HEATER & AIR CONDITIONER

SECTION HA

CONTENTS

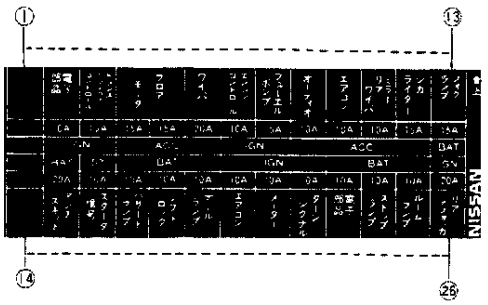
1. Full Automatic Air Conditioner

1-1 PRIOR TO TROUBLE DIAGNOSIS

This fully automatic air conditioner has a self-diagnostic function for checking its major components. Using this self-diagnostic function, it is possible to check whether the signal issued from each sensor is within the effective range of the respective sensor characteristics, and whether each actuator can respond correctly to a control signal issued by force under a predetermined condition. It is also possible to check the function of the display section, mode signal, and each sensor. This means that, using the self-diagnostic function, most components of this fully automatic air conditioner can be checked. After identifying a faulty section, however, each sensor or actuator must be examined using conventional method.

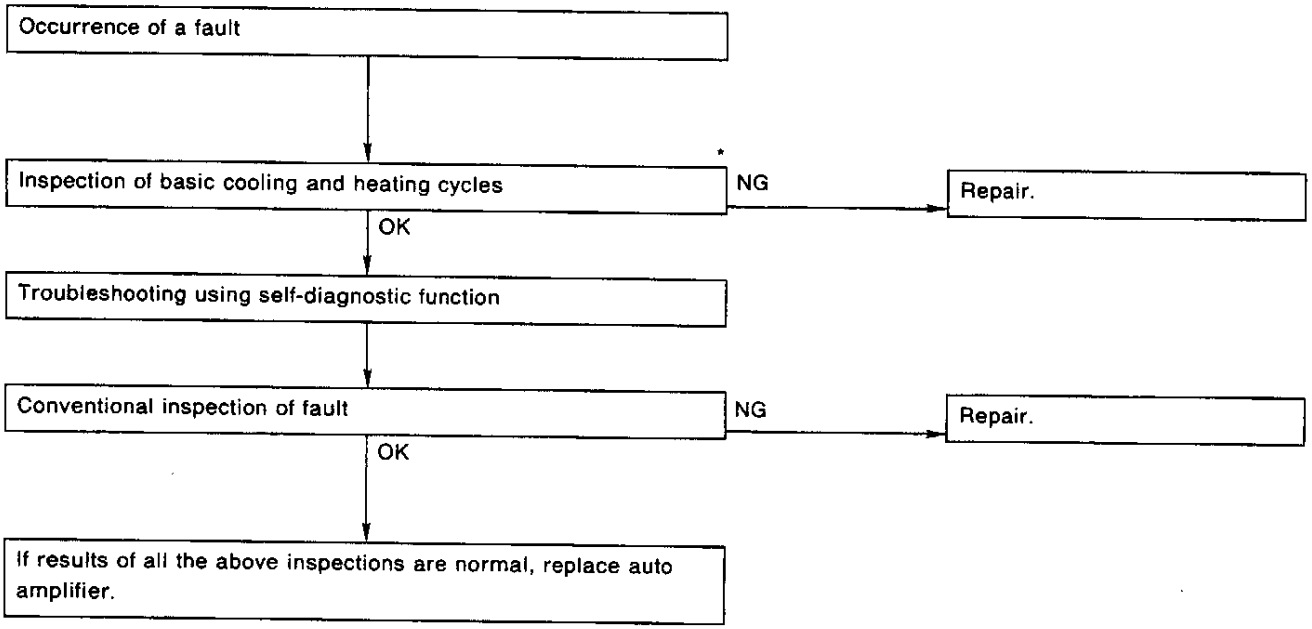
If an error in the electrical system is determined as the cause of a fault, for example, it is also necessary to check fuses, connectors, and terminals, etc. in addition to self-diagnosis.

Fuses that need inspection



No.	Capacity	Power supply system	Major load (Air conditioner)
4	15A	ACC	Blower fan motor, auto amplifier
5			
10	10A		Magnet clutch
20		IGN	Air conditioner relay, intake door actuator, HI relay, auto amplifier
23		BAT	Auto amplifier

The basic troubleshooting flow diagram is shown below:

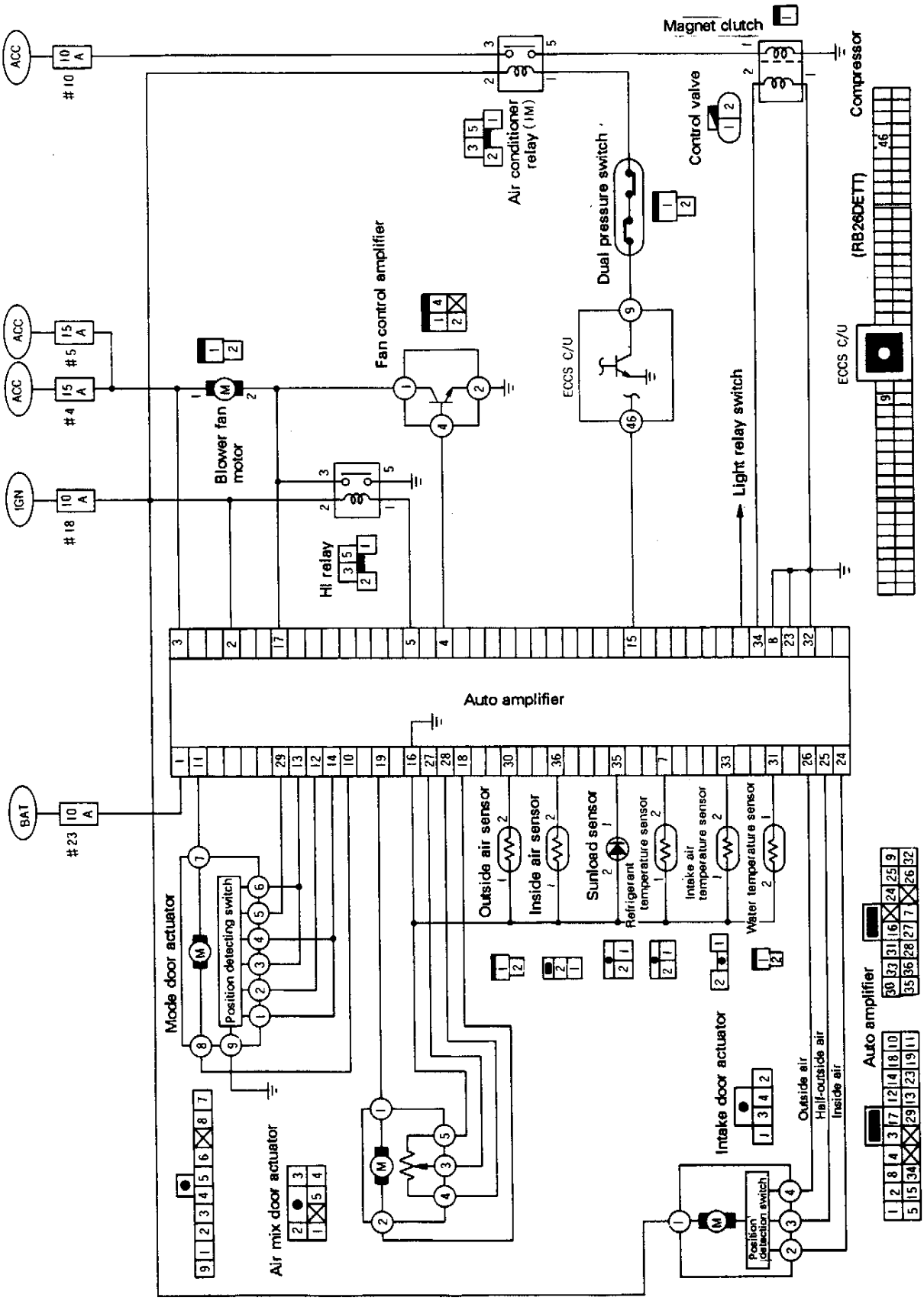


(*) NOTE:

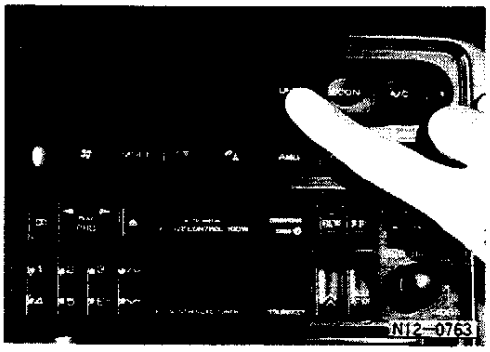
Self-diagnostic function is unable to check such phenomena that cannot be reproduced.

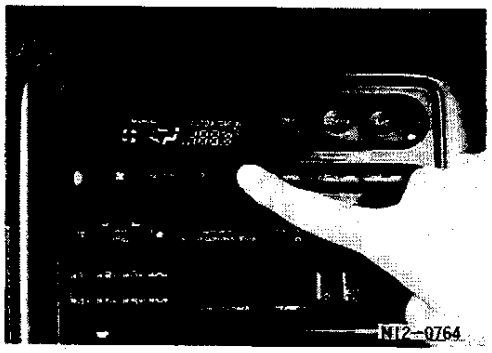
1. Full Automatic Air Conditioner (Cont'd)

1-2 SYSTEM DIAGRAM



1. Full Automatic Air Conditioner (Cont'd)





1-3 SELF-DIAGNOSIS

(1) Self-diagnosis set

To change from ordinary automatic air conditioner control mode into self-diagnosis mode, depress automatic air conditioner OFF switch for more than five seconds within 10 seconds after turning ignition switch to ON from OFF. Start engine to prevent discharging discharged battery when performing self-diagnosis.

To return to automatic air conditioner control mode from self-diagnostic mode, turn ignition switch OFF, or depress air conditioner switch.

Self-diagnostic program is designed to facilitate detection of a fault. It consists of the following five self-diagnostic steps and one customizing step.

