

MULTIPOINT FUEL INJECTION (MPI)

NOTE: This group is not applicable to vehicles for Taiwan.

GENERAL INFORMATION

The Multipoint Fuel Injection System consists of sensors which detect the engine conditions, the engine-ECU <M/T> or engine-A/T-ECU <A/T> which controls the system based on signals from these sensors, and actuators which operate under the control of the engine-ECU <M/T> or engine-A/T-ECU <A/T>.

The engine-ECU <M/T> or engine-A/T-ECU <A/T> carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the engine-ECU <M/T> or engine-A/T-ECU <A/T> is equipped with several diagnosis modes which simplify troubleshooting when a problem develops.

FUEL INJECTION CONTROL

The injector drive times and injector 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 <M/T> or engine-A/T-ECU <A/T> 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 <M/T> or engine-A/T-ECU <A/T> 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.

IDLE AIR CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that bypasses the throttle valve in accordance with changes in idling conditions and engine load during idling. The engine-ECU <M/T> or engine-A/T-ECU <A/T> drives the idle speed control (ISC) motor to keep the engine running at the pre-set idle target speed in accordance with

the engine coolant temperature and air conditioner load. In addition, when the air conditioner switch is turned off and on while the engine is idling, the ISC motor operates to adjust the throttle valve bypass air amount in accordance with the engine load conditions in order 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 <M/T> or engine-A/T-ECU <A/T> from the engine speed, intake air volume, engine coolant temperature and atmospheric pressure.

SELF-DIAGNOSIS FUNCTION

1. 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.
2. When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
3. The RAM data inside the engine-ECU <M/T> or engine-A/T-ECU <A/T> that is related to the sensors and actuators can be read by means of the MUT-II. 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 Relay Control
Turns the compressor clutch of the A/C ON and OFF.
3. Purge Control Solenoid Valve Control
Refer to GROUP 17.
4. EGR Control Solenoid Valve Control
Refer to GROUP 17.

GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	60
	Throttle position sensor	Variable resistor type
	Idle speed control servo	Stepper motor type (Stepper motor type by-pass air control system with the air volume limiter)
Engine-ECU <M/T>	Identification model No.	E2T79471 <Australia> E2T79472 <General Export-6G72 for LHD without catalytic converter, GCC-6G72> E2T79473 <General Export-6G72 for RHD> E2T79474 <General Export-6G74 for LHD without catalytic converter, GCC-6G74> E2T79477 <General Export-6G74 for RHD> E2T79478 <Brazil> E2T79479 <General Export-6G72 for LHD with catalytic converter> E2T79480 <General Export-6G74 for LHD with catalytic converter> E2T79481 <South Africa-6G72> E2T79482 <South Africa-6G74>
Engine-A/T- ECU <A/T>	Identification model No.	E2T79374 <Australia> E2T79375 <General Export-6G72 for LHD without catalytic converter> E2T79376 <General Export-6G72 for RHD without catalytic converter> E2T79377 <General Export-6G74 for LHD without catalytic converter, GCC-6G74> E2T79383 <General Export-6G74 for RHD, GCC-6G72> E2T79384 <Brazil-6G72> E2T79385 <Brazil-6G74> E2T79386 <General Export-6G72 for RHD with catalytic converter> E2T79387 <General Export-6G72 for LHD with catalytic converter> E2T79388 <General Export-6G74 for RHD with catalytic converter> E2T79390 <South Africa>

Items		Specifications
Sensors	Air flow sensor	Karman vortex type
	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type <Vehicles with catalytic converter>
	Vehicle speed sensor	Magnetic resistive element type
	Camshaft position sensor	Hall element type
	Crank angle sensor	Hall element type
	Power steering fluid pressure switch	Contact switch type
Actuators	Control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector type and number	Electromagnetic type, 6
	Injector identification mark	EDH210 <6G72> EDH240 <6G74>
Fuel pressure regulator	Regulator pressure kPa	329

SYSTEM DIAGRAM

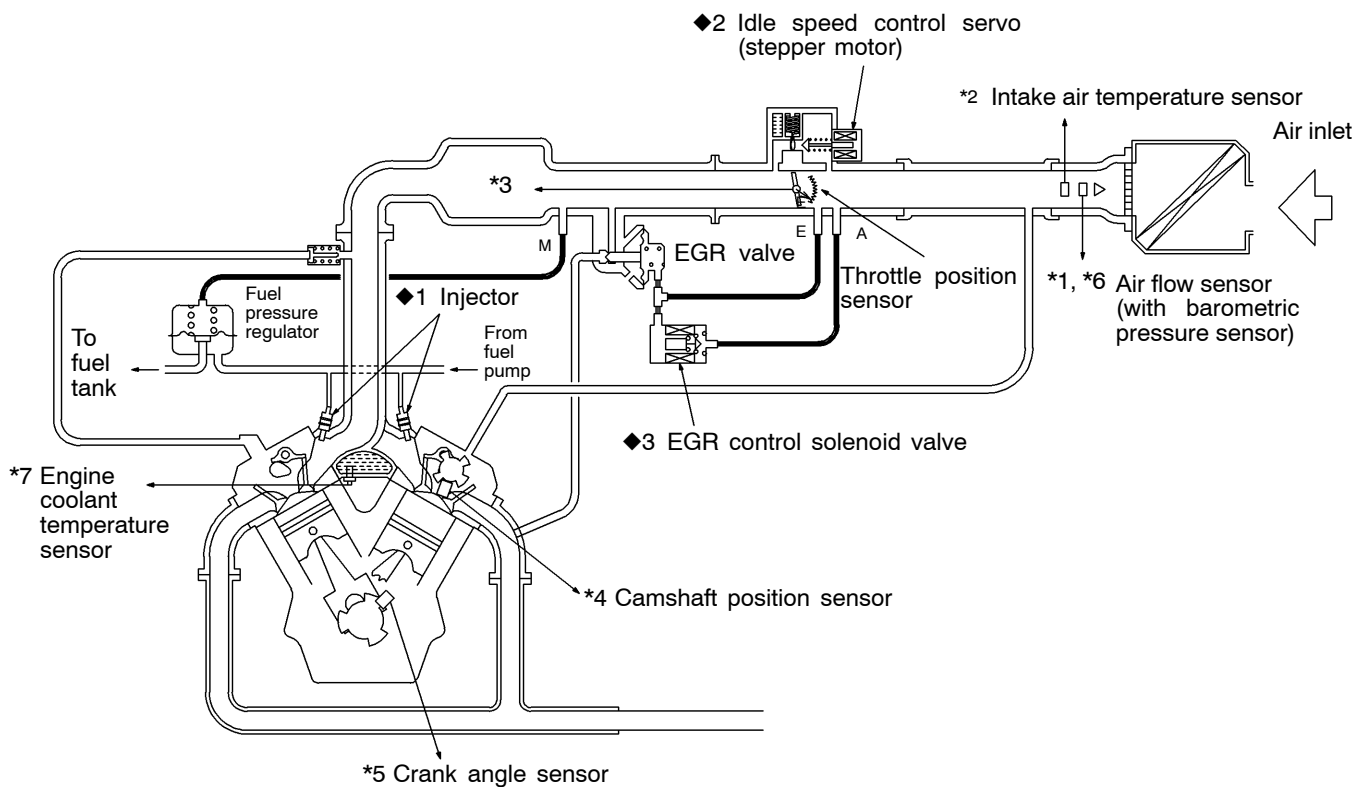
<Vehicles for General Export without catalytic converter, South Africa>

- *1. Air flow sensor
- *2. Intake air temperature sensor
- *3. Throttle position sensor
- *4. Camshaft position sensor
- *5. Crank angle sensor
- *6. Barometric pressure sensor
- *7. Engine coolant temperature sensor

- Power supply
- Vehicle speed sensor
- A/C switch
- Inhibitor switch
- Power steering fluid pressure switch
- Ignition switch-ST
- Ignition switch-IG

⇒ Engine-ECU
<M/T> or En-
gine-A/T-ECU
<A/T>

- ◆1 Injector
 - ◆2 Idle speed control servo
 - ◆3 EGR control solenoid valve
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- Fuel pump relay
 - Control relay
 - A/C power relay
 - Condenser fan relay
 - Engine warning lamp
 - Diagnosis signal
 - Ignition coil, power transistor



X 6188CA

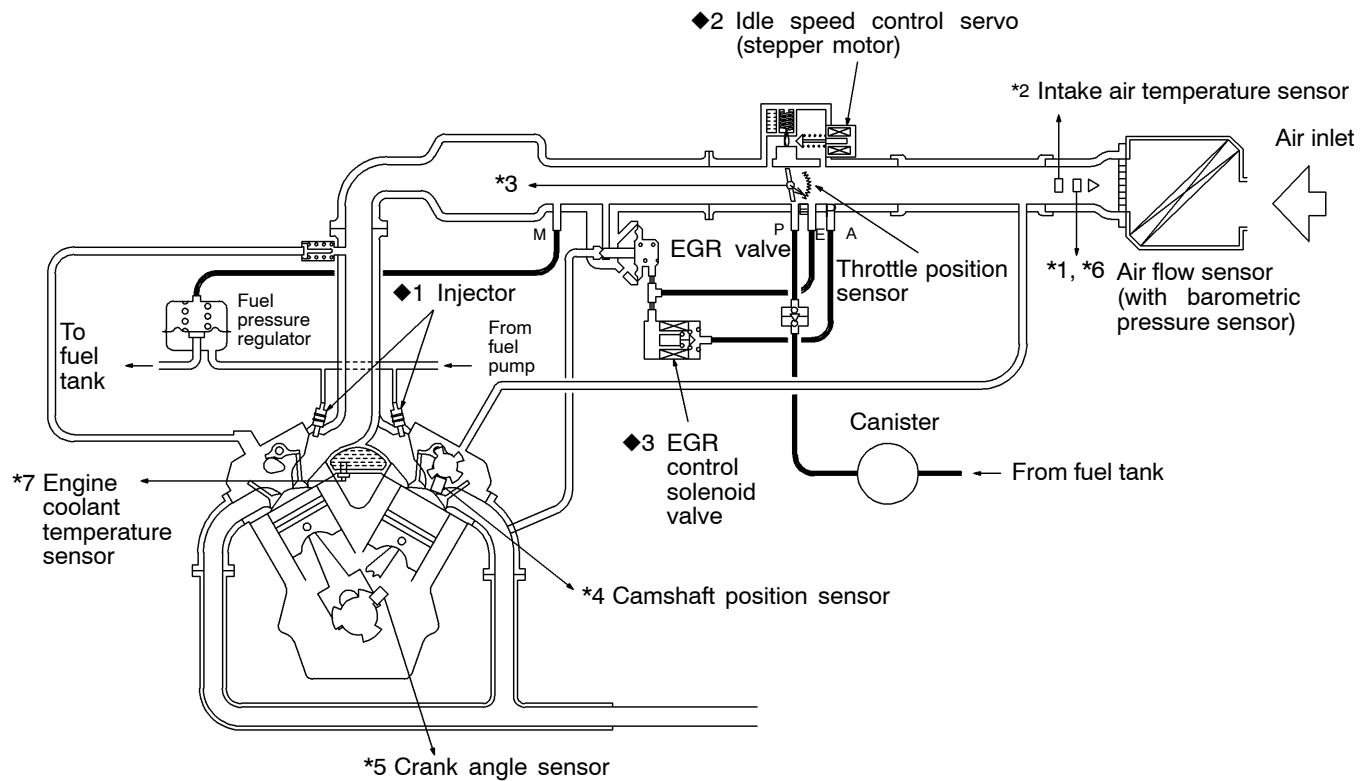
<Vehicles for GCC>

- *1. Air flow sensor
- *2. Intake air temperature sensor
- *3. Throttle position sensor
- *4. Camshaft position sensor
- *5. Crank angle sensor
- *6. Barometric pressure sensor
- *7. Engine coolant temperature sensor

- Power supply
- Vehicle speed sensor
- A/C switch
- Inhibitor switch
- Power steering fluid pressure switch
- Ignition switch-ST
- Ignition switch-IG

⇒ Engine-ECU
<M/T> or En-
gine-A/T-ECU
<A/T>

- ◆1 Injector
 - ◆2 Idle speed control servo
 - ◆3 EGR control solenoid valve
-
- Fuel pump relay
 - Control relay
 - A/C power relay
 - Condenser fan relay
 - Engine warning lamp
 - Diagnosis signal
 - Ignition coil, power transistor



X6158CA

<Vehicles for General Export with catalytic converter, Brazil>

- *1. Oxygen sensor
- *2. Air flow sensor
- *3. Intake air temperature sensor
- *4. Throttle position sensor
- *5. Camshaft position sensor
- *6. Crank angle sensor
- *7. Barometric pressure sensor
- *8. Engine coolant temperature sensor

- Power supply
- Vehicle speed sensor
- A/C switch
- Inhibitor switch
- Power steering fluid pressure switch
- Ignition switch-ST
- Ignition switch-IG

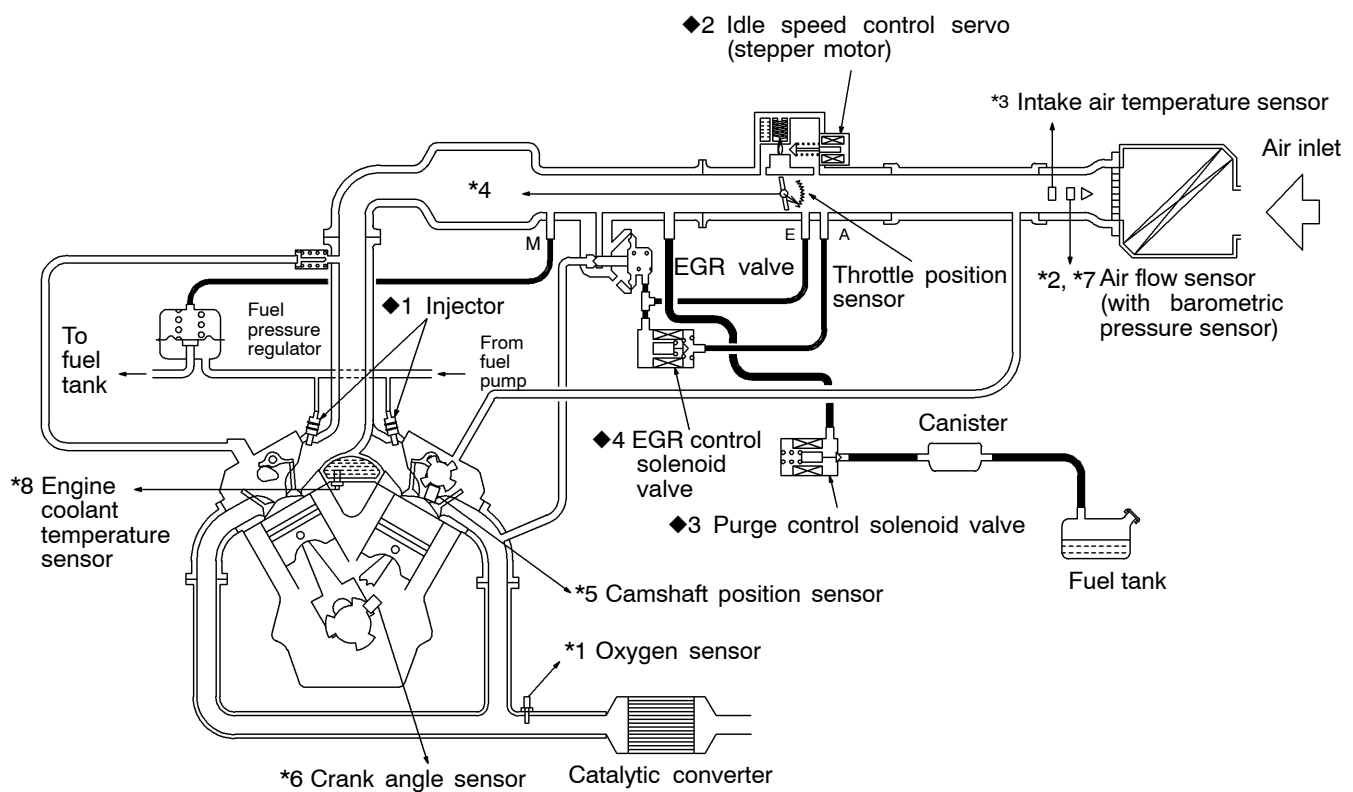


Engine-ECU
<M/T> or En-
gine-A/T-ECU
<A/T>



- ◆1 Injector
- ◆2 Idle speed control servo
- ◆3 Purge control solenoid valve
- ◆4 EGR control solenoid valve

- Fuel pump relay
- Control relay
- A/C power relay
- Condenser fan relay
- Engine warning lamp
- Diagnosis signal
- Ignition coil, power transistor



<Vehicles for Australia>

- *1. Oxygen sensor
- *2. Air flow sensor
- *3. Intake air temperature sensor
- *4. Throttle position sensor
- *5. Camshaft position sensor
- *6. Crank angle sensor
- *7. Barometric pressure sensor
- *8. Engine coolant temperature sensor

- Power supply
- Vehicle speed sensor
- A/C switch
- Inhibitor switch
- Power steering fluid pressure switch
- Ignition switch-ST
- Ignition switch-IG

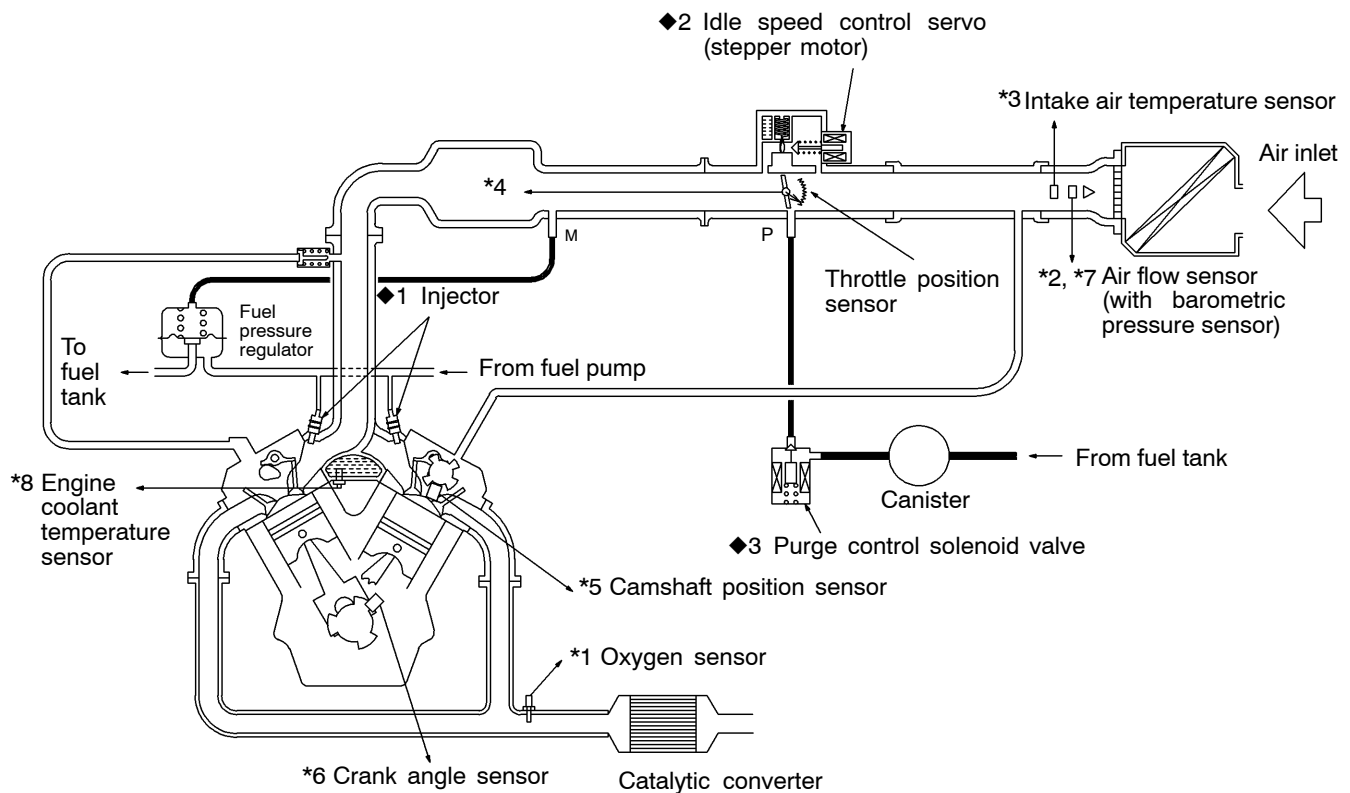


Engine-ECU
<M/T> or En-
gine-A/T-ECU
<A/T>



- ◆1 Injector
- ◆2 Idle speed control servo
- ◆3 Purge control solenoid valve

- Fuel pump relay
- Control relay
- A/C power relay
- Condenser fan relay
- Engine warning lamp
- Diagnosis signal
- Ignition coil, power transistor



X6173CA

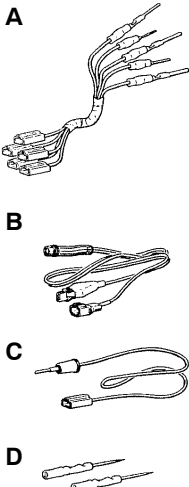
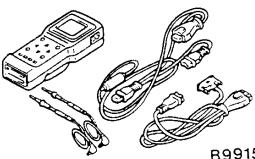
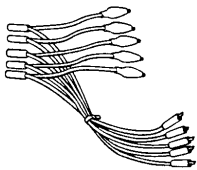
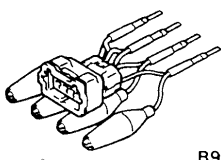
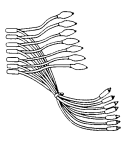
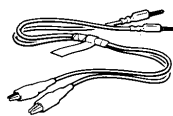
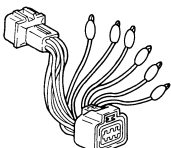
SERVICE SPECIFICATIONS

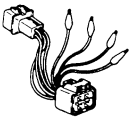
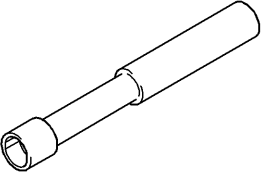
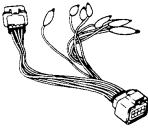

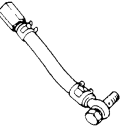
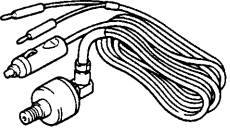

Items		Specifications
Basic idle speed r/min		700 ± 50
Throttle position sensor adjusting voltage mV		535 – 735
Throttle position sensor resistance kΩ		3.5 – 6.5
Idle speed control servo coil resistance Ω		28 – 33 (at 20°C)
Intake air temperature sensor resistance kΩ	At 20°C	2.3 – 3.0
	At 80°C	0.30 – 0.42
Engine coolant temperature sensor resistance kΩ	At 20°C	2.1 – 2.7
	At 80°C	0.26 – 0.36
Oxygen sensor output voltage V <Vehicles for Australia, Brazil, General Export with catalytic converter>		0.6 – 1.0
Fuel pressure kPa	Vacuum hose disconnection	324 – 343 at curb idle
	Vacuum hose connection	Approx. 265 at curb idle
Injector coil resistance Ω		13 – 16 (at 20°C)
Mixture adjusting screw (Variable resistor) resistance <Vehicles for General Export without catalytic converter, South Africa, GCC> kΩ		4 – 6

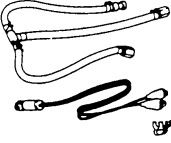
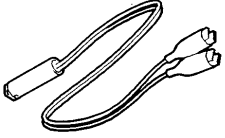

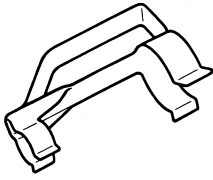
SEALANT

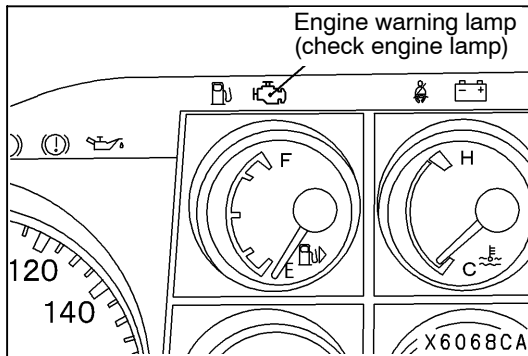
Item	Specified sealant	Remark
Engine coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

SPECIAL TOOLS

Tool	Number	Name	Use
 <p>A: MB991219 B: MB991220 C: MB991221 D: MB991222</p>	MB991223	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	Measurement of terminal voltage A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 <p>B991502</p>	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> Reading diagnosis code MPI system inspection
	MB991348 and MB991658	Test harness set	Inspection using an analyzer
 <p>B991536</p>	MB991536	Test harness set	Adjustment of throttle position sensor
 <p>MB991709</p>	MB991709	Test harness	<ul style="list-style-type: none"> Trouble shooting-voltage measurement Inspection using an analyzer
	MB991529	Diagnosis code check harness	<ul style="list-style-type: none"> Reading diagnosis code Adjustment of basic idle speed
	MD998463	Test harness (6-pin, square)	<ul style="list-style-type: none"> Inspection of idle speed control servo Inspection using an analyzer

Tool	Number	Name	Use
	MD998464	Test harness (4-pin, square)	Inspection of oxygen sensor
	MD998299	MAS screwdriver	Inspection of mixture adjusting screw
	MD998474	Test harness (8 pin, square)	Inspection using an analyzer
	MD998478	Test harness (3 pin, triangle)	
	MD998709	Adaptor hose	Measurement of fuel pressure
 B991637	MB991637	Fuel pressure gauge set	Measurement of fuel pressure
	MD998742	Hose adaptor	

Tool	Number	Name	Use
	MD998706	Injector test set	Checking the spray condition of injectors
 MB991607	MB991607	Injector test harness	
 MD998741	MD998741	Injector test adaptor	
	MB991692	Clip	



TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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

DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the Multipoint Fuel Injection (MPI) system, the engine warning lamp will illuminate.

If the lamp remains illuminated or if the lamp illuminates while the engine is running, check the diagnosis code output.

Engine warning lamp inspection items

Engine-ECU <M/T>, Engine-A/T-ECU <A/T>
Air flow sensor
Intake air temperature sensor
Throttle position sensor
Engine coolant temperature sensor
Crank angle sensor
Camshaft position sensor
Barometric pressure sensor
Injector
Ignition coil, power transistor
Immobilizer system

METHOD OF READING AND ERASING DIAGNOSIS CODES

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

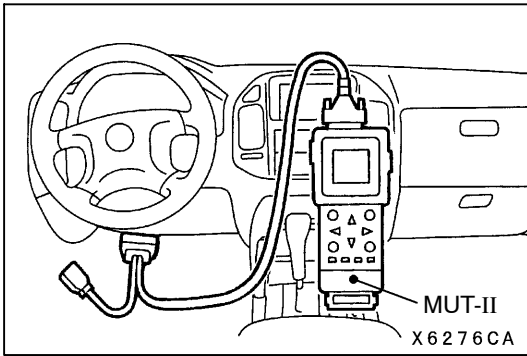
DIAGNOSIS USING DIAGNOSIS 2 MODE

1. Switch the diagnosis mode of the engine control unit to DIAGNOSIS 2 mode using the MUT-II.
2. Carry out a road test.
3. Take a reading of the diagnosis code and repair the problem location.
4. Turn the ignition switch to OFF and then back to ON again.

NOTE

By turning the ignition switch to OFF, the ENGINE-ECU <M/T> or ENGINE-A/T-ECU <A/T> will switch the diagnosis mode from DIAGNOSIS 2 mode to DIAGNOSIS 1 mode.

5. Erase the diagnosis codes.



INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

1. Carry out inspection by means of the data list and the actuator test function.
If there is an abnormality, check and repair the chassis harnesses and components.
2. After repairing, re-check using the MUT-II and check that the abnormal input and output have returned to normal as a result of the repairs.
3. Erase the diagnosis code memory.
4. Remove the MUT-II.
5. Start the engine again and carry out a road test to confirm that the problem has disappeared.

FAIL-SAFE FUNCTION REFERENCE TABLE

When the main sensor malfunctions are detected by the diagnosis function, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

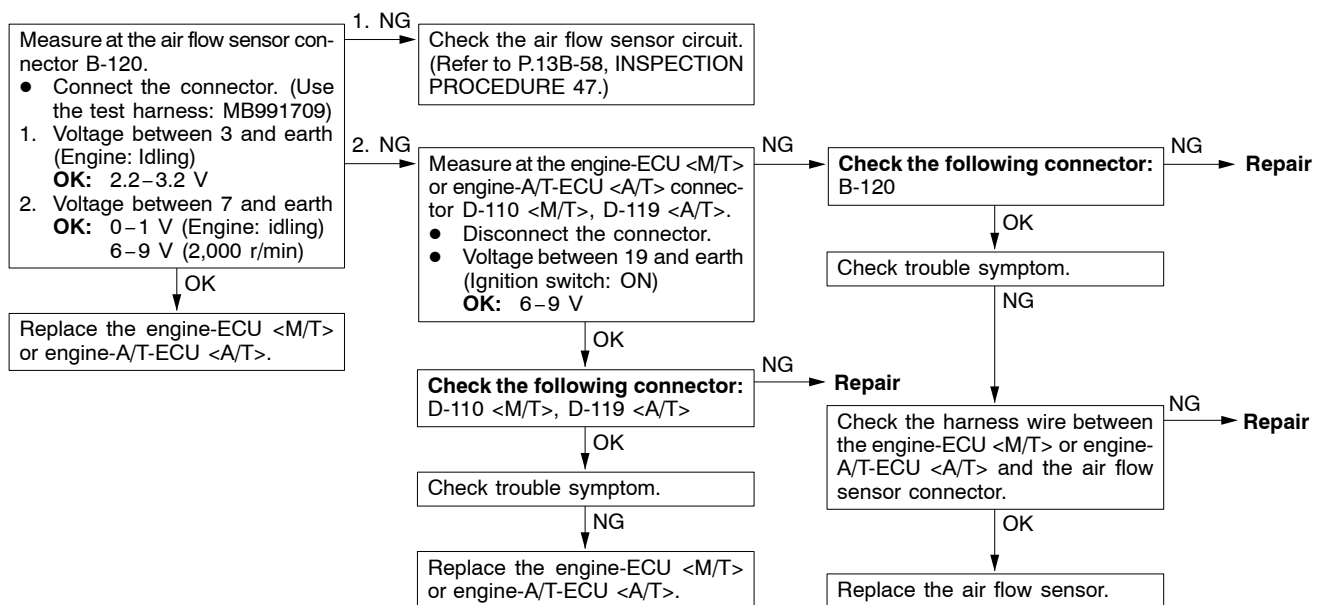
Malfunctioning item	Control contents during malfunction
Air flow sensor	<ol style="list-style-type: none"> 1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping. 2. Fixes the ISC servo in the appointed position so idle control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C.
Camshaft position sensor	<p>Injects fuel to all cylinders simultaneously.</p> <p>(However, after the ignition switch is turned to ON, the No. 1 cylinder top dead centre is not detected at all.)</p>
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Ignition coil, power transistor unit	Cut off the fuel supply to cylinders with an abnormal ignition signal.

INSPECTION CHART FOR DIAGNOSIS CODES

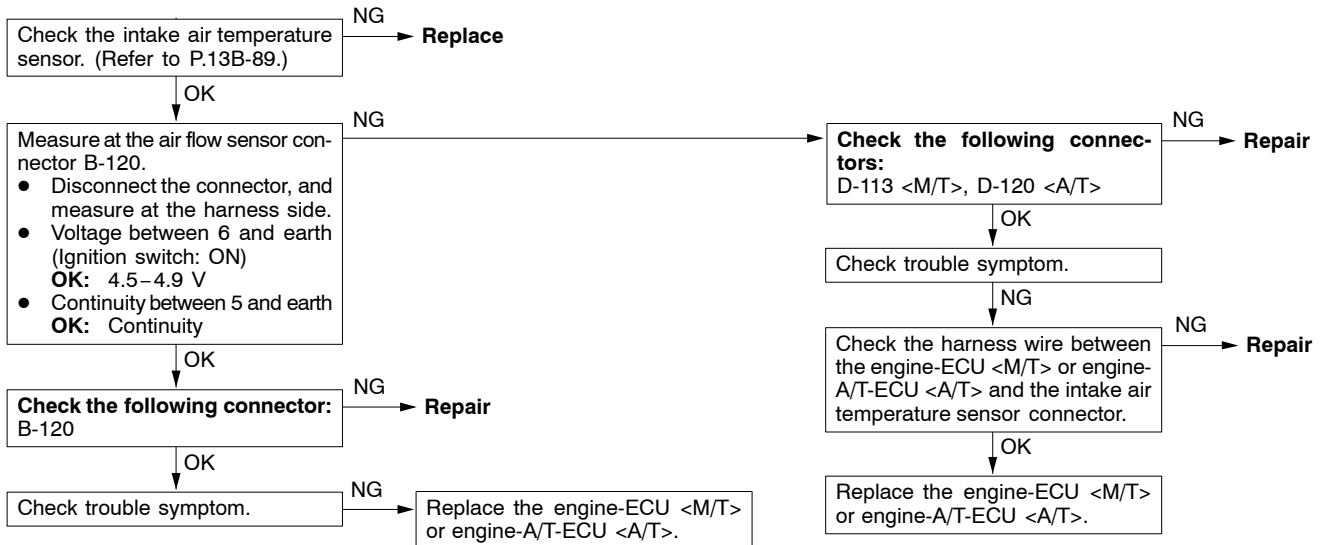
Code No.	Diagnosis item	Reference page
12	Air flow sensor system	13B-15
13	Intake air temperature sensor system	13B-16
14	Throttle position sensor system	13B-16
21	Engine coolant temperature sensor system	13B-17
22	Crank angle sensor system	13B-18
23	Camshaft position sensor system	13B-19
24	Vehicle speed sensor system	13B-19
25	Barometric pressure sensor system	13B-20
41	Injector system	13B-21
44	Ignition coil and power transistor unit system (for No. 1 and No. 4 cylinders)	13B-21
52	Ignition coil and power transistor unit system (for No. 2 and No. 5 cylinders)	13B-21
53	Ignition coil and power transistor unit system (for No. 3 and No. 6 cylinders)	13B-21
54	Immobilizer system <Vehicles for South Africa, Australia>	13B-22

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

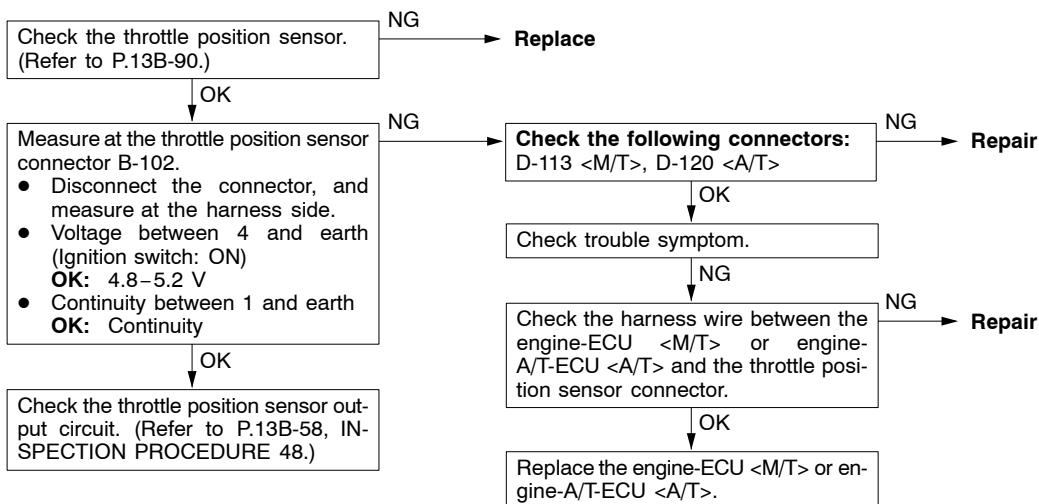
Code No. 12 Air flow sensor system	Probable cause
Range of Check • Engine speed is 500 r/min or more. Set conditions • Sensor output frequency is 3 Hz or less for 4 seconds.	• Malfunction of the air flow sensor • Improper connector contact, open circuit or short-circuited harness wire of the air flow sensor • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



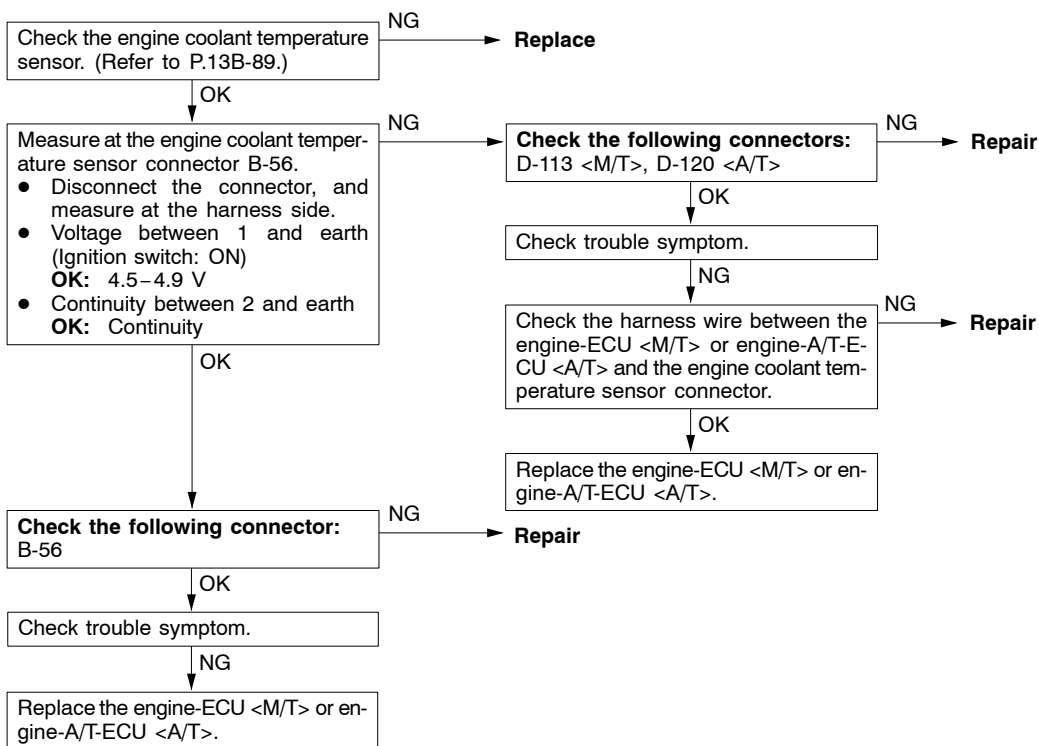
Code No. 13 Intake air temperature sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage is 4.6 V or more (corresponding to an intake air temperature of -45°C or less) for 4 seconds. <p>or</p> <ul style="list-style-type: none"> Sensor output voltage is 0.2V or less (corresponding to an intake air temperature of 125°C or more) for 4 seconds. 	<ul style="list-style-type: none"> Malfunction of the intake air temperature sensor Improper connector contact, open circuit or short-circuited harness wire of the intake air temperature sensor circuit Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



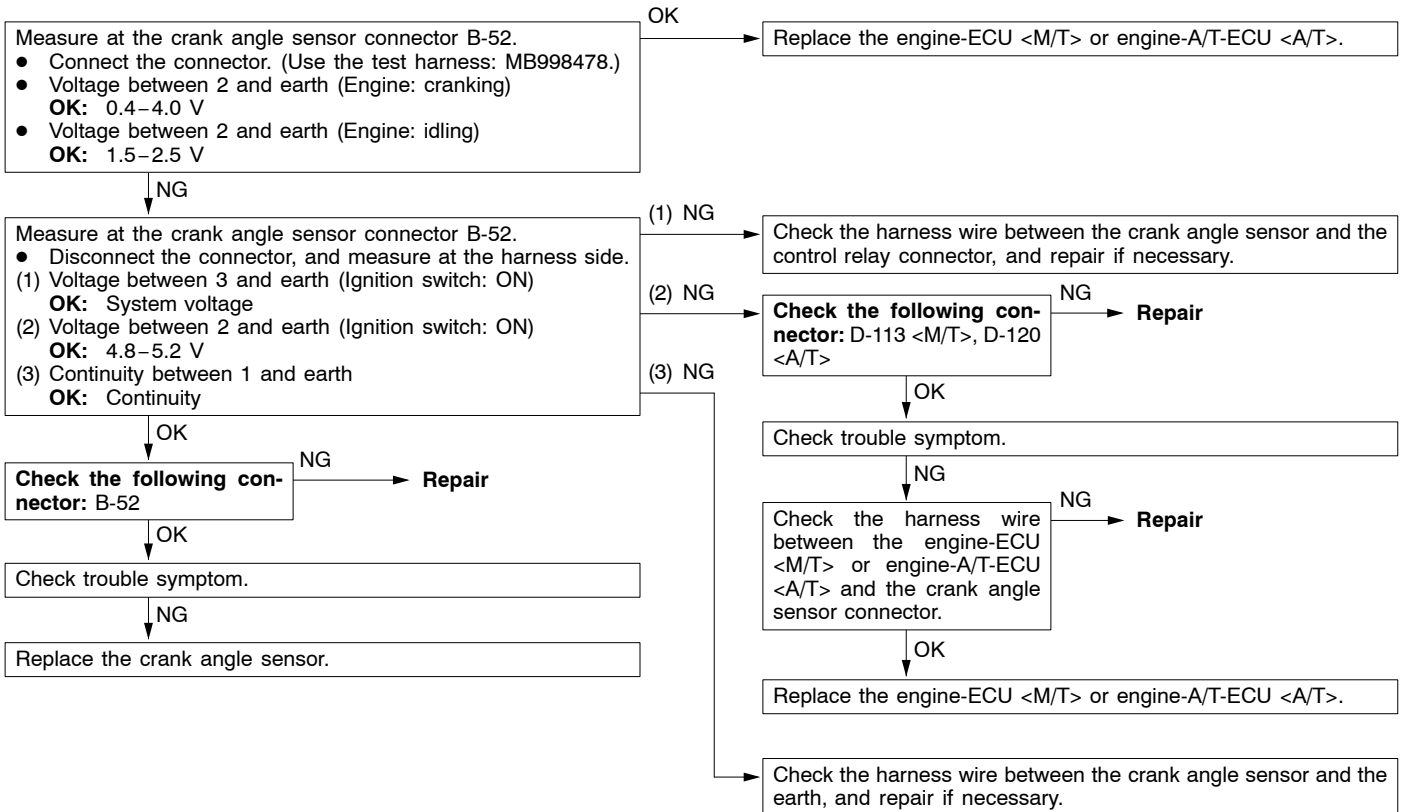
Code No. 14 Throttle position sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. <p>Set conditions</p> <ul style="list-style-type: none"> When the sensor output voltage is 2 V or more for 4 seconds. <p>or</p> <ul style="list-style-type: none"> The sensor output voltage is 0.2 V or less for 4 seconds. 	<ul style="list-style-type: none"> Malfunction of the throttle position sensor or maladjustment Improper connector contact, open circuit or short-circuited harness wire of the throttle position sensor circuit Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



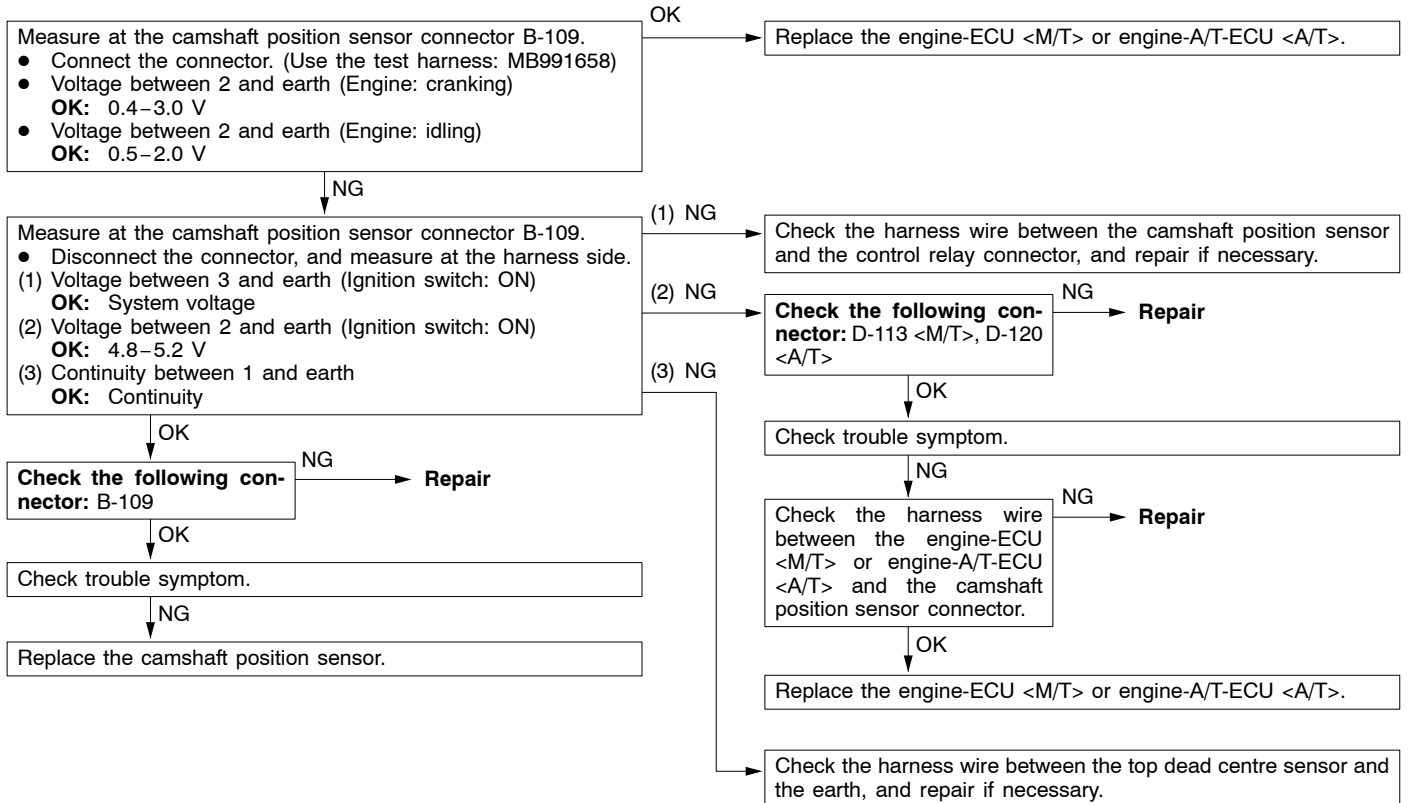
Code No. 21 Engine coolant temperature sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage is 4.6 V or more (corresponding to an engine coolant temperature of -45°C or less) for 4 seconds. <p>or</p> <ul style="list-style-type: none"> Sensor output voltage is 0.1 V or less (corresponding to an engine coolant temperature of 140°C or more) for 4 seconds. 	<ul style="list-style-type: none"> Malfunction of the engine coolant temperature sensor Improper connector contact, open circuit or short-circuited harness wire of the engine coolant temperature sensor circuit Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Engine speed is approx. 50 r/min or more <p>Set conditions</p> <ul style="list-style-type: none"> The sensor output voltage increases from 1.6 V or less (corresponding to an engine coolant temperature of 40°C or more) to 1.6 V or more (corresponding to an engine coolant temperature of 40°C or less). After this, the sensor output voltage is 1.6 V or more for 5 minutes. 	



