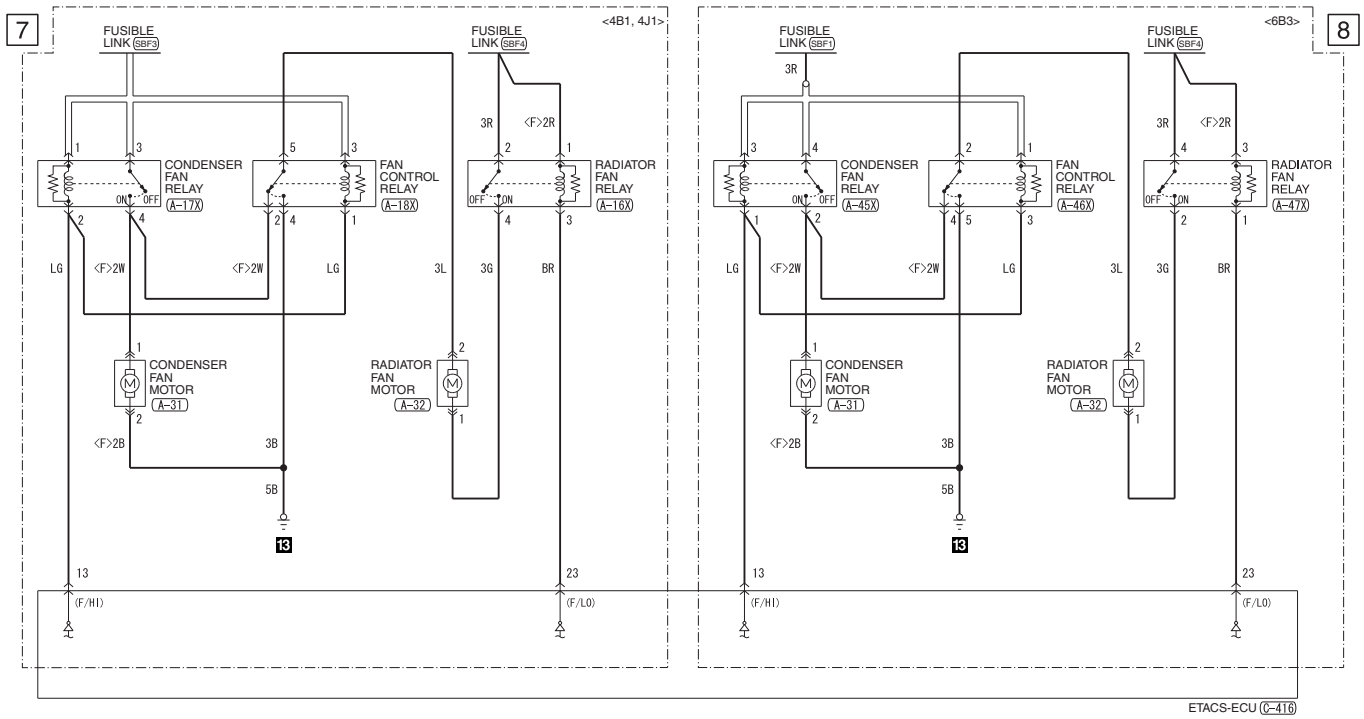
AIR CONDITIONER <4B1, 4J1, 6B3 (LHD)> (CONTINUED)

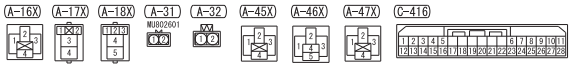


AIR CONDITIONER <4B1, 4J1, 6B3 (LHD)> (CONTINUED)



AIR CONDITIONER <4B1, 4J1, 6B3 (LHD)> (CONTINUED)

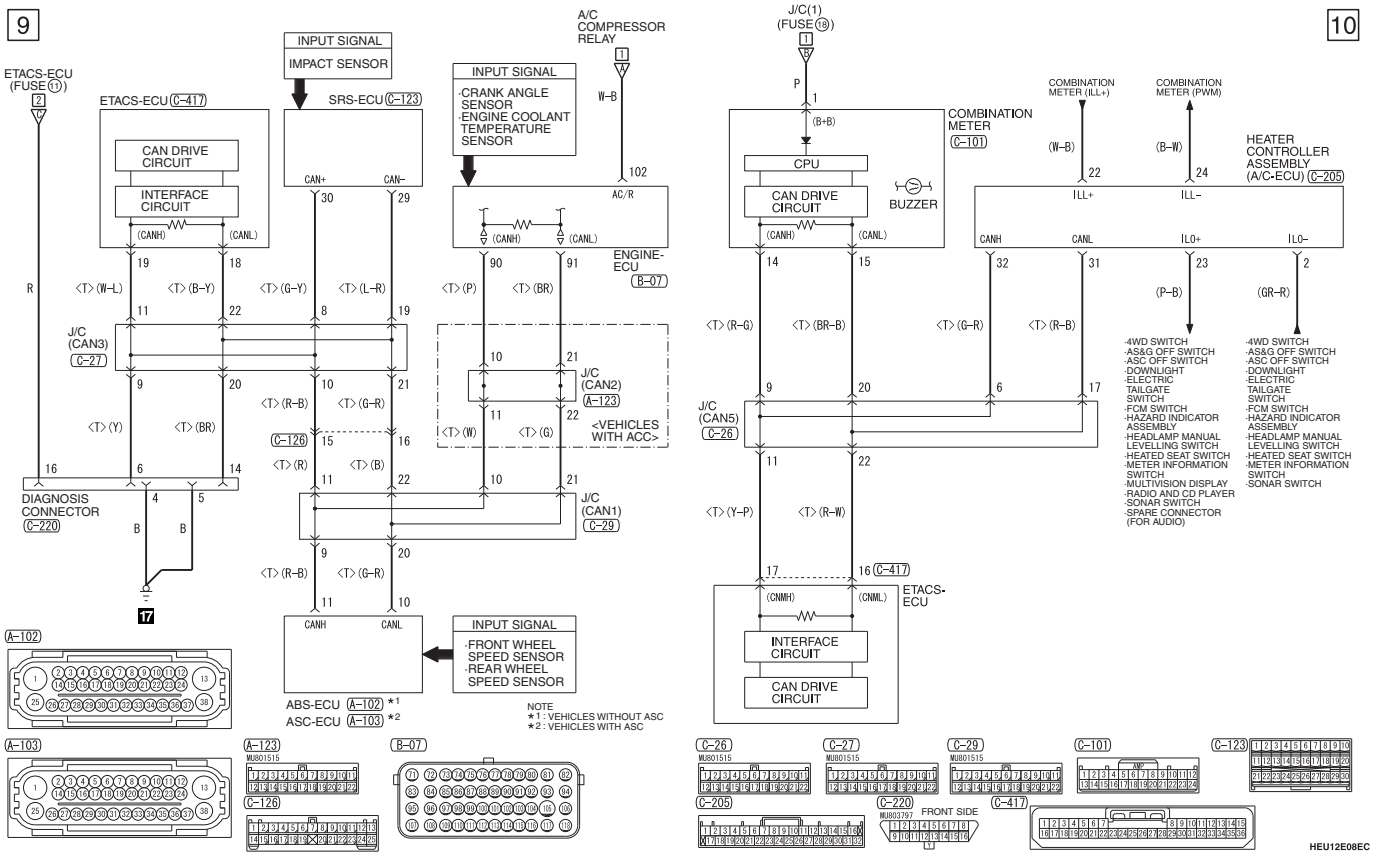




Wire colour code
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BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU12E08DC

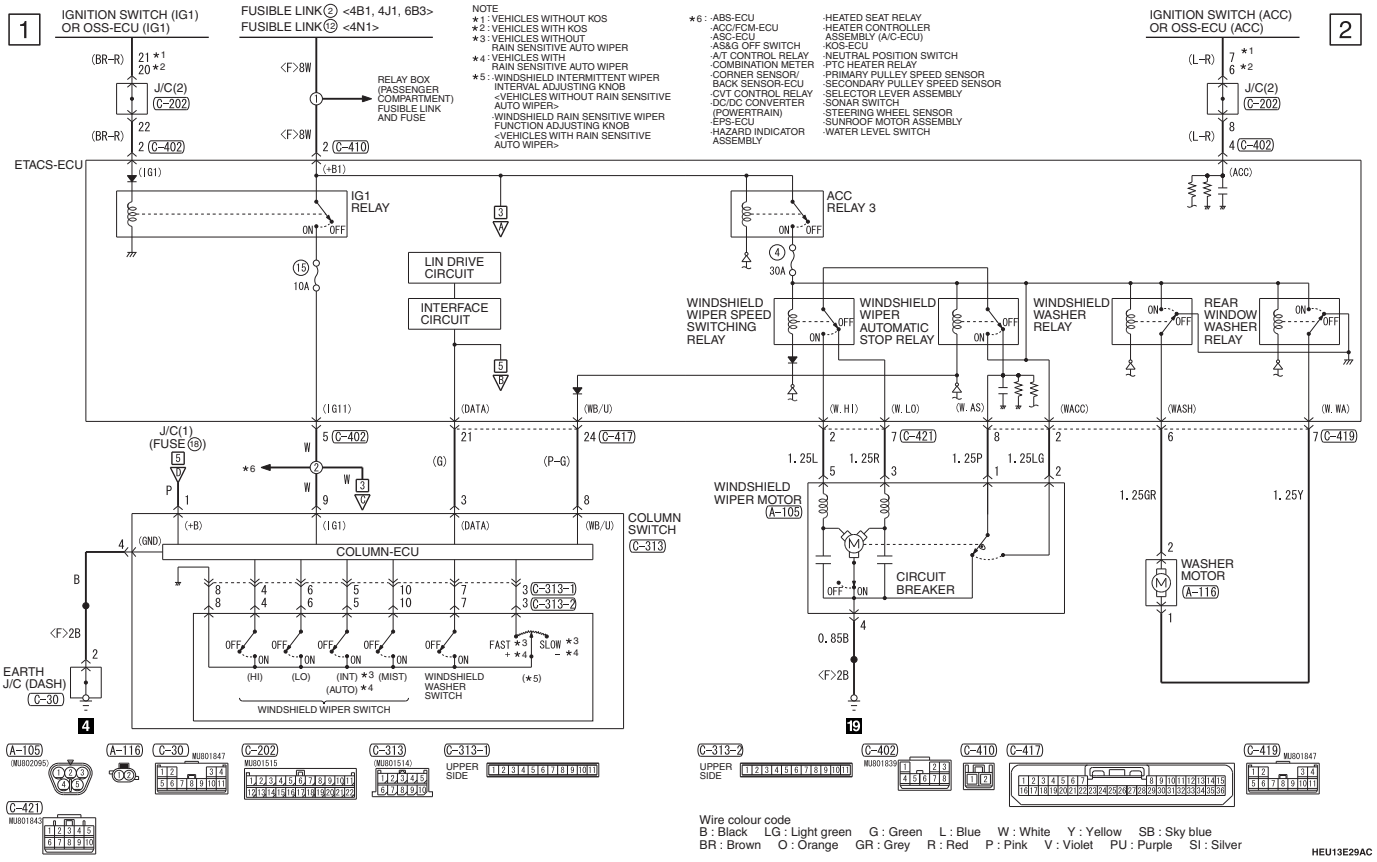
AIR CONDITIONER <4B1, 4J1, 6B3 (LHD)> (CONTINUED)



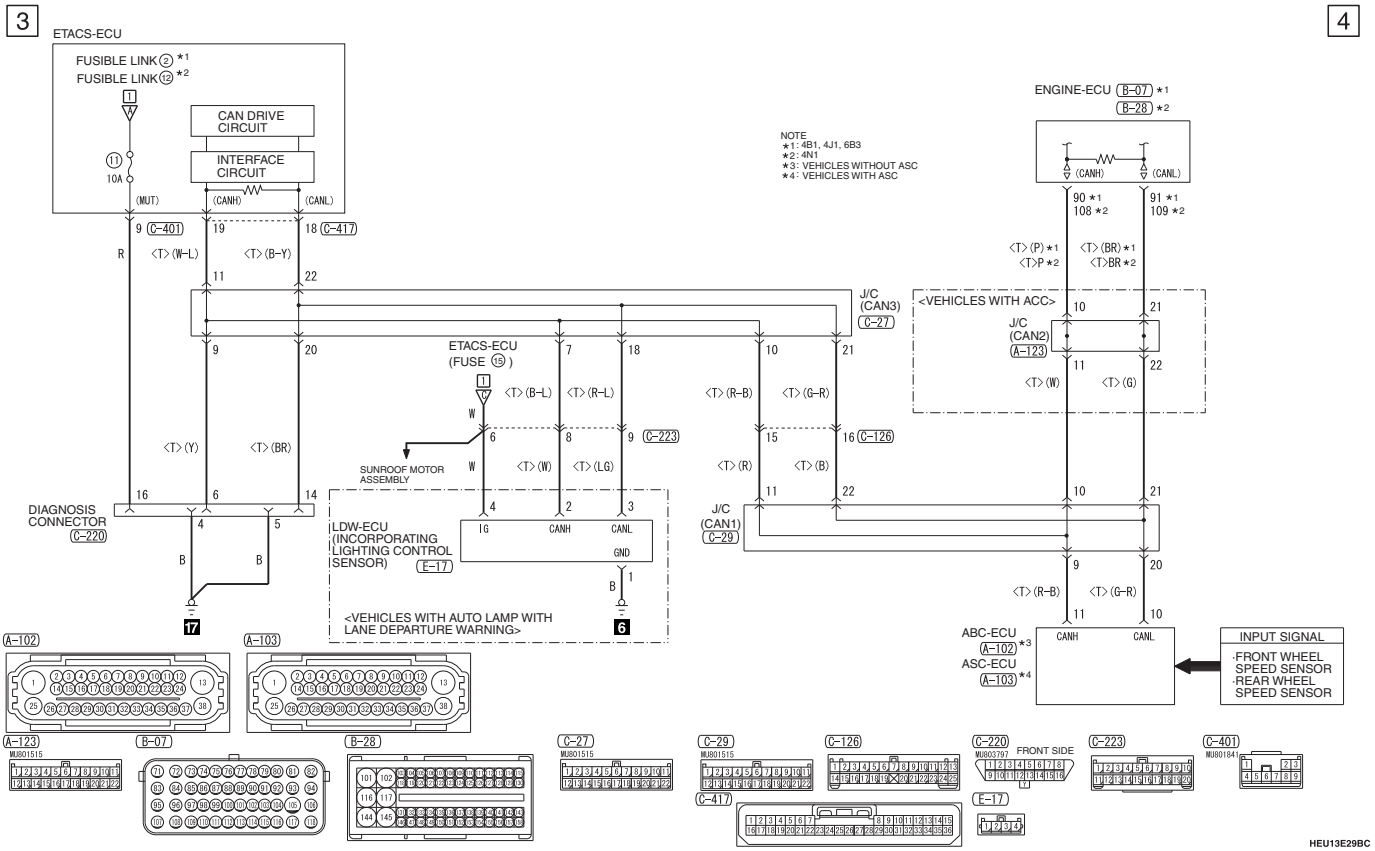
HEU12E08EC

WINDSHIELD WIPER AND WASHER <LHD>

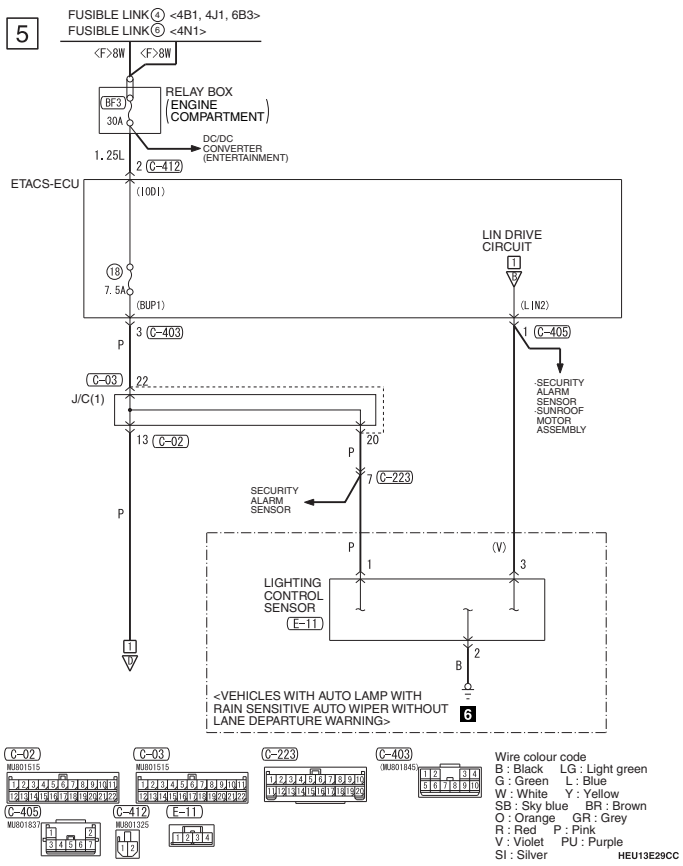
M1901006106432



WINDSHIELD WIPER AND WASHER <LHD> (CONTINUED)

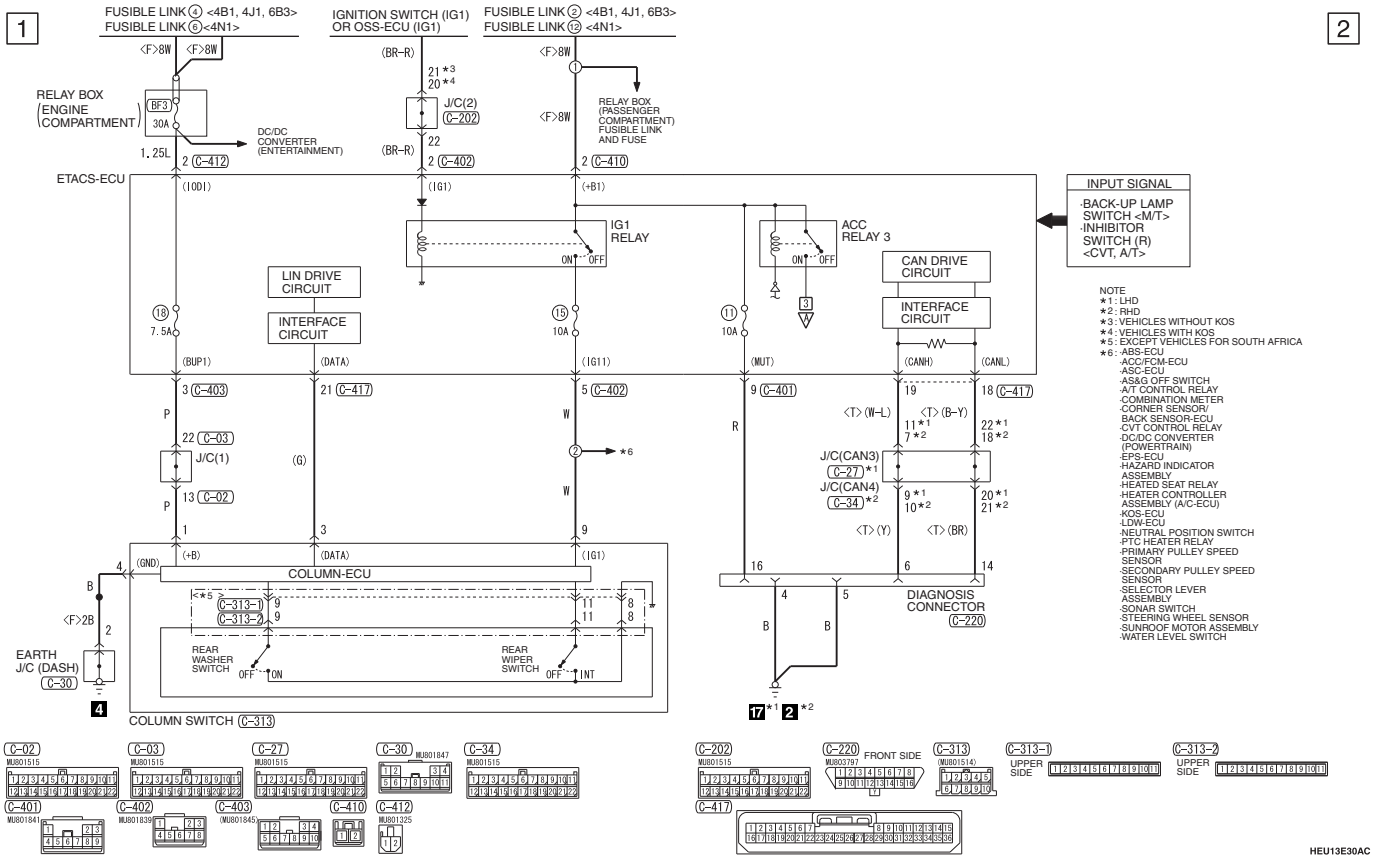


WINDSHIELD WIPER AND WASHER <LHD> (CONTINUED)

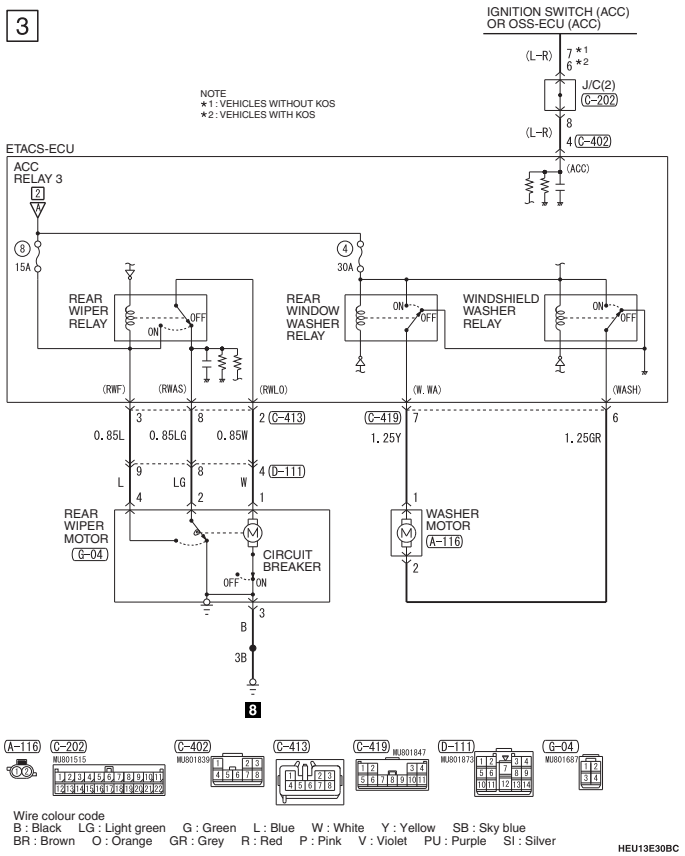


REAR WIPER AND WASHER

M1901006204455



REAR WIPER AND WASHER (CONTINUED)

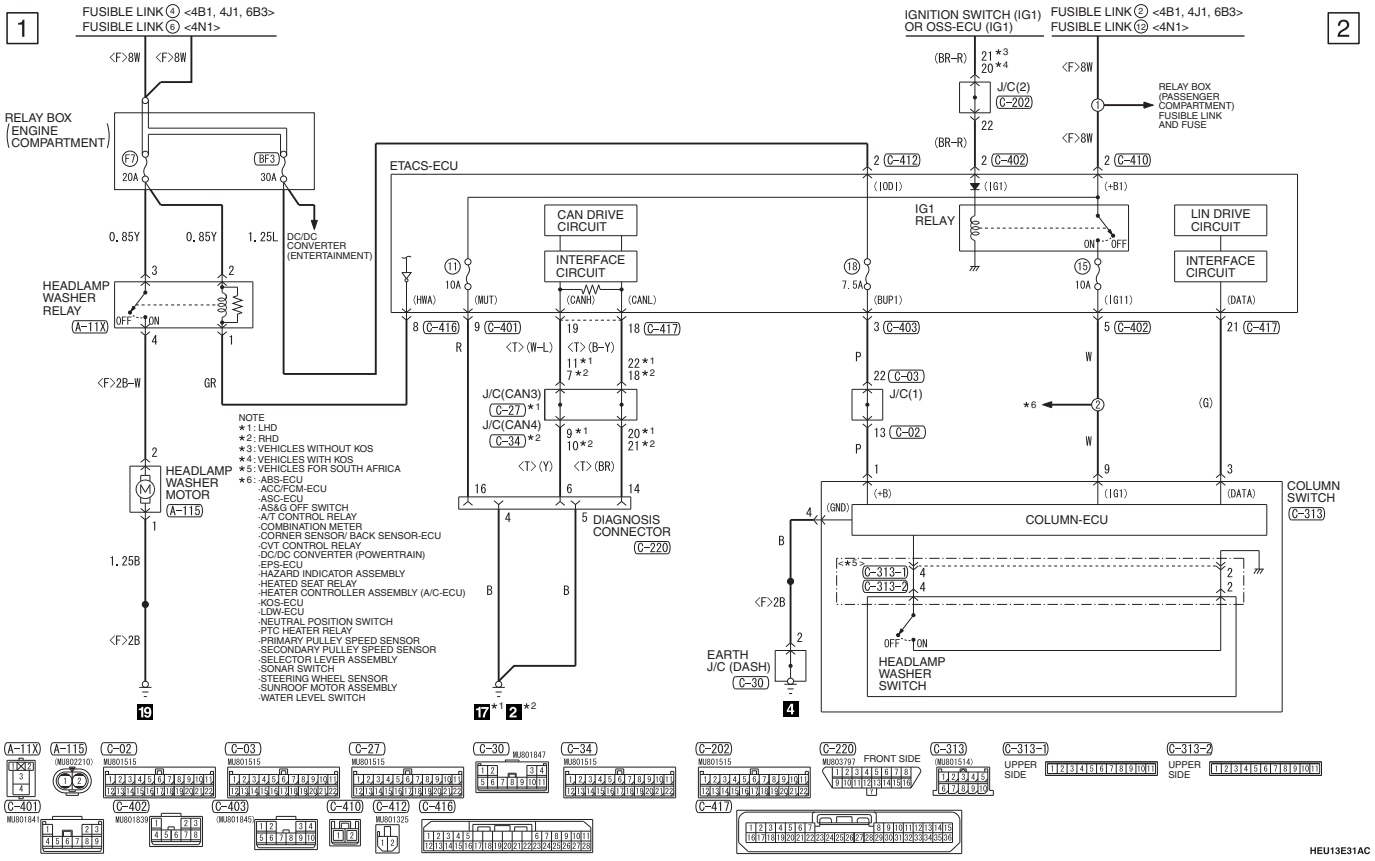


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU13E30BC

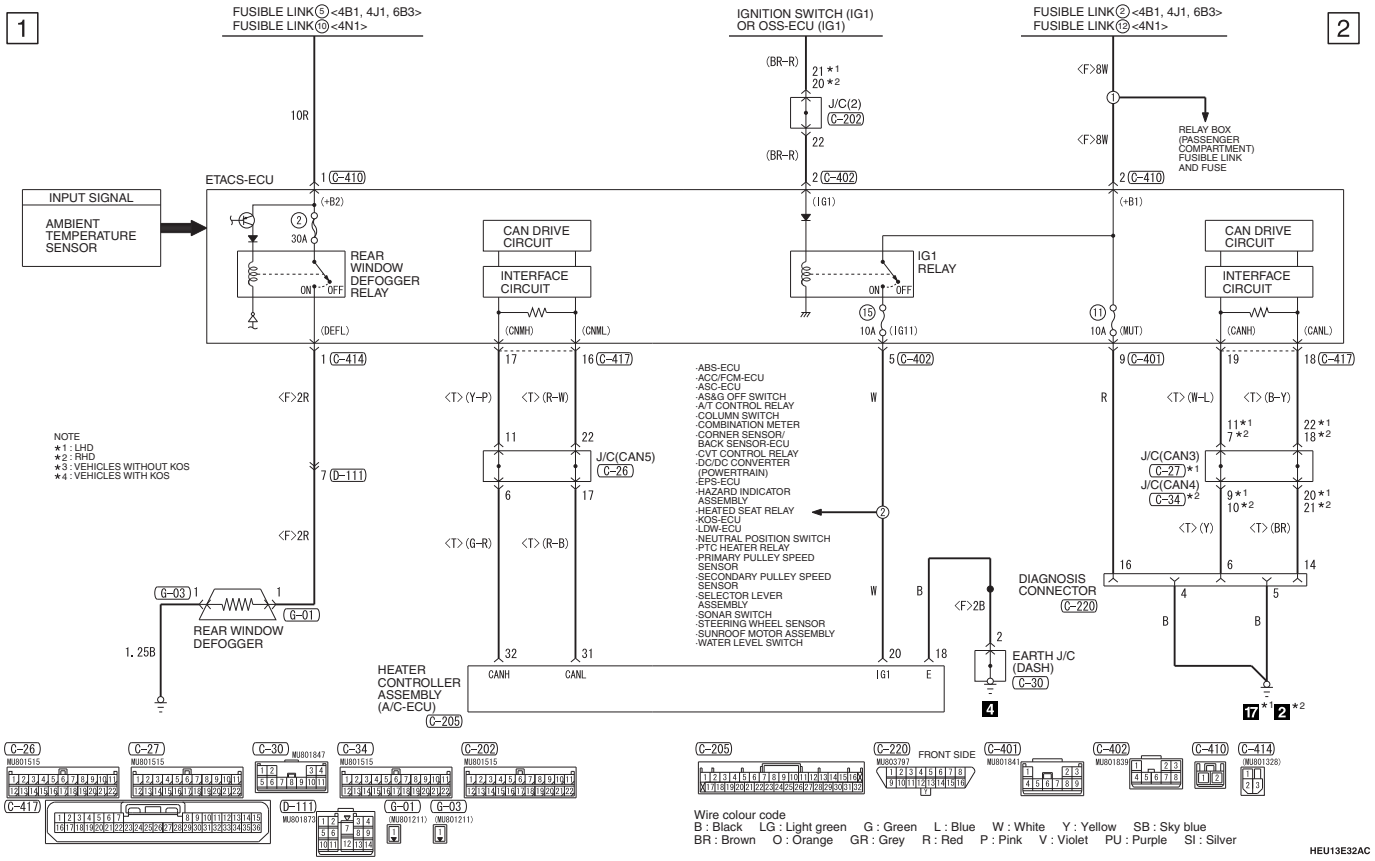
HEADLAMP WASHER

M1901018900998



REAR WINDOW DEFOGGER

M1901006403757

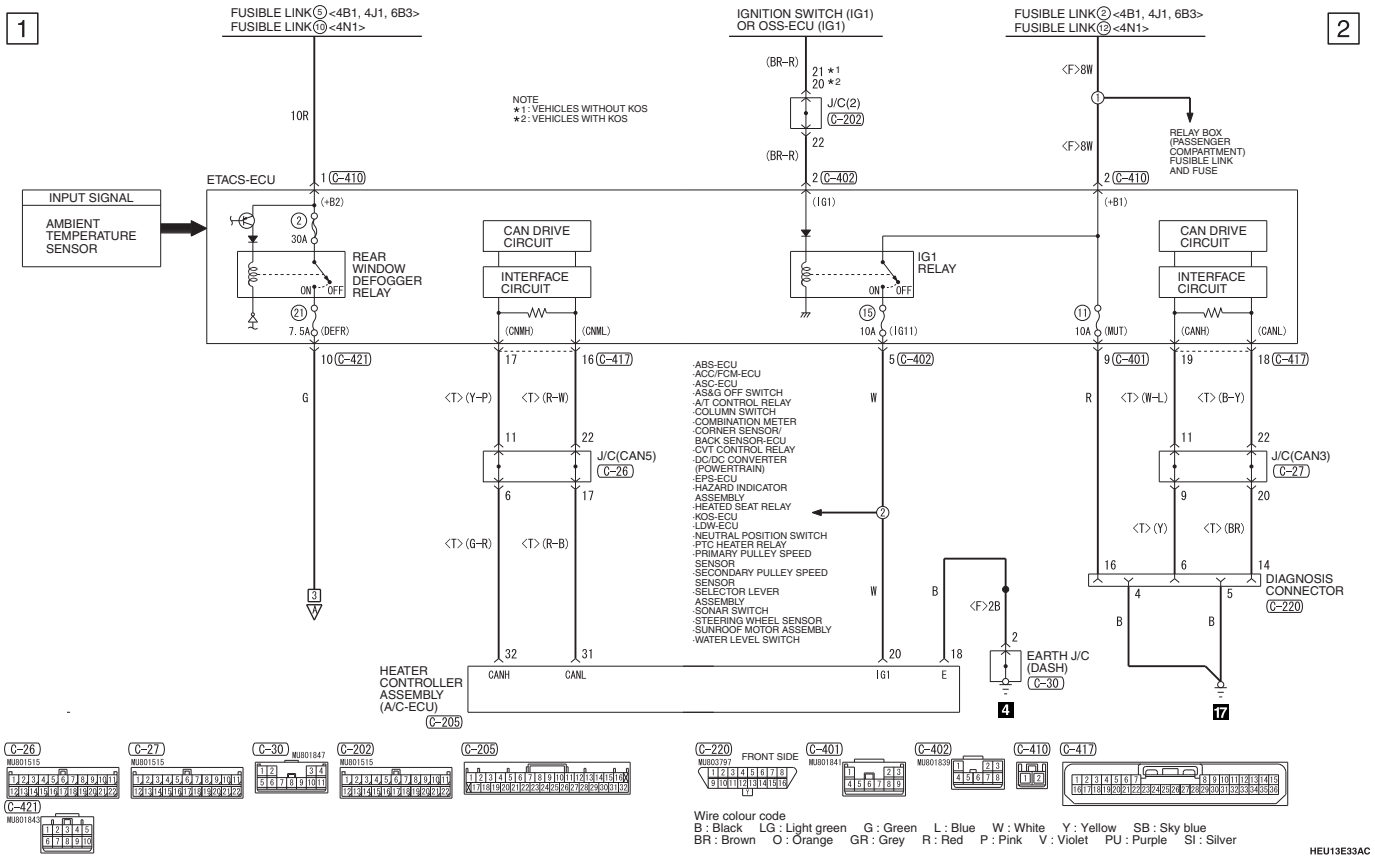


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU13E32AC

WIPER DEICER

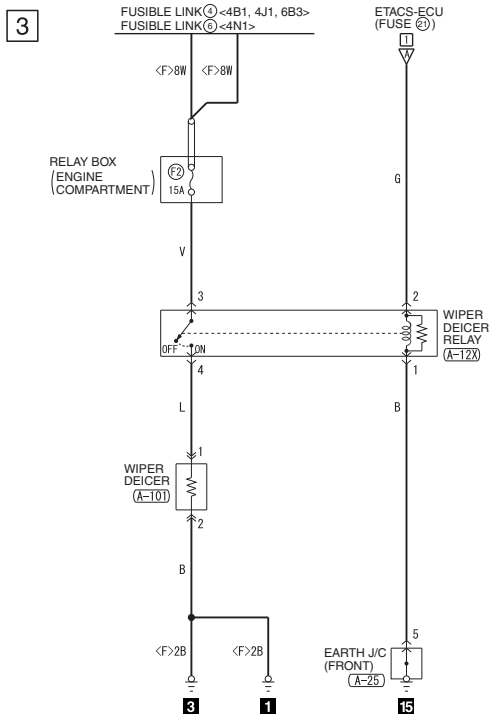
M1901006900407



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU13E33AC

WIPER DEICER (CONTINUED)