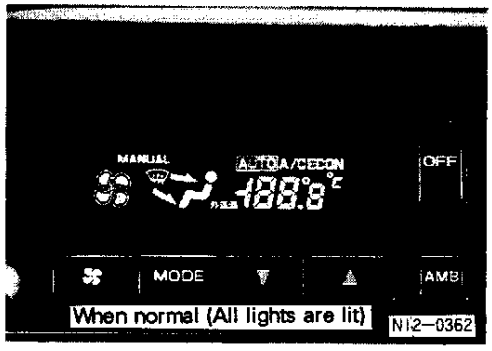
Steps 1-5 can be selected by depressing HOT switch or COLD switch. Steps 5 and 6 can be selected by depressing fan switch.

NOTE:

Step 6 is not used for trouble diagnosis.

Description of each step

Step 1:	Segment check (Display section and LED)
Step 2:	Sensor check
Step 3:	Mode door position check
Step 4:	Actuator operation check
Step 5:	Sensor recognition temperature display
Step 6:	• To set difference between display temperature and sensed temperature • To memorize intake port when ignition switch is OFF

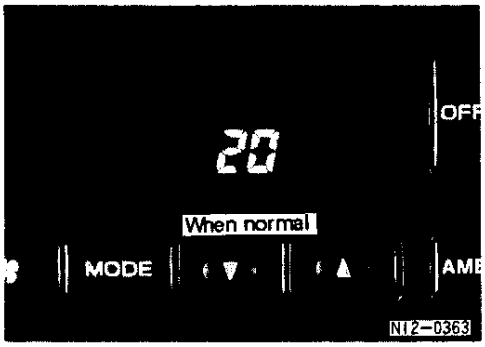


(2) Step 1 (Display section and LED segment check)

Normal: All display and LEDs are lit.

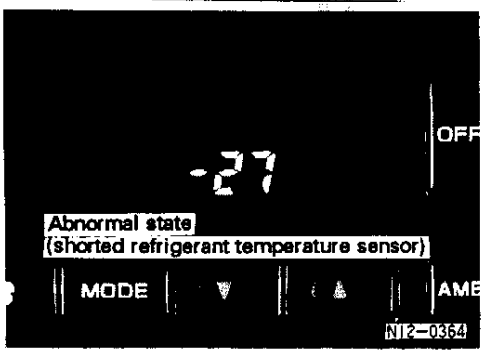
Abnormal: Failed portion is not lit.

1. Full Automatic Air Conditioner (Cont'd)



(3) Step 2 (Sensor check)

Step 2 is selected by depressing HOT switch(△)while in step 1 status.
Microcomputer detects whether each sensor input signal satisfies set conditions, and results are displayed on display section.
Normal: '20' is displayed in display section.



Abnormal: Failed sensor number is displayed. If sensor short-circuit is detected, a minus sign (-) is also indicated.
If error is detected in two or more sensors, each sensor number is displayed by flashing twice in turn.

NOTE:
If vehicle is positioned in dark place or if sunlight is exceptionally strong, then sunload sensor error may be indicated.

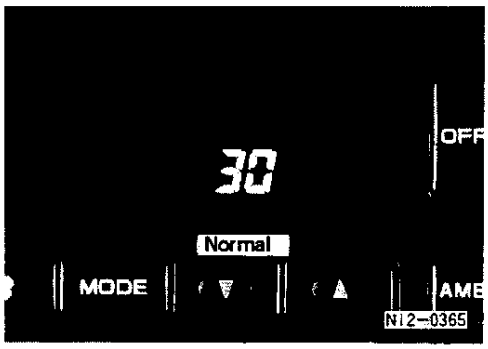
Display number and corresponding sensor, and judgment criteria

Display No.	Sensor	When disconnected	When shorted
20	(Normal)	—	—
21	Outside air sensor	Below –60°C (–76°F)	Above 100°C (212°F)
22	Inside air sensor	Below –60°C (–76°F)	Above 100°C (212°F)
23	Water temperature sensor	Below –50°C (–58°F)	Above 150°C (302°F)
24	Intake temperature sensor	Below –50°C (–58°F)	Above 100°C (212°F)
25	Sunload sensor	Below 0.030 kW (26 kcal/h, 103 BTU/h)/m^2 [0.0028 kW (2.42 kcal/h, 9.6 BTU/h)/sq ft]	Above 1.323 kW (1,138 kcal/h, 4,516 BTU/h)m^2 [0.1229 kW (105.72 kcal/h, 419.5 BTU/h)/sq ft]
26	PBR (Note)	Above 4.9V	Below 0.1V
27	Refrigerant temperature sensor	Below –50°C (–58°F)	Above 100°C (212°F)

NOTE:
PBR is judged based on air mix door opening of 40%.
(Full cold: 0%, full hot: 100%)

If sensor is judged as faulty in step 2, check single sensor according to "1-4. SENSOR INSPECTION", and determine whether failure is in sensor or harness.

1. Full Automatic Air Conditioner (Cont'd)



(4) Step 3 (Mode door position check)

Depress HOT switch (△) while in step 2 status, and step 3 will be selected.

In this step, mode door actuator operates, and whether input signal from position detection switch is normal is checked by microcomputer, and the results are indicated on display section.

NOTE:

Approximately 16 seconds are required to complete inspection of all modes.

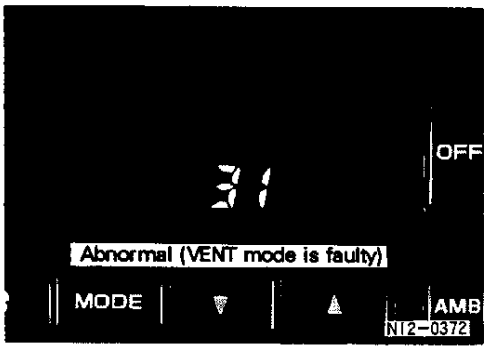
NORMAL: '30' will be displayed.

ABNORMAL: Number of faulty modes are displayed.

If two or more modes are faulty, each mode number is displayed by flashing twice in turn.

NOTE:

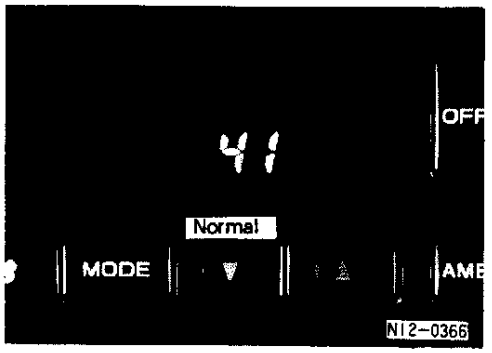
Connector disconnection is indicated by the following pattern: 31 → 32 → 34 → 35 → 36.



Display number and corresponding mode

Display No.	Mode	Display No.	Mode
30	(Normal)	34	FOOT
31	VENT	35	D/F
32	B/L	36	DEF

If any mode is judged as faulty in step 3, it indicates that harness or mode door actuator is faulty.



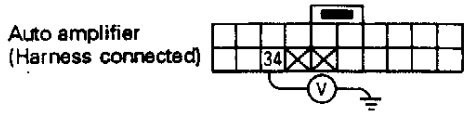
(5) Step 4 (Each actuator operation check)

If HOT switch (△) is depressed while in step 3, step 4 is selected, and '41' displayed. If AMB switch ([AMB]) is depressed in this status, displayed number will change to 42, 43, ... upon each depression of switch, and return to 41 after 47 is displayed.

Auto amplifier provides specified output to each actuator, blower motor and compressor corresponding to these displayed numbers. Check operation of these units visually, or by listening or feeling vibration.

1. Full Automatic Air Conditioner (Cont'd)

NOTE:
Output to compressor is provided as magnet clutch ON-OFF signal and control valve output signal. Control valve output signal causes compressor swash plate inclination angle to change to control compressor delivery. This can be checked by measuring auto amplifier output voltage using a circuit tester.

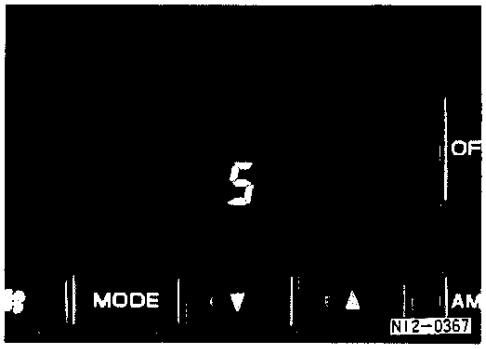


Display number and operation status

Display number	Intake door	Air mix door	Mode door	Blower motor	Compressor	
					Magnet clutch ON-OFF	Output voltage to control valve
41	Inside air	Full cold	VENT	5V	ON	Approx. 1V
42	Inside air	Full cold	VENT	5V	ON	Approx. 4.5V
43	Inside air	Full cold	B/L	10.5V	ON	Approx. 2.5V
44	Half-outside air	Full hot	B/L	8.5V	ON	Approx. 2.5V
45	Outside air	Full hot	FOOT	8.5V	ON	Approx. 4.5V
46	Outside air	Full hot	D/F	8.5V	OFF	0V
47	Outside air	Full hot	DEF	12V	ON	Approx. 2.5V

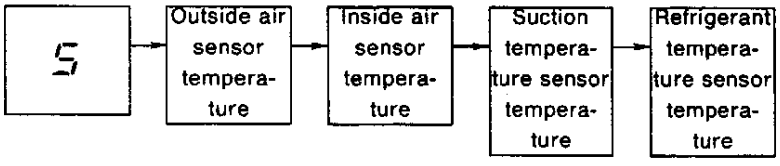
If abnormality of any portion is detected in step 4, be sure to perform inspection according to "1-5 ACTUATOR INSPECTION" flowchart.