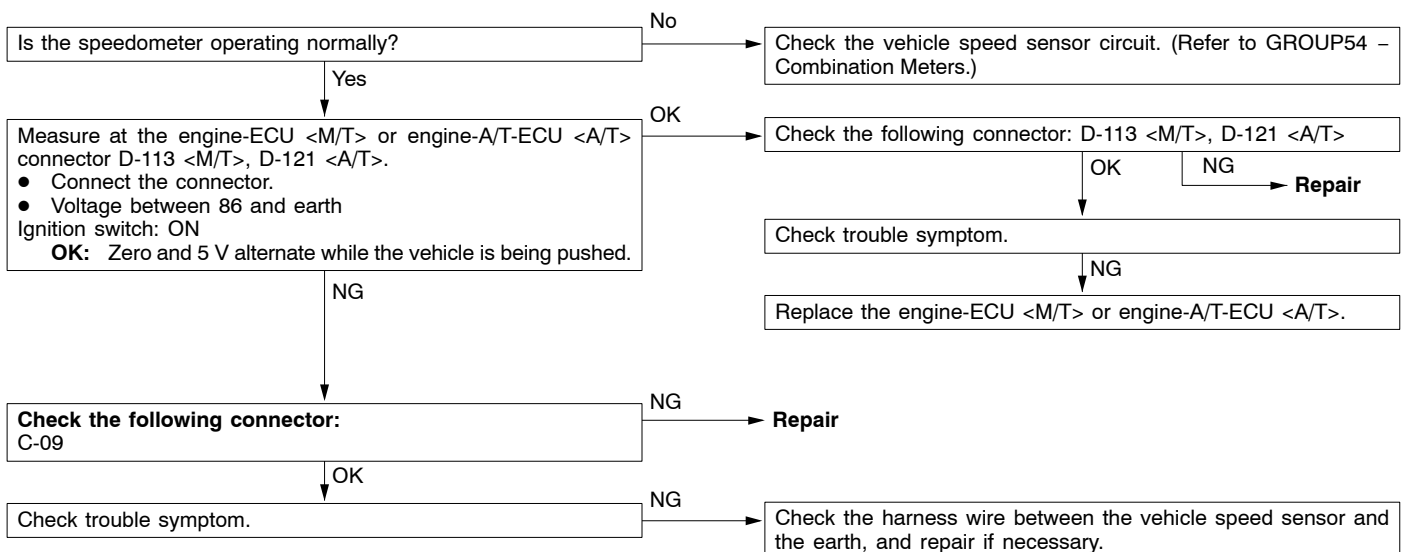
Code No. 22 Crank angle sensor system	Probable cause
Range of Check • Engine is cranking. Set conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input.)	• Malfunction of the crank angle sensor • Improper connector contact, open circuit or short-circuited harness wire of the crank angle sensor circuit • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



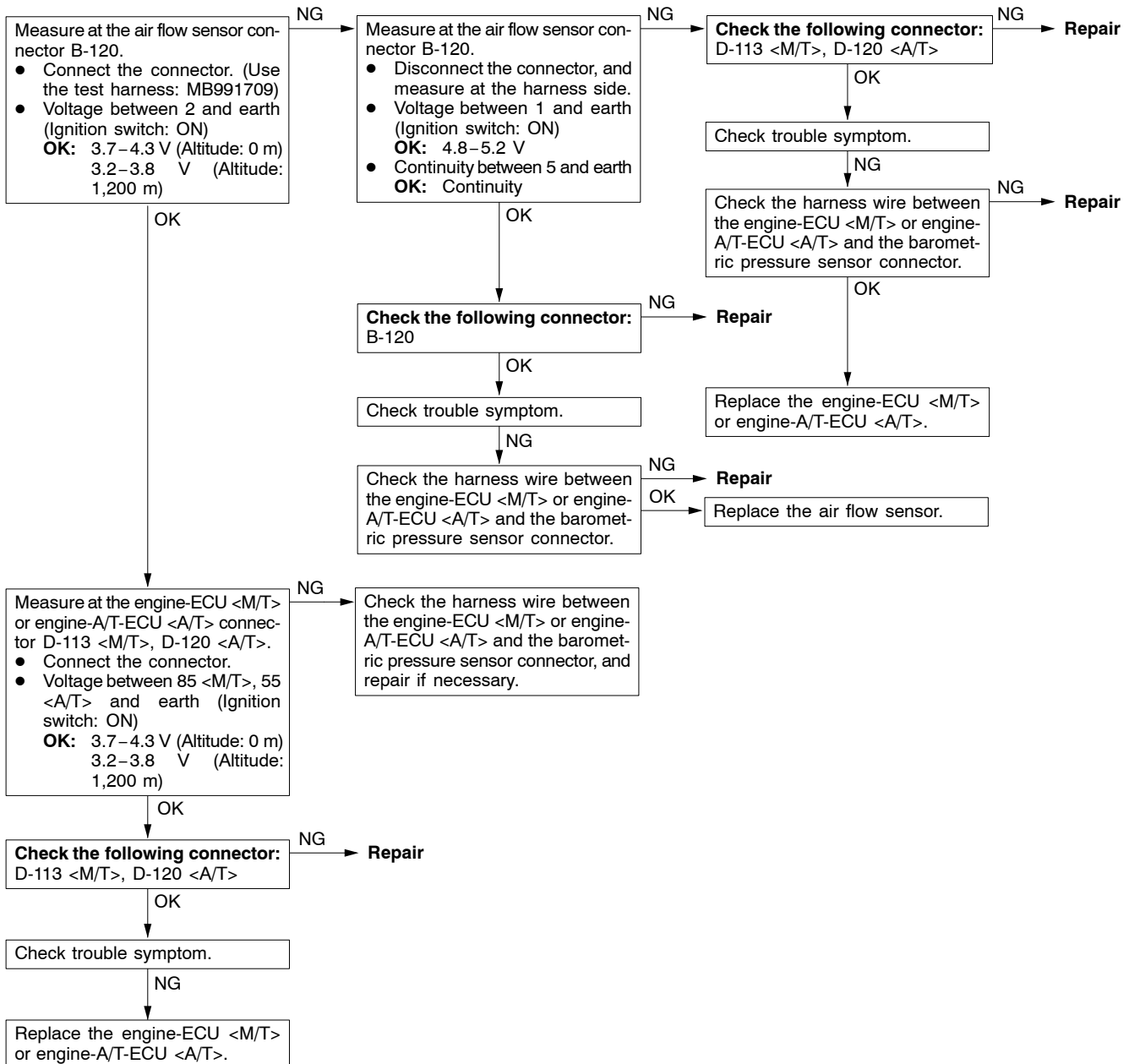
Code No. 23 Camshaft position sensor system	Probable cause
Range of Check <ul style="list-style-type: none"> Ignition switch: ON Engine speed is approx. 50 r/min or more. Set conditions <ul style="list-style-type: none"> Sensor output voltage does not change for 4 seconds (no pulse signal input.) 	<ul style="list-style-type: none"> Malfunction of the camshaft position sensor Improper connector contact, open circuit or short-circuited harness wire of the camshaft position sensor circuit Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



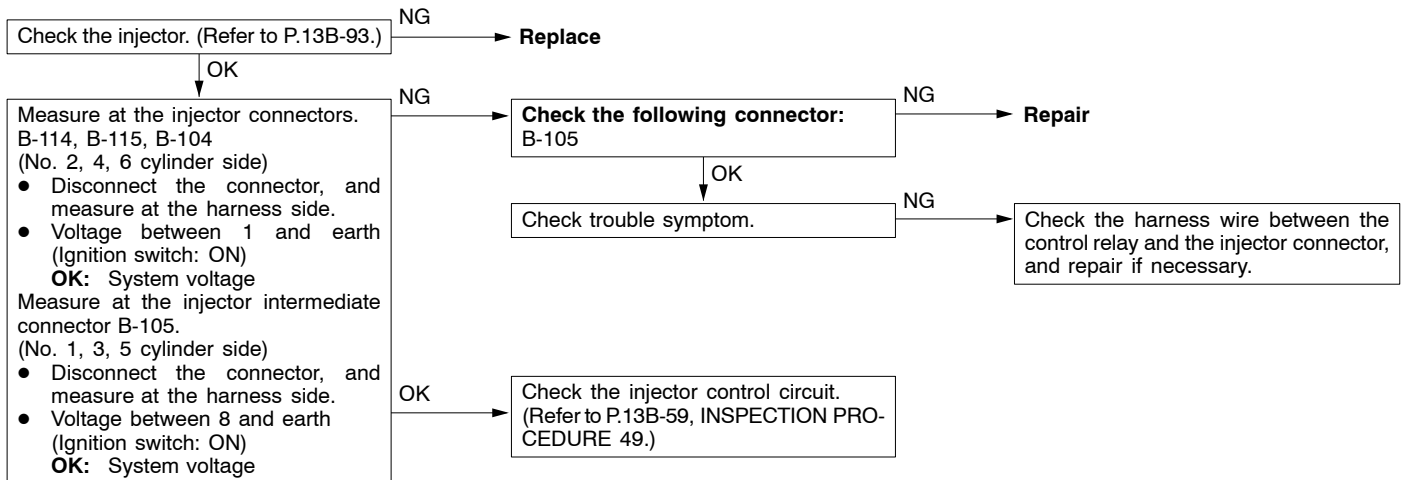
Code No.24 Vehicle speed sensor system	Probable cause
Range of Check <ul style="list-style-type: none"> Excluding 60 seconds after the engine starts. Engine speed is 3,000 r/min. Driving under high engine load conditions. Set condition <ul style="list-style-type: none"> Sensor output voltage does not changes for 4 seconds (no pulse signal input). 	<ul style="list-style-type: none"> Malfunction of the vehicle speed sensor Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



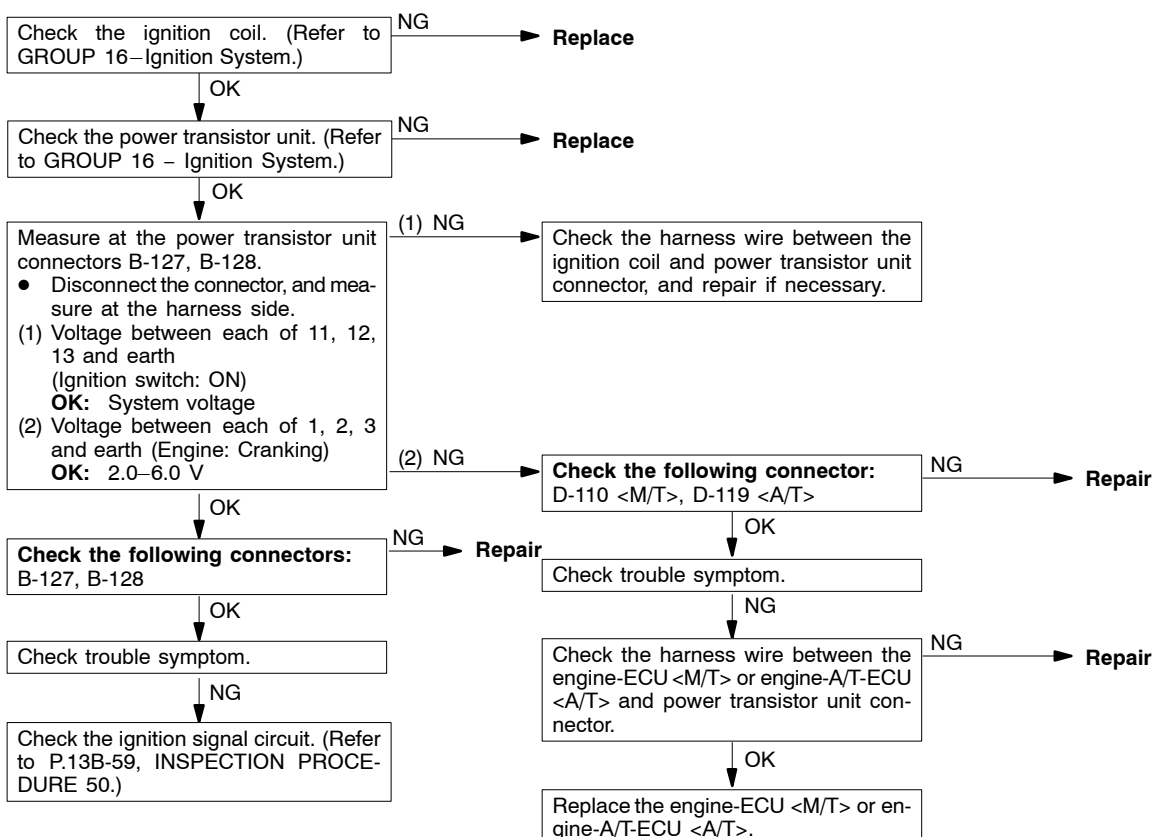
Code No. 25 Barometric pressure sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Battery voltage is 8 V or more. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage is 4.5 V or more (corresponding to a barometric pressure of 114 kPa or more) for 4 seconds. <p>or</p> <ul style="list-style-type: none"> Sensor output voltage is 0.2 V or less (corresponding to a barometric pressure of 5.33 kPa or less) for 4 seconds. 	<ul style="list-style-type: none"> Malfunction of the barometric pressure sensor Improper connector contact, open circuit or short-circuited harness wire of the barometric pressure sensor circuit Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



Code No. 41 Injector system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Engine speed is approx. 50–1,000 r/min The throttle position sensor output voltage is 1.15 V or less. Actuator test by MUT-II is not carried out. <p>Set conditions</p> <ul style="list-style-type: none"> Surge voltage of injector coil is not detected for 4 seconds. 	<ul style="list-style-type: none"> Malfunction of the injector Improper connector contact, open circuit or short-circuited harness wire of the injector circuit Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



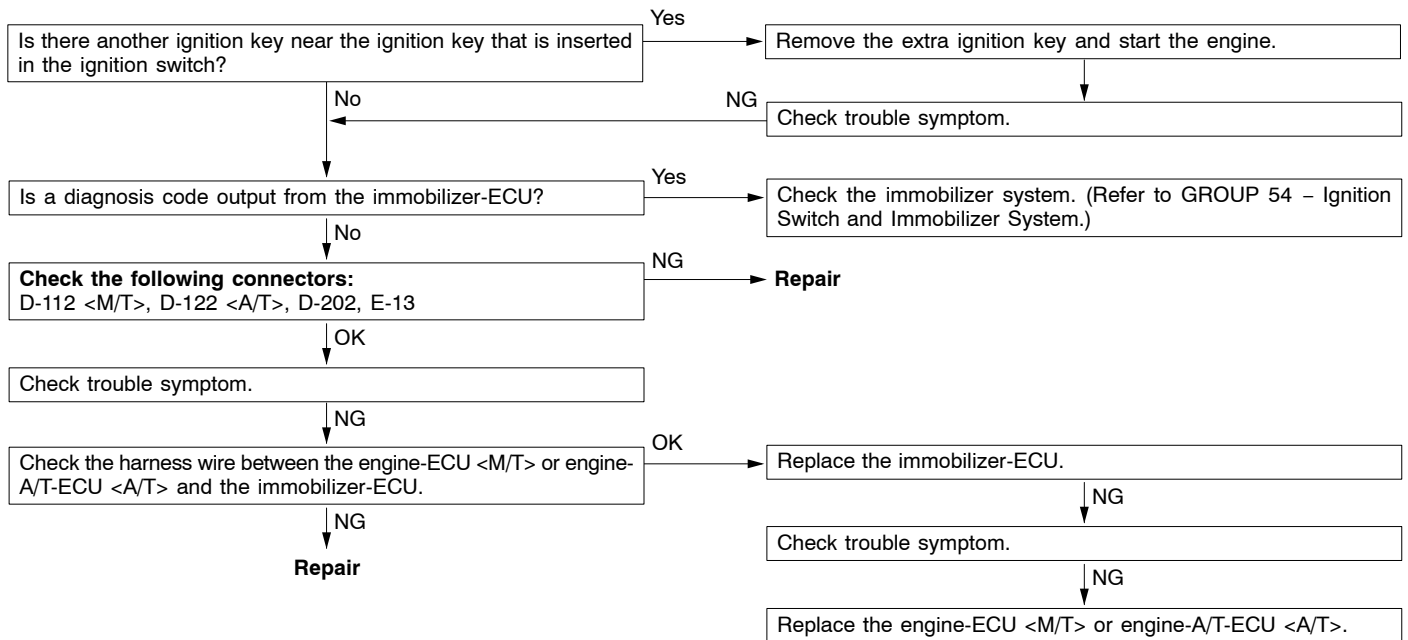
Code No. 44, 52, 53 Ignition coil and power transistor unit system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Engine speed is approx. 50 – 4,000 r/min. Engine is not cranking. <p>Set conditions</p> <ul style="list-style-type: none"> The ignition signal from the same coil is not input for 4 seconds. <p>However, this excludes cases where no ignition signal is input from any coils.</p>	<ul style="list-style-type: none"> Malfunction of the ignition coil Improper connector contact, open circuit or short-circuited harness wire of the ignition primary circuit Malfunction of the power transistor unit Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



Code No.54 Immobilizer system <Vehicles for South Africa, Australia>		Probable cause
Range of Check • Ignition switch: ON Set Conditions • Improper communication between the engine-ECU <M/T> or engine-A/T-ECU <A/T> and immobilizer-ECU	Range of Check • Ignition switch: ON Set Conditions • Improper communication between the engine-ECU <M/T> or engine-A/T-ECU <A/T> and immobilizer-ECU	<ul style="list-style-type: none"> • Radio interference of encrypted codes • Incorrect encrypted code • Malfunction of harness or connector • Malfunction of immobilizer-ECU • Malfunction of engine-ECU <M/T> or engine-A/T-ECU <A/T>

NOTE

- (1) If the ignition switches are close each other when starting the engine, radio interference may cause this code to be displayed.
- (2) This code may be displayed when registering the key encrypted code.

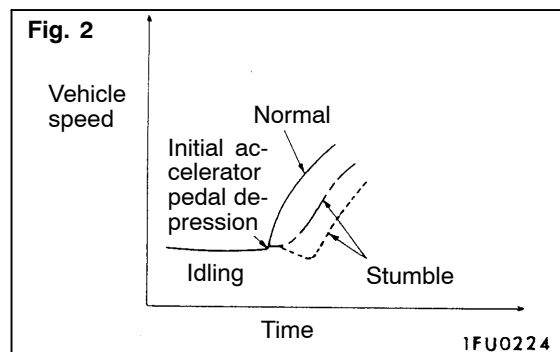
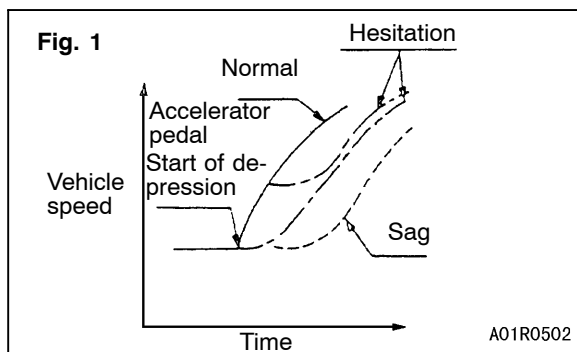


INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13B-25
	Communication with engine-ECU <M/T> or engine-A/T-ECU <A/T> only is not possible.	2	13B-25
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13B-26
	The engine warning lamp remains illuminating and never goes out.	4	13B-27
Starting	No initial combustion (starting impossible)	5	13B-27
	Initial combustion but no complete combustion (starting impossible)	6	13B-28
	Long time to start (improper starting)	7	13B-28
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	8	13B-29
	Idling speed is high. (Improper idling speed)	9	13B-30
	Idling speed is low. (Improper idling speed)	10	13B-30
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	11	13B-31
	When the engine becomes hot, it stalls at idling. (Die out)	12	13B-32
	The engine stalls when starting the car. (Pass out)	13	13B-33
	The engine stalls when decelerating.	14	13B-33
Driving	Hesitation, sag or stumble	15	13B-34
	The feeling of impact or vibration when accelerating	16	13B-34
	The feeling of impact or vibration when decelerating	17	13B-35
	Poor acceleration	18	13B-35
	Surge	19	13B-36
	Knocking	20	13B-36
Dieseling		21	13B-36
Too high CO and HC concentration when idling		22	13B-37
Idling speed is improper when A/C is operating		23	13B-38
A/C condensor fan is inoperative		24	13B-38

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

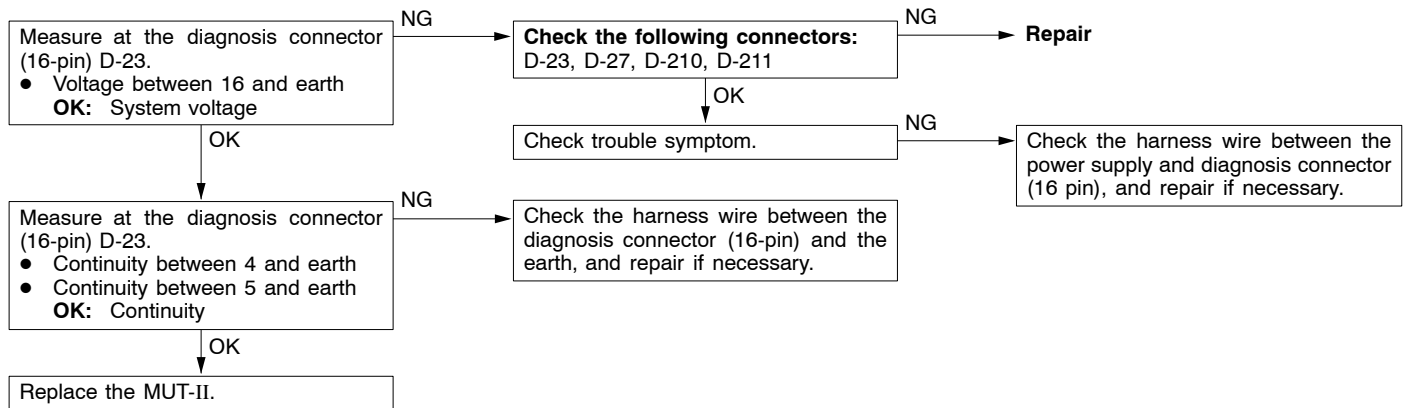
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed doesn't remain constant; changes at idle.
	Rough idle	Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idle.
	Incorrect idle speed	The engine doesn't idle at the usual correct speed.
	Engine stall (Die out)	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicles is moving or not.
	Engine stall (Pass out)	The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation Sag	"Hesitation" is the delay in response of the vehicle speed (engine speed) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag". (See figure 1.)
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration. (See figure 2.)
	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run on ("Dieseling")	The condition in which the engine continues to run after the ignition switch is turned to OFF. Also called "Dieseling".



INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

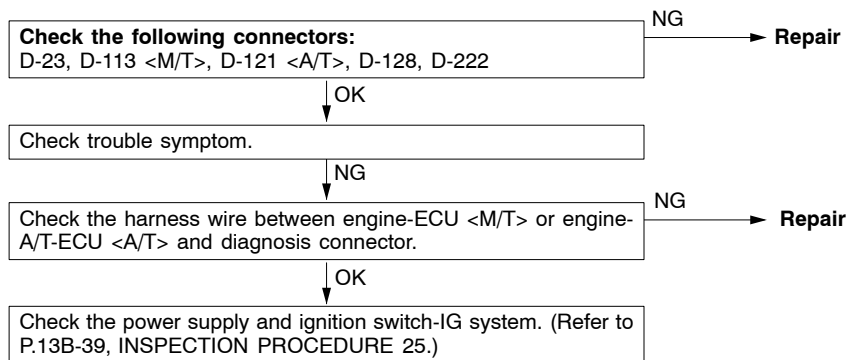
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	<ul style="list-style-type: none"> • Malfunction of the connector • Malfunction of the harness wire • Malfunction of the MUT-II



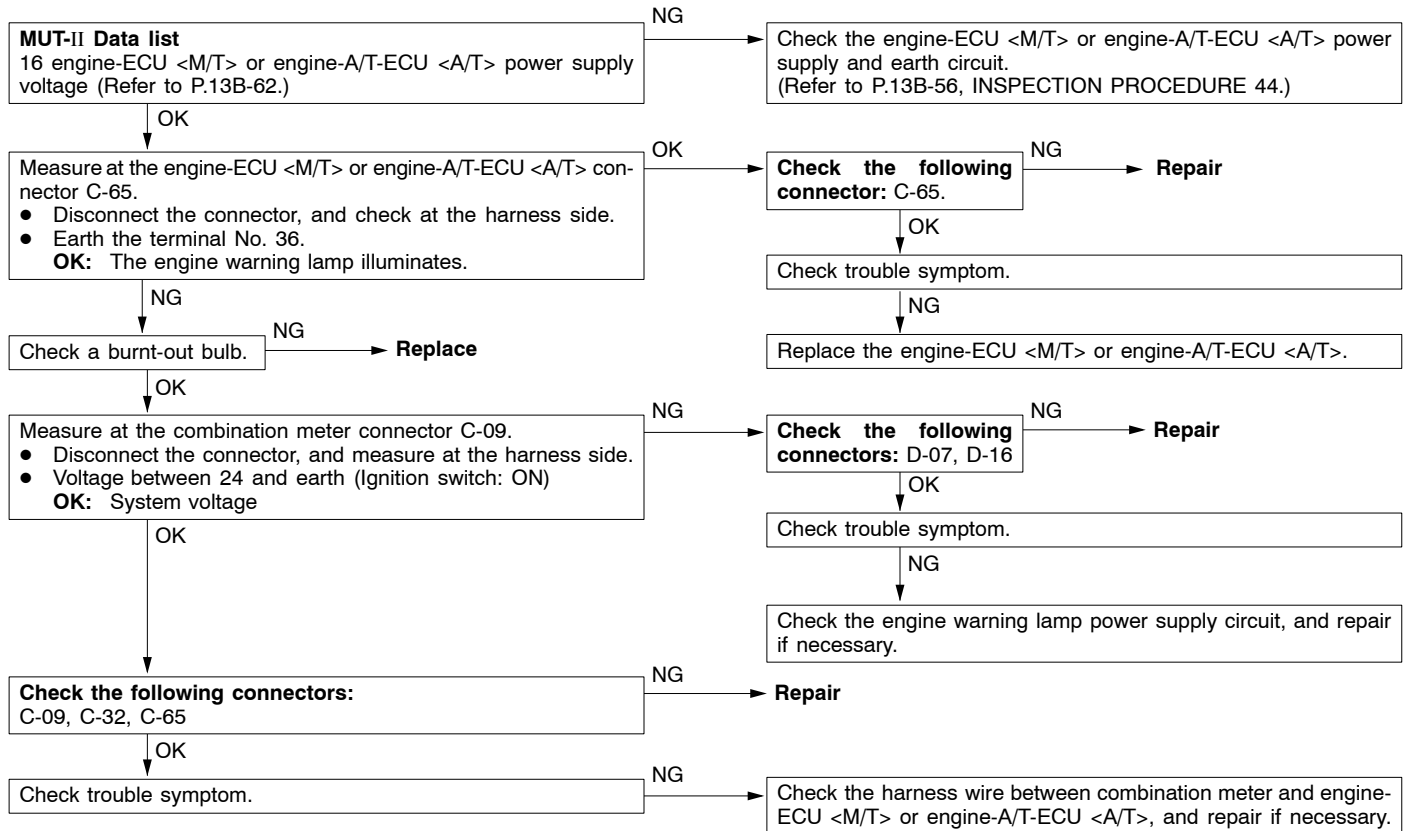
INSPECTION PROCEDURE 2

MUT-II communication with engine-ECU <M/T> or engine-A/T-ECU <A/T> is not possible.	Probable cause
One of the following causes may be suspected. <ul style="list-style-type: none"> • No power supply to engine-ECU <M/T> or engine-A/T-ECU <A/T>. • Defective earth circuit of engine-ECU <M/T> or engine-A/T-ECU <A/T>. • Defective engine-ECU <M/T> or engine-A/T-ECU <A/T>. • Improper communication line between engine-ECU <M/T> or engine-A/T-ECU <A/T> and MUT-II 	<ul style="list-style-type: none"> • Malfunction of engine-ECU <M/T> or engine-A/T-ECU <A/T> power supply circuit • Malfunction of engine-ECU <M/T> or engine-A/T-ECU <A/T> • Open circuit between the engine-ECU <M/T> or engine-A/T-ECU <A/T> and diagnosis connector



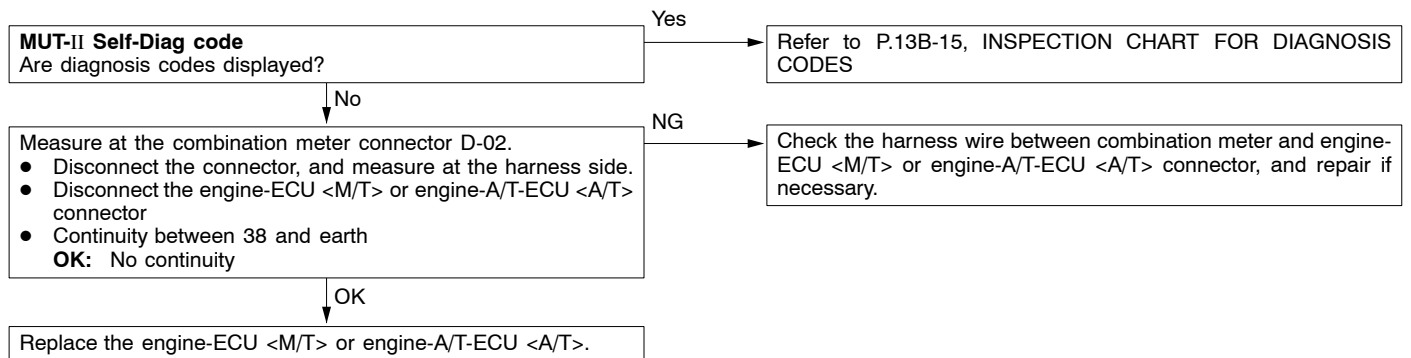
INSPECTION PROCEDURE 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	Probable cause
<p>Because there is a burnt-out bulb, the engine-ECU <M/T> or engine-A/T-ECU <A/T> causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON. If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of the malfunctions listed at right has probably occurred.</p>	<ul style="list-style-type: none"> • Burnt-out bulb • Defective warning lamp circuit • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



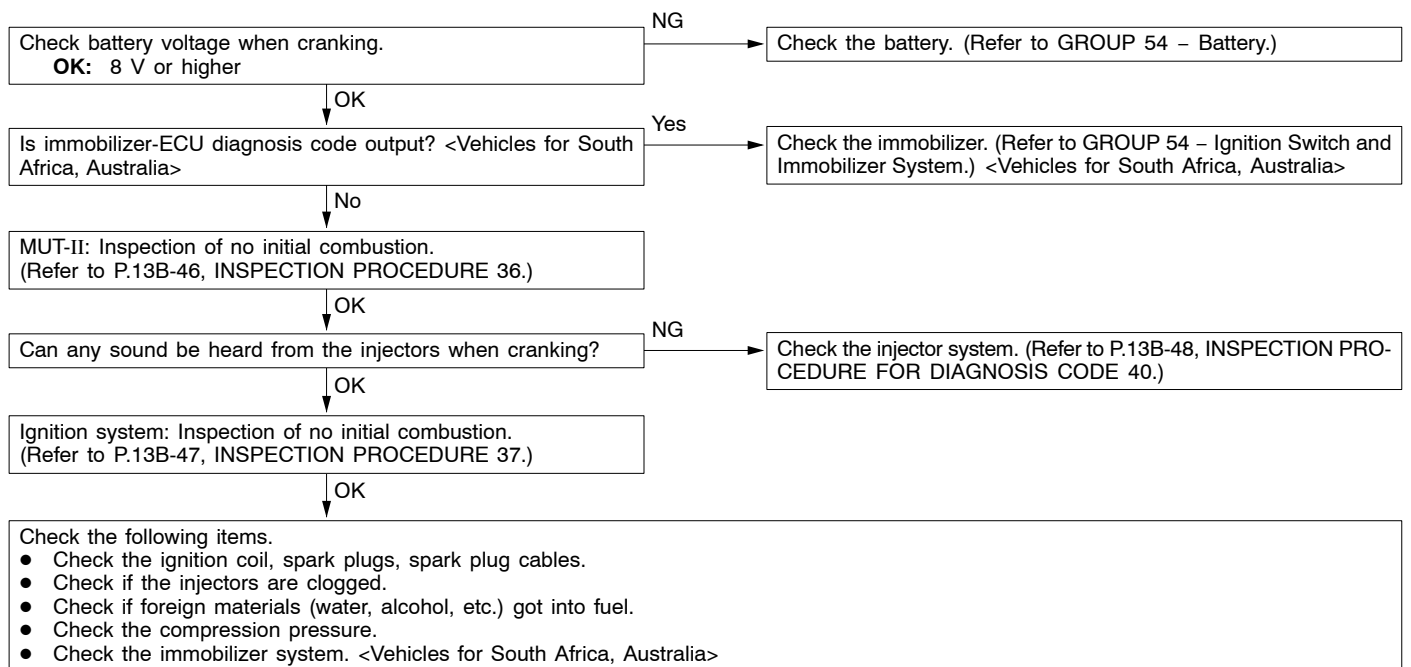
INSPECTION PROCEDURE 4

The engine warning lamp remains illuminating and never goes out.	Probable cause
In cases such as the above, the cause is probably that the engine-ECU <M/T> or engine-A/T-ECU <A/T> is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.	<ul style="list-style-type: none"> Short-circuit between the engine warning lamp and engine-ECU <M/T> or engine-A/T-ECU <A/T> Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>

