TRUCK.BUS

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Harness Repair Manual

FUSO

TRUCK.BUS

Harness Repair Manual

FOREWORD

This manual describes procedures for the repair of vehicle wiring harnesses. Focusing particularly on the handling of connectors, it also explains the purpose of each procedure and contains a list of parts. The purpose of this manual is to enable service personnel to repair wiring harnesses smoothly and correctly such that the possibility of secondary malfunctions is minimized.
Construction and handling methods vary from one connector type to another, so it is important to read this manual carefully before carrying out repair work.
(Please note that this manual describes only common connectors and electronic controlled connectors used for Mitsubishi Fuso Truck & Bus Corporation, not other connectors and commercially available connectors.)

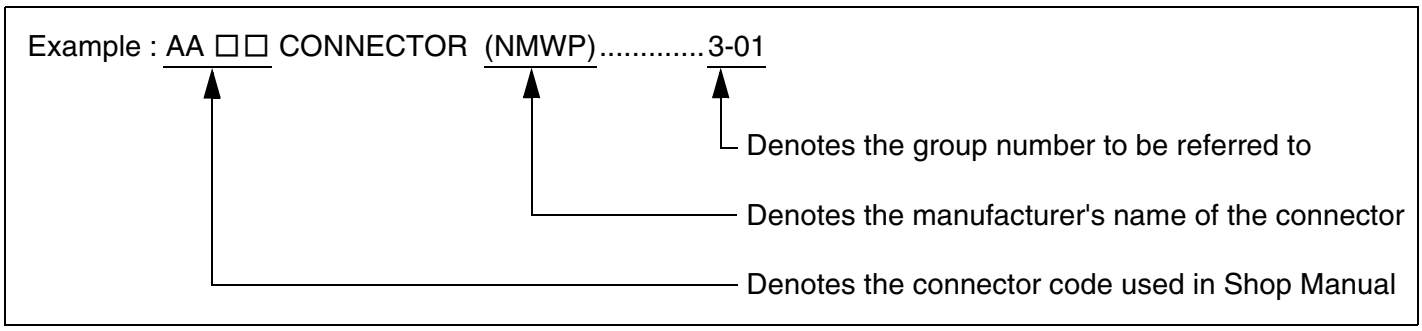
Details in this document may be changed for improvement without prior notice.

SEPTEMBER 2009

 Printed in Japan

INDEX

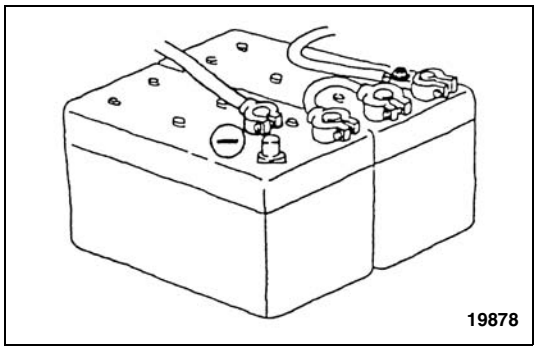
INDEX



1 DESCRIPTIONS OF PROCEDURES

POINTS TO NOTE ON MAINTENANCE

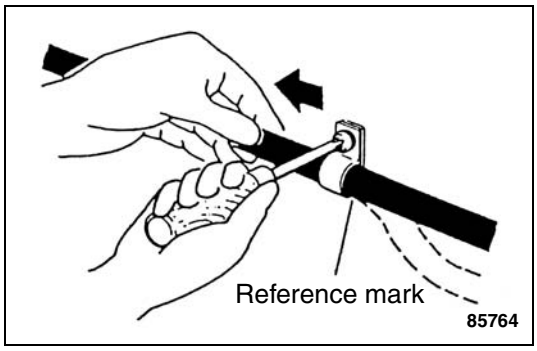
1. Points to note on electric system maintenance



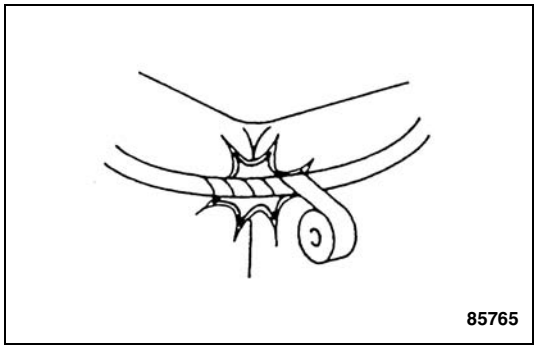
Disconnect the (-) battery terminal to prevent burn due to short-circuit.