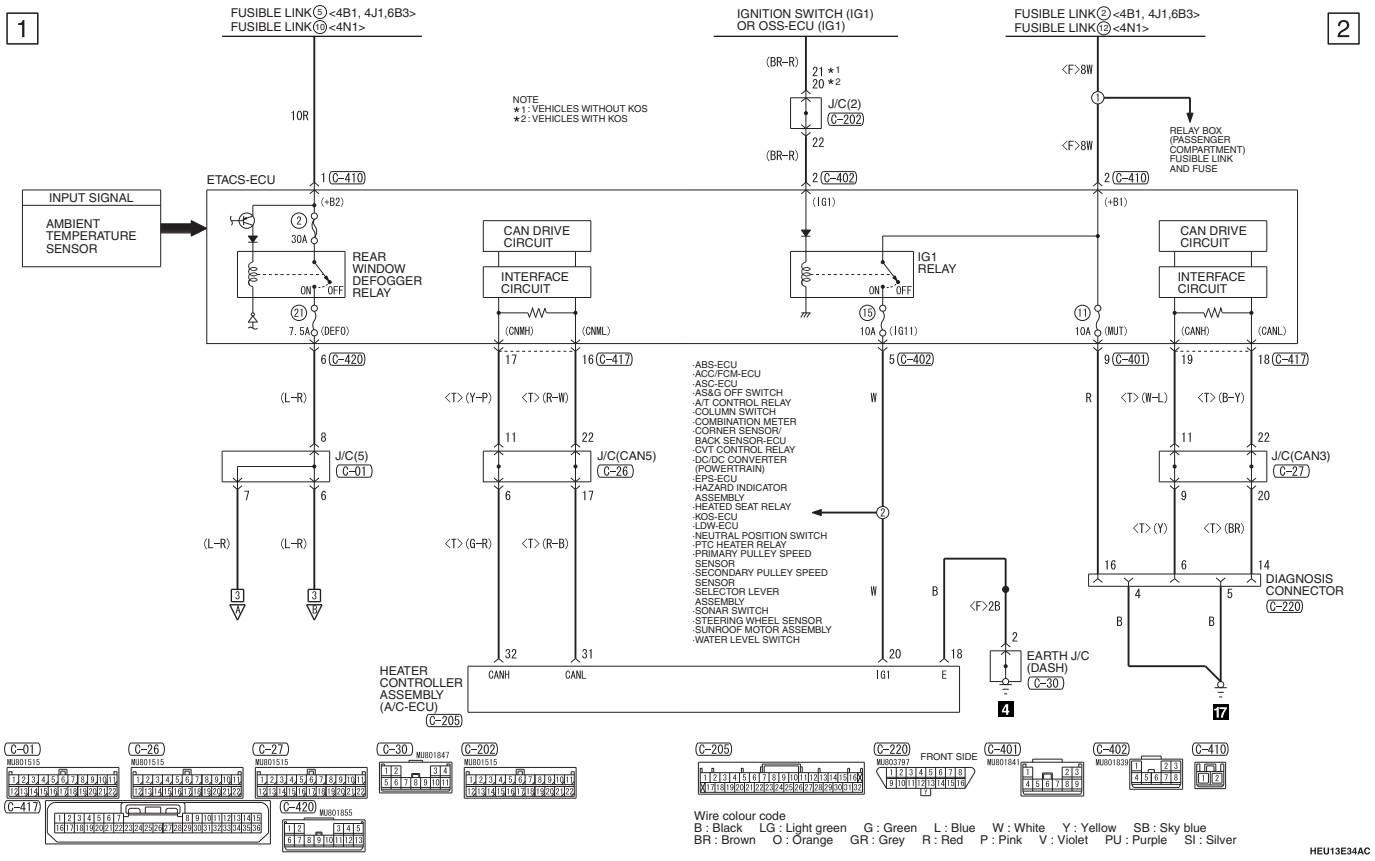


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU13E33BC

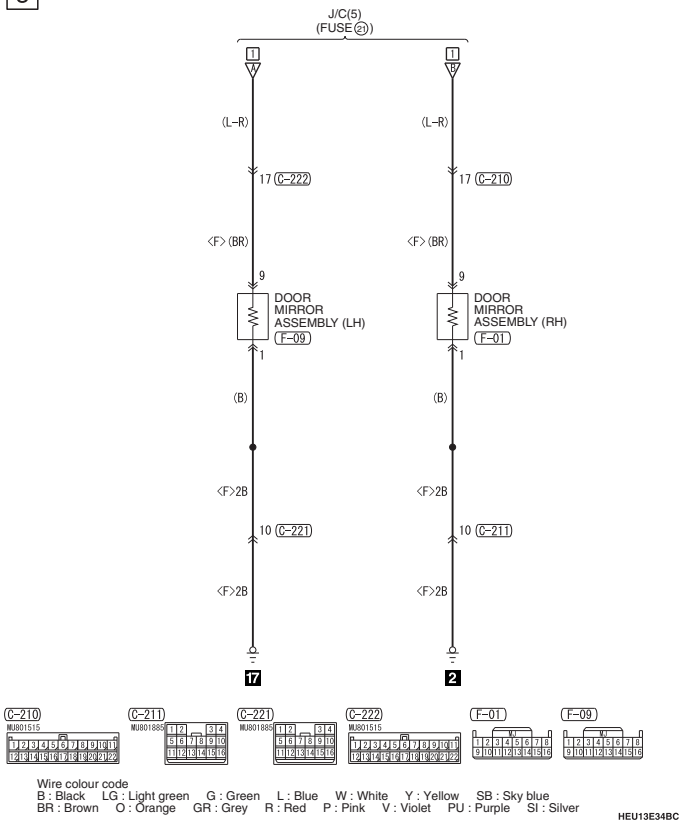
HEATED DOOR MIRROR <LHD>

M1901021401413



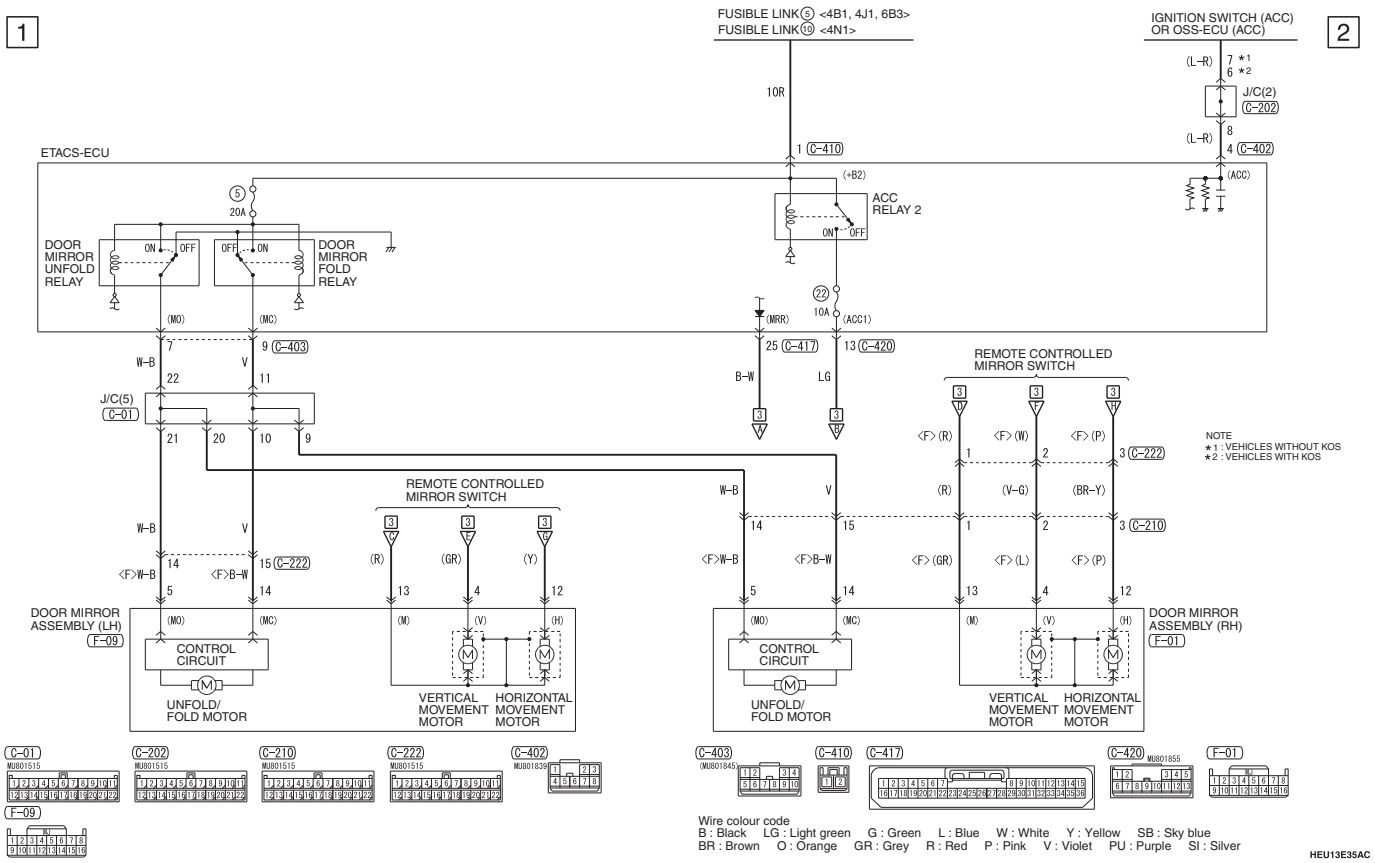
HEATED DOOR MIRROR <LHD> (CONTINUED)

3



ELECTRIC RETRACTABLE REMOTE CONTROLLED MIRROR <LHD>

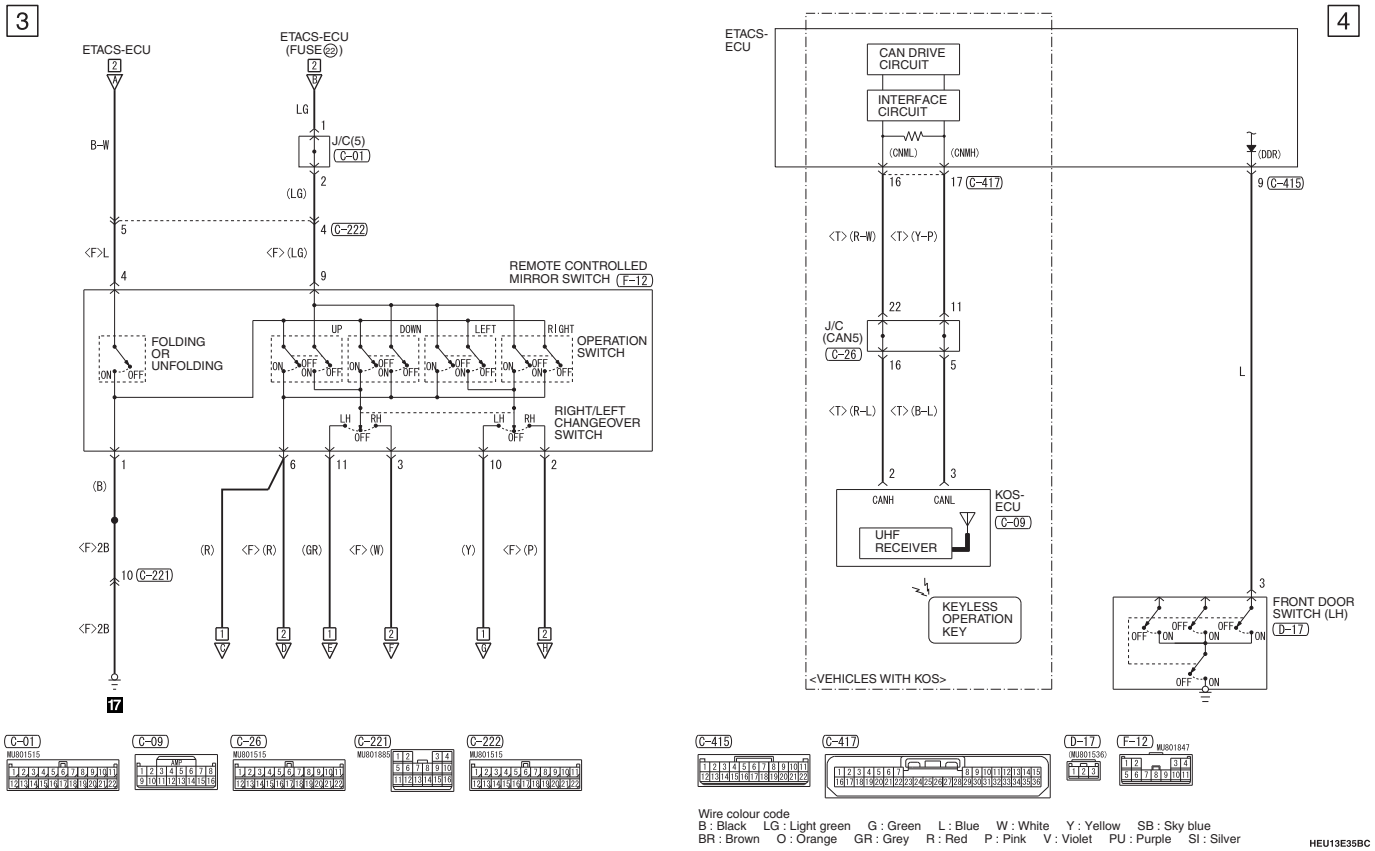
M1901006602190



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU13E35AC

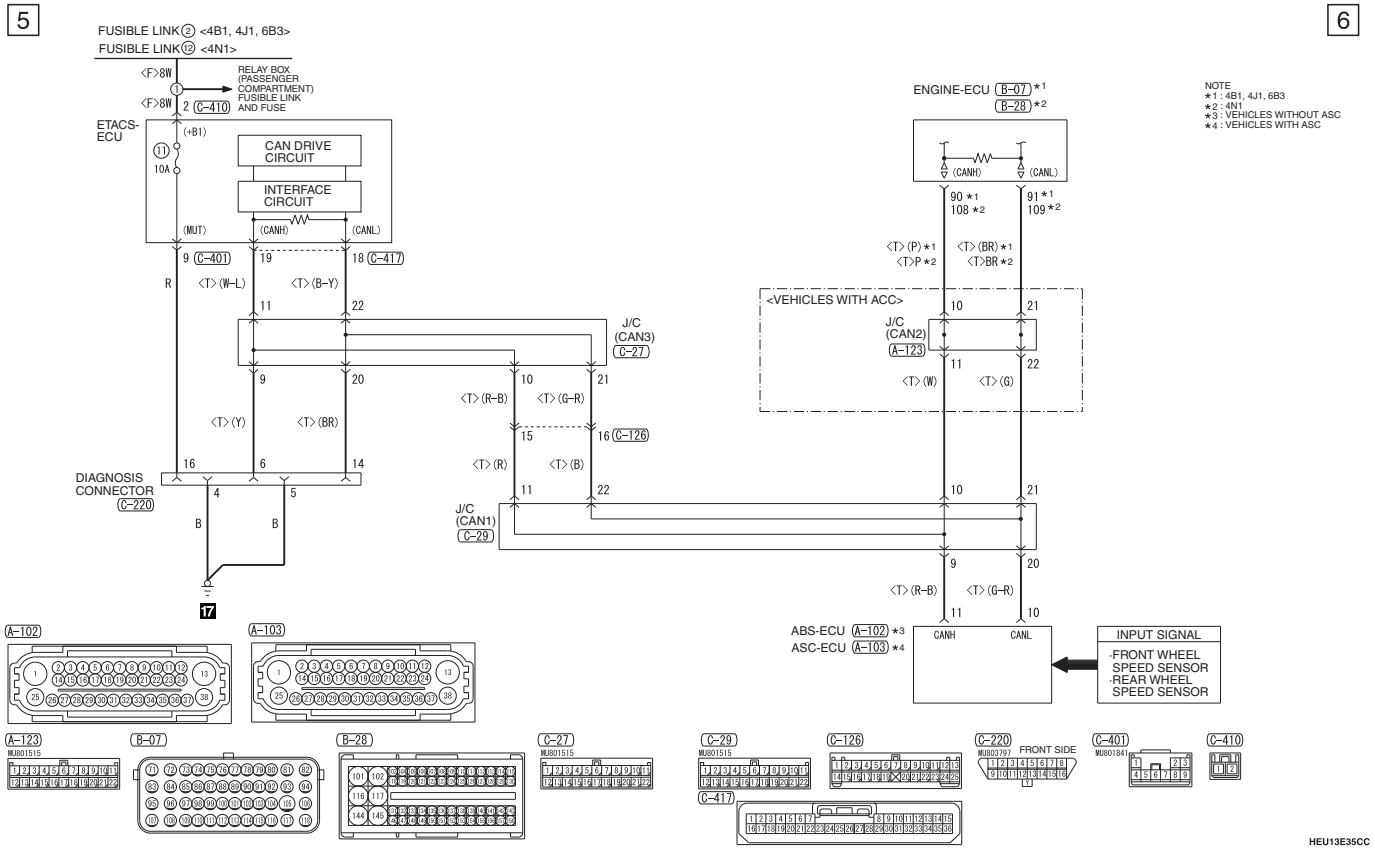
ELECTRIC RETRACTABLE REMOTE CONTROLLED MIRROR <LHD> (CONTINUED)



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

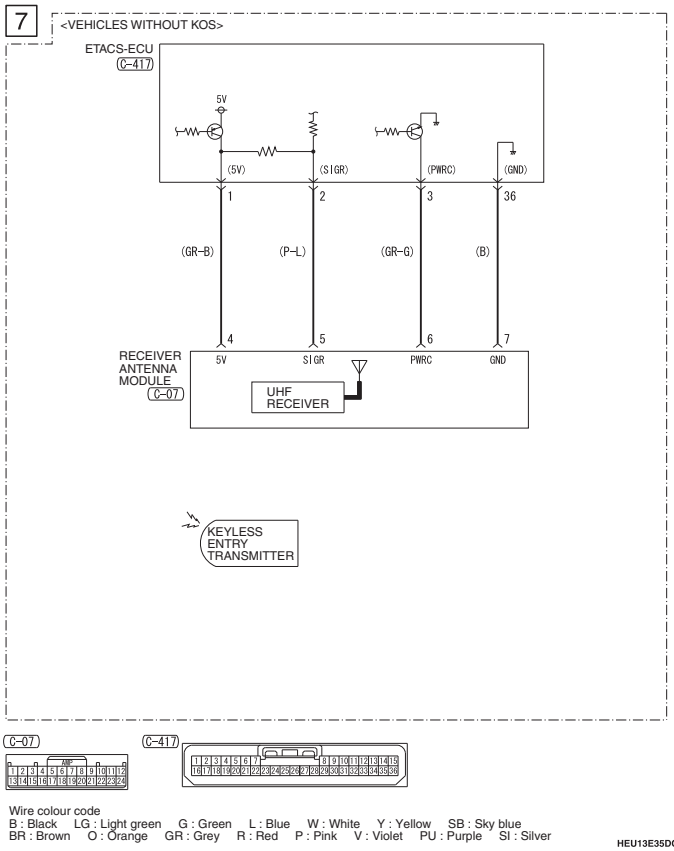
HEU13E35BC

ELECTRIC RETRACTABLE REMOTE CONTROLLED MIRROR <LHD> (CONTINUED)



HEU13E35CC

ELECTRIC RETRACTABLE REMOTE CONTROLLED MIRROR <LHD> (CONTINUED)

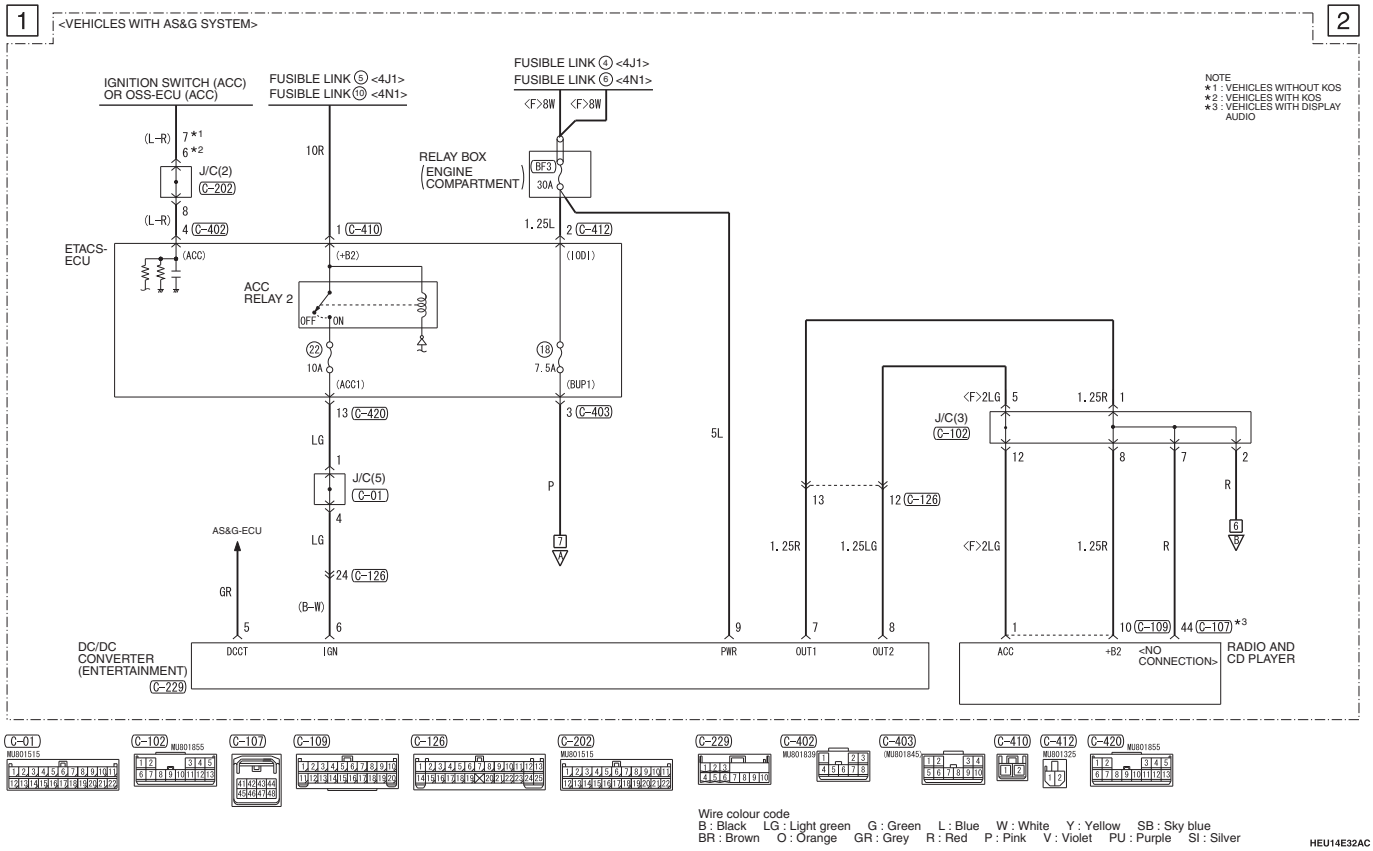


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU13E35DC

AUDIO SYSTEM <LHD>

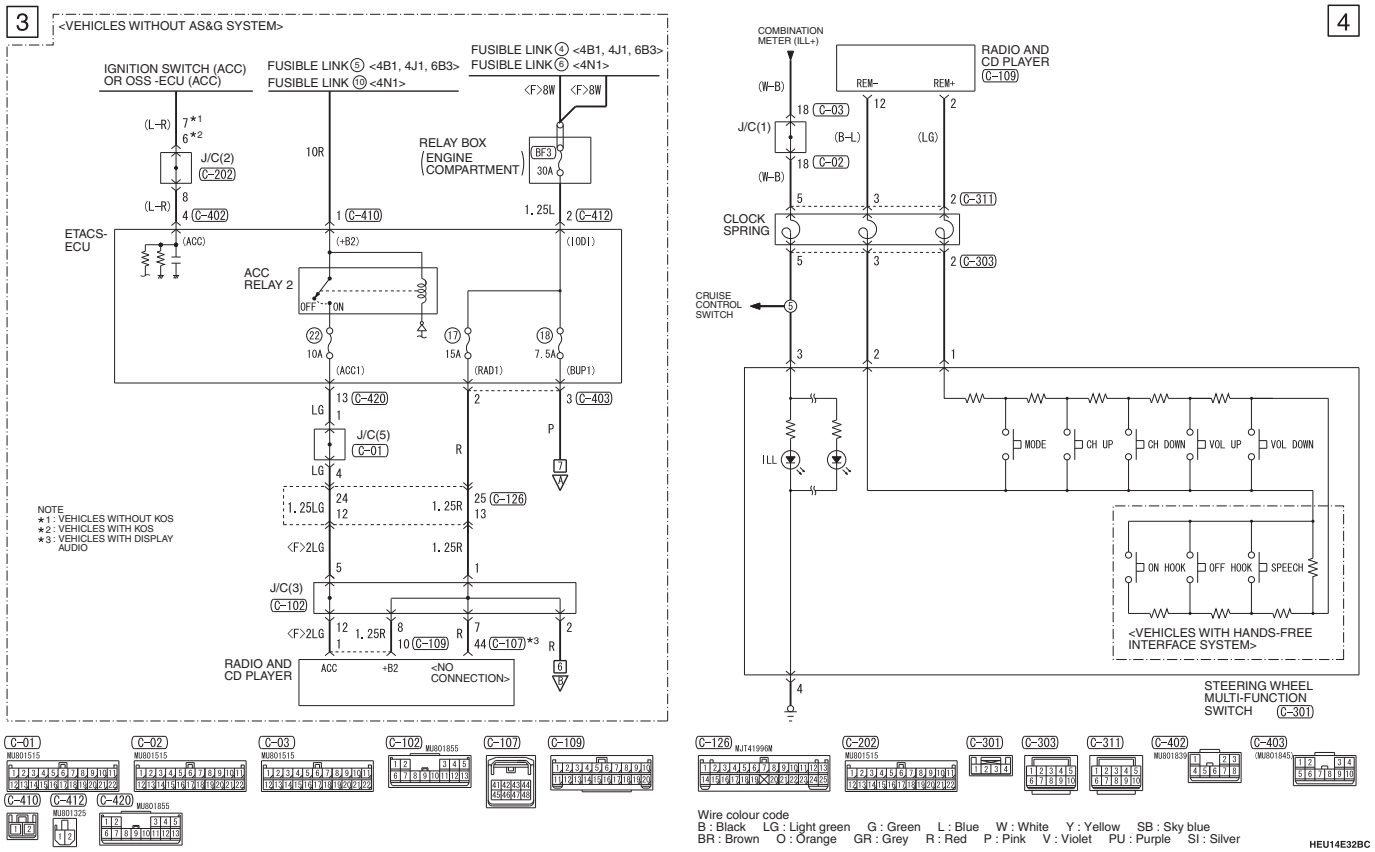
M1901015607740



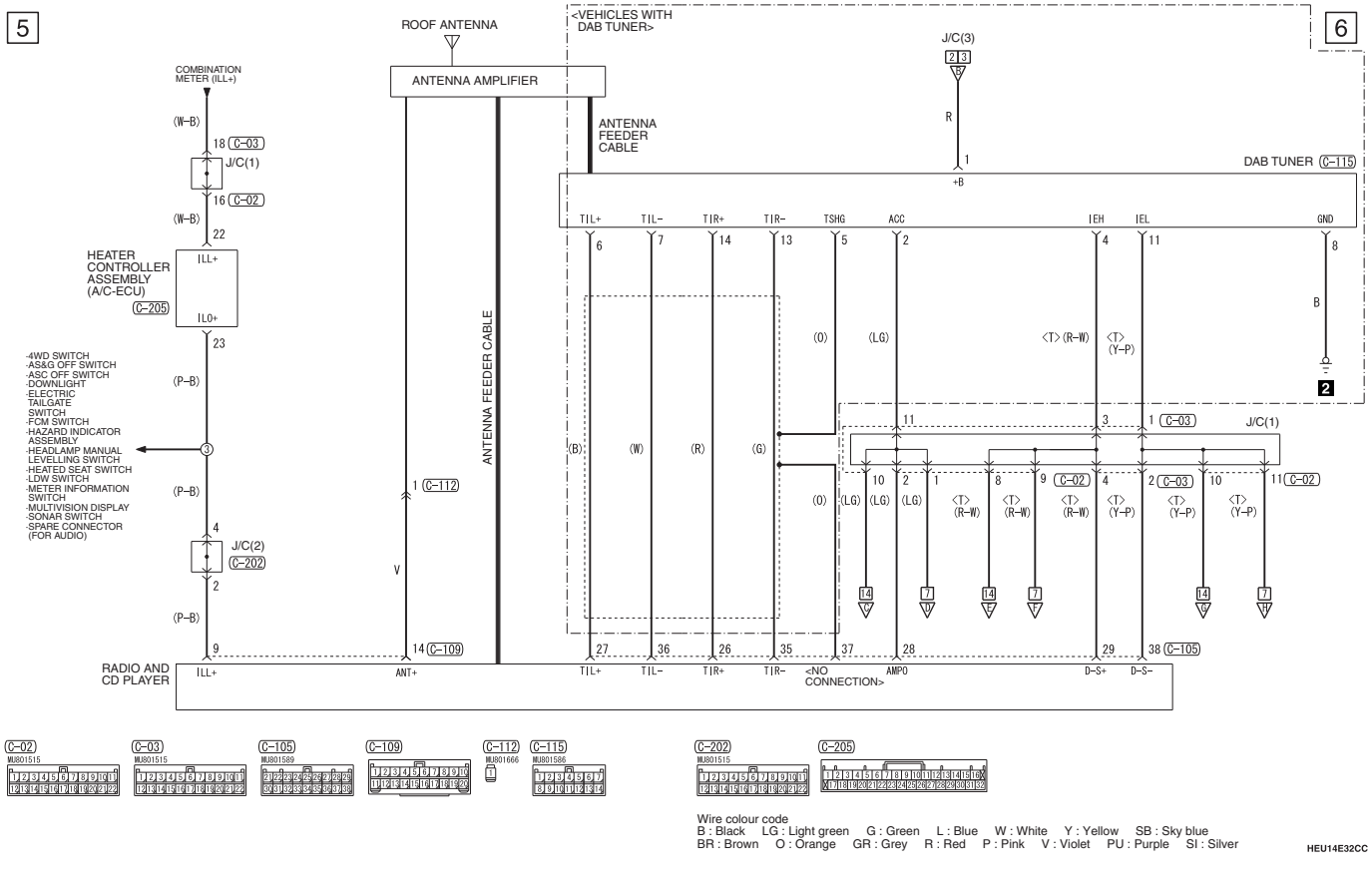
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU14E32AC

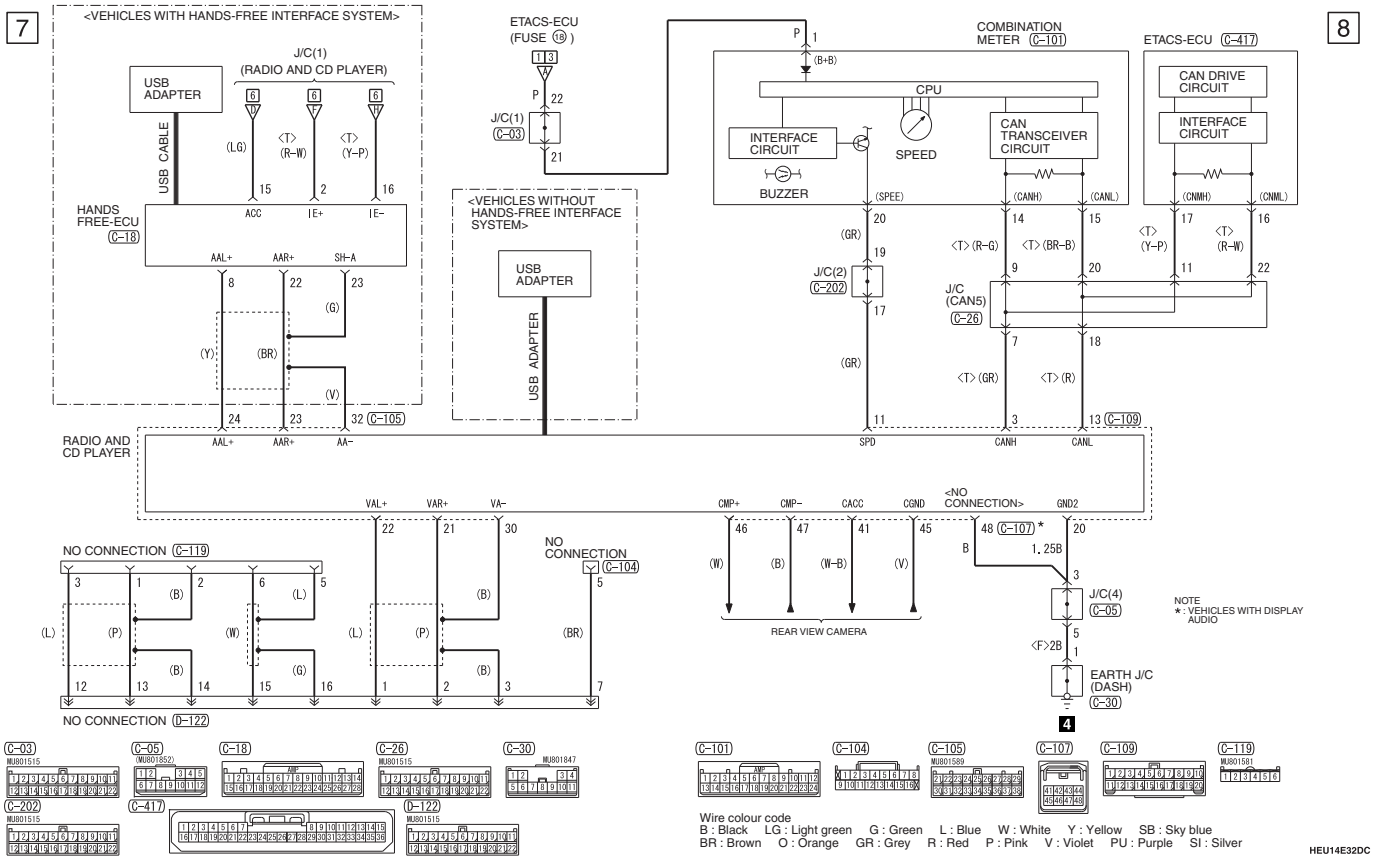
AUDIO SYSTEM <LHD> (CONTINUED)



