

HEATER AND AIR CONDITIONING SYSTEM

OPERATION CHECK

1. CHECK COOLING PERFORMANCE

- (a) Install the air conditioning tool set to the vehicle.
- (b) Set the vehicle to the following conditions.[*1]

Item	Condition
Vehicle body	Vehicle is parked in the shade and the engine is stopped
Doors	Fully open
A/C switch	ON
Engine speed	2000 r/min
Air inlet control damper position	Air inlet position
Air outlet damper position	FACE
Temperature setting	MAX COOL
Blower speed	HIGH
Air inlet temperature *2	25 to 30°C
Condenser pressure (gauge high pressure side) *3	1.37 to 1.57 MPa (14 to 16 kgf/cm ²)

HINT:

*2 ... If the air inlet temperature is out of the range of 25 to 30°C, determination may be inaccurate. Postpone the inspection if the temperature is too low.

*3 ... When the condenser pressure (gauge pressure side) is too high, pour water on the condenser to decrease the pressure. Conversely, when it is too low, cover the front side of the condenser to increase the pressure.

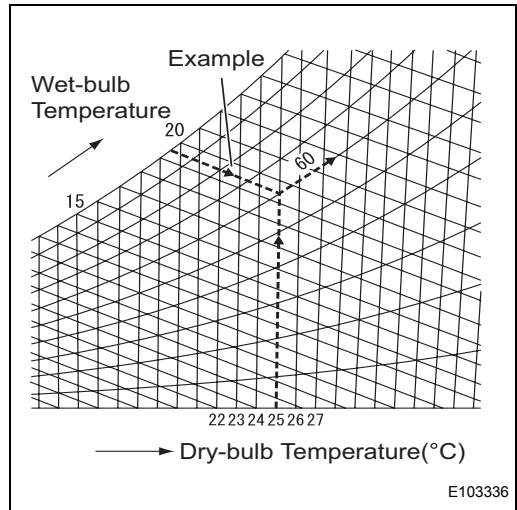
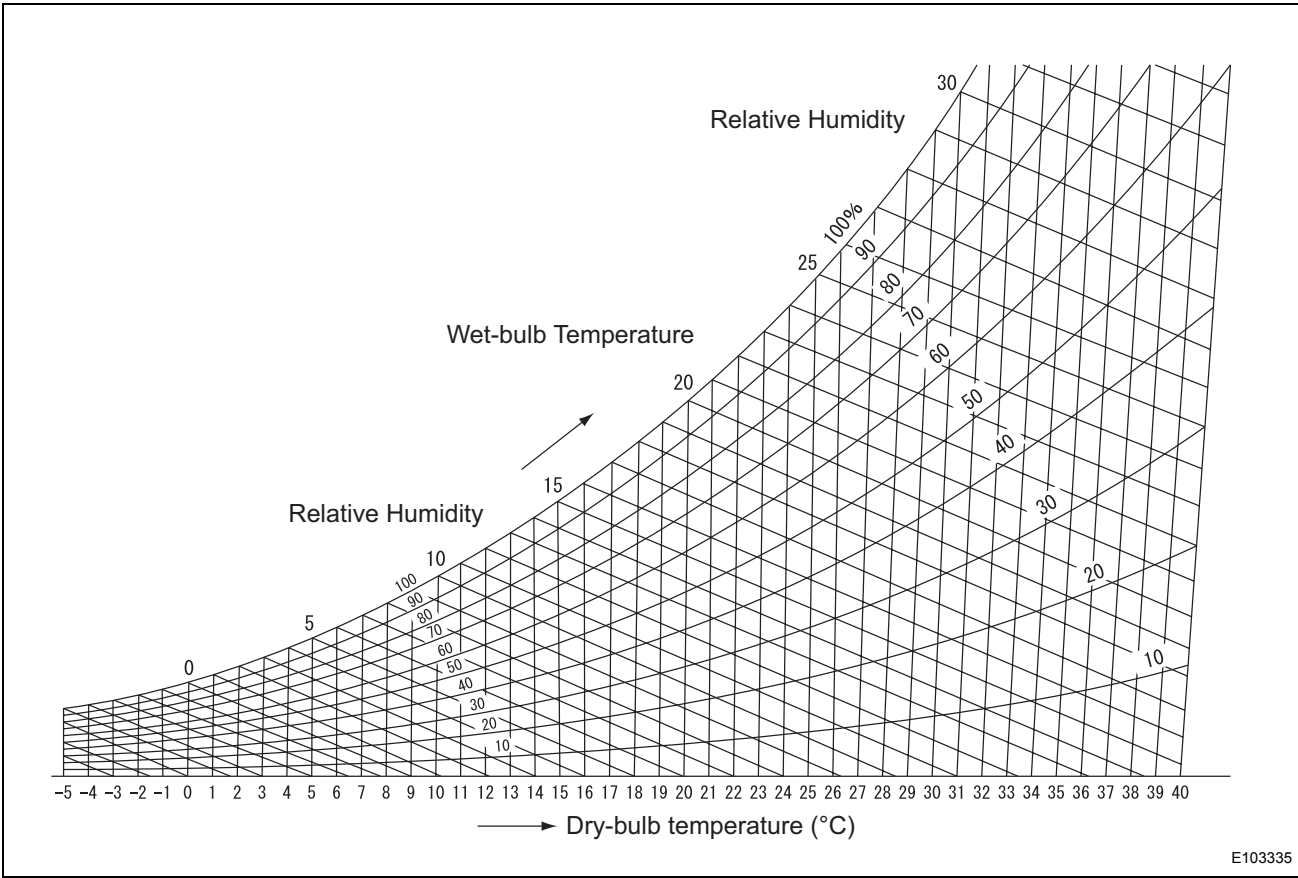
- (c) Place the hygrometer at the air inlet (to measure the humidity) and insert the hygrometer bulb into the mouth of the air outlet.
- (d) Operate the air conditioning system under condition [*1], and stabilize the temperature of the air outlet. (Approximately 5 to 6 minutes)
- (e) Measure the dry-bulb temperature of the air inlet and the wet-bulb temperature of the air outlet.

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- (f) Apply the dry and wet bulb temperatures of the air inlet to the psychrometric diagram to determine the relative humidity.

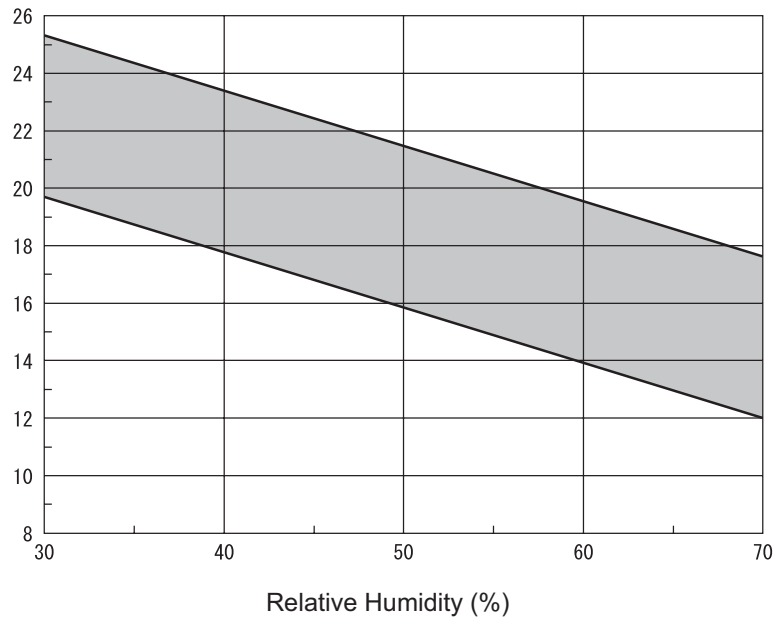
AC



- (1) The example shows how to determine the relative humidity, In the example, the air inlet dry-bulb temperature is 25°C and the wet-bulb temperature is 19.5°C. The intersection point on the diagram indicates the relative humidity, which is 60%.