CAUTION ⚠

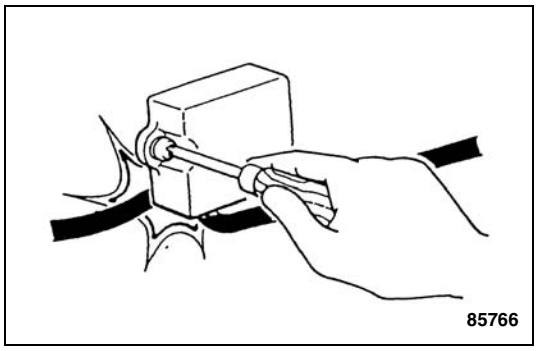
Be sure to turn OFF the ignition switch and light switches before disconnecting/connecting the battery terminal. (Semiconductor components may be damaged.)



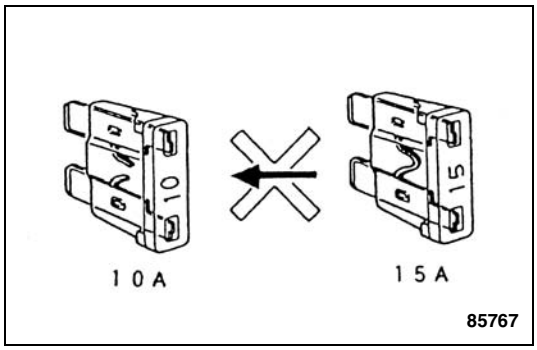
Clamp all harnesses securely so that they do no become loose. With any harness that runs close to moving parts such as engine, leave sufficient slack in the harness so that it can be clamped far enough from the moving parts that it does not make contact during engine operation.
Further, if there is a reference mark showing where a harness should be secured, be sure to clamp the harness at that point.



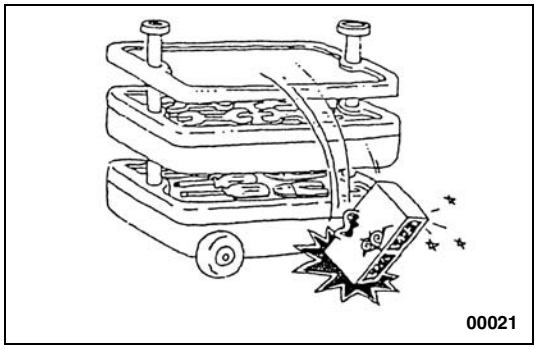
Whenever harnesses run over the edges or corners of other parts, wrap them with tape to protect them from damage.



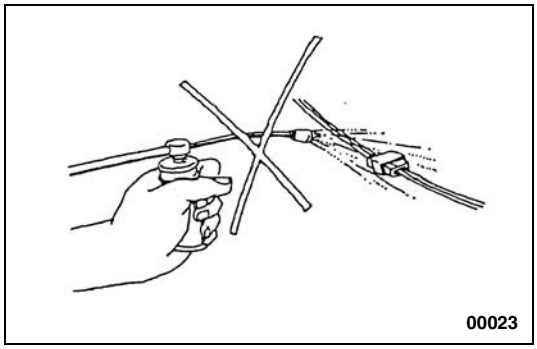
Be careful not to trap or damage harnesses when installing other parts. Do not pull the harness with undue force when a harness runs through the vehicle body hole.



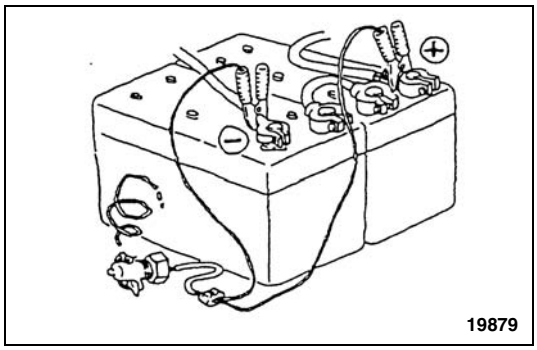
Whenever a fuse blows, be sure to replace it with a fuse of the same amperage. If a fuse with a higher amperage is used, component damage and fires may occur.