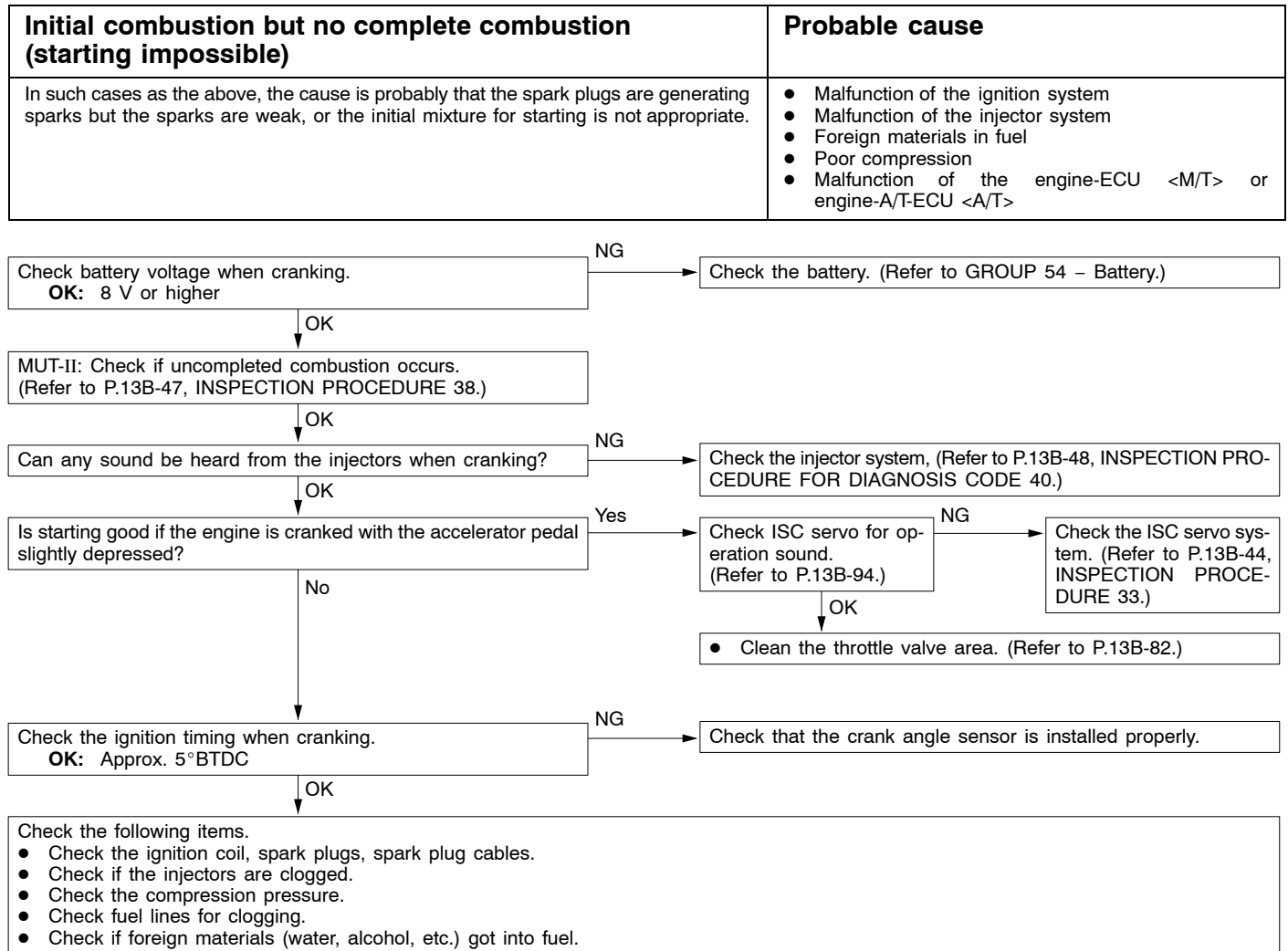


INSPECTION PROCEDURE 5

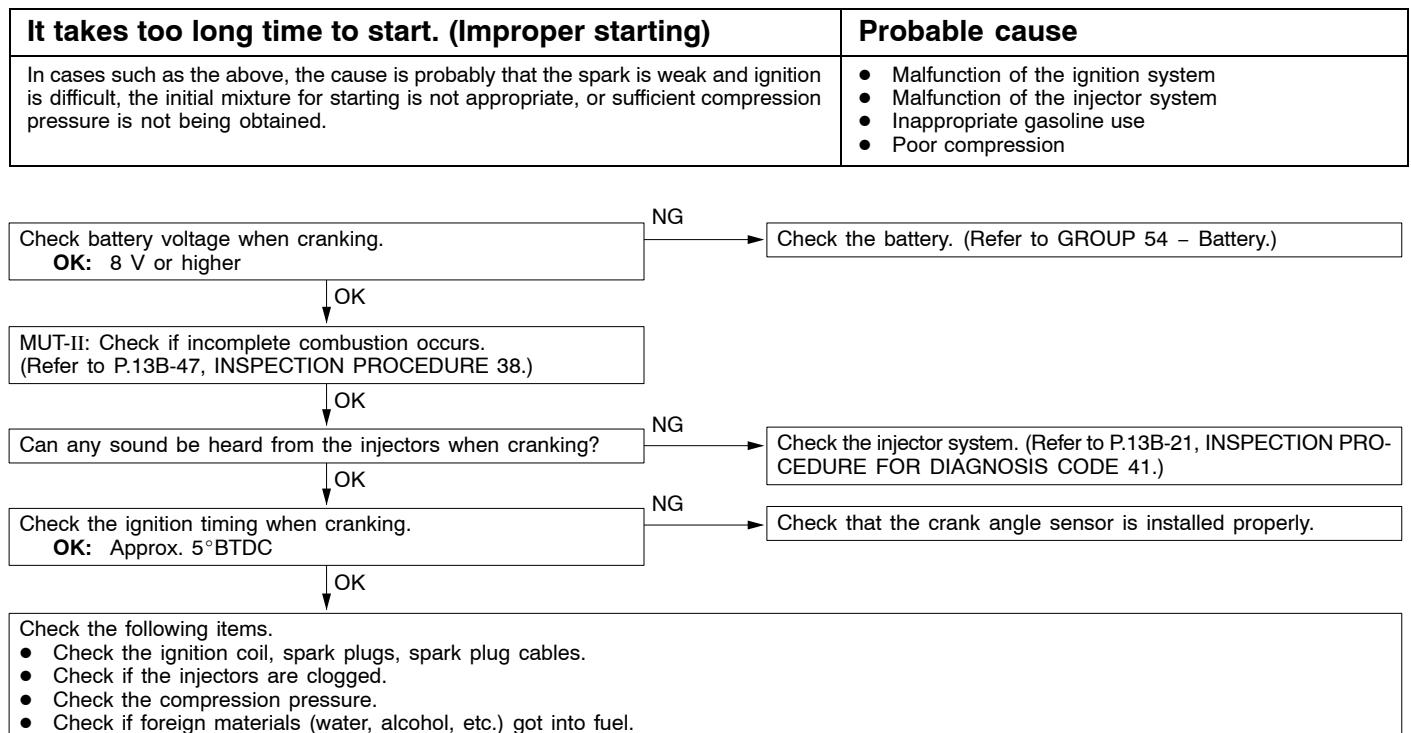
No initial combustion (starting impossible)	Probable cause
In cases such as the above, the cause is probably that a spark plug is defective, or that the supply of fuel to the combustion chamber is defective. In addition, foreign materials (water, kerosene, etc.) may be mixed with the fuel.	<ul style="list-style-type: none"> Malfunction of the ignition system Malfunction of the fuel pump system Malfunction of the injectors Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T> Malfunction of the immobilizer system <Vehicles for South Africa, Australia> Foreign materials in fuel



INSPECTION PROCEDURE 6

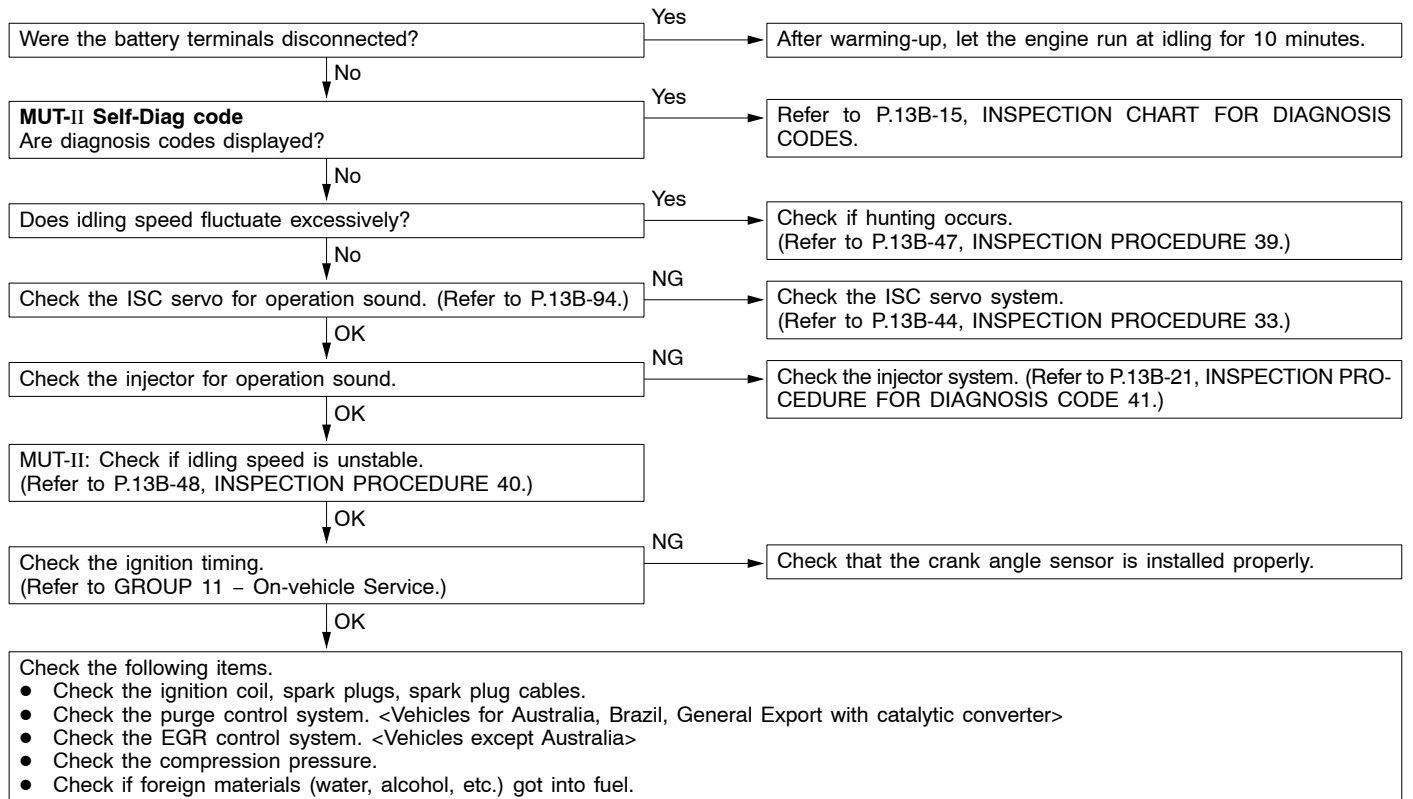


INSPECTION PROCEDURE 7



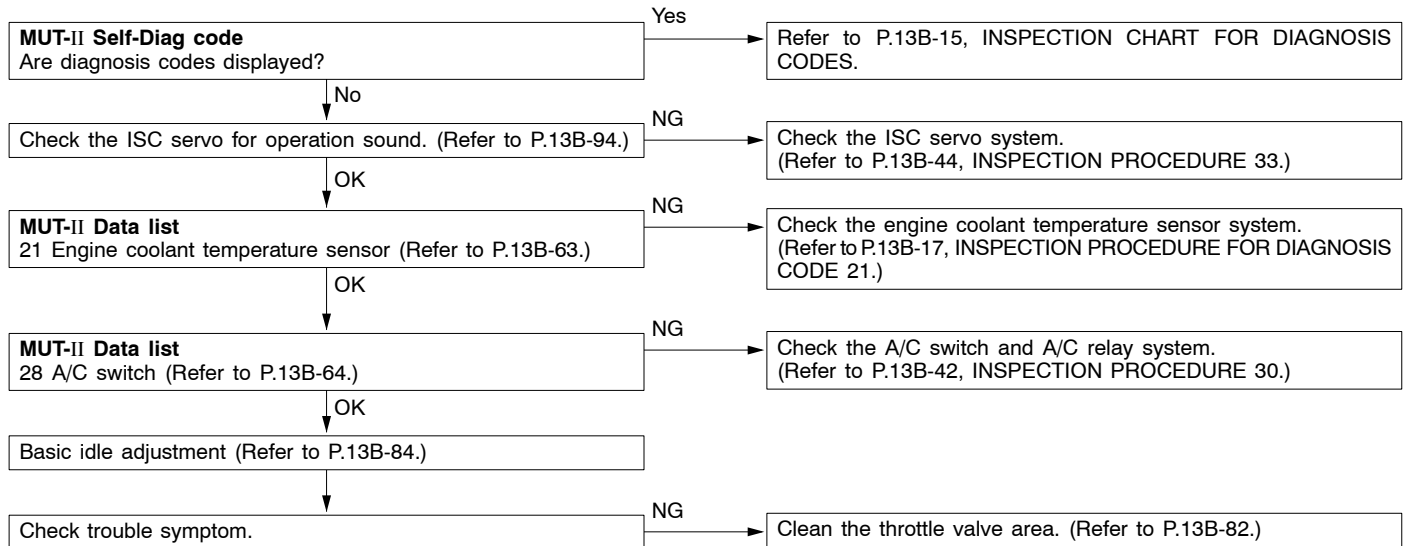
INSPECTION PROCEDURE 8

Unstable idling (Rough idling, hunting)	Probable cause
In cases as the above, the cause is probably that the ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective. Because the range of possible causes is broad, inspection is narrowed down to simple items.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Malfunction of the purge control solenoid valve system <Vehicles for Australia, Brazil, General Export with catalytic converter> • Malfunction of the EGR control solenoid valve system <Vehicles except Australia> • Poor compression • Drawing air into exhaust system



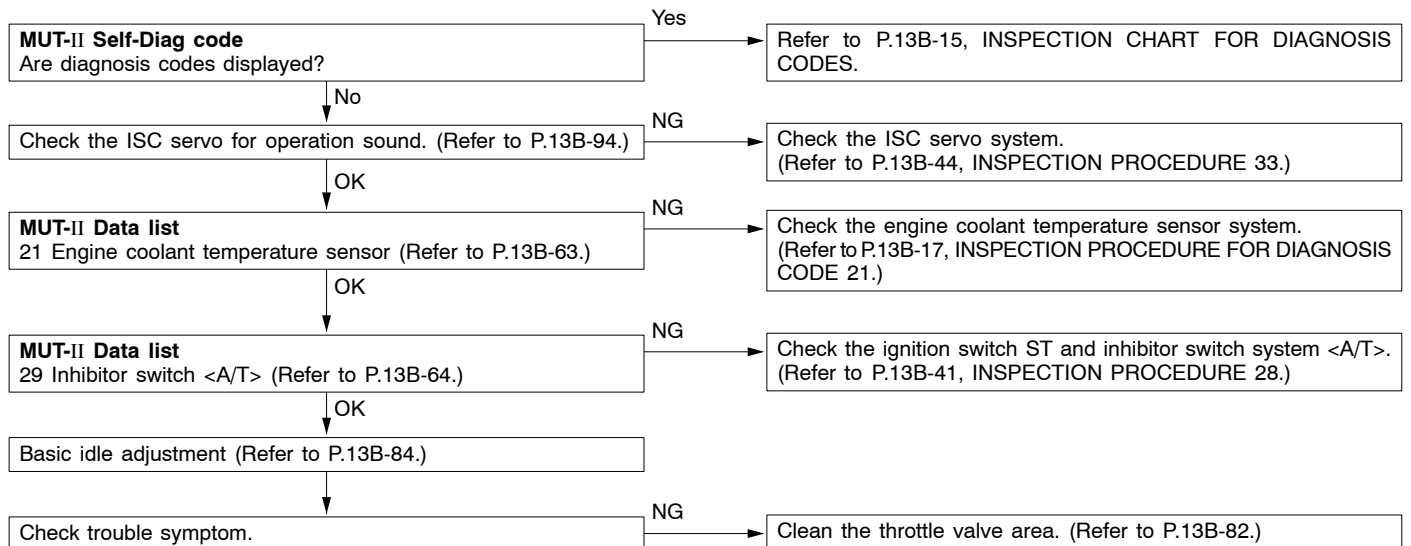
INSPECTION PROCEDURE 9

Idling speed is high. (Improper idling speed)	Probable cause
In such cases as the above, the cause is probably that the intake air volume during idling is too great.	<ul style="list-style-type: none"> • Malfunction of the ISC servo system • Malfunction of the throttle body



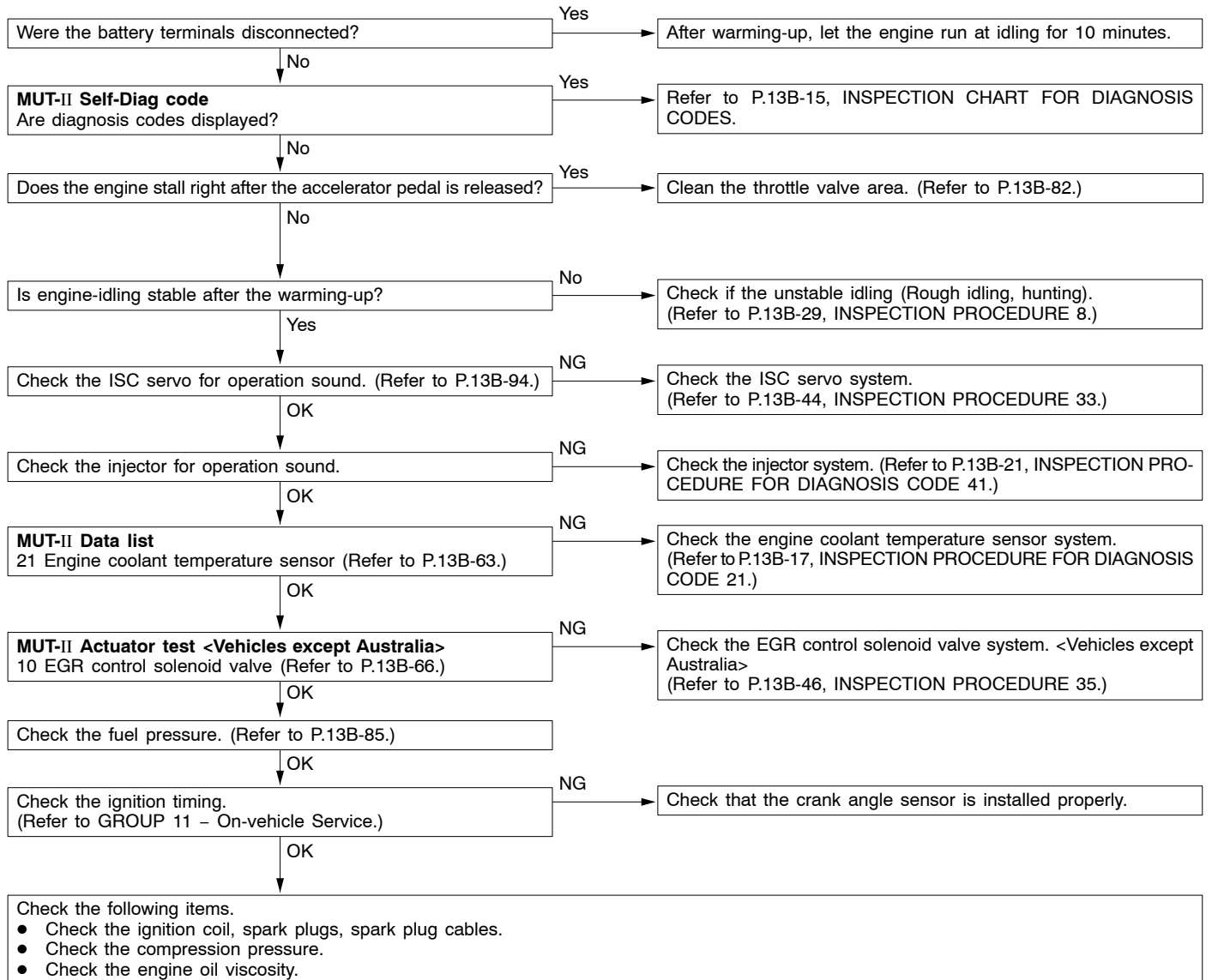
INSPECTION PROCEDURE 10

Idling speed is low. (Improper idling speed)	Probable cause
In cases such as the above, the cause is probably that the intake air volume during idling is too small.	<ul style="list-style-type: none"> • Malfunction of the ISC servo system • Malfunction of the throttle body



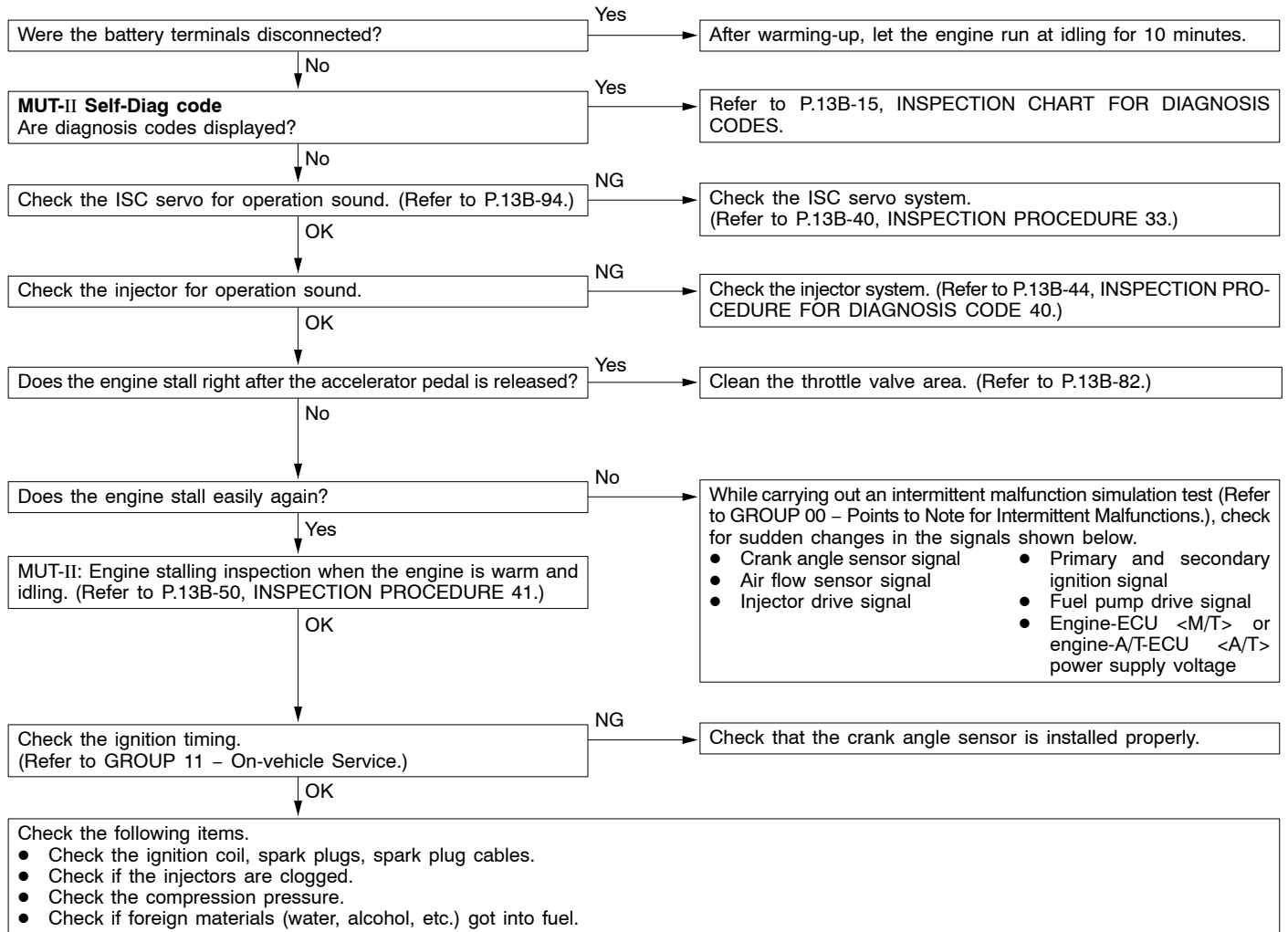
INSPECTION PROCEDURE 11

When the engine is cold, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	<ul style="list-style-type: none"> • Malfunction of the ISC servo system • Malfunction of the throttle body • Malfunction of the injector system • Malfunction of the ignition system



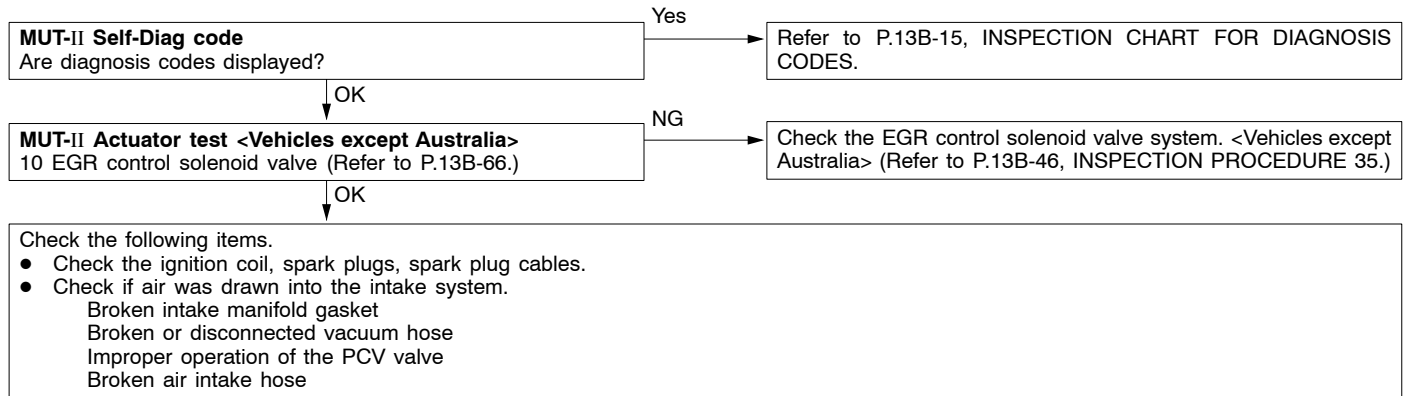
INSPECTION PROCEDURE 12

When the engine becomes hot, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective. In addition, if the engine suddenly stalls, the cause may also be a defective connector contact.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Drawing air into intake system • Improper connector contact



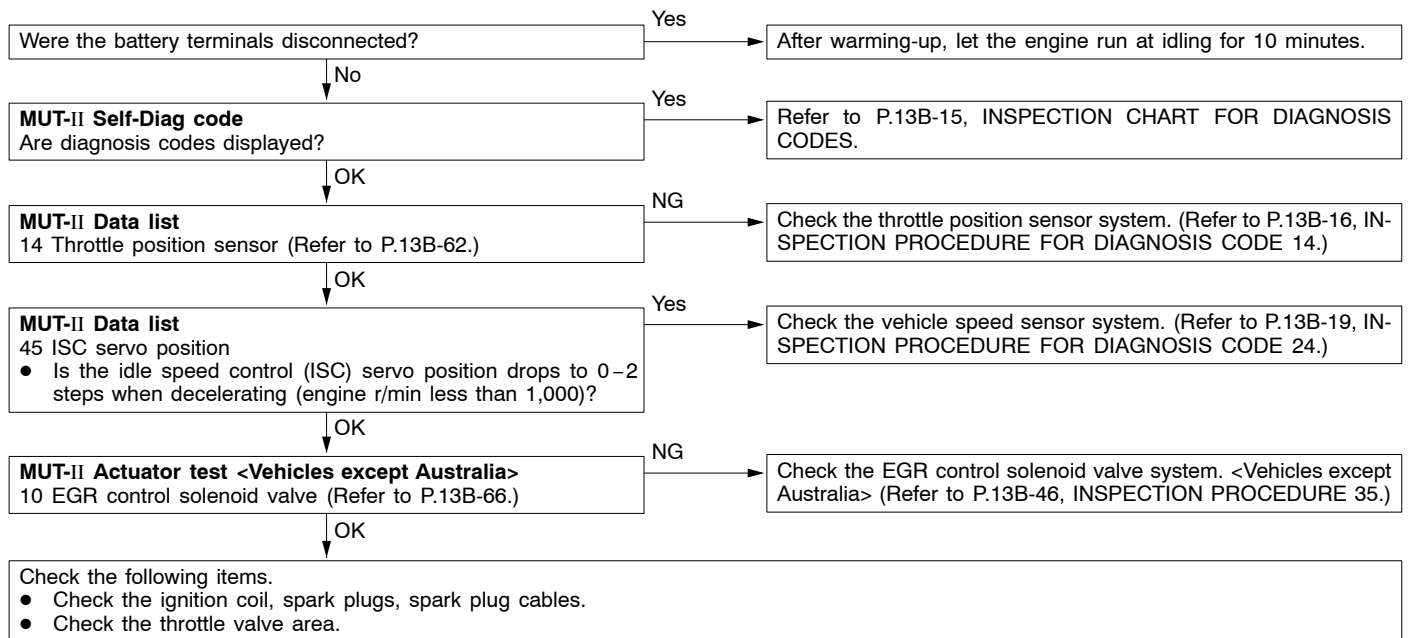
INSPECTION PROCEDURE 13

The engine stalls when starting the car. (Pass out)	Probable cause
In cases such as the above, the cause is probably misfiring due to a weak spark, or an inappropriate air/fuel mixture when the accelerator pedal is depressed.	<ul style="list-style-type: none"> • Drawing air into intake system • Malfunction of the ignition system



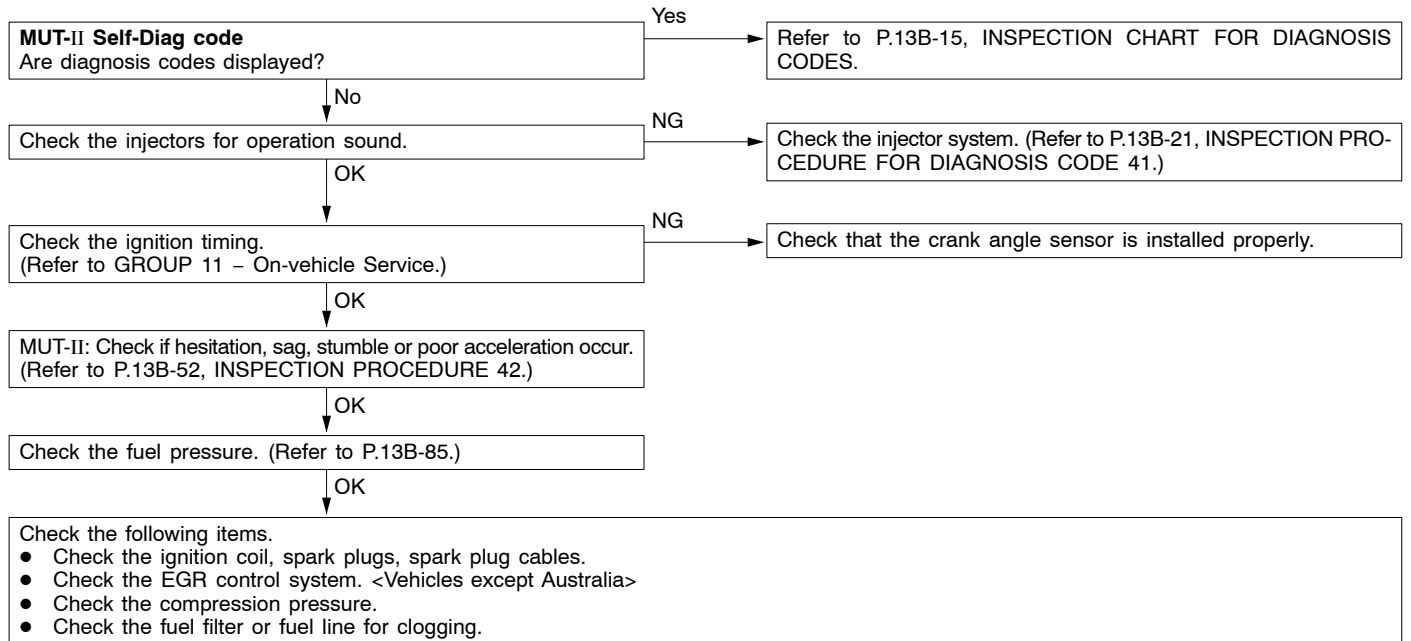
INSPECTION PROCEDURE 14

The engine stalls when decelerating.	Probable cause
In cases such as the above, the cause is probably that the intake air volume is insufficient due to a defective idle speed control (ISC) servo system.	<ul style="list-style-type: none"> • Malfunction of the ISC system

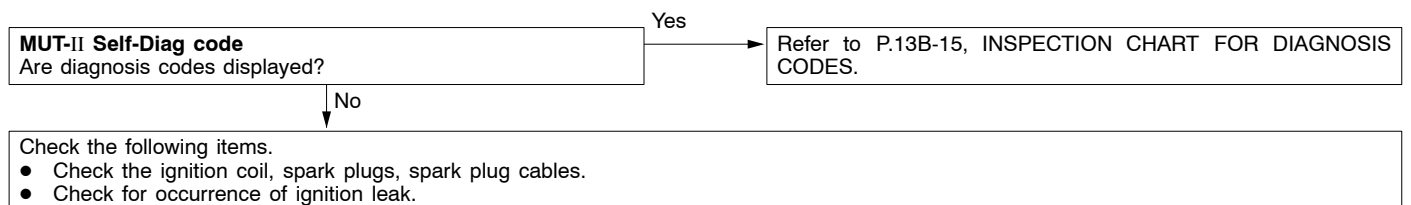


INSPECTION PROCEDURE 15

Hesitation, sag or stumble	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture or compression pressure is defective.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Malfunction of the EGR control solenoid valve system <Vehicles except Australia> • Poor compression

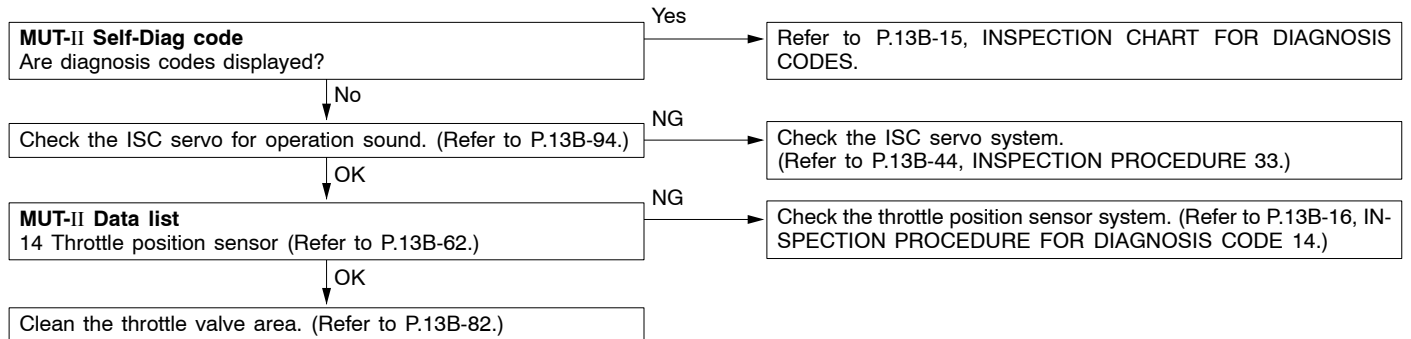
**INSPECTION PROCEDURE 16**

The feeling of impact or vibration when accelerating	Probable cause
In cases such as the above, the cause is probably that there is an ignition leak accompanying the increase in the spark plug demand voltage during acceleration.	<ul style="list-style-type: none"> • Malfunction of the ignition system



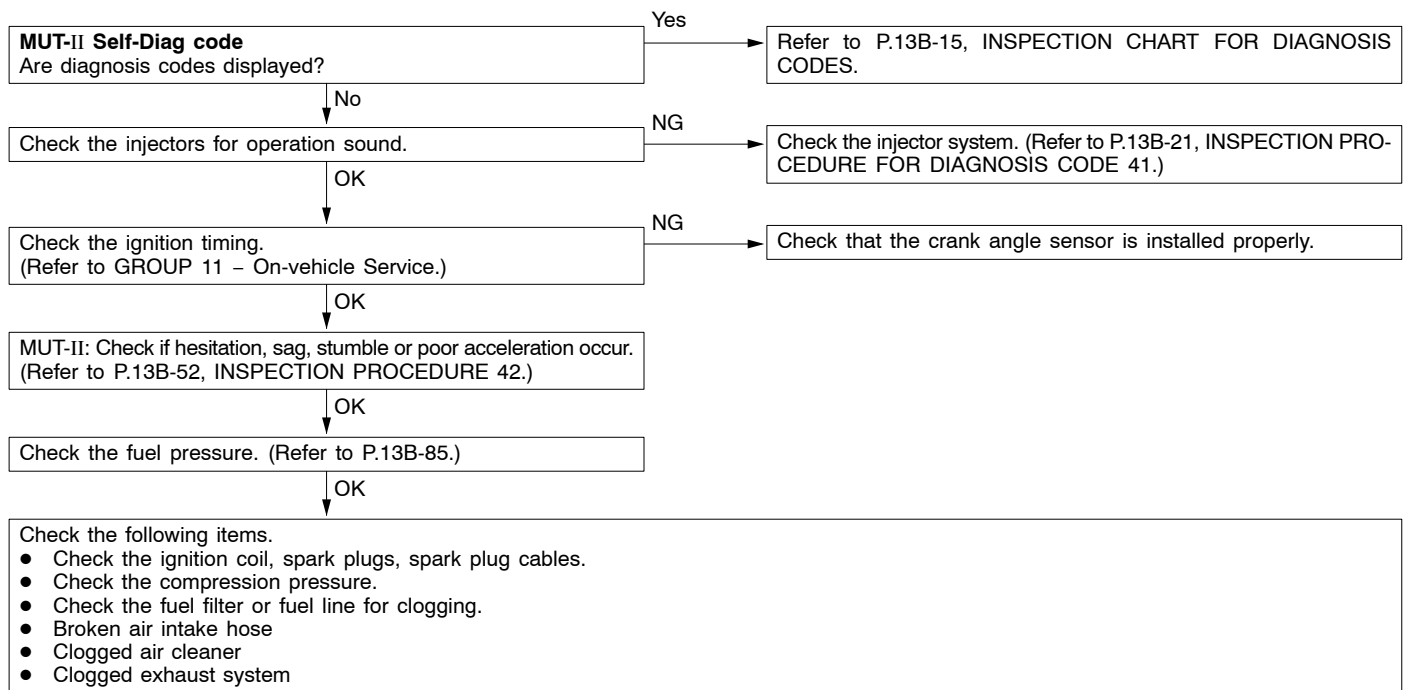
INSPECTION PROCEDURE 17

The feeling of impact or vibration when decelerating.	Probable cause
Malfunction of the ISC system is suspected.	<ul style="list-style-type: none"> Malfunction of the ISC system



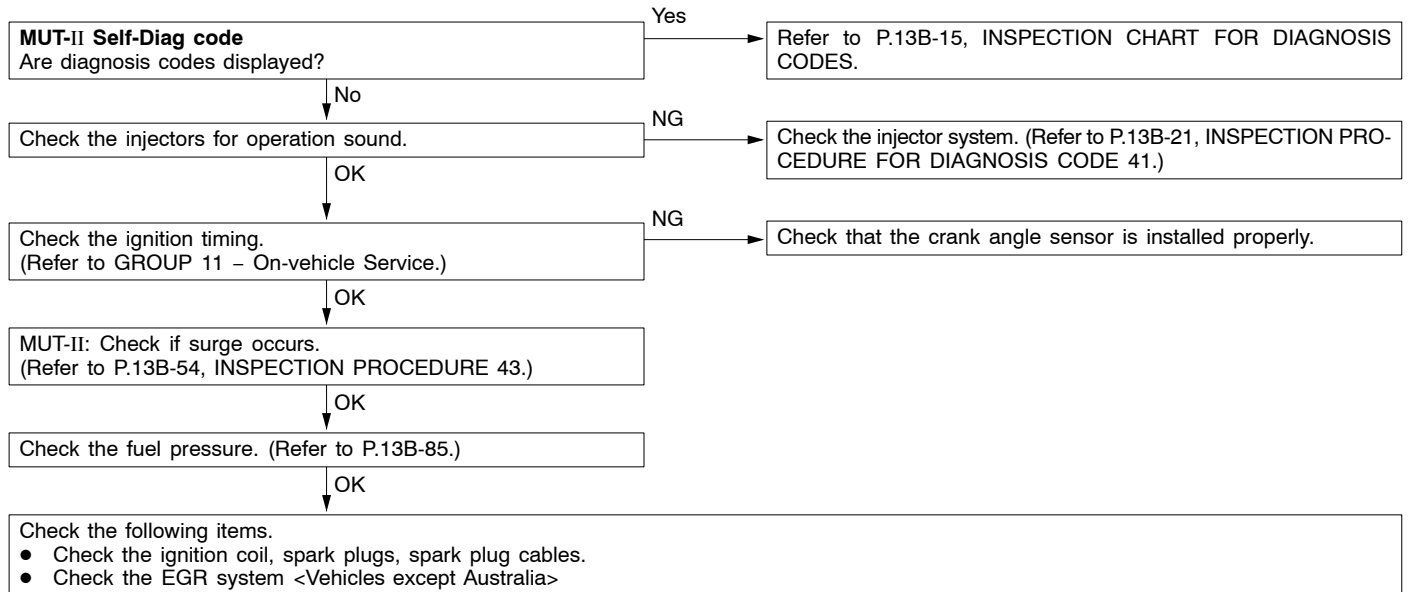
INSPECTION PROCEDURE 18

Poor acceleration	Probable cause
Defective ignition system, abnormal air-fuel ratio, poor compression pressure, etc. are suspected.	<ul style="list-style-type: none"> Malfunction of the ignition system Malfunction of air-fuel ratio control system Malfunction of the fuel supply system Poor acceleration Clogged exhaust system



INSPECTION PROCEDURE 19

Surge	Probable cause
Defective ignition system, abnormal air-fuel ratio, etc. are suspected.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the EGR control solenoid valve system <Vehicles except Australia>



INSPECTION PROCEDURE 20

Knocking	Probable cause
In cases as the above, the cause is probably that the heat value of the spark plug is inappropriate.	<ul style="list-style-type: none"> • Inappropriate heat value of the spark plug

Check the following items.

- Spark plugs
- Check if foreign materials (water, alcohol, etc.) got into fuel.