- (g) Check the cooling performance by referring to the relative humidity on the standard performance chart and the difference between the measured inlet and outlet temperatures.

Temperature Difference
Between Inlet and Outlet ($^{\circ}\text{C}$)



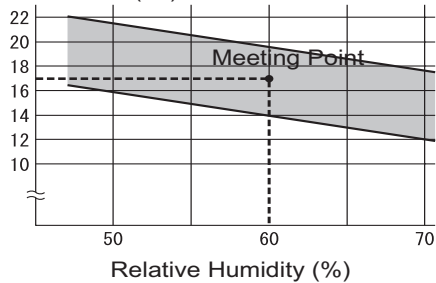
AC

Standard:

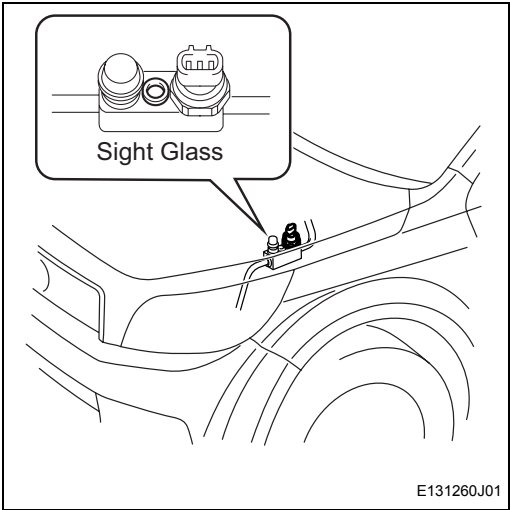
Within the shaded area in the illustration

- (1) The example shows how to determine the cooling performance by using the standard performance chart. In the example, the difference between inlet and outlet dry-bulb temperatures is 17°C and the relative humidity is 60%.

Temperature
Difference Between
Inlet And Outlet ($^{\circ}\text{C}$)



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2. CHECK REFRIGERANT PRESSURE

- (a) INSPECT REFRIGERANT VOLUME
- (1) Check the sight glass of liquid tube A.
 - (2) Set the vehicle to the following conditions.[*1]

Item	Condition
Doors	Fully open
Temperature setting	MAX COOL
Engine speed	1500 r/min
Blower speed	HIGH
A/C	ON

- (3) Under condition [*1], check the sight glass.

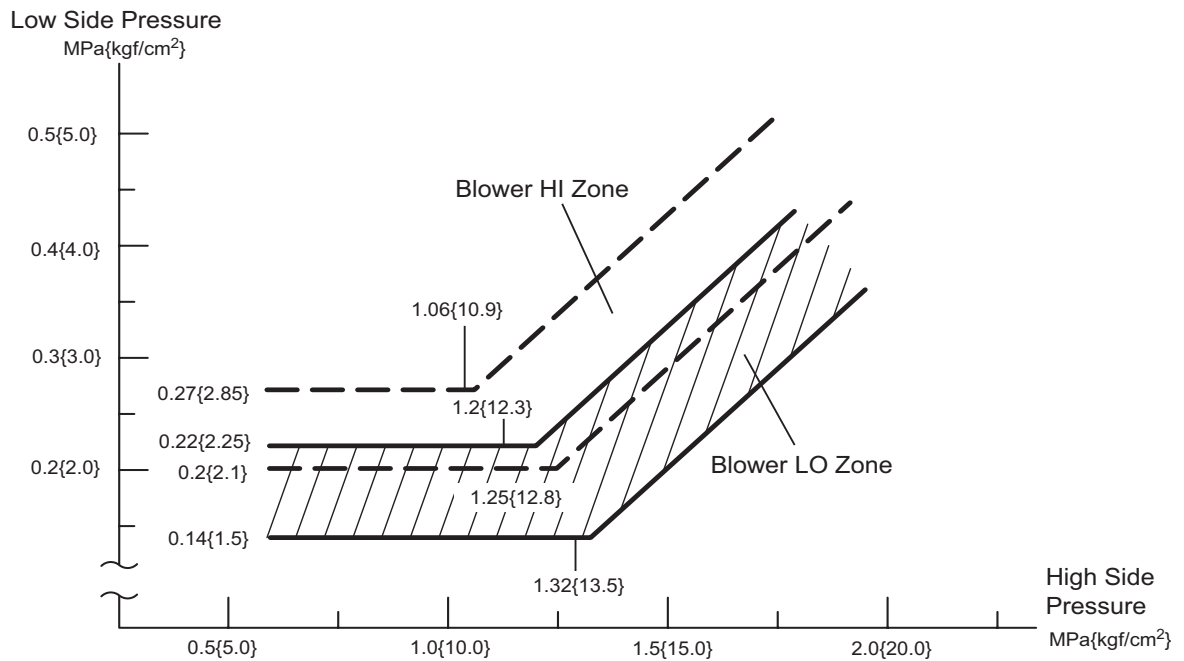
Symptom	Amount of Refrigerant	Countermeasure
Bubbles appear in the sight glass	Not enough	• Check for gas leakage and repair if necessary • Pour refrigerant until the air bubbles are gone.
Bubbles do not appear in the sight glass	None, not enough, too many	See (*2) and (*3)
There is no temperature difference between the compressor intake vent and exhaust vent (*2)	Empty or nearly empty	• Check for gas leakage and repair if necessary • Pour refrigerant until the air bubbles are gone.
There is a notable temperature difference between the compressor intake vent and exhaust vent (*3)	Reasonable or too much	Refer to (*4) and (*5)
The refrigerant in the sight glass is transparent immediately after turning off the air conditioner (*4)	Too much	• Discharge refrigerant • Bleed the air, then pour in the proper amount of new refrigerant
The refrigerant is bubbling, then becomes transparent immediately after turning off the air conditioner (*5)	Reasonable	-

HINT:

When the room temperature is higher than normal, presume that air bubbles in the sight glass are normal when there is sufficient cooling,

(b) INSPECT REFRIGERANT PRESSURE USING GAUGE

Gauge Indicated Value Reference Data



E100247J01

- (1) Install the air conditioning tool set.
- (2) Set the vehicle to the following conditions.[*2]

Item	Condition
Engine	After warm up
Doors	Fully open
A/C	ON
Engine speed	1500 r/min
Air inlet mode switch	RECIRCULATION
Temperature setting	MAX COOL
Blower speed	HIGH
Air inlet temperature	30°C to 35°C

- (3) Under condition [*2], check the gauge reading.

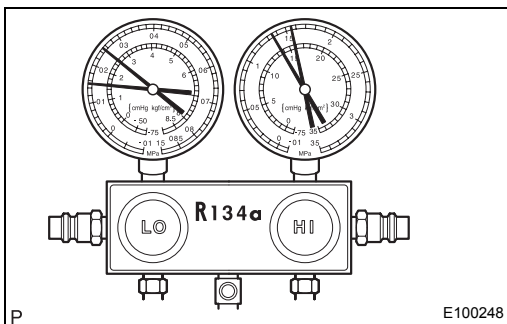
Standard:

0.15 to 0.25 MPa (1.5 to 2.5 kgf/cm²) (Low pressure side)

1.37 to 1.57 MPa (14 to 16 kgf/cm²) (High pressure side)

HINT:

The specified value is applicable when the refrigerant charge volume is normal.



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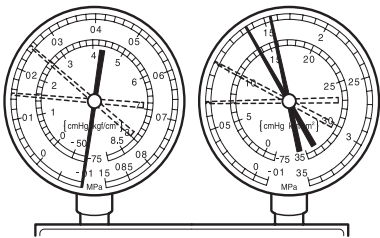
E100248

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(4) Under condition [*2], check the gauge reading.