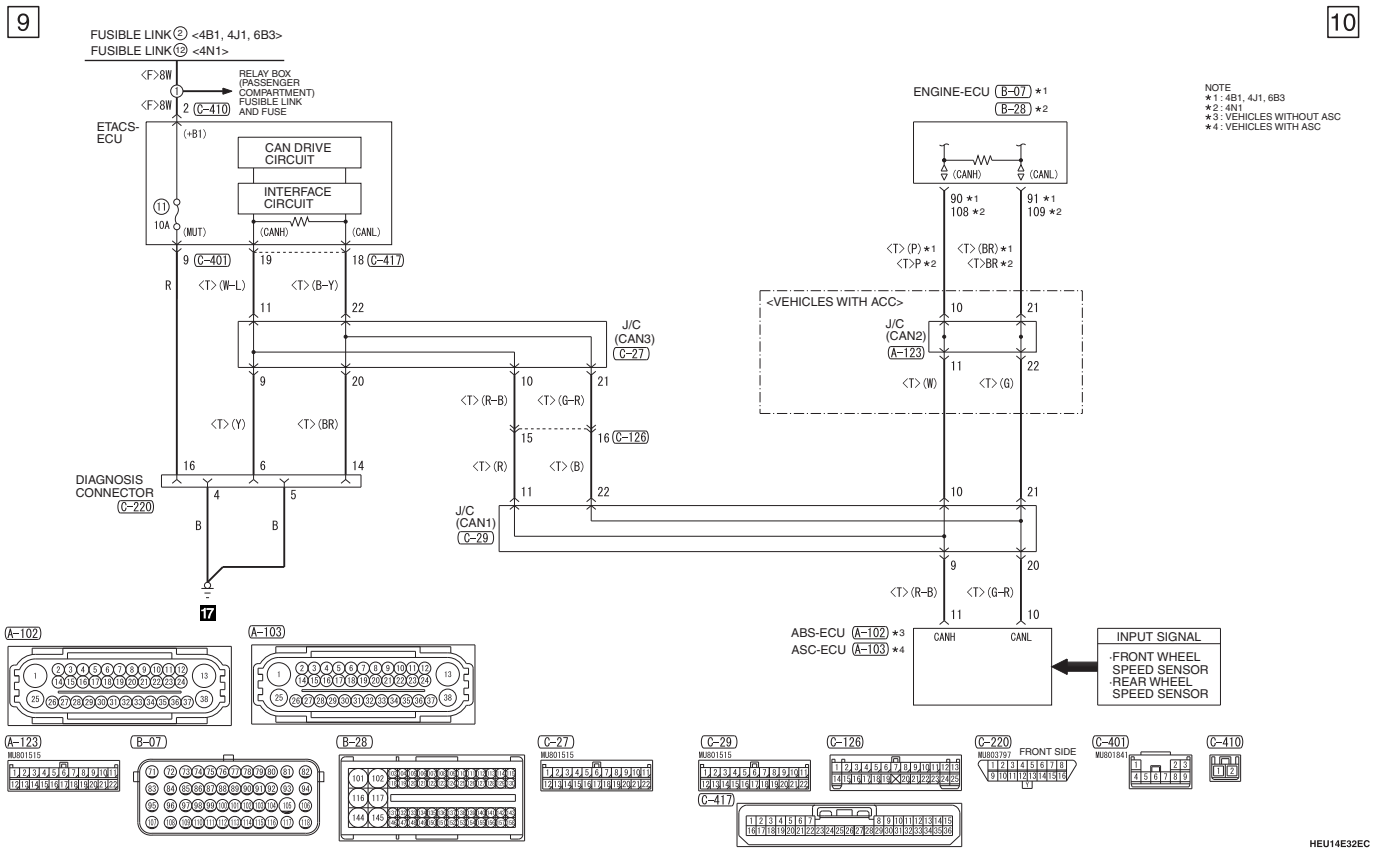
AUDIO SYSTEM <LHD> (CONTINUED)



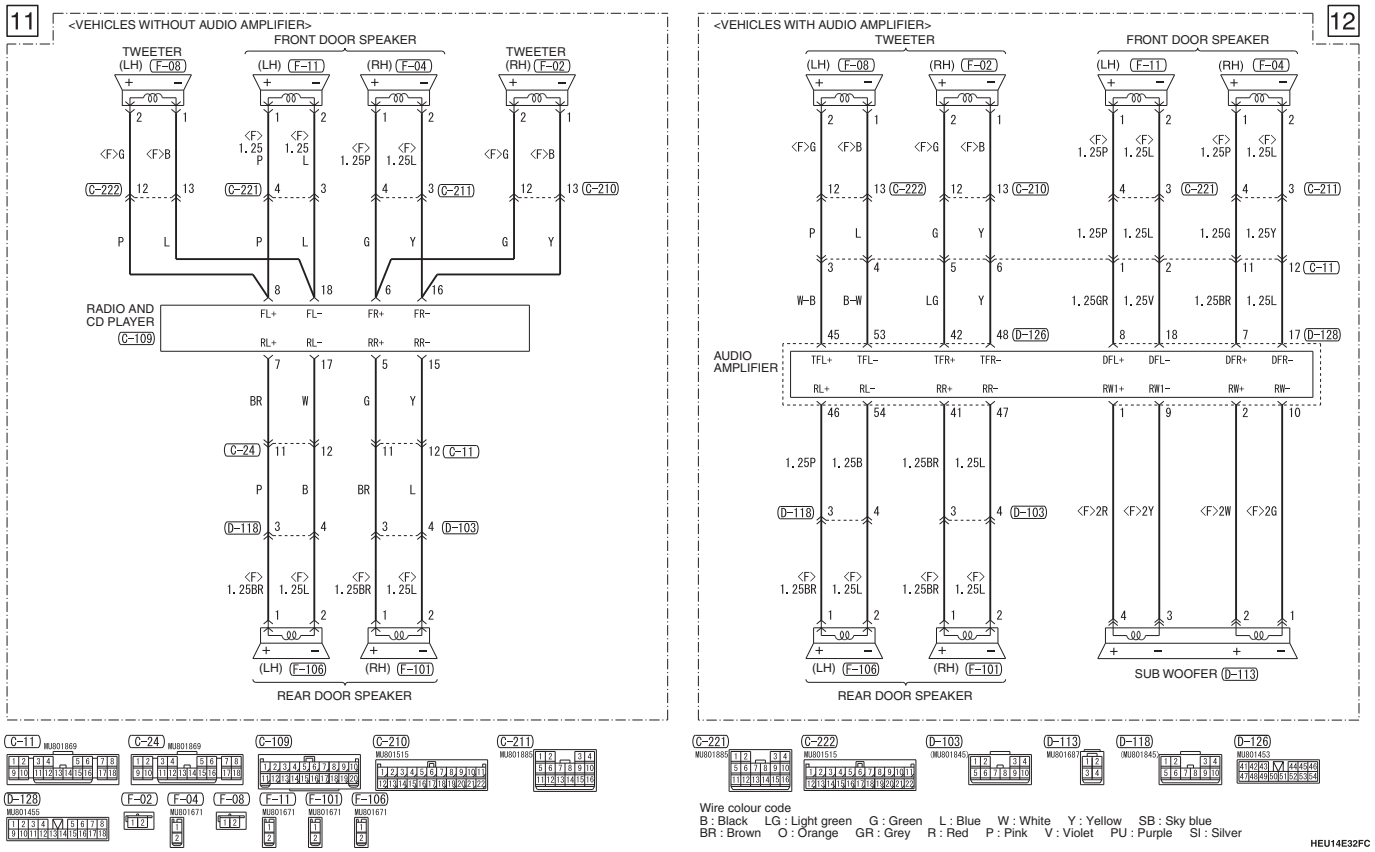
AUDIO SYSTEM <LHD> (CONTINUED)



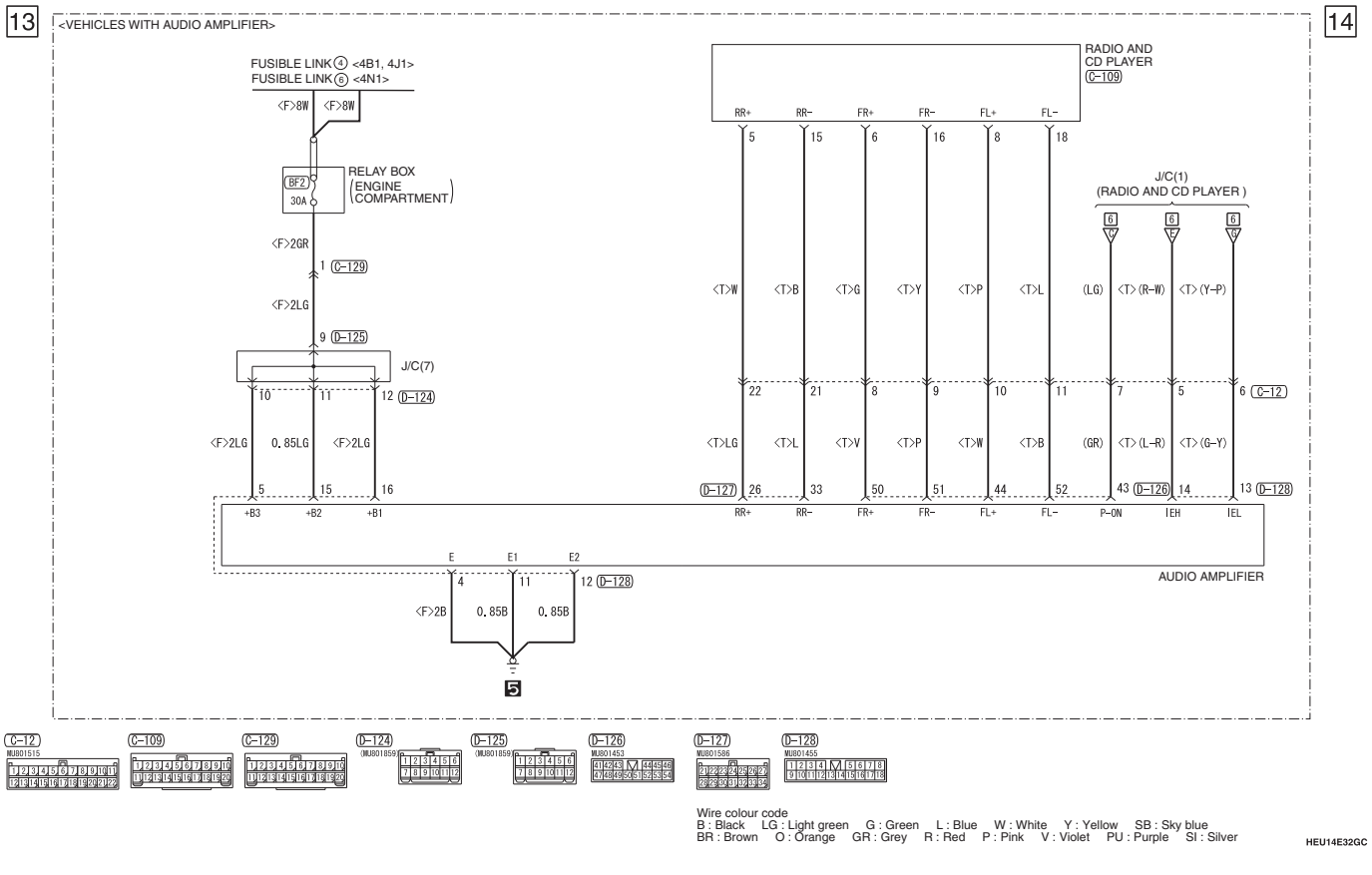
AUDIO SYSTEM <LHD> (CONTINUED)



AUDIO SYSTEM <LHD> (CONTINUED)

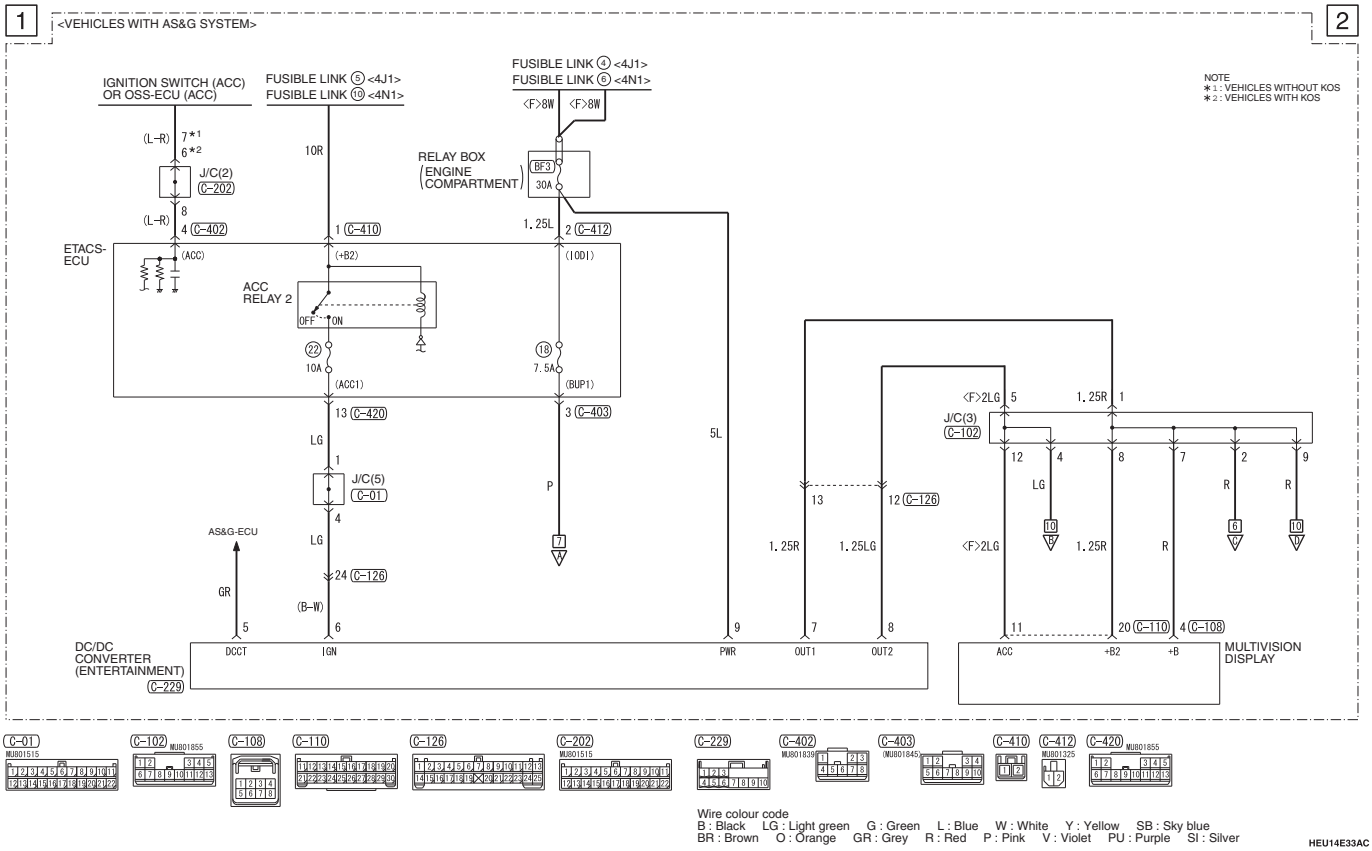


AUDIO SYSTEM <LHD> (CONTINUED)

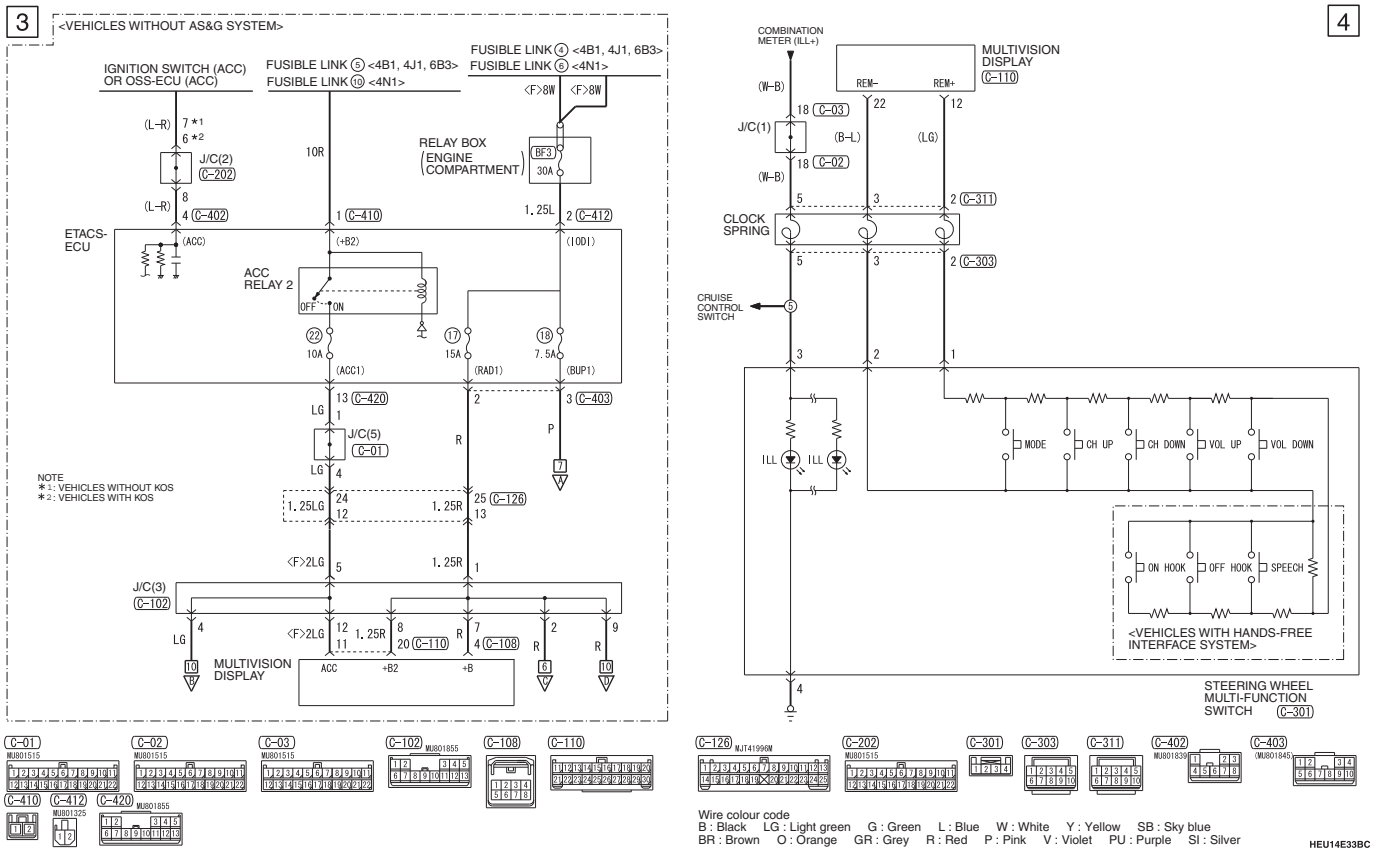


MMCS <LHD>

M1901007503047



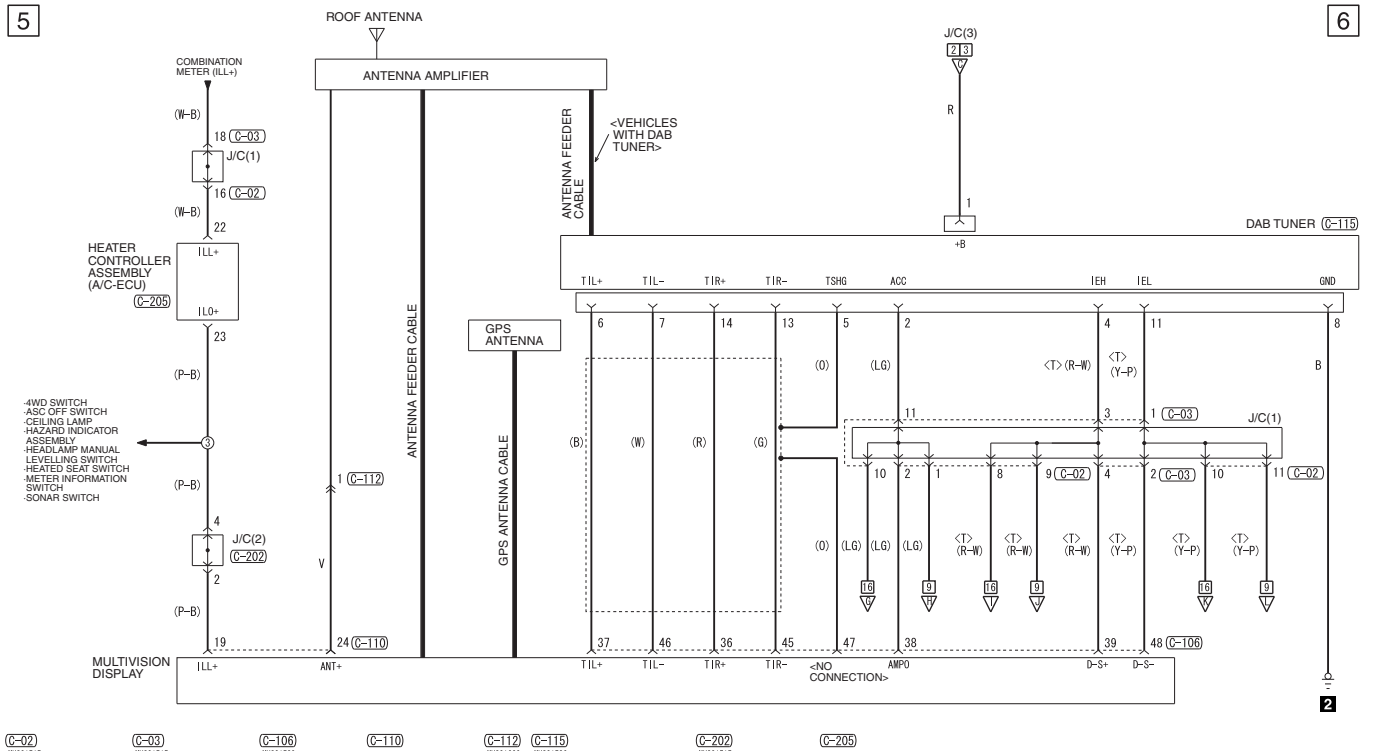
MMCS <LHD> (CONTINUED)



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU14E33BC

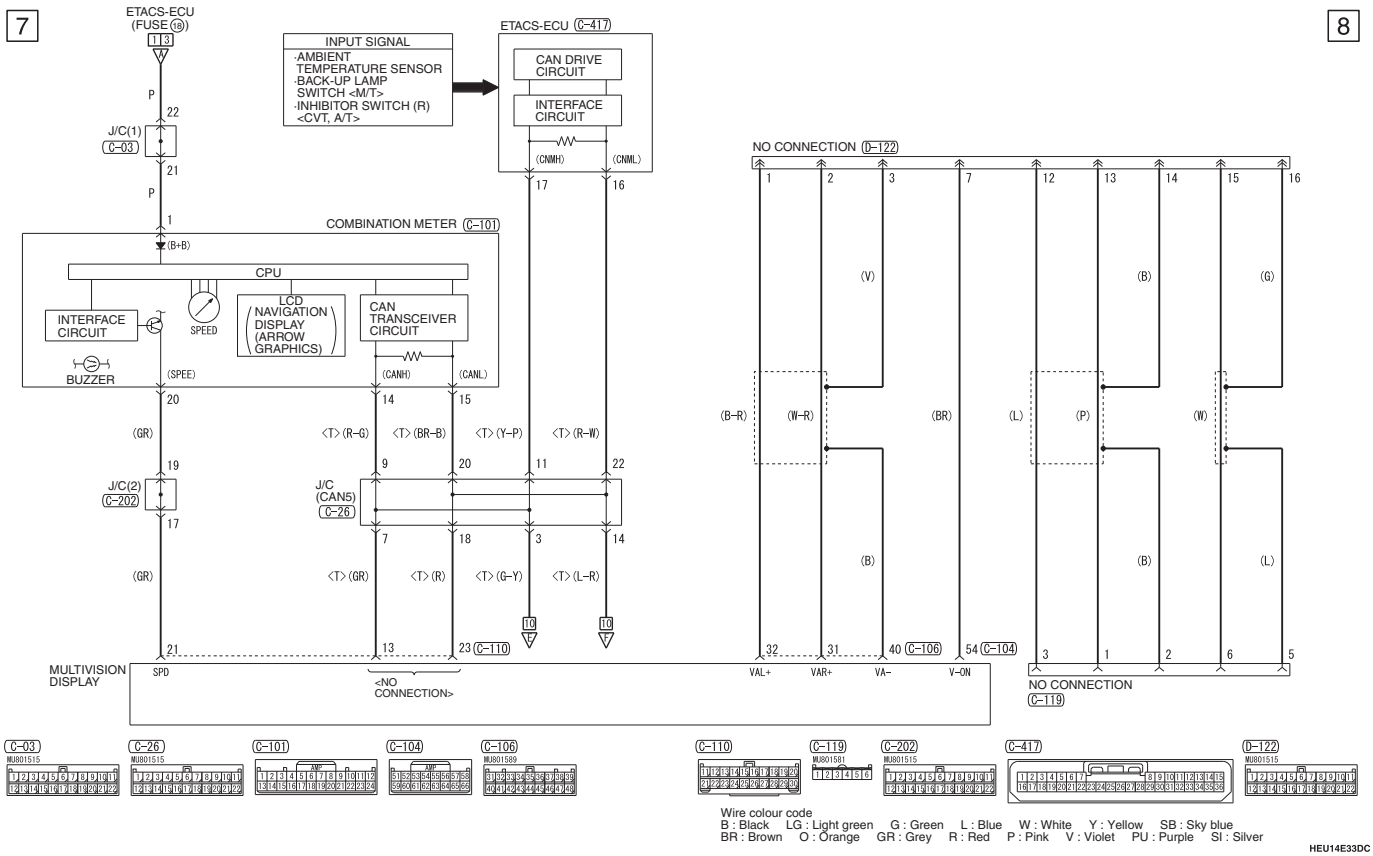
MMCS <LHD> (CONTINUED)



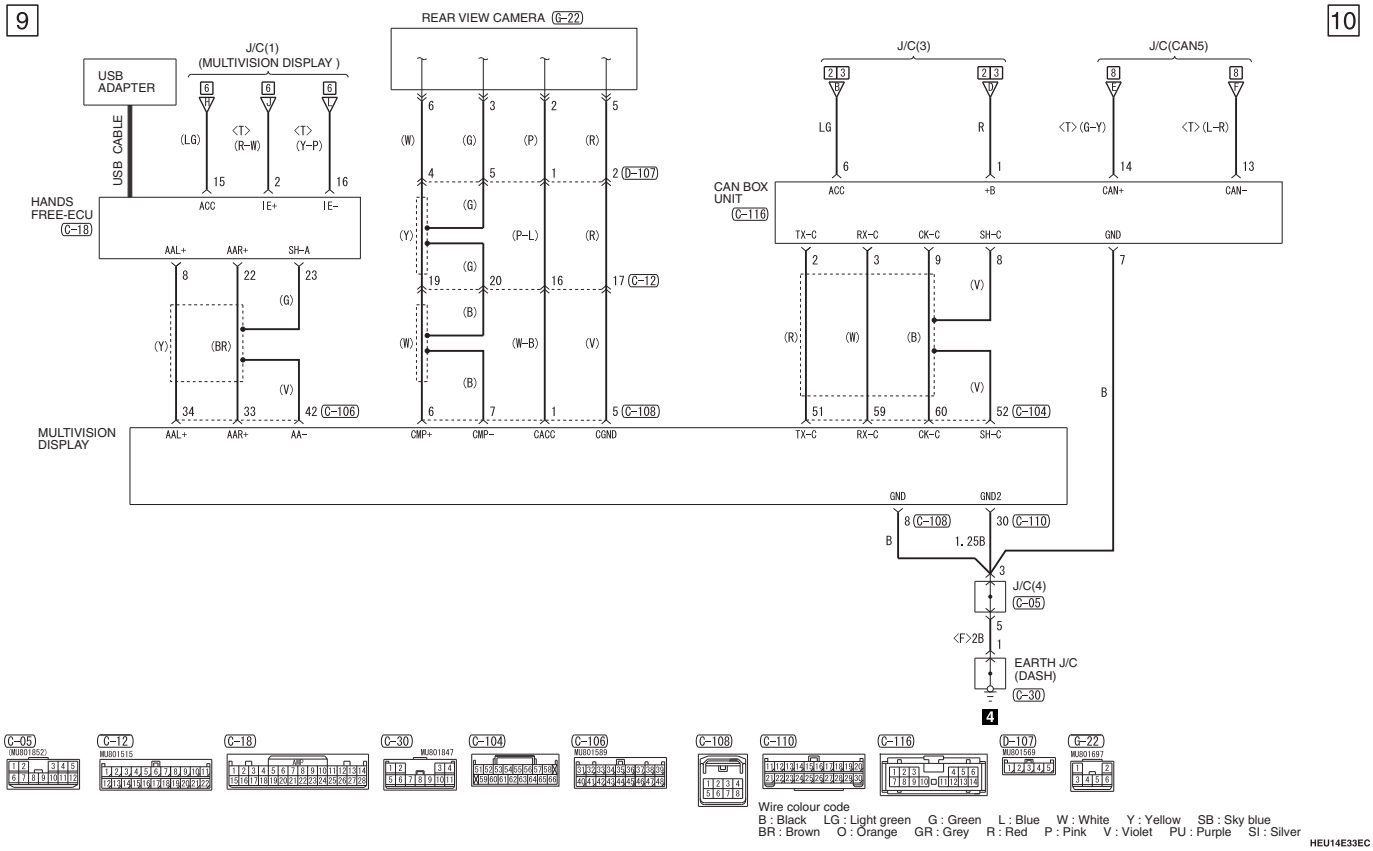
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU14E33CC

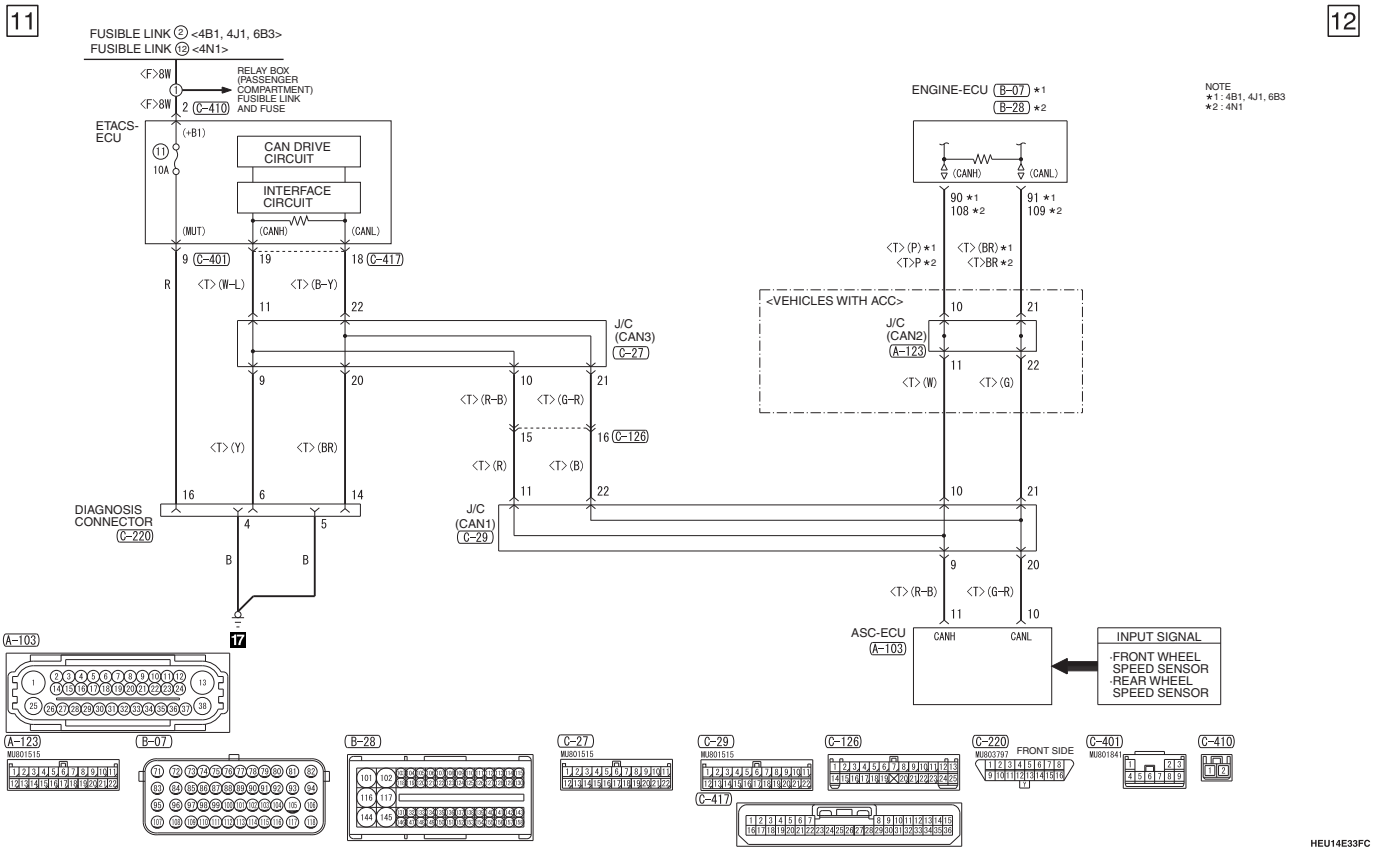
MMCS <LHD> (CONTINUED)



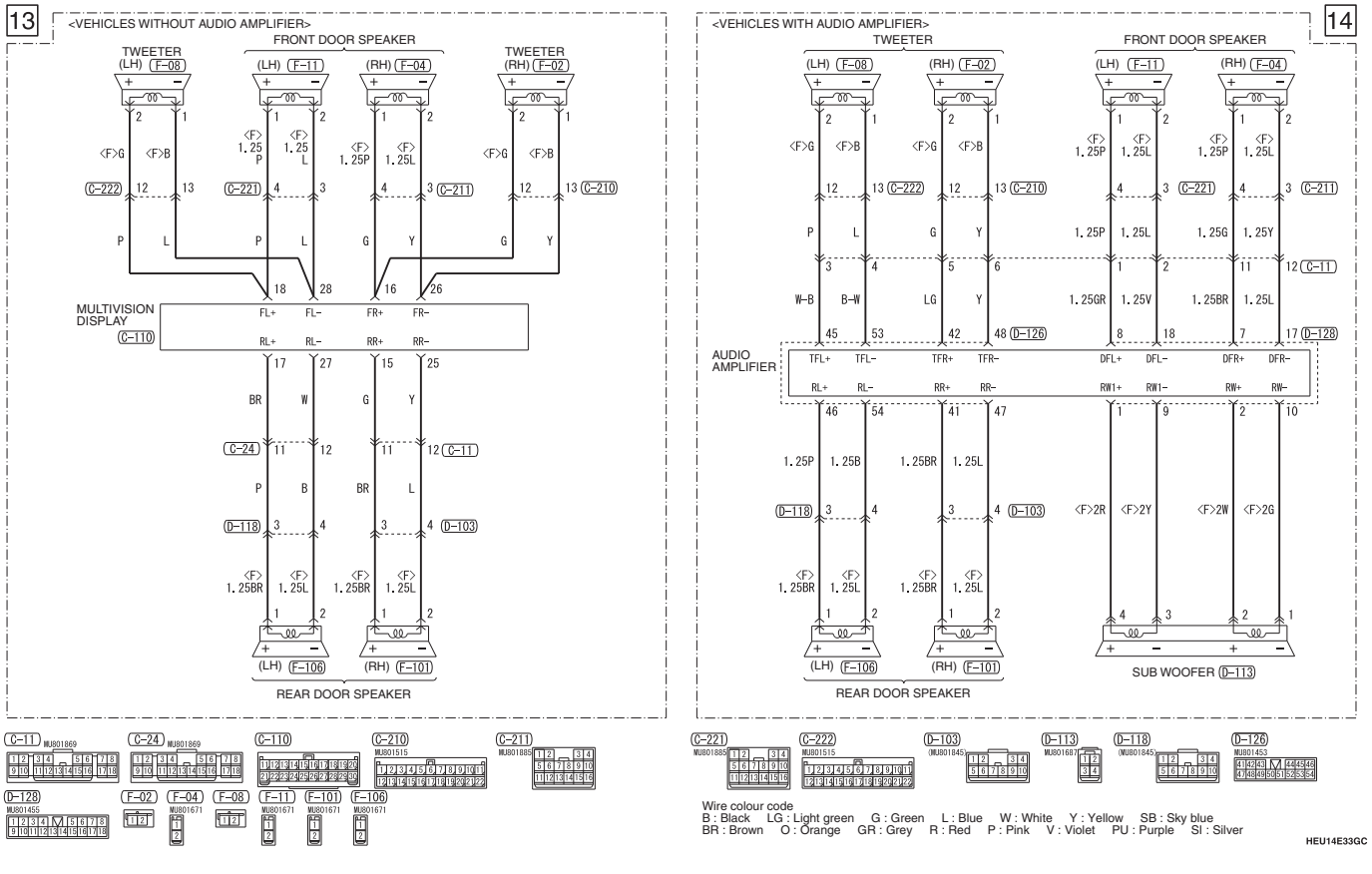
MMCS <LHD> (CONTINUED)