Abnormal section	Flowchart
Intake door	1-5 (1) Intake door system
Air mix door	1-5 (2) Air mix door system
Blower motor	1-5 (3) Blower motor system
Compressor	1-5 (4) Compressor system

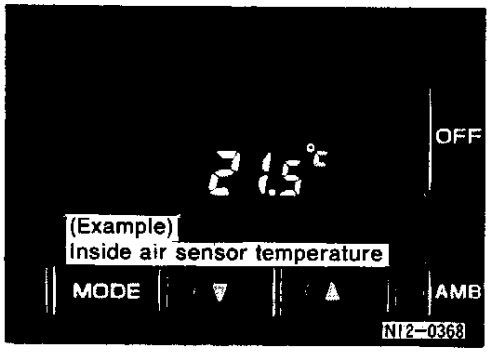


(6) Step 5 (Sensor recognition temperature indication)

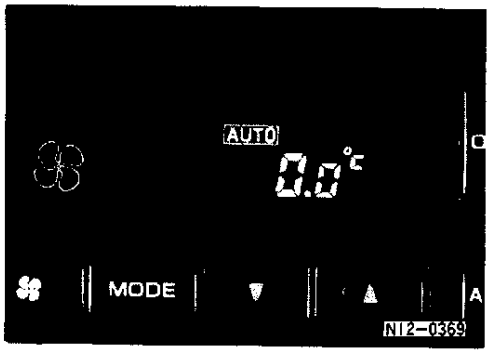
If HOT switch (△) is depressed while in step 4, then step 5 is selected and '5' is indicated in display section. If AMB switch ([AMB]) is depressed in this status, temperatures sensed by outside air sensor, inside air sensor, suction temperature sensor and refrigerant temperature sensor are displayed in the following sequence.



1. Full Automatic Air Conditioner (Cont'd)



If temperature displayed in step 5 is excessively different from actual temperature, check suspected sensor according to "1-4 SENSOR INSPECTION".

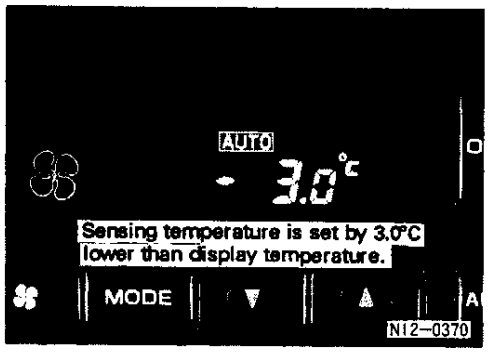


(7) Step 6 (Not used when troubleshooting)

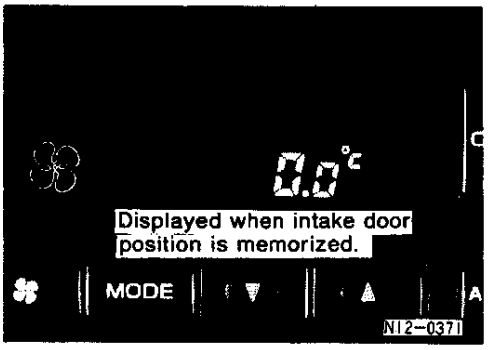
Depress fan switch ( ) while in step 5, then step 6 is selected and display appears as shown at left. If fan switch is depressed again, step 5 is selected again.

① Setting difference between indicated temperature and sensed temperature

- If passenger's bodily sensation differs from the temperature set on the display section, then the auto amplifier sensing temperature can be changed with respect to the displayed temperature.



In this case, depress HOT switch (△) or COLD switch in step 6. Each time the switch is depressed, displayed temperature will change by 0.5°C. In this way, sensed temperature can be varied in the range from +3.0 to –3.0°C.
(Example)
If the sensed temperature is set –3.0°C as shown at left with respect to the set display temperature of 25°C, the auto amplifier sensing temperature will be 22.0°C (25.0 – 3.0 = 22.0). Thus, the actual temperature is controlled at a level lower than the displayed temperature.



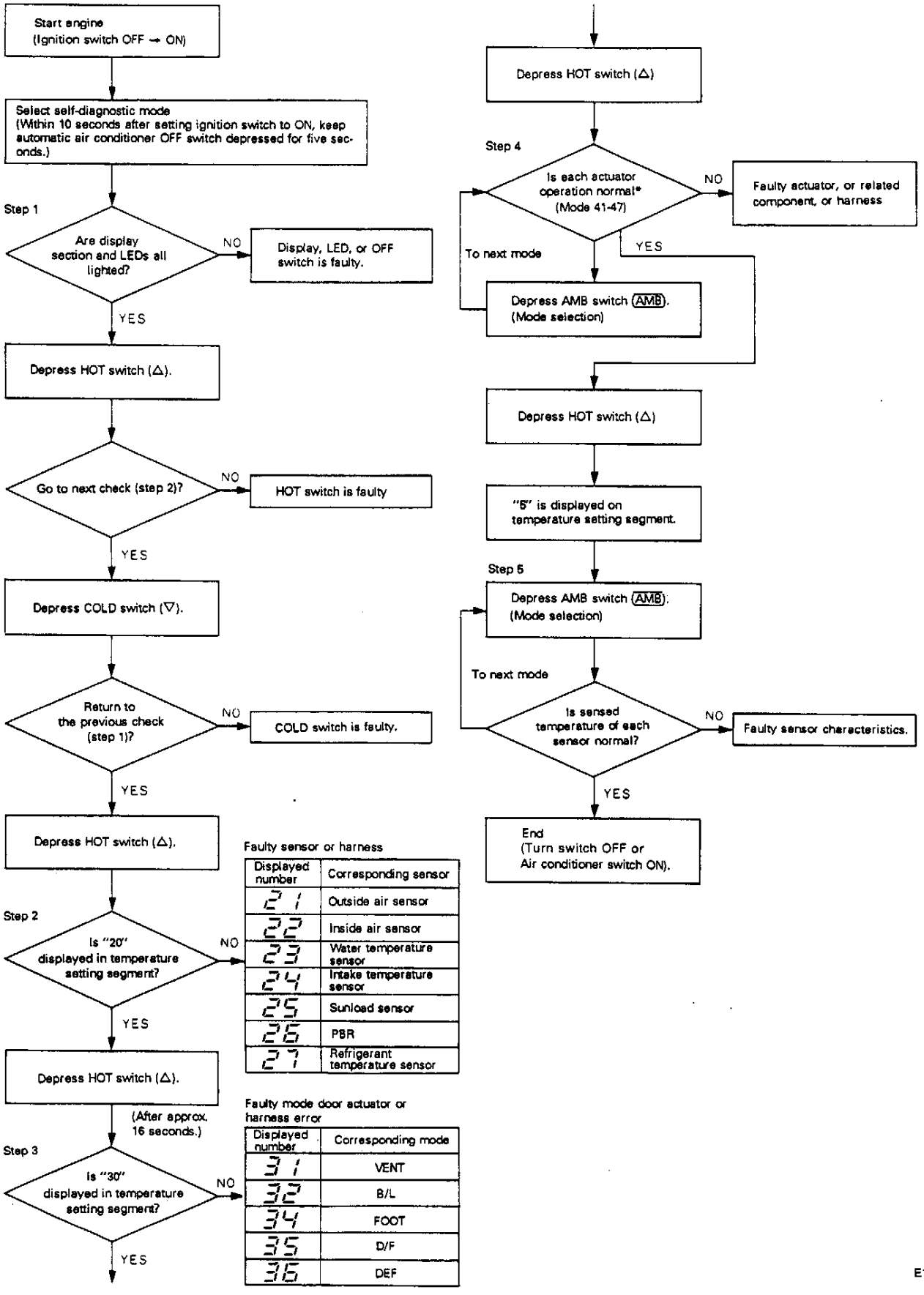
② Memorizing intake door position when turning ignition switch OFF

The intake door position when turning the ignition switch OFF can be memorized, and the air conditioner can be started at the memorized intake door position.
To use this function, depress REC switch in step 6. This will cause the AUTO display to go out and the memory function to be activated. Pressing the REC switch again will cause AUTO to be displayed and the memory function canceled.

NOTE:
Even if condition ① or ② is set in step 6, the set condition will be canceled when the battery is disconnected. If step 6 is set at customer's request, it is necessary to explain this point to the customer.

1. Full Automatic Air Conditioner (Cont'd)

(8) Self-diagnostic procedure flowchart



Faulty sensor or harness

Displayed number	Corresponding sensor
21	Outside air sensor
22	Inside air sensor
23	Water temperature sensor
24	Intake temperature sensor
25	Sunload sensor
26	PBR
27	Refrigerant temperature sensor

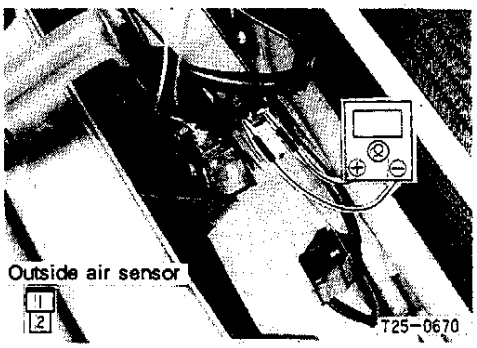
Faulty mode door actuator or harness error

Displayed number	Corresponding mode
31	VENT
32	B/L
34	FOOT
35	D/F
36	DEF

E14-0374

1. Full Automatic Air Conditioner (Cont'd)

1-4 SENSOR INSPECTION

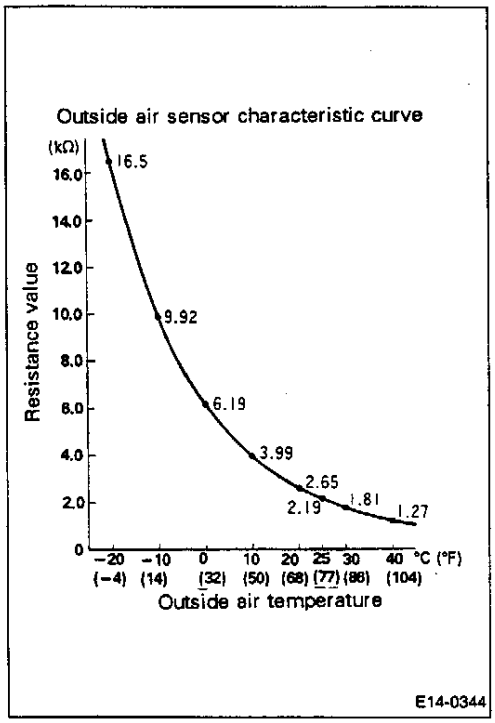


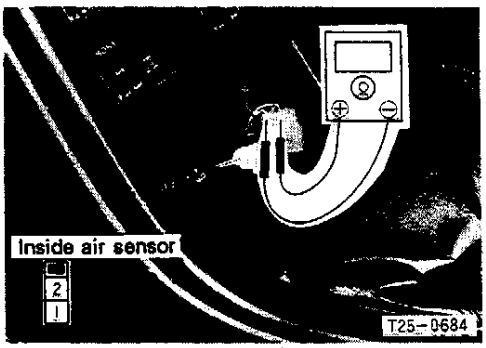
(1) Outside air sensor

Disconnect outside air sensor connector, and measure resistance value between terminals on sensor side.