Since sensors and relays are vulnerable to impact or heat, do not remove the cover of the ECU (electronic control unit) or paint it without permission.



Before washing the vehicle, provide waterproof (covering with a plastic sheet) on the electric equipment. Do not water the harness connector or the sensor directly. If the connector or the sensor comes in contact with water, wipe it immediately.



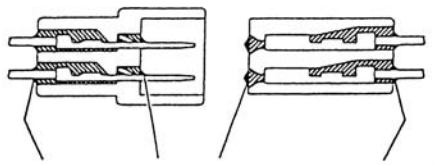
Check (+) or (-) when the voltage is applied. Be sure to increase the voltage from 0V and do not apply the voltage more than specified.
Note that the voltage of the ECU or sensors is not always 24V.

2. Points to note on repair of connectors

- Before using any harness, check the connectors for cracks and chips in the housings, for deformation of the terminals, and for splits and gouges in the waterproof rubber. Otherwise, the housings and terminals may not fit together properly and malfunctions may occur later on.
- After mounting terminals, housings and retainers, check that they fit together properly. (Due to operating conditions, it is not always possible to hear a click as parts lock together.)
- Never insert terminal releasing tools or other tools into terminal contacts. If you insert a tool into a terminal contact accidentally, replace the terminal with a new one.

POINTS TO NOTE ON MAINTENANCE

- Housings, terminals, and waterproofing rubber deteriorate at different rates during storage. Terminal contacts and waterproofing rubber (including waterproof housings with rubber attached) are particularly prone to deterioration. Avoid using any part that has been stored for more than a year since being manufactured.
- Connect the joints securely using the crimp joint terminals. Insulate the joint completely with a heat shrinkable tape or taping. For extension of a cable outside the compartment, provide waterproof and insulate the cable completely.



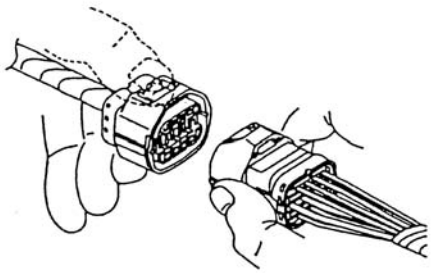
83485

● **Waterproof grease**

For area filled with waterproof grease on the open connector without using the waterproof connector, refill the connector with waterproof grease (See Other supplied parts on P2-4.) after repair of the connector.

CAUTION ⚠

Waterproof grease expands the rubber of the waterproof connector. Do not use waterproof grease.


85768

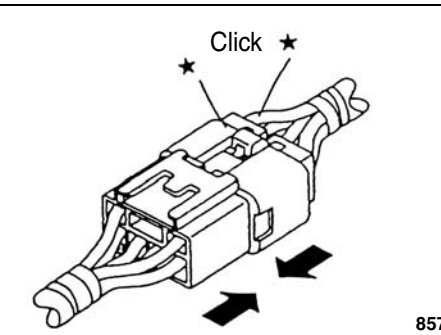
● **Assembly/removal of connectors**

[Separating]

Grasp the connectors firmly, press the lock buttons or lock levers on the male connector and female connector housings, then pull the connectors apart in a straight line.

CAUTION ⚠

Grasp the housings when separating connectors. Never hold the wires.



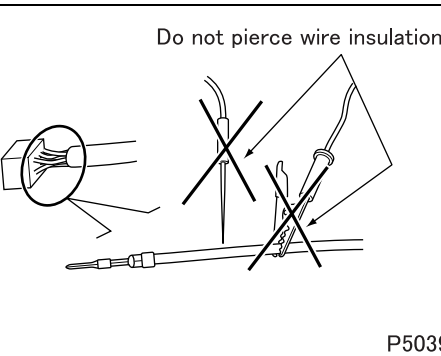
85769

[Joining]

- Grasp the connectors firmly, then push them together in a straight line until they click.
- After joining, pull the housings to make sure they are locked securely together.

CAUTION ⚠

Push the connectors together in a straight line. Never tilt or twist them.

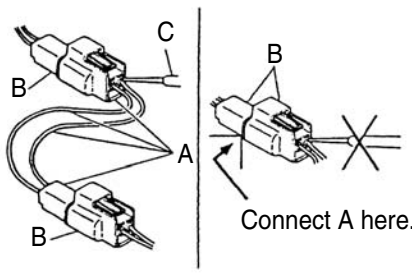


P50395E

● **Inspection with tester**

CAUTION ⚠

Do not pierce wire insulation with test probes or alligator clips when performing electrical inspections. Doing so can, particularly with the chassis harness, hasten corrosion.



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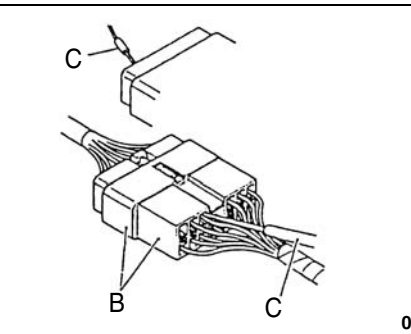
(1) Check of active connector (with the power supplied to the circuit)

<Waterproof connector>

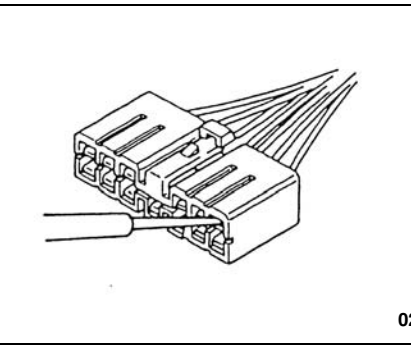
- Prepare a check harness and connector A. Connect the check harness and the connector prepared in circuit check connector B which is checked.
- Place test bar C on the check connector for checking.
- If you insert the test bar in the waterproof connector from the harness side, the seal may be damaged and the waterproof performance is deteriorated, resulting in corrosion of the terminal and the harness. Never insert the test bar.



02588

<Non-waterproof connector>

Insert test bar C from the harness side. If the connector including the control unit is too small to insert the test bar, do not insert it with undue force and use a super-thin test bar.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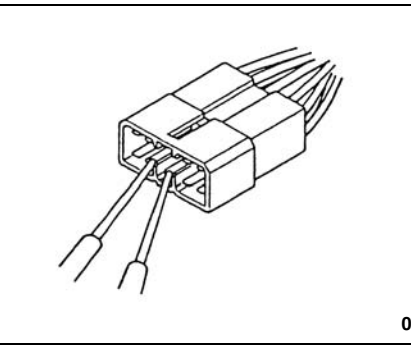
(2) Check after separating connector

[Check with female pin]

Insert the test bar in the terminal. If the test bar is inserted with undue force, a contact error may occur. When it is difficult to insert the test bar, use a super-thin test bar.

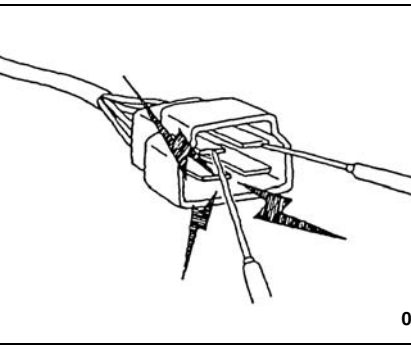

02590

[Check with male pin]

Place the test bar directly on the terminal.

CAUTION ⚠

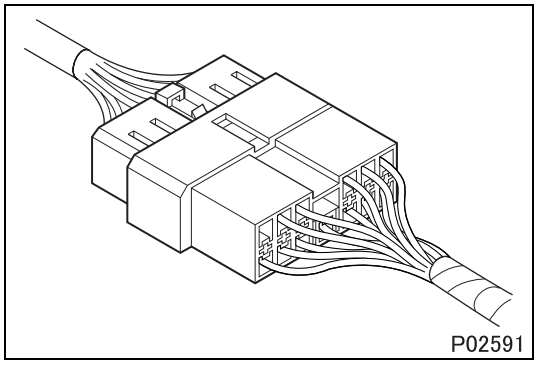
Do not short-circuit the test bar between terminals.
A short-circuit in an ECU may damage the internal circuit of the ECU.


00027

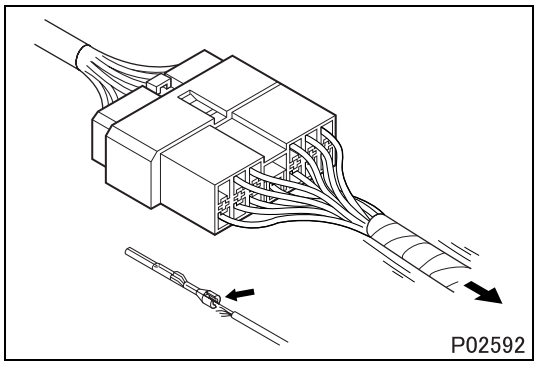
Be careful not to allow contact of the test bar with other terminals for check with the power supplied.

(3) Inspection of connectors

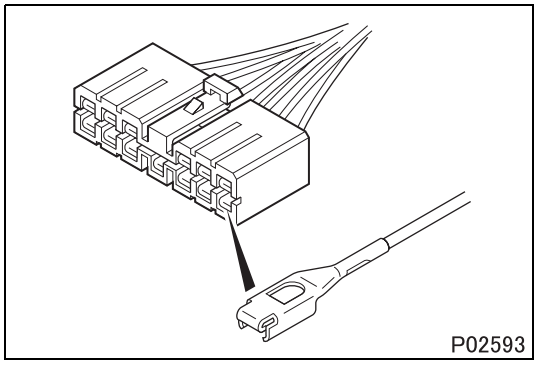
(3.1) Visual inspection



- Check that the connectors are fitted together securely.

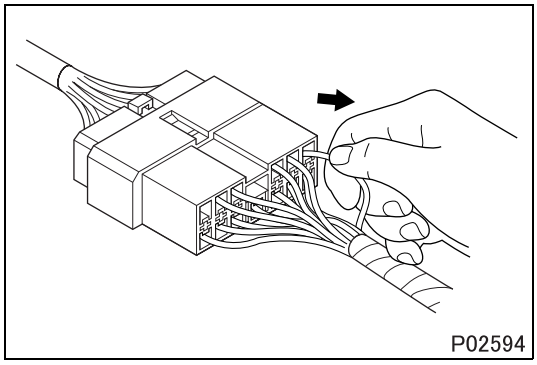


- Check whether wires have been separated from their terminals due to pulling of the harness.



- Check that male and female terminals fit together tightly.
- Check for defective connections caused by loose terminals, by rust on terminals, or by contamination of terminals by foreign substances.

(3.2) Checking for loose terminals



- If connector terminal retainers become damaged, male and female terminals may not mate with each other when the connector bodies are fitted together. To check for such terminals, gently pull each wire and see whether any terminals slip out of their connector housings.

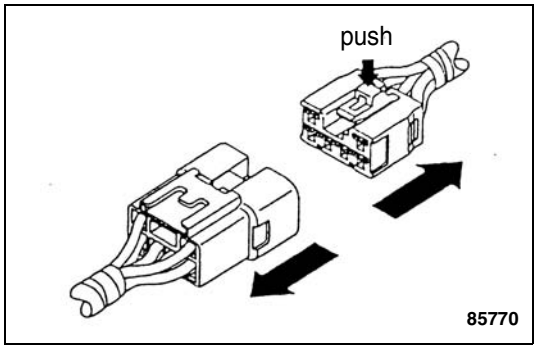
3. Points to note on vehicle with airbag

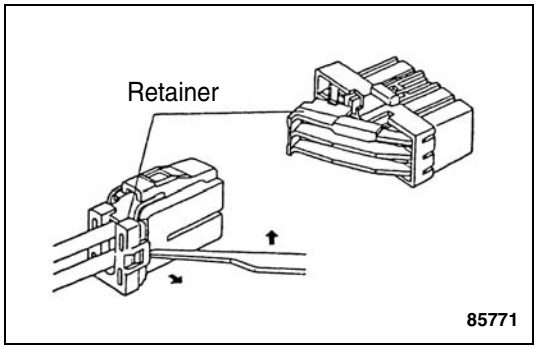
- For maintenance of SRS airbags and seat belts with pretensioners, work should be conducted safely by following the work procedure and precautions provided in this manual. (See Shop Manual chassis Gr52.)

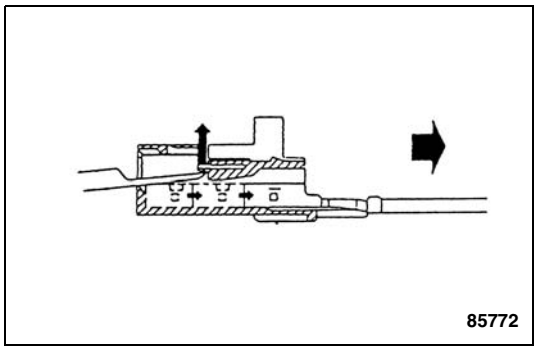
POINTS TO NOTE ON STORAGE

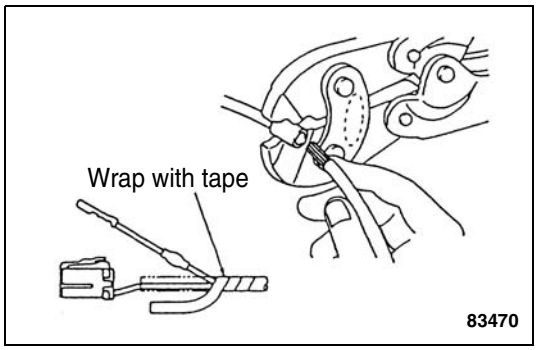
- Once a bag has been opened and some items removed, the remaining items should be left in the bag together with the product label, and the bag should be resealed.
- Do not expose any parts to direct sunlight for long periods.
- Store all parts in a room with well regulated temperature and humidity.