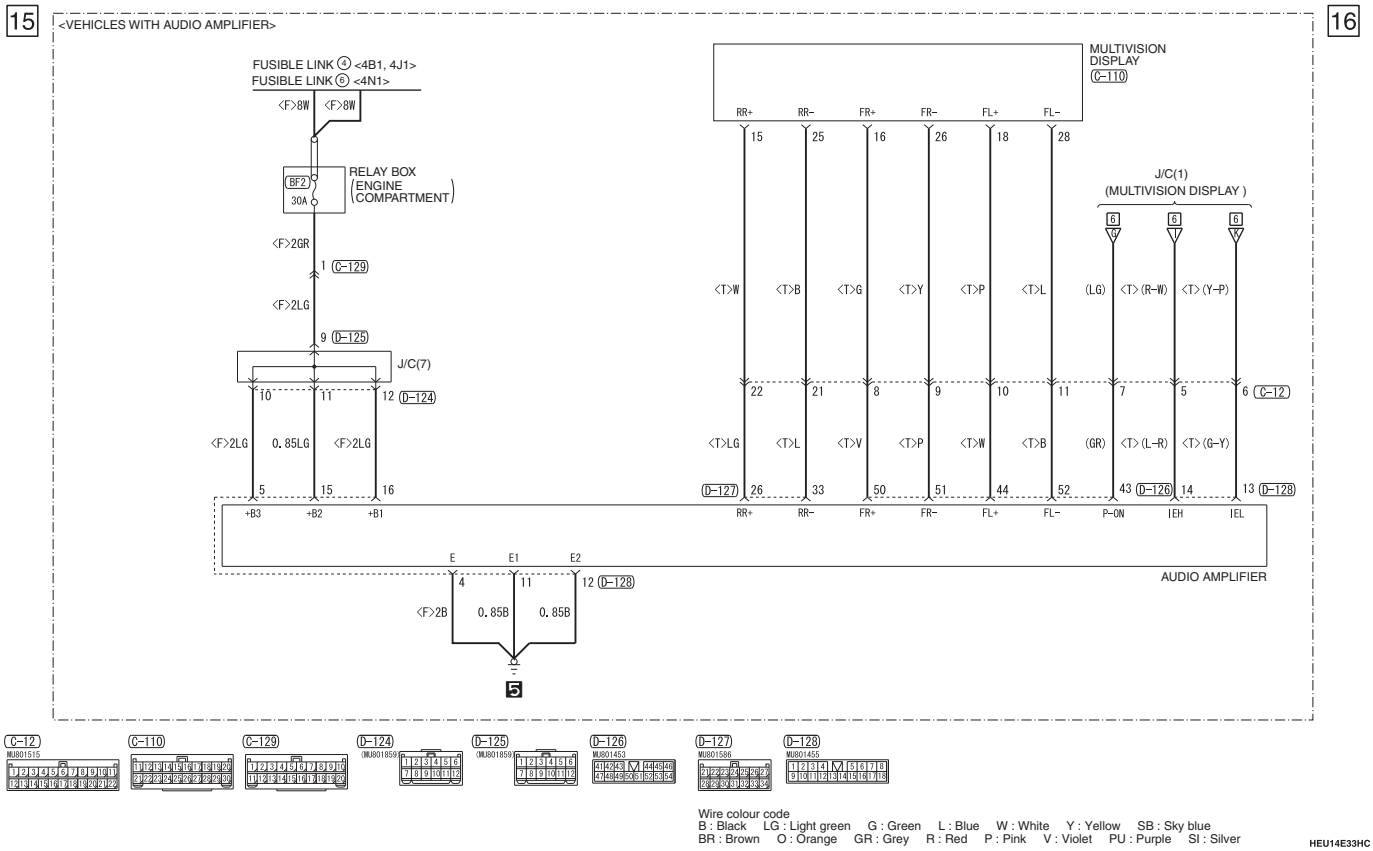
MMCS <LHD> (CONTINUED)



MMCS <LHD> (CONTINUED)



MMCS <LHD> (CONTINUED)



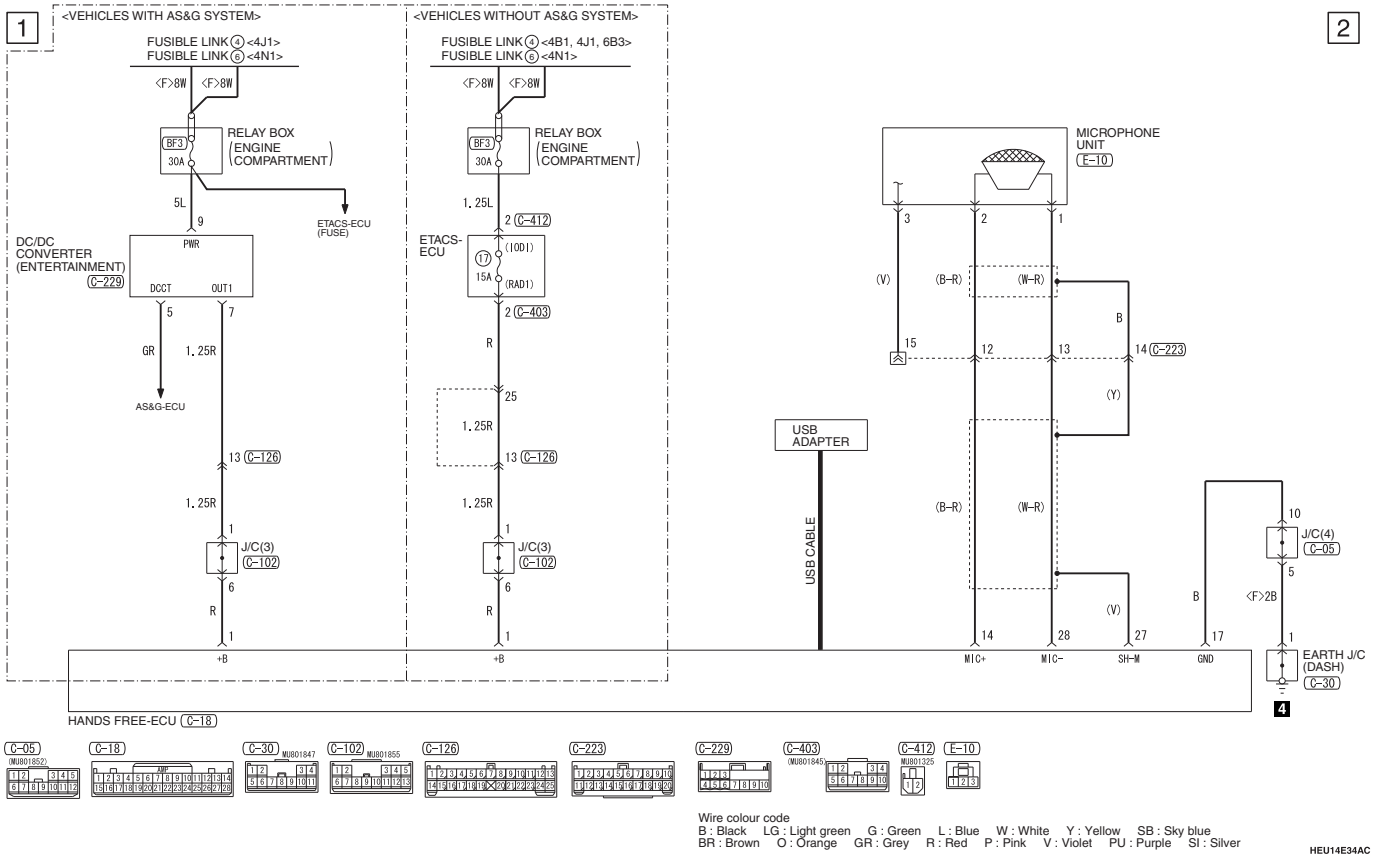
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU14E33HC

HANDS-FREE INTERFACE SYSTEM

HANDS-FREE INTERFACE SYSTEM <VEHICLES WITHOUT MMCS (LHD)>

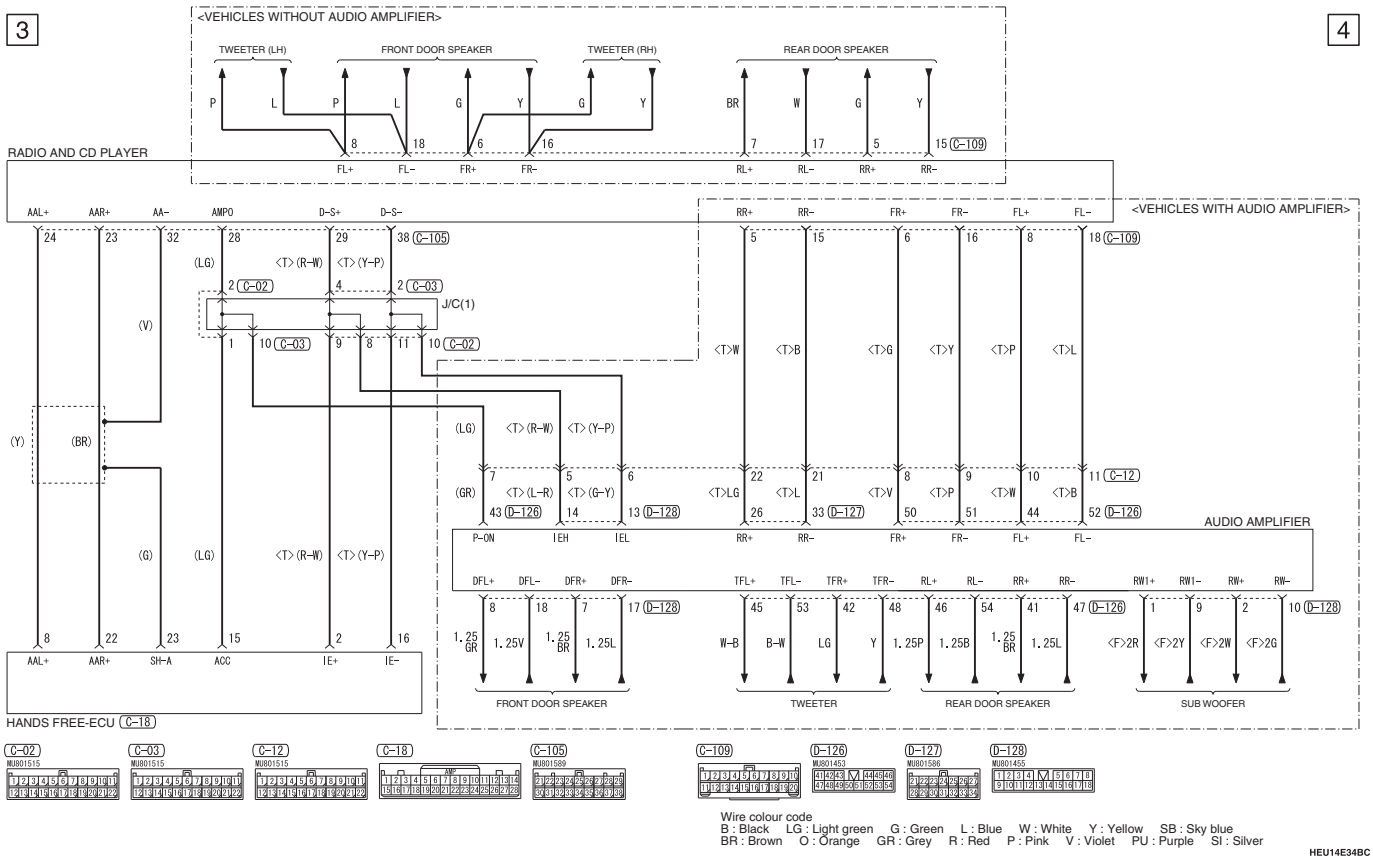
M1901036101214



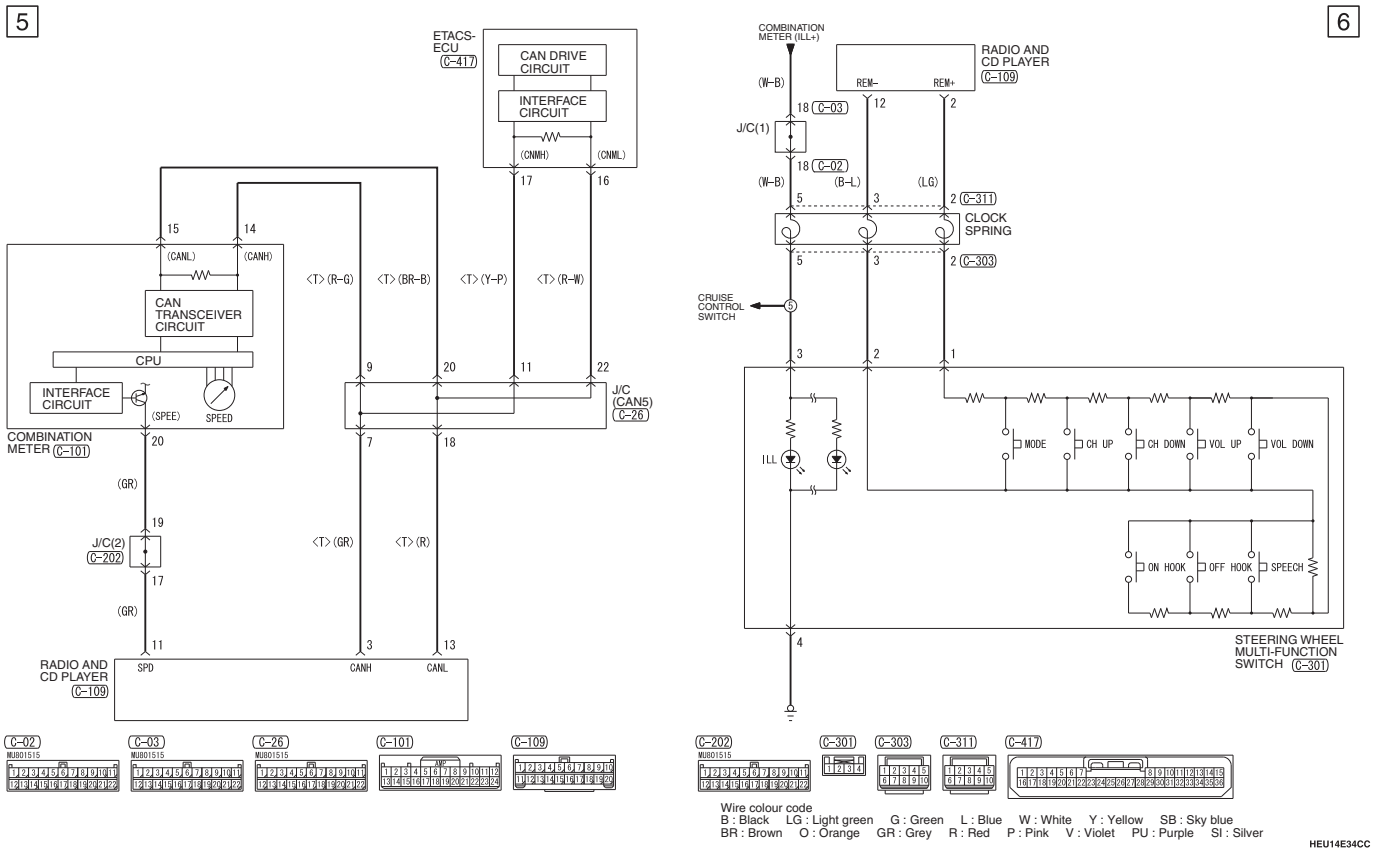
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU14E34AC

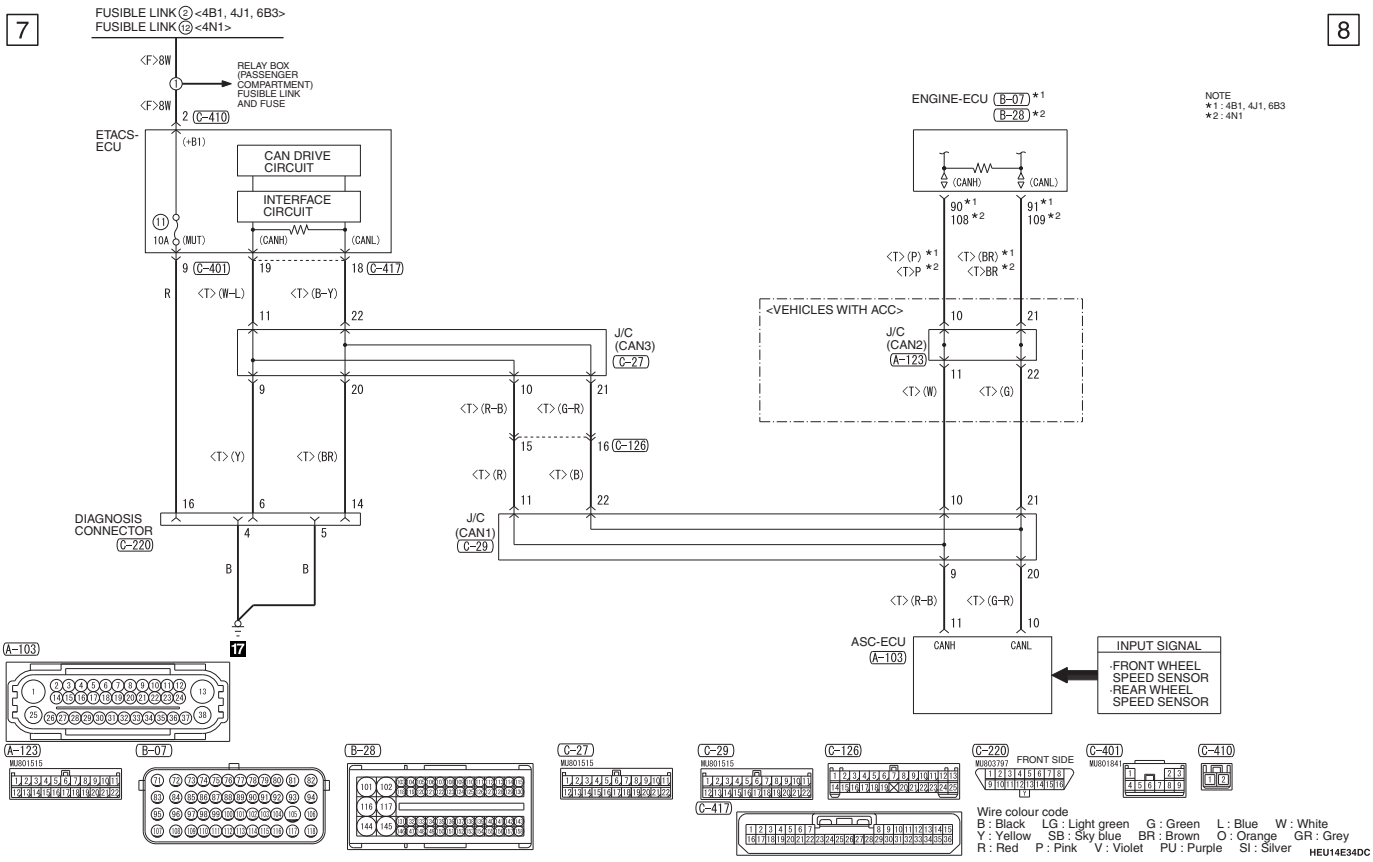
HANDS-FREE INTERFACE SYSTEM <VEHICLES WITHOUT MMCS (LHD)> (CONTINUED)



HANDS-FREE INTERFACE SYSTEM <VEHICLES WITHOUT MMCS (LHD)> (CONTINUED)

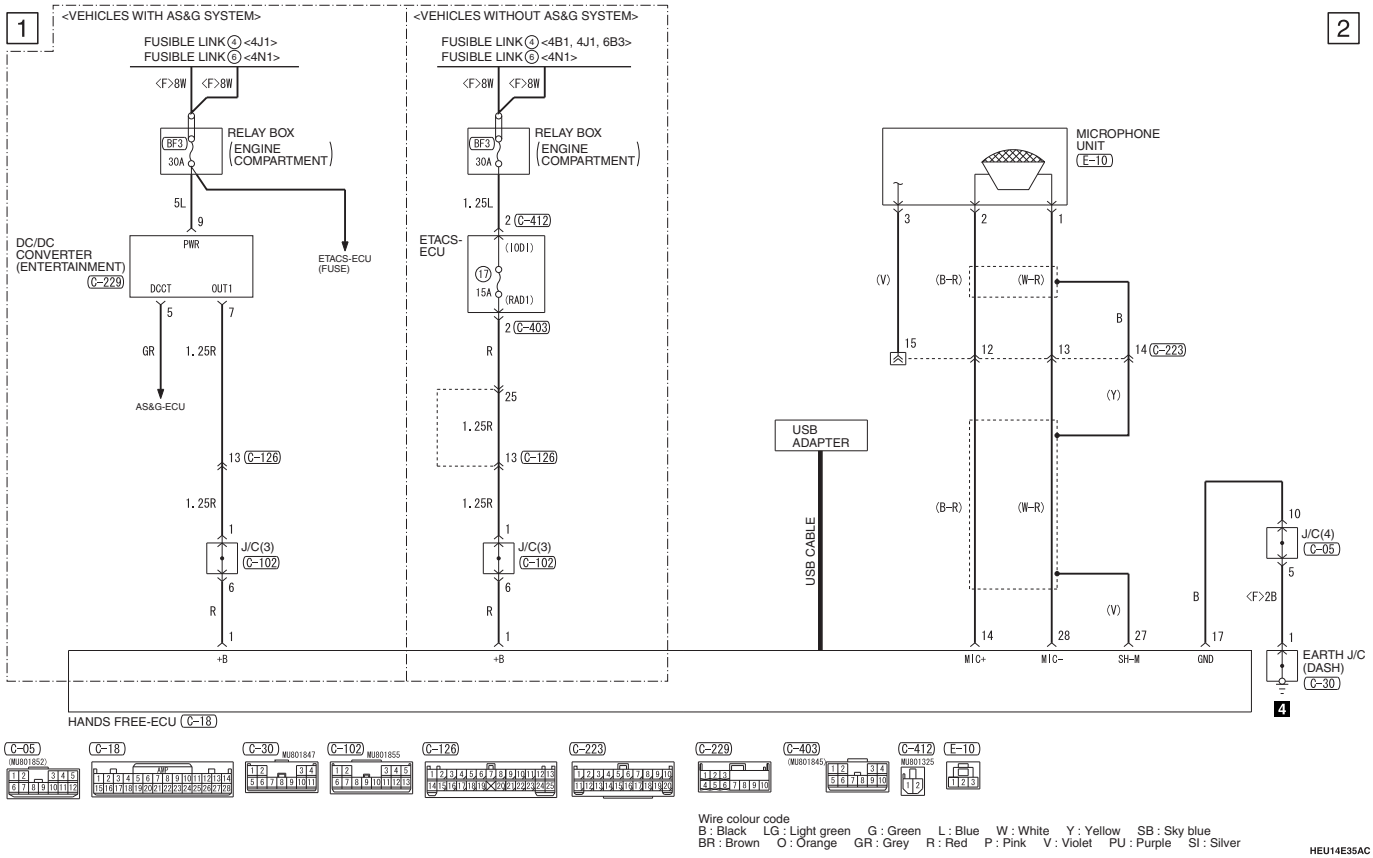


HANDS-FREE INTERFACE SYSTEM <VEHICLES WITHOUT MMCS (LHD)> (CONTINUED)



HANDS-FREE INTERFACE SYSTEM <VEHICLES WITH MMCS (LHD)>

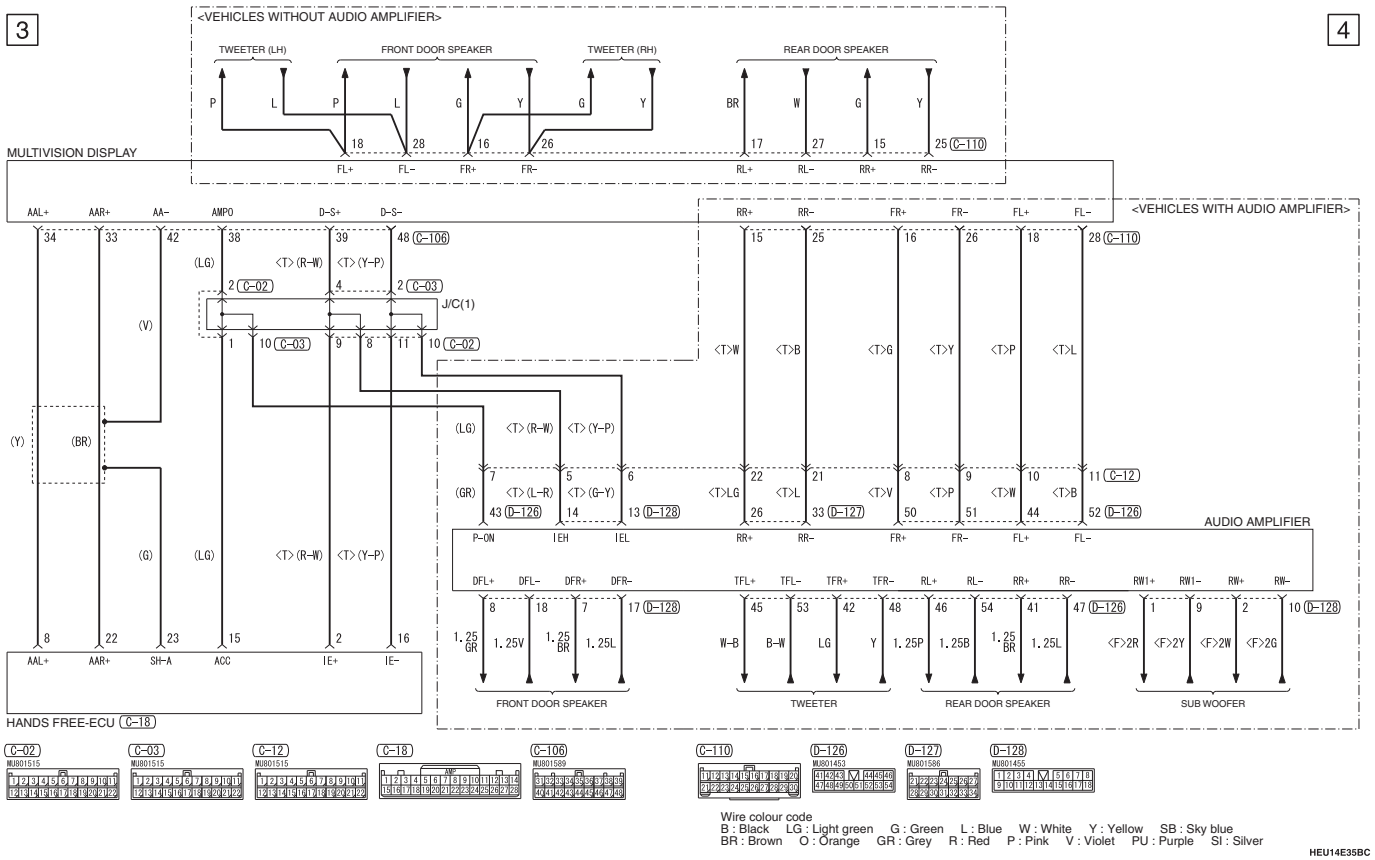
M1901036101225



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU14E35AC

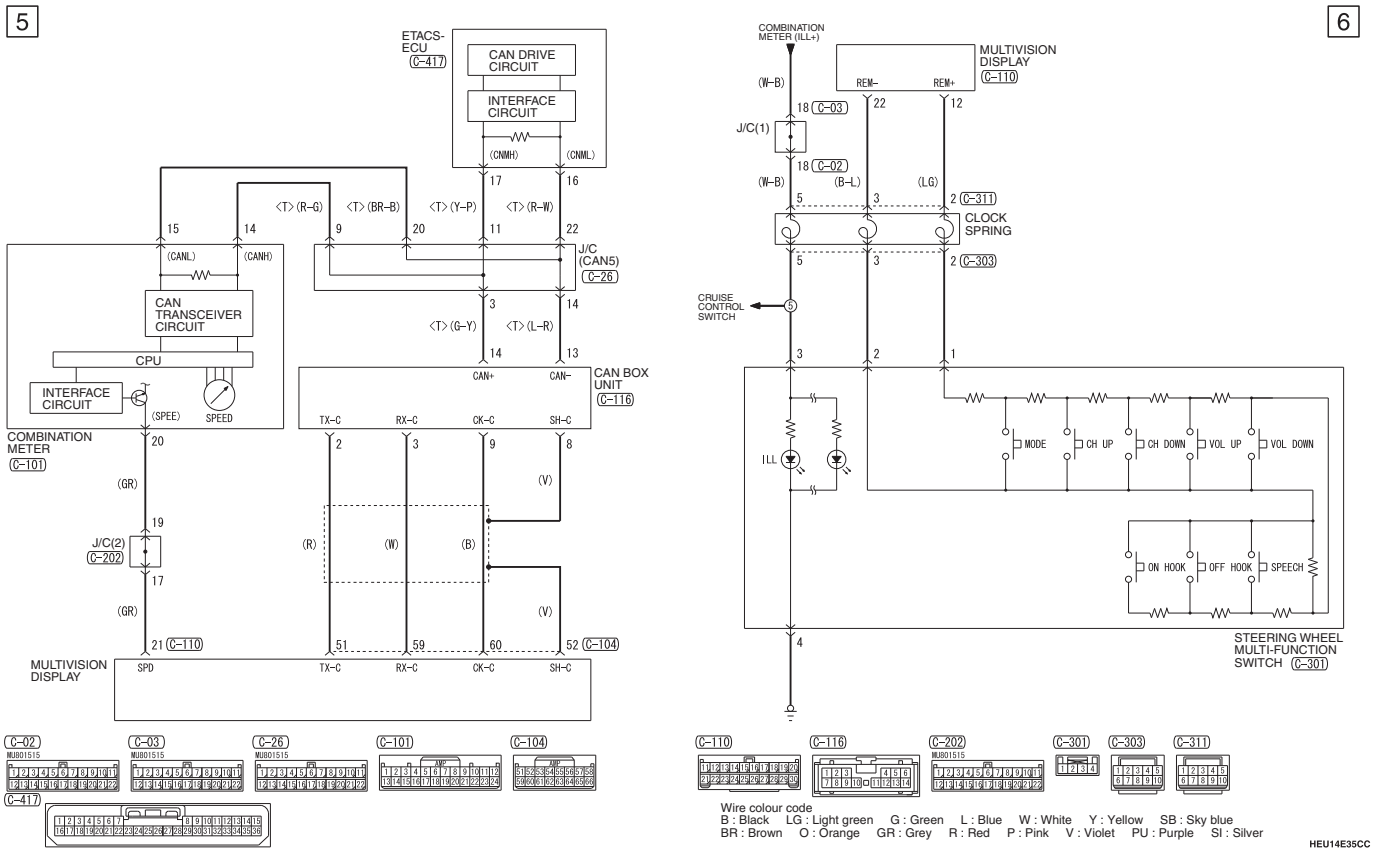
HANDS-FREE INTERFACE SYSTEM <VEHICLES WITH MMCS (LHD)> (CONTINUED)



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU14E35BC

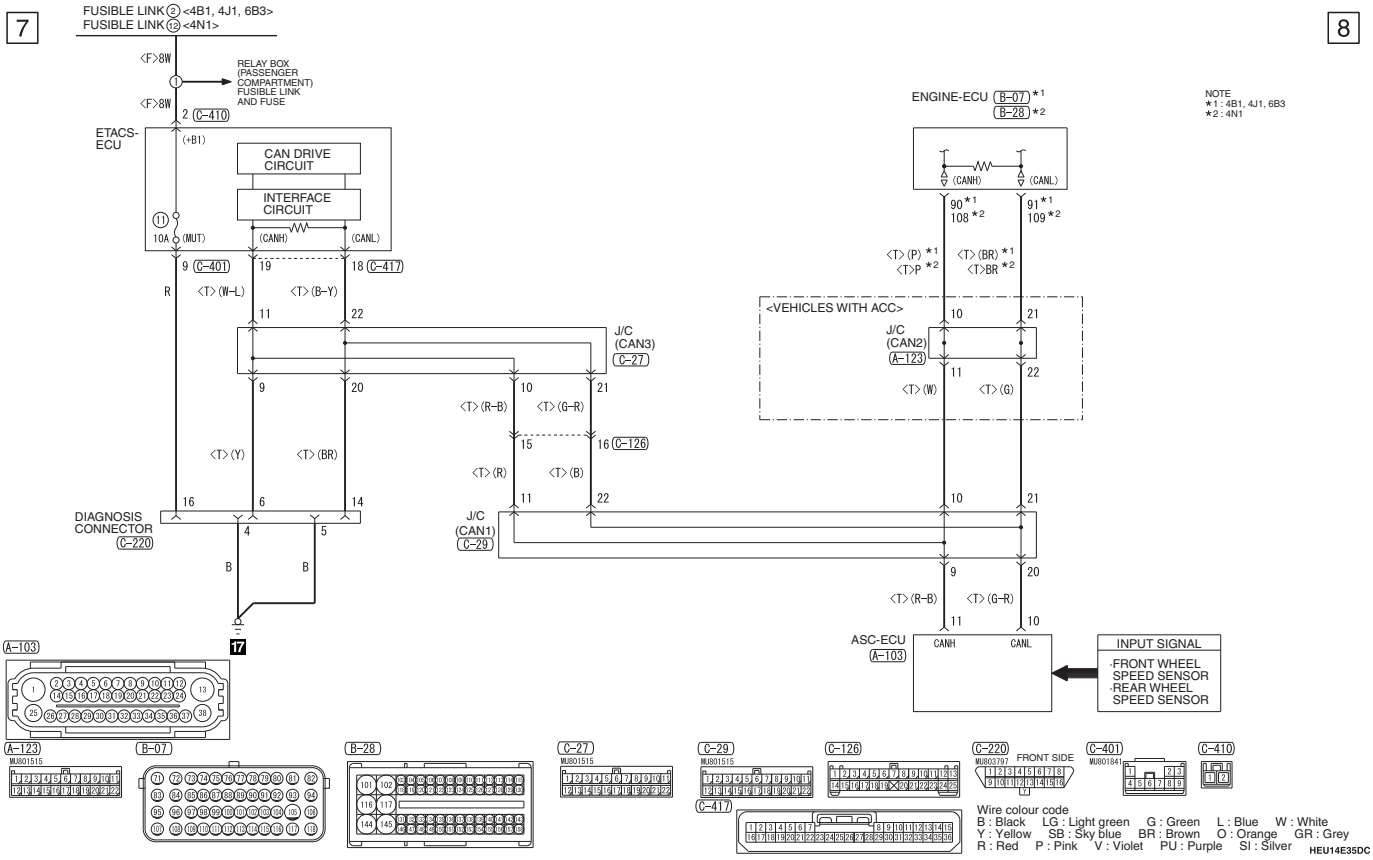
HANDS-FREE INTERFACE SYSTEM <VEHICLES WITH MMCS (LHD)> (CONTINUED)



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

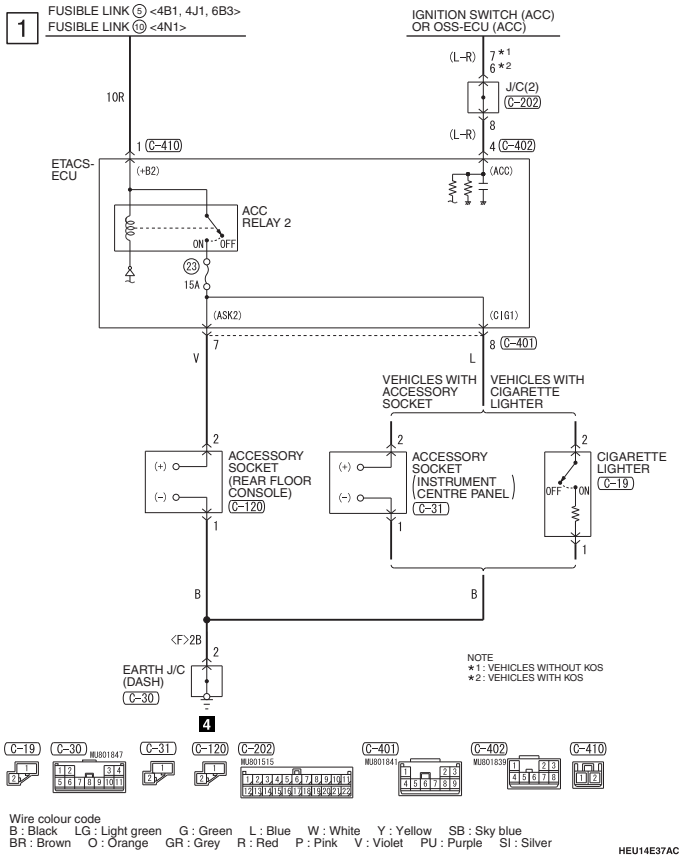
HEU14E35CC

HANDS-FREE INTERFACE SYSTEM <VEHICLES WITH MMCS (LHD)> (CONTINUED)



ACCESSORY SOCKET AND CIGARETTE LIGHTER

M1901030900587

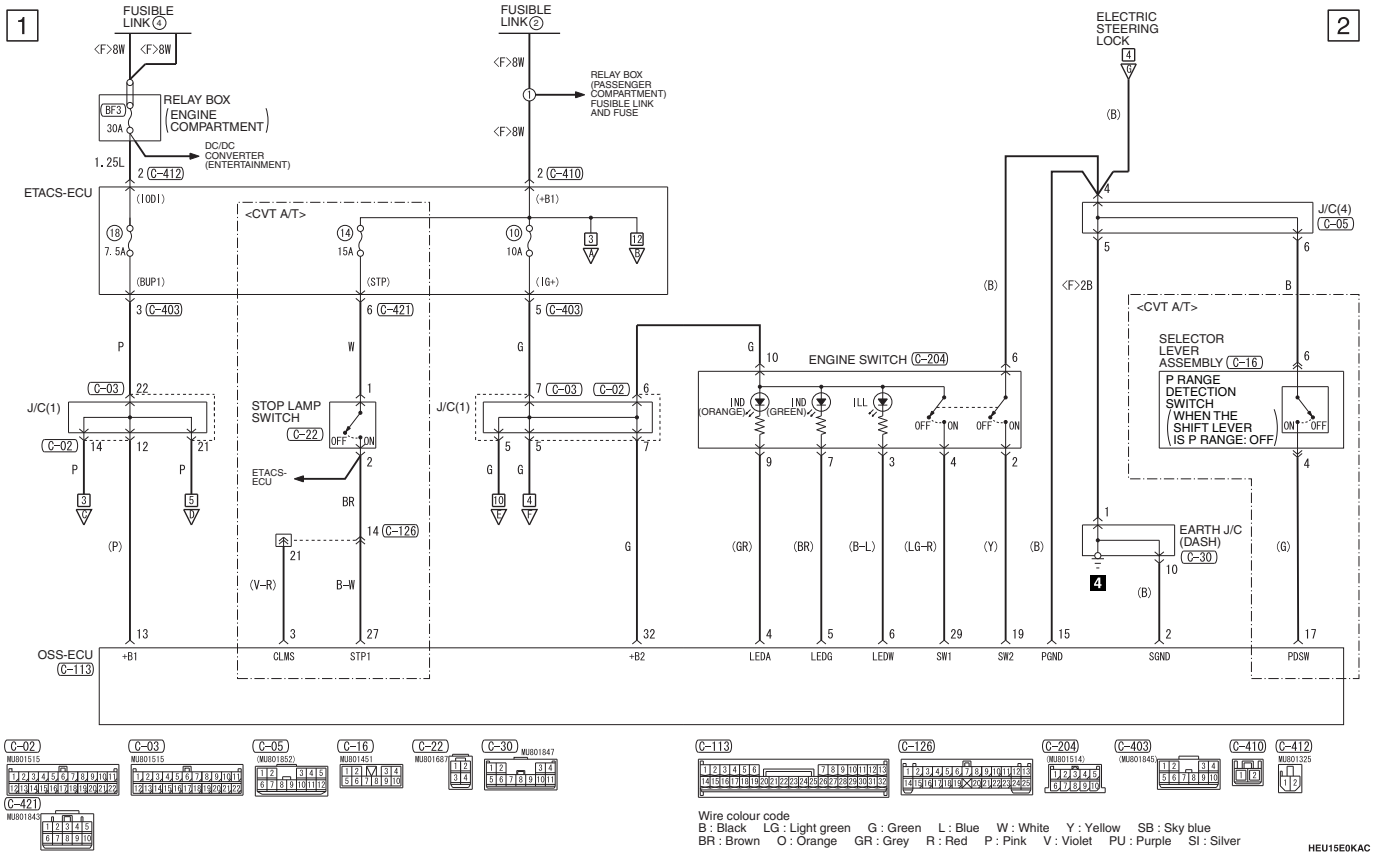


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

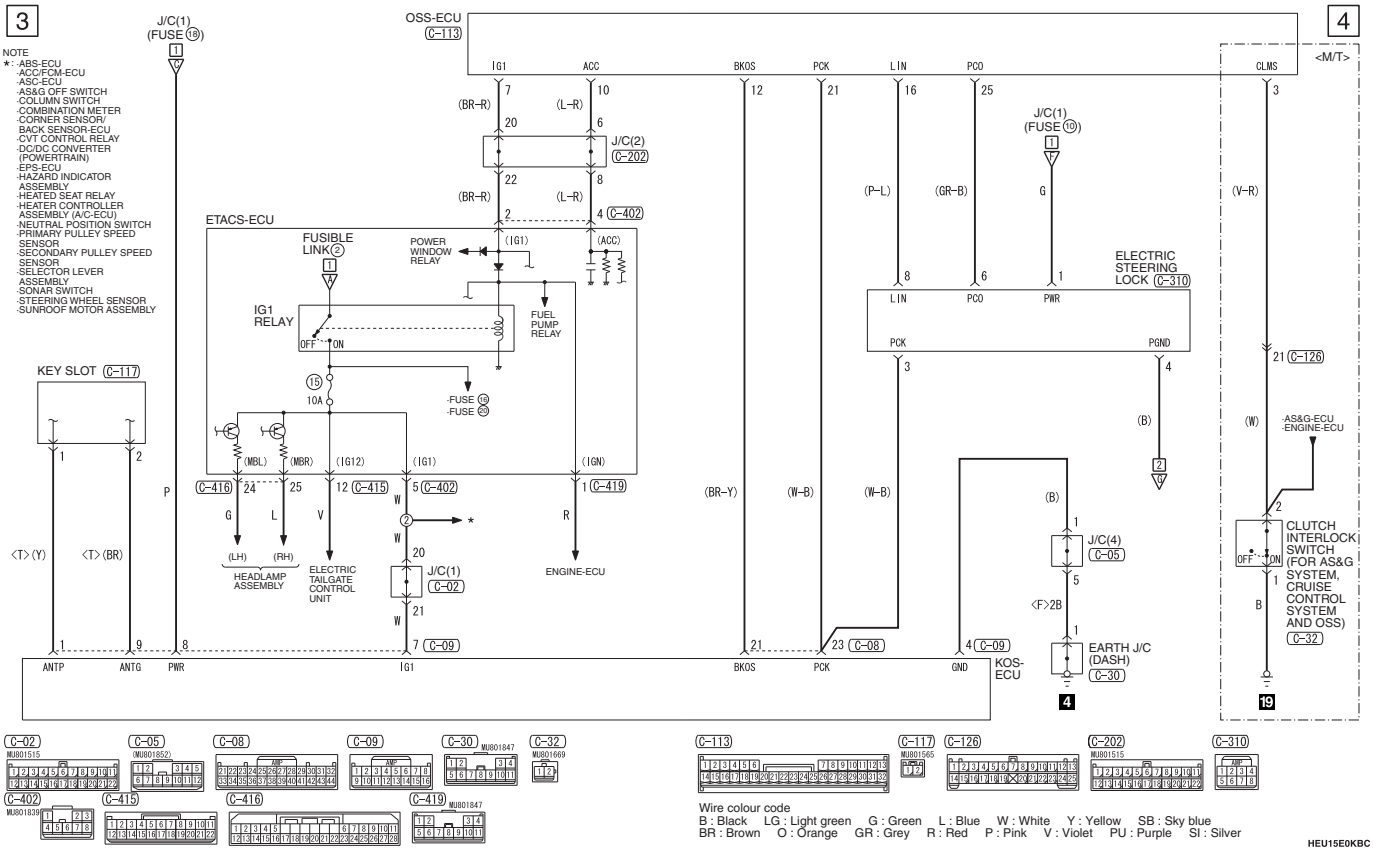
HEU14E37AC

ONE-TOUCH START SYSTEM (OSS) <4B1, 4J1, 6B3 (LHD)>

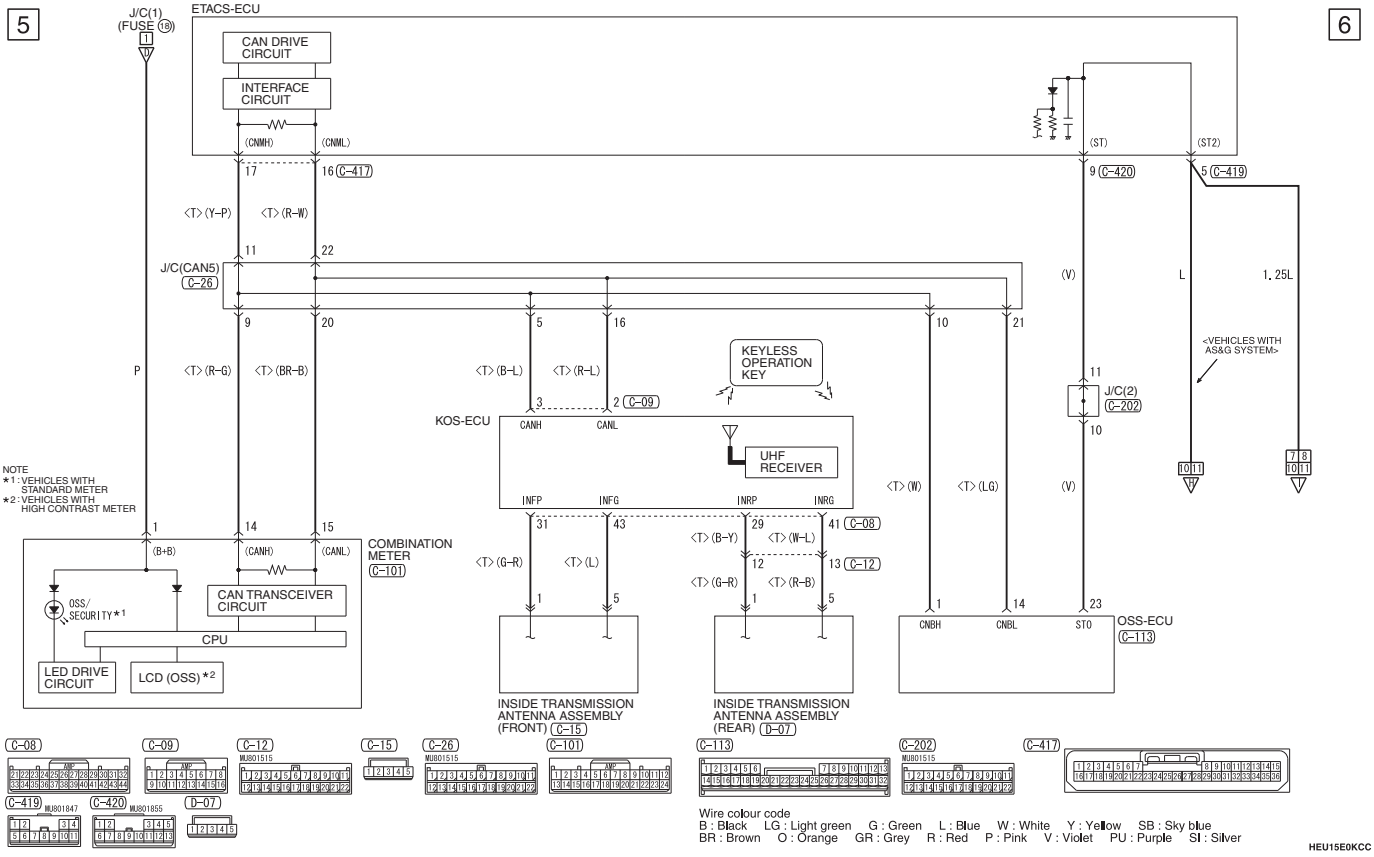
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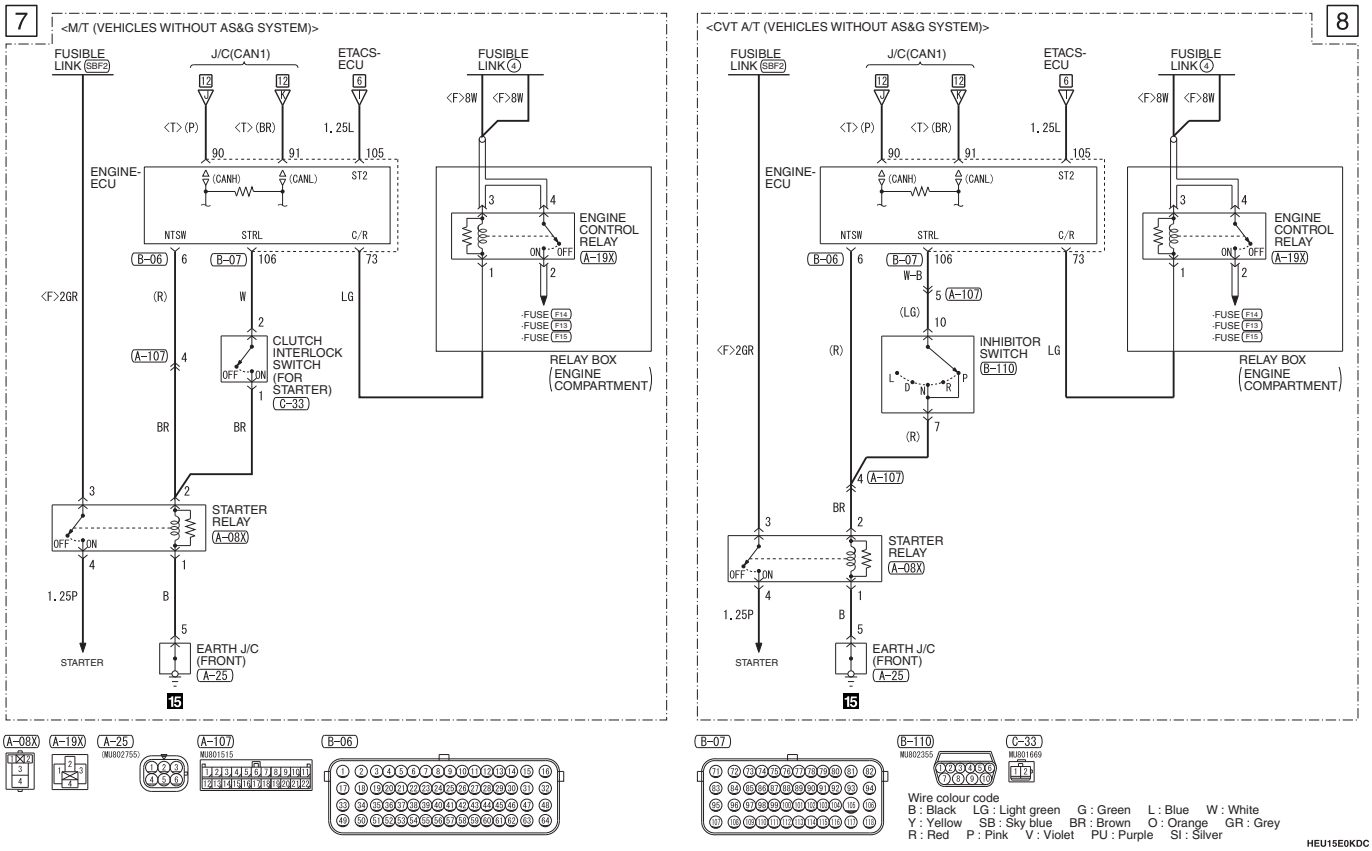
ONE-TOUCH START SYSTEM (OSS) <4B1, 4J1, 6B3 (LHD)> (CONTINUED)



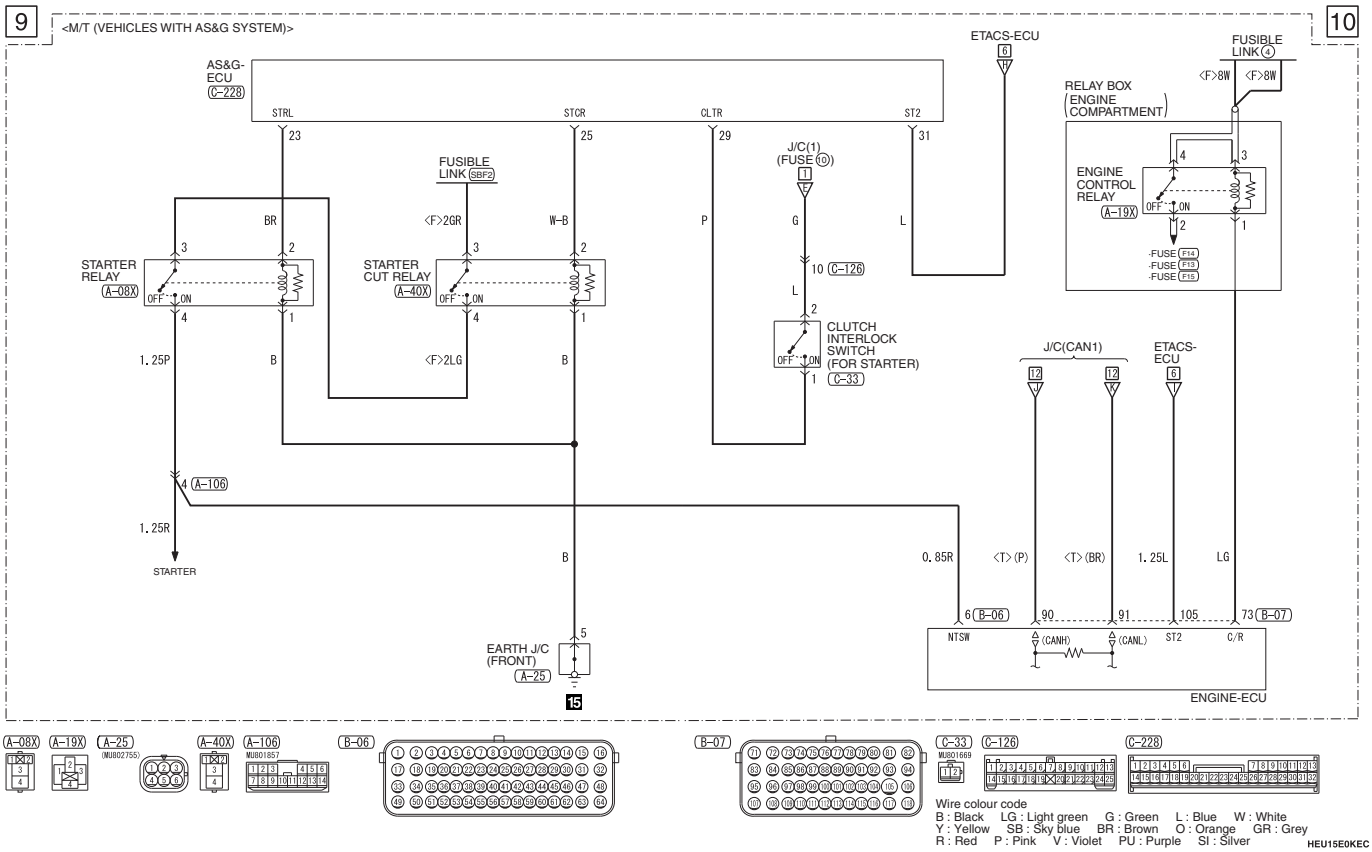
ONE-TOUCH START SYSTEM (OSS) <4B1, 4J1, 6B3 (LHD)> (CONTINUED)



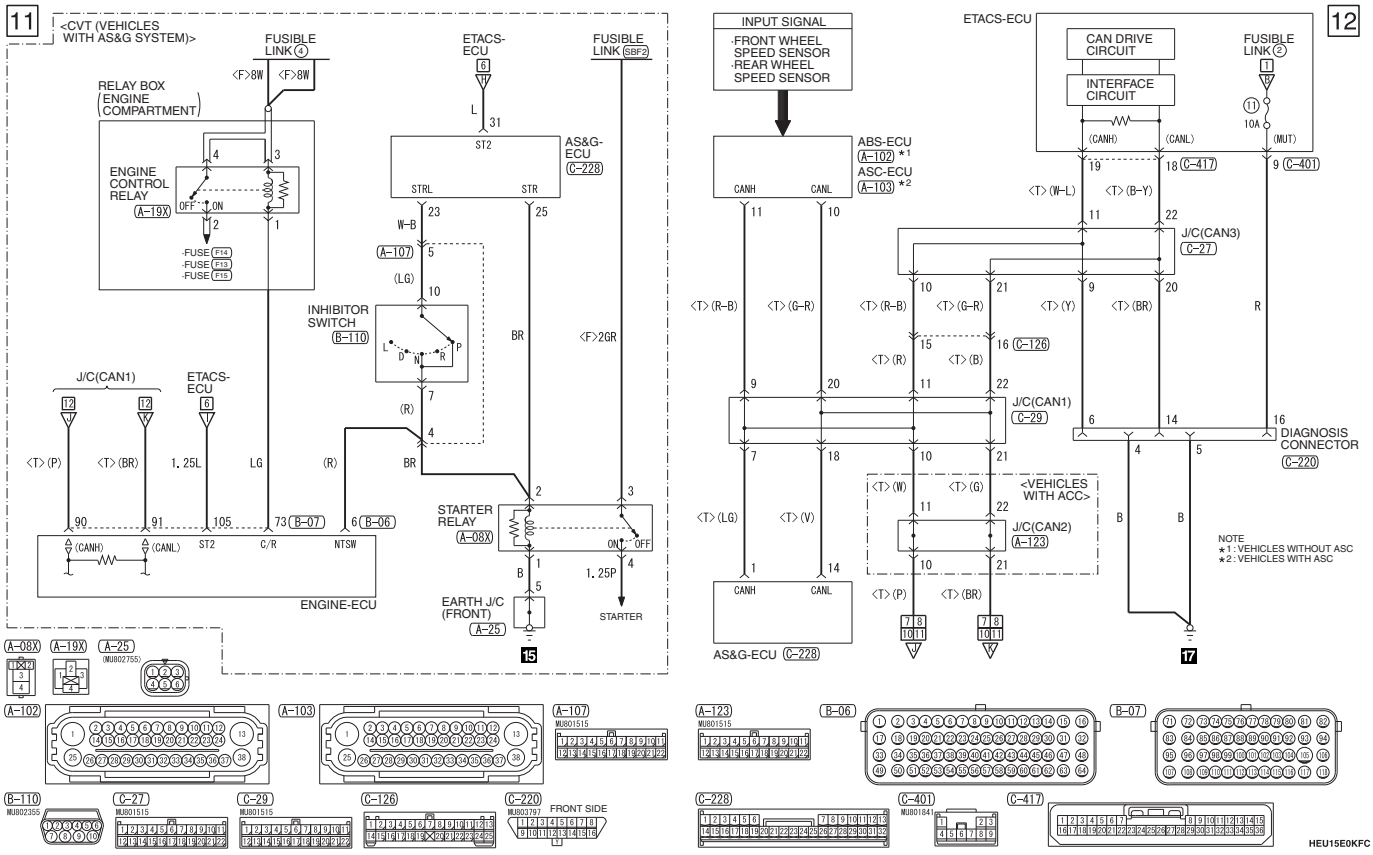
ONE-TOUCH START SYSTEM (OSS) <4B1, 4J1, 6B3 (LHD)> (CONTINUED)



ONE-TOUCH START SYSTEM (OSS) <4B1, 4J1, 6B3 (LHD)> (CONTINUED)

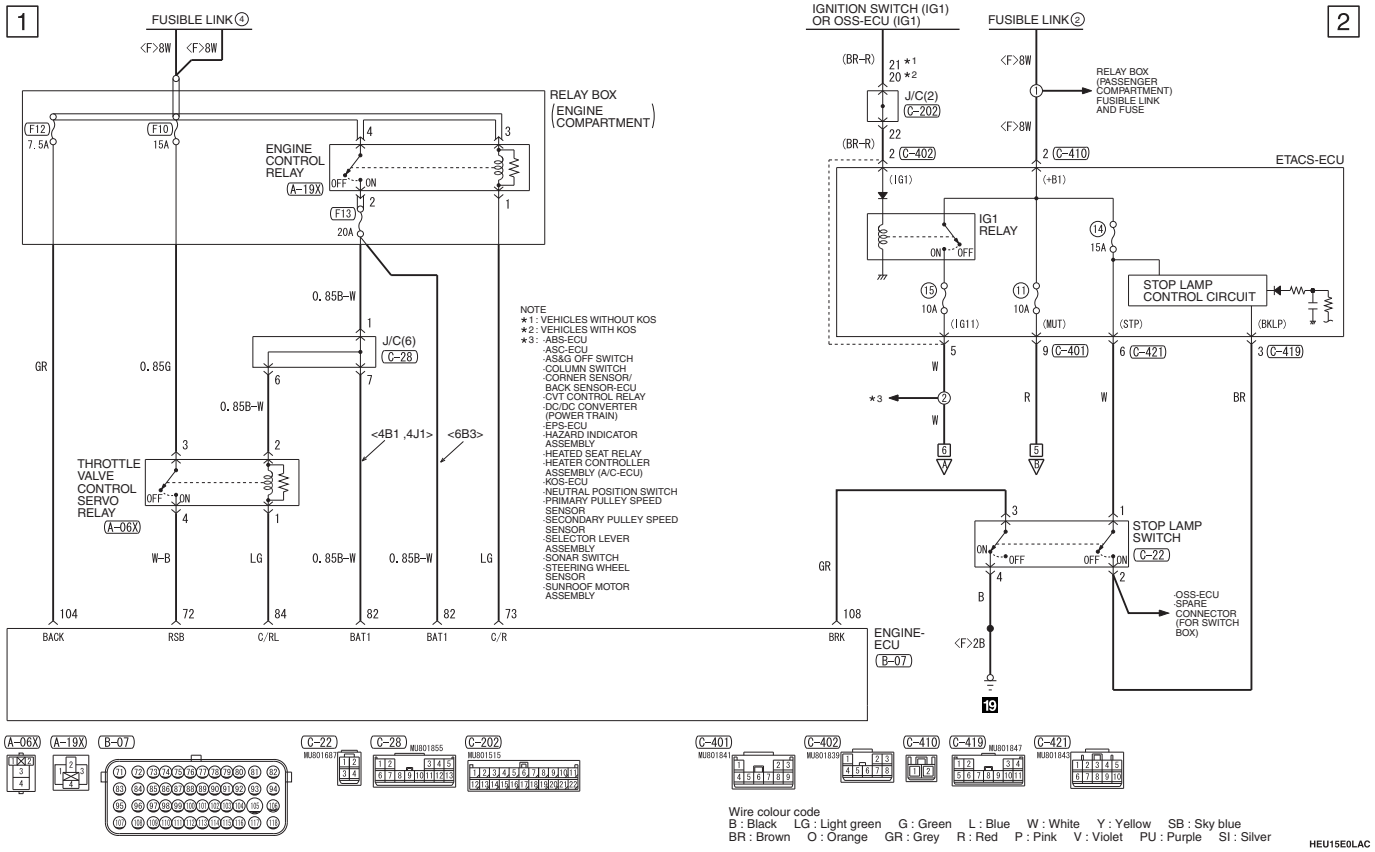


ONE-TOUCH START SYSTEM (OSS) <4B1, 4J1, 6B3 (LHD)> (CONTINUED)



CRUISE CONTROL SYSTEM <4B1, 4J1, 6B3 (LHD)>

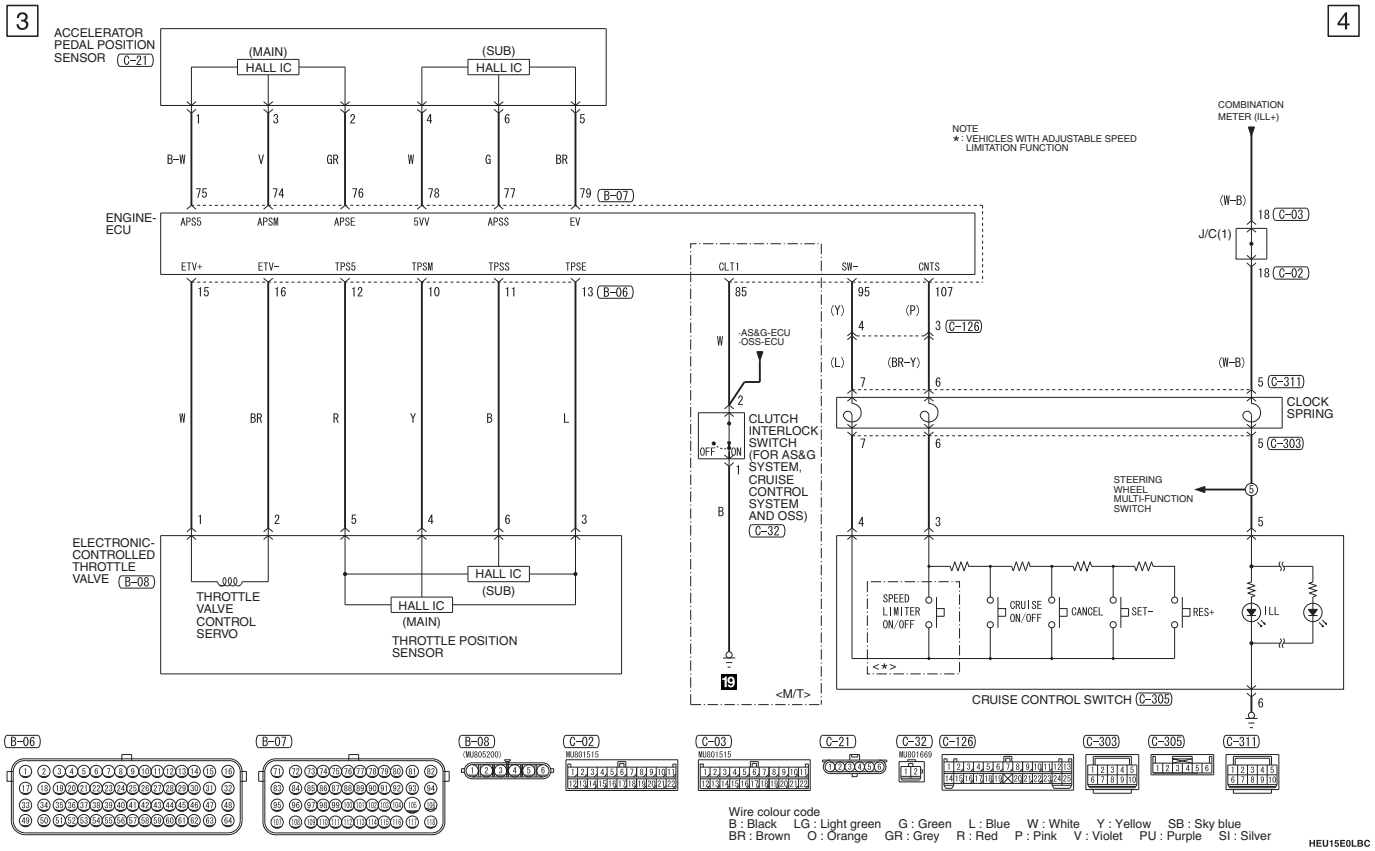
M1901032902471



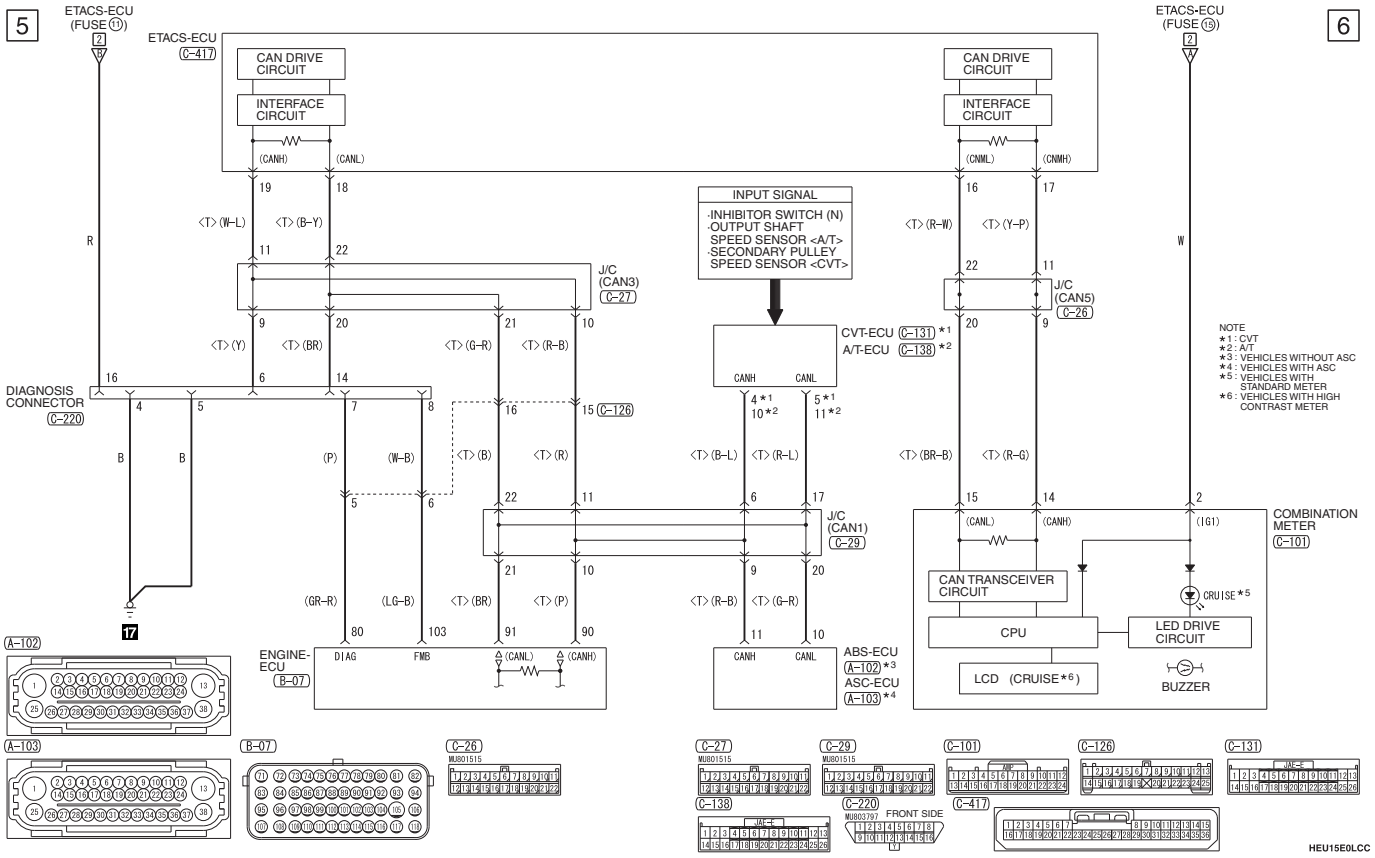
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0LAC