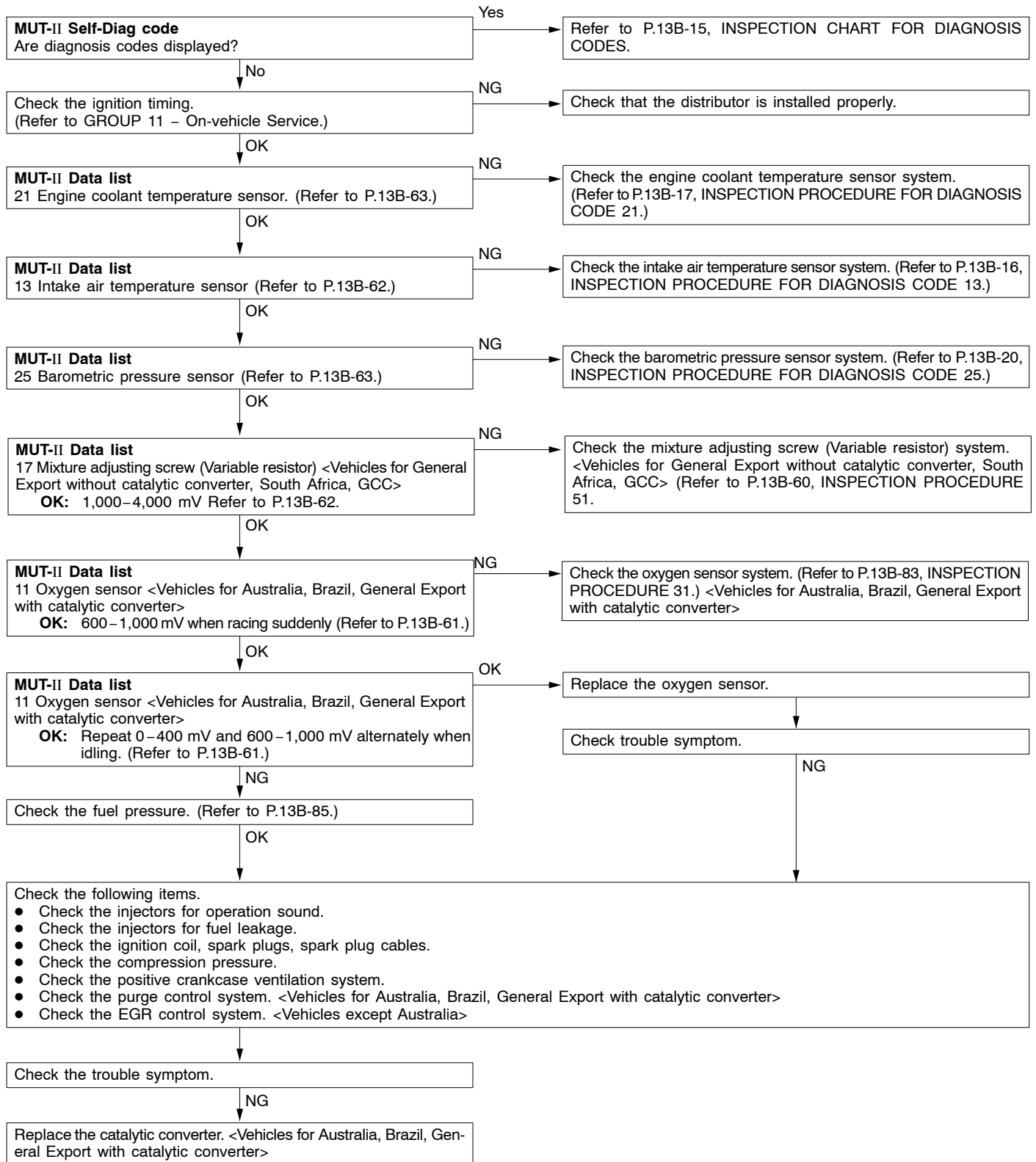
INSPECTION PROCEDURE 21

Dieseling	Probable cause
Fuel leakage from injectors is suspected.	<ul style="list-style-type: none"> • Fuel leakage from injectors

Check the injectors for fuel leakage.

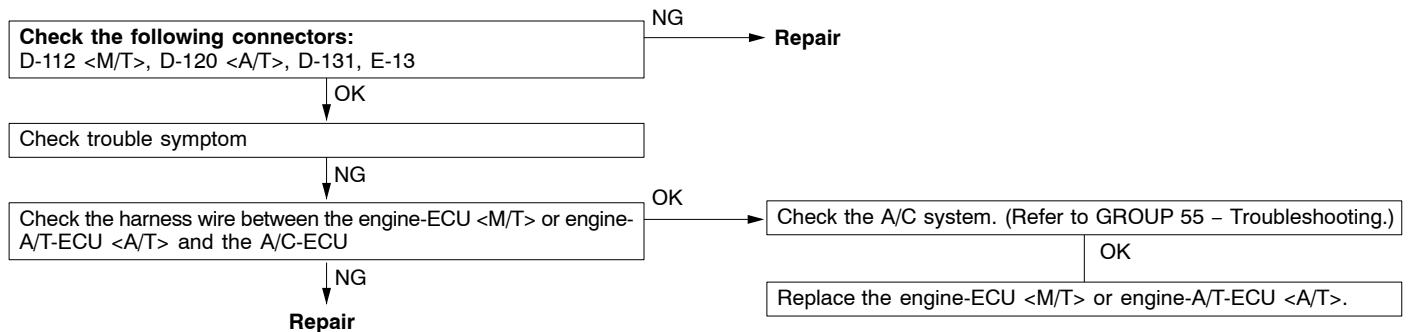
INSPECTION PROCEDURE 22

Too high CO and HC concentration when idling	Probable cause
Abnormal air-fuel ratio is suspected.	<ul style="list-style-type: none"> Malfunction of the air-fuel ratio control system Deteriorated catalyst



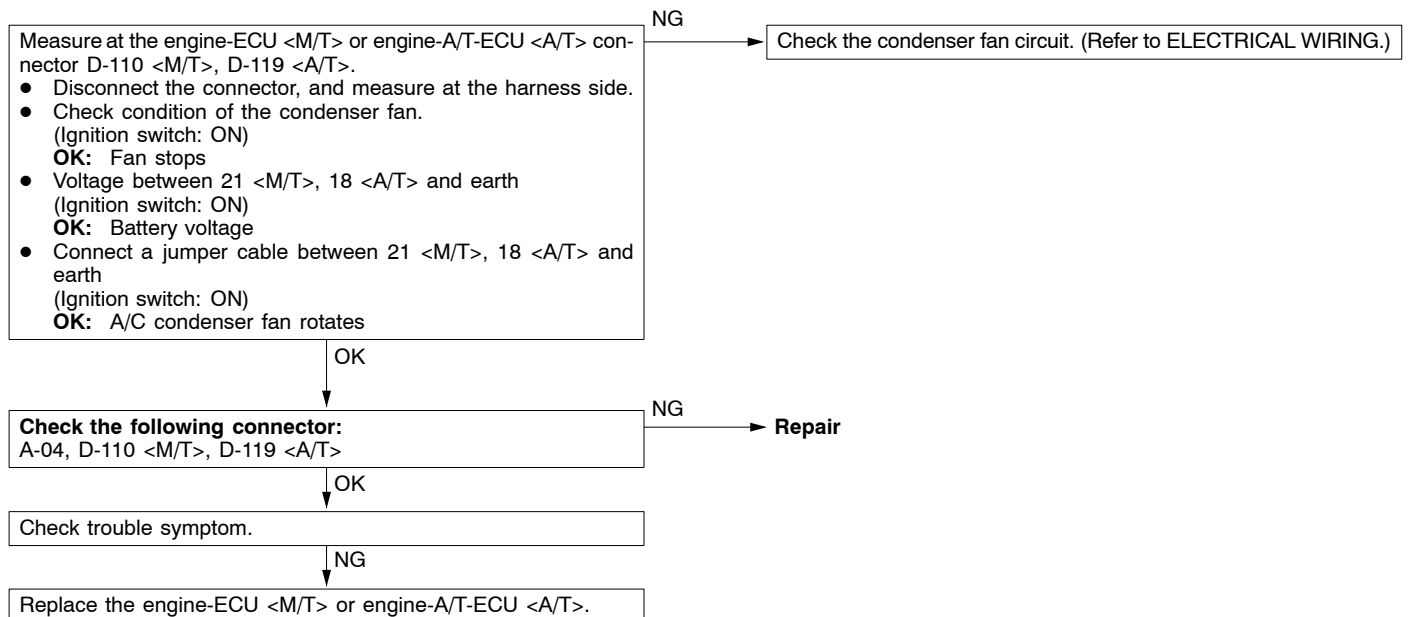
INSPECTION PROCEDURE 23

Idling speed is improper when A/C is operating (A/C switch 2 signal)	Probable cause
<p>The A/C-ECU judges if load caused by air conditioner is high or low, and converts it to A/C switch 2 signal to send the engine-ECU <M/T> or engine-A/T-ECU <A/T> it.</p> <p>Based on this signal, the engine-ECU <M/T> or engine-A/T-ECU <A/T> operates the throttle control servo to control the idle-up speed. If the load is lower than usual, the engine-ECU <M/T> or engine-A/T-ECU <A/T> decreases the idle-up speed.</p>	<ul style="list-style-type: none"> • Malfunction of the A/C control system • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



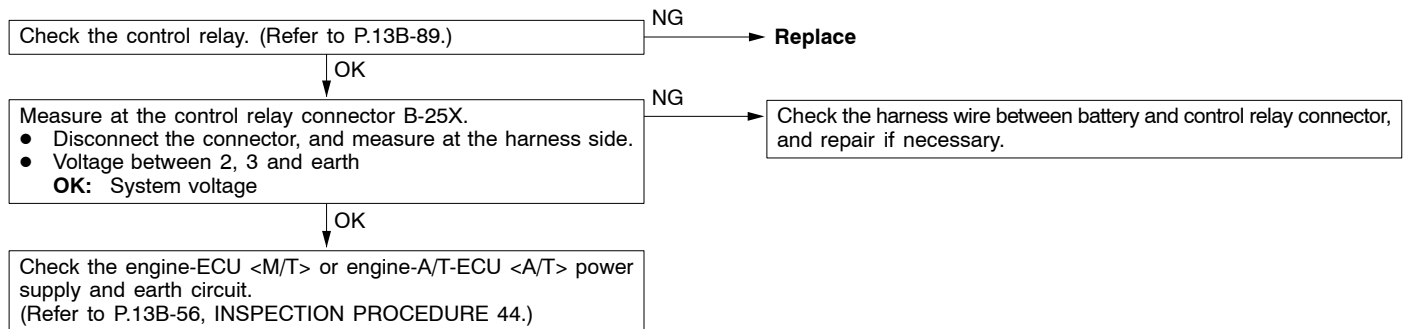
INSPECTION PROCEDURE 24

A/C condenser fan is inoperative	Probable cause
<p>The fan motor relay is controlled by turning on and off the power transistor in the engine-ECU <M/T> or engine-A/T-ECU <A/T>.</p>	<ul style="list-style-type: none"> • Malfunction of the A/C condenser fan relay • Malfunction of the condenser fan motor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



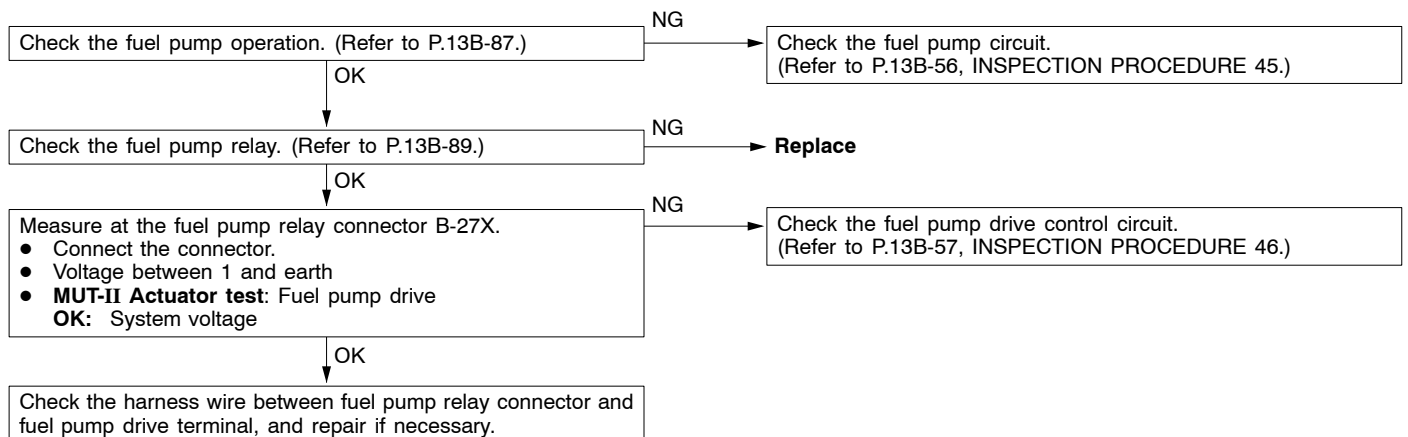
INSPECTION PROCEDURE 25

Power supply system and ignition switch-IG system	Probable cause
When an ignition switch ON signal is input to the engine-ECU <M/T> or engine-A/T-ECU <A/T>, the engine-ECU <M/T> or engine-A/T-ECU <A/T> turns the control relay ON. This causes battery voltage to be supplied to the engine-ECU <M/T> or engine-A/T-ECU <A/T>, injectors and air flow sensor.	<ul style="list-style-type: none"> • Malfunction of the ignition switch • Malfunction of the control relay • Improper connector contact, open circuit or short-circuited harness wire • Disconnected engine-ECU <M/T> or engine-A/T-ECU <A/T> earth wire • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



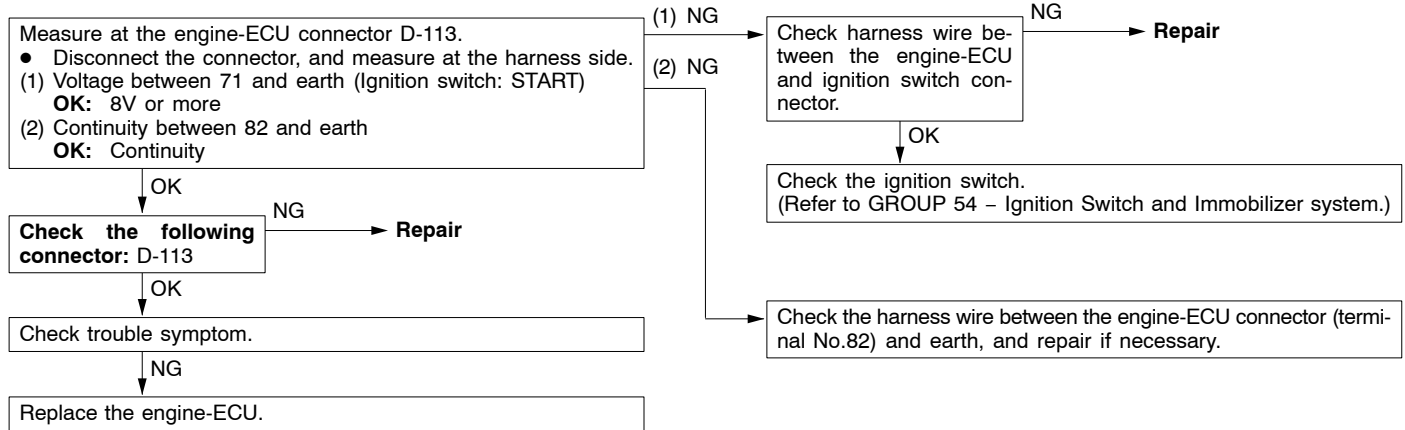
INSPECTION PROCEDURE 26

Fuel pump system	Probable cause
The engine-ECU <M/T> or engine-A/T-ECU <A/T> turns the control relay ON when the engine is cranking or running, and this supplies power to drive the fuel pump.	<ul style="list-style-type: none"> • Malfunction of the fuel pump relay • Malfunction of the fuel pump • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



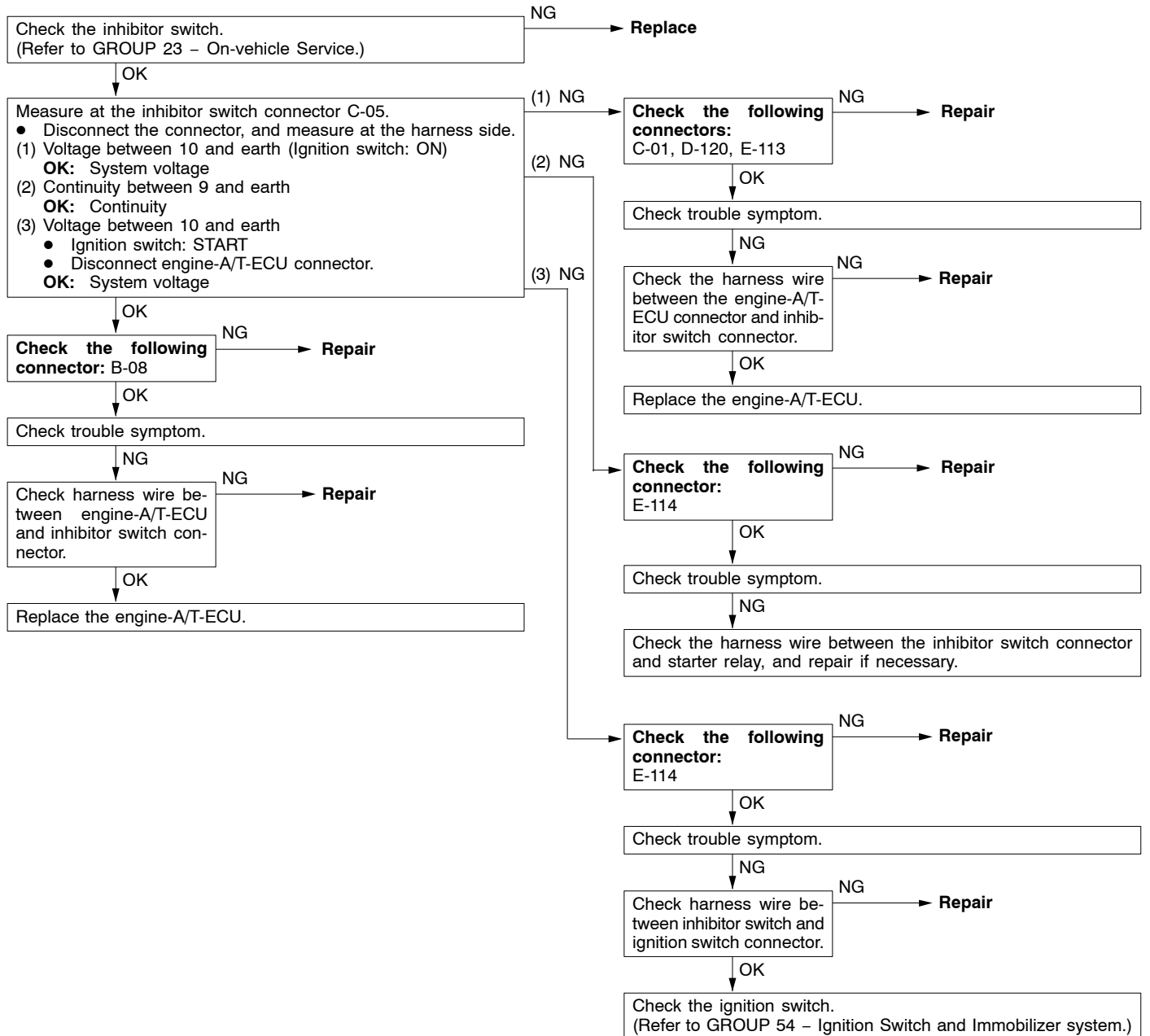
INSPECTION PROCEDURE 27

Ignition switch-ST system <M/T>	Probable cause
<p>The ignition switch-ST inputs a HIGH signal to the engine-ECU while the engine is cranking.</p> <p>The engine-ECU controls fuel injection, etc. during starting based on this input.</p>	<ul style="list-style-type: none"> • Malfunction of ignition switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



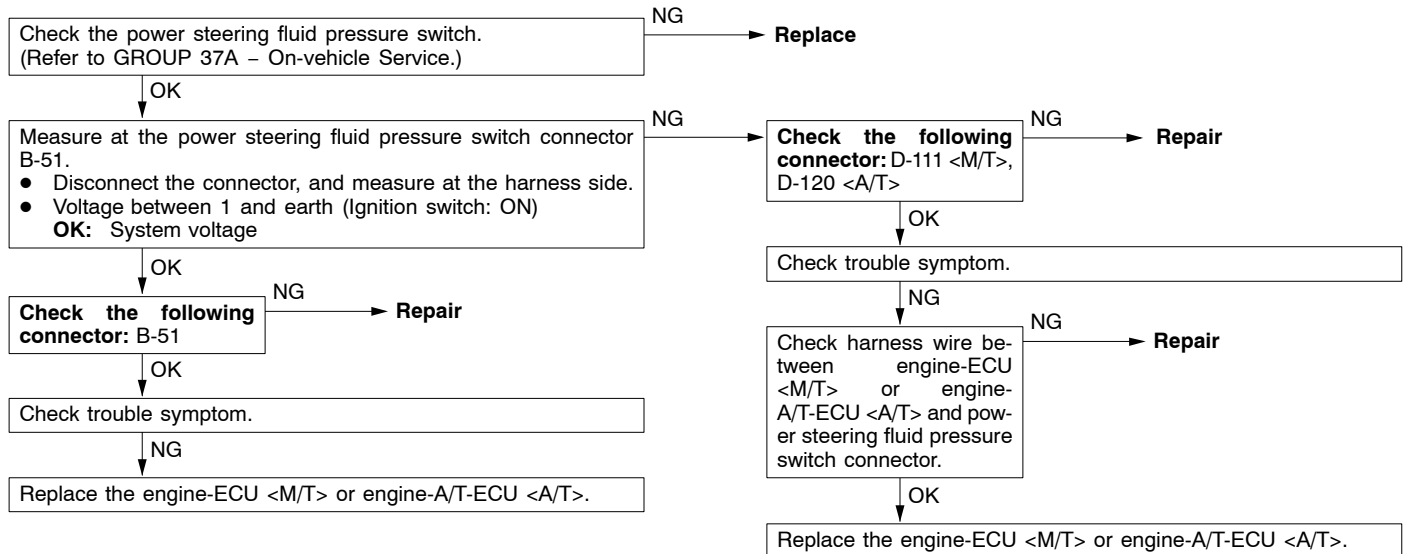
INSPECTION PROCEDURE 28

Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
<ul style="list-style-type: none"> The ignition switch-ST inputs a HIGH signal to the engine-A/T-ECU while the engine is cranking. The engine-A/T-ECU controls fuel injection, etc. during starting based on this input. The inhibitor switch inputs the condition of the select lever, i.e. whether it is in P or N range or in some other range, to the engine-A/T-ECU. The engine-A/T-ECU controls the idle speed control (ISC) servo based on this input. 	<ul style="list-style-type: none"> Malfunction of ignition switch Malfunction of inhibitor switch Improper connector contact, open circuit or short-circuited harness wire Malfunction of the engine-A/T-ECU



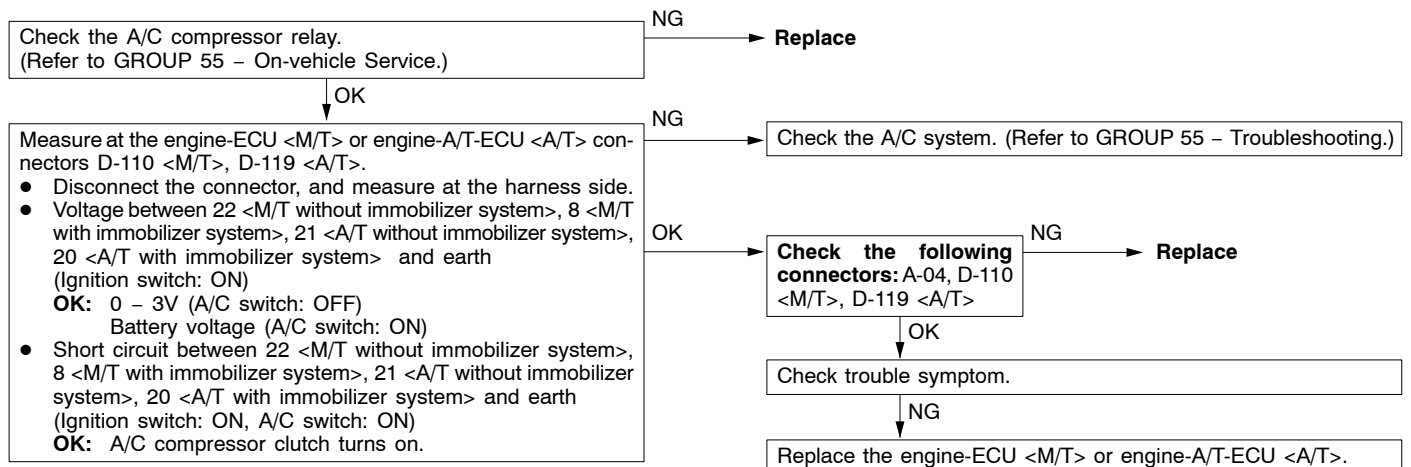
INSPECTION PROCEDURE 29

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the engine-ECU <M/T> or engine-A/T-ECU <A/T>. The engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the idle speed control (ISC) servo based on this input.	<ul style="list-style-type: none"> • Malfunction of power steering fluid pressure switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



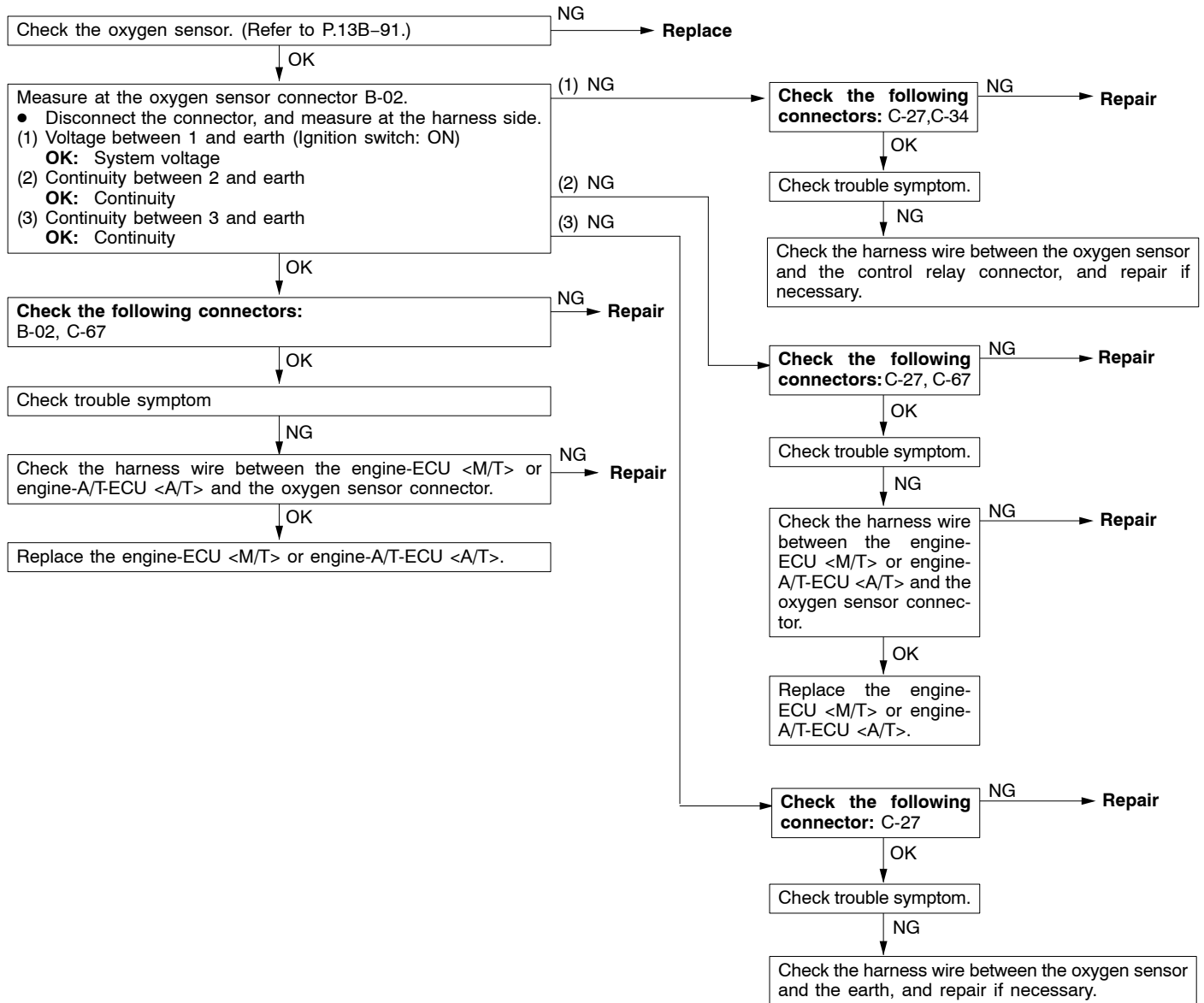
INSPECTION PROCEDURE 30

A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine-ECU <M/T> or engine-A/T-ECU <A/T>, the engine-ECU <M/T> or engine-A/T-ECU <A/T> carries out control of the idle speed control (ISC) servo, and also operates the A/C compressor magnetic clutch.	<ul style="list-style-type: none"> • Malfunction of A/C control system • Malfunction of A/C switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>

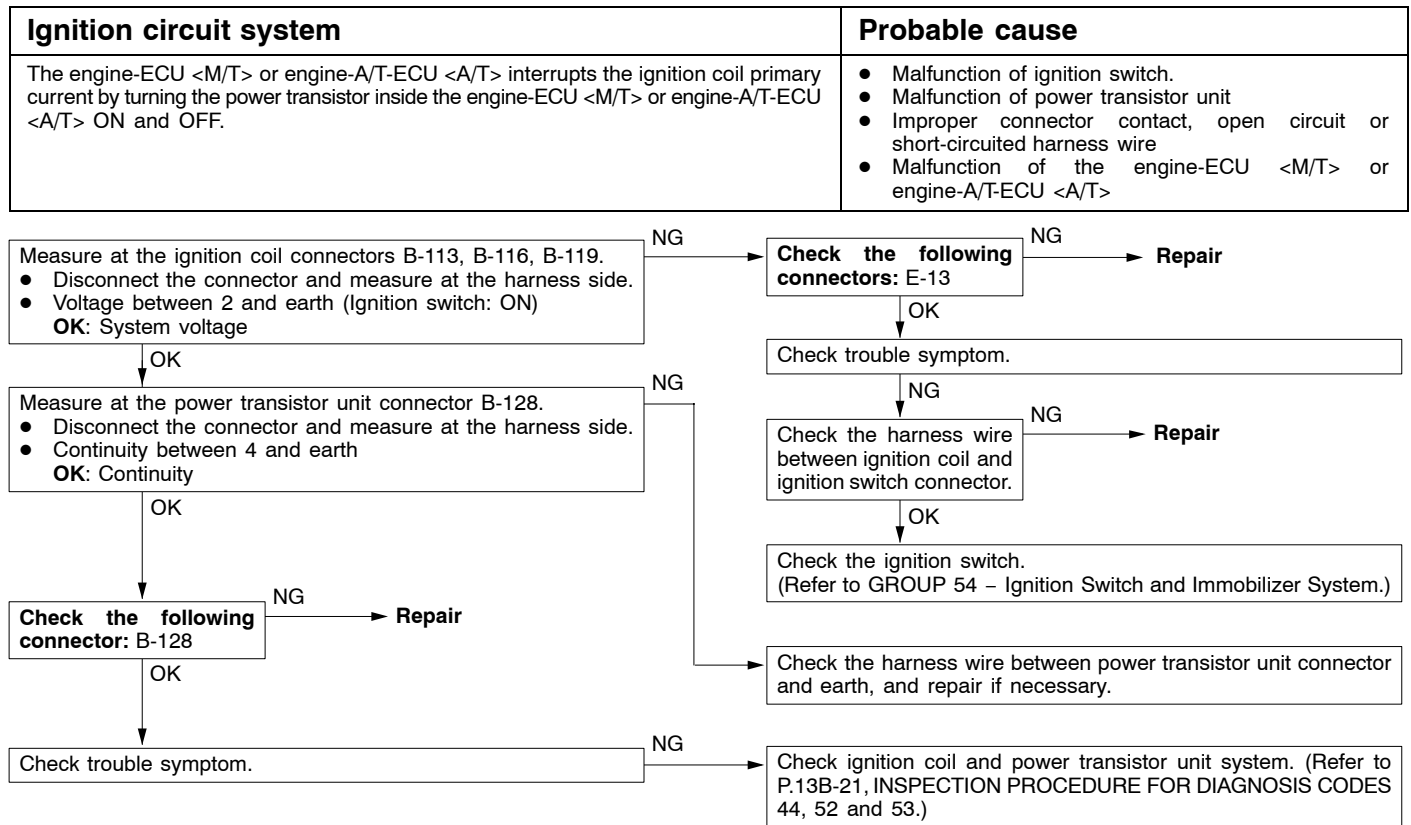


INSPECTION PROCEDURE 31

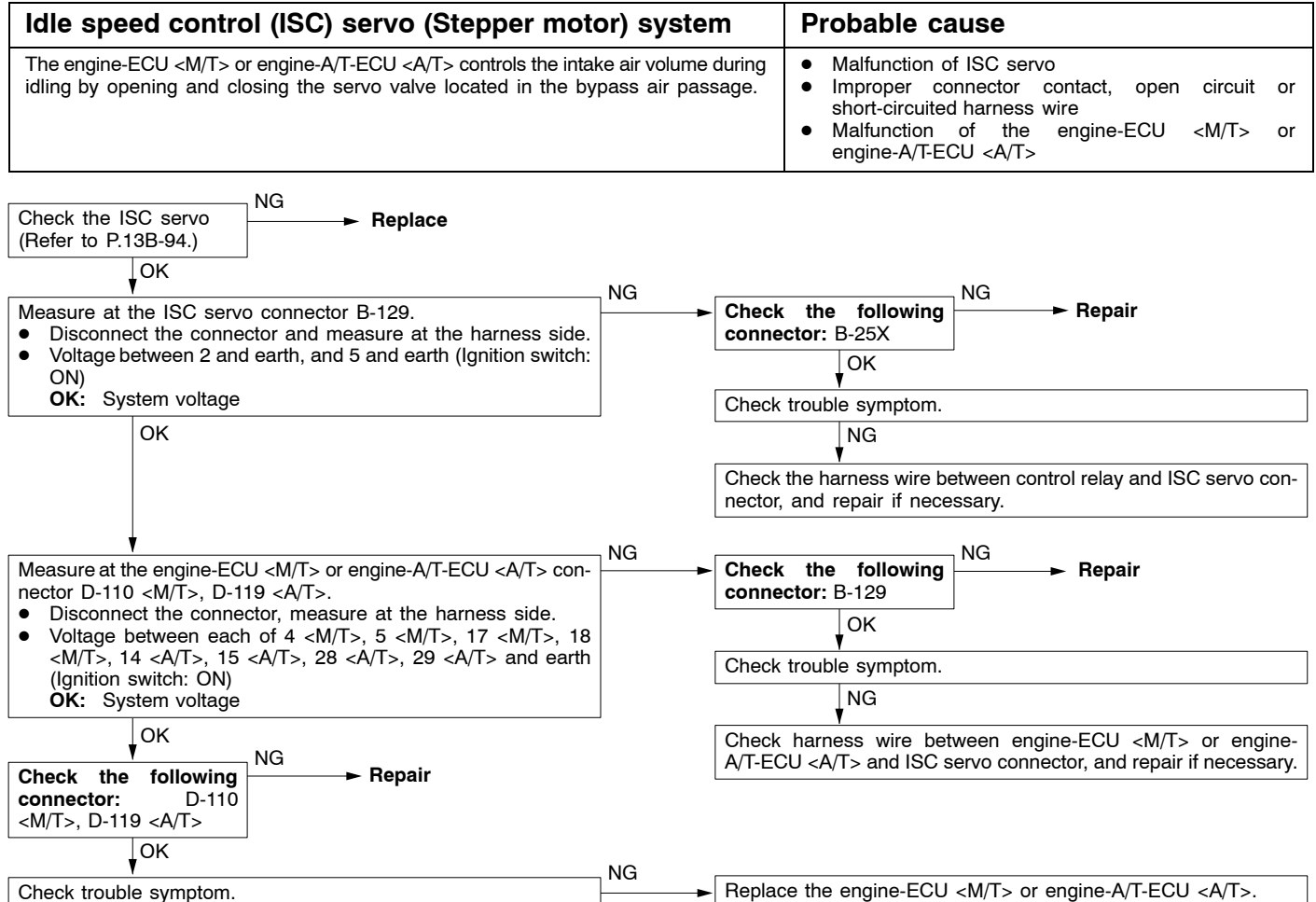
Oxygen sensor system <Vehicles for Australia, Brazil, General Export with catalytic converter>	Probable cause
<p>If the CO and HC contents are high, the probable causes mentioned to the right column are suspected.</p> <ul style="list-style-type: none"> • The oxygen sensor detects the oxygen content in exhaust gas, converts it to voltage, and sends the voltage to the engine-ECU <M/T> or engine-A/T-ECU <A/T>. • The engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the fuel injection amount to adjust the air/fuel ratio to theoretical one. 	<ul style="list-style-type: none"> • Malfunction of the oxygen sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



INSPECTION PROCEDURE 32

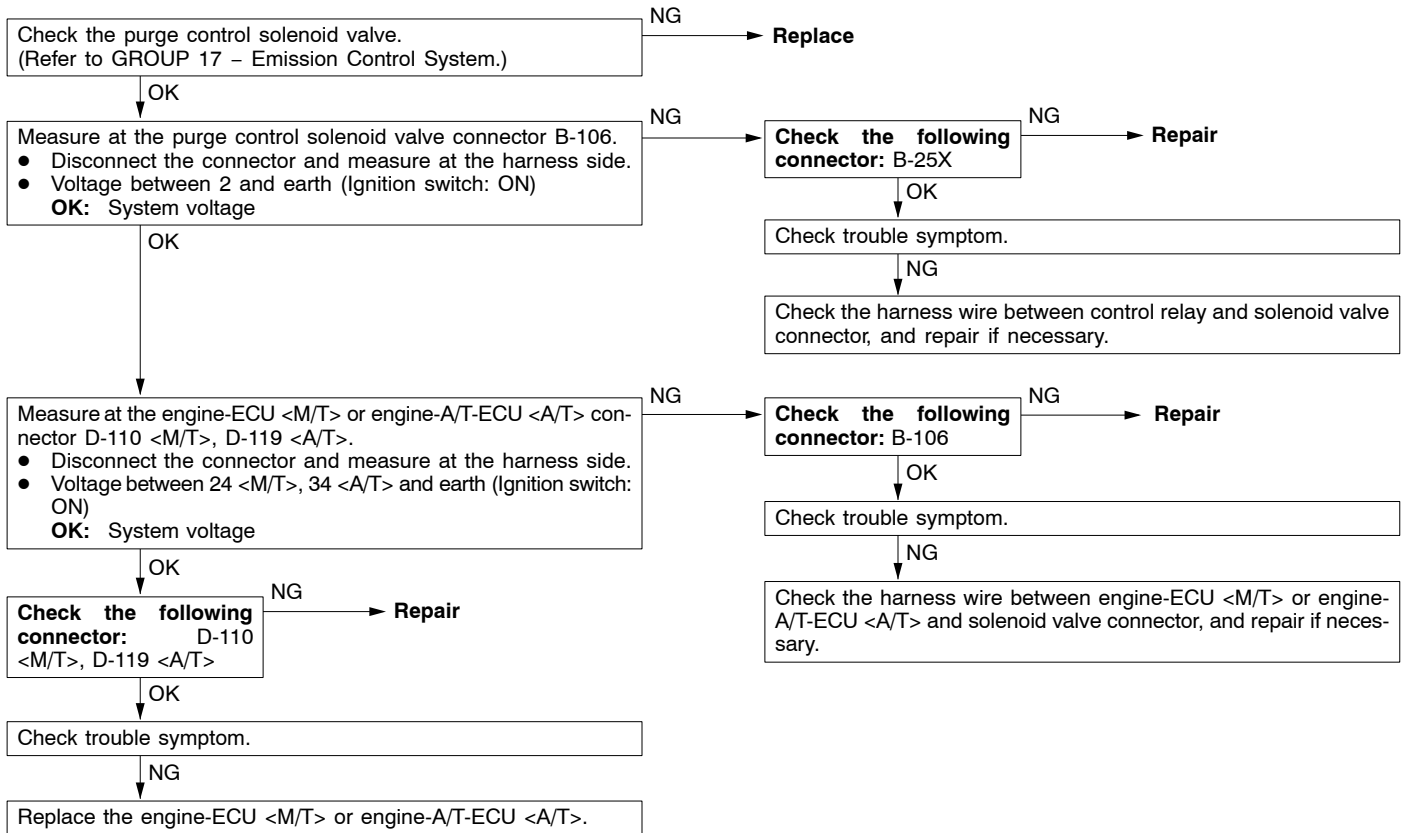


INSPECTION PROCEDURE 33



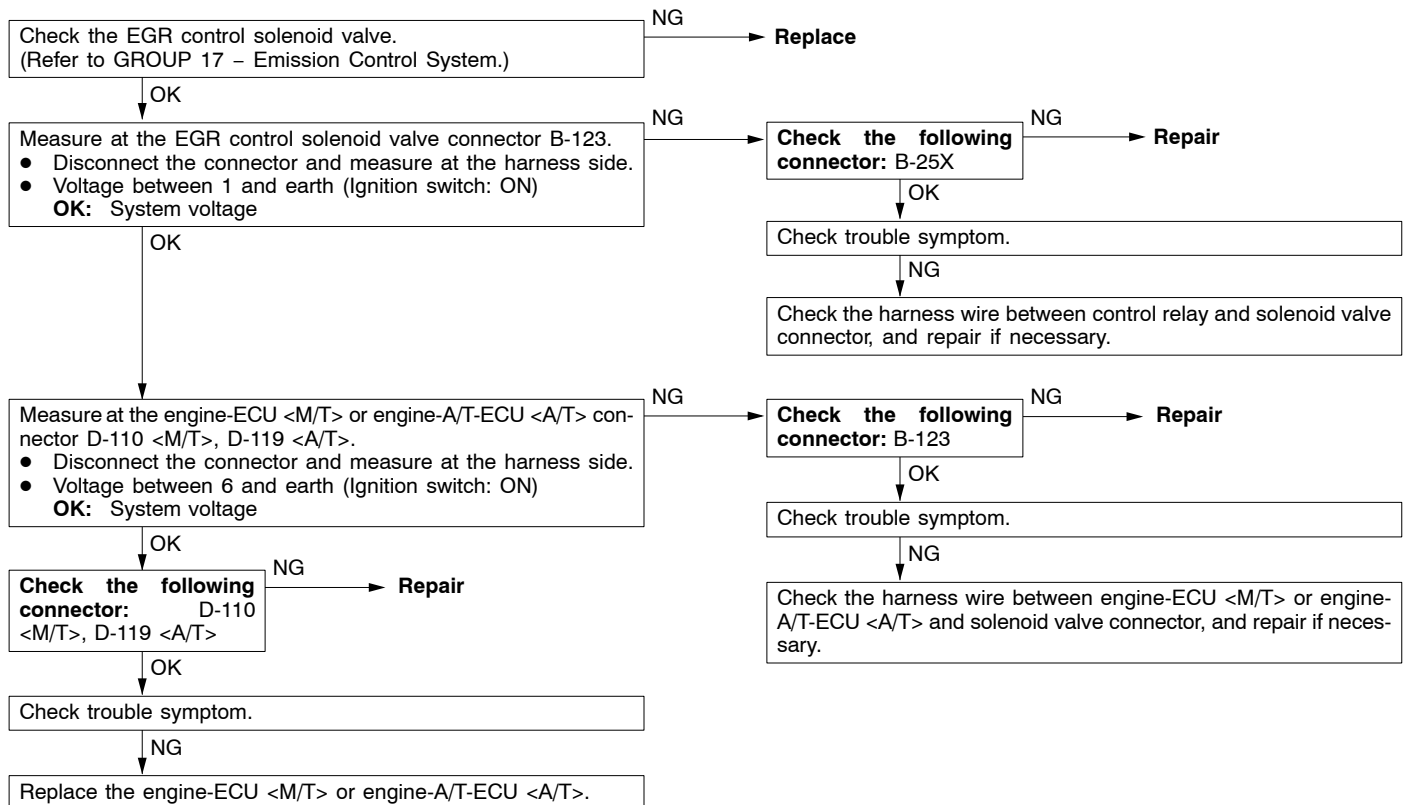
INSPECTION PROCEDURE 34

Purge control solenoid valve system <Vehicles for Australia, Brazil, General Export with catalytic converter>	Probable cause
The purge control solenoid valve controls the purging of air from the canister located inside the intake manifold.	<ul style="list-style-type: none"> Malfunction of solenoid valve Improper connector contact, open circuit or short-circuited harness wire. Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



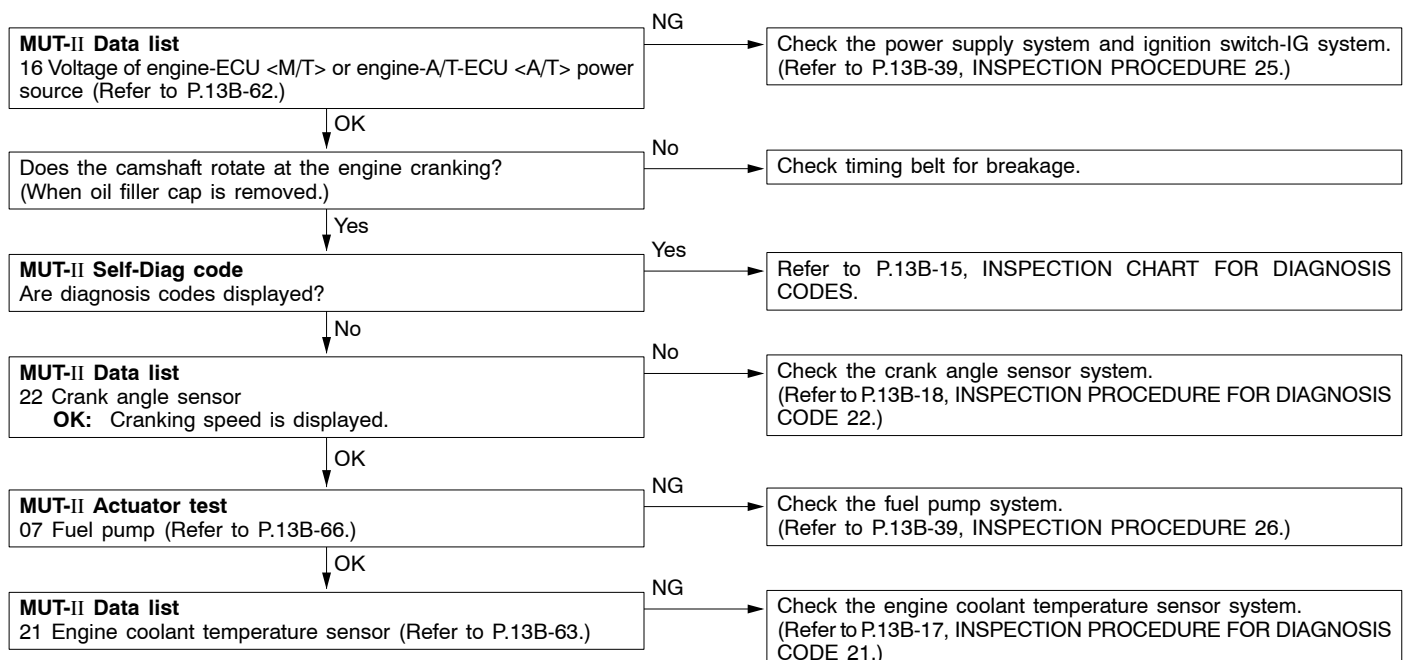
INSPECTION PROCEDURE 35

EGR control solenoid valve system <Vehicles except Australia>	Probable cause
The EGR control solenoid valve is controlled by the negative pressure resulting from EGR operation leaking to port "A" of the throttle body.	<ul style="list-style-type: none"> Malfunction of solenoid valve Improper connector contact, open circuit or short-circuited harness wire. Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



INSPECTION PROCEDURE 36

MUT-II: Inspection of no initial combustion



INSPECTION PROCEDURE 37**Ignition system: Inspection of no initial combustion.**

Measure at the power transistor connector B-128

- Connect the connector. (Use test harness: MB991348)
- Connect a primary voltage detection-type tachometer to terminals 11, 12, and 13 in that order.

OK: Each terminal displays a speed on the engine tachometer that is 1/3 of the cranking speed.

NG

Check ignition circuit system.
(Refer to P.13B-44, INSPECTION PROCEDURE 32.)

OK

Check the ignition timing when cranking.
OK: Approx. 5° BTDC

NG

Check that the crank angle sensor is installed properly.

INSPECTION PROCEDURE 38**MUT-II: Check if incomplete combustion occurs.**

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes

Refer to P.13B-15, INSPECTION CHART FOR DIAGNOSIS CODE

No

MUT-II Actuator test
07 Fuel pump (Refer to P.13B-66.)

NG

Check the fuel pump system.
(Refer to P.13B-39, INSPECTION PROCEDURE 26.)

OK

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13B-63.)

NG

Check the engine coolant temperature sensor system.
(Refer to P.13B-17, INSPECTION PROCEDURES FOR DIAGNOSIS CODE 21.)

OK

MUT-II Data list
18 Ignition switch-ST (Refer to P.13B-62.)

NG

Check the ignition switch-ST system <M/T>.
(Refer to P.13B-40, INSPECTION PROCEDURE 27.)
Check the ignition switch-ST and inhibitor switch system <A/T>.
(Refer to P.13B-41, INSPECTION PROCEDURE 28.)

INSPECTION PROCEDURE 39**Check if hunting occurs.**

Clean the throttle body. (Refer to P.13B-82.)



Check trouble symptom.

NG

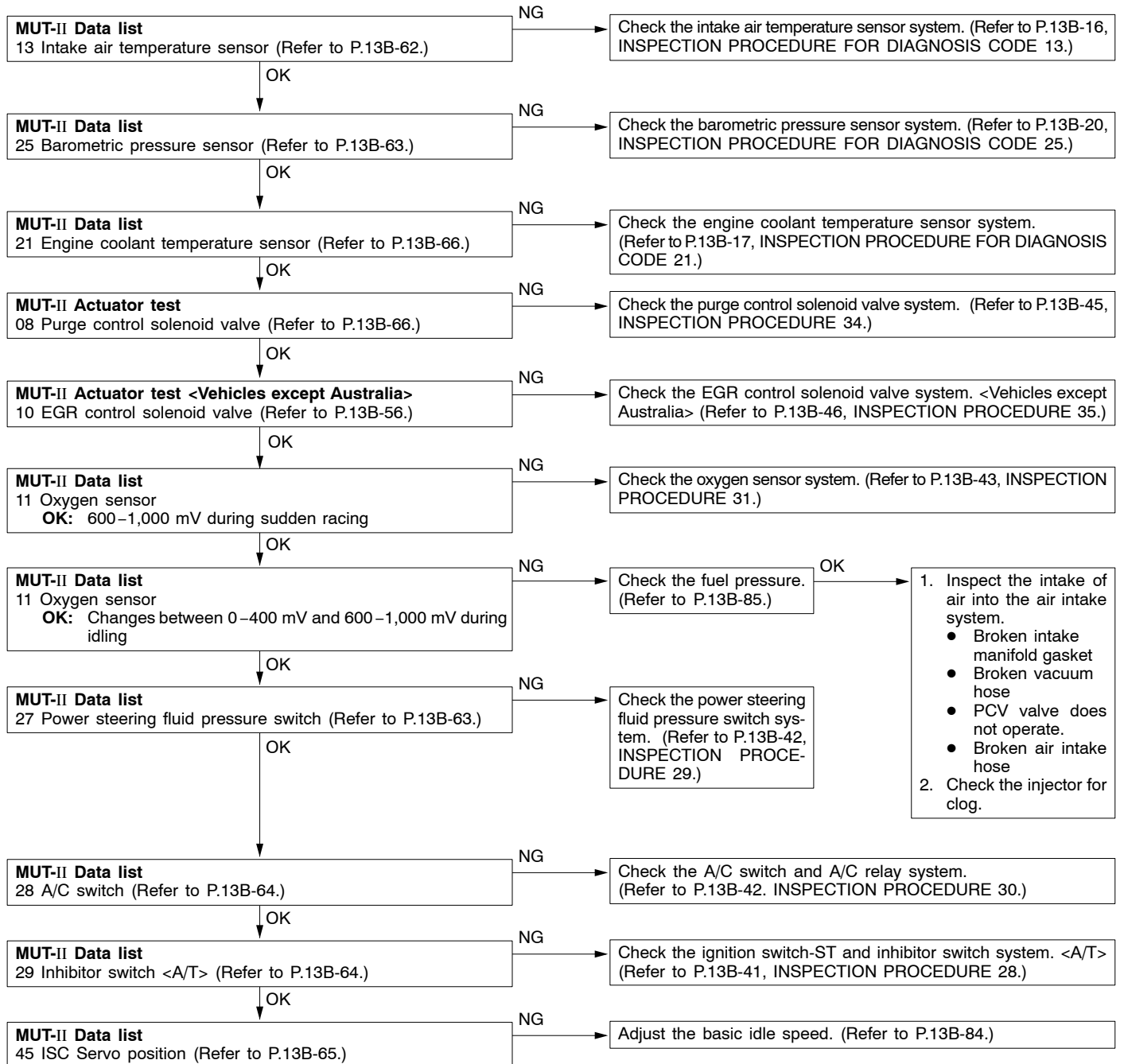
Inspect the intake of air into the air intake system.

- Broken intake manifold gasket
- Broken air intake hose
- Broken vacuum hose
- Positive crankcase ventilation valve does not operate.

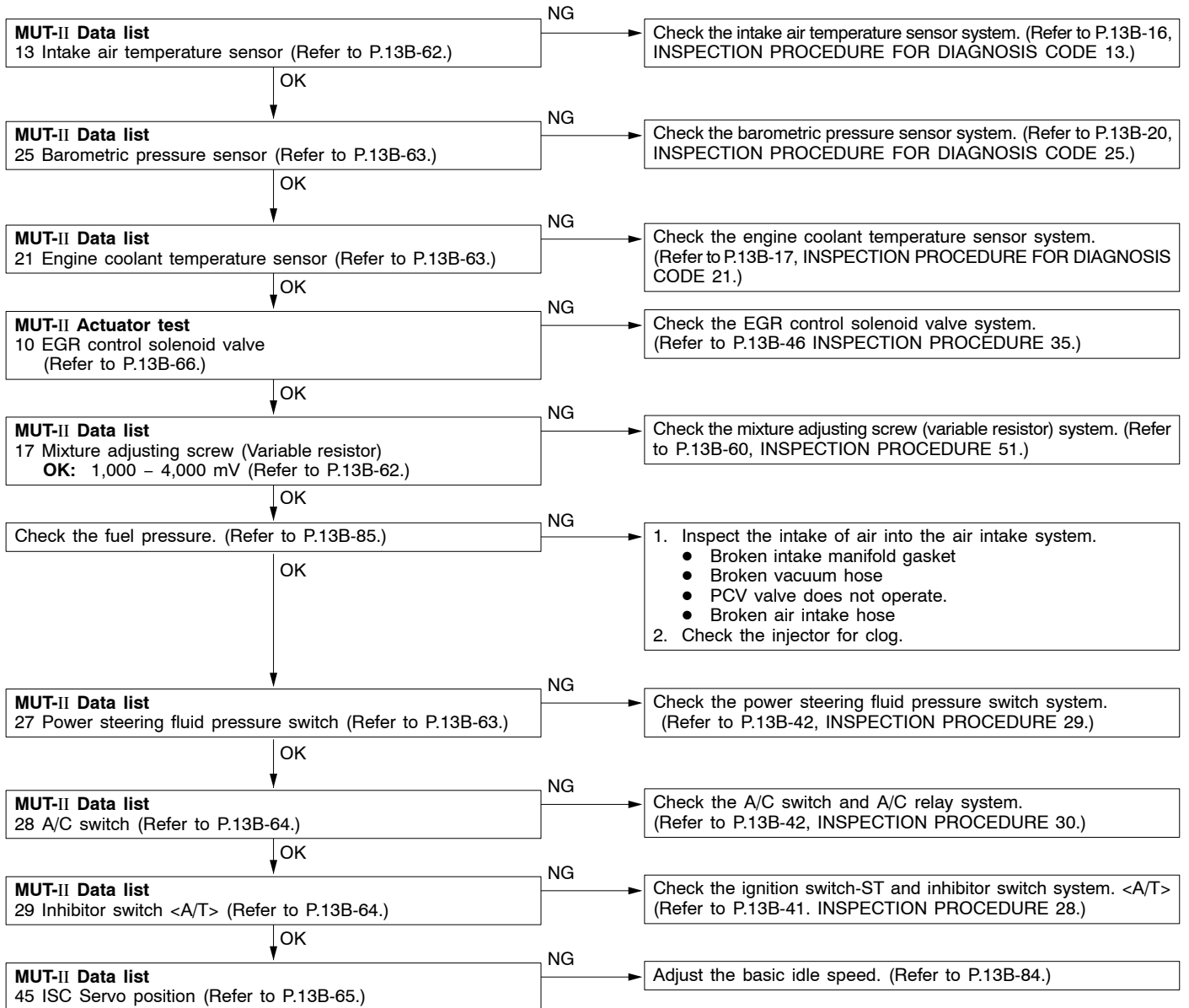
INSPECTION PROCEDURE 40

MUT-II: Check if idling speed is unstable.

<Vehicles for Australia, Brazil, General Export with catalytic converter>



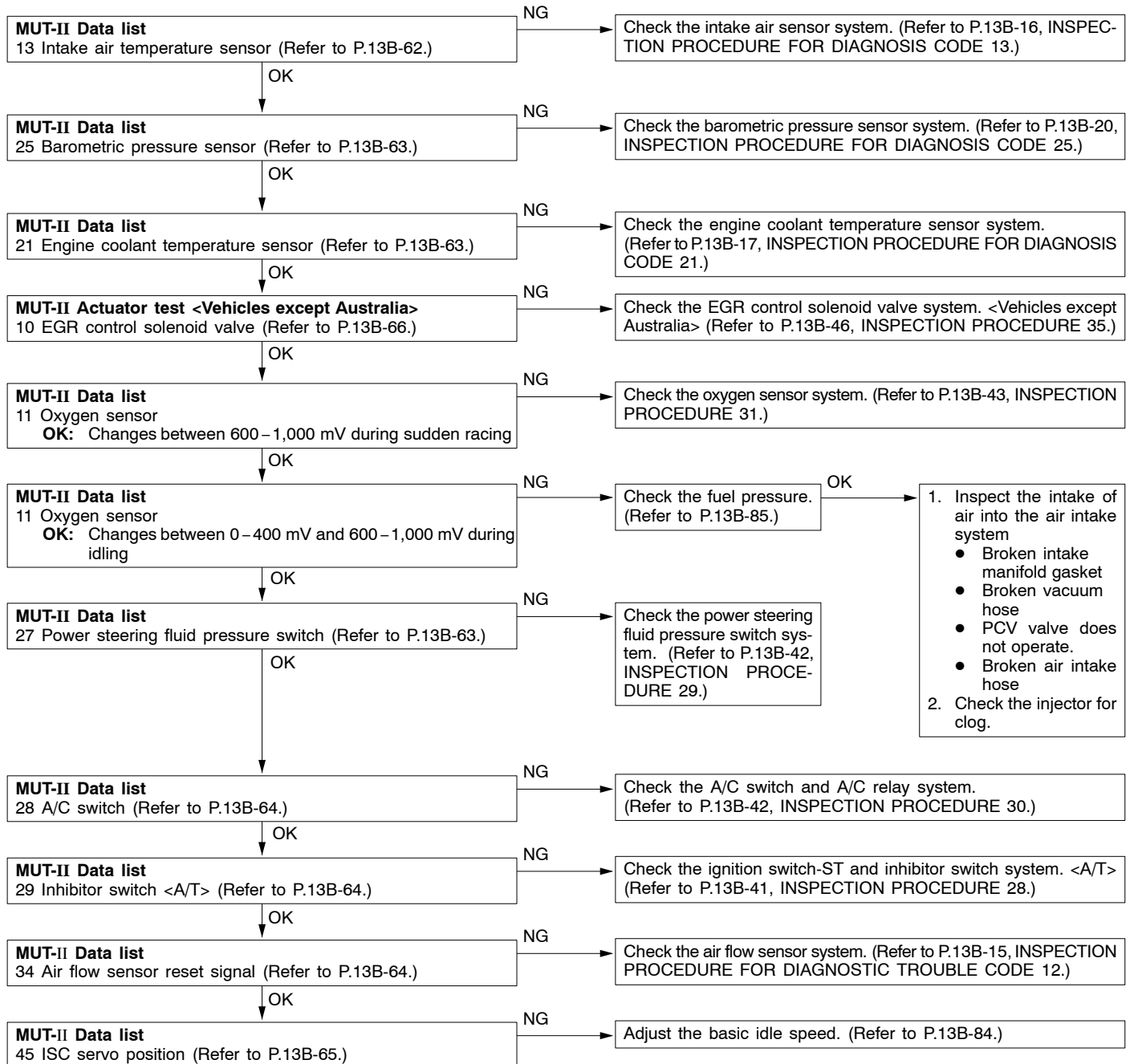
<Vehicles for General Export without catalytic converter, South Africa, GCC>



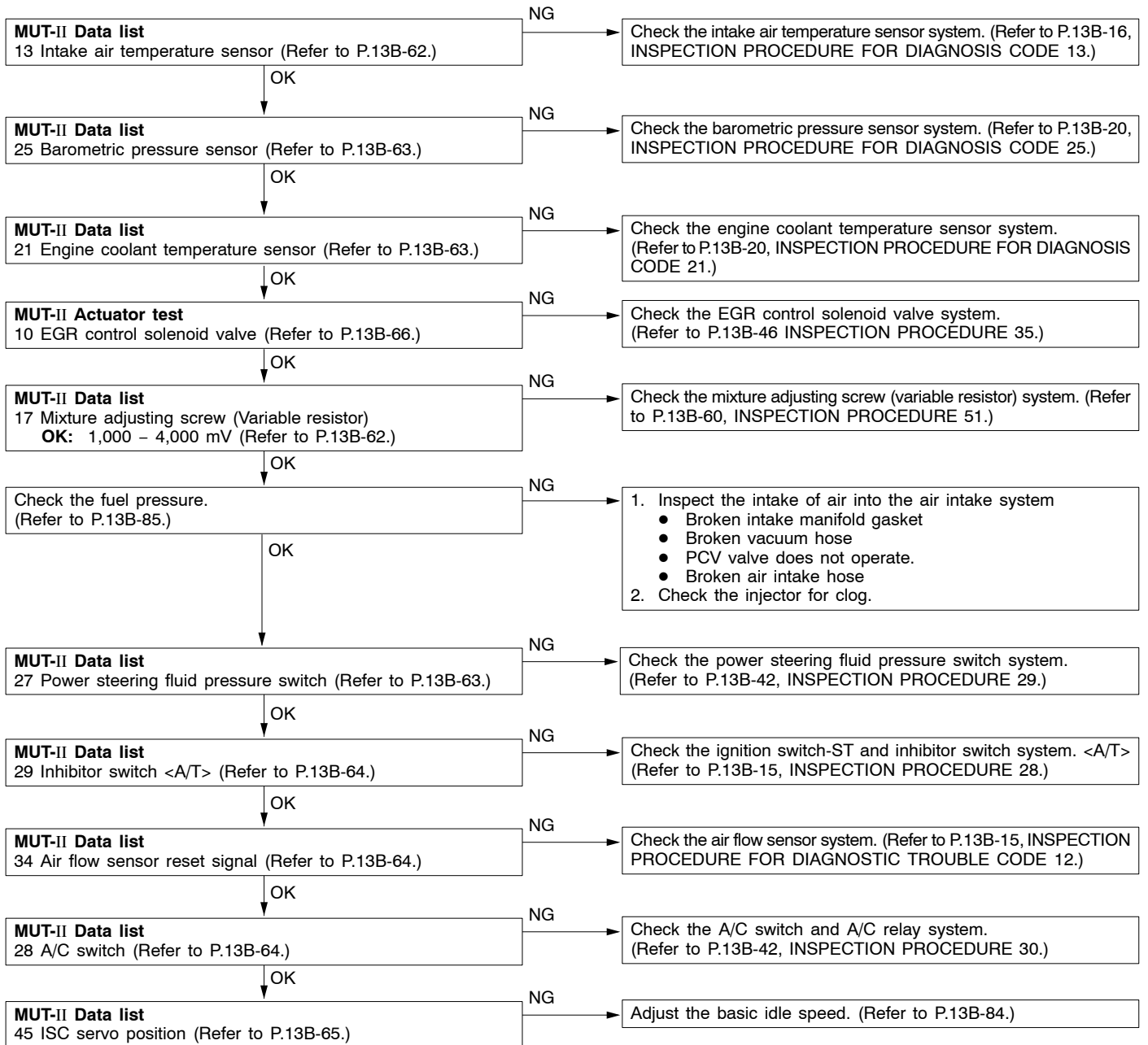
INSPECTION PROCEDURE 41

MUT-II: Engine stalling inspection when the engine is warmed up and idling.

<Vehicles for Australia, Brazil, General Export with catalytic converter>



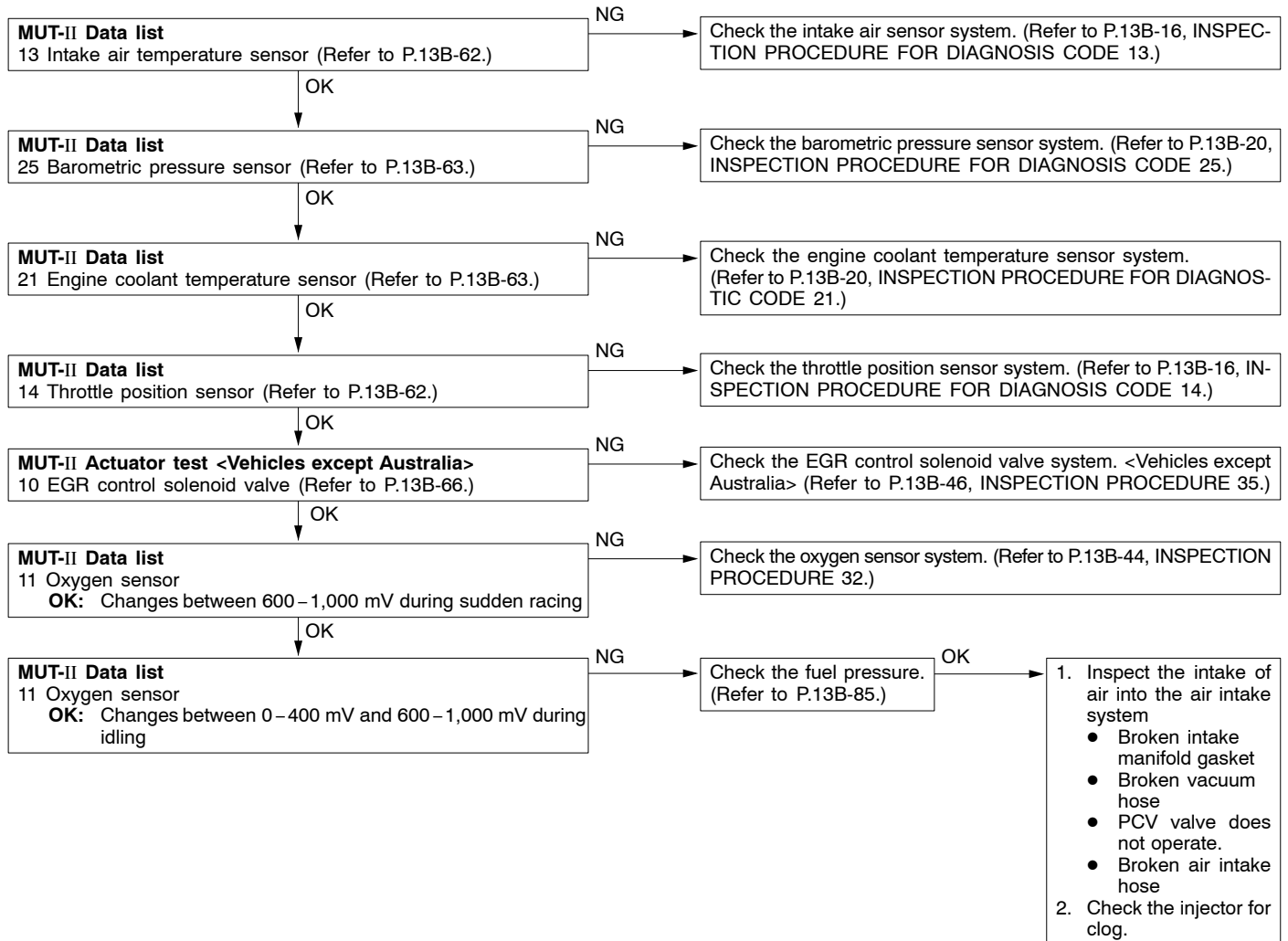
<Vehicles for general Export without catalytic converter, South Africa, GCC>



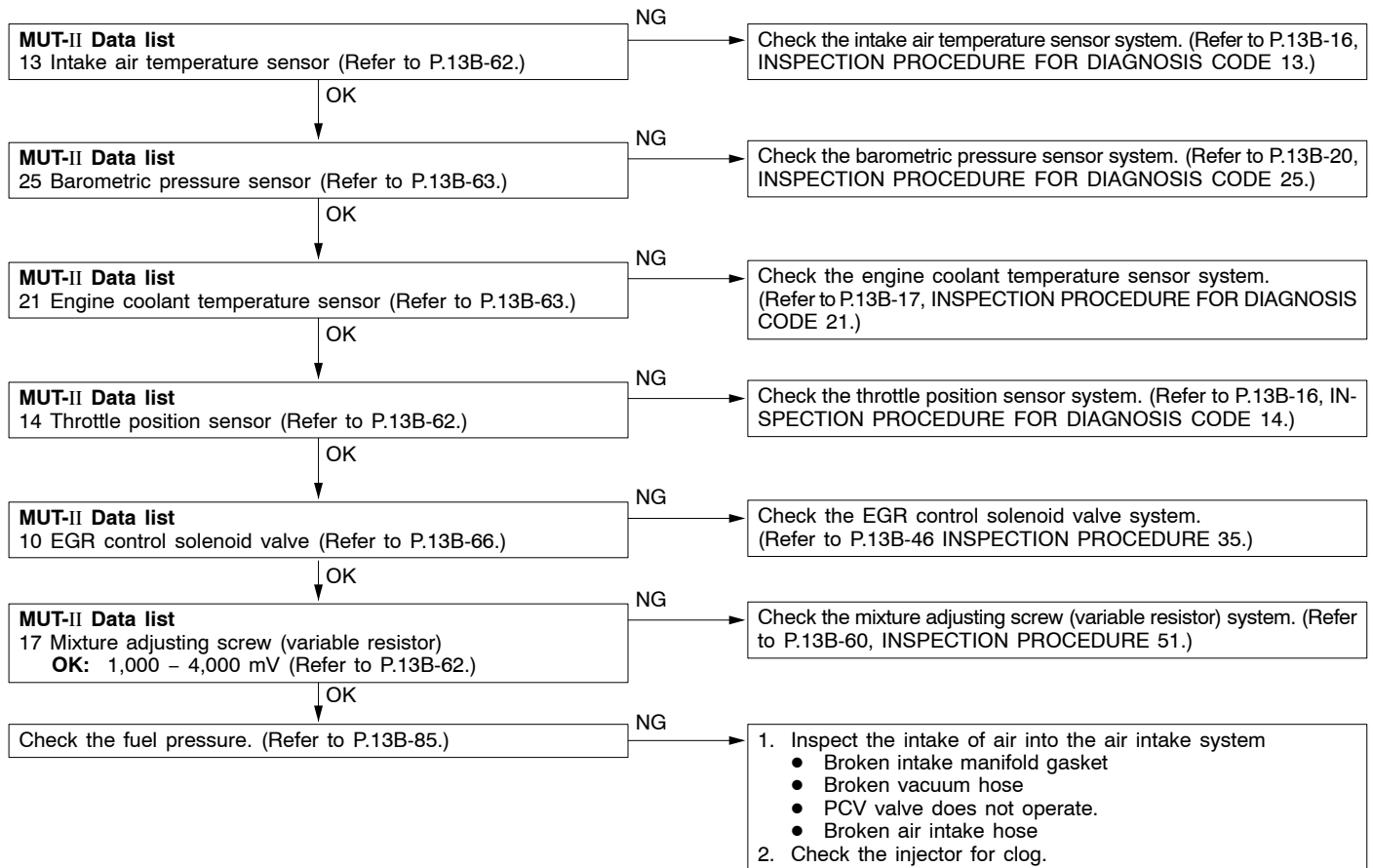
INSPECTION PROCEDURE 42

MUT-II: Check if hesitation, sag, stumble or poor acceleration occurs.

<Vehicles for Australia, Brazil, General Export with catalytic converter>



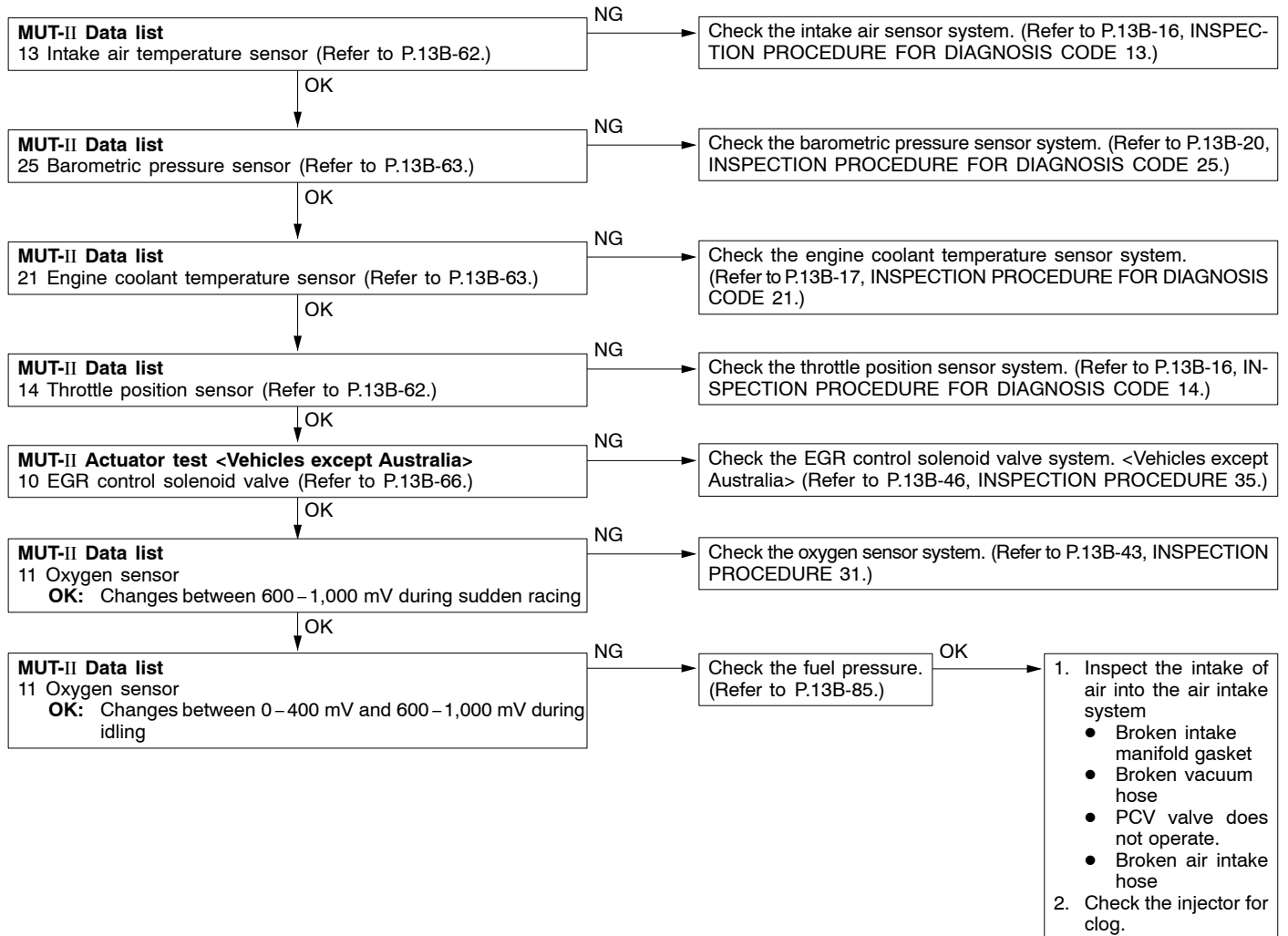
<Vehicles for General Export with out catalytic converter, South Africa, GCC>



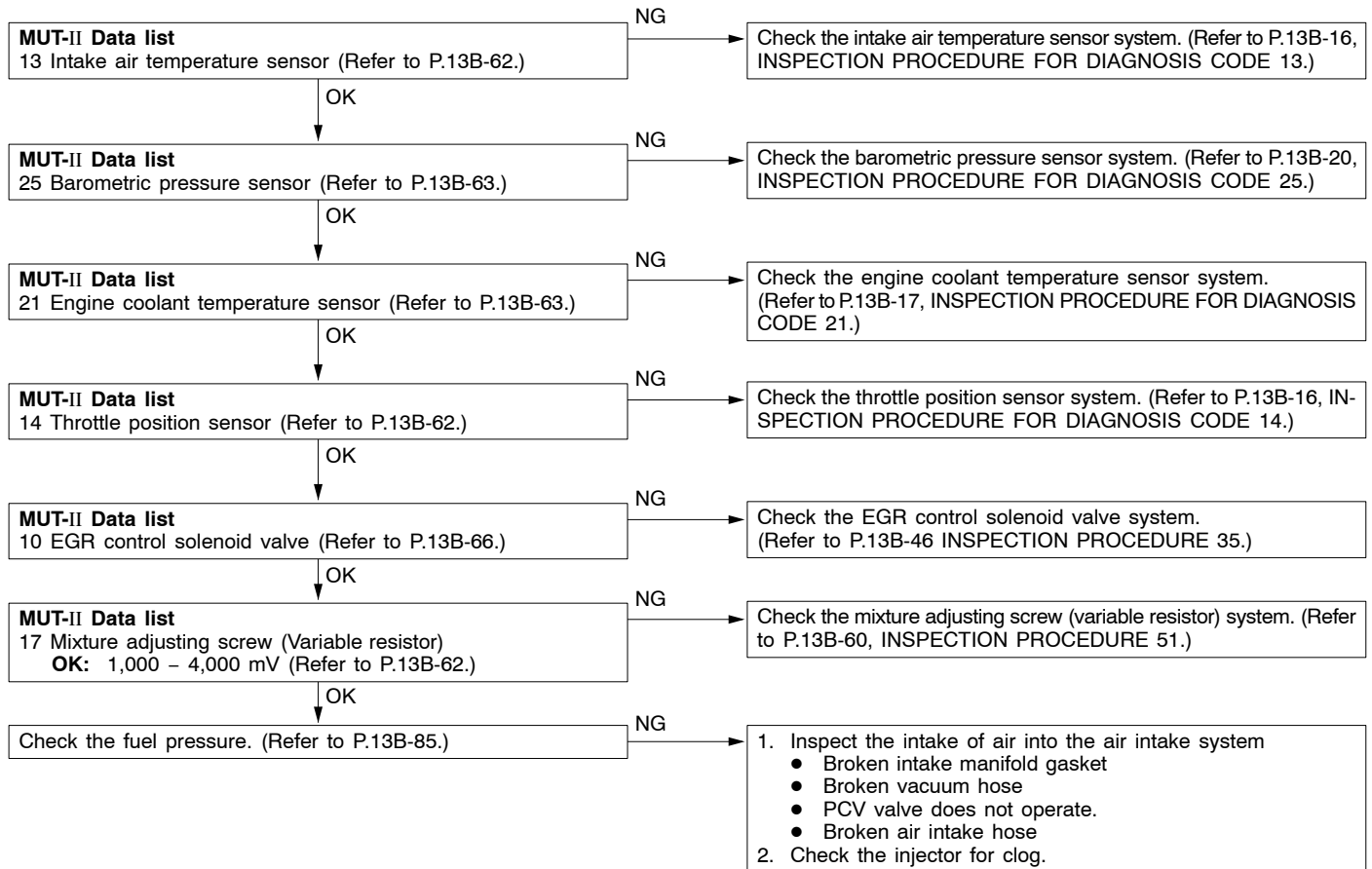
INSPECTION PROCEDURE 43

MUT-II: Check if surge occurs.

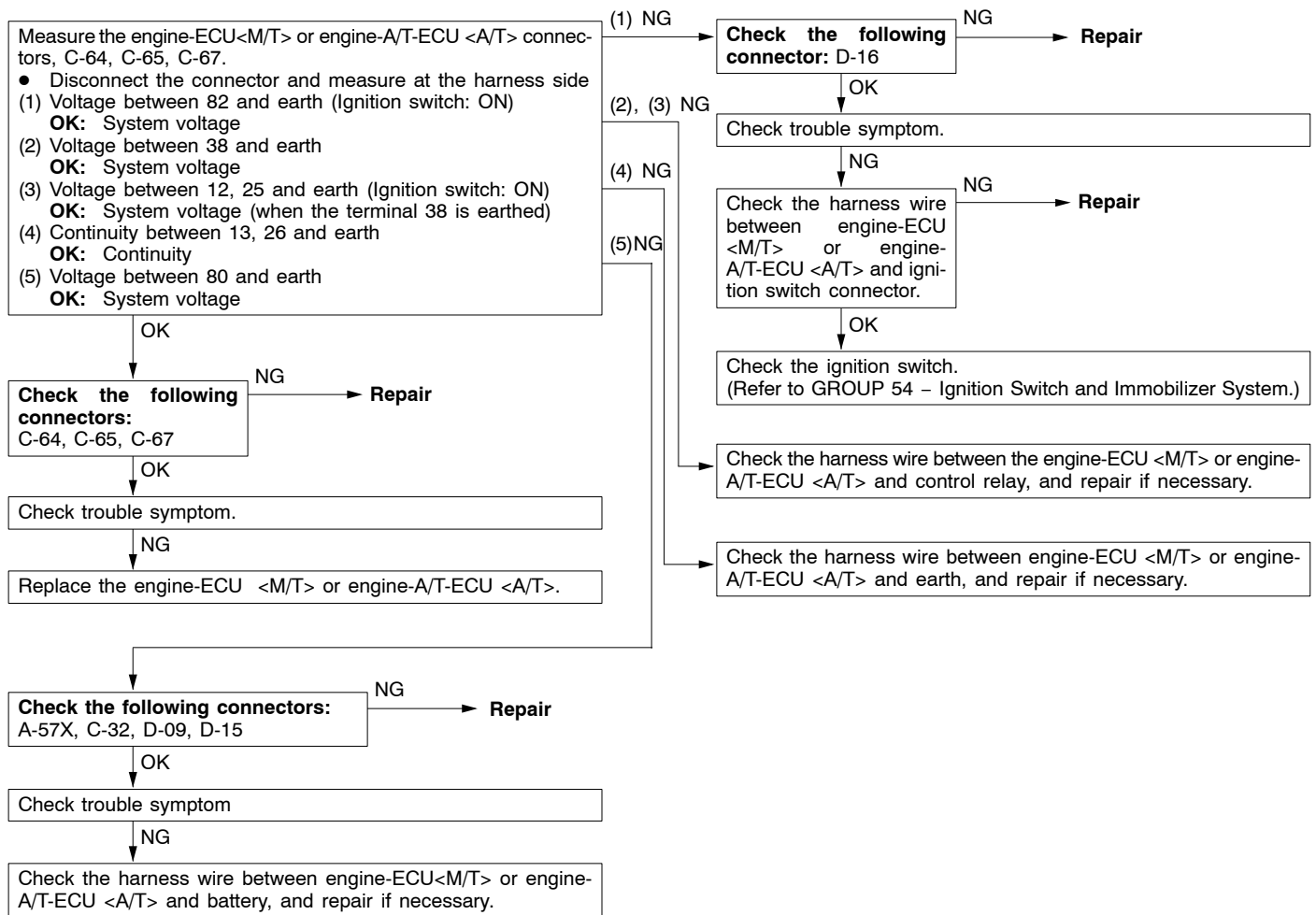
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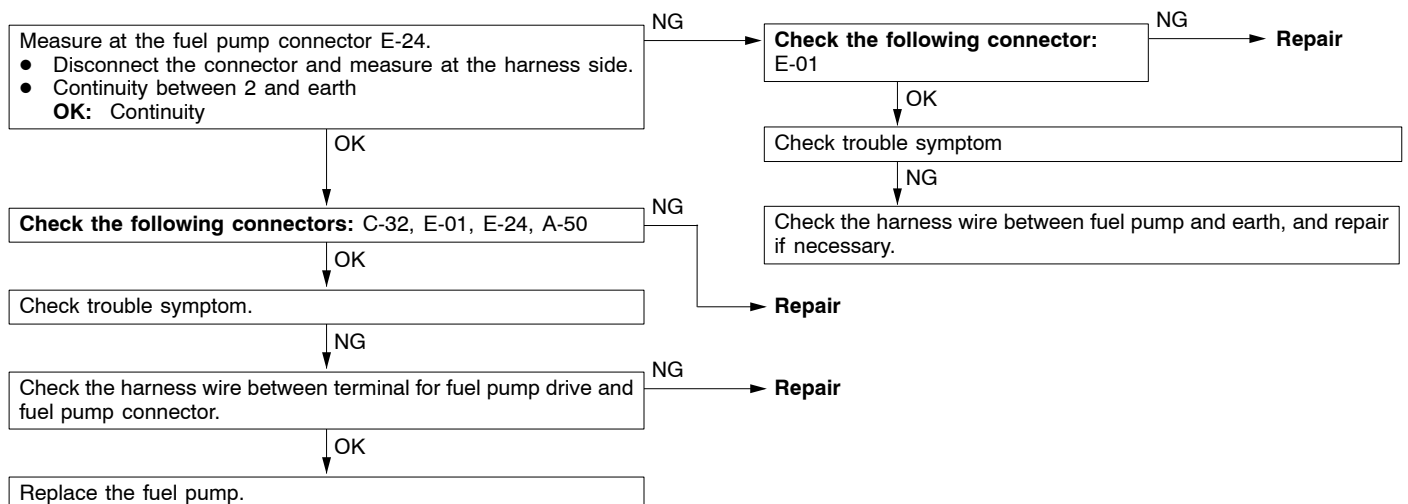
<Vehicles for General Export without catalytic converter, South Africa, GCC>



INSPECTION PROCEDURE 44

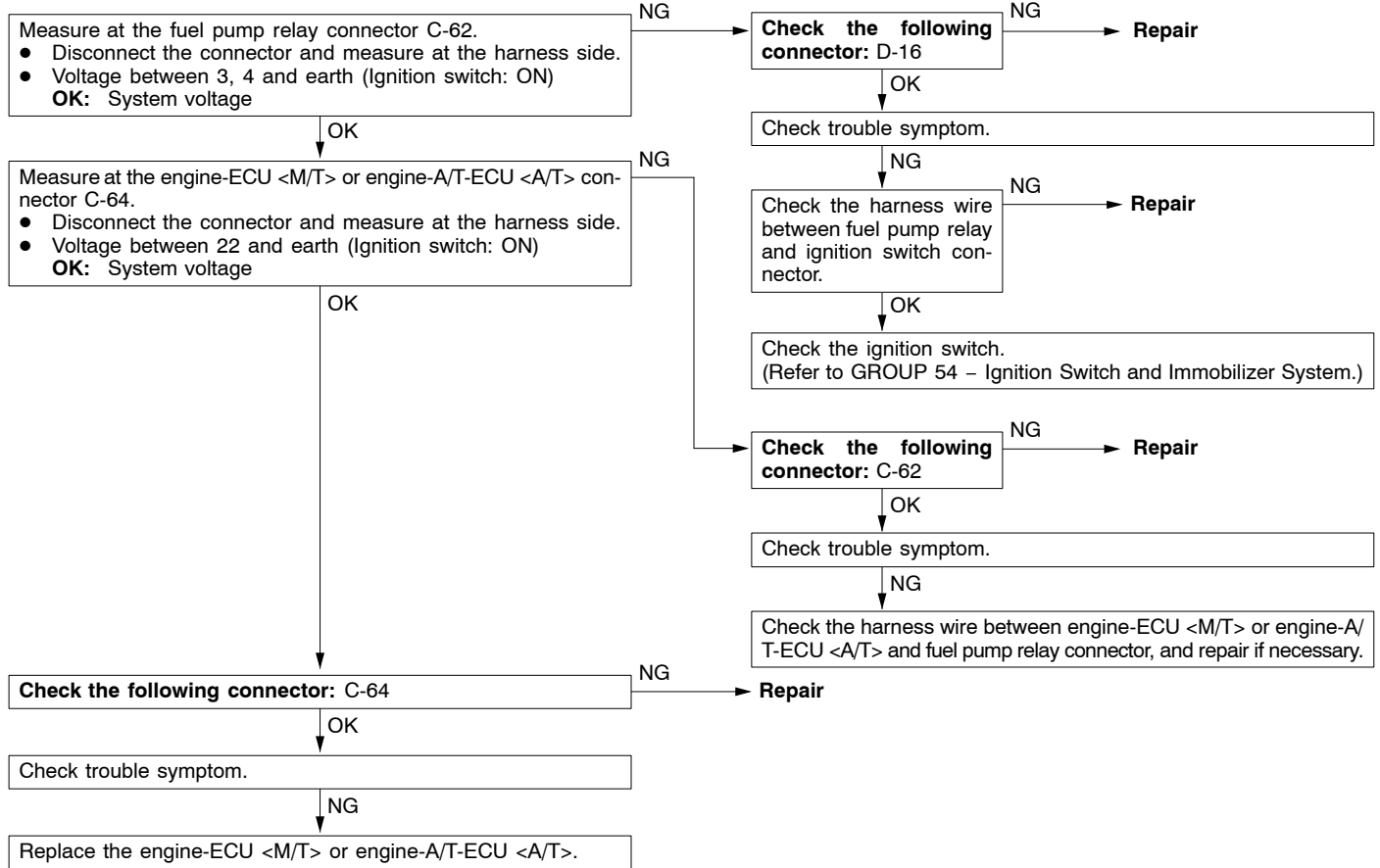
Check the engine-ECU <M/T> or engine-A/T-ECU <A/T> power supply and earth circuit.

INSPECTION PROCEDURE 45

Check the fuel pump circuit.

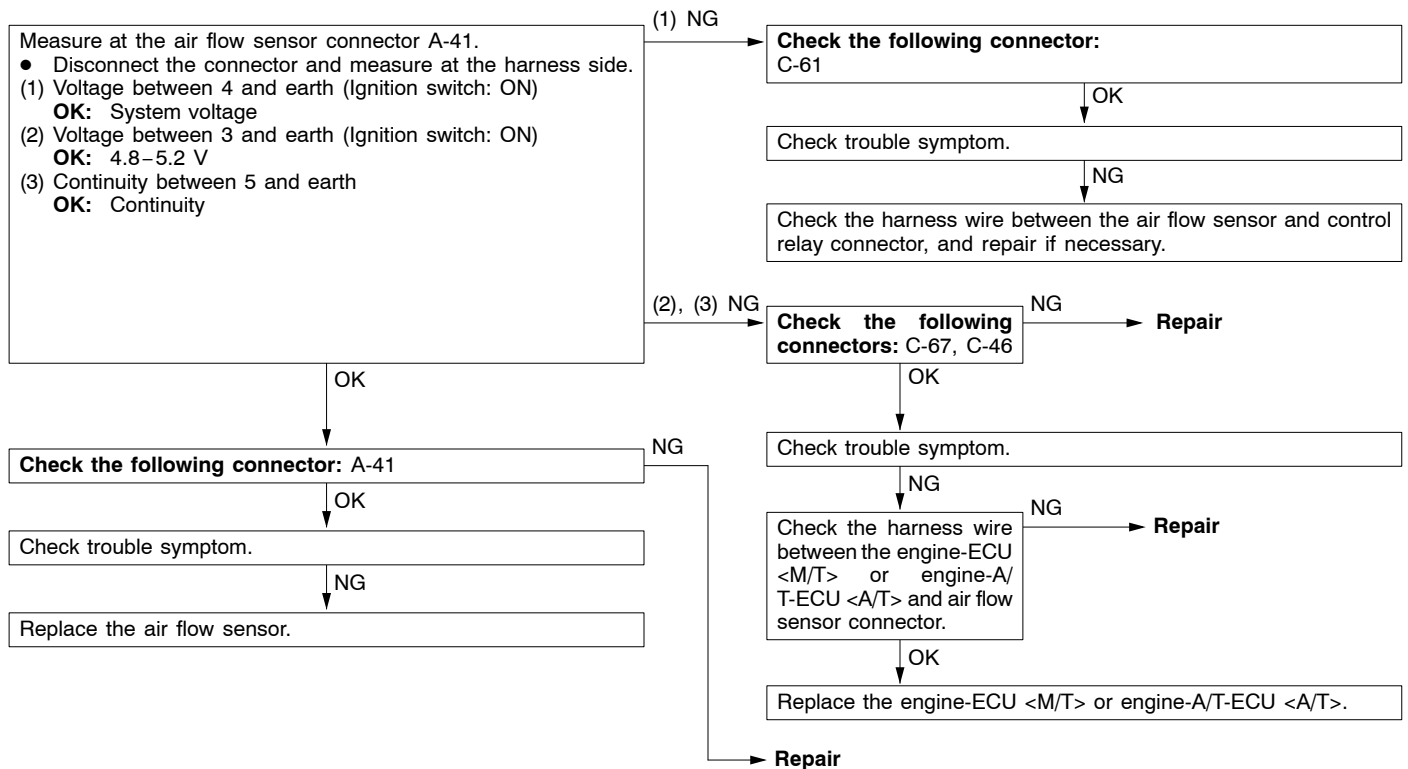
INSPECTION PROCEDURE 46

Check the fuel pump drive control circuit.



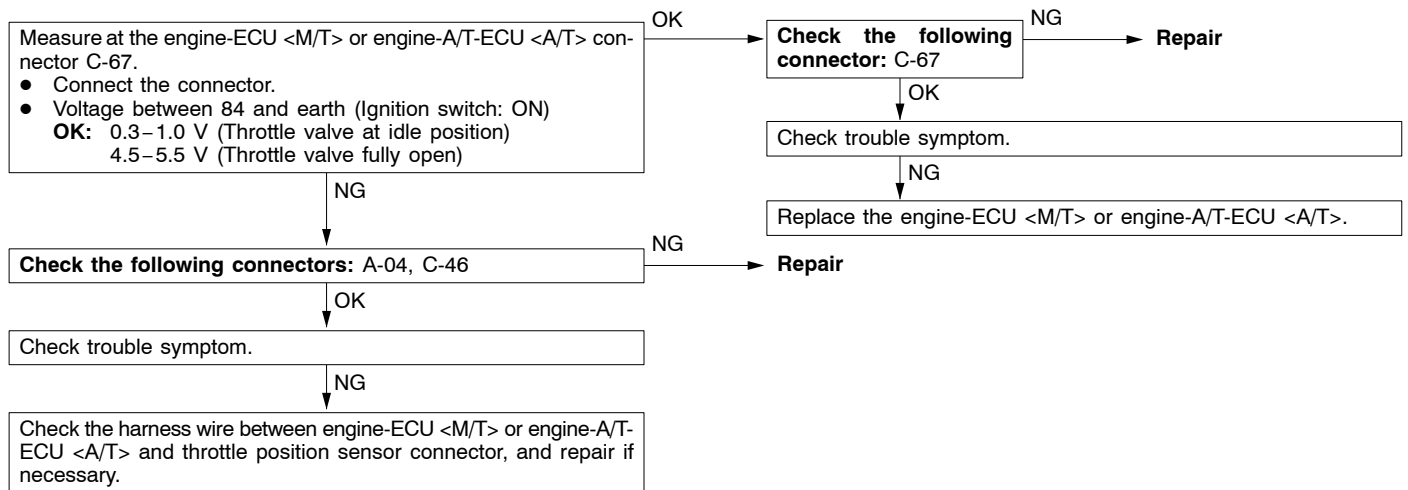
INSPECTION PROCEDURE 47

Check the air flow sensor (AFS) control circuit.



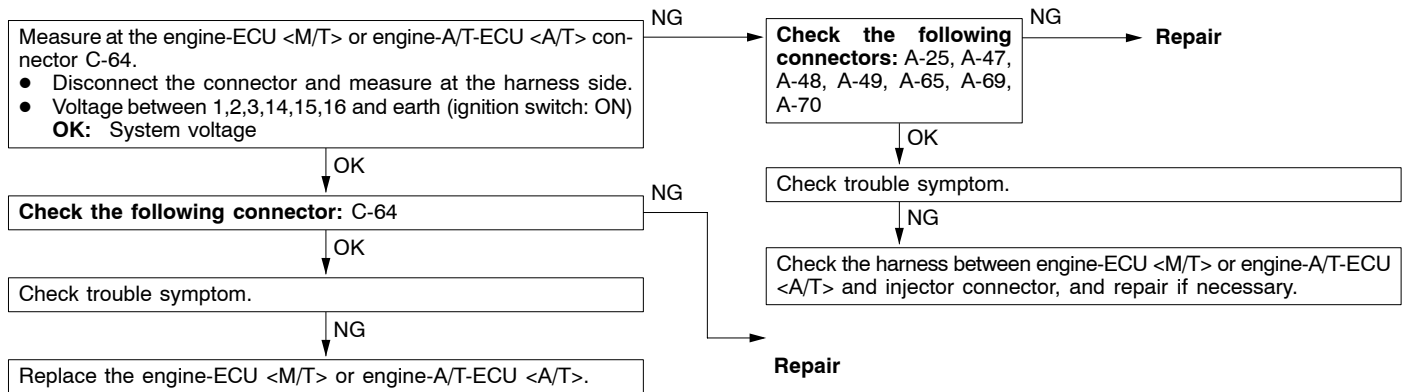
INSPECTION PROCEDURE 48

Check the throttle position sensor (TPS) output circuit.



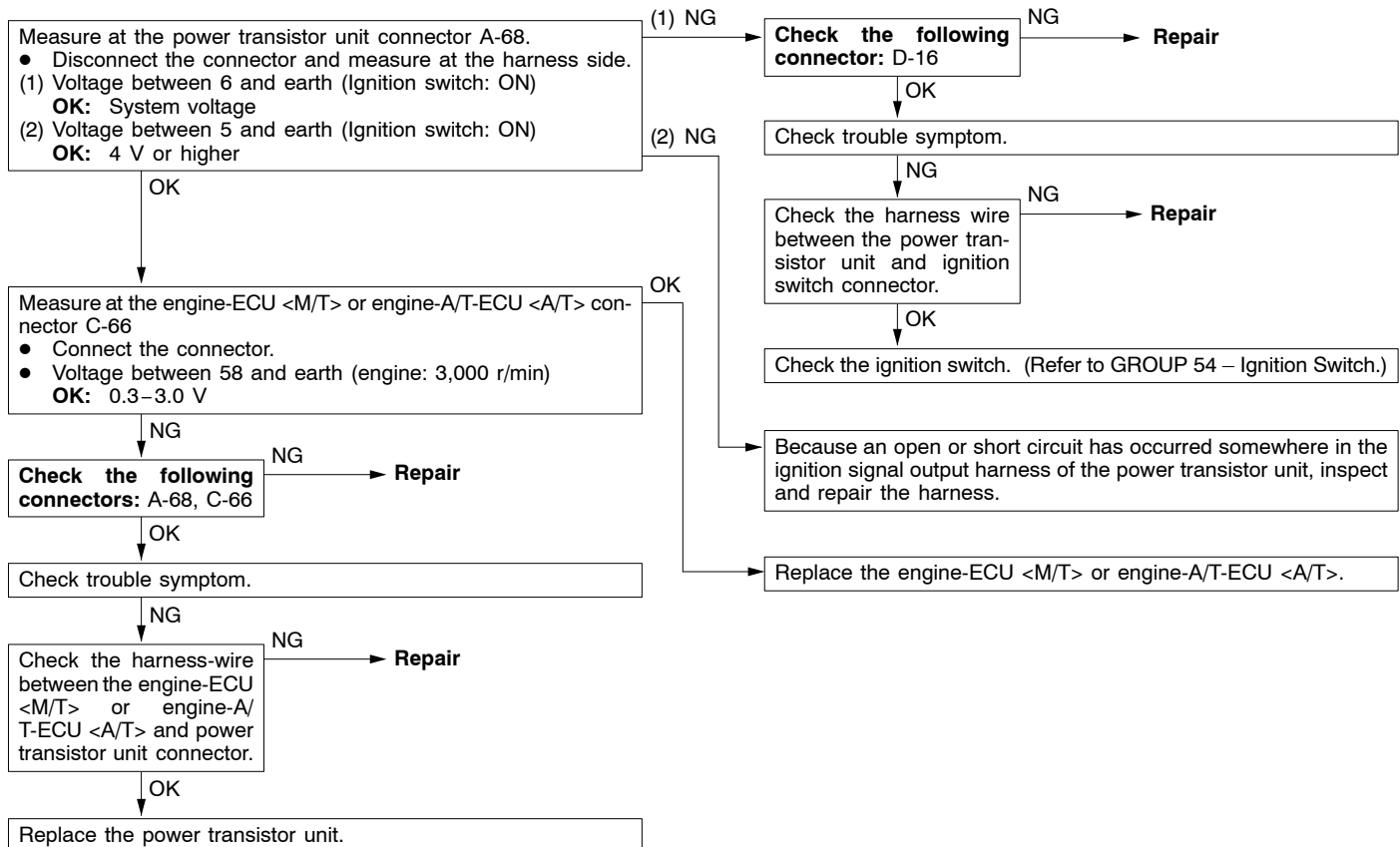
INSPECTION PROCEDURE 49

Check the injector control circuit.



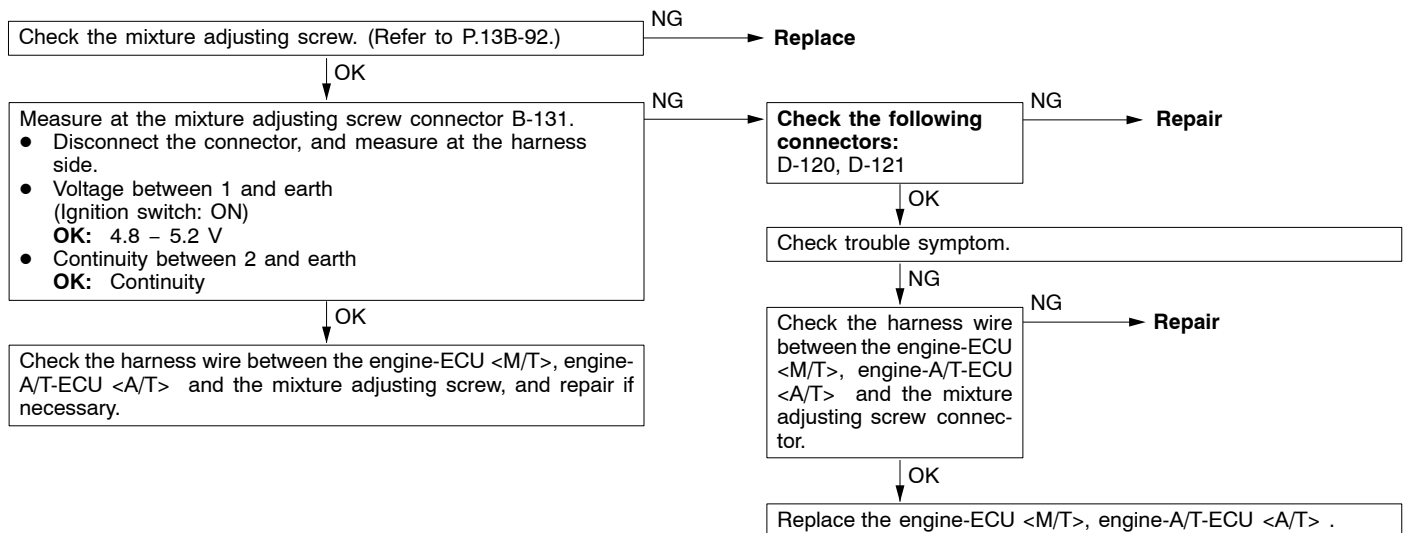
INSPECTION PROCEDURE 50

Check the ignition signal circuit.



INSPECTION PROCEDURE 51

Mixture adjusting screw (variable resistor) system <Vehicles for General Export without catalytic converter, South Africa, GCC>	Probable cause
<ul style="list-style-type: none"> • The mixture adjusting screw is a variable resistor for manually adjusting the idling fuel mixture. • When the shaft of the mixture adjusting screw is turned, the resistance between the output terminal and the earth terminal changes. Because of this, the output voltage also changes in accordance with the turning of the shaft. • The engine-ECU <M/T>, engine-A/T-ECU <A/T> controls the injectors to produce a richer idling fuel mixture in accordance with the increase in the output voltage. 	<ul style="list-style-type: none"> • Malfunction of the mixture adjusting screw • Improper connector contact, open circuit or short circuit • Malfunction of the engine-ECU <M/T>, engine-A/T-ECU <A/T>



DATA LIST REFERENCE TABLE

Caution

When shifting the select lever to D range, the brakes should be applied so that the vehicle does not move forward.

NOTE

- *1. In a new vehicle [driven approximately 500 km or less], the air flow sensor output frequency is sometimes 10% higher than the standard frequency.
- *2. The injector drive time represents the time when the cranking speed is at 250 r/min or below when the power supply voltage is 11 V.
- *3. In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.
- *4. In a new vehicle [driven approximately 500 km or less], the step of the stepper motor is sometimes 30 steps greater than the standard value.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor <Vehicles for Australia, Brazil, General Export with catalytic converter>	Engine:After having warmed up Air/fuel mixture is made leaner when decelerating, and is made richer when racing.	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Procedure No. 31	13B-43
			When engine is suddenly raced	600 – 1,000 mV		
		Engine:After having warmed up The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition by the engine-ECU <M/T> or engine-A/T-ECU <A/T>.	Engine is idling	400 mV or less ↑ (Changes) ↓ 600 – 1,000 mV		
			2,500 r/min	400 mV or less ↑ (Changes) ↓ 600 – 1,000 mV		
12	Air flow sensor*1	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Lamps and all accessories: OFF Transmission: Neutral (A/T: P range) 	Engine is idling	17 – 43 Hz	–	–
			2,500 r/min	72 – 112 Hz <6G72> 64 – 104 Hz <6G74>		
			Engine is raced	Frequency increases in response to racing		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is -20°C	-20°C	Code No. 13	13B-33
			When intake air temperature is 0°C	0°C		
			When intake air temperature is 20°C	20°C		
			When intake air temperature is 40°C	40°C		
			When intake air temperature is 80°C	80°C		
14	Throttle position sensor	Ignition switch: ON	Set to idle position	300 – 1,000 mV	Code No. 14	13B-33
			Gradually open	Increases in proportion to throttle opening angle		
			Open fully	4,500 – 5,500 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 25	13B-39
17	Mixture adjusting screw (ignition switch-ST) <Vehicles for General Export without catalytic converter, South Africa, GCC>	Ignition switch: ON		1,000 – 4,000 mV	Procedure No. 51	13B-60
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 27 <M/T>	13B-40 <M/T> 13B-41 <A/T>
			Engine: Cranking	ON	Procedure No. 28 <A/T>	

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is -20°C	-20°C	Code No. 21	13B-36
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
			When engine coolant temperature is 80°C	80°C		
22	Crank angle sensor	<ul style="list-style-type: none"> Engine: Cranking Tachometer: Connected 	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. 22	13B-37
		<ul style="list-style-type: none"> Engine: Idling Idle position switch: ON 	When engine coolant temperature is -20°C	1,300 – 1,500 r/min		
			When engine coolant temperature is 0°C	1,200 – 1,400 r/min		
			When engine coolant temperature is 20°C	1,100 – 1,300 r/min		
			When engine coolant temperature is 40°C	900 – 1,100 r/min		
			When engine coolant temperature is 80°C	600 – 800 r/min		
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. 25	13B-39
			At altitude of 600 m	95 kPa		
			At altitude of 1,200 m	88 kPa		
			At altitude of 1,800 m	81 kPa		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 29	13B-42
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (when A/C switch is ON, A/C compressor should be operating.)	A/C switch: OFF	OFF	Procedure No. 30	13B-42
			A/C switch: ON	ON		

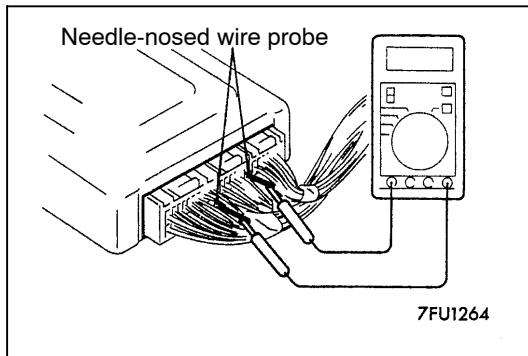
Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 28	13B-41
			D, 2, L or R	D, 2, L or R		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No. 12	13B-32
			2,500 r/min	OFF		
37	Volumetric efficiency	<ul style="list-style-type: none"> Engine coolant temperature: 80–95 °C Lamps and all accessories: OFF Transmission: Neutral (A/T : P range) 	Engine is idling	15–35 %	—	—
			2,500 r/min	15–35 %		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	<ul style="list-style-type: none"> Engine: Cranking [reading is possible at 2,000 r/min or less] Tachometer: Connected 	Engine speeds displayed on the MUT-II and tachometer are identical.		—	—
41	Injectors* ²	Engine: Cranking	When engine coolant temperature is 0°C (injection is carried out for all cylinders simultaneously)	13.2 – 19.8 ms <6G72> 14.6 – 22.0 ms <6G74>	—	—
			When engine coolant temperature is 20°C	33.2 – 49.8 ms <6G72> 36.8 – 55.2 ms <6G74>		
			When engine coolant temperature is 80°C	8.2 – 12.4 ms <6G72> 9.2 – 13.8 ms <6G74>		
41	Injectors* ³	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Lamps and all accessories: OFF Transmission: Neutral (A/T : P range) 	Engine is idling	2.2 – 3.4 ms <6G72> 2.4 – 3.6 ms <6G74>	—	—
			2,500 r/min	1.9 – 3.1 ms <6G72> 2.1 – 3.3 ms <6G72>		
			When engine is suddenly raced	Increases		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
44	Ignition coils and power transistors	<ul style="list-style-type: none">● Engine: After having warmed up● Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)	Engine is idling	7–23° BTDC	–	–
			2,500 r/min	27 – 47° BTDC		
45	ISC (stepper) motor position *4	<ul style="list-style-type: none">● Engine coolant temperature: 80–95°C● Lamps and accessories: OFF● Transmission: Neutral (A/T : P range)● Idle position switch: ON● Engine: Idling● When A/C switch is ON, A/C compressor should be operating	A/C switch: OFF	2–25 STEP	–	–
			A/C switch: OFF → ON	Increases by 10–70 steps		
			<ul style="list-style-type: none">● A/C switch: OFF● Select lever: N range → D range	Increases by 5–50 steps		
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 30	13B-42
			A/C switch: ON	ON (Compressor clutch is operating)		

ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/ Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idling condition becomes different (becomes unstable).	Code No. 40	13B-48
02		Cut fuel to No. 2 injector				
03		Cut fuel to No. 3 injector				
04		Cut fuel to No. 4 injector				
05		Cut fuel to No. 5 injector				
06		Cut fuel to No. 6 injector				

Item No.	Inspection item	Drive contents	Inspection contents		Normal condition	Inspection procedure No.	Reference page
07	Fuel pump	Fuel pump operates and fuel is recirculated.	<ul style="list-style-type: none"> Engine: Cranking Fuel pump: Forced driving Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated. Listen near the fuel tank for the sound of fuel pump operation.	Pulse is felt. Sound of operation is heard.	Procedure No. 26	13B-39
08	Purge control solenoid valve <Vehicles for Australia, Brazil, General Export with catalytic converter>	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Procedure No.34	13B-45
10	EGR control solenoid valve <Vehicles except Australia>	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Procedure No.35	13B-46
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idling Timing light is set		5° BTDC	–	–
21	Fan controller	Drive the fan motor	<ul style="list-style-type: none"> Ignition switch: ON 		Condenser fan rotate at high speed	Procedure No. 24	13B-38



CHECK AT THE ENGINE-ECU <M/T> OR ENGINE-A/T-ECU <A/T> TERMINALS

TERMINAL VOLTAGE CHECK CHART

1. Connect a needle-nosed wire probe (test harness: MB991223) to a voltmeter probe.
2. Insert the needle-nosed wire probe into each of the engine-ECU <M/T> or engine-A/T-ECU <A/T> connector terminals from the wire side, and measure the voltage while referring to the check chart.

NOTE

- (1) Make the voltage measurement with the engine-ECU <M/T> or engine-A/T-ECU <A/T> connectors connected.
- (2) You may find it convenient to pull out the engine-ECU <M/T> or engine-A/T-ECU <A/T> to make it easier to reach the connector terminals.
- (3) The checks can be carried out off the order given in the chart.

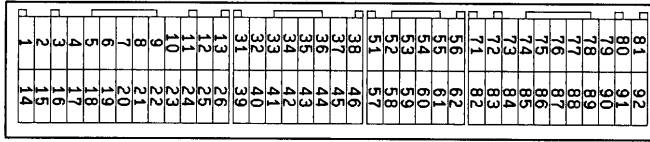
Caution

Short-circuiting the positive (+) probe between a connector terminal and earth could damage the vehicle wiring, the sensor, engine-ECU <M/T> or engine-A/T-ECU <A/T> or all of them. Be careful to prevent this!

3. If voltmeter shows any division from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
4. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

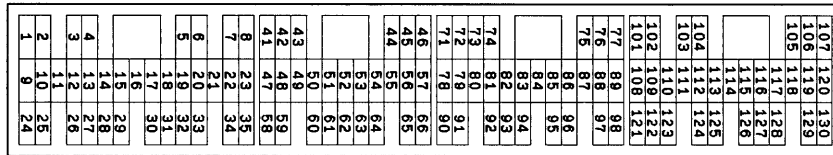
Engine-ECU <M/T> or engine-A/T-ECU <A/T> Connector Terminal Arrangement

<M/T>



9FU0393

<A/T>



7FU1763

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)	Normal condition
1	1	No. 1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 11 – 14 V, momentarily drops slightly
14	9	No. 2 injector		
2	24	No. 3 injector		
15	2	No. 4 injector		
3	10	No. 5 injector		
16	25	No. 6 injector		
4	14	Stepper motor coil <A1>	Engine: Soon after the warmed up engine is started	10 – 15 V ↔ 0 – 6 V (Changes repeatedly)
17	28	Stepper motor coil <A2>		
5	15	Stepper motor coil <B1>		
18	29	Stepper motor coil <B2>		
6	6	EGR control solenoid valve <Vehicles except Australia>	Ignition switch: ON	System Voltage
			While engine is idling, suddenly depress the accelerator pedal.	From system voltage, momentarily drops
8	20	Fuel pump relay <Vehicles except South Africa, Australia>	Ignition switch: ON	System voltage
			Engine: Idle speed	0 – 3 V
		A/C relay <Vehicles for South Africa, Australia>	<ul style="list-style-type: none"> Engine: Idle speed A/C switch: OFF → ON (A/C compressor is operating) 	System voltage or momentarily 6 V or more → 0 – 3 V
10	11	Power transistor unit (A)	Engine r/min: 3,000 r/min	0.3 – 3.0 V
11	12	Power transistor unit (B)		
23	13	Power transistor unit (C)		

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)		Normal condition
12	41	Power supply	Ignition switch: ON		System voltage
25	47				
19	19	Air flow sensor reset signal	Engine: Idle speed		0 – 1 V
			Engine r/min: 3,000 r/min		6 – 9 V
21	18	Fan relay	When the condenser fan is not operating		System voltage
			When the radiator fan and condenser fan are operating		0 – 3 V
22	21	A/C relay <Vehicles except South Africa, Australia>	<ul style="list-style-type: none"> Engine: Idle speed A/C switch: OFF → ON (A/C compressor is operating) 		System voltage or momentarily 6 V or more → 0 – 3 V
		Fuel pump relay <Vehicles for South Africa, Australia>	Ignition switch: ON		System voltage
			Engine: Idle speed		0 – 3 V
		Purge control solenoid valve <Vehicles with catalytic converter>	Ignition switch: ON		System voltage
24	34		Running at 3,000 r/min while engine is warming up after having been started.		0 – 3 V
36	22	Engine warning lamp	Ignition switch: OFF → ON		0 – 3 V → 9 – 13 V (After several seconds have elapsed)
37	52	Power steering fluid pressure switch	Engine: Idling after warming up	When steering wheel is stationary	System voltage
				When steering wheel is turned	0 – 3 V
38	49	Control relay (Power supply)	Ignition switch: OFF		System voltage
			Ignition switch: ON		0 – 3 V
44	44	Anti-lock brake signal	Engine: Idle speed		Battery voltage
			<ul style="list-style-type: none"> After ignition switch is turned ON, at time of first departure Vehicle speed: 0 – 10 km/h 		Battery voltage → 0 – 3 V (momentarily)
45	83	A/C switch 1	Engine: Idle speed	Turn the A/C switch OFF	0 – 3 V
				Turn the A/C switch ON (A/C compressor is operating)	System voltage

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)		Normal condition
57	61	A/C switch 2	<ul style="list-style-type: none"> Engine: Idling Outside air temperature: 25°C or more 	When A/C is MAX. COOL condition (when the load by A/C is high)	0 – 3 V
				When A/C is MAX. HOT condition (When the load by A/C is low)	System voltage
71	58	Ignition switch – ST	Engine: Cranking		8 V or more
72	64	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C	3.2 – 3.8 V
				When intake air temperature is 20°C	2.3 – 2.9 V
				When intake air temperature is 40°C	1.5 – 2.1 V
				When intake air temperature is 80°C	0.4 – 1.0 V
–	71	Mixture adjusting screw (variable resistor) <Vehicles without catalytic converter>	Ignition switch: ON		1 ↔ 4 V
76	–	Mixture adjusting screw (variable resistor) <Vehicles with catalytic converter>	Ignition switch: ON		1 ↔ 4 V
		Oxygen sensor <Vehicles without catalytic converter>	Engine: Running at 2,500 r/min after warmed up (Check using a digital type voltmeter)		0 ↔ 0.8 V (Changes repeatedly)
80	66	Backup power supply	Ignition switch: OFF		System voltage
81	46	Sensor impressed voltage	Ignition switch: ON		4.5 – 5.5 V
82	98	Ignition switch – IG	Ignition switch: ON		System voltage

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)		Normal condition
83	44	Engine coolant temperature sensor	Ignition switch: ON	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 80°C	0.3 – 0.9 V
84	78	Throttle position sensor	Ignition switch: ON	Set throttle valve to idle position	0.3 – 1.0 V
				Fully open throttle valve	4.5 – 5.5 V
85	55	Barometric pressure sensor	Ignition switch: ON	When altitude is 0 m	3.7 – 4.3 V
				When altitude is 1,200 m	3.2 – 3.8 V
86	80	Vehicle speed sensor	<ul style="list-style-type: none">Ignition switch: ONMove the vehicle slowly forward		0 ↔ 5 V (Changes repeatedly)
87	79	Idle position signal	Ignition switch: ON	Set throttle valve to idle position	0 – 1 V
				Slightly open throttle valve	4 V or more
88	56	Top dead centre sensor	Engine: Cranking		0.4 – 3.0 V
			Engine: Idle speed		0.5 – 2.0 V
89	45	Crank angle sensor	Engine: Cranking		0.4 – 4.0 V
			Engine: Idle speed		1.5 – 2.5 V
90	65	Air flow sensor	Engine: Idle speed		2.2 – 3.2 V
			Engine r/min: 2,500r/min		

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

1. Turn the ignition switch to OFF.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

NOTE

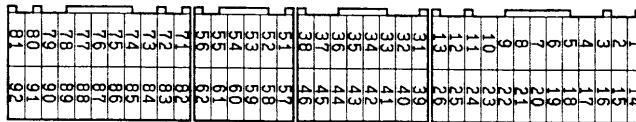
- (1) When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
- (2) Checking need not be carried out in the order given in the chart.

Caution

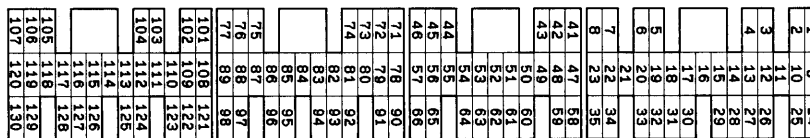
If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine-ECU and/or ohmmeter.

Be careful to prevent this!

4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-ECU <M/T> or engine-A/T-ECU <A/T> Harness Side Connector Terminal Arrangement
<M/T>
**<A/T>**

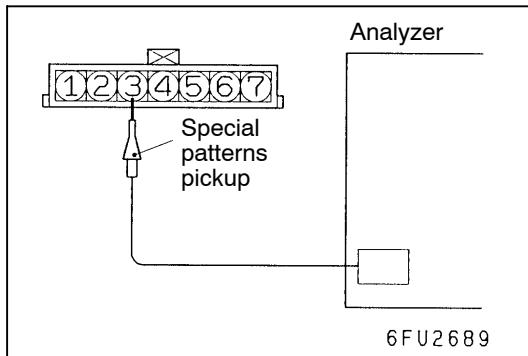
9FU0392



7FU1764

Terminal No. <M/T>	Terminal No. <A/T>	Inspection item	Normal condition (Check condition)
1 – 12	1 – 41	No. 1 injector	13 – 16 Ω (At 20°C)
14 – 12	9 – 41	No. 2 injector	
2 – 12	24 – 41	No. 3 injector	
15 – 12	2 – 41	No. 4 injector	
3 – 12	10 – 41	No. 5 injector	
16 – 12	25 – 41	No. 6 injector	

Terminal No. <M/T>	Terminal No. <A/T>	Inspection item	Normal condition (Check condition)
4 – 12	14 – 41	Stepper motor coil (A1)	28 – 33 Ω (At 20°C)
17 – 12	28 – 41	Stepper motor coil (A2)	
5 – 12	15 – 41	Stepper motor coil (B1)	
18 – 12	29 – 41	Stepper motor coil (B2)	
6 – 12	6 – 41	EGR control solenoid valve <Vehicles except Australia>	36 – 44 Ω (At 20°C)
24 – 12	34 – 41	Purge control solenoid valve	36 – 44 Ω (At 20°C)
13 – Body earth	42 – Body earth	Engine-ECU earth	Continuity (0 Ω)
26 – Body earth	48 – Body earth	Engine-ECU earth	
72 – 92	64 – 57	Intake air temperature sensor	5.3 – 6.7 k Ω (When intake air temperature is 0°C)
			2.3 – 3.0 k Ω (When intake air temperature is 20°C)
			1.0 – 1.5 k Ω (When intake air temperature is 40°C)
			0.30 – 0.42 k Ω (When intake air temperature is 80°C)
83 – 92	44 – 57	Engine coolant temperature sensor	5.1 – 6.5 k Ω (When coolant temperature is 0°C)
			2.1 – 2.7 k Ω (When coolant temperature is 20°C)
			0.9 – 1.3 k Ω (When coolant temperature is 40°C)
			0.26 – 0.36 k Ω (When coolant temperature is 80°C)
87 – 92	79 – 57	Idle position signal	Continuity (when throttle valve is at idle position)
			No continuity (when throttle valve is slightly open)



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

1. Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to air flow sensor connector terminal 3.

Alternate Method (Test harness not available)

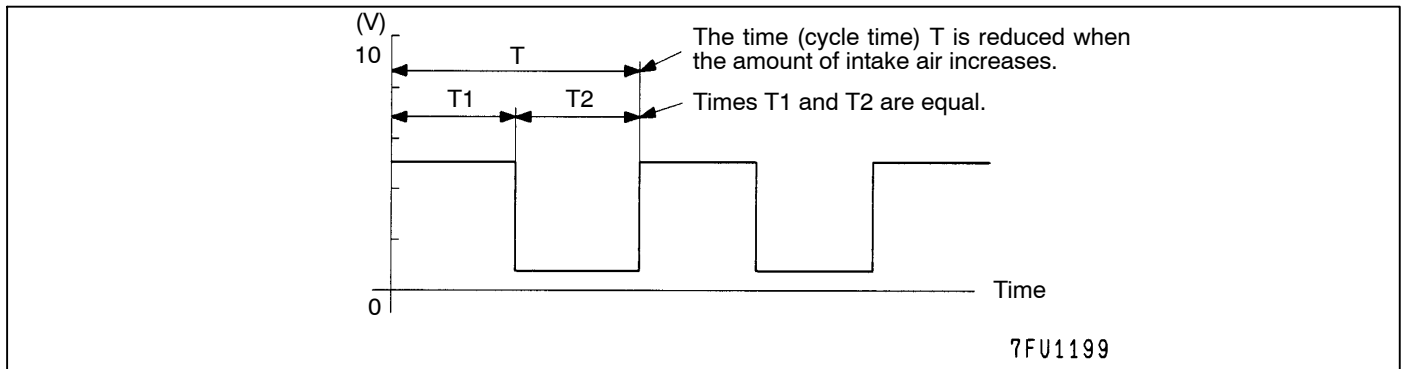
1. Connect the analyzer special patterns pickup to engine-ECU terminal 90 <M/T> or engine-A/T-ECU terminal 65 <A/T>.

Standard Wave Pattern

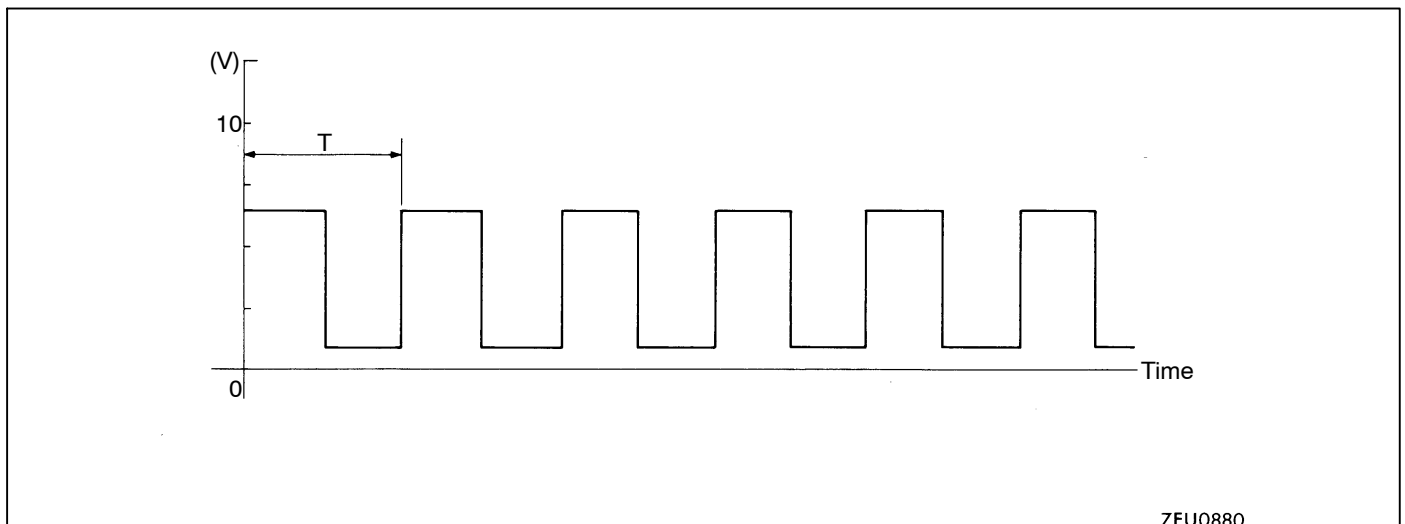
Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern

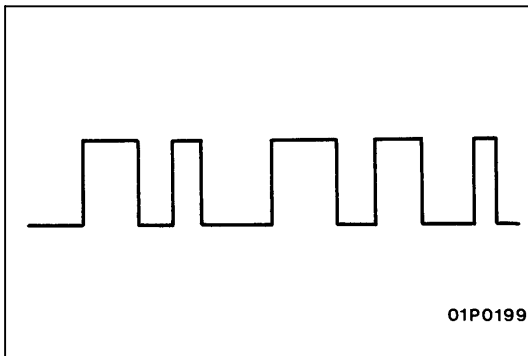


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.



Examples of Abnormal Wave Patterns

- Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

Rectangular wave pattern is output even when the engine is not started.

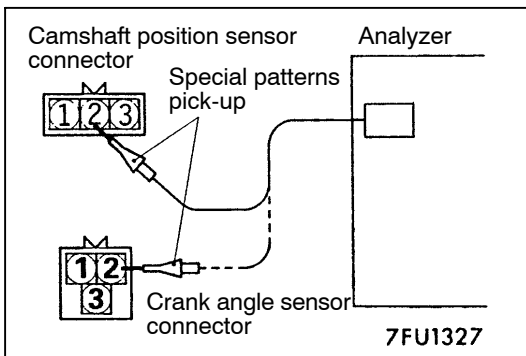
- Example 2

Cause of problem

Damaged rectifier or vortex generation column

Wave pattern characteristics

Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the air flow sensor is normal.



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

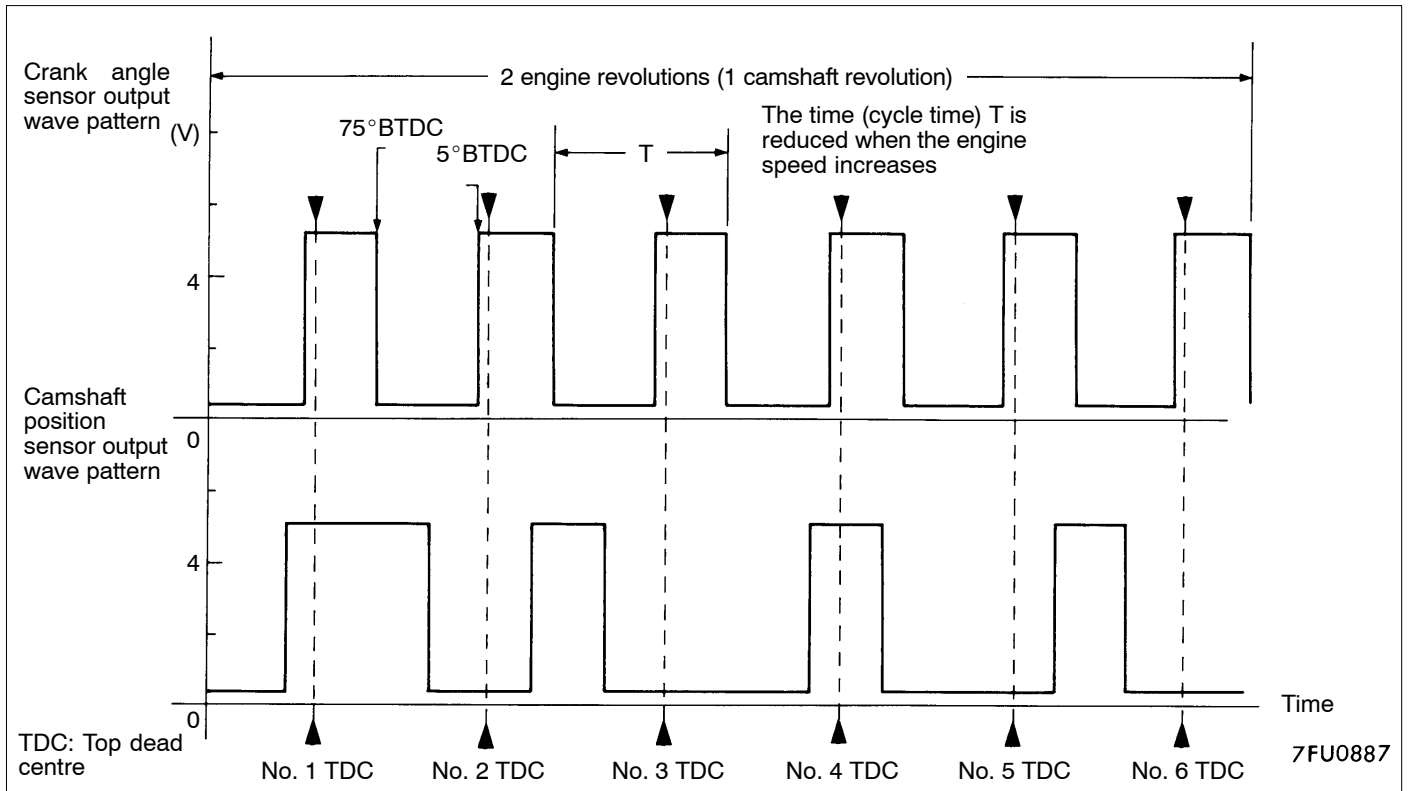
1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991658) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

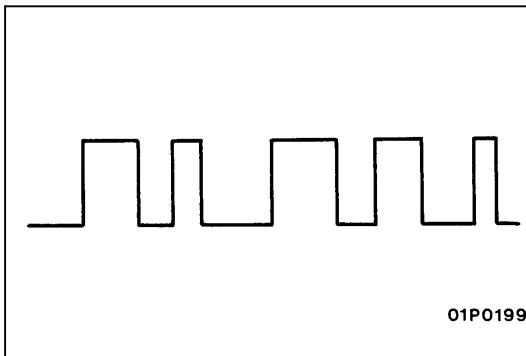
1. Connect the analyzer special patterns pickup to engine-ECU terminal 88 <M/T> or engine-A/T-ECU terminal 56 <A/T>. (When checking the top dead centre sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 89 <M/T> or engine-A/T-ECU terminal 45. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern**Observation conditions**

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min.	Idle speed

Standard wave pattern**Wave Pattern Observation Points**

Check that cycle time T becomes shorter and the frequency increases when the engine speed increases.



Examples of Abnormal Wave Patterns

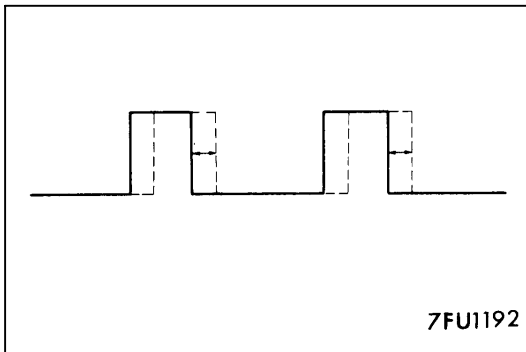
- Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

Rectangular wave pattern is output even when the engine is not started.



- Example 2

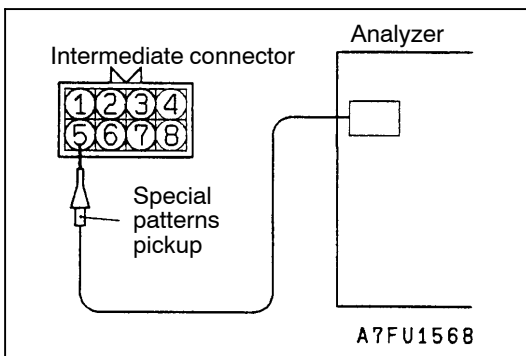
Cause of problem

Loose timing belt

Abnormality in sensor disk

Wave pattern characteristics

Wave pattern is displaced to the left or right.



INJECTOR

Measurement Method

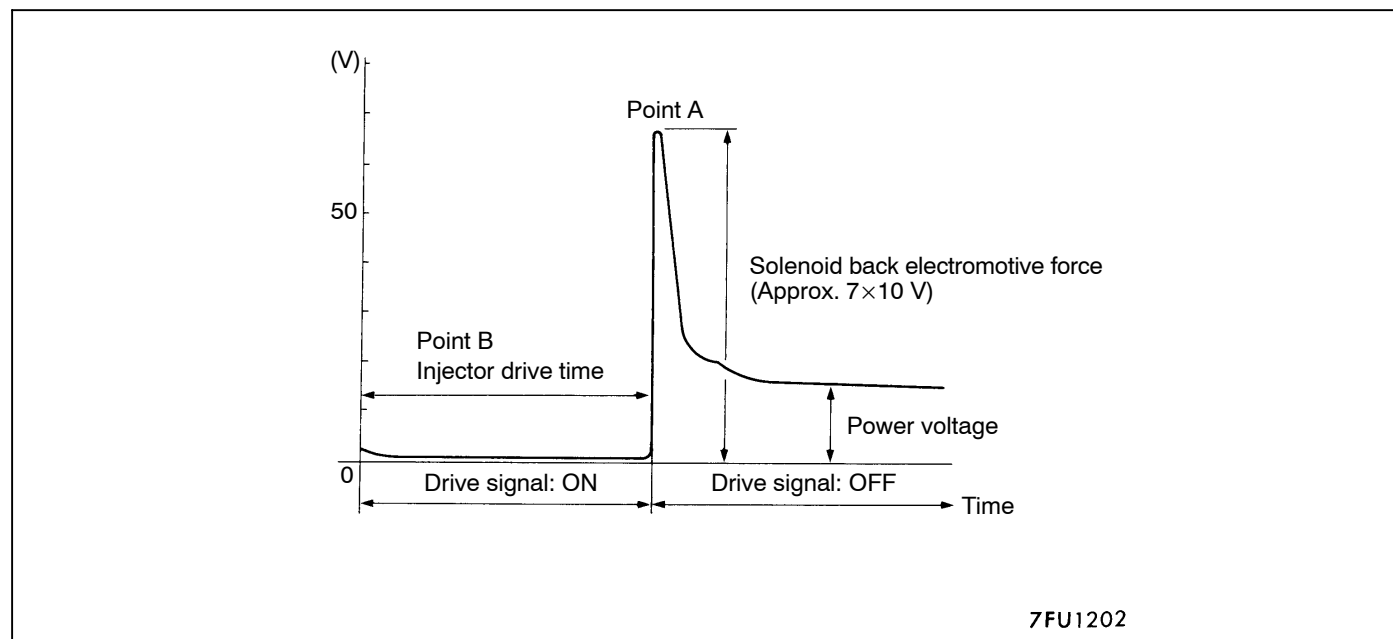
1. Disconnect the injector intermediate harness connector, and then connect the special tool (test harness: MD998474) in between. (Both the power supply side and engine-ECU side should be connected.)
2. To measure cylinder No. 1, connect the analyzer special patterns pickup to terminal 3 (red clip [red lead wire] of the special tool). For cylinder No. 2, connect to terminal 2 (yellow clip [yellow lead wire]). For cylinder No. 3, connect to terminal 1 (green clip [green lead wire]). For cylinder No. 4, connect to terminal 7 (white clip [white lead wire]). For cylinder No. 5, connect to terminal 6 (green clip [green and black lead wire]). For cylinder No. 6, connect to terminal 5 (yellow clip [red and yellow lead wire]).

Alternate Method (Test harness not available)

1. Connect the analyzer special patterns pickup to engine-ECU terminal 1 <M/T> or engine-A/T-ECU terminal 1 <A/T>. (When checking the No. 1 cylinder.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 14 <M/T> or engine-A/T-ECU terminal 9 <A/T>. (When checking the No. 2 cylinder.)
3. Connect the analyzer special patterns pickup to engine-ECU terminal 2 <M/T> or engine-A/T-ECU terminal 24 <A/T>. (When checking the No. 3 cylinder.)
4. Connect the analyzer special patterns pickup to engine-ECU terminal 15 <M/T> or engine-A/T-ECU terminal 2 <A/T>. (When checking the No. 4 cylinder.)
5. Connect the analyzer special patterns pickup to engine-ECU terminal 3 <M/T> or engine-A/T-ECU terminal 10 <A/T>. (When checking the No. 5 cylinder.)
6. Connect the analyzer special patterns pickup to engine-ECU terminal 16 <M/T> or engine-A/T-ECU terminal 25 <A/T>. (When checking the No. 6 cylinder.)

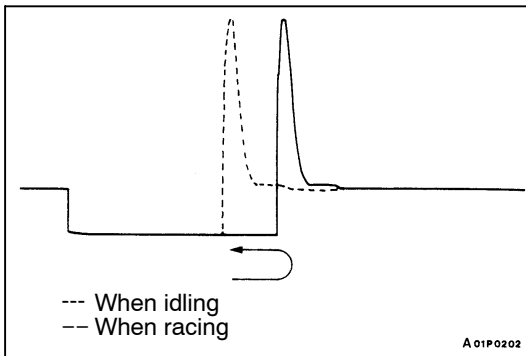
Standard Wave Pattern**Observation conditions**

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern**Wave Pattern Observation Points****Explanation of Wave Pattern**

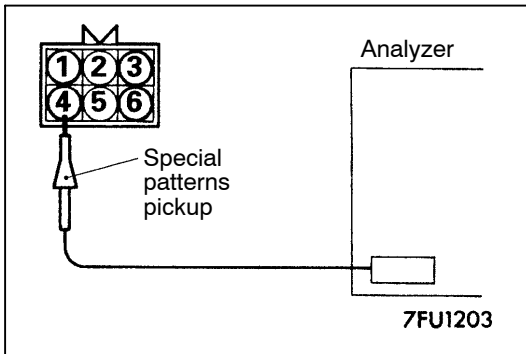
Point A: Height of solenoid back electromotive force

Contrast with standard wave pattern	Probable cause
Solenoid coil back electromotive force is low or doesn't appear at all.	Short in the injector solenoid



Point B: Injector drive time

- The injector drive time will be synchronized with the MUT-II tester display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.



STEPPER MOTOR

Measurement Method

1. Disconnect the stepper motor connector, and connect the special tool (test harness: MD998463) in between.
2. Connect the analyzer special patterns pickup to the stepper motor-side connector terminal 1 (red clip of special tool), terminal 3 (blue clip), terminal 4 (black clip) and terminal 6 (yellow clip) respectively.

Alternate Method (Test harness not available)

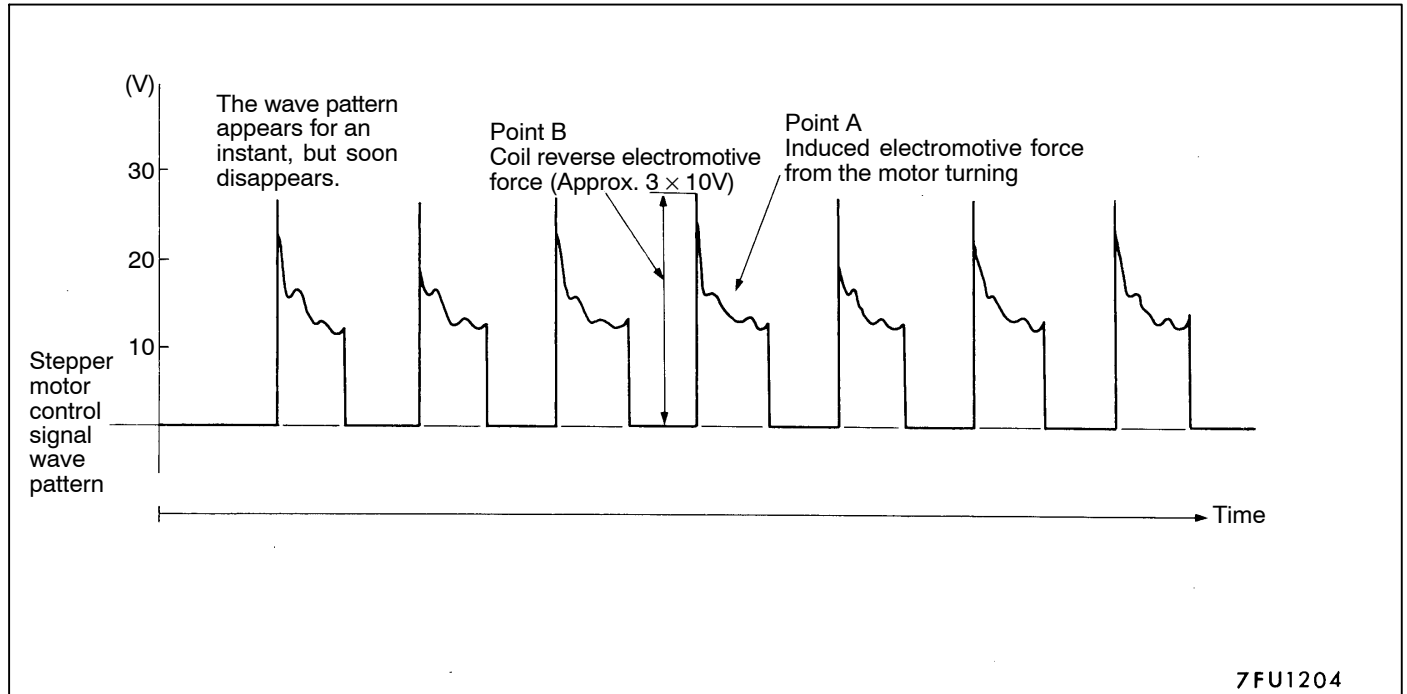
1. Connect the analyzer special patterns pickup to engine-ECU terminal 4, 5, 17, 18 <M/T> or engine-A/T-ECU terminal 14, 15, 28, 29 <A/T> respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	When the engine coolant temperature is 20°C or below, turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the A/C switch to ON.
	Immediately after starting the warm engine (approx. 1 minute)

Standard wave pattern



Wave Pattern Observation Points

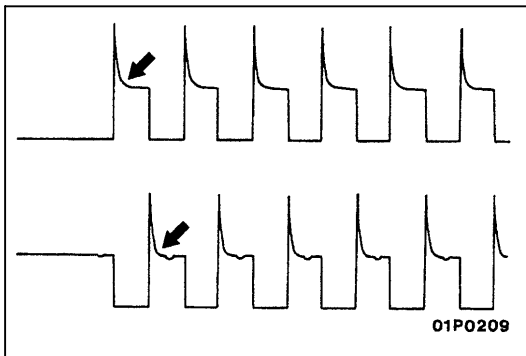
Check that the standard wave pattern appears when the stepper motor is operating.

Point A: Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

Contrast with standard wave pattern	Probable cause
Induced electromotive force does not appear or is extremely small.	Motor is malfunctioning

Point B: Height of coil reverse electromotive force

Contrast with standard wave pattern	Probable cause
Coil reverse electromotive force does not appear or is extremely small.	Short in the coil



Examples of Abnormal Wave Pattern

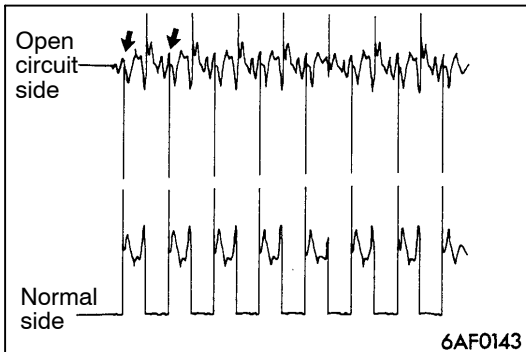
• Example 1

Cause of problem

Motor is malfunctioning. (Motor is not operating.)

Wave pattern characteristics

Induced electromotive force from the motor turning does not appear.



• Example 2

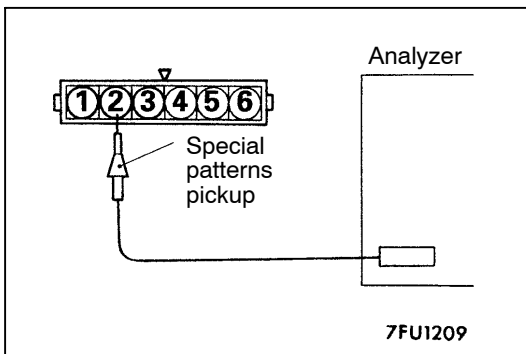
Cause of problem

Open circuit in the line between the stepper motor and the engine-ECU.

Wave pattern characteristics

Current is not supplied to the motor coil on the open circuit side. (Voltage does not drop to 0 V.)

Furthermore, the induced electromotive force waveform at the normal side is slightly different from the normal waveform.



IGNITION COIL AND POWER TRANSISTOR

• Ignition coil primary signal

Refer to GROUP 16 – Ignition System

• Power transistor control signal

Measurement Method

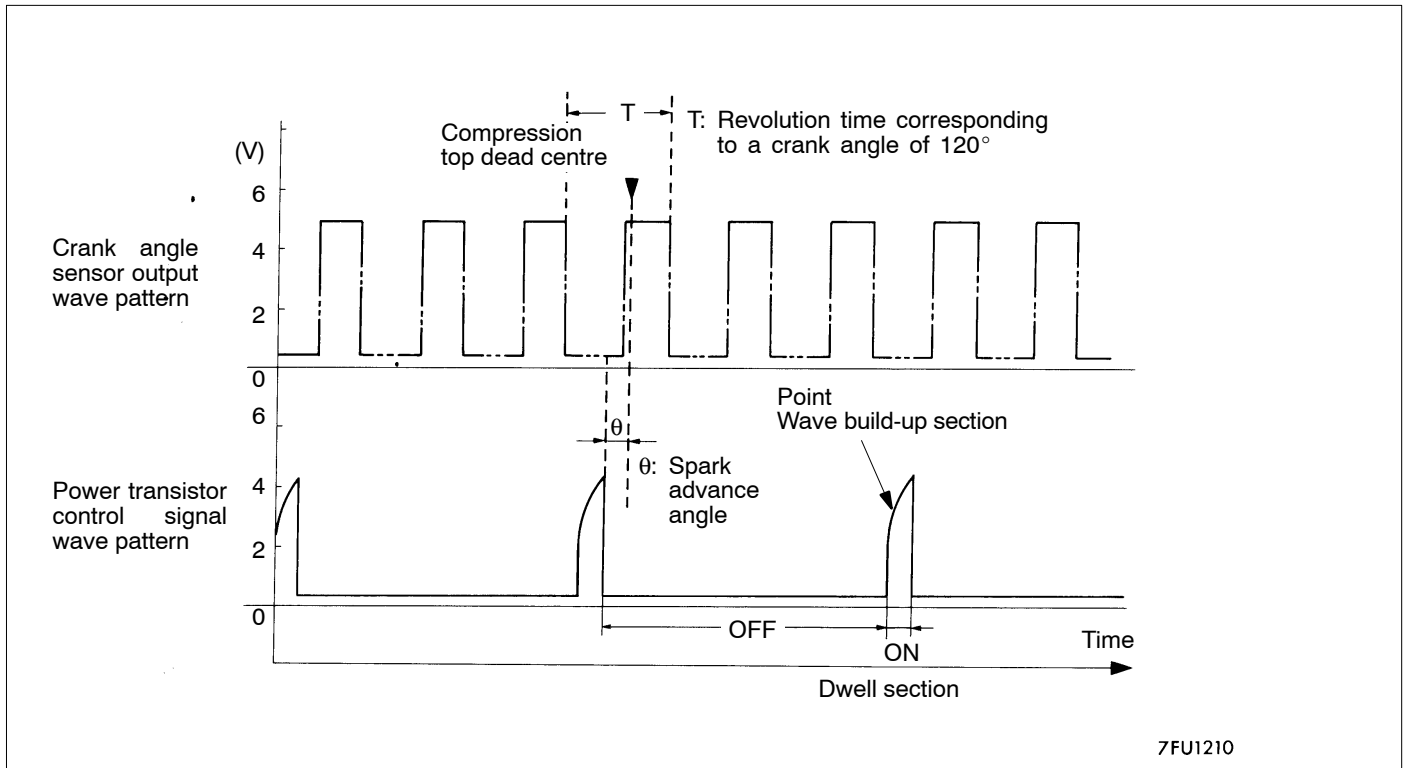
1. Disconnect the power transistor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to the power transistor connector terminal 1 (No. 3 – No. 6), terminal 2 (No. 2 – No. 5) and terminal 3 (No. 1 – No. 4) respectively.

Alternate Method (Test harness not available)

1. Connect the analyzer special patterns pickup to the engine ECU terminal 10 (No. 1 – No. 4), terminal 11 (No. 3 – No. 6), terminal 23 (No. 2 – No. 5) <M/T> or engine-A/T-ECU terminal 11 (No.1 – No.4), terminal 13 (No.3 – No.6), terminal 12 (No.2 – No.5) <A/T> respectively.

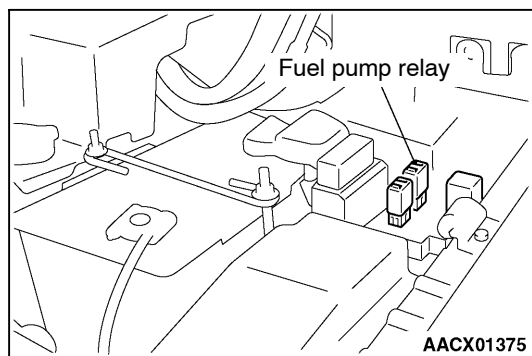
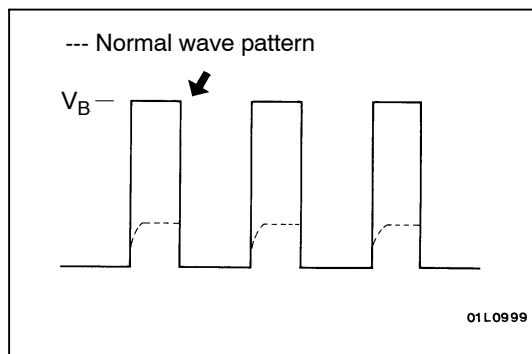
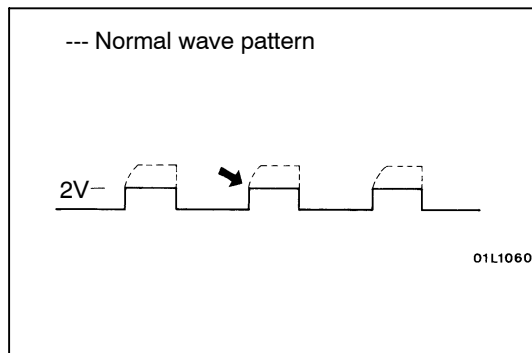
Standard Wave Pattern**Observation condition**

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Approx. 1,200 r/min

Standard wave pattern**Wave Pattern Observation Points**

Point: Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from approx.. 2V to approx. 4.5V at the top-right	Normal
2V rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Power transistor malfunction



Examples of Abnormal Wave Patterns

● Example 1

Wave pattern during engine cranking

Cause of problem

Open-circuit in ignition primary circuit

Wave pattern characteristics

Top-right part of the build-up section cannot be seen, and voltage value is approximately 2 V too low.

● Example 2

Wave pattern during engine cranking

Cause of problem

Malfunction in power transistor

Wave pattern characteristics

Power voltage results when the power transistor is ON.

ON-VEHICLE SERVICE

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE FUEL PRESSURE)

When removing the fuel pipe, hose, etc., since fuel pressure in the fuel pipe line is high, do the following operation so as to release fuel pressure in the line and prevent fuel from running out.

1. Remove the fuel filler cap to release pressure in the fuel tank.
2. Remove the fuel pump relay.
3. Connect the MUT-II to the diagnosis connector.

Caution

Turn off the ignition switch before disconnecting or connecting the MUT-II.

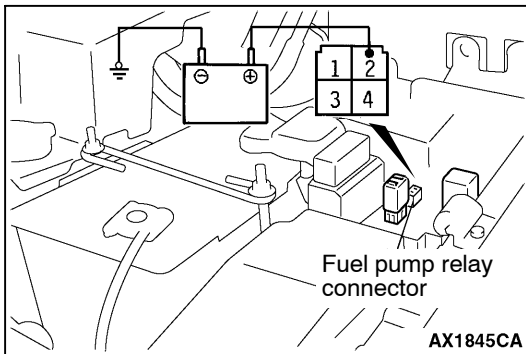
4. Turn off the ignition switch.
5. Select "Item No.74" from the MUT-II Data list.
6. Crank the engine for at least two seconds.
7. If the engine is not be started, use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.

8. If the engine is started, release fuel pressure by the following procedure:
 - (1) Turn off the ignition switch, and then stop the engine.
 - (2) Disconnect one of the ignition coil connectors.
 - (3) Crank the engine for at least two seconds.
 - (4) If the engine is not be started, use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.
 - (5) If the engine is started, stop it by racing and use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.
 - (6) Reconnect the ignition coil connector.

Caution

Clean the spark plug which corresponds to the disconnected ignition coil connector.

9. Remove the MUT-II.
10. Install the fuel pump relay.

**FUEL PUMP OPERATION CHECK**

1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.
2. If the fuel pump will not operate, check by using the following procedure, and if it is normal, check the drive circuit.
 - (1) Turn off the ignition switch.
 - (2) Remove the fuel pump relay. Connect the terminal No.2 of the harness-side connector to the battery. Check if the fuel pump operation sound can be heard at this time.

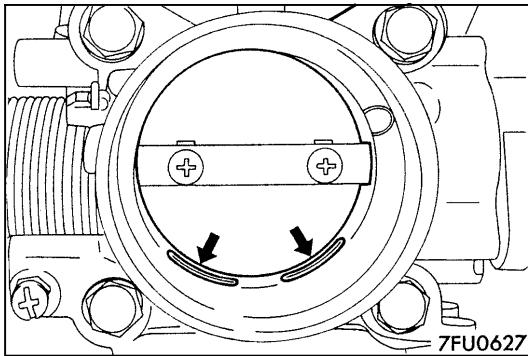
NOTE

As the fuel pump is an in-tank type, the fuel pump sound is hard to hear, so remove the fuel filler cap and check from the tank inlet.

- (3) Check the fuel pressure by pinching the fuel hose with the fingertips.

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

1. Start the engine and warm it up until the coolant is heated to 80°C or higher and then stop the engine.
2. Remove the air intake hose from the throttle body.



3. Plug the bypass passage inlet of the throttle body.

Caution

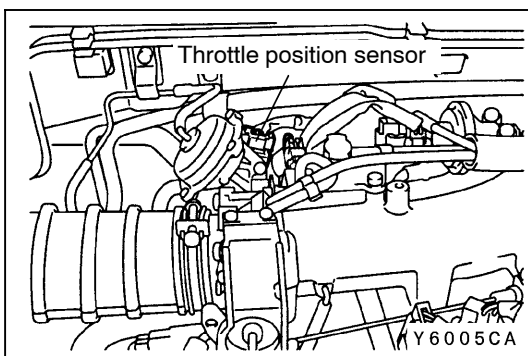
Do not allow cleaning solvent to enter the bypass passage.

4. Spray cleaning solvent into the valve through the throttle body intake port and leave it for about 5 minutes.

5. Start the engine, race it several times and idle it for about 1 minute. If the idling speed becomes unstable (or if the engine stalls) due to the bypass passage being plugged, slightly open the throttle valve to keep the engine running.
6. If the throttle valve deposits are not removed, repeat steps 4 and 5.
7. Unplug the bypass passage inlet.
8. Attach the air intake hose.
9. Use the MUT-II to erase the self-diagnosis code.
10. Adjust the basic idle speed. (Refer to P.13B-84.)

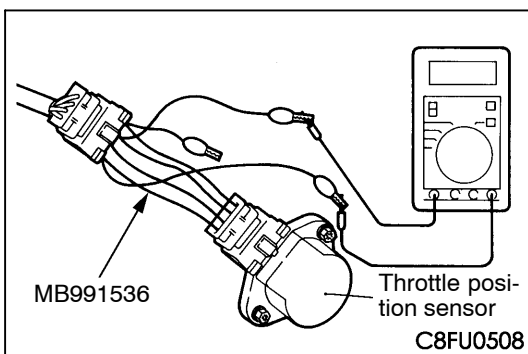
NOTE

If the engine hunts while idling after adjustment of the basic idle speed, disconnect the (–) cable from the battery for 10 seconds or more, and then reconnect it and run the engine at idle for about 10 minutes.



THROTTLE POSITION SENSOR ADJUSTMENT

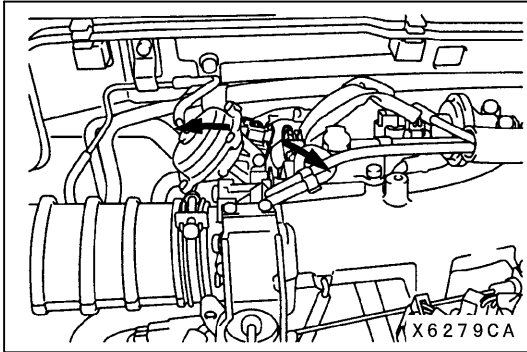
1. Connect the MUT-II to the diagnosis connector.
When not using the MUT-II, proceed as follows;



- (1) Disconnect the throttle position sensor connector, and connect the special tool (throttle position sensor test harness: MB991536) between the disconnected connector taking care not to confuse terminal to be connected.
- (2) Connect digital voltmeter between the terminal No.3 (sensor output: yellow clip of special tool) and the terminal No.1 (sensor earth: red clip of special tool) of the throttle position sensor connector.

2. Turn the ignition switch to ON (but do not start the engine).
3. Check the output voltage of the throttle position sensor.

Standard value: 535 – 735 mV



4. If not within the standard value, loosen the throttle position sensor mounting bolts. Then rotate the sensor body to adjust.
5. Turn the ignition switch to OFF.
6. Remove the MUT-II. If the MUT-II is not used, remove the special tool, and then connect the throttle position sensor connector.
7. If a diagnosis code is displayed, erase the diagnosis code by using the MUT-II or disconnect the negative battery cable from the battery terminal and then leave it for at least ten seconds. After that, reconnect the battery cable, and then let the engine run at idle for approx. ten minutes.

BASIC IDLE SPEED ADJUSTMENT

NOTE

- (1) The standard idling speed has been adjusted, by the speed adjusting screw (SAS), by the manufacturer, and there should usually be no need for readjustment.
 - (2) If the adjustment has been changed by mistake, the idle speed may become too high or the idle speed may drop too low when loads from components such as the A/C are placed on the engine. If this occurs, adjust by the following procedure.
 - (3) The adjustment, if made, should be made after first confirming that the spark plugs, the injectors, the idle speed control servo, the compression pressure, etc., are all normal.
1. Before inspection and adjustment, set the vehicle to the pre-inspection condition.
 2. Connect the MUT-II to the diagnosis connector.

NOTE

When the MUT-II is connected, the diagnosis control terminal should be earthed.

3. Start the engine and run at idle.
4. Select the item No. 30 of the MUT-II Actuator test.

NOTE

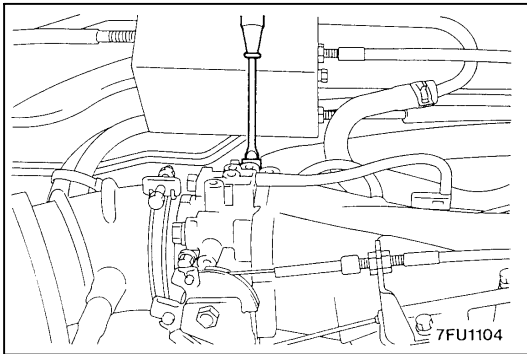
This holds the ISC servo at the basic step to adjust the basic idle speed.

5. Check the idle speed.

Standard value: 700 ± 50 r/min

NOTE

- (1) The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km or less], but no adjustment is necessary.
- (2) If the engine stalls or the engine speed is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P.13B-82.)



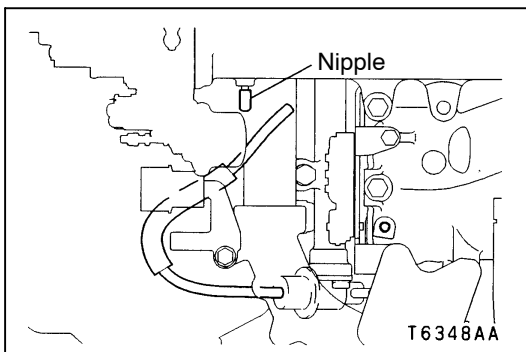
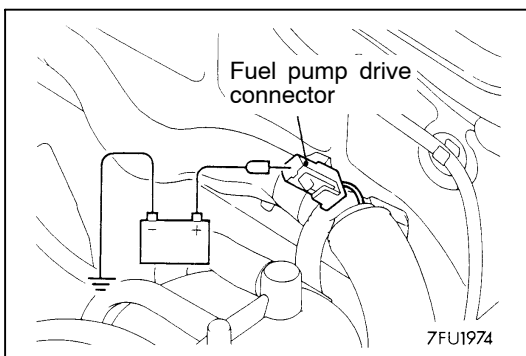
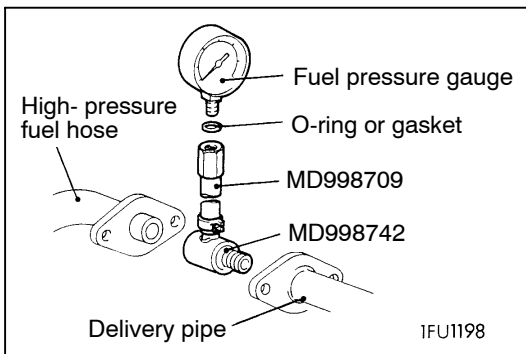
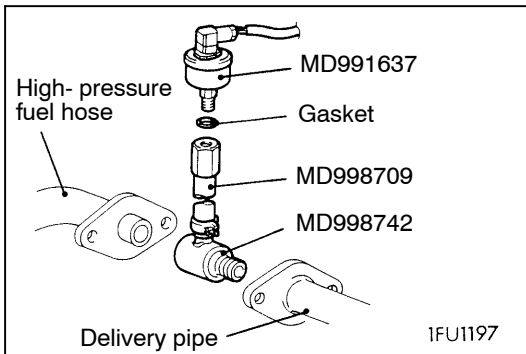
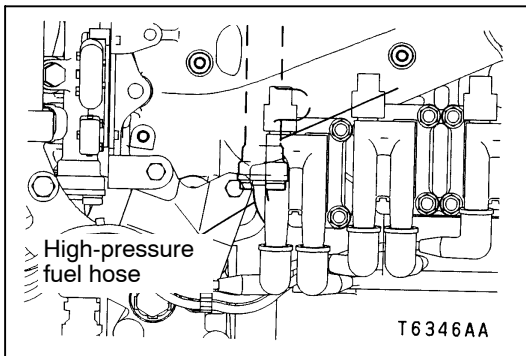
6. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.

7. Press the MUT-II clear key, and release the ISC servo from the Actuator test mode.

NOTE

Unless the ISC servo is released, the Actuator test mode will continue 27 minutes.

8. Switch OFF the ignition switch.
9. Disconnect the MUT-II.
10. Start the engine again and let it run at idle speed for about 10 minutes; check that the idling condition is normal.



FUEL PRESSURE TEST

1. Release residual pressure from the fuel pipe line to prevent fuel from gushing out. (Refer to P.13B-87.)
2. Disconnect the high-pressure fuel hose at the delivery pipe side.

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.

3. Change the fuel pressure measurement special tool adapter.
4. Attach the fuel pressure measurement special tool adapter.

<When using the MUT-II>

1. Attach the fuel pressure measurement special tool between the delivery pipe and the high-pressure hose.
2. Pass a gasket over the fuel pressure special measurement tool and then install the tool into the fuel pressure gauge set (special tool).
3. Connect the fuel pressure gauge set lead wires to the power supply (cigarette lighter socket) and the MUT-II.

<When not using the MUT-II>

1. Place an O-ring or gasket over the fuel pressure measurement special tool and then install the tool into the fuel pressure gauge.
2. Install the special tool assembled in 1. above between the delivery pipe and the high-pressure hose.

5. Connect the fuel pump drive connector with the battery (+) terminal using a jumper wire and drive the fuel pump. Under fuel pressure, check the fuel pressure gauge and special tool connections for leaks.
6. Disconnect the jumper wire from the fuel pump drive terminal to stop the fuel pump.
7. Start the engine and run at idle.
8. Measure fuel pressure while the engine is running at idle.

Standard value:

Approx. 265 kPa at curb idle

9. Disconnect the vacuum hose from the fuel pressure regulator and measure fuel pressure with the hose end closed by a finger.

Standard value:

324 – 343 kPa at kerb idle

10. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
11. Racing the engine repeatedly, hold the fuel return hose lightly with fingers to feel that fuel pressure is present in the return hose.

NOTE

If the fuel flow rate is low, there will be no fuel pressure in the return hose.

12. If any of fuel pressure measured in steps 8 to 11 is out of specification, troubleshoot and repair according to the table.

Symptom	Probable cause	Remedy
<ul style="list-style-type: none"> Fuel pressure too low Fuel pressure drops after racing No fuel pressure in fuel return hose 	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace fuel pressure regulator
	Low fuel pump delivery pressure	Replace fuel pump
Fuel pressure too high	Binding valve in fuel pressure regulator	Replace fuel pressure regulator
	Clogged fuel return hose or pipe	Clean or replace hose or pipe
Same fuel pressure when vacuum hose is connected and when disconnected	Damaged vacuum hose or clogged nipple	Replace vacuum hose or clean nipple

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. (Refer to the following section in this page.)
 15. Remove the fuel pressure gauge and special tool from the delivery pipe.

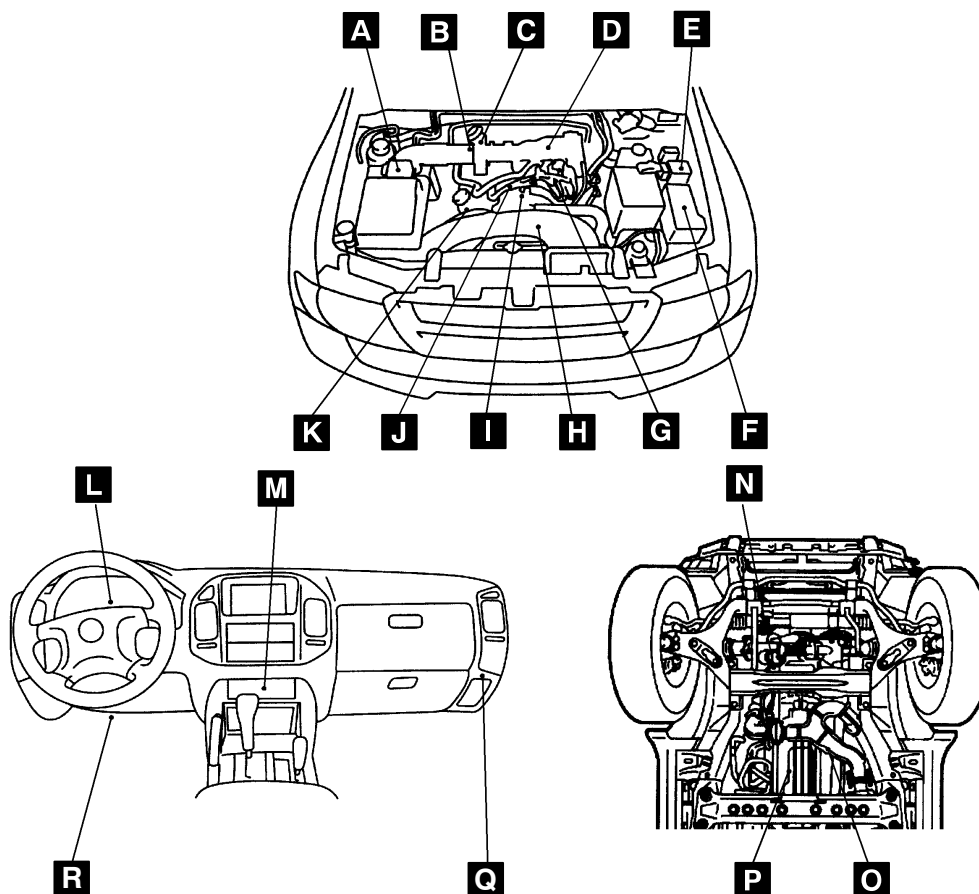
Caution

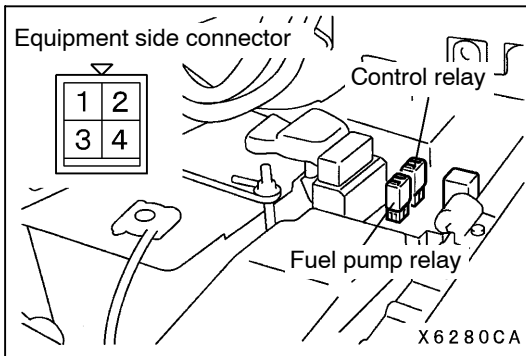
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

16. Replace the O-ring at the end of the fuel high pressure hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.
 17. Fit the fuel high pressure hose over the delivery pipe and tighten the bolt to specified torque.
 18. Check for fuel leaks.
 (1) Apply the battery voltage to the fuel pump drive terminal to drive the fuel pump.
 (2) Under fuel pressure, check the fuel line for leaks.

COMPONENT LOCATION

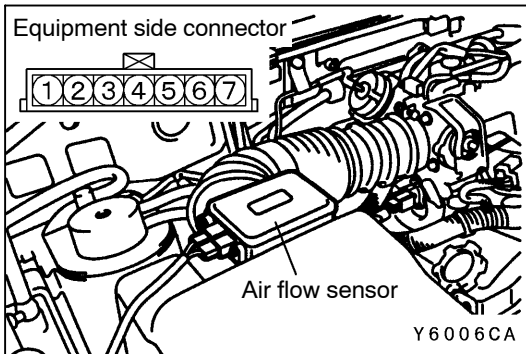
Name	Symbol	Name	Symbol
A/C relay	F	Idle speed control servo	B
A/C switch	M	Ignition coil and power transistor unit	G
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)	A	Inhibitor switch	N
Camshaft position sensor	D	Injector	I
Control relay and fuel pump relay	E	Mixture adjusting screw <Vehicles for General Export without catalytic converter, South Africa, GCC>	A
Crank angle sensor	H		
Diagnosis connector	R	Oxygen sensor <Vehicles for Australia, Brazil, General Export with catalytic converter>	O
Engine coolant temperature sensor	J	Power steering fluid pressure switch	K
Engine-ECU <M/T>, Engine-A/T-ECU <A/T>	Q	Throttle position sensor	C
Engine warning lamp (check engine lamp)	L	Vehicle speed sensor	P





CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○		○
Supplied	○	⊖	○	⊕



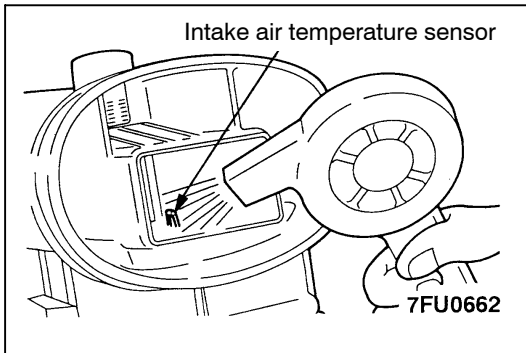
INTAKE AIR TEMPERATURE SENSOR CHECK

1. Disconnect the air flow sensor connector.
2. Measure resistance between terminals 4 and 6.

Standard value:

2.3 – 3.0 kΩ (at 20°C)

0.30 – 0.42 kΩ (at 80°C)

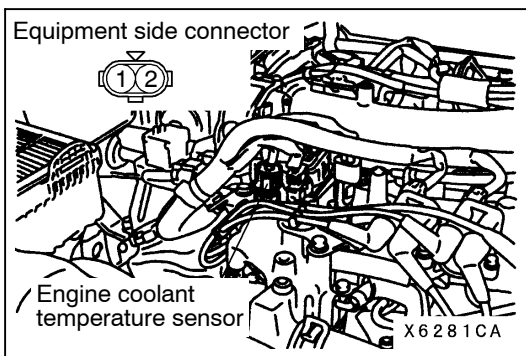


3. Measure resistance while heating the sensor using a hair drier.

Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

4. If the value divides from the standard value or the resistance remains unchanged, replace the air flow sensor.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

Caution

Be careful not to touch the connector (resin section) with the tool when removing and installing.

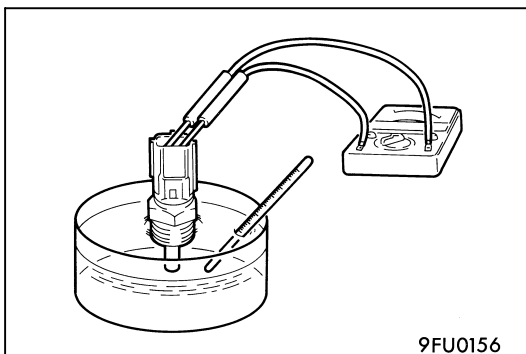
1. Remove the engine coolant temperature sensor.
2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

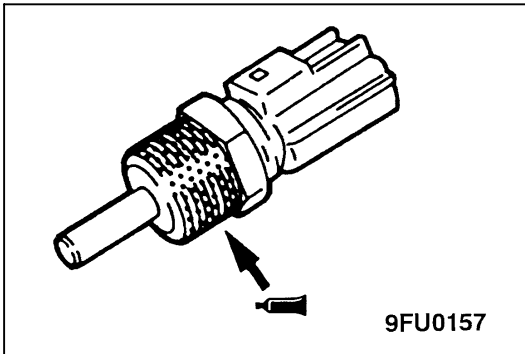
Standard value:

2.1 – 2.7 kΩ (at 20°C)

0.26 – 0.36 kΩ (at 80°C)

3. If the resistance deviates from the standard value greatly, replace the sensor.





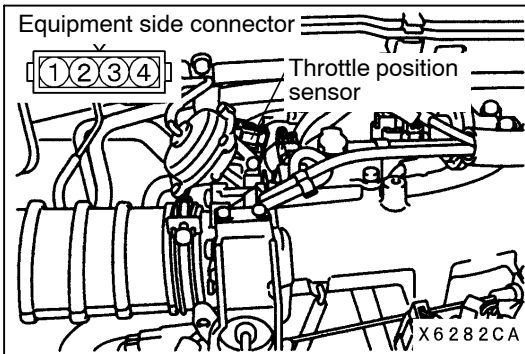
4. Apply sealant to threaded portion.

Specified sealant:

3M Nut Locking Part No.4171 or equivalent

5. Install the engine coolant temperature sensor and tighten it to the specified torque.

Tightening torque: 29 Nm



THROTTLE POSITION SENSOR CHECK

1. Disconnect the throttle position sensor connector.
2. Measure the resistance between the throttle position sensor side connector terminal 1 and terminal 4.

Standard value: 3.5 – 6.5 kΩ

3. Measure the resistance between the throttle position sensor side connector terminal 1 and terminal 3.

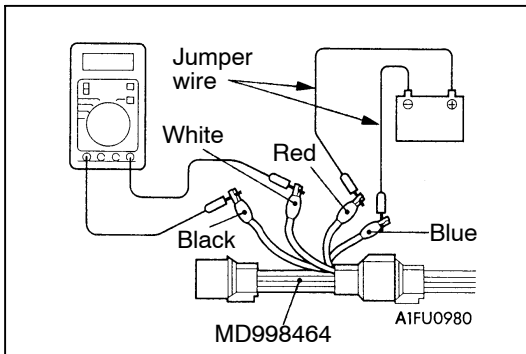
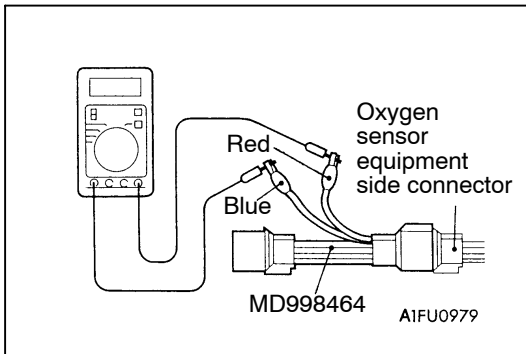
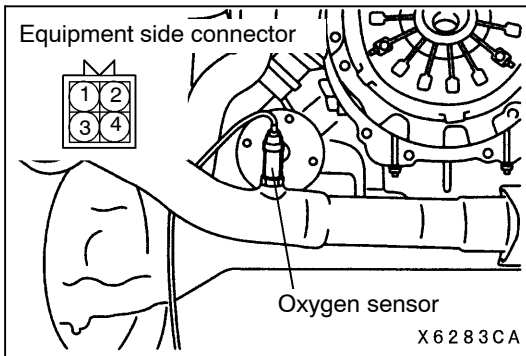
Normal condition:

Throttle valve slowly open until fully open from the idle position	Changes smoothly in proportion to the opening angle of the throttle valve
--	---

4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

NOTE

For the throttle position sensor adjustment procedure, refer to P.13B-83.



OXYGEN SENSOR CHECK <Vehicles for General Export with catalytic converter, Brazil, Australia>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity ($4.5 - 8.0 \Omega$ at 20°C) between terminal 1 (red clip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.

5. Use the jumper wire to connect terminal 1 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 3 (blue clip) to the battery (-) terminal.

Caution

Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.

6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

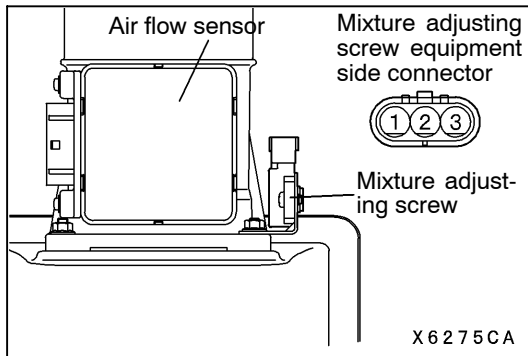
Standard value:

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.

8. If the sensor is defective, replace the oxygen sensor.

NOTE

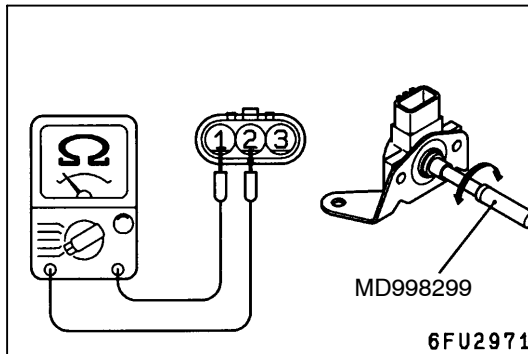
For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.



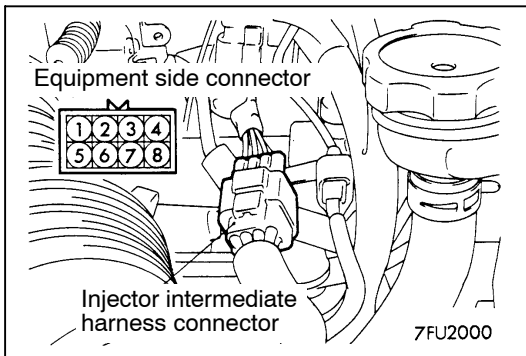
MIXTURE ADJUSTING SCREW (VARIABLE RESISTOR) CHECK <Vehicles for General Export without catalytic converter, South Africa, GCC>

1. Disconnect the variable resistor connector.
2. Use a circuit tester to measure the resistance between terminal No.1 and terminal No.3 of the variable resistor connector.

Standard value: 4 – 6 k Ω



3. Connect the circuit tester between the terminal No.1 and terminal No.2.
4. Check that the resistance changes smoothly when the adjusting screw is rotated by the special tool (MAS screwdriver).
5. Inspect the body for crack or other damage.
6. If any defect is found, replace the variable resistor as an assembly.



INJECTOR CHECK

Measurement of Resistance between Terminals

1. Disconnect the injector intermediate harness connectors.
2. Measure the resistance between terminals.

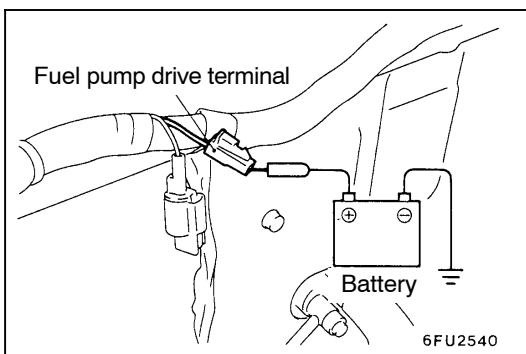
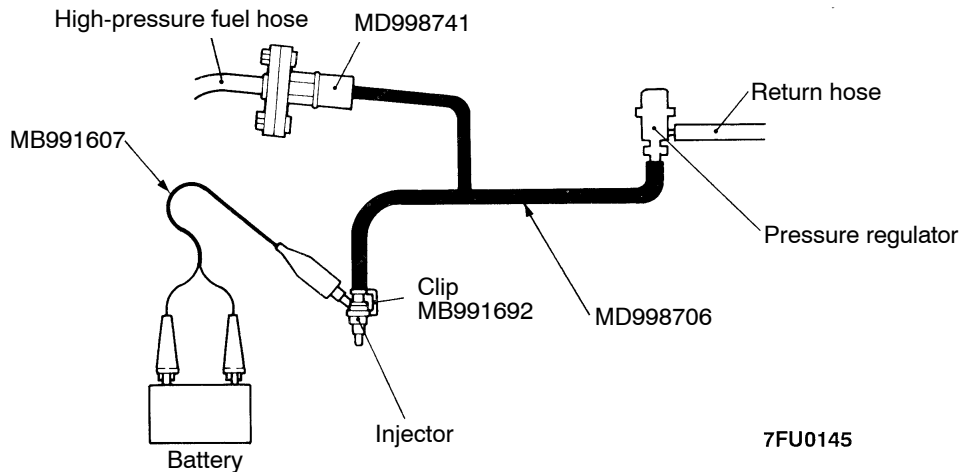
Standard value: 13 – 16 Ω (at 20°C)

Injector	Measurement terminal
No. 1 cylinder	8 – 3
No. 2 cylinder	8 – 2
No. 3 cylinder	8 – 1
No. 4 cylinder	8 – 7
No. 5 cylinder	8 – 6
No. 6 cylinder	8 – 5

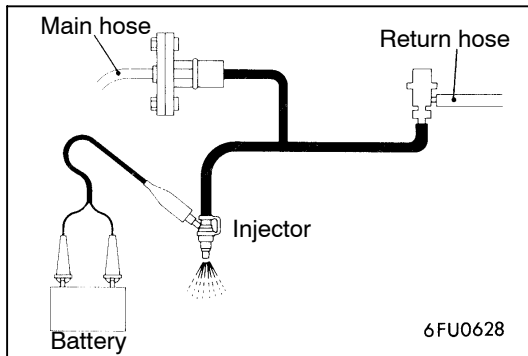
3. Connect the injector intermediate harness connectors.

Checking the Injection Condition

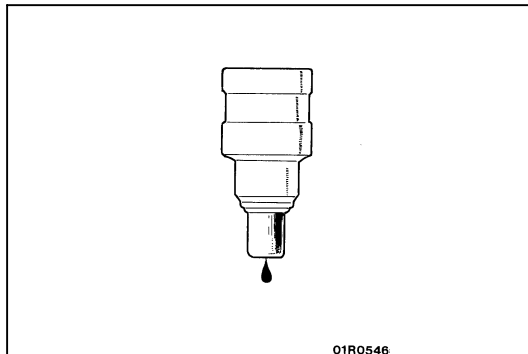
1. Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel.
(Refer to P.13B-87.)
2. Remove the injector.
3. Arrange the special tools (injector test set, adapter, injector test clip), the fuel pressure regulator and the injector as shown in the illustration below.



4. Apply battery voltage to the fuel pump drive terminal (black) and activate the fuel pump.



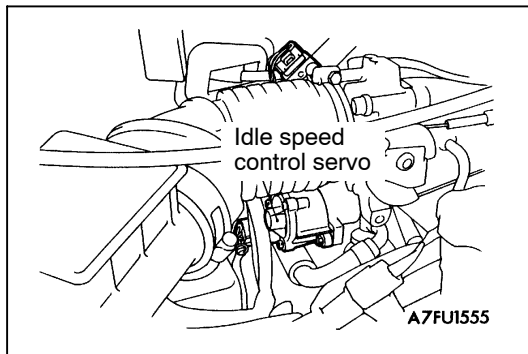
5. Activate the injector and check the atomized spray condition of the fuel.
The condition can be considered satisfactory unless it is extremely poor.



6. Stop the actuation of the injector, and check for leakage from the injector's nozzle.

Standard value: 1 drop or less per minute

7. Activate the injector without activating the fuel pump; then, when the spray emission of fuel from the injector stops, disconnect the special tool and restore it to its original condition.



IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECK

Checking the Operation Sound

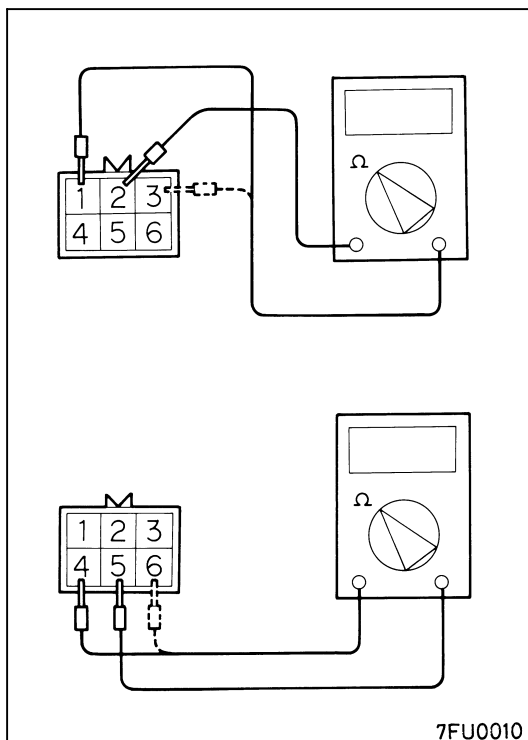
1. Check that the engine coolant temperature is 20°C or below.

NOTE

Disconnecting the engine coolant temperature sensor connector and connecting the harness-side of the connector to another engine coolant temperature sensor that is at 20°C or below is also okay.

2. Check that the operation sound of the stepper motor can be heard after the ignition is switched ON. (but without starting the motor.)
3. If the operation sound cannot be heard, check the stepper motor's activation circuit.

If the circuit is normal, it is probable that there is a malfunction of the stepper motor or of the engine control unit.



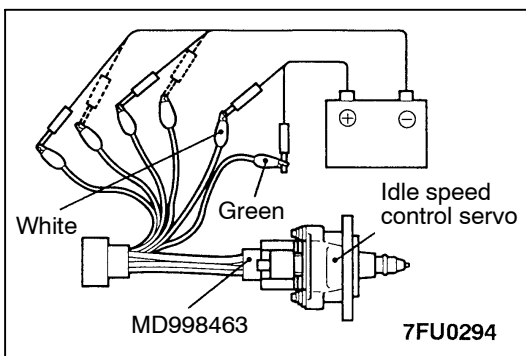
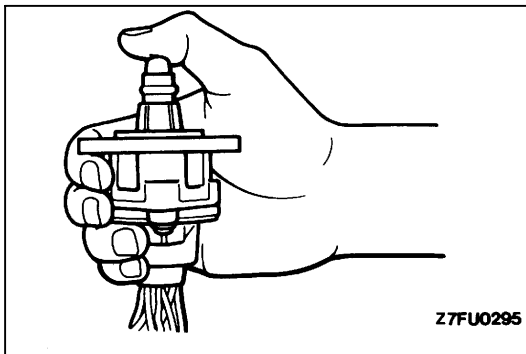
Checking the Coil Resistance

1. Disconnect the idle speed control servo connector and connect the special tool (test harness).
2. Measure the resistance between terminal 2 (white clip of the special tool) and either terminal 1 (red clip) or terminal 3 (blue clip) of the connector at the idle speed control servo side.

Standard value: 28 – 33 Ω (at 20°C)

3. Measure the resistance between terminal 5 (green clip of the special tool) and either terminal 6 (yellow clip) or terminal 4 (black clip) of the connector at the idle speed control servo side.

Standard value: 28 – 33 Ω (at 20°C)

**Operational Check**

1. Remove the throttle body.
2. Remove the stepper motor.
3. Connect the special tool (test harness) to the idle speed control servo connector.
4. Connect the positive (+) terminal of a power supply (approx. 6V) to the white clip and the green clip.
5. With the idle speed control servo as shown in the illustration, connect the negative (-) terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.
 - (1) Connect the negative (-) terminal of the power supply to the red and black clip.
 - (2) Connect the negative (-) terminal of the power supply to the blue and black clip.
 - (3) Connect the negative (-) terminal of the power supply to the blue and yellow clip.
 - (4) Connect the negative (-) terminal of the power supply to the red and yellow clip.
 - (5) Connect the negative (-) terminal of the power supply to the red and black clip.
 - (6) Repeat the tests in sequence from (5) to (1).
6. If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.

INJECTOR

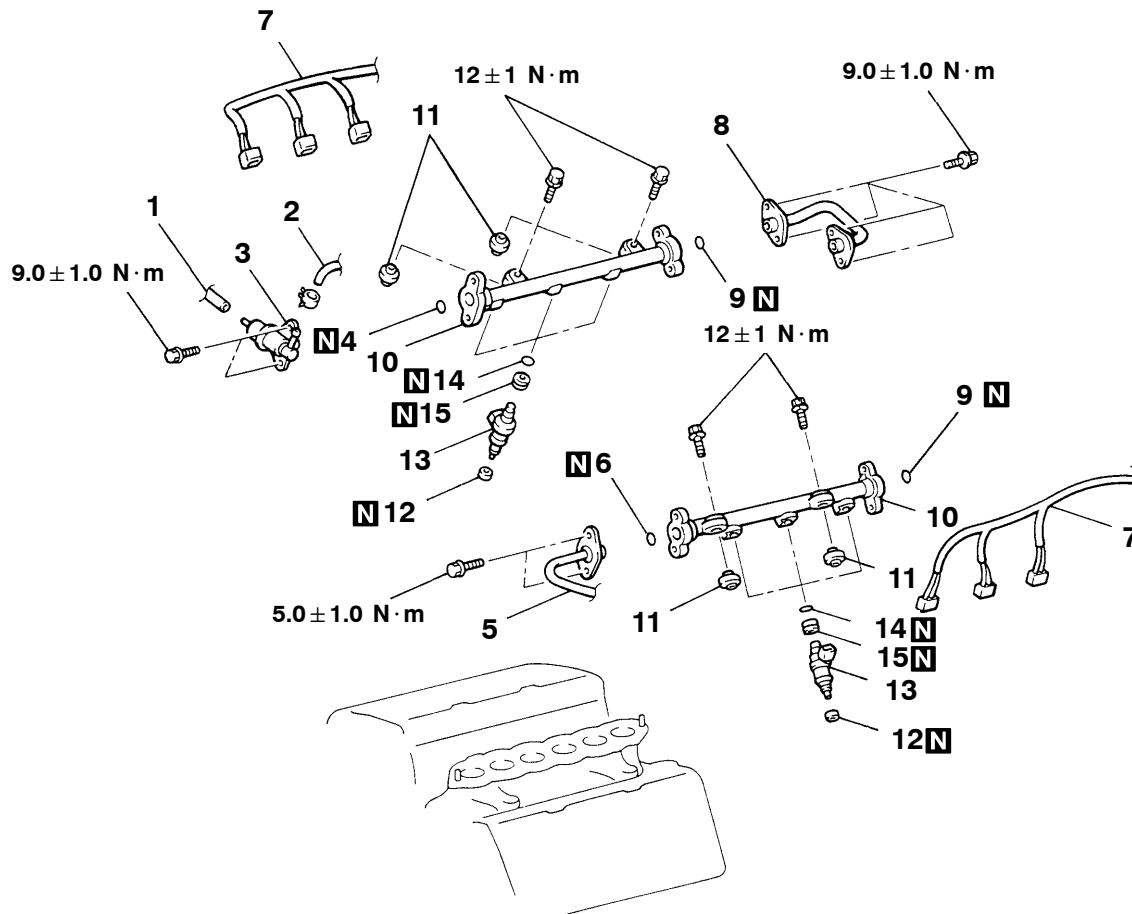
REMOVAL AND INSTALLATION

Pre-removal Operation

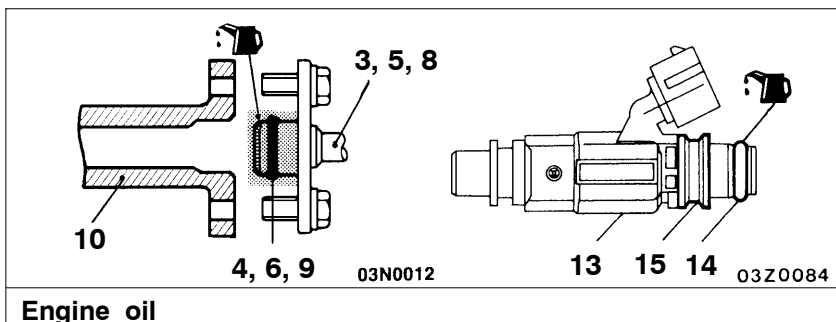
- Fuel Line Pressure Reduction (Refer to P.13B-82.)
- Intake Manifold Plenum Removal (Refer to GROUP 15 – Intake Manifold.)

Post-installation Operation

- Intake Manifold Plenum Removal (Refer to GROUP 15 – Intake Manifold.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)
- Fuel Leakage Inspection



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Engine oil

Removal steps

1. Vacuum hose
2. Fuel return hose connection
3. Fuel pressure regulator
4. O-ring
5. High-pressure fuel hose connection
6. O-ring
7. Injector connectors
8. Fuel pipe



9. O-rings
10. Delivery pipes
11. Insulators
12. Insulators
13. Injectors
14. O-rings
15. Grommets

REMOVAL SERVICE POINT**◀A▶ DELIVERY PIPES/INJECTORS REMOVAL**

Remove the delivery pipes (with the injectors attached).

Caution

Do not drop the injector(s).

INSTALLATION SERVICE POINT**▶A◀ INJECTORS/FUEL PRESSURE
REGULATOR/HIGH-PRESSURE FUEL HOSE
INSTALLATION**

1. Apply a drop of new engine oil to the O-ring.

Caution

Do not let the engine oil get into the delivery pipes or the injectors will be damaged.

2. Turn the injectors. To the right and left to install to the delivery pipes. Repeat for fuel pressure regulator and high-pressure fuel hose.
Be careful not to damage the O-ring. After installing, check that the item turns smoothly.
3. If it does not turn smoothly, the O-ring may be trapped, remove the item, re-install it into the delivery pipes and check again.
4. Tighten the high-pressure fuel hose and fuel pressure regulator to the specified torque.

Tightening torque:

$9.0 \pm 1.0 \text{ N} \cdot \text{m}$ <Fuel pressure regulator>

$5.0 \pm 1.0 \text{ N} \cdot \text{m}$ <High-pressure fuel hose>

THROTTLE BODY

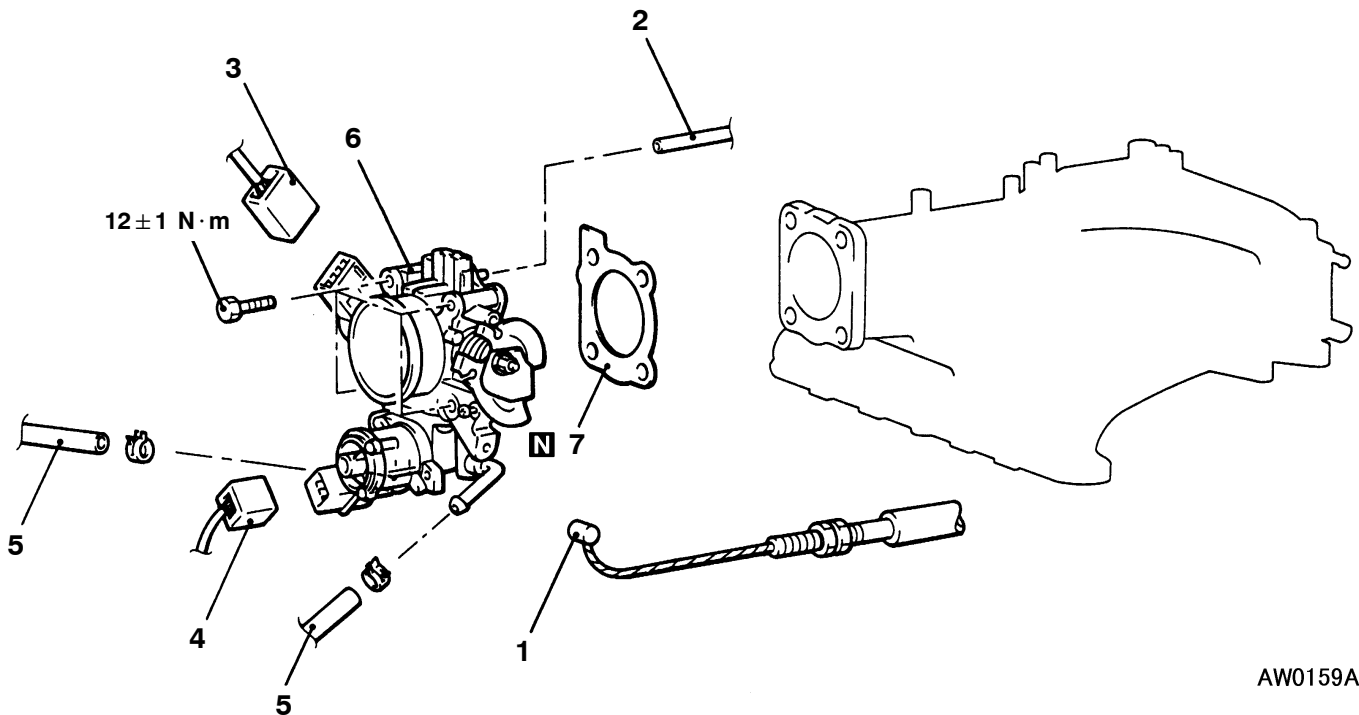
REMOVAL AND INSTALLATION

Pre-removal Operation

- Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service.)
- Air Cleaner Removal (Refer to GROUP 15 – Air Cleaner.)

Post-installation Operation

- Air Cleaner Installation (Refer to GROUP 15 – Air Cleaner.)
- Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)

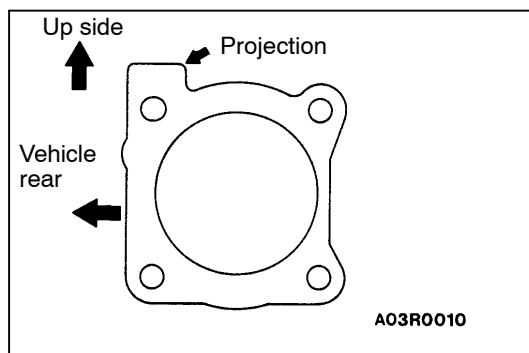


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Removal steps

1. Accelerator cable connection
2. Vacuum hose connection
3. Throttle position sensor connector
4. Idle speed control servo connector

5. Heater hose connector
6. Throttle body
7. Throttle body gasket



INSTALLATION SERVICE POINT

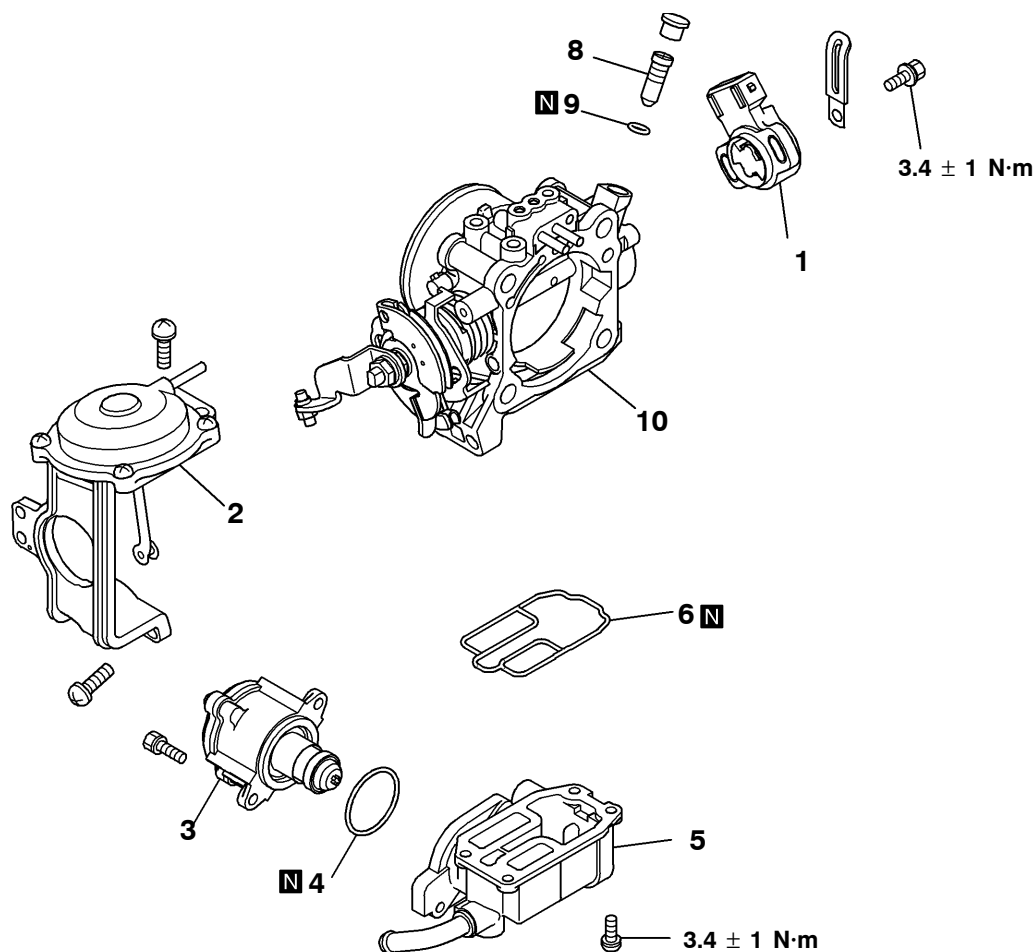
▶A◀ THROTTLE BODY GASKET INSTALLATION

Install the throttle body gasket as shown in the illustration.

Caution

Poor idling etc. may result if the throttle body gasket is installed incorrectly.

DISASSEMBLY AND REASSEMBLY



X 6278CA

Disassembly steps

1. Throttle position sensor
2. Lever assembly
3. Idle speed control servo (Stepper motor)
4. O-ring
5. Fast idle air valve

6. O-ring
7. Speed adjusting screw (SAS)
8. O-ring
9. Throttle body

CLEANING THROTTLE BODY PARTS

1. Clean all throttle body parts.
Do not use solvent to clean the following parts:
 - Throttle position sensor
 - Accelerator pedal position sensor
 - Idle speed control body assemblyIf these parts are immersed in solvent, their insulation will deteriorate.
Wipe them with cloth only.
2. Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

REASSEMBLY SERVICE POINT**►A◄ THROTTLE POSITION SENSOR (TPS)
INSTALLATION**

1. Install the TPS so that it faces as shown in the illustration, and then tighten it with the screw.
2. Connect a multimeter between terminal (4) (TPS power supply) and terminal (3) (TPS output) of the TPS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully-open position.
3. If is an abnormality, replace the TPS.