Condition: Periodically Cools And Then Fails To Cool



E100249J02

Result

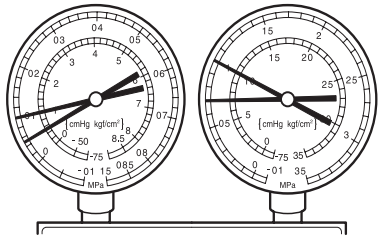
Symptom	Cause	Diagnosis	Countermeasure
During operation, the pressure on the low-pressure side cycles between vacuum and normal	Moisture in the refrigeration system freezes at the expansion valve orifice, causing a temporary stop of cycle. But after the ice melts, the system will return to normal	- Cooler dryer is overly saturated - Moisture in refrigeration system freezes at expansion valve orifice and blocks refrigerant gas circulation	- Replace cooler dryer - Remove moisture from cycle by repeatedly evacuating air - Supply the appropriate volume of new refrigerant

HINT:

These gauge readings indicate that moisture is in the cooling system

(5) Under condition [*2], check the gauge reading.

Condition: Insufficient Cooling



E100250J02

Result

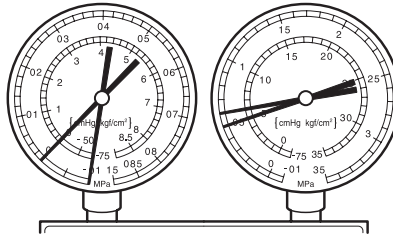
Symptom	Cause	Diagnosis	Countermeasure
- The pressure of both high and low side is low - Bubbles appear continuously in the sight glass - Cooling performance is insufficient	There is gas leakage from the refrigeration system	- Insufficient refrigerant - Refrigerant leakage	- Check for refrigerant leakage and repair if necessary - Supply the appropriate volume of new refrigerant - If the indicated pressure value is close to 0 when connected to the gauge, perform vacuum purging after inspecting and repairing the location of the leak

HINT:

These gauge readings indicate that cooling performance is poor.

(6) Under condition [*2], check the gauge reading.

Condition: Insufficient Cooling



E100251J01

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Result

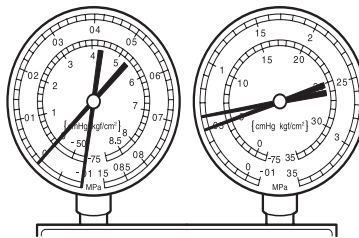
Symptom	Cause	Diagnosis	Countermeasure
- The pressure of both high and low side is low - There is frost on the piping from the cooler condenser to the A/C unit	Refrigerant flow is obstructed by dirt in the cooler condenser core	Cooler condenser core blockage	Replace the cooler condenser core

HINT:

These gauge readings indicate that cooling performance is poor.

(7) Under condition [*2], check the gauge reading.

Condition: Does Not Cool (Cools From Time To Time In Some Cases)



E100252J01

Result

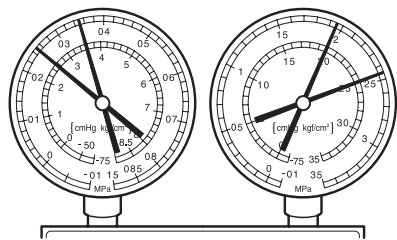
Symptom	Cause	Diagnosis	Countermeasure
- Vacuum indicated on the low-pressure side, and extremely low pressure indicated on the high-pressure side - Frost or condensation is seen on the piping on both sides of the cooler condenser core or cooler expansion valve	- Refrigerant gas flow is obstructed by moisture or dirt in the refrigeration system - Refrigerant gas flow is obstructed by refrigerant gas leakage from the cooler expansion valve	Refrigerant does not circulate	- Check the cooler expansion valve - Remove dirt from the cooler expansion valve using an air gun - Replace the cooler condenser core - After vacuum purging, supply the appropriate volume of refrigerant - If there is refrigerant leakage from the cooler expansion valve, replace the cooler expansion valve

HINT:

These gauge readings indicate that the refrigerant is not circulating.

(8) Under condition [*2], check the gauge reading.

Condition: Insufficient Cooling



E100253J01

Result

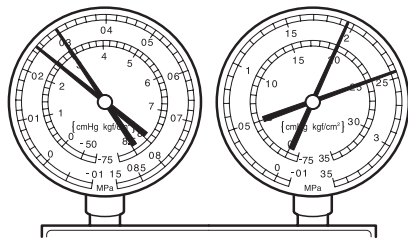
Symptom	Cause	Diagnosis	Countermeasure
- The pressure on both the high and low-pressure sides is too high - Bubbles do not appear in the sight glass even when engine speed is reduced	- Excessive refrigerant - Insufficient cooling of the cooler condenser core	- Excessive refrigerant - Cooling failure of the cooler condenser core	- Clean the cooler condenser core fins - Check the operation of the condenser fan motor - If 1 and 2 are normal, check the amount of refrigerant and supply the appropriate volume of refrigerant

HINT:

These gauge readings indicate that the amount of refrigerant is excessive or that there is insufficient cooling of the cooler condenser core.

(9) Under condition [*2], check the gauge reading.

Condition: Insufficient Cooling



NOTE: These gauge indications are shown when the refrigeration system has been opened and the refrigerant charged without vacuum purging.

E100254J01

Result

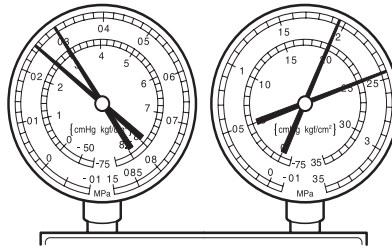
Symptom	Cause	Diagnosis	Countermeasure
- The pressure on both the high and low pressure sides is too high - The low-pressure piping is too hot to touch - Bubbles appear in the sight glass	Air in the refrigeration system	- Air in the refrigeration system - Insufficient vacuum purging	- Check to see if the compressor oil is dirty or low - After vacuum purging, supply new refrigerant

HINT:

These gauge readings indicate that there is air in the refrigeration system.

(10) Under condition [*2], check the gauge reading.

Condition: Insufficient Cooling



E100255J01

Result

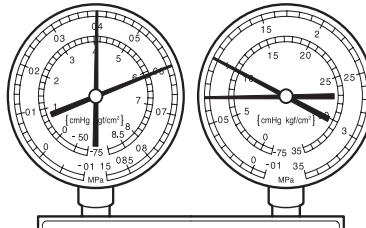
Symptom	Cause	Diagnosis	Countermeasure
- The pressure on both the high and low-pressure sides is too high - Frost or condensation on the low-pressure side	Cooler extension valve trouble	- Excessive refrigerant in the low pressure piping - The cooler expansion valve is open too wide	Replace the cooler expansion valve

HINT:

These gauge readings indicate that there is a problem with the cooler extension valve.

(11) Under condition [*2], check the gauge reading.

Condition: Insufficient Cooling



E100256J01

Result

Symptom	Cause	Diagnosis	Countermeasure
- The pressure on both the high and low pressure sides is too high - The pressure on the high pressure side is too low	Leakage in the cooler compressor	- Compression failure - Valve leakage or damage to sliding parts	Repair or replace cooler compressor

HINT:

These gauge readings indicate a compression failure of the cooler compressor.

3. INSPECT COOLER CONDENSER ASSEMBLY

- (a) If the fins of the cooler condenser are dirty, clean them with water and dry them with compressed air.

NOTICE:

Do not scratch the fins of the cooler condenser assembly.

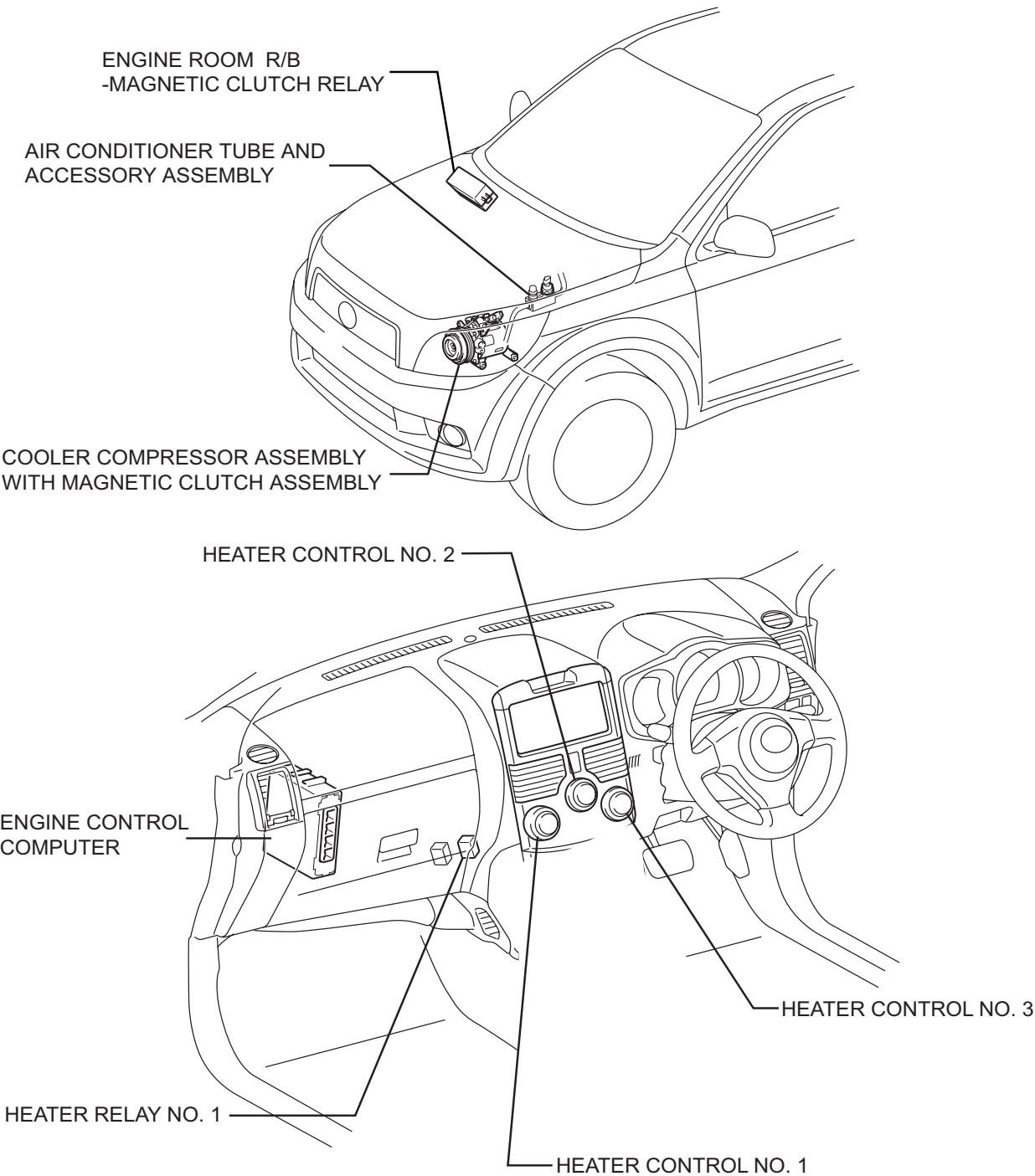
- (b) If the fins of the cooler condenser are bent, straighten them using a screwdriver or pliers.

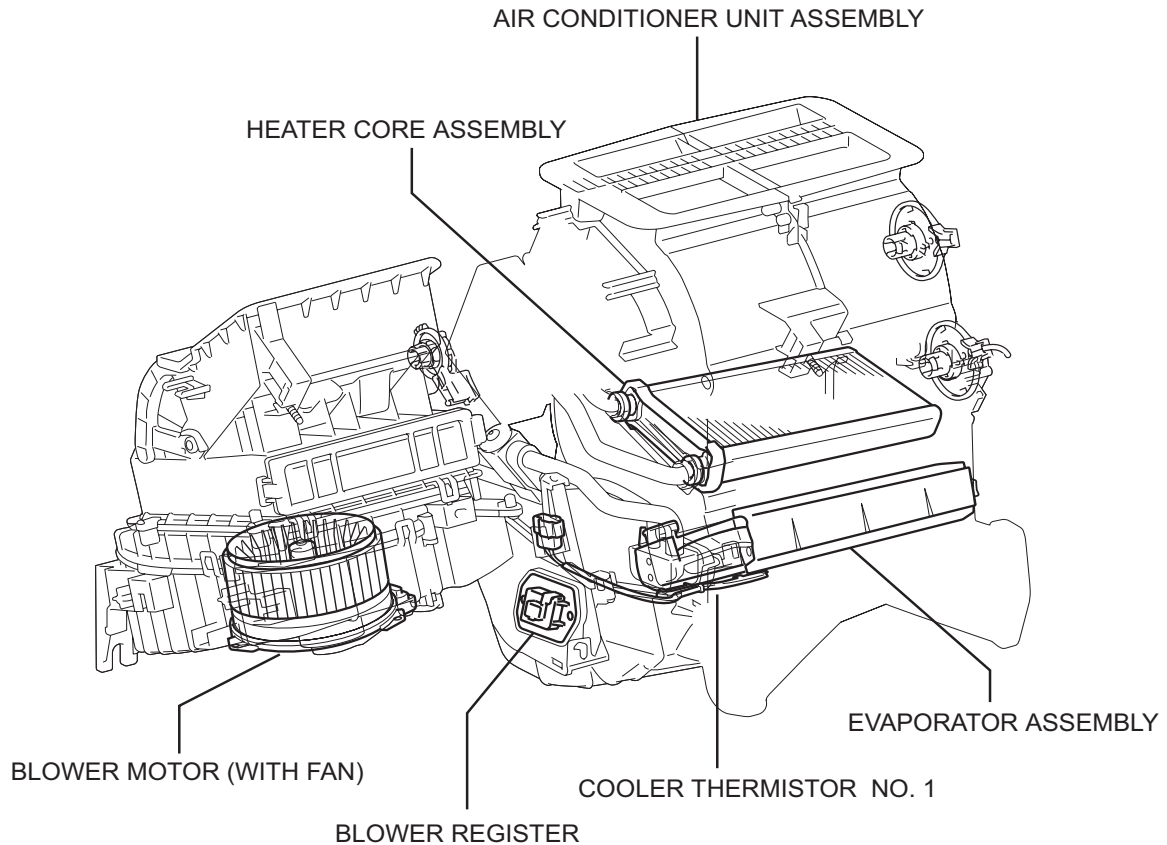
4. CHECK FOR REFRIGERANT LEAKAGE

- (a) Check for refrigerant leaks from the piping connections using a halogen leak detector.
- (b) Check the tightening torque of the joint if refrigerant leakage is detected in a pipe joint.

LOCATION

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E131271J01

PROBLEM SYMPTOMS TABLE

MANUAL AIR CONDITIONER

Symptom	Suspected Area	See Page
All functions of the A/C system do not operate	Check fuse (IG1 / BACK)	-
	No. 1 heater control	AC-34
	Wire harness and connector	-
Blower motor (with fan) does not operate	Check fuse (HEATER)	-
	Check heater relay No. 1	AC-62
	Check blower motor (with fan)	AC-65
	Check heater control No. 2	AC-35
	Check blower register	AC-60
	Wire harness and connector	-
Blower motor (with fan) does not operate	Check blower register	AC-60
	Check blower motor (with fan)	AC-65
	Check heater control No. 2	AC-35
	Wire harness and connector	-

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Symptom	Suspected Area	See Page
Cabin temperature does not decrease (does not get cooler)	Check the refrigerant charge volume	AC-1
	Check refrigerant pressure	AC-4
	Check air conditioning tube and accessory assembly	AC-63
	Check cooler compressor assembly with magnetic clutch assembly	AC-55
	Check the cooler expansion valve	-
Compressor does not turn ON	Check fuse (MGC)	-
	Check refrigerant pressure	AC-4
	Check cooler compressor assembly with magnetic clutch assembly	AC-55
	Check air conditioning tube and accessory assembly	AC-63
	Check cooler thermistor No. 1 (evaporator rear sensor)	AC-61
	Engine control computer	ES-16
	Wire harness and connector	-

CUSTOMER PROBLEM ANALYSIS CHECK

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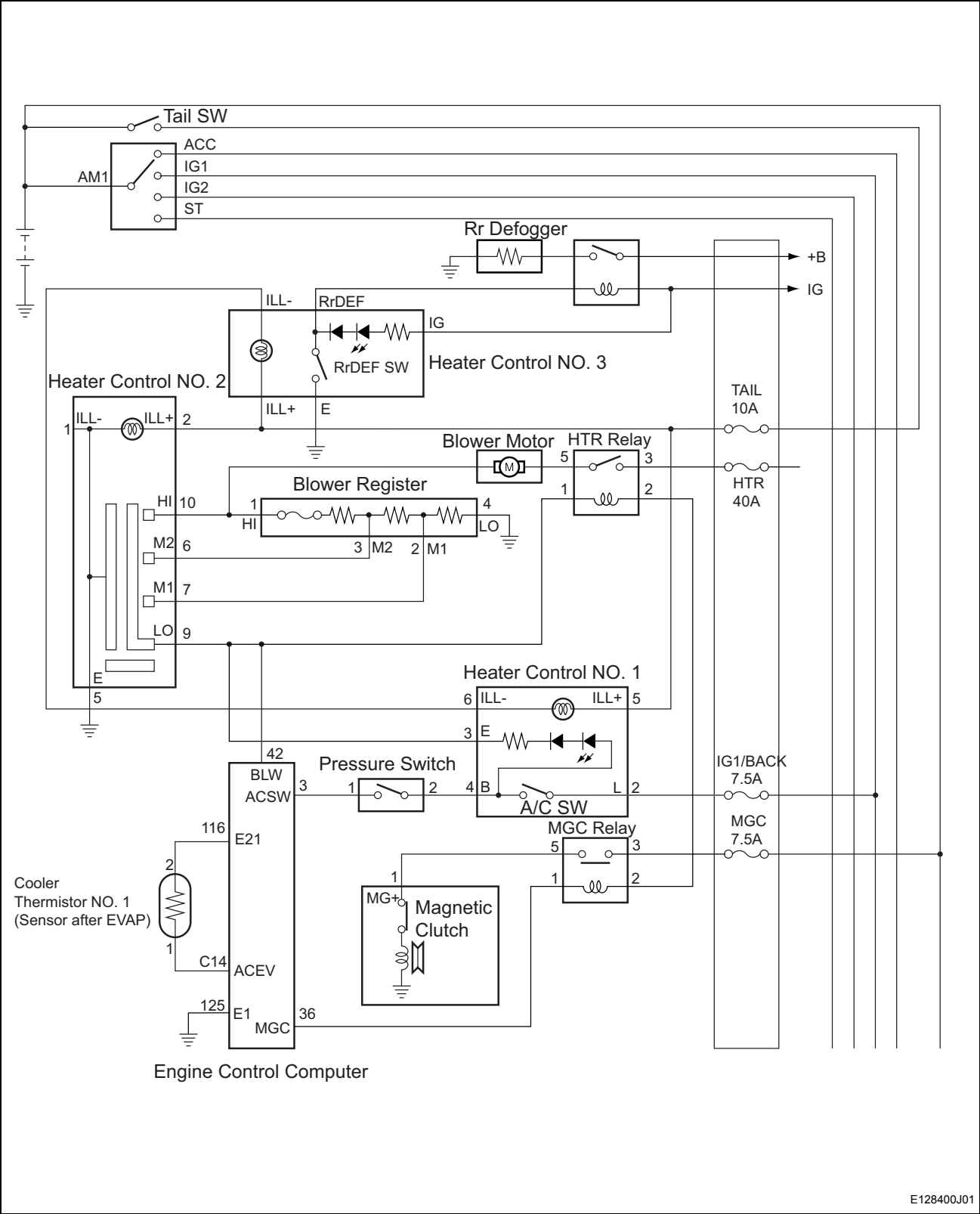
Heater and Air Conditioning System Check Sheet

 Date Vehicle Brought In
 / /

Customer's Name		License Plate No.	First Registration Year
		Model	VIN
Written by	Inspector's Name	Engine Type	Odometer Reading km
Description of Symptoms			
Date Problem First Occurred		Date	Time
Frequency Problem Occurs		Constant Occasional (___ times per day , ___ times per month)	
Conditions (Method of use and results)			
Weather	☐ Clear ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Others ()		Air Temperature Approx. ()°C
Road	City Suburb Highway Others ()		☐ Paved ☐ Unpaved
Problem Symptoms	Wind Volume Control Poor	☐ Blower motor does not operate ☐ Blower motor speed does not change Always at high, medium, or low speed	
	Temperature Control Poor	☐ Room temperature does not decrease ☐ Room temperature does not increase ☐ Slow response	
	Suction Port Control Poor	☐ No circulation between entering ambient air and room air Always room air / Always ambient air	
	Blower Exit Control Poor	☐ Blower port not allow air to pass ☐ Does not enter the desired mode	
	Others		

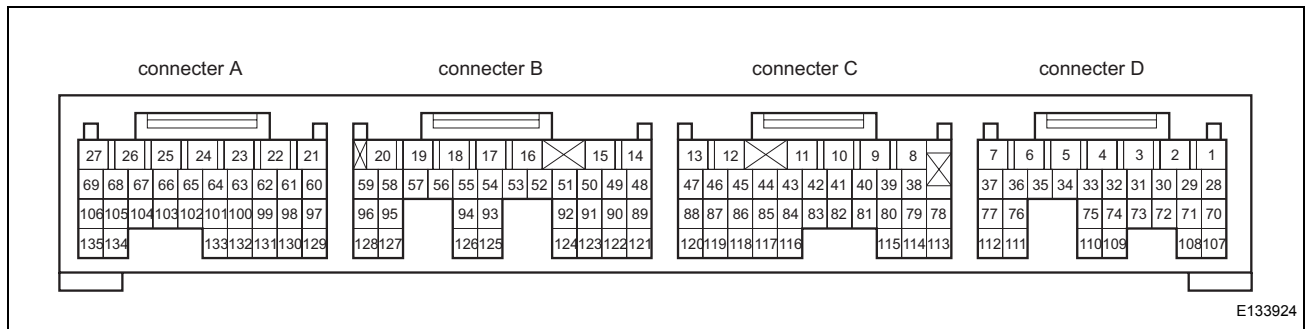
CIRCUIT DIAGRAM

AC



ECU TERMINALS

1. Engine control computer



(a) TERMINAL LAYOUT

Terminal Symbol (Terminal No.)	Input / Output	Item	Measurement Condition	Standard
MGC ↔ E1 [36 ↔ 125]	Output	Voltage	Engine idling, blower switch LO; A/C switch is turned from OFF to ON (Magnetic clutch ON)	10 to 14 V → 1 V or less
ACSW ↔ E1 [3 ↔ 125]	Input	Voltage	The engine is started; the magnetic clutch is changed from OFF to ON	1 V or less → 10 to 14 V
BLW ↔ E1 (42 ↔ 125)	Input	Voltage	IG ON, blower switch LO, OFF - ON	Changes from 10 to 14 V to 0 to 0.5 V
ACEV ↔ E21 (45 ↔ 116)	Input	Voltage	IG ON, A/C switch ON	0.15 to 4.8 V

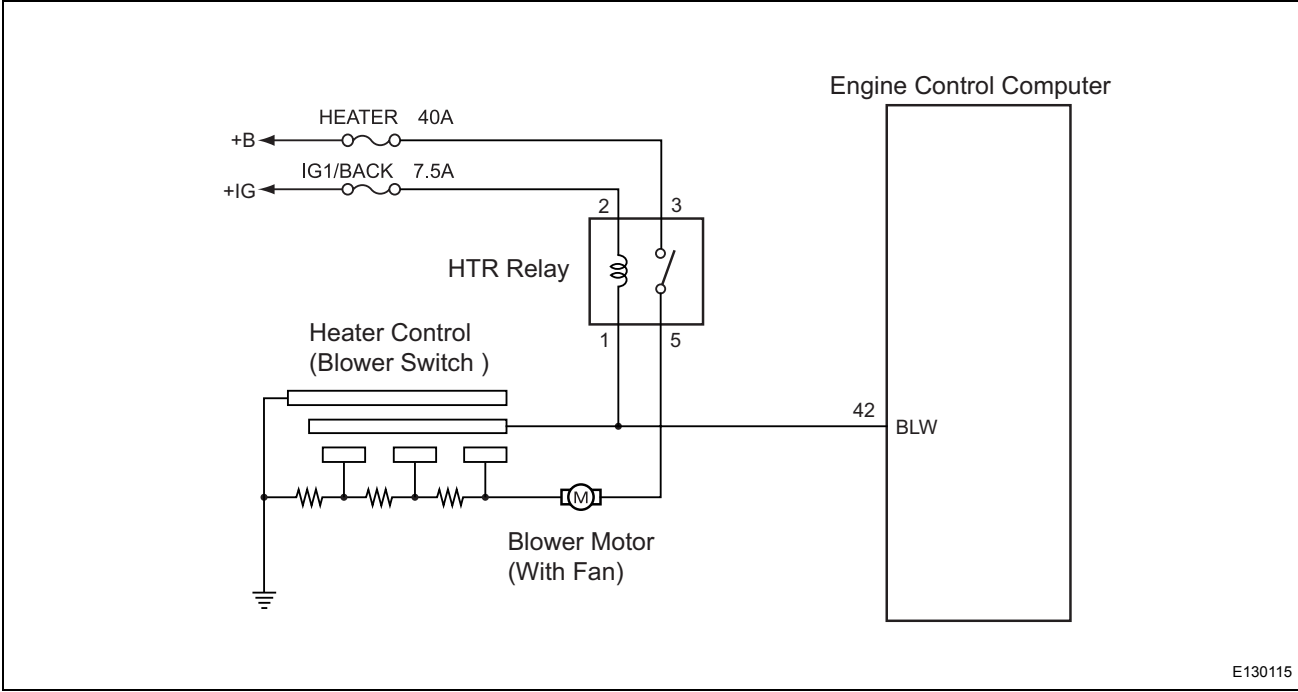
BLOWER MOTOR CIRCUIT

DESCRIPTION

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When the heater control (blower switch) is operated with 0 to 1 or more, No. 1 heater relay (HTR Relay) turns on and the current leads the blower motor (with fan) to rotate. Speed change of the blower motor (with fan) is operated by heater control (blower switch) to transit between ground ←→ blower register circuit.

CIRCUIT DIAGRAM



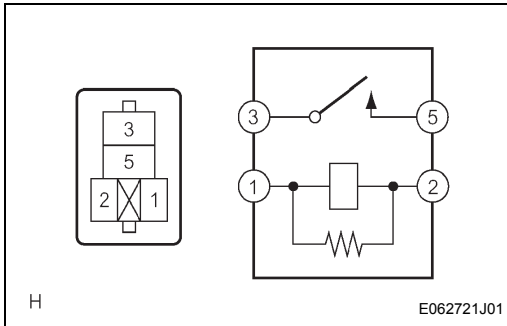
INSPECTION PROCEDURE

1	CHECK FUSE (IG1 / BACK, HEATER)
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- (a) Check fuse (IG1 / BACK 7.5A) of the instrument panel J/B.
- (b) Check fusible link assembly (HEATER 40A) in the engine room R/B.

OK

NG	REPLACE FUSES
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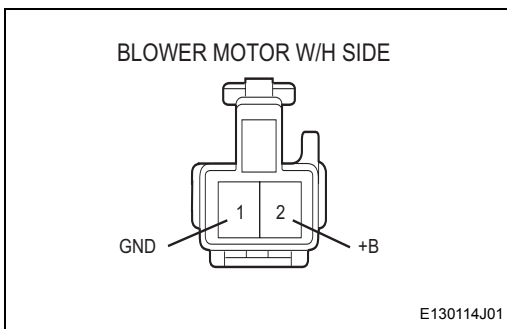
2**CHECK HEATER RELAY NO. 1 (HTR)**

- (a) Using the tester, check the continuity between each of the connector terminals.

Standard

Tester Connection	Standard
Terminal 1 $\leftrightarrow$ Terminal 2	Continuity
Terminal 3 $\leftrightarrow$ Terminal 5	No continuity

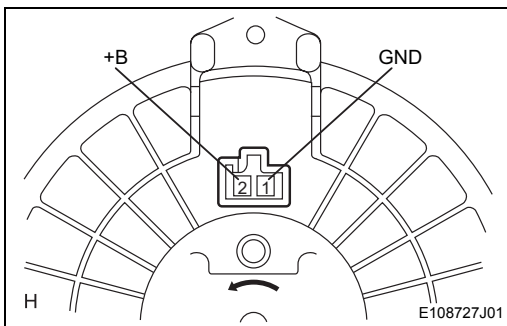
- (b) Using the tester, check the continuity between terminal 3 and 5 when battery voltage is applied to terminal 1 and 2.

Standard:**Continuity****NG****REPLACE HEATER RELAY NO. 1****OK****3****CHECK WIRE HARNESS OR CONNECTOR (POWER SOURCE SYSTEM)**

- (a) Turn the ignition switch to the ON position.
 (b) Using the tester, check the voltage between the blower motor (with fan) vehicle wire harness side connector (+B) terminal 2 and the body ground.

Standard

Tester Connection	Measurement Condition	Standard
2 (+B) $\leftrightarrow$ body ground	Blower switch 0 $\rightarrow$ 4	0 V $\rightarrow$ 10 to 14 V

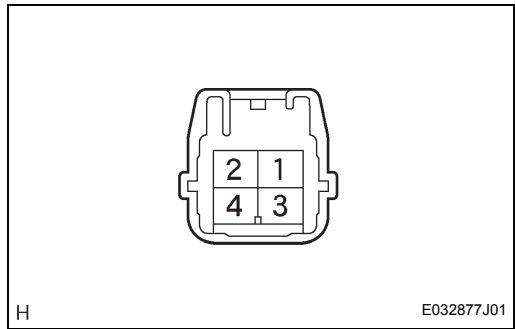
NG**REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR****OK****4****CHECK BLOWER MOTOR UNIT (WITH FAN)**

- (a) Check that the operation of the motor when connector terminal 2 is connected to the positive battery terminal and terminal 1 is connected to the negative battery terminal.

NG**REPLACE BLOWER MOTOR (WITH FAN)****OK****AC**

5 CHECK BLOWER REGISTER

AC



- (a) Disconnect the connector of the blower register.
- (b) Using the tester, check the resistance between each terminal of the blower register.

Standard

Tester Connection	Standard
Terminal 1 (HI) ↔ Terminal 4 (LO)	$3.43 \pm 0.24 \Omega$
Terminal 1 (HI) ↔ Terminal 2 (MI)	$1.03 \pm 0.07 \Omega$
Terminal 1 (HI) ↔ Terminal 3 (M2)	$0.47 \pm 0.03 \Omega$

HINT:

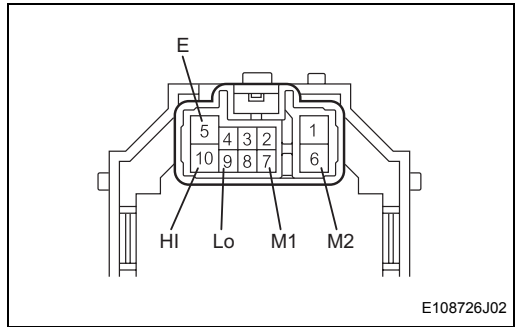
There is a thermal fuse between terminal 1 - terminal 2, 3 and 4.

NG

REPLACE BLOWER REGISTER

OK

6 CHECK HEATER CONTROL (NO. 2, BLOWER SWITCH)



- (a) Disconnect the connector of the heater control.
- (b) Using the tester, check the continuity between each of the heater control terminals.

Standard

Tester Connection	Measurement Condition	Continuity
Terminals ↔ 5 (E)	Blower switch 0	None
9 (LO) ↔ 5 (E)	Blower switch 1	Continuity
7 (M1) ↔ 5 (E)	Blower switch 2	Continuity
6 (M2) ↔ 5 (E)	Blower switch 3	Continuity
10 (HI) ↔ 5 (E)	Blower switch 4	Continuity

NG

REPLACE HEATER CONTROL (NO. 2)

OK

REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

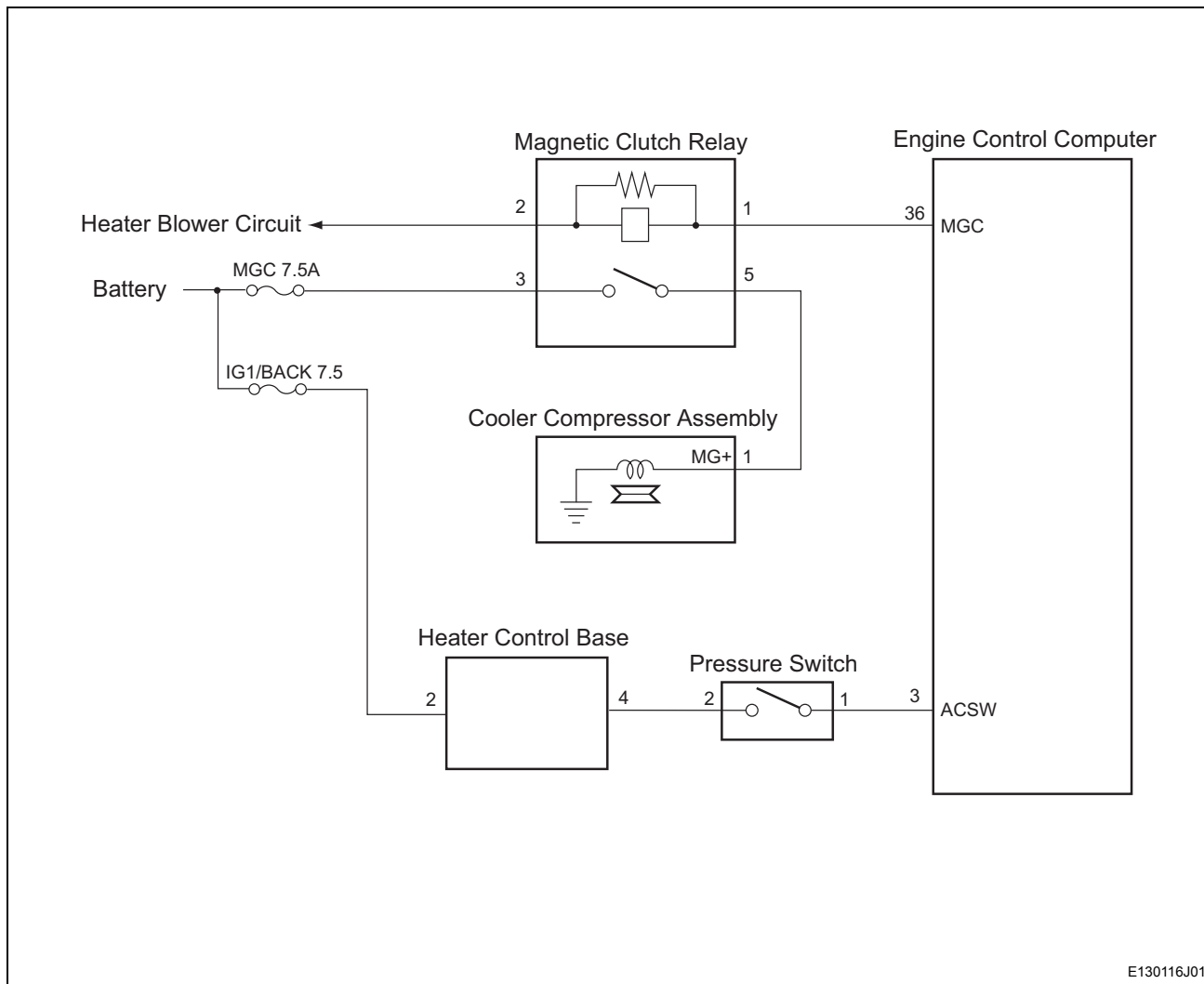
MAGNETIC CLUTCH RELAY CIRCUIT

DESCRIPTION

- The heater control base sends magnetic clutch ON command signal to the ECM.
- The ECM actuates the magnetic clutch relay to turn ON the magnetic clutch.

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CIRCUIT DIAGRAM



INSPECTION PROCEDURE

1

CHECK FUSE (MGC)

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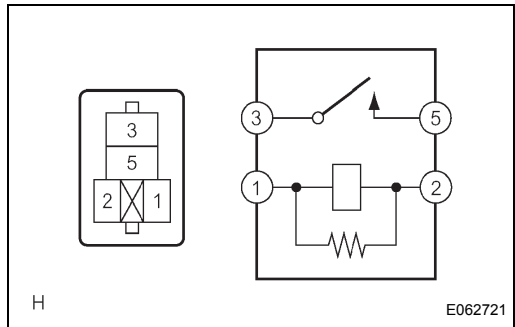
REPAIR OR REPLACE FUSE

OK

AC

2

CHECK MAGNETIC CLUTCH RELAY



OK

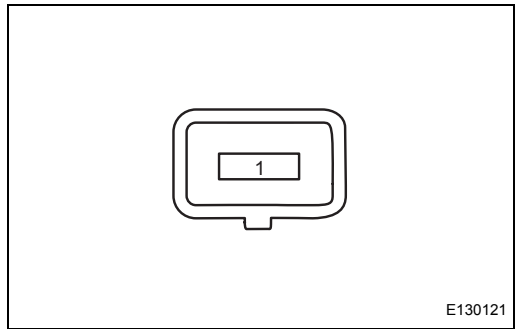
- (a) Remove the magnetic clutch relay from the relay block assembly.
- (b) Using the tester, check the continuity between the connector terminals.
Standard:
Continuity between terminal 1 and terminal 2
Continuity between terminal 3 and terminal 5
- (c) Using the tester, check the continuity between terminal 3 and 5 when battery voltage is applied to terminal 1 and 2.
Standard:
Continuity between terminal 3 and terminal 5

NG

REPLACE MAGNETIC CLUTCH RELAY

3

CHECK COOLER COMPRESSOR WITH MAGNETIC CLUTCH ASSEMBLY



OK

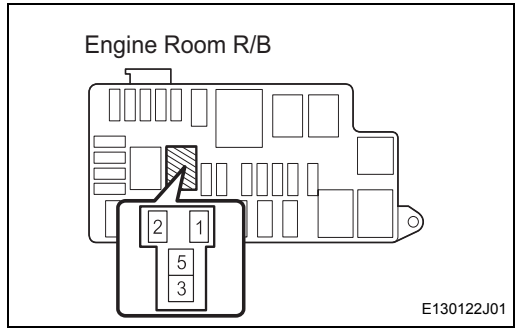
- (a) Disconnect the cooler compressor assembly connector.
- (b) Using the tester, check the continuity between connector terminal 1 (MG+) and the ground.
Standard:
Continuity
- (c) When connector terminal 1 (MG+) is connected to the positive battery terminal and the body ground is connected to the negative battery terminal, check that the magnetic clutch makes a sound indicating that it is operating, and check that the magnetic clutch's hub and rotor lock.

NG

REPLACE COOLER COMPRESSOR WITH MAGNETIC CLUTCH ASSEMBLY

4

CHECK WIRE HARNESS OR CONNECTOR (POWER SOURCE SYSTEM AND MAGNETIC CLUTCH RELAY)



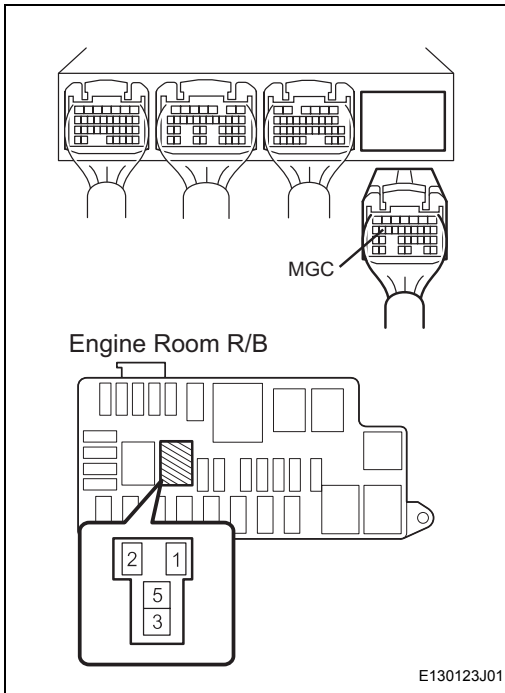
OK

- (a) Turn the ignition switch to the ON position.
- (b) Using the tester, check the voltage between terminals in the engine Room R/B.
Standard:

Tester Connection	Standard
3 ↔ The body ground	10 to 14 V

NG

REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

5**CHECK WIRE HARNESS OR CONNECTOR (MAGNETIC CLUTCH RELAY AND ECM)**

- (a) Disconnect the ECM connector.
- (b) Using the tester, check for continuity and GND short between the terminals of the vehicle wire harness connector.

Measuring Point

ECM Side Terminal No. (Terminal Symbols)	Relay Block Assembly Side Terminal No.
36 (MGC)	1

Standard:

There is continuity between the terminals but no short to GND

NG**REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR****OK****CHECK AND REPLACE ENGINE ECM****AC**

PRESSURE SWITCH CIRCUIT

DESCRIPTION

To detect malfunctions in refrigerant pressure, the pressure switch is installed on the high pressure piping block of the front of the condenser. If an abnormal condition occurs in refrigerant pressure, the pressure switch sends a switch OFF signal to the ECM. The ECM receives the signals and stops the cooler compressor control.

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CIRCUIT DIAGRAM

(See page AC-19)

INSPECTION PROCEDURE

1

CHECK FUSE (IG1 / BACK)

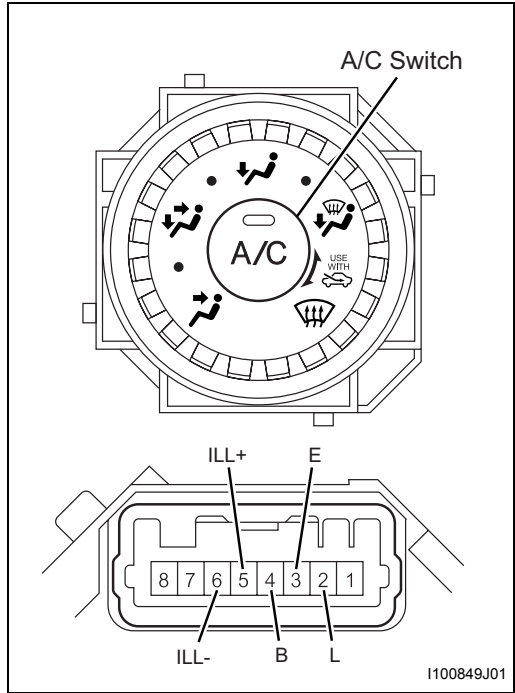
NG

REPLACE FUSES

OK

2

CHECK HEATER CONTROL (NO. 1, A/C SWITCH)



- (a) Check the continuity.
- (1) Using the tester, check the continuity between each of the connector terminals of the heater control knob.

Terminal No. (Terminal Name)	Measurement Condition	Continuity
3 (E) ↔ 2 (L)	The A/C switch is OFF.	None
4 (B) ↔ 2 (L)	The A/C switch is OFF.	None
3(E) ↔ 4 (B)	Always	Continuity
3 (E) ↔ 2 (L)	The A/C switch is ON	Continuity
4 (B) ↔ 2 (L)	The A/C switch is ON	Continuity
5 (ILL+) ↔ 6 (ILL-)	Always	Continuity

- (b) CHECK ILLUMINATION
- (1) Connect the positive battery lead to terminal 5 of the connector, and the negative battery lead to terminal 6, then check that the illumination of the heater control knob comes on.

NG

HEATER CONTROL (NO. 1)

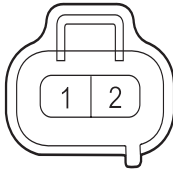
OK

3

CHECK WIRE HARNESS OR CONNECTOR (POWER SOURCE)

- (a) Disconnect the connector of the pressure switch.

Pressure Switch W/H Side Connector



E130120J01

- (b) Using the tester, check the continuity between the vehicle wire harness side connector terminal 1 and the body ground of the pressure switch.

Standard:

Continuity

- (c) Turn IG ON and turn the A/C switch ON.
 (d) Using the tester, check the voltage between the vehicle wire harness side connector terminal 2 and terminal 1 of the pressure switch.

Standard:

10 to 14 V

NG

REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

OK

4**CHECK AIR CONDITIONER TUBE AND ACCESSORY ASSEMBLY**

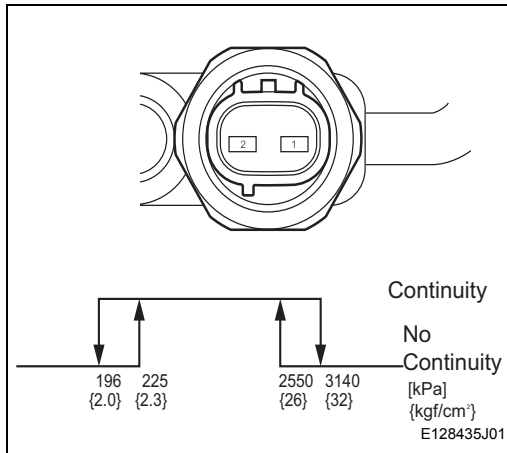
- (a) CHECK PRESSURE SWITCH

- (1) Install the air conditioning tool set.
 (2) Start the engine and operate the cooler.
 (3) Using the tester, check the continuity between the pressure switch terminals.

Standard:

Depending on the refrigerant pressure, the continuity standard will be like that shown in the illustration.

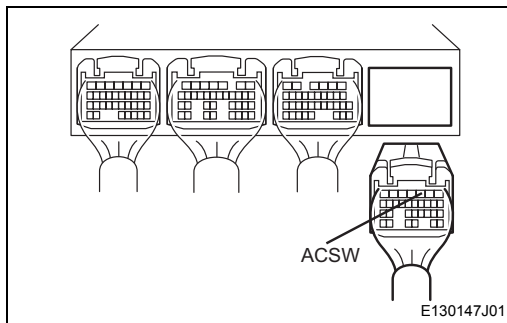
NG

CHECK AIR CONDITIONING TUBE AND ACCESSORY ASSEMBLY


OK

5**CHECK ECM**

- (a) Disconnect the ECM's connector D.
 (b) Start the engine and turn the A/C switch ON.
 (c) Using the tester, check the voltage between the vehicle side connector of the engine control connector and the body ground.



NG

REPAIR OR REPLACE WIRE HARNESS OR CONNECTOR

Terminal Symbol (Terminal No.)	Measurement Condition	Standard
ACSW ↔ E1 [3 ↔ 125]	Start the engine and turn the A/C switch from OFF to ON.	1 V or less → 10 to 14 V

OK

CHECK AND REPLACE ECM

AC