CRUISE CONTROL SYSTEM <4B1, 4J1, 6B3 (LHD)> (CONTINUED)

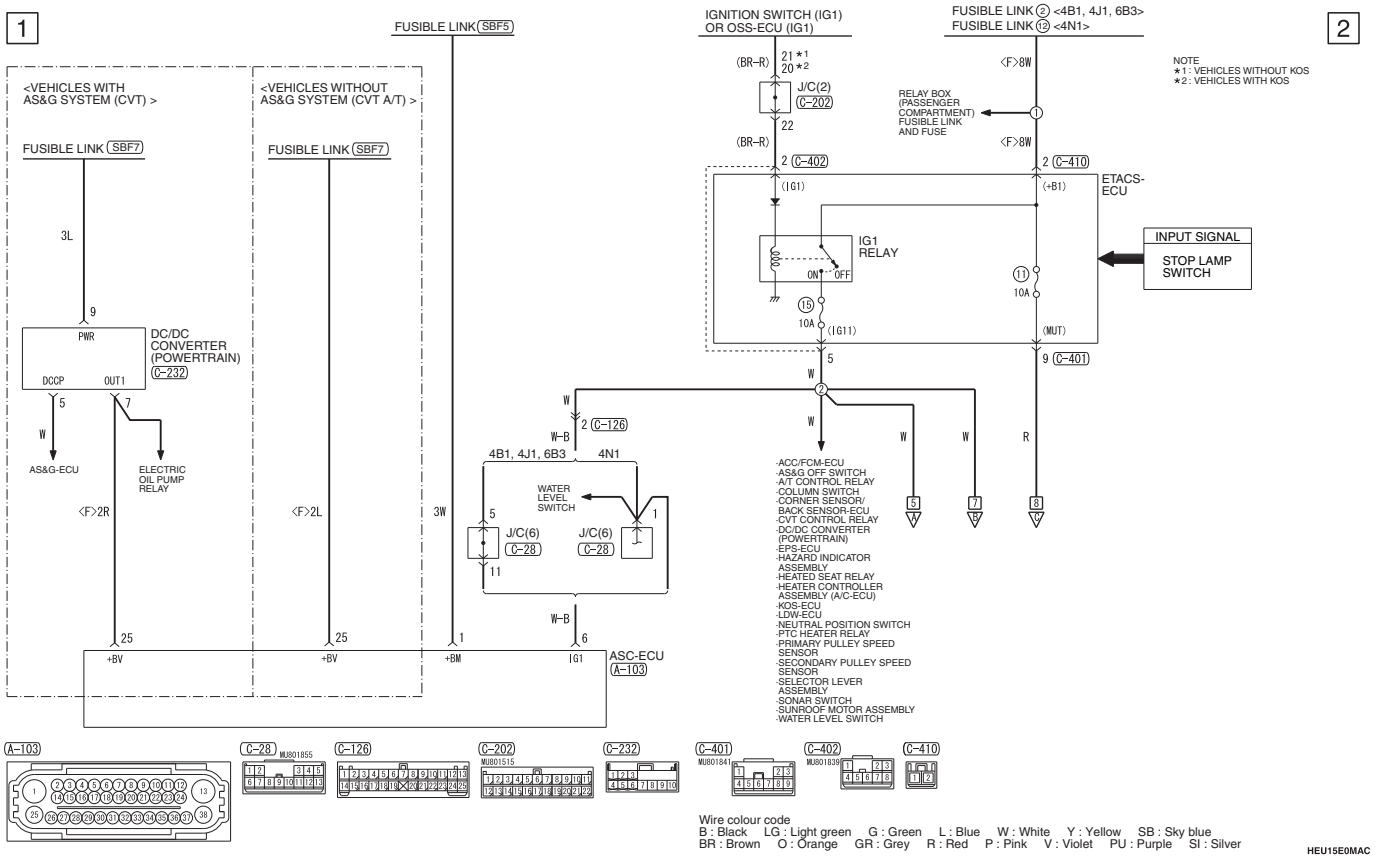


CRUISE CONTROL SYSTEM <4B1, 4J1, 6B3 (LHD)> (CONTINUED)



ACTIVE STABILITY CONTROL (ASC) AND HILL START ASSIST (HSA) <LHD>

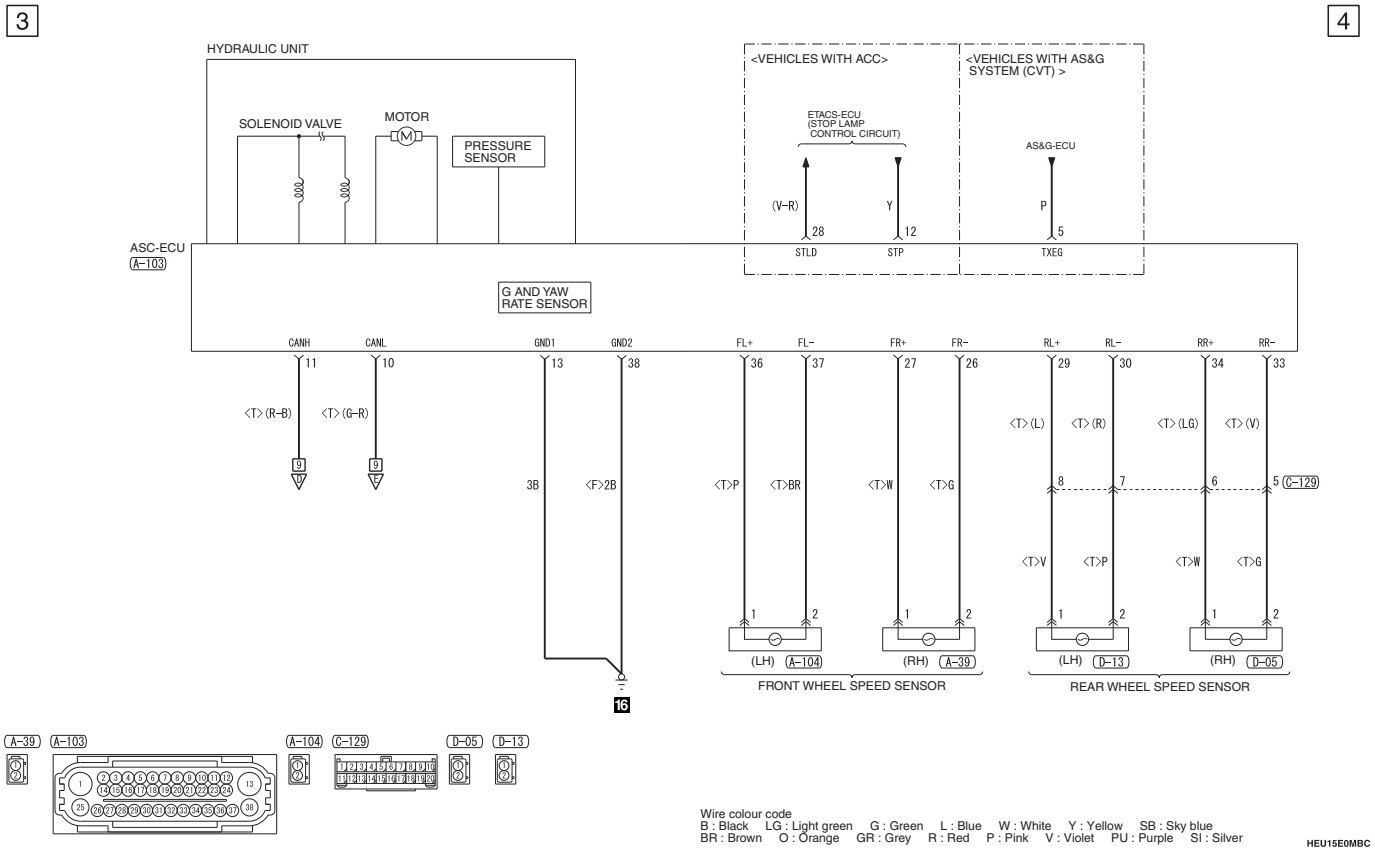
M1901035500391



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0MAC

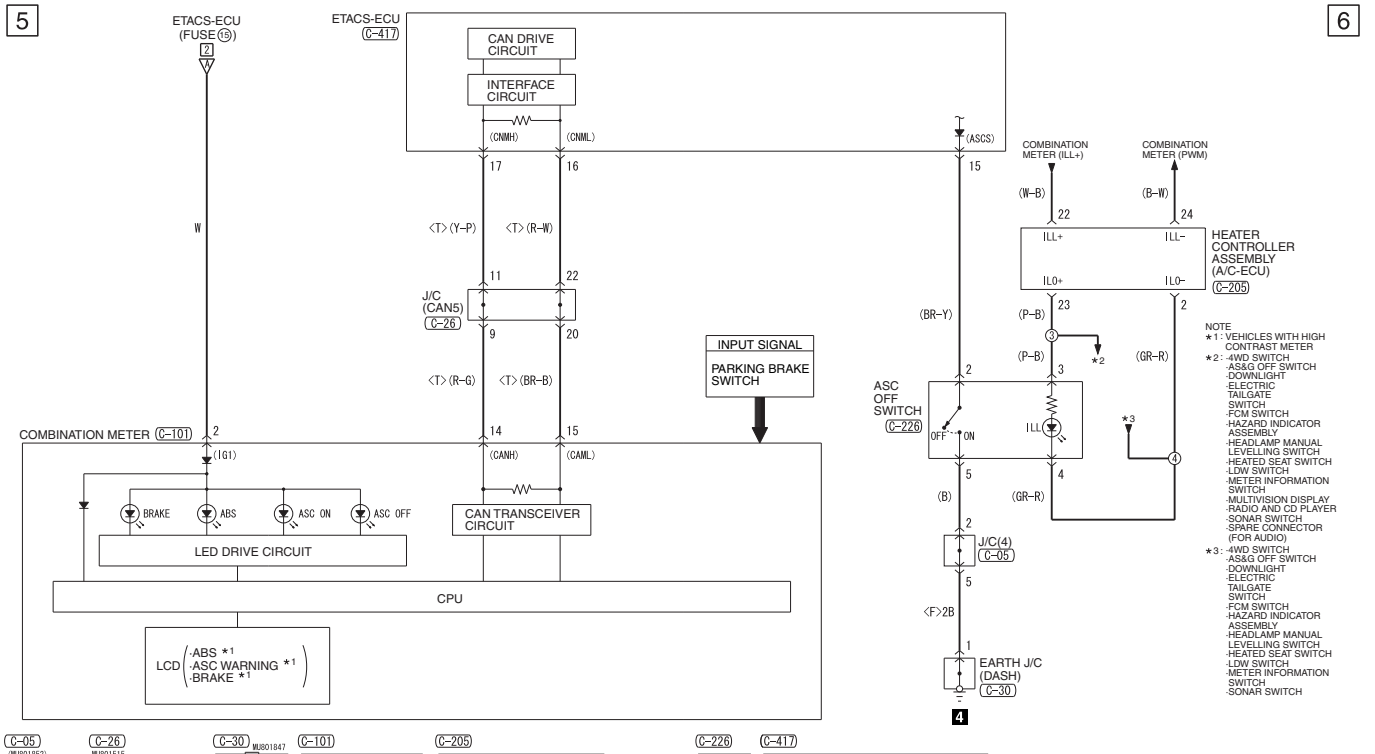
ACTIVE STABILITY CONTROL (ASC) AND HILL START ASSIST (HSA) <LHD> (CONTINUED)

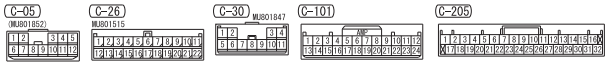


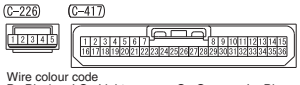
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0MBC

ACTIVE STABILITY CONTROL (ASC) AND HILL START ASSIST (HSA) <LHD> (CONTINUED)



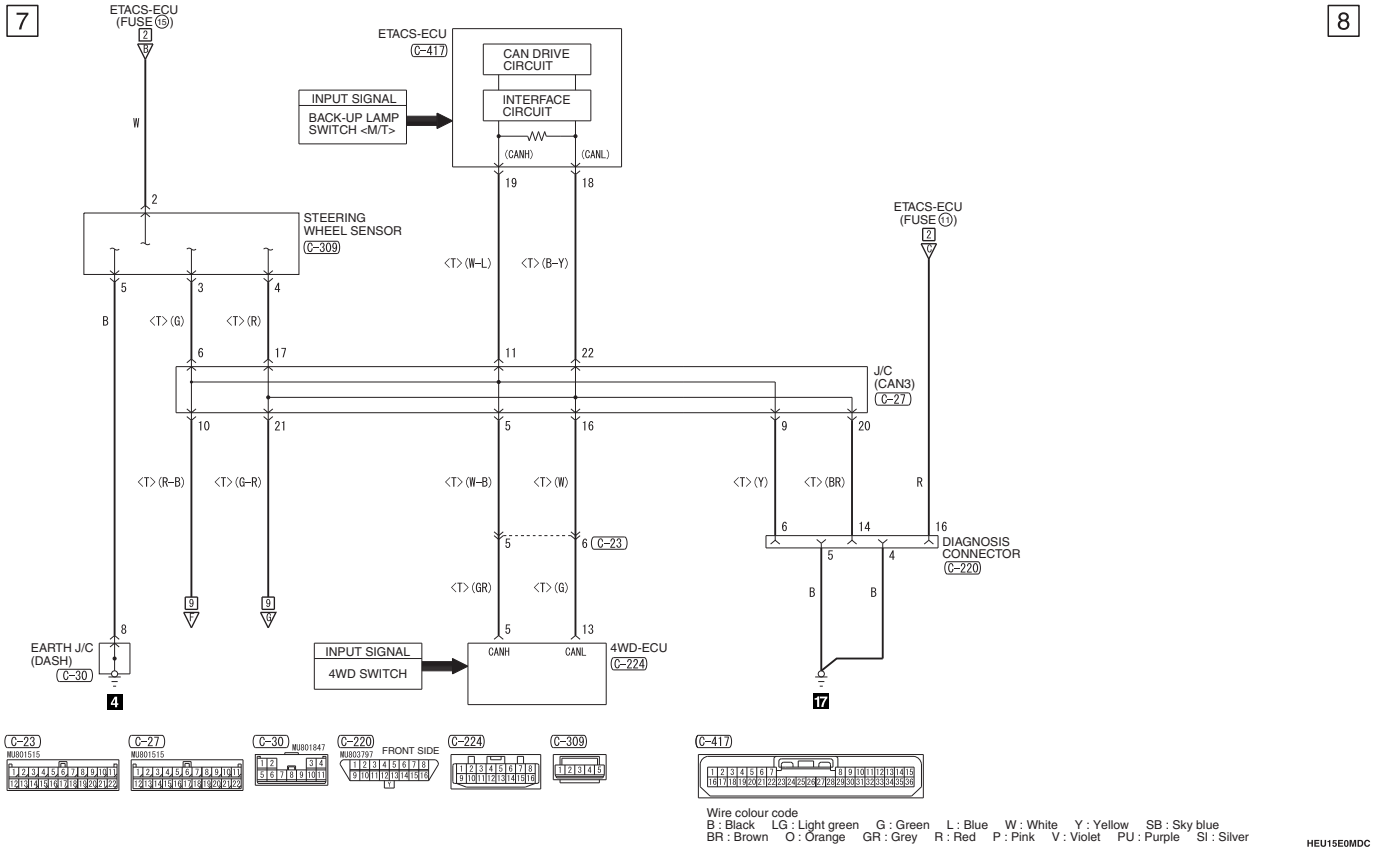




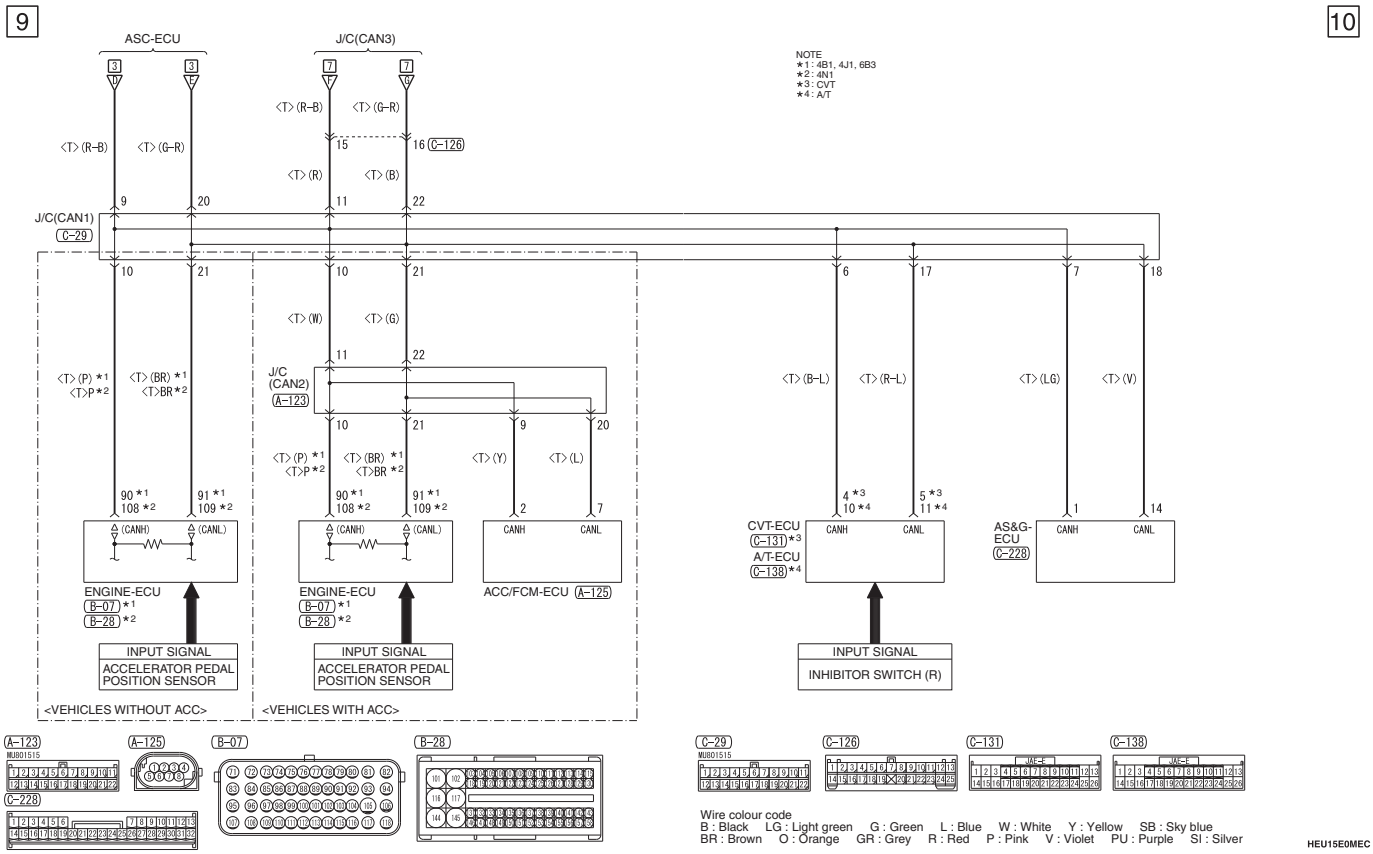
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0MCC

ACTIVE STABILITY CONTROL (ASC) AND HILL START ASSIST (HSA) <LHD> (CONTINUED)

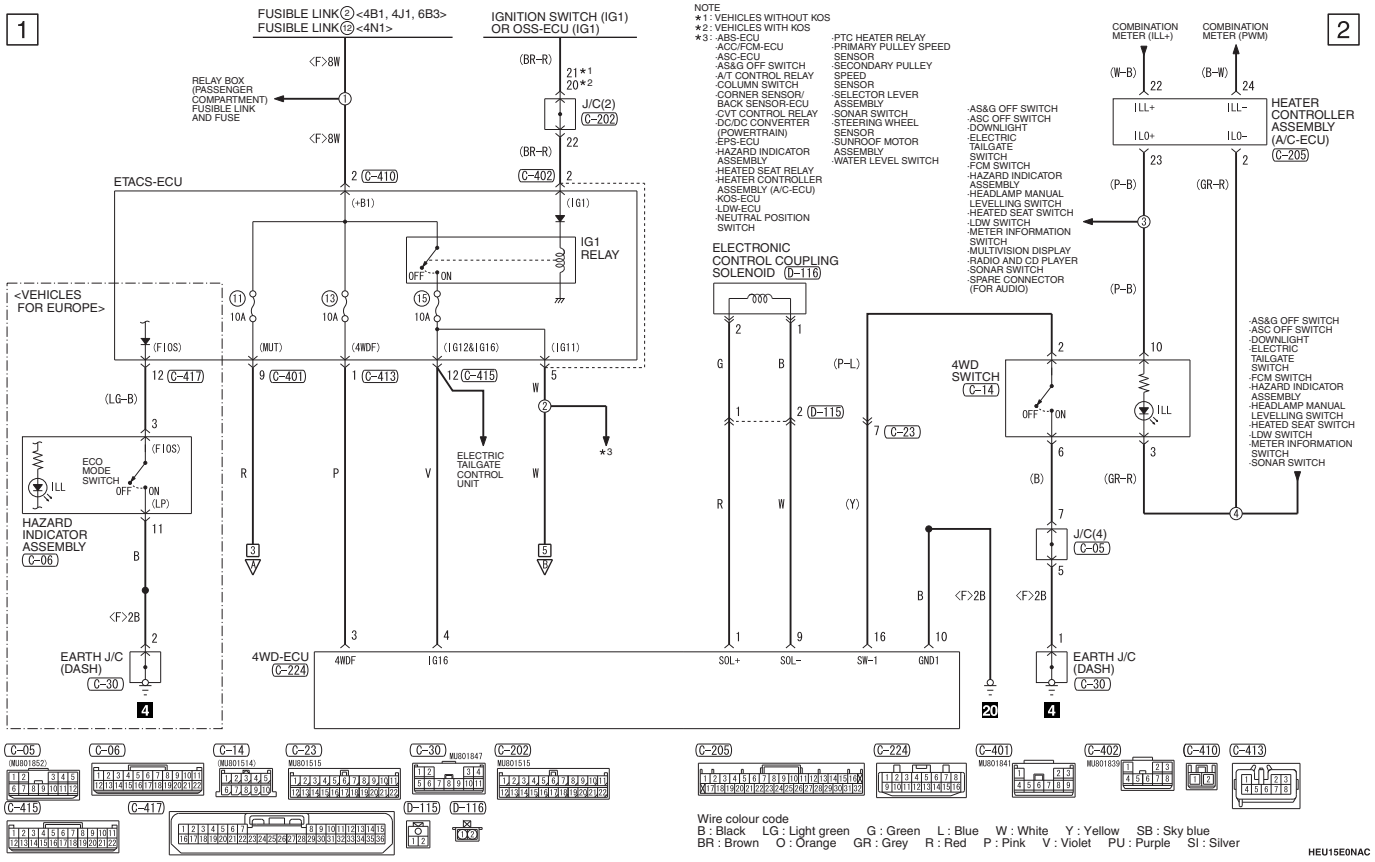


ACTIVE STABILITY CONTROL (ASC) AND HILL START ASSIST (HSA) <LHD> (CONTINUED)



ELECTRONIC CONTROLLED 4WD <LHD>

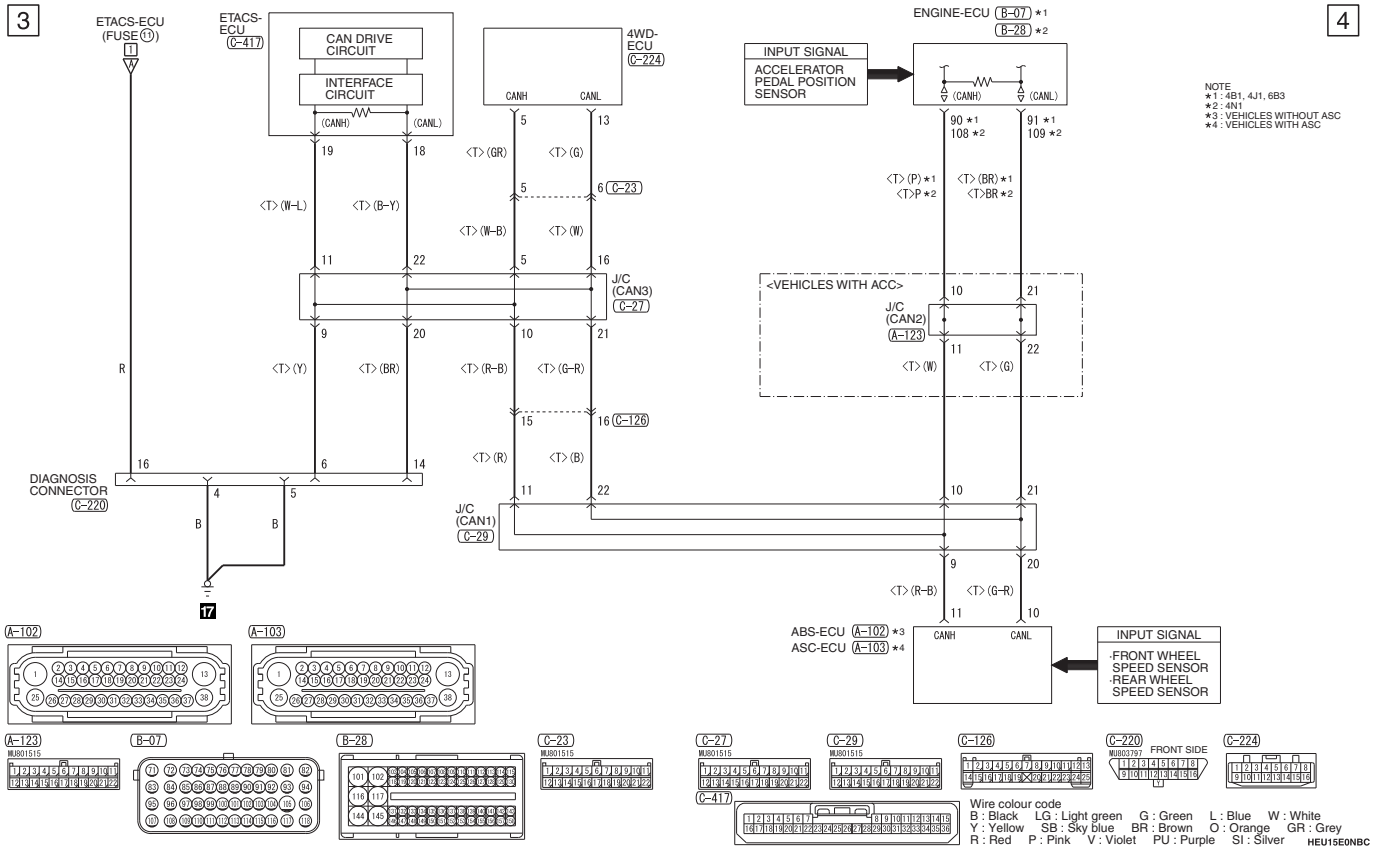
M1901027001037



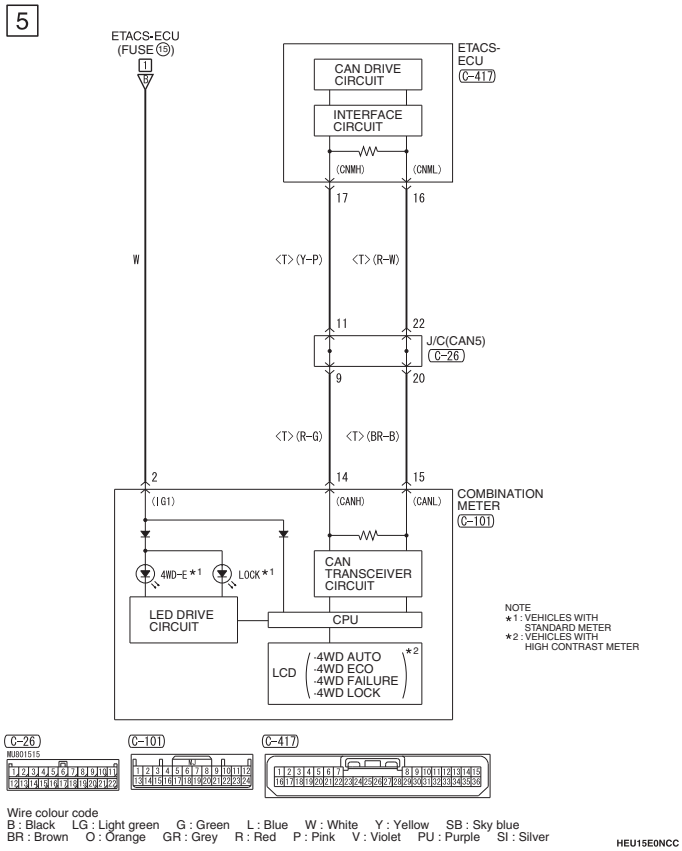
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0NAC

ELECTRONIC CONTROLLED 4WD <LHD> (CONTINUED)

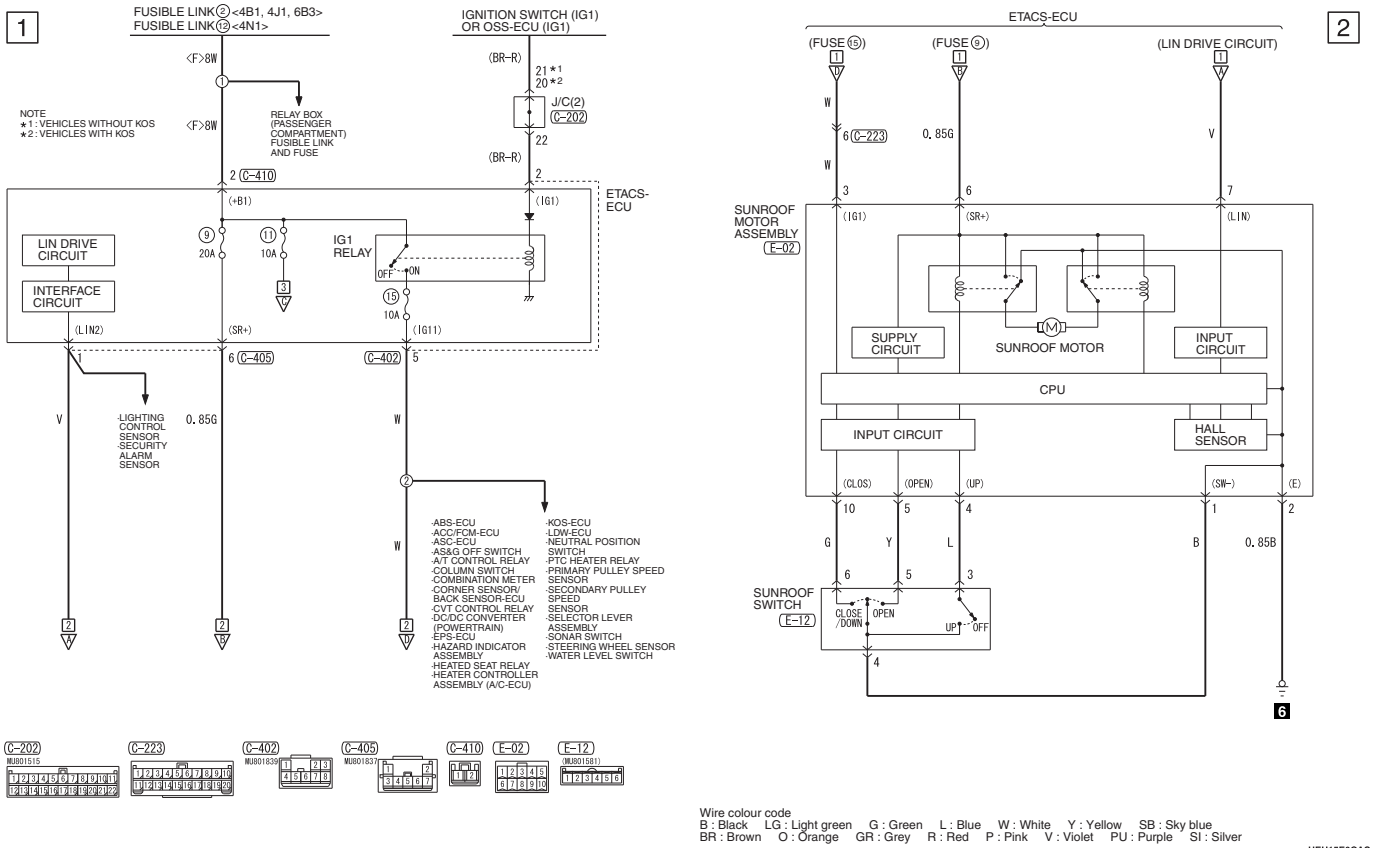


ELECTRONIC CONTROLLED 4WD <LHD> (CONTINUED)



SUNROOF

M1901009903643

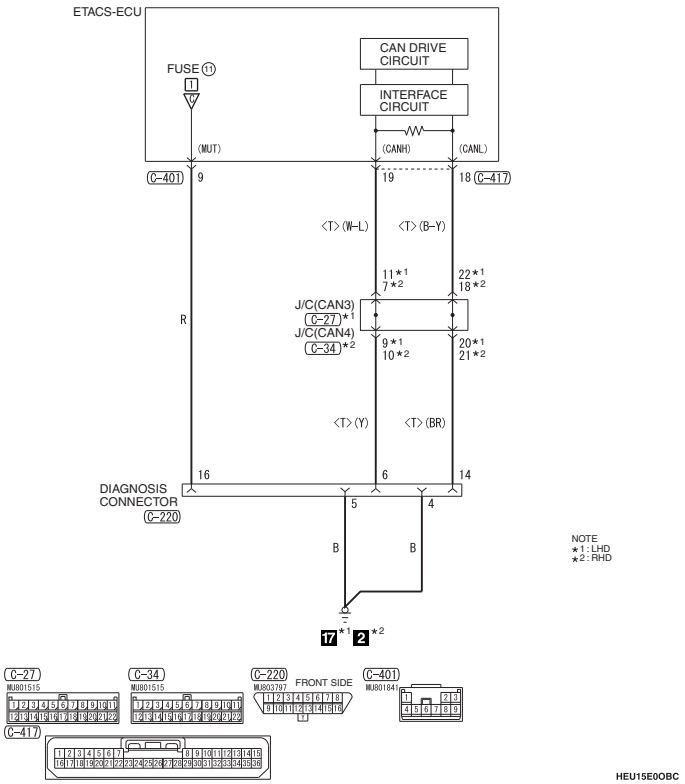


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0OAC

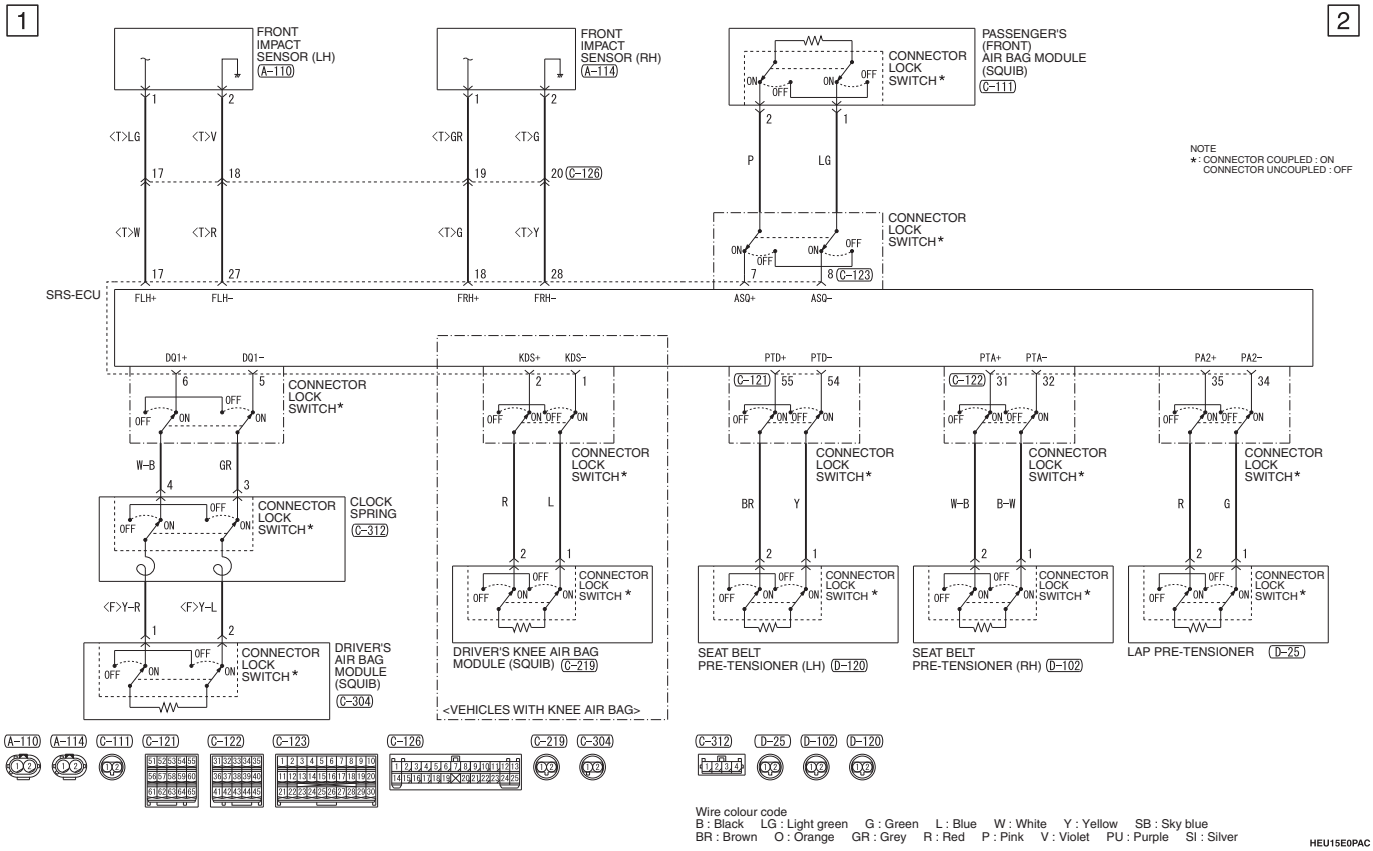
SUNROOF (CONTINUED)

3



SRS <LHD>

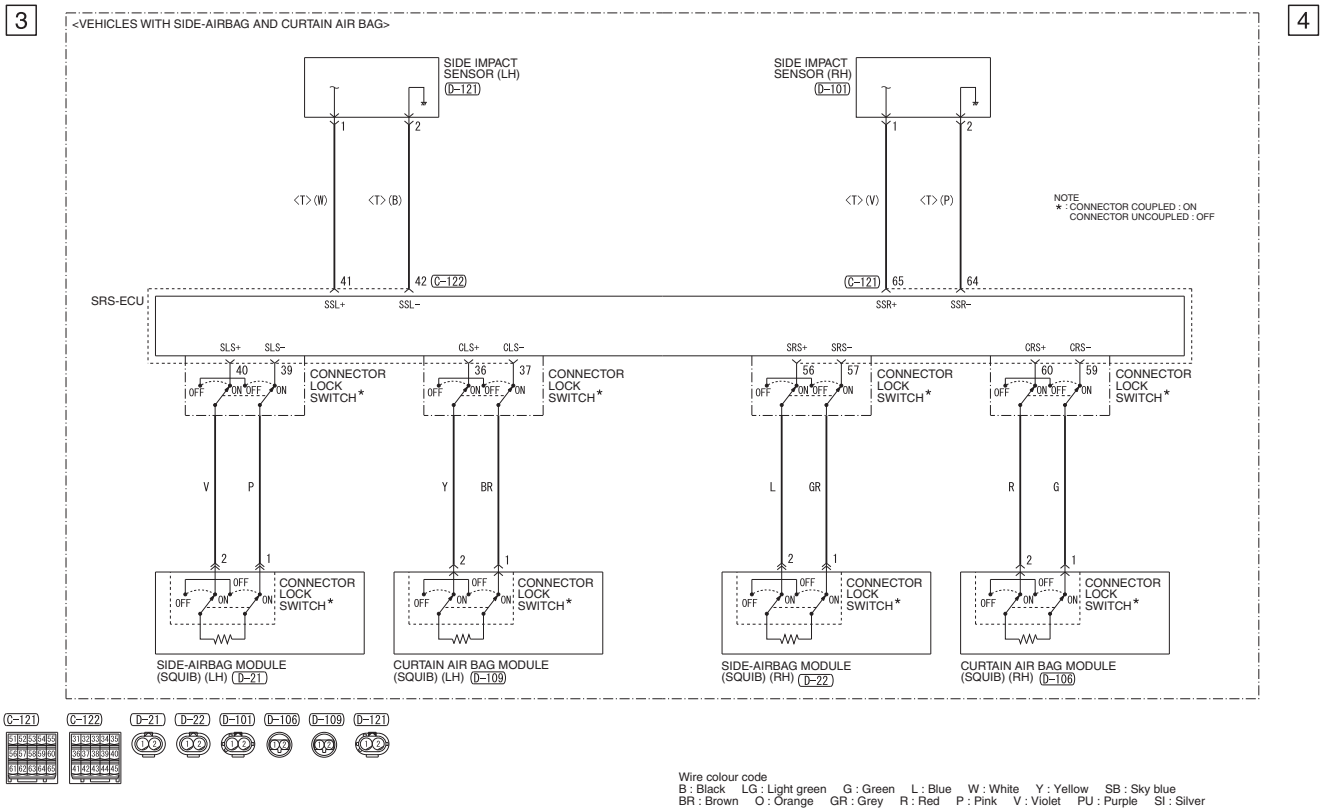
M1901021003013



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0PAC

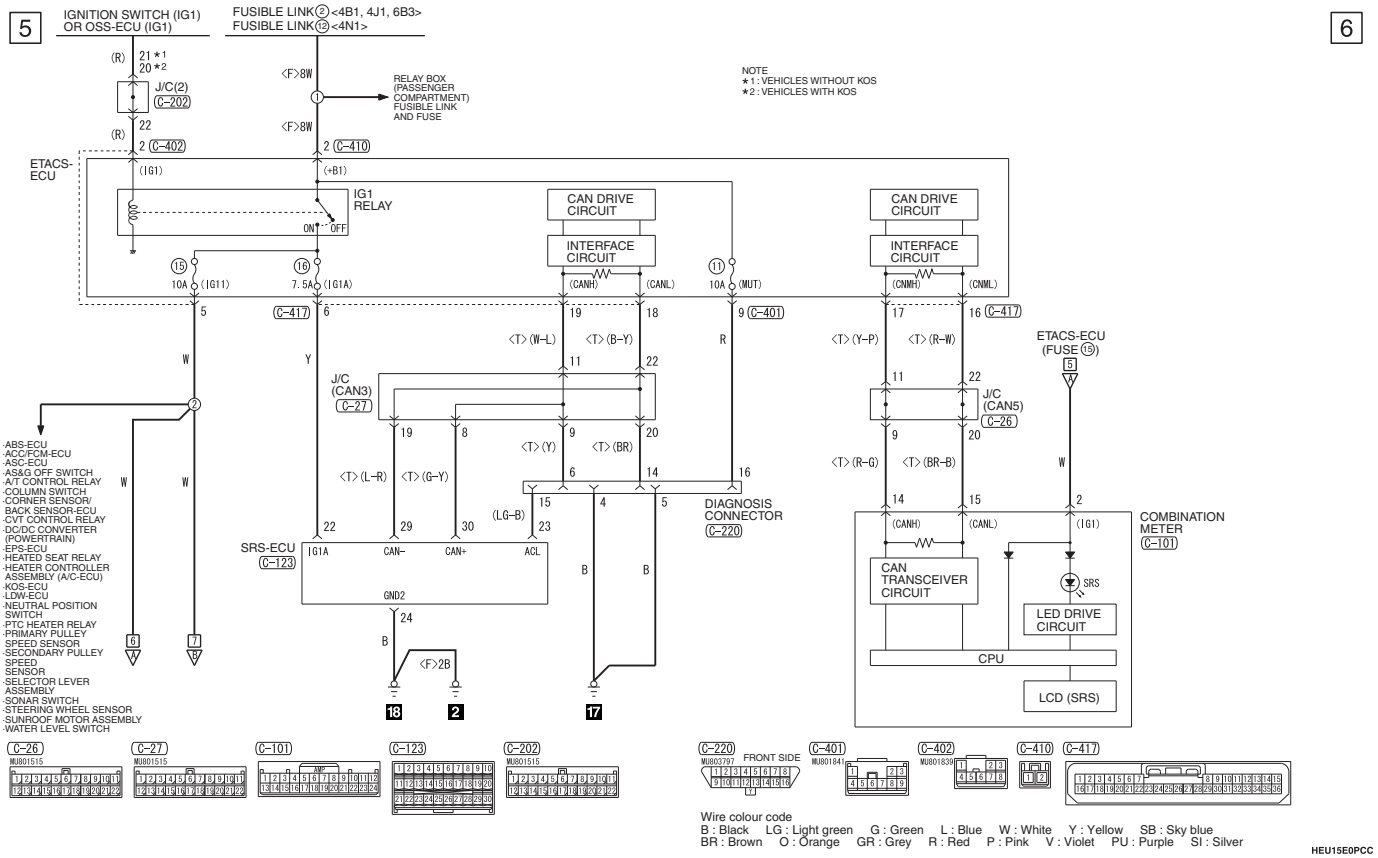
SRS <LHD> (CONTINUED)



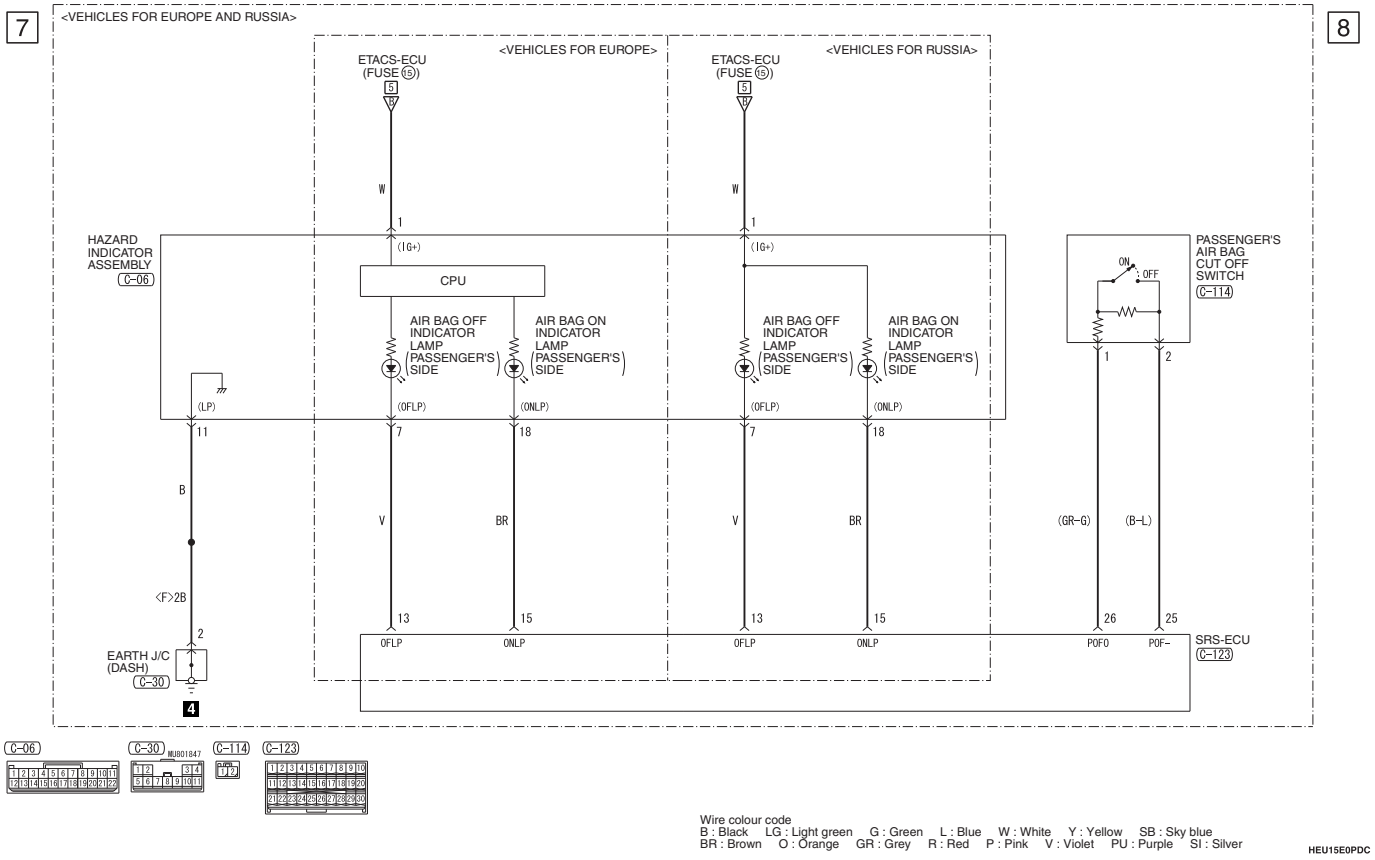
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0PBC

SRS <LHD> (CONTINUED)

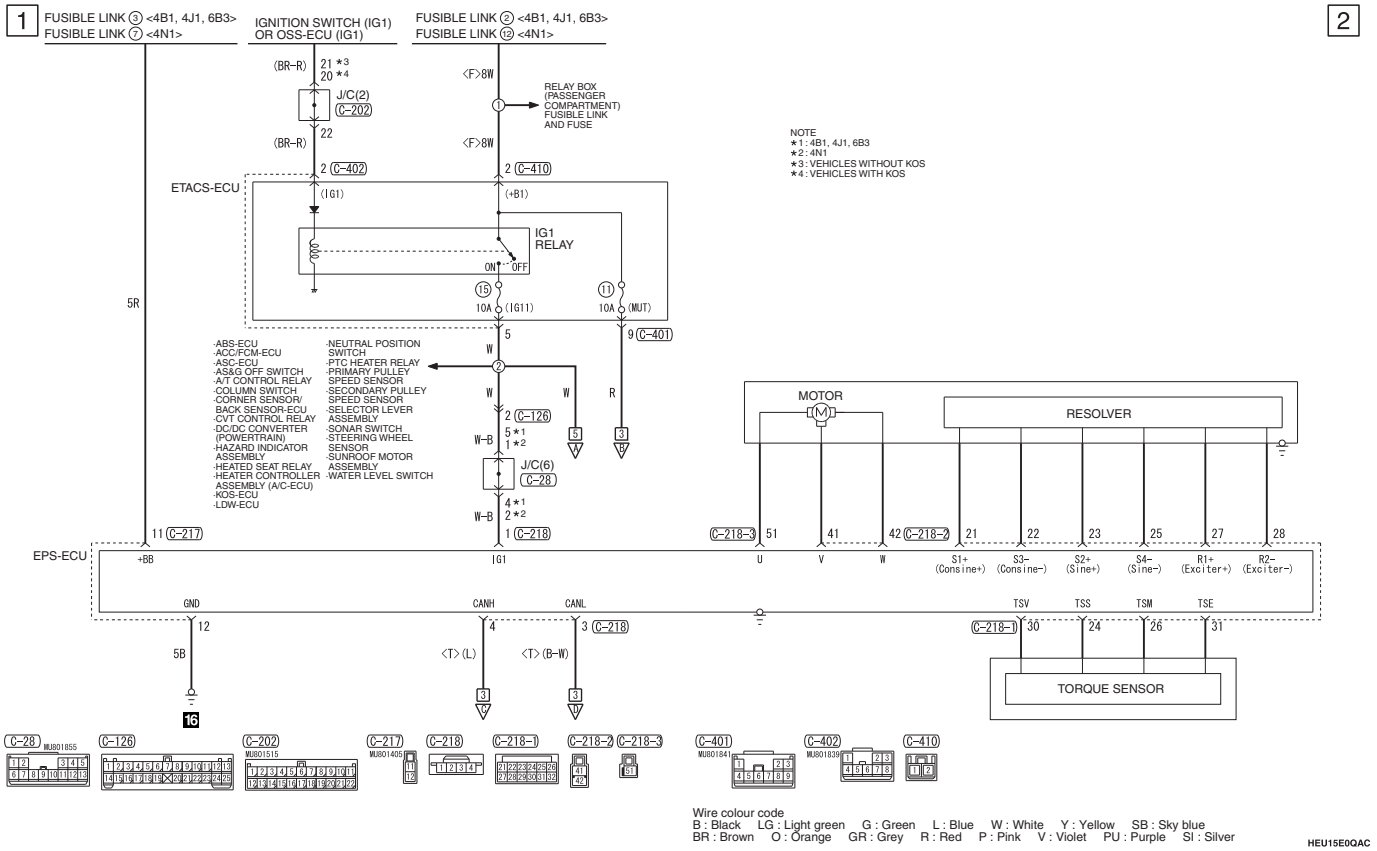


SRS <LHD> (CONTINUED)



ELECTRIC POWER STEERING SYSTEM <LHD>

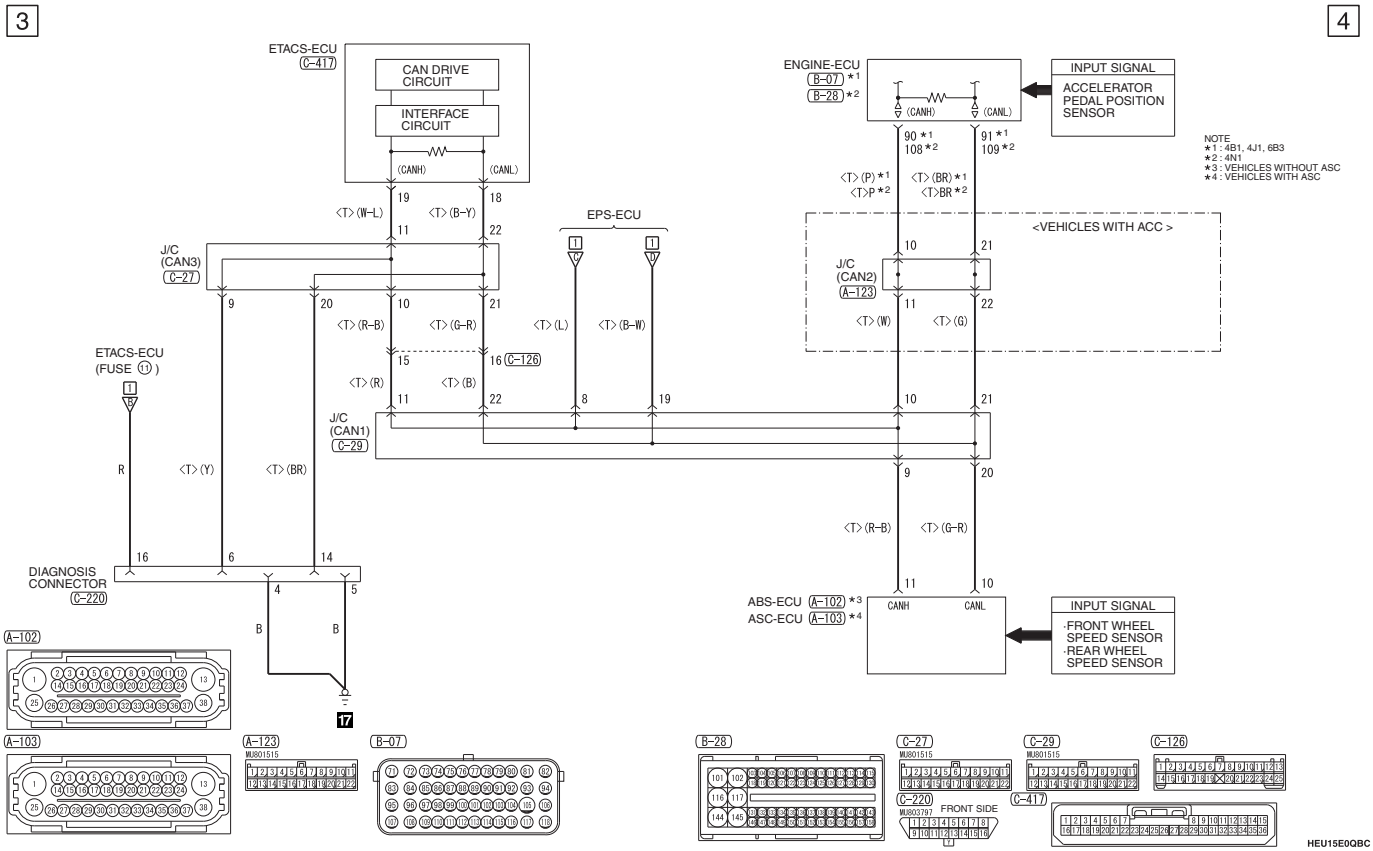
M1901021800849



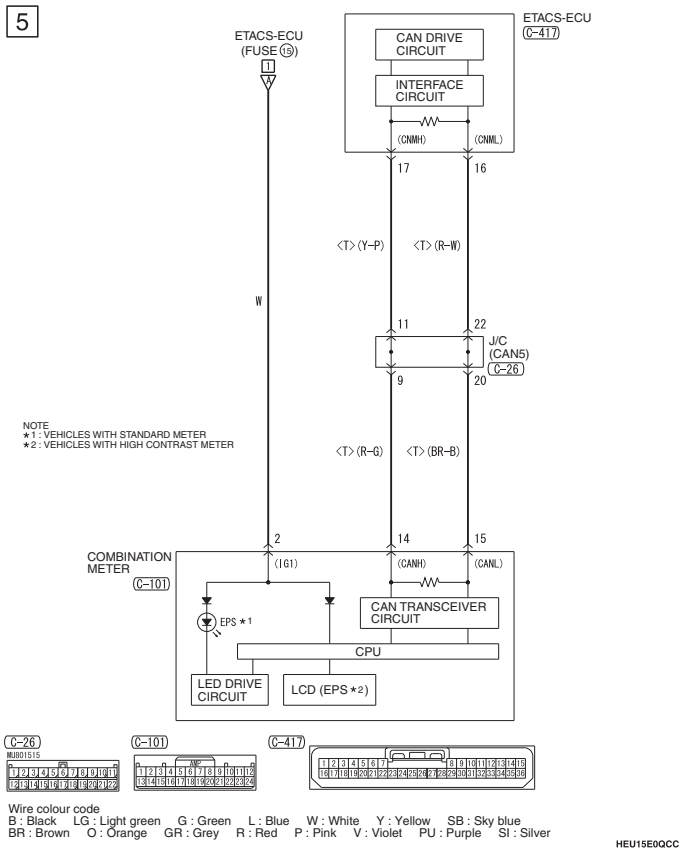
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0QAC

ELECTRIC POWER STEERING SYSTEM <LHD> (CONTINUED)

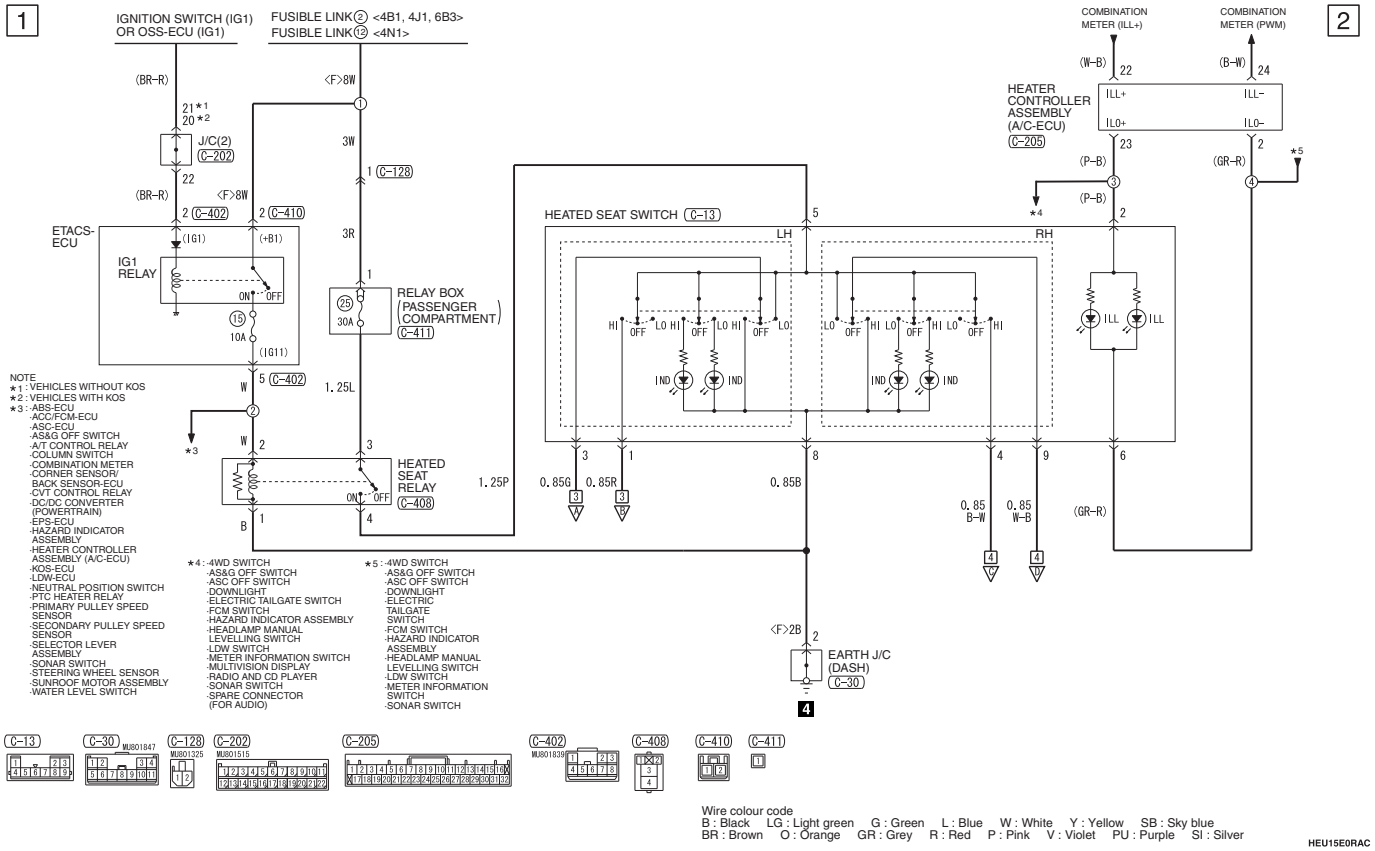


ELECTRIC POWER STEERING SYSTEM <LHD> (CONTINUED)

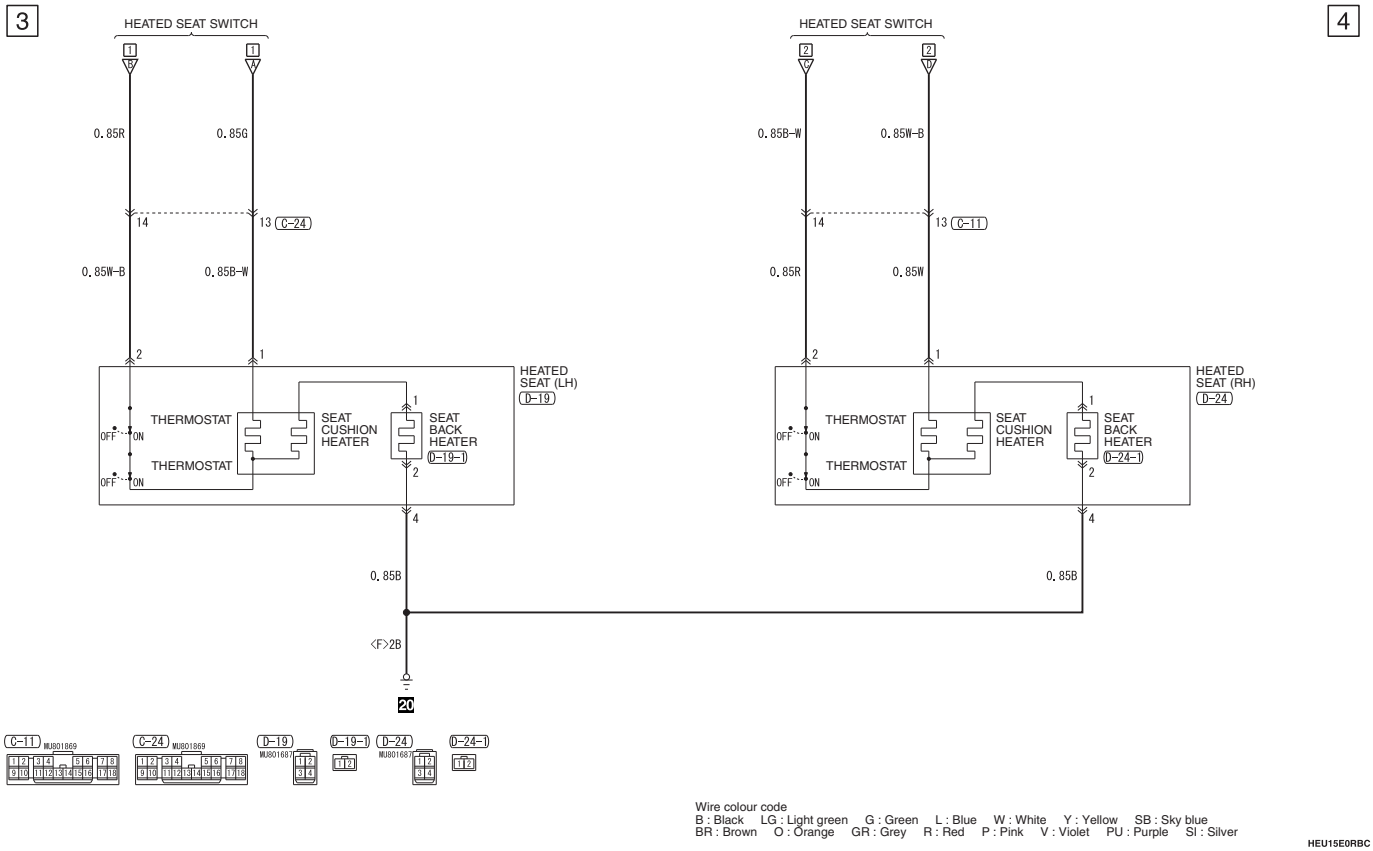


HEATED SEAT

M1901010702781



HEATED SEAT (CONTINUED)

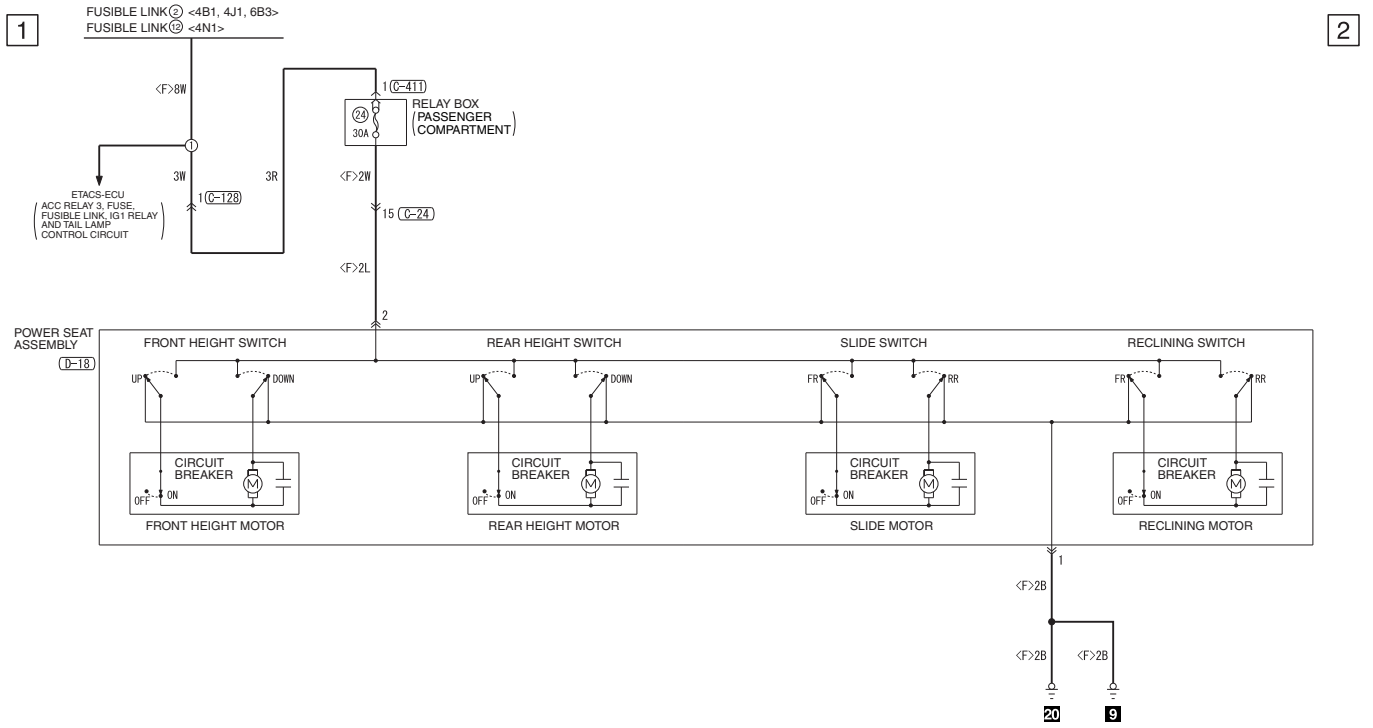


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0RBC

POWER SEAT

M1901010401679



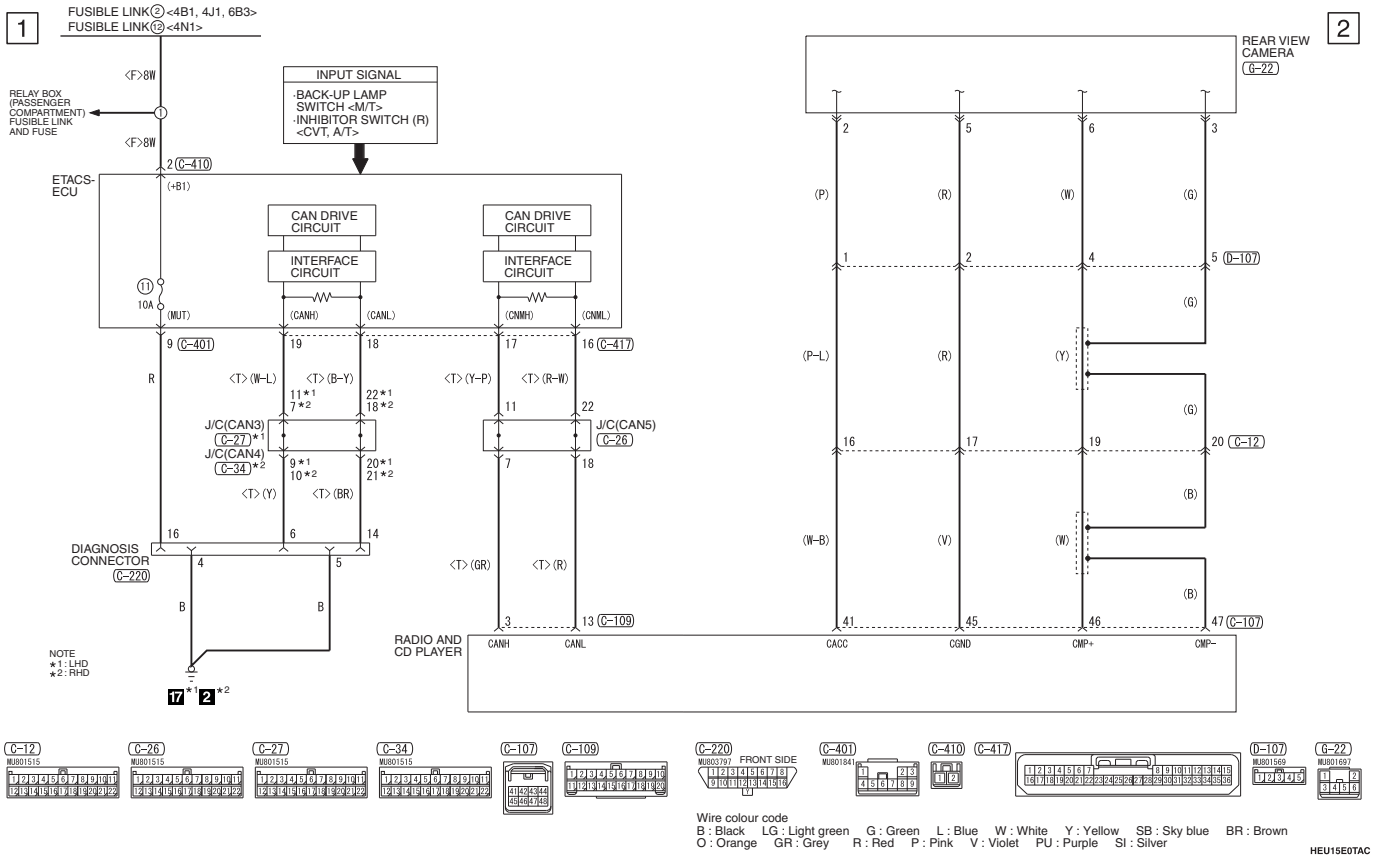


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0SAC

REAR VIEW CAMERA <VEHICLES WITH DISPLAY AUDIO>

M1901025600762

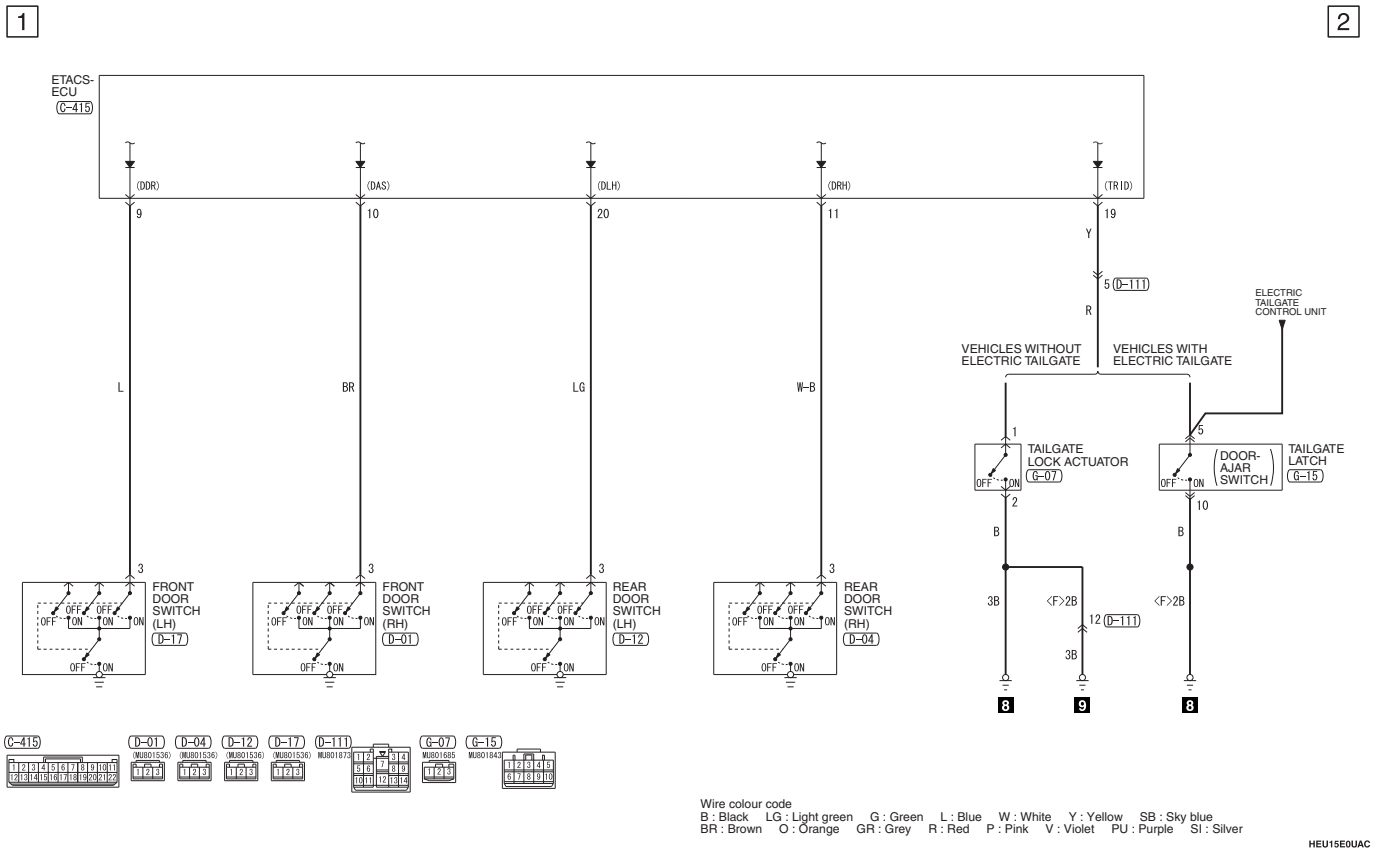


Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue BR : Brown
O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0TAC

DOOR AJAR WARNING BUZZER <LHD>

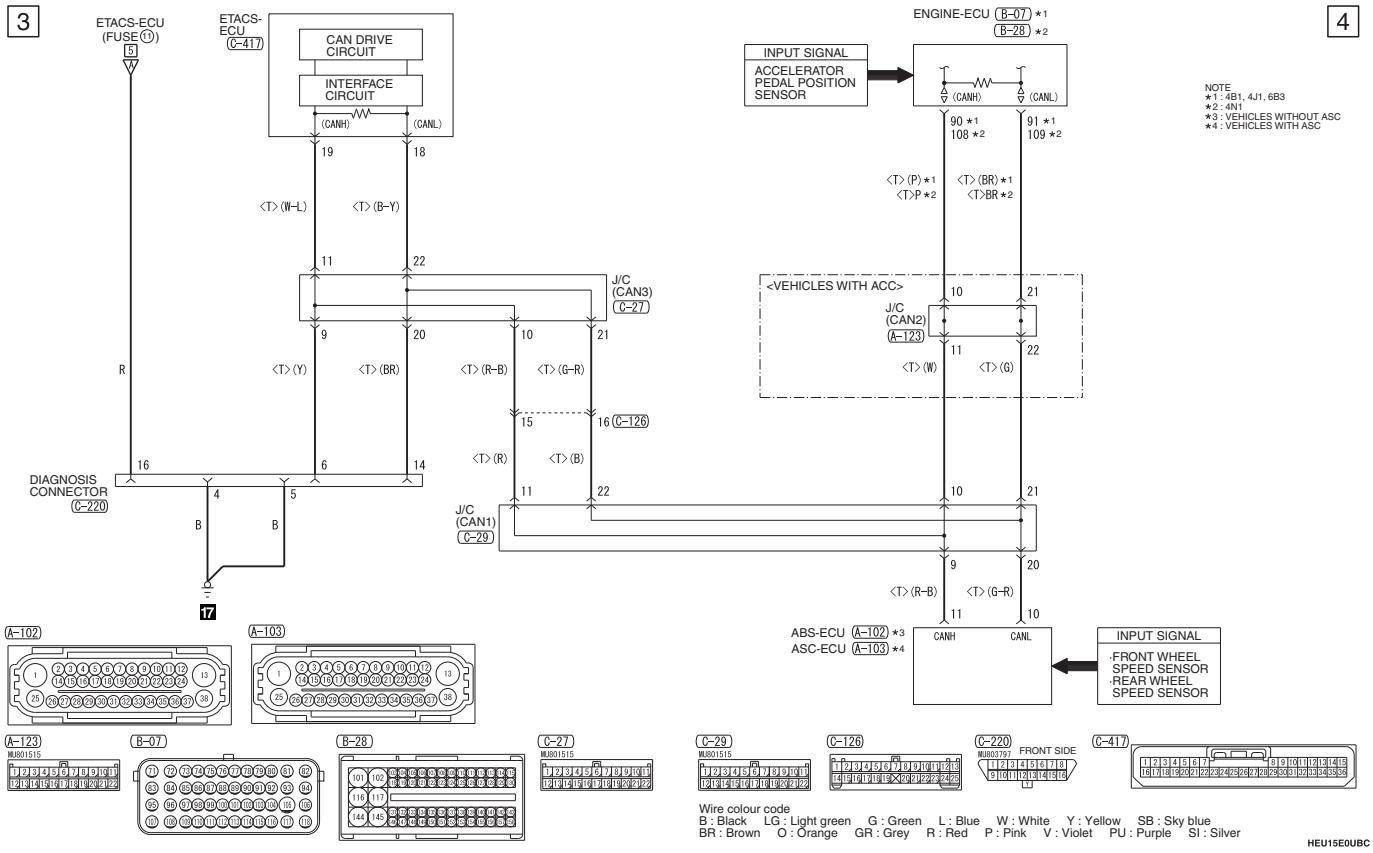
M1901016604249



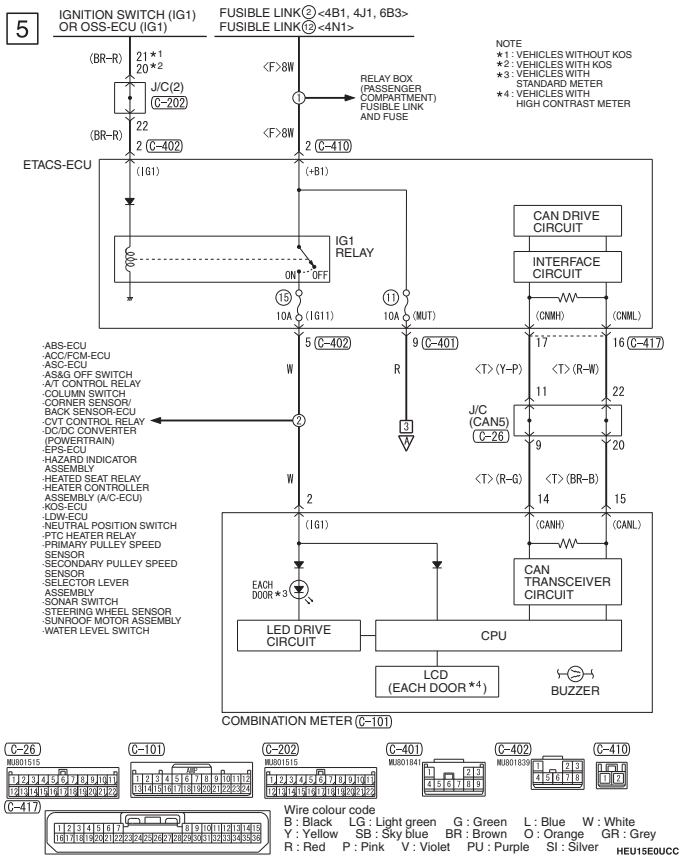
Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0UAC

DOOR AJAR WARNING BUZZER <LHD> (CONTINUED)

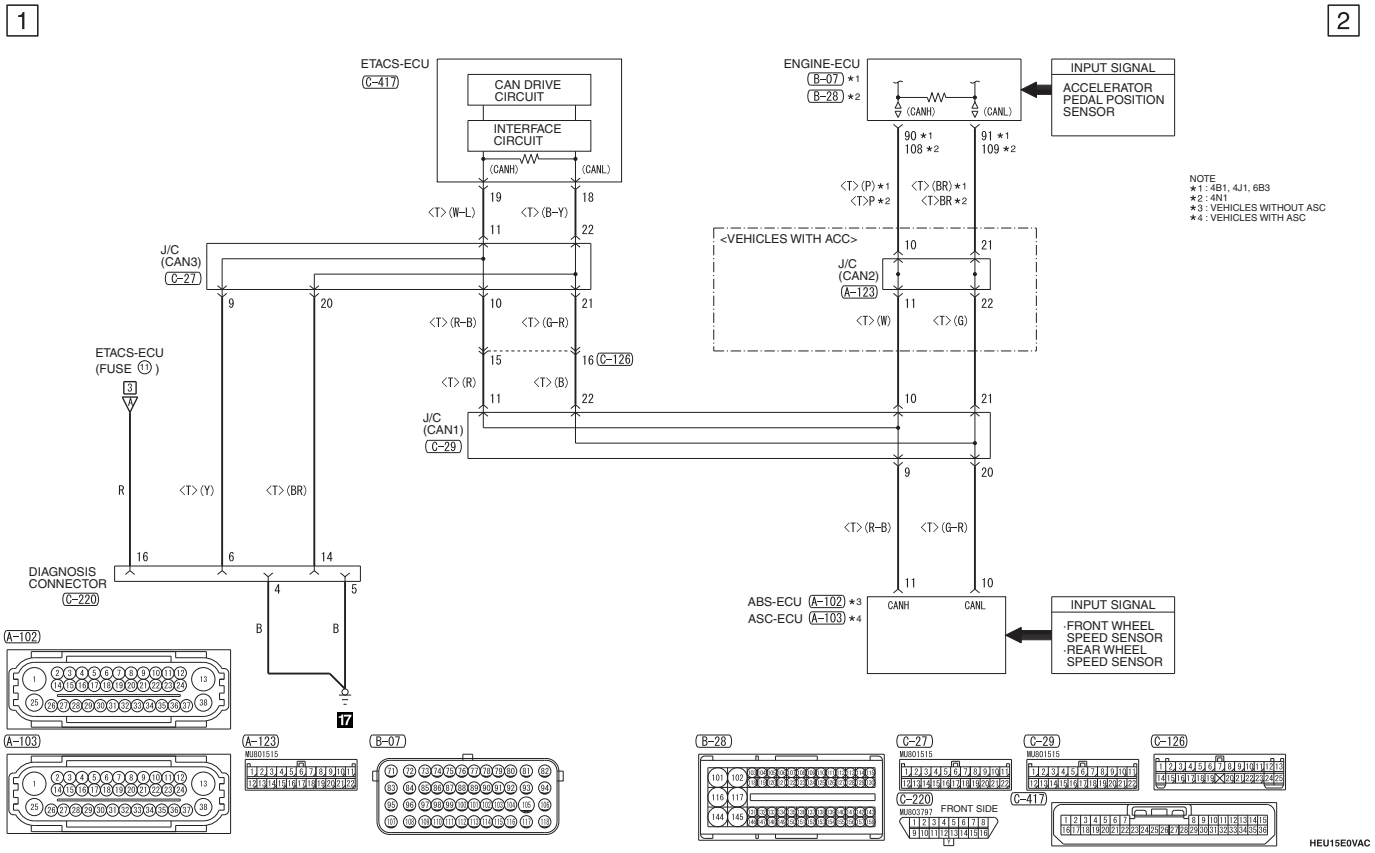


DOOR AJAR WARNING BUZZER <LHD> (CONTINUED)

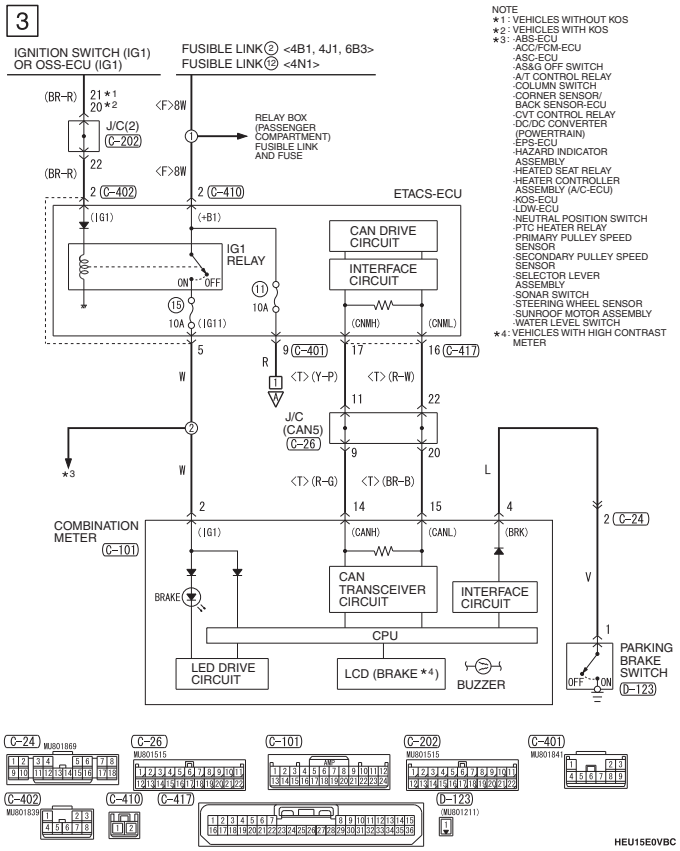


PARKING BRAKE REMINDER BUZZER <LHD>

M1901033501473

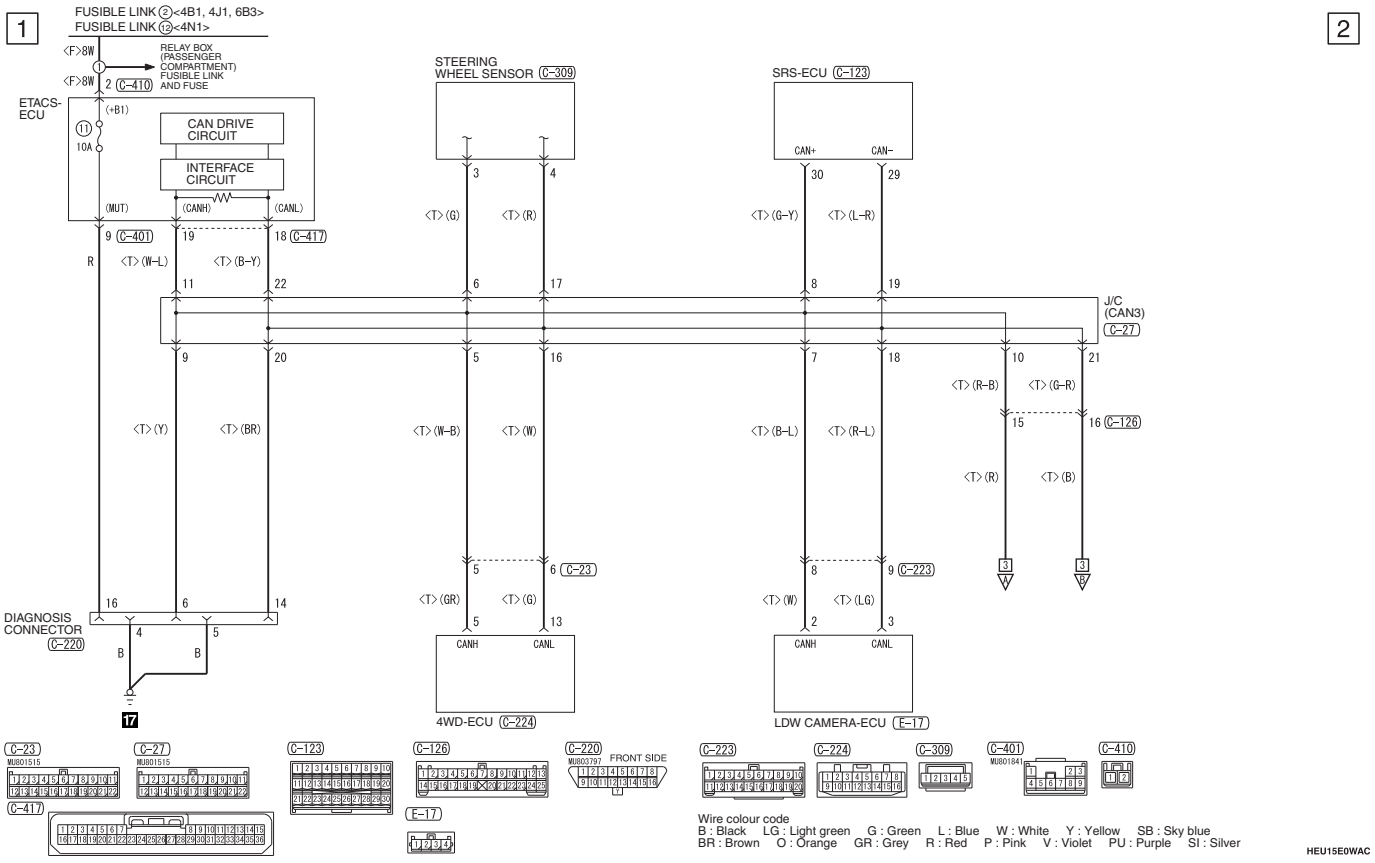


PARKING BRAKE REMINDER BUZZER <LHD>

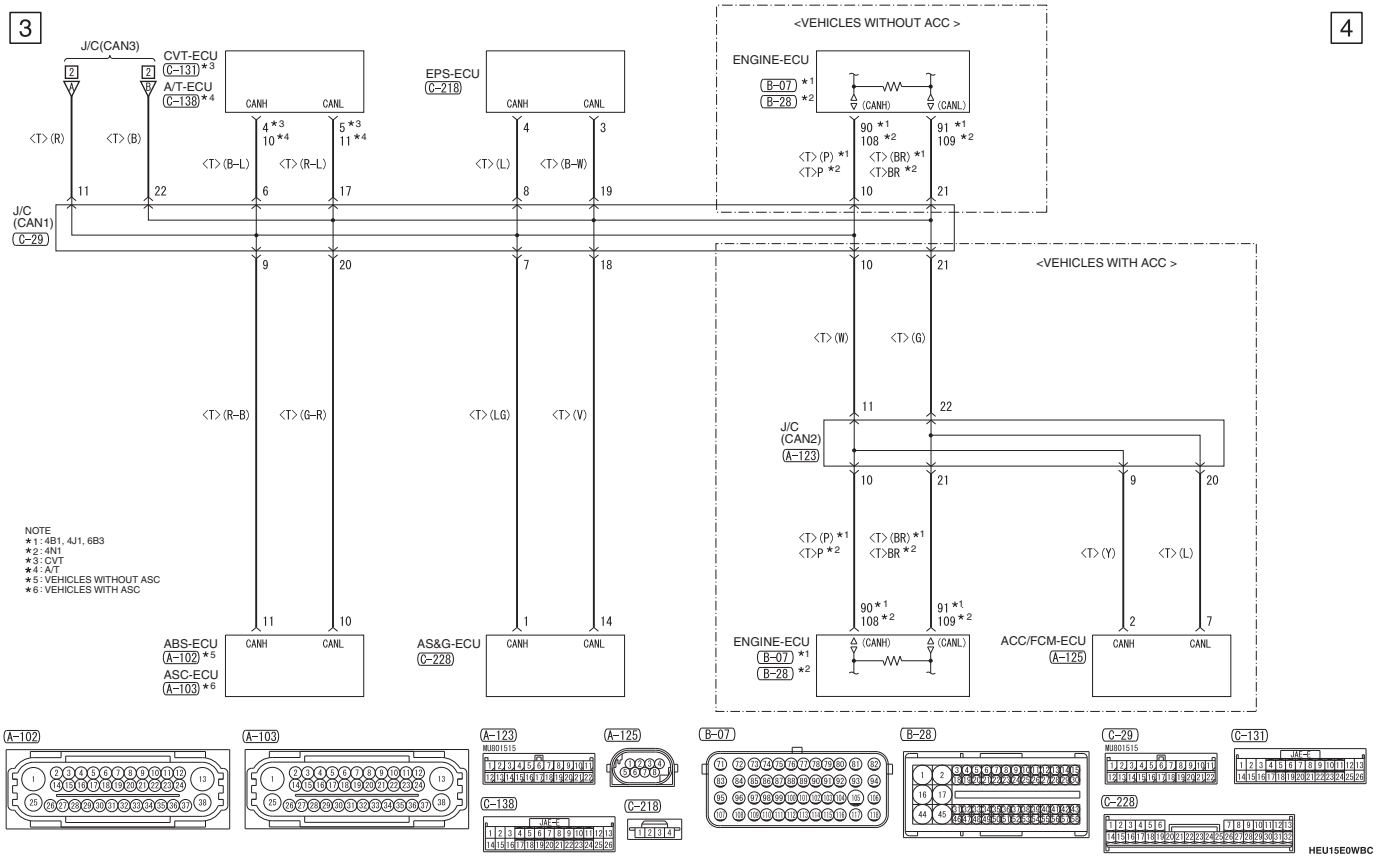


CAN <LHD>

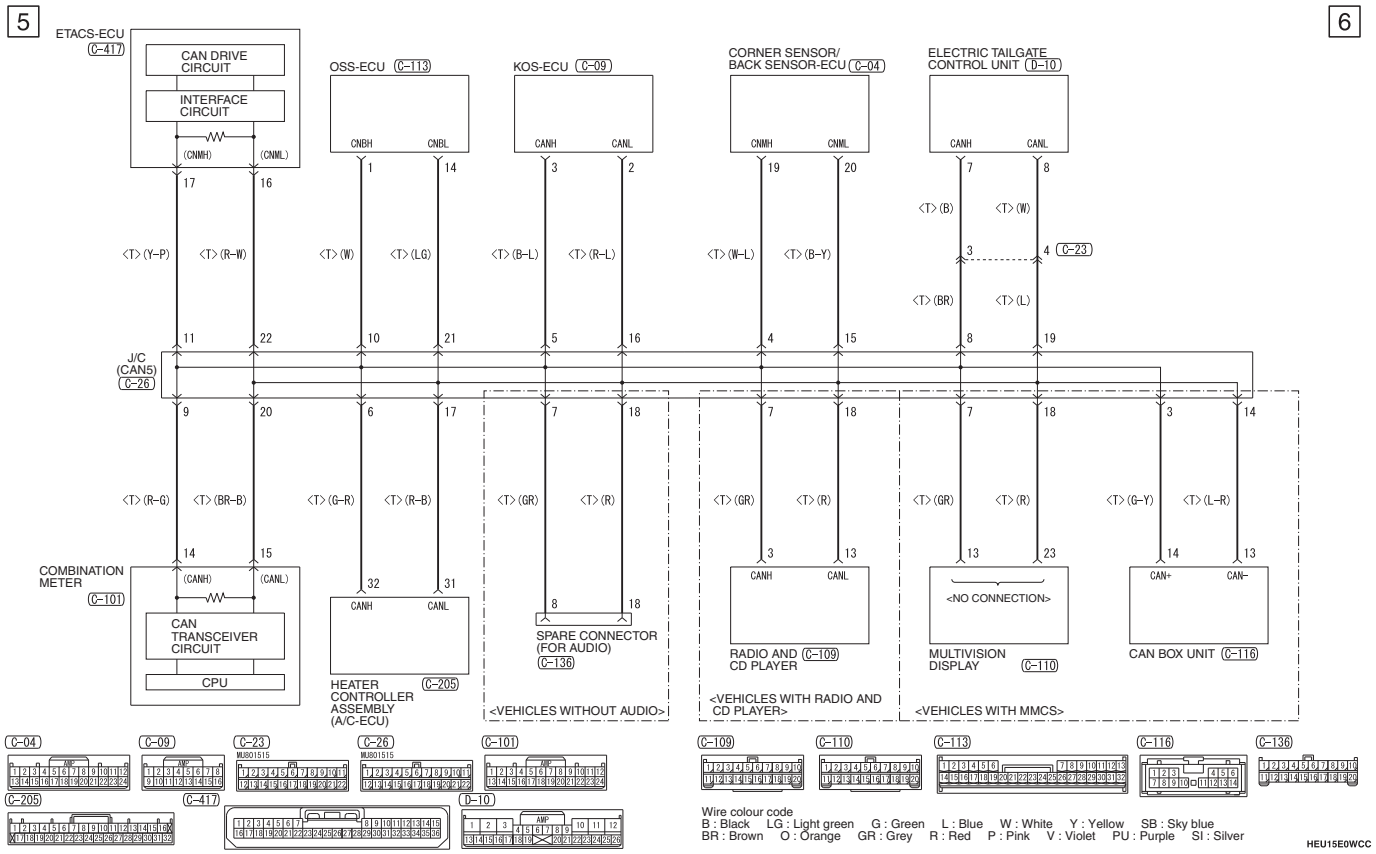
M1901021104121



CAN <LHD> (CONTINUED)

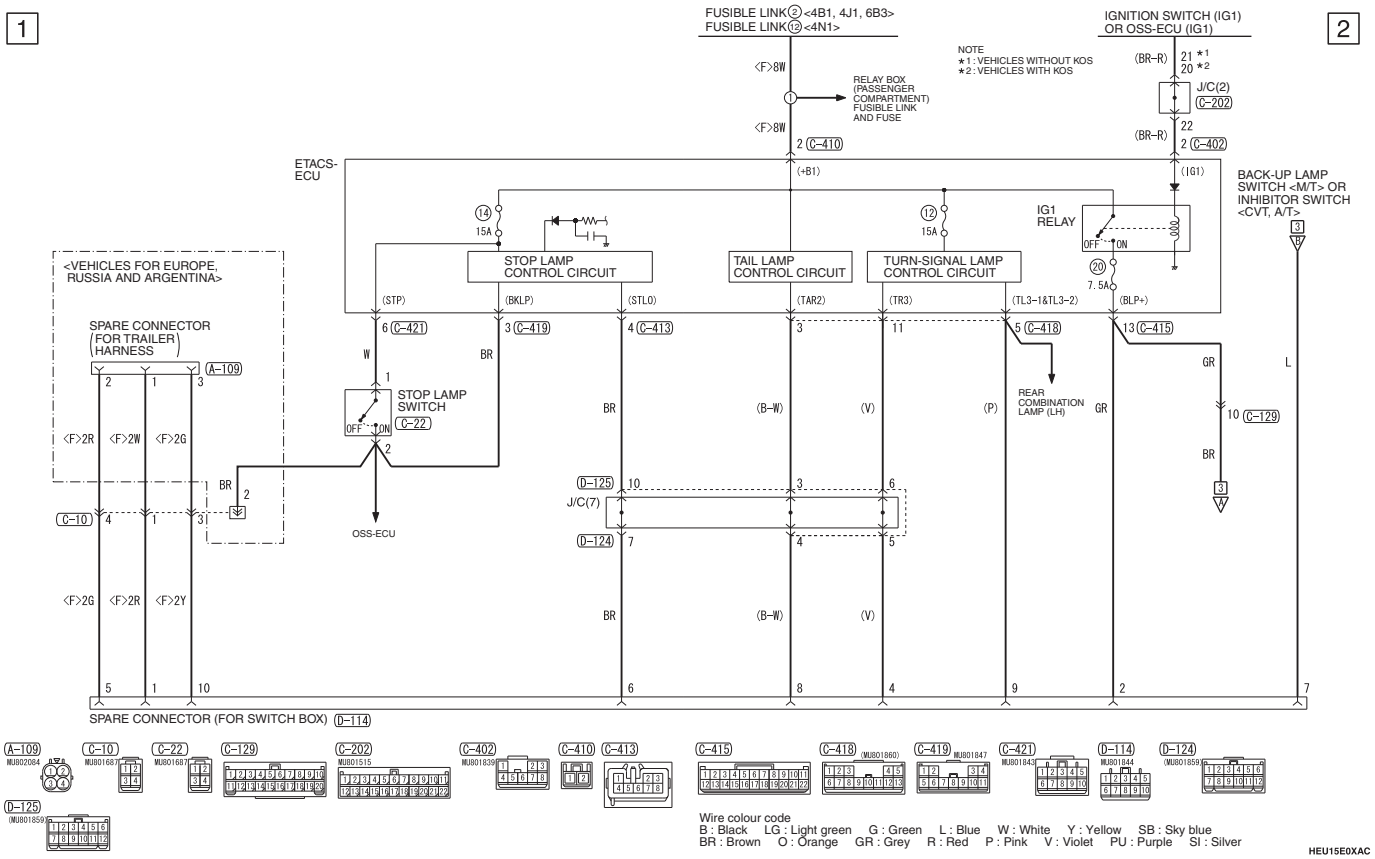


CAN <LHD> (CONTINUED)

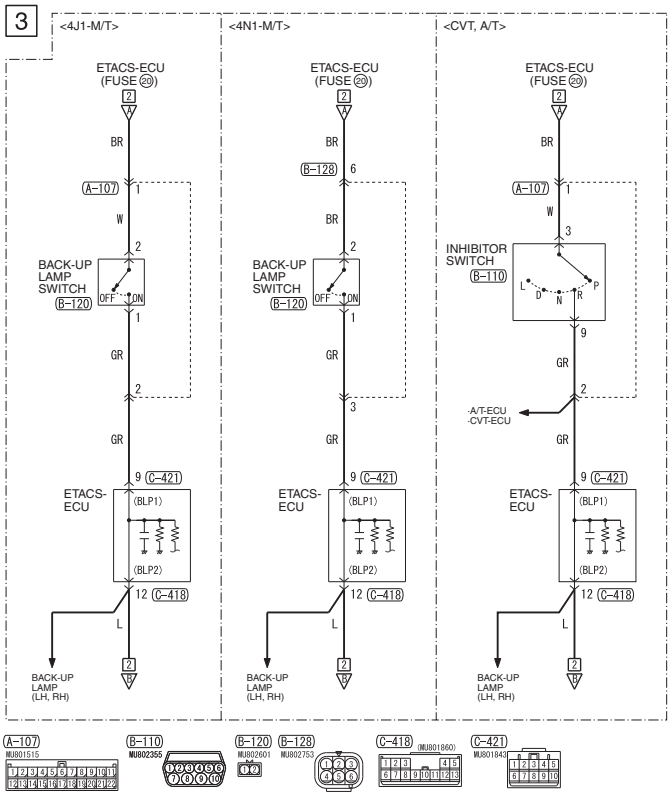


SPARE CONNECTOR (FOR TRAILER LAMPS)

M1901029701292



SPARE CONNECTOR (FOR TRAILER LAMPS) (CONTINUED)



Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple SI : Silver

HEU15E0XBC