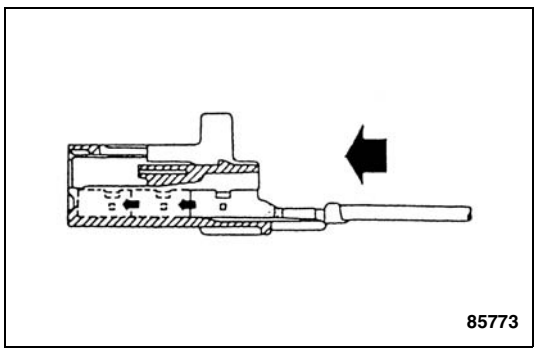
WORK PROCEDURES



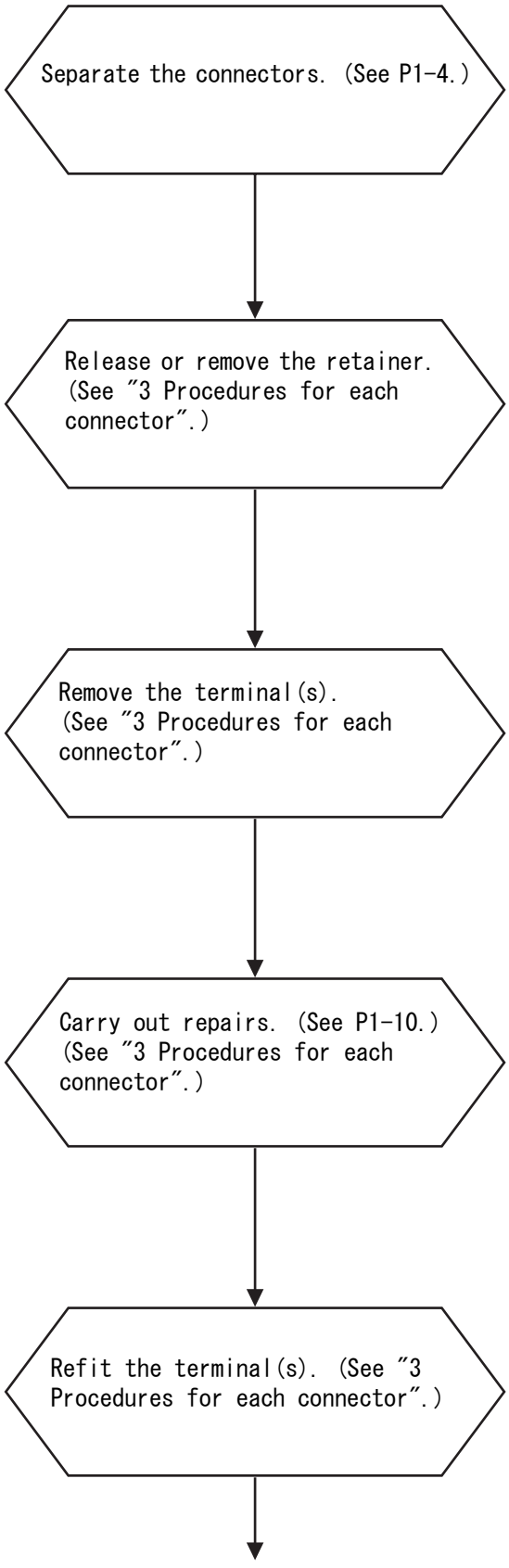


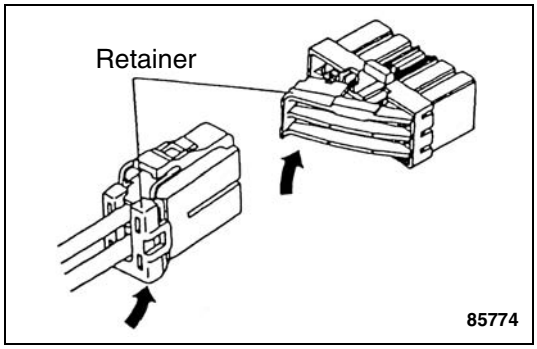


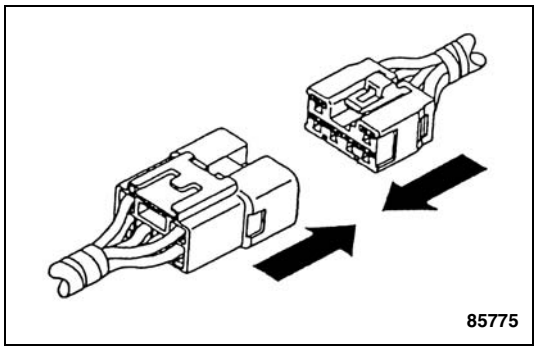




When making repairs of the harness, follow the basic connector handling procedure shown below:




Retainer
85774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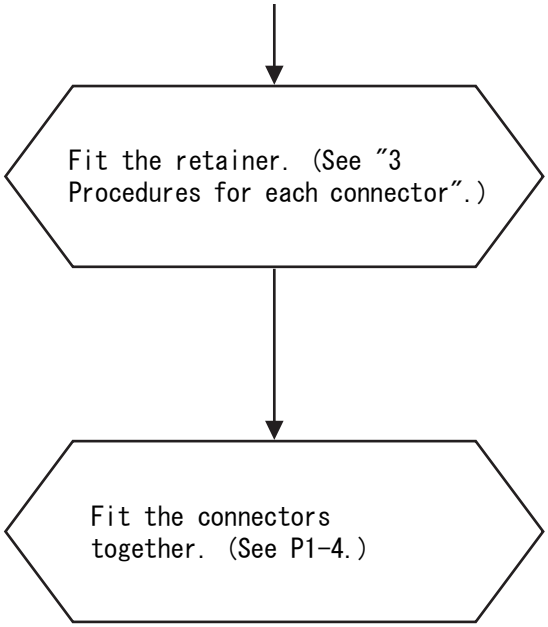
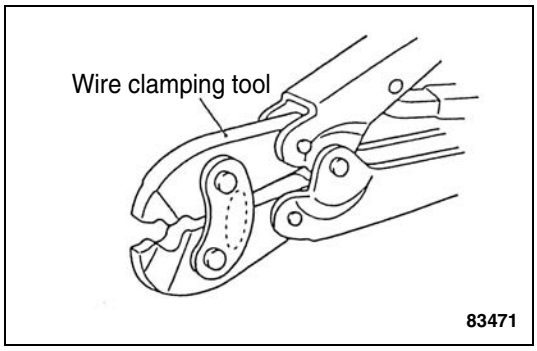

Fit the retainer. (See "3 Procedures for each connector".)
Fit the connectors together. (See P1-4.)

REPAIR WORK

1. Connection with bare crimp joint terminal and heat shrinkable tube



- Select an appropriate bare crimp joint terminal (hereinafter referred to as "splice". See Other supplied parts on P2-4.) and the crimping cavity of the wire clamping tool (See Special tool on P2-2.) from the table below.
- The wire clamping tool has 3 crimping cavities. The cavity varies depending on the wire combination used for crimp. There are 3 types of splices for each combination of the crimp wire.
- The heat shrinkable tube (See Other supplied parts on P2-4.) has application of waterproof adhesive inside. It has functions of insulation from the external parts, sealing of water and protections from impact or friction.

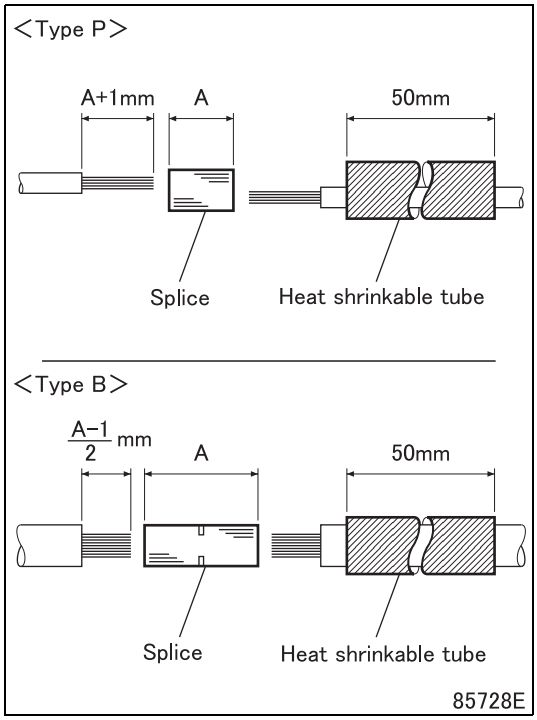
<Combination of wires and applicable splice>

Wire size	0.5	0.85	1.25	2	3	5
0.5	P-1.25	P-2	P-2	P-2	P-5.5	P-5.5
0.85	P-2	P-2	P-2	P-5.5	P-5.5	P-5.5
1.25	P-2	P-2	P-5.5	P-5.5	P-5.5	P-5.5
2	P-2	P-5.5	P-5.5	P-5.5	P-5.5	×
3	P-5.5	P-5.5	P-5.5	P-5.5	×	×
5	P-5.5	P-5.5	P-5.5	×	×	×

Splice		Identification at wire clamping tool crimp
Name	Part No.	
P-1.25	MK410134	1.25
P-2	MK410135	2
P-5.5	MK410136	5.5

CAUTION ⚠

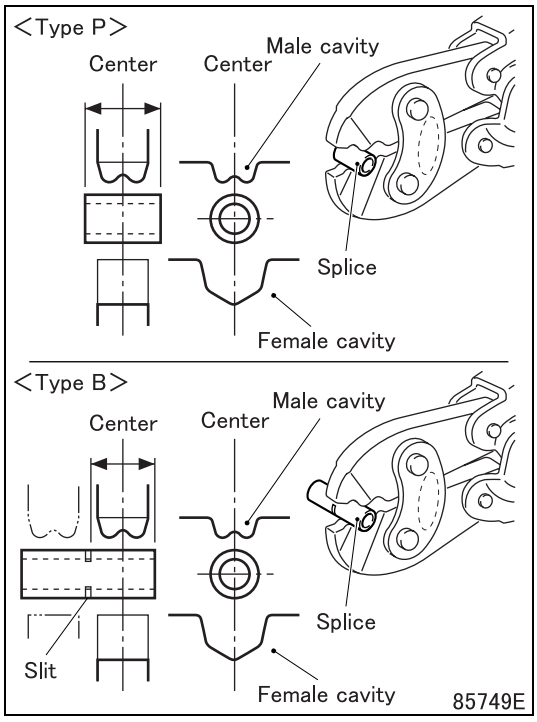
If the wire clamping tool is used frequently or incorrectly, the crimