# GENERAL <ELECTRICAL>

## CONTENTS

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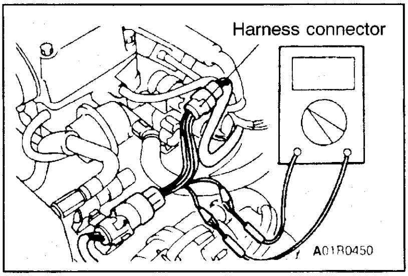
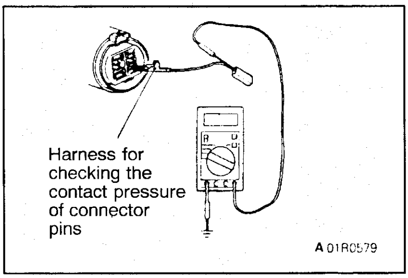



# HARNESS CONNECTOR INSPECTION

00100390048

## CONNECTOR CONTINUITY AND VOLTAGE TEST

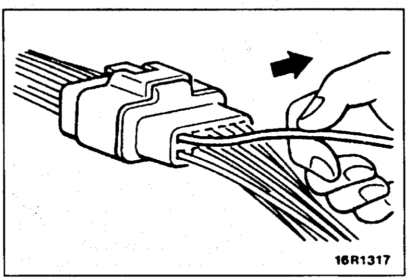



Follow the steps below to avoid causing poor connector contact and/or reduced waterproof performance of connectors when checking continuity and/or voltage at connectors of waterproof connectors.

(1) If checking is performed with the circuit in the state of continuity, be sure to use the special tool (harness connector). Never insert a test bar from the harness side, because to do so will reduce the waterproof performance and result in corrosion.

(2) If the connector is disconnected for checking and the facing part is the female pin side, the harness for checking the contact pressure of connector pins should be used. Never force the insertion of a test bar, because to do so will cause poor or improper contact.

(3) If the facing part is the male pin side, contact the test bar directly to the pins. Care must be taken not to short-circuit the connector pins.

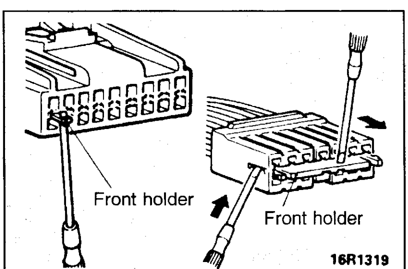



## IMPROPER TERMINAL ENGAGEMENT CHECK

When the terminal stopper of the connector is out of order, engagement of the male and female terminals becomes improper even when the connector itself is engaged perfectly and terminal sometimes slips out to rear side of connector. Make sure, that each terminal does not come off the connector by pulling each harness wire.

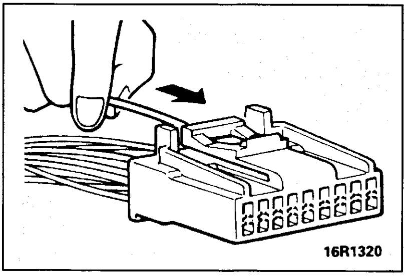
## CONNECTOR TERMINAL ENGAGEMENT AND DISENGAGEMENT

A connector that engages loosely can be repaired by removing the female terminal from the connector housing and raising its lance to establish securer engagement. Removal of the connector terminal used for MFI and ELC-4 A/T control circuit can be done in the following manner.

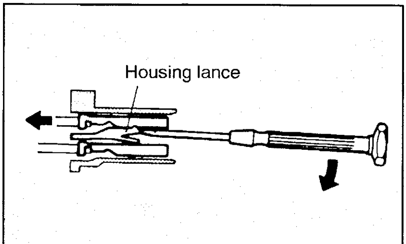



## COMPUTER CONNECTOR

(1) Insert a screwdriver [1.4 mm (.06 in.) width] as shown in the figure, disengage front holder, and remove it.


16R1320

(2) Insert the harness terminal to be repaired deep into the connector from harness side and hold it there.

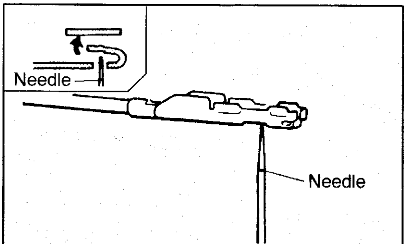


16R1321

(3) Insert the tip of the screwdriver [1.4 mm (.06 in.) width] into the connector as shown in the figure, raise the housing lance slightly with it, and pull out the harness.

**Caution**

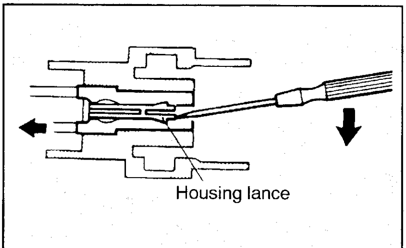
**Tool No. 753787-1 supplied by AMP can be used instead of screwdriver.**



16R1322

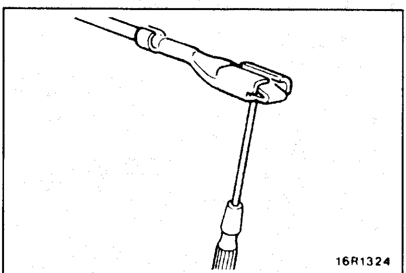
(4) Insert a needle through the hole provided on the terminal and raise the contact point of the male terminal.

## ROUND WATERPROOF CONNECTOR

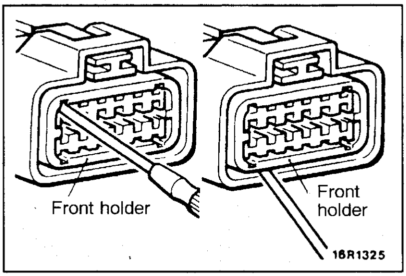


16R1323

(1) Remove the waterproof cap by using a screwdriver.
(2) Insert the tip of the screwdriver [1.4 mm (.06 in.) or 2.0 mm (.08 in.) width] into the connector as shown in the figure, raise the housing lance slightly with it, and pull out harness.

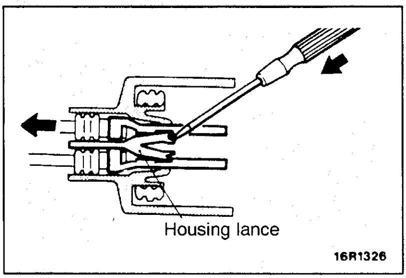

16R1324

(3) Insert a screwdriver through the hole provided on the terminal and raise the contact point of the male terminal.

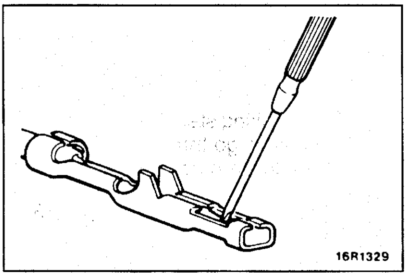



## RECTANGULAR WATERPROOF CONNECTOR

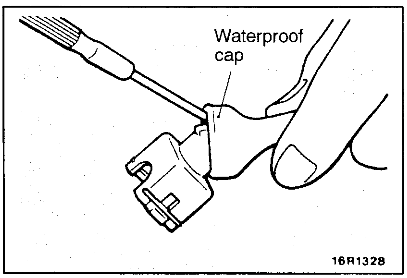
(1) Disengage the front holder by using a screwdriver and remove it.




(2) Insert the tip of a screwdriver [*0.8 mm (.03 in.) width] into the connector as shown in the figure, push it lightly to raise the housing lance, and pull out the harness.
*If the right size screwdriver is not available, convert a conventional driver to the proper size.

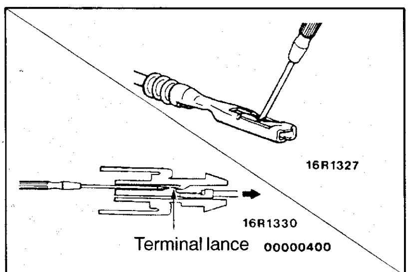



(3) Press the contact point of the male terminal down by holding a screwdriver [1.4 mm (.06 in.) width] as shown in the figure.




## INJECTOR CONNECTOR

(1) Remove the waterproof cap.




(2) Insert the tip of a screwdriver [1.4 mm (.06 in.) width] into the connector as shown in the figure, press in the terminal lance, and pull out the harness.
(3) Press the contact point of the male terminal down by holding a screwdriver [1.4 mm (.06 in.) width] as shown in the figure.

**Caution**
**Make sure the lance is in the proper condition before the terminal is inserted into the connector.**

# HOW TO DIAGNOSE

00100430016

The most important point in troubleshooting is to determine "Probable Causes". Once the probable causes are determined, parts to be checked can be limited to those associated with such probable causes. Therefore, unnecessary checks can be eliminated. The determination of the probable causes must be based on a theory and be supported by facts and must not be based on intuition only.

## TROUBLESHOOTING STEPS

If an attempt is made to solve a problem without going through correct steps for troubleshooting, the problem symptoms could become more complicated, resulting in failure to determine the causes correctly and making incorrect repairs. The four steps below should be followed in troubleshooting.

**1 Observation of Problem Symptoms**

Observe the symptom carefully. Check if there are also other problems.

**2 Determination of Probable Causes**

In determining the probable causes, it is necessary to check the wiring diagram to understand the circuit as a system. Knowledge of switches, relays and other parts is necessary for accurate determination. The causes of similar problems in the past must be taken into account.

**3 Checking of Parts Associated with Probable Causes and Determination of Faulty Parts**

Troubleshooting is carried out by making step by step checks until the true cause is found. Always go through the procedures considering what check is to be made where for the best results.

**4 Repair and Confirmation**

After the problems are corrected, be sure to check that the system operates correctly. Also check that new problems have not been caused by the repair.

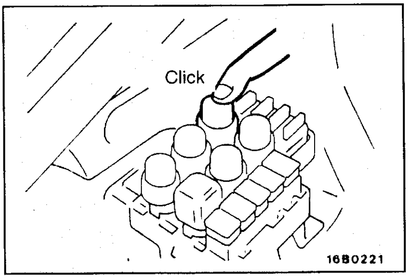
## INFORMATION FOR DIAGNOSIS

This manual contains the cable diagrams as well as the individual circuit drawings, operational explanations, and troubleshooting hints for each component required to facilitate the task of troubleshooting. The information is complied in the following manner:

(1) Cable diagrams show the connector positions, etc., on the actual vehicle as well as the harness path.
(2) Circuit drawings show the configuration of the circuit with all switches in their normal positions.
(3) Operational explanations include circuit drawings of voltage flow when the switch is operated and how the component operates in reaction.
(4) Troubleshooting hints include numerous examples of problems which might occur, traced backward in a common-sense manner to the origin of the trouble. Problems whose origins may not be found in this manner are pursued through the various system circuits.

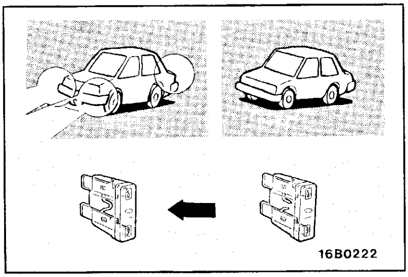
NOTE
Components of ECI, ETACS, ECS, etc. with ECU do not include 3 and 4 above. For this information, refer to a manual which includes details of these components.

## INSPECTION



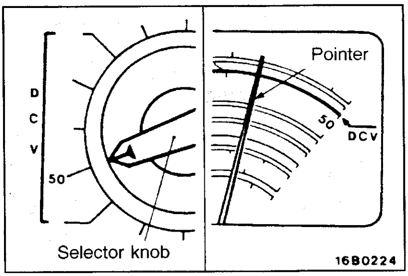

### 1. Visual and aural checks

Check relay operation, blower motor rotation, light illumination, etc. visually or aurally. The flow of current is invisible but can be checked by the operation of the parts.




### 2. Simple checks

For example, if a headlight does not come on and a faulty fuse or poor grounding is suspected, replace the fuse with a new one or ground the light to the body by a jumper wire to determine which part is responsible for the problem.

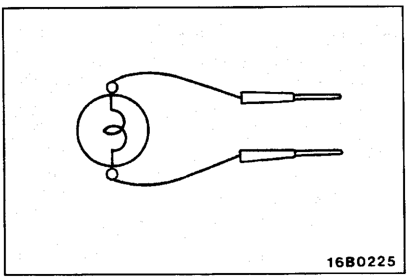



### 3. Checking with instruments

Use an appropriate instrument in an adequate range and read the indication correctly. You must have sufficient knowledge and experience to handle instruments correctly.

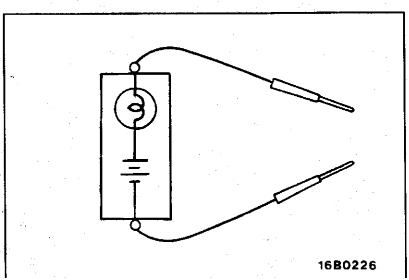
## INSPECTION INSTRUMENTS

For inspection, use the following instruments:



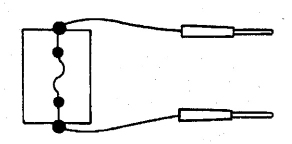

### 1. Test lights

A test light consists of a 12V bulb and lead wires. It is used to check voltages or shortcircuits.




### 2. Self-power test light

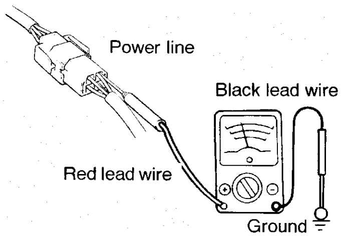
A self-power test light consists of a bulb, battery and lead wires connected in series. It is used to check continuity or grounding.



16B0227

### 3. Jumper wire

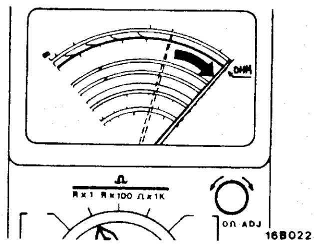
A jumper wire is used to close an open circuit. Never use one to connect a power supply directly to a load.




16B0228

### 4. Voltmeter

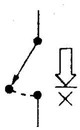
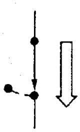
A voltmeter is used to measure the circuit voltage. Normally, the positive (red lead) probe is applied to the point of voltage measurement and the negative (black lead) probe to the body ground.

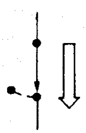
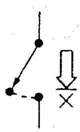


16B0223

### 5. Ohmmeter

An ohmmeter is used to check continuity or measure resistance of a switch or coil. If the measuring range has been changed, the zero point must be adjusted before measurement.

| Normal open (NO) type | |
|---|---|
| OFF | ON |
|  Current does not flow 16X0690 |  Current flows 16X0691 00000401 |

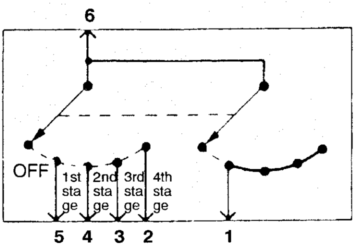
| Normal close (NC) type | |
|---|---|
| OFF | ON |
|  Current flows 16X0691 |  Current does not flow 16X0690 00000402 |

## CHECKING SWITCHES

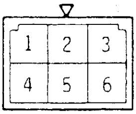
In a circuit diagram, a switch is represented by a symbol and in the idle state.

### 1. Normal open or normal close switch

Switches are classified into those which make the circuit open and those which make the circuit closed when off.




16A0253



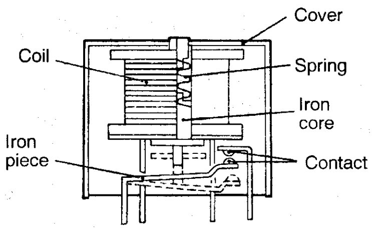

16W898
00000403

2. **Switch connection**

This figure illustrates a complex switch. The continuity between terminals at each position is as indicated in the table below.

| Position | Terminal No. 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| OFF | | | | | | |
| 1st stage | O | | | | O | O |
| 2nd stage | O | | | O | | O |
| 3rd stage | O | | O | | | O |
| 4th stage | O | O | | | | O |

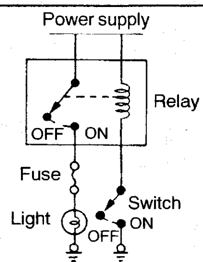
NOTE
O—O denotes continuity between terminals.




A16B0231

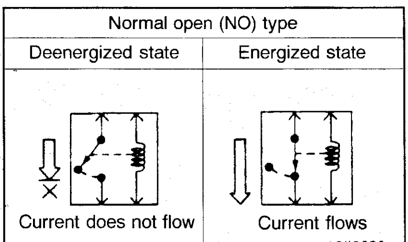
## CHECKING RELAYS

1. When current flows through the coil of a relay, its core is magnetized to attract the iron piece, closing (ON) the contact at the tip of the iron piece. When the coil current is turned off, the iron piece returns to its original position by a spring, opening the contact (OFF).




16A0254

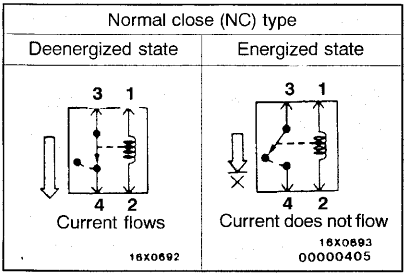
2. By using a relay, a heavy current can be turned on and off by a switch of small capacity. For example, in the circuit shown here, when the switch is turned on (closed), current flows to the coil of the relay. Then, its contact is turned on (closed) and the light comes on. The current flowing at this time to the switch is the relay coil current only, and is very small.




16X0694
16X0695
00000404

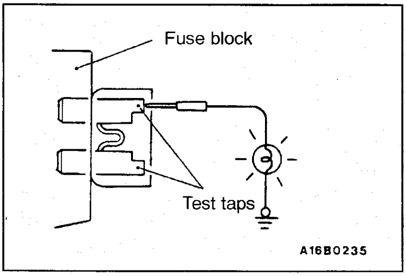
3. The relays may be classified into the normal open-type and the normal close-type by their contact construction.

NOTE
The deenergized state means that no current is flowing through the coil and the energized state means that current is flowing through the coil.



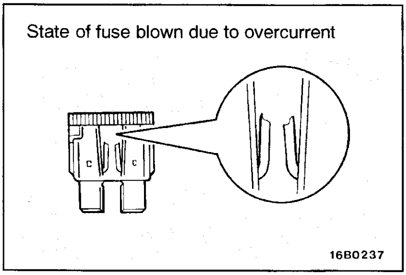

When a normal close-type relay as illustrated here is checked, there should be continuity between terminals 1 and 2 and between terminals 3 and 4 when the relay is deenergized, and the continuity should be lost between terminals 3 and 4 when the battery voltage is applied to the terminals 1 and 2. A relay can be checked in this manner. It cannot be determine if a relay is okay or faulty by checking its state only when it is deenergized (or energized).

## CHECKING FUSES



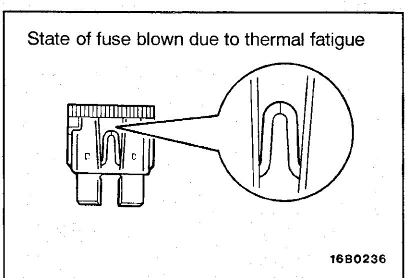

A blade type fuse has test taps provided to allow checking of the fuse itself without removing it from the fuse block. The fuse is okay if the test light comes on when its one lead is connected to the test taps (one at a time) and the other lead is grounded. (Change the ignition switch position so that the fuse circuit becomes live.)

### CAUTIONS IN EVENT OF BLOWN FUSE

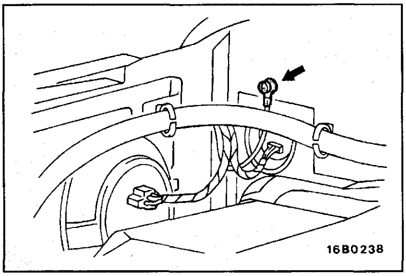


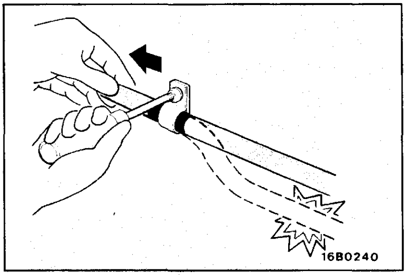

When a fuse is blown, there are two probable causes as follows: One is that it is blown due to flow of current exceeding its rating. The other is that it is blown due to repeated on/off current flowing through it. Which of the two causes is responsible can be easily determined by visual check as described below.

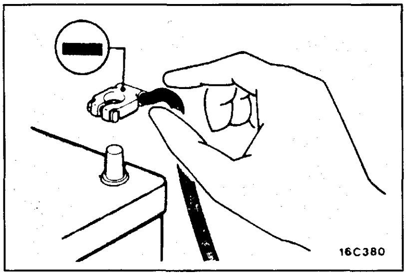
(1) Fuse blown due to current exceeding rating
The illustration shows the state of a fuse blown due to this cause. In this case, do not replace the fuse with a new one hastily since a current heavy enough to blow the fuse has flowed through it. First, check the circuit use only a fase of the for shorts and check for abnormal electric parts. After correcting shorts or replacing parts, use only a fuse of the same capacity as a replacement. Never use a fuse of larger capacity than the one that has blown. If such a fuse is used, electric parts or wirings could be damaged before the fuse blows in the event an overcurrent occurs again.




(2) Fuse blown due to repeated current on/off
The illustration shows the state of a fuse blown due to repeated current on/off. Normally, this type of problem occurs after a fairly long period of use and is less frequent than the above type. In this case, simply replace with a new fuse of the same capacity.



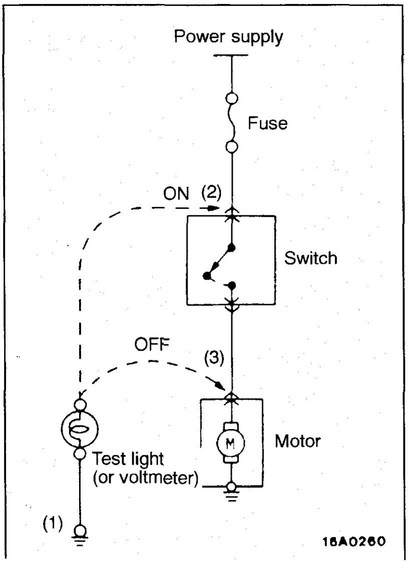




## CABLES AND WIRES CHECK

1. Check connections for looseness, rust and stains.
2. Check terminals and wires for corrosion by battery electrolyte, etc.
3. Check terminals and wires for open circuit or impending open circuit.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check conductive parts of terminals for contact with other metallic parts (vehicle body and other parts).
6. Check grounding parts to verify that there is complete continuity between attaching bolt(s) and vehicle body.
7. Check for incorrect wiring.
8. Check that wirings are clamped to prevent contact with sharp corners of the vehicle body, etc. or hot parts (exhaust manifold, pipe, etc.).
9. Check that wirings are clamped firmly to secure enough clearance from the fan pulley, fan belt, and other rotating or moving parts.
10. Check that the wirings between the fixed parts such as the vehicle body and the vibrating parts such as the engine are made with adequate allowance for vibrations.

## BATTERY HANDLING

When checking or servicing does not require power from the on-vehicle battery, be sure to disconnect the cable from the battery (-) terminal. This is to prevent problems that could be caused by a short circuit. Disconnect the (-) terminal first and reconnect it last.




## GENERAL ELECTRICAL SYSTEM CHECK

A circuit consists of the power supply, switch, relay, load, ground, etc. There are various methods to check a circuit including an overall check, voltage check, short-circuit check, and continuity check. Each of # these methods is briefly described in the following:

### 1. VOLTAGE CHECK

(1) Ground one lead wire of the test light. If a voltmeter is used instead of the test light, ground the grounding side lead wire.

(2) Connect the other lead wire of the test light to the power side terminal of the switch connector. The test light should come on or the voltmeter should indicate a voltage.

(3) Then, connect the test light or voltmeter to the motor connector. The test light should not come on, or the voltmeter should indicate no voltage. When the switch is turned on in this state, the test light should come on, or the voltmeter should indicate a voltage, with motor starting to run.

(4) The circuit illustrated here is normal. If there is any problem, such as the motor failing to run, check voltages beginning at the connector nearest to the motor until the faulty part is identified.

## 2. SHORT-CIRCUIT CHECK

Because the fuse has blown, it is probable that there is a short circuit. Follow the procedures below to narrow down the short-circuit location.

Take out the blown fuse and connect the test light to the disconnected terminal (switch: OFF).

↓

The test light illuminates. — Yes → Short-circuit between the fuse block and the switch **A**.

↓ No

Switch ON the switch. (The test light illuminates but the illumination light does not.)

↓

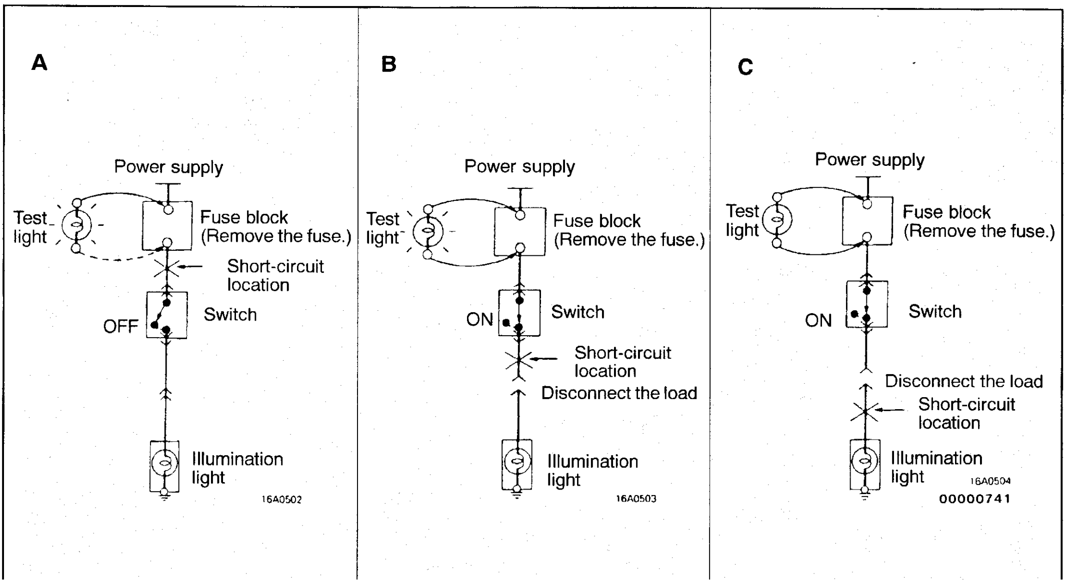
Disconnect the connector of the illumination light.

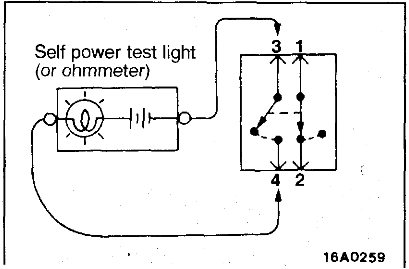
↓

The test light remains illuminated. — Yes → Short-circuit between the switch and the illumination light **B**.

↓ No

Short-circuit between the connector and the illumination light **C**.






### 3. CONTINUITY CHECK

(1) When the switch is in the OFF position, the self power test light must illuminate or the ohmmeter should read 0 ohm, only when the terminals 1 and 2 are interconnected.

(2) When the switch is the ON position, the self power test light should come on or the ohmmeter should read 0 ohm, only when the terminals 3 and 4 are interconnected.