NOTE:

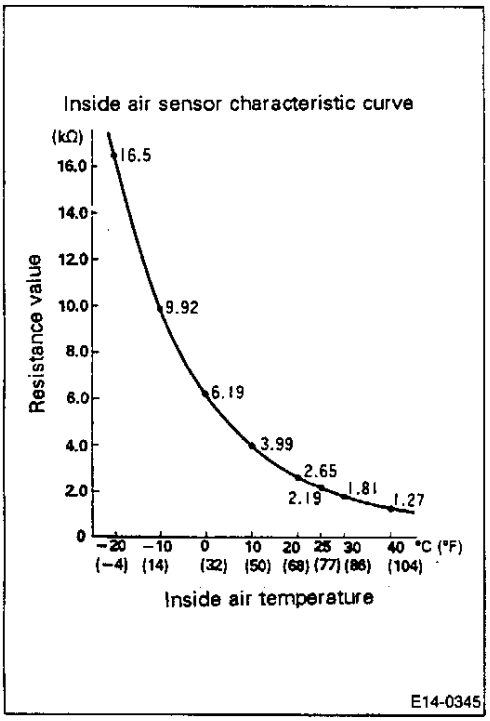
Perform this check with ignition switch set in OFF position. If the outside air sensor connector or auto amplifier connector is disconnected with the ignition switch ON, the outside air temperature is sensed as extremely low. If the connector is connected after turning the ignition switch OFF, and if the ignition switch is set again to ON, the outside air temperature correcting function prevents the sensing value from rising quickly to correct level. As a result, the compressor remains OFF, and heating function operates. In this case, disconnect the outside air sensor with the ignition switch ON, and then reconnect the sensor connector.

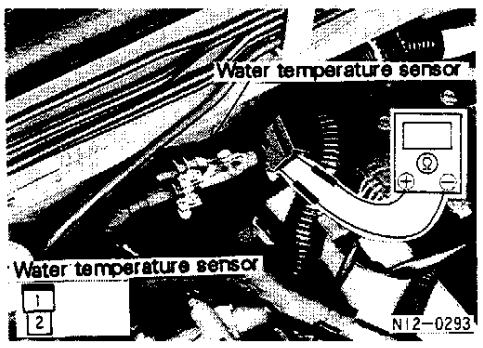




(2) Inside air sensor

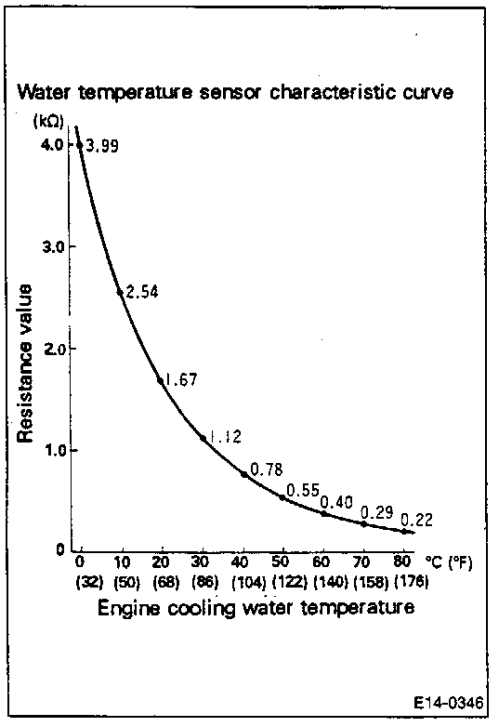
Disconnect inside air sensor connector, and measure resistance between terminals on sensor side.



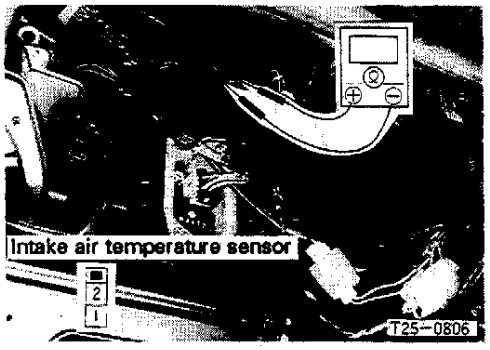


(3) Water temperature sensor

Disconnect water temperature sensor connector, and measure resistance value between terminals on sensor side.

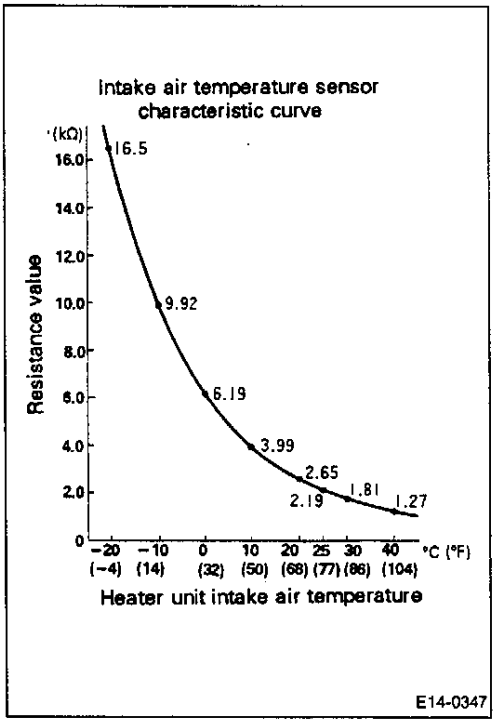


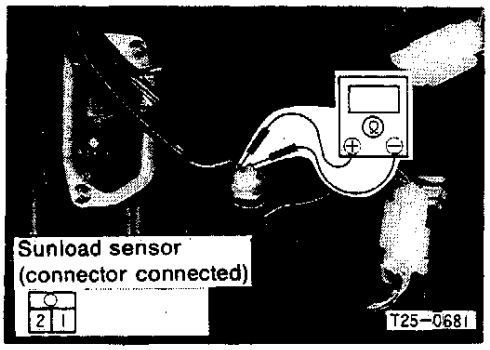
1. Full Automatic Air Conditioner (Cont'd)



(4) Intake air temperature sensor

Disconnect intake air temperature sensor connector, and measure resistance between terminals on sensor side.





(5) Sunload sensor

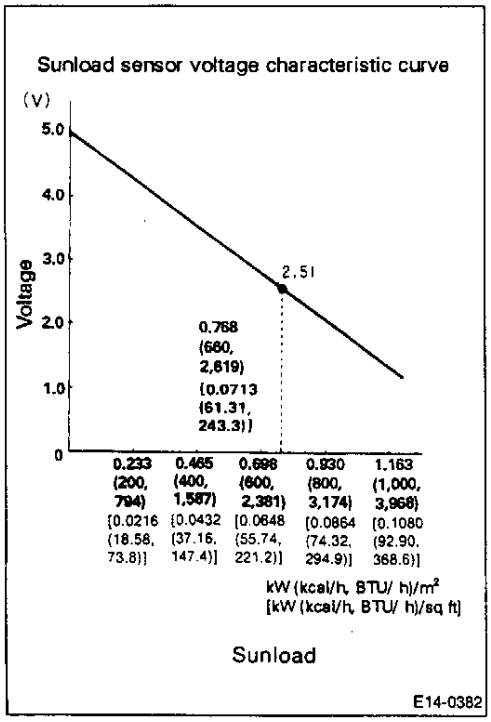
With sunload sensor connector connected, measure voltage between terminals.

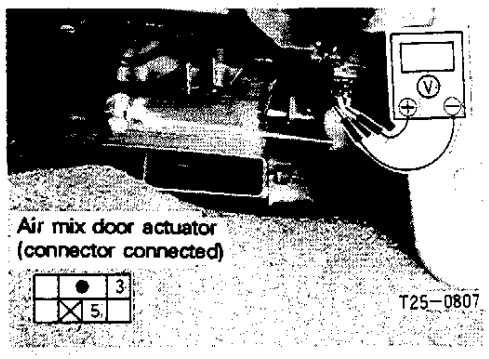
Ignition switch	Terminals		Standard value
	Positive ⊕	Negative ⊖	
ON	①	②	See characteristic curve.

NOTE:

When performing this check indoors, move a 60 watt lamp toward or away from sensor while reading voltage.

Reference: Sunload by direct sunlight during fine weather is equivalent to 0.768 kW (660 kcal/h, 2,619BTU/h)/m^2 [0.0713 kW (61.31 kcal/h, 243.4 BTU/h)/sq ft].

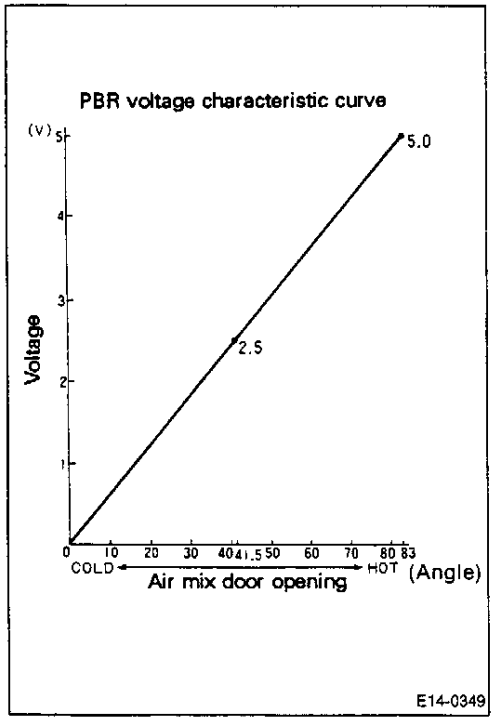




(6) PBR

With air mix door actuator connector connected, measure voltage between terminals.

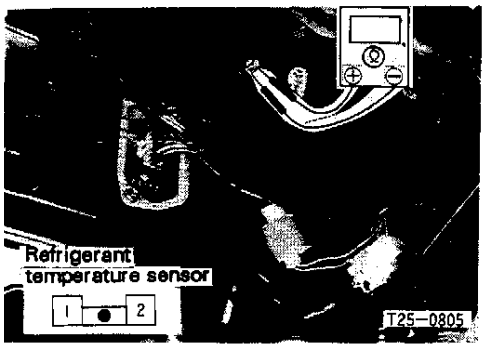
Ignition switch	Terminals		Standard value
	Positive ⊕	Negative ⊖	
ON	3	5	See characteristic curve.

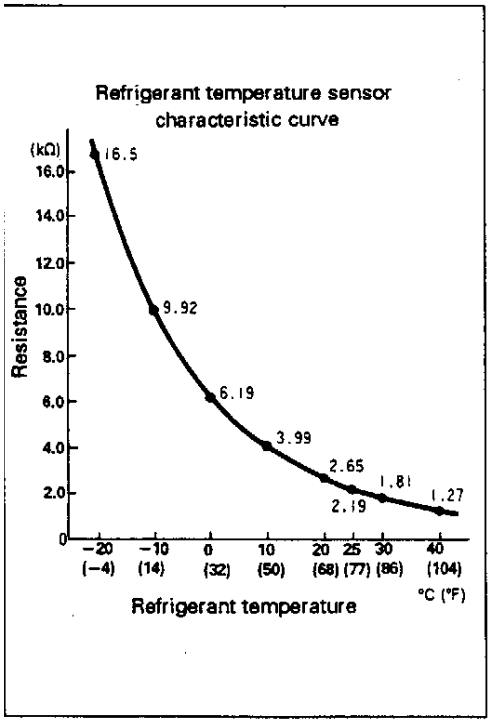


1. Full Automatic Air Conditioner (Cont'd)

(7) Refrigerant temperature sensor

Disconnect refrigerant temperature sensor connector, and measure resistance between terminals on sensor side.

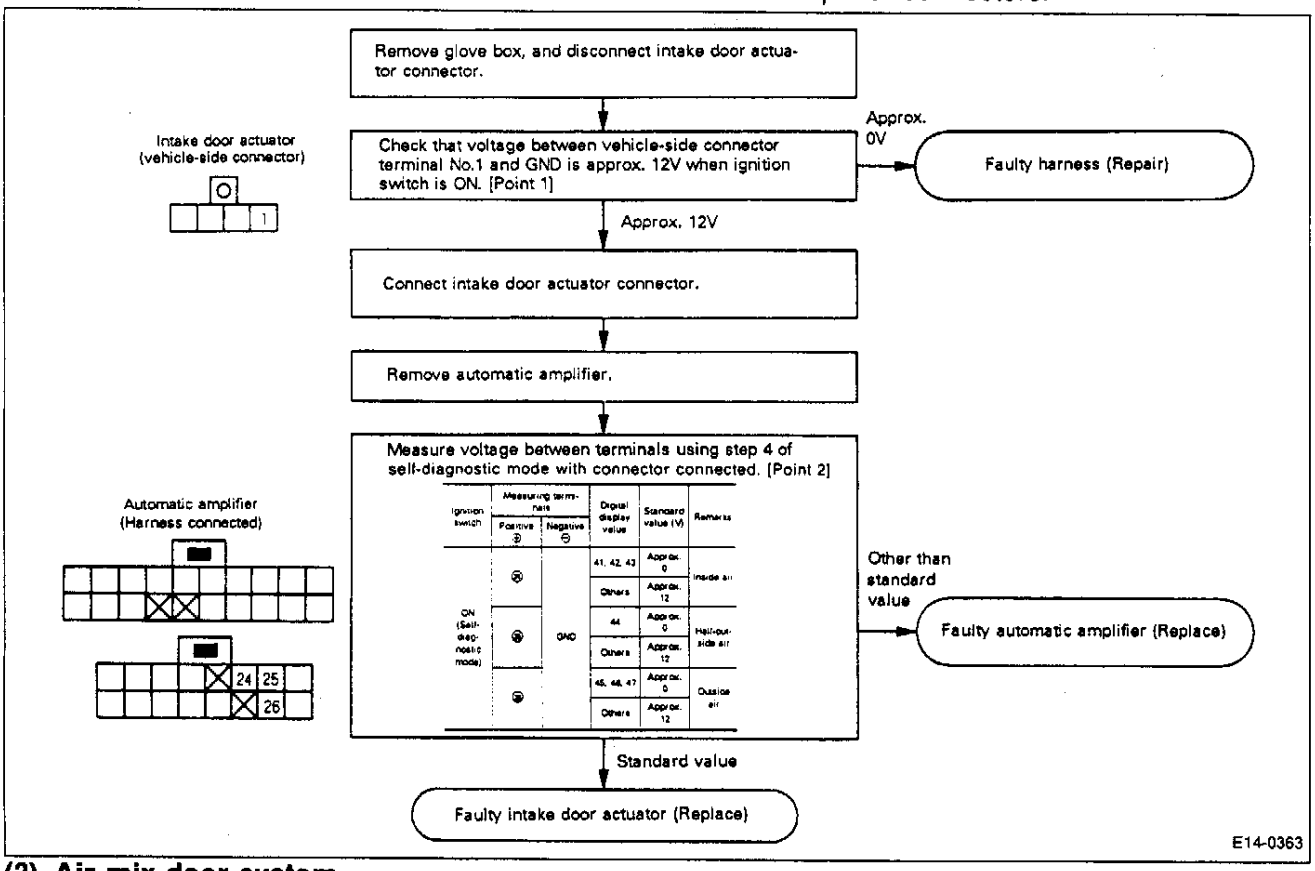




1-5 ACTUATOR INSPECTION

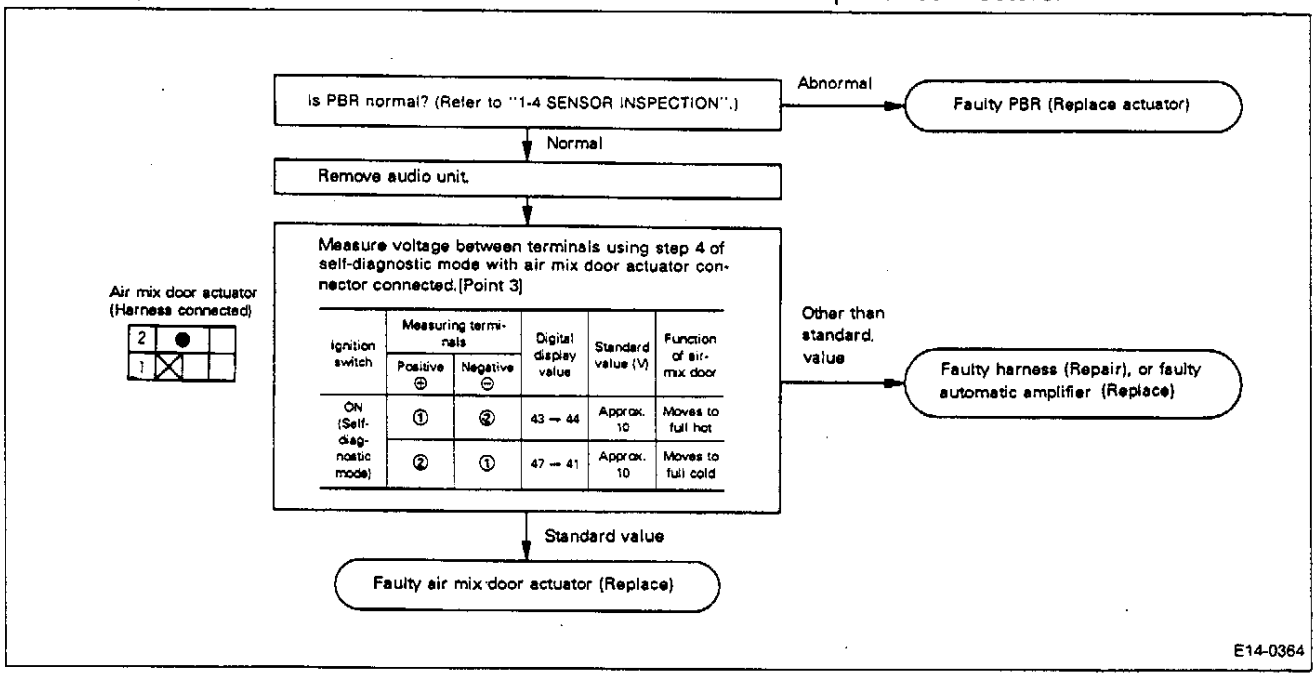
(2) Intake door system

Before inspection, check intake door actuator and automatic amplifier connectors.



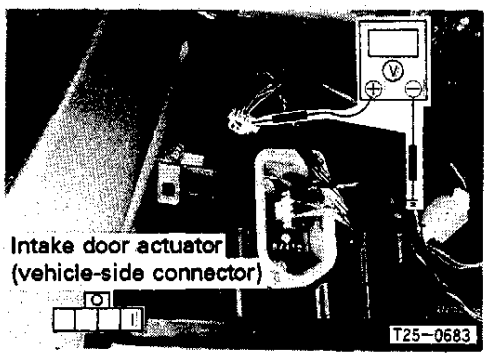
(2) Air mix door system

Before inspection, check air mix door actuator and automatic amplifier connectors.



Ignition switch	Measuring terminals: Positive ⊕	Measuring terminals: Negative ⊖	Digital display value	Standard value (V)	Function of air-mix door
ON (Self-diagnostic mode)	①	②	43 → 44	Approx. 10	Moves to full hot
	②	①	47 → 41	Approx. 10	Moves to full cold

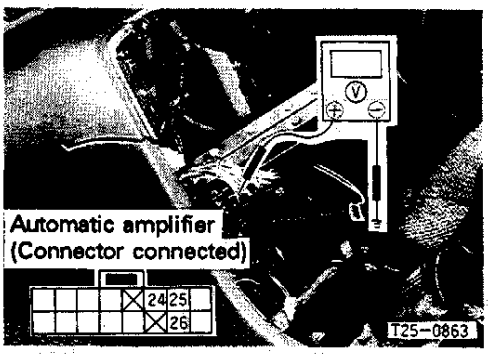
1. Full Automatic Air Conditioner (Cont'd)



[Point 1] Intake door actuator power inspection

- Remove intake door actuator, and measure voltage between vehicle-side connector and GND.

Measuring range	Ignition switch	Measuring terminals		Standard value
		Positive ⊕	Negative ⊖	
Ⓥ	ON	①	GND	Approx. 12V



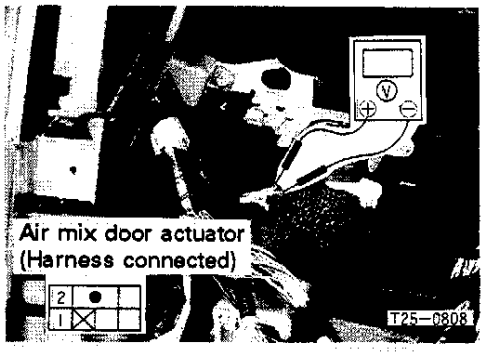
[Point 2] Automatic amplifier output inspection

- Remove automatic amplifier, and measure voltage by applying circuit tester probes to 16-terminal connector. Use step 4 of self-diagnostic mode and keep connector connected during measurement.

Measuring range	Ignition switch	Measuring terminal		Digital display value	Standard value	Remarks
		⊕	⊖			
Ⓥ	ON (Self-diagnostic mode)	㉔	GND	41, 42, 43	Approx. 0V	Inside air
				Others	Approx. 12V	
		㉕		44	Approx. 0V	Half-outside air
				Others	Approx. 12V	
		㉖		45, 46, 47	Approx. 0V	Outside air
				Others	Approx. 12V	

NOTE:
If standard value of approx. 12V is not present, internal circuit of intake door actuator may be disconnected.

1. Full Automatic Air Conditioner (Cont'd)



[Point 3] Automatic amplifier output inspection

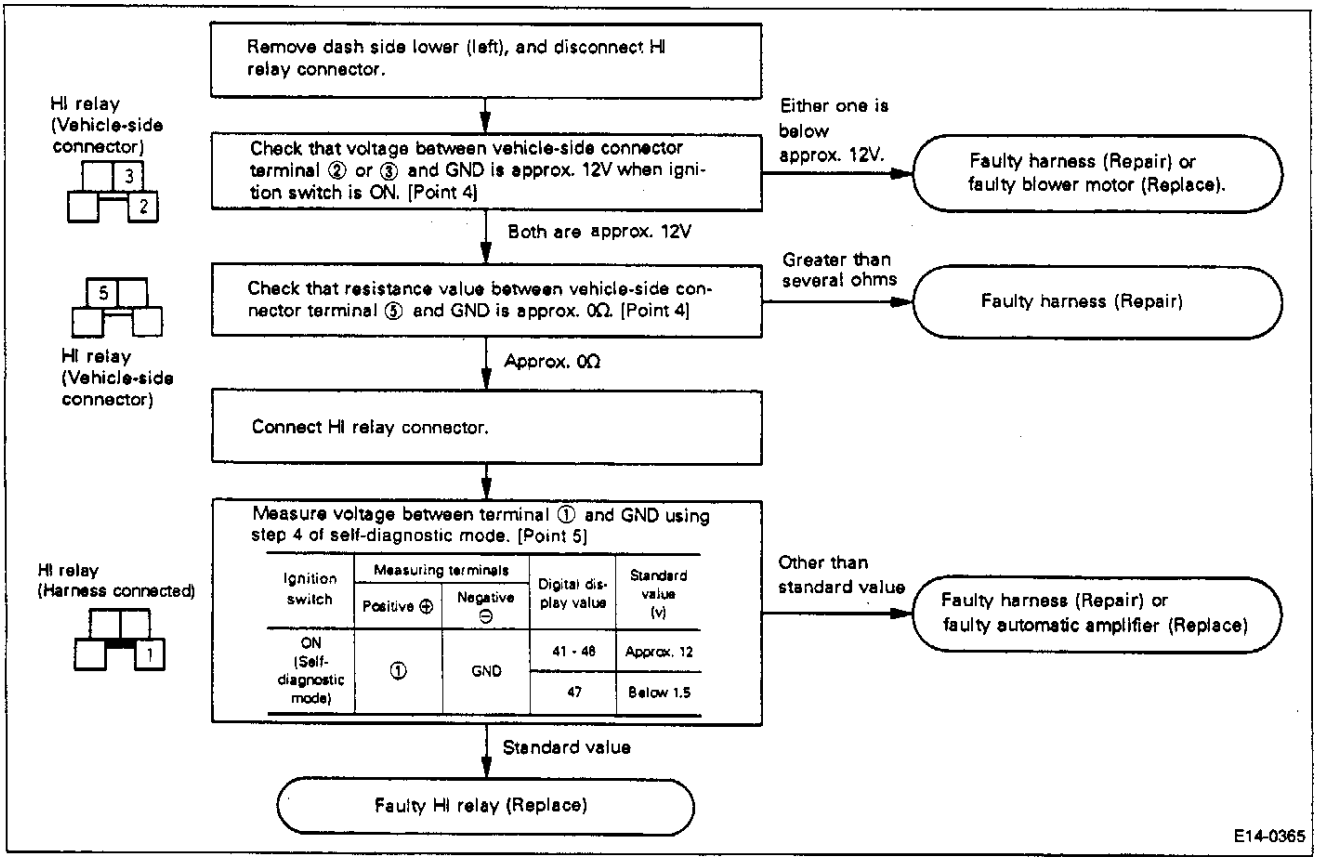
- With air mix door actuator connector connected, measure voltage using step 4 of self-diagnostic mode.

Measuring range	Ignition switch	Measuring terminal ⊕	Measuring terminal ⊖	Digital display value	Standard value	Function of air mix door
Ⓥ	ON (Self-diagnostic mode)	①	②	43 → 44	Approx. 10V	Moves to full hot
		②	①	47 → 41	Approx. 10V	Moves to full cold

(3) Blower motor system

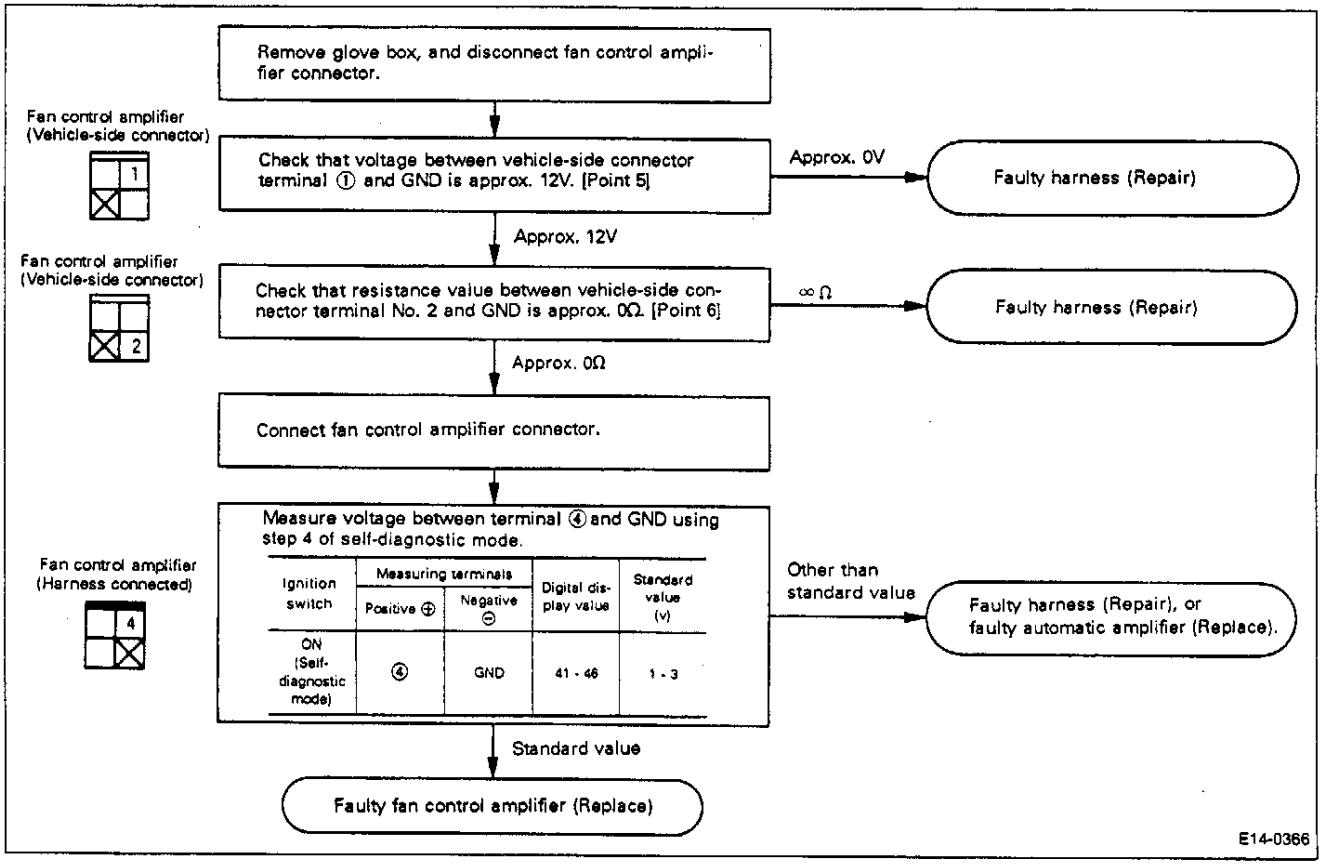
Before inspection, check blower motor, fan control amplifier, HI relay and automatic amplifier connectors.

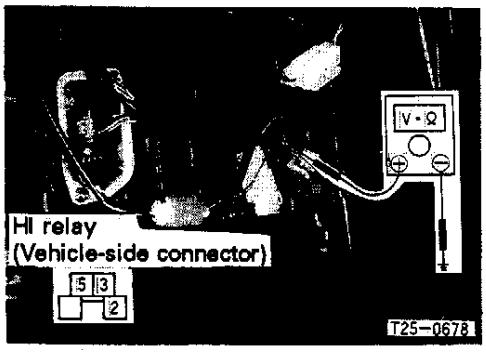
① Blower motor fails to run in HI position.

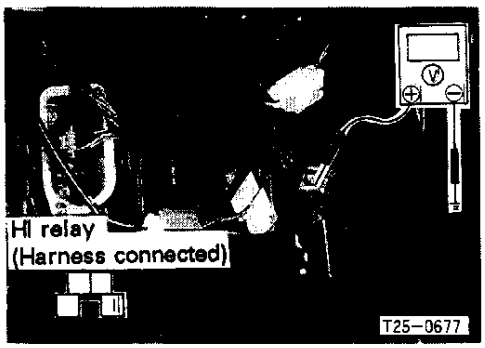


1. Full Automatic Air Conditioner (Cont'd)

② Unable to change blower motor speed, or motor fails to run at any position other than HI.







[Point 4] HI relay power and GND circuit inspection

- Disconnect HI relay connector, and measure voltage and check continuity between vehicle-side connector and GND.

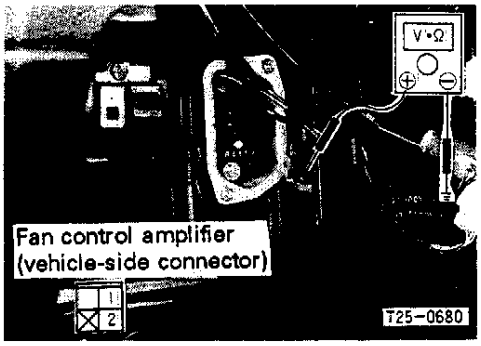
Measuring range	Ignition switch	Fan switch	Measuring terminals ⊕	Measuring terminals ⊖	Standard value
Ⓥ	ACC	OFF	③	GND	Approx. 12V
	ON		②		
Ω	OFF		⑤		0Ω

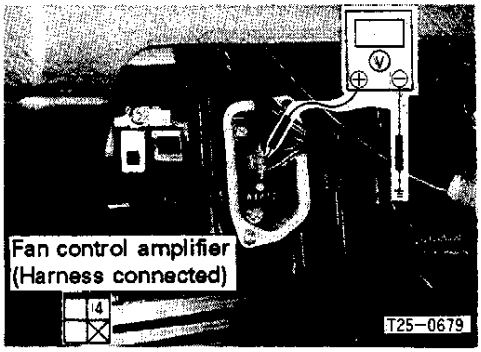
[Point 5] Automatic amplifier output inspection

- With HI relay connector connected, measure voltage using step 4 of self-diagnostic mode.

Measuring range	Ignition switch	Measuring terminals ⊕	Measuring terminals ⊖	Digital display value	Standard value
Ⓥ	ON (Self-diagnostic mode)	①	GND	41 - 46	Approx. 12V
				47	Below 1.5V

1. Full Automatic Air Conditioner (Cont'd)





[Point 6] Fan control amplifier power and GND circuit inspection

- Disconnect fan control amplifier connector, and measure voltage and check continuity between vehicle-side connector and GND.

Measuring range	Ignition switch	Fan switch	Measuring terminals		Standard value
			⊕	⊖	
Ⓥ	ACC	OFF	①	GND	Approx. 12V
Ω	OFF		②		0Ω

[Point 7] Automatic amplifier output inspection

- With fan control amplifier connector connected, measure voltage using step 4 of self-diagnostic mode.

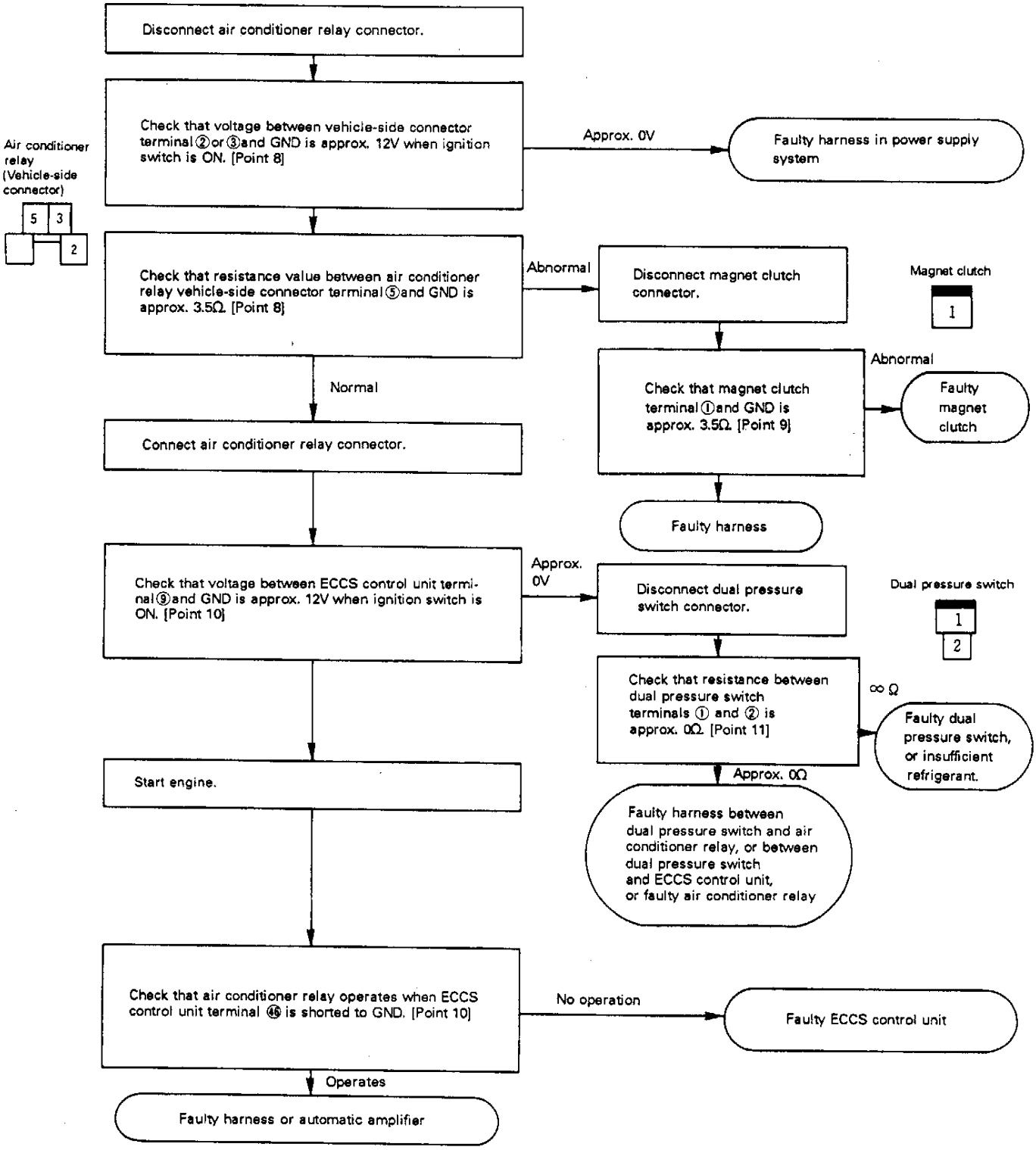
Measuring range	Ignition switch	Measuring terminals		Digital display value	Standard value
		⊕	⊖		
Ⓥ	ON (Self-diagnostic mode)	④	GND	41 - 46	1 - 3V

1. Full Automatic Air Conditioner (Cont'd)

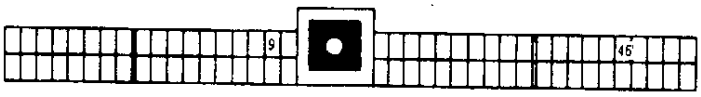
(4) Compressor system

Before inspection, check air conditioner relay, dual pressure switch, automatic amplifier magnet clutch connectors.

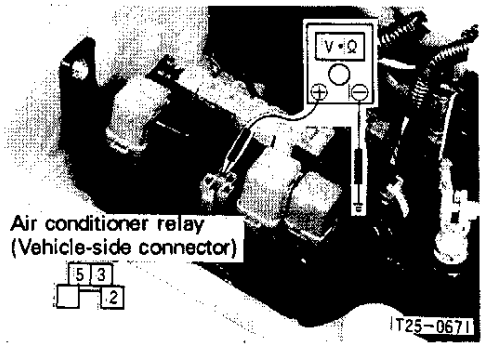
① Magnet clutch system



ECCS C/U (RB26DETT)



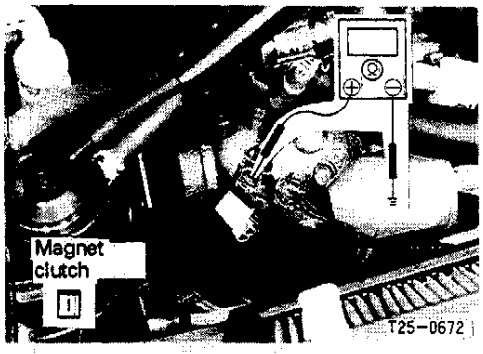
1. Full Automatic Air Conditioner (Cont'd)



[Point 8] Air conditioner relay power supply and magnet clutch circuit inspection

- Remove air conditioner relay, and measure voltage and resistance between vehicle-side connector and GND.

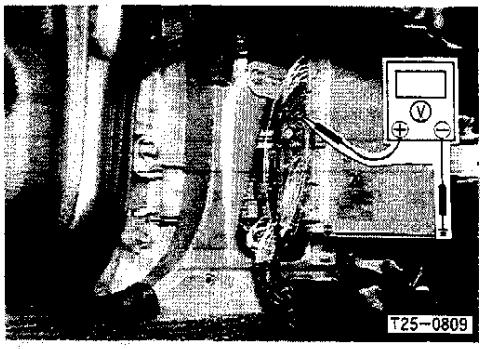
Measuring range	Ignition switch	Measuring terminal ⊕	Measuring terminal ⊖	Standard value	Remarks
Ⓥ	ON	②	GND	Approx. 12V	IGN power
Ⓥ	ACC	③	GND	Approx. 12V	ACC power
Ω	OFF	⑤	GND	Approx. 3.5Ω	Magnet clutch coil resistance



[Point 9] Magnet clutch inspection

- Disconnect magnet clutch connector, and measure resistance between clutch-side connector and GND.

Measuring range	Measuring terminals ⊕	Measuring terminals ⊖	Standard value
Ω	①	GND	Approx. 3.5Ω



[Point 10] Air conditioner control circuit inspection

- With harness connected to ECCS control unit, measure voltage and check relay operation by applying tester probes as shown.

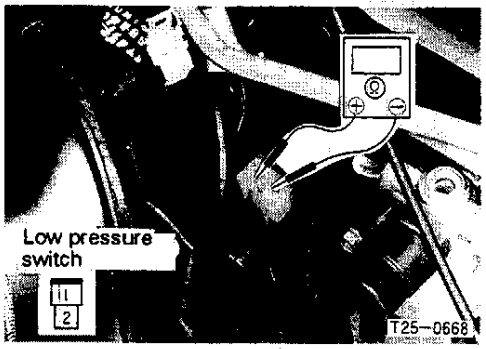
① Air conditioner control circuit inspection

Measuring range	Ignition switch	Measuring terminals ⊕	Measuring terminals ⊖	Standard value
Ⓥ	ON	⑨	GND	Approx. 12V

② Air conditioner relay operation inspection

Ignition switch	Terminal to be shorted to GND	Air conditioner relay operation
ON (Engine is running)	㊻	Air conditioner relay must turn ON.

1. Full Automatic Air Conditioner (Cont'd)



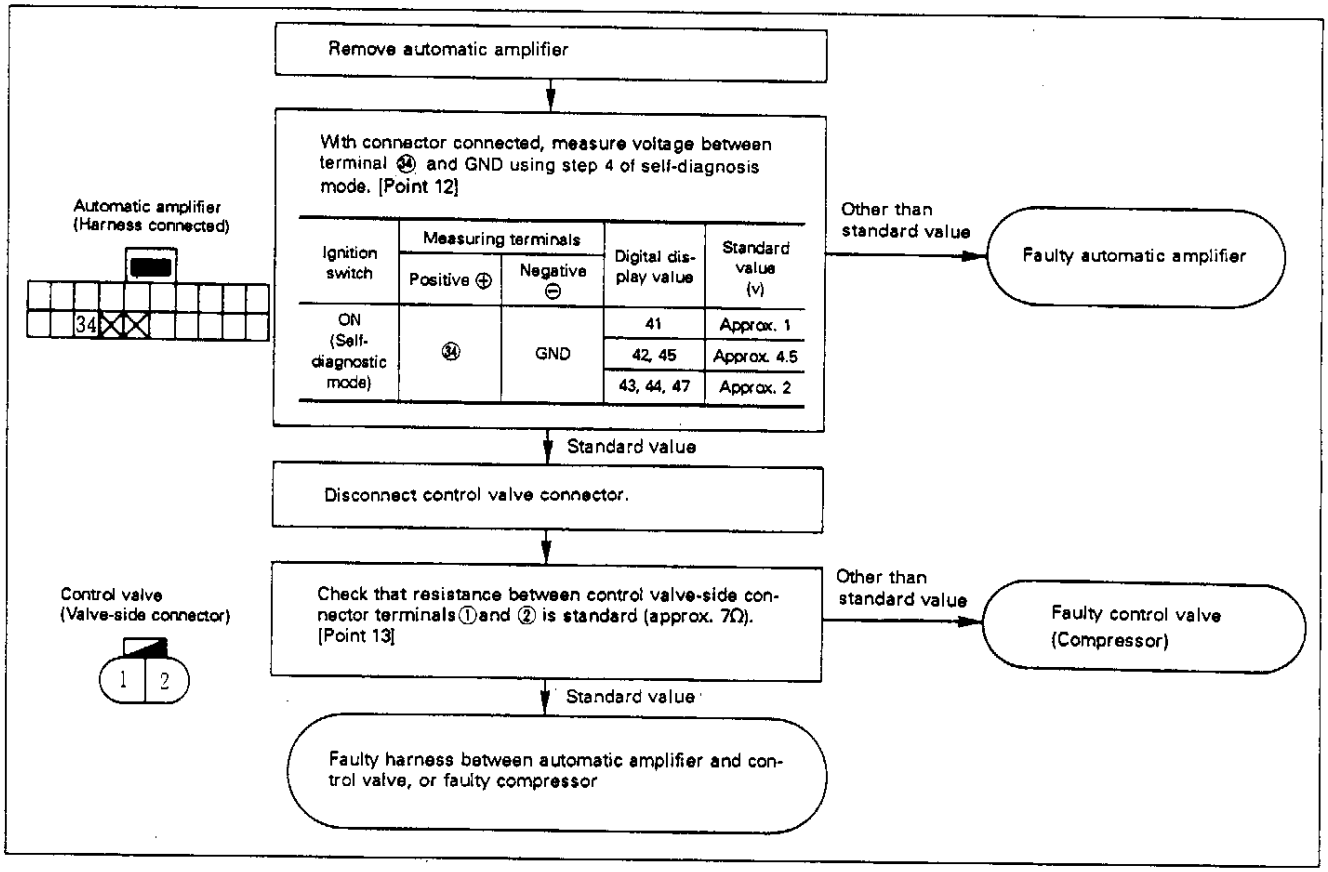
[Point 11] Dual pressure switch continuity inspection

- Disconnect dual pressure switch connector, and measure resistance by applying tester probes to switch side connector as shown.

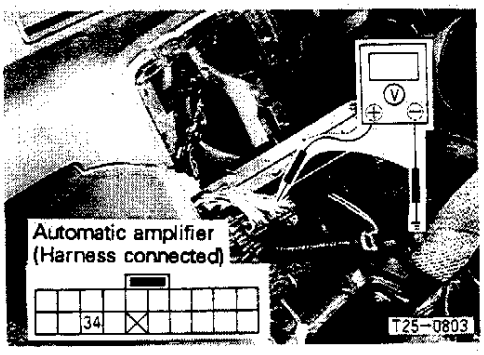
Measuring range	Measuring terminals	Standard value
Ω	① - ②	Approx. 0Ω

NOTE:
If dual pressure switch is OFF, the cause may be a faulty air conditioner cycle.

② Control valve system



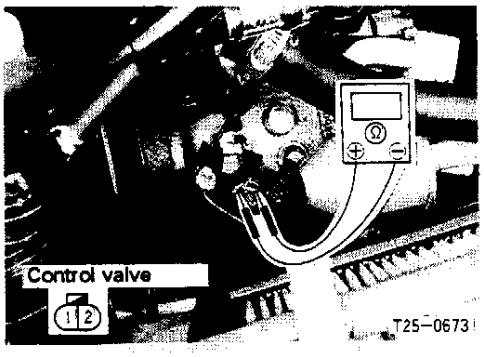
1. Full Automatic Air Conditioner (Cont'd)



[Point 12] Automatic amplifier output signal inspection

- Remove automatic amplifier. With connector connected, measure voltage by applying tester probes to the 20-terminal connector using step 4 of self-diagnostic mode.

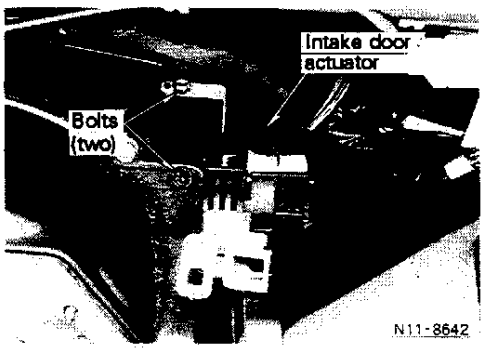
Measuring range	Ignition switch	Measuring terminals ⊕	Measuring terminals ⊖	Digital display value	Standard value
Ⓥ	ON (Self-diagnostic mode)	㉞	GND	41	Approx. 1V
				42, 45	Approx. 4.5V
				43, 44, 47	Approx. 2V



[Point 13] Coil resistance inspection in control valve

- Disconnect control valve connector, and measure resistance of coil by applying tester probes to valve-side connector.

Measuring range	Measuring terminals	Standard value
Ω	① - ②	Approx. 7Ω



1-6 ACTUATOR REMOVAL AND INSTALLATION

(1) Intake door actuator

Removal

Remove and install: Glove box, glove box cover (Parts not shown)

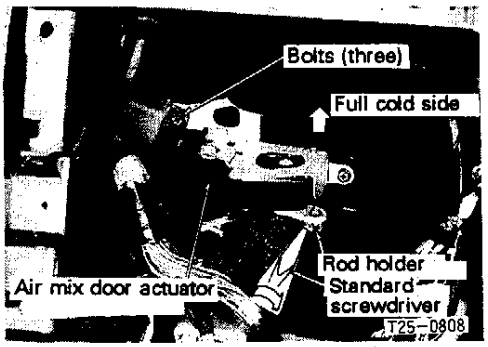
- Remove harness and securing bolts (two), and remove intake door actuator.

NOTE:
Remove actuator in REC state.

Installation

- Connect intake door actuator connector to vehicle harness.
- Set ignition switch to ACC, and set push control REC switch to ON. (Actuator is set in REC state.)
- Install intake door actuator while fixing actuator link in inside air position.
- Operate REC switch to see if actuator link is movable over full stroke range.

1. Full Automatic Air Conditioner (Cont'd)



(2) Air mix door actuator

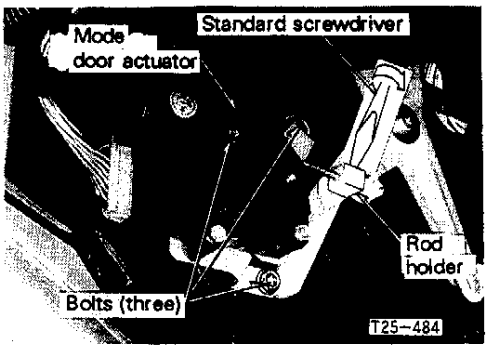
Removal

Remove and install: Automatic transmission finisher, cluster lid C, audio unit, heater nozzle (left)

- Remove connector and securing bolts (three), and remove rod from rod holder.

Installation

- Connect air mix door actuator connector to vehicle-side harness.
- Set ignition switch to ON, and activate self-diagnostic mode step 4, then set full cold status (display value 41, 42, or 43). After this, turn OFF ignition switch.
- Install air mix door actuator.
- Fix air mix door actuator to rod holder while pressing door link toward full cold (driver seat).
- Activate step 4 of self-diagnostic mode. Make sure that air mix door moves over full stroke range when display value is changed from 43 to 44 or from 47 to 41.



(3) Mode door actuator removal and installation

Removal

Remove and install: Instrument panel lower cover

- Remove connector and securing bolts (three), and remove rod by rotating rod holder with standard screwdriver.

NOTE:
Remove rod holder in DEF state.

Installation

- Connect mode door actuator connector to vehicle-side harness.
- Set ignition switch to ACC, and set push control DEF switch to ON. (Actuator is set in DEF state.)
- Install mode door actuator.
- Fix side link to rod holder while holding side link in DEF mode position (by rotating counterclockwise until it stops).
- Operate mode switch and make sure that side link is capable of moving over full stroke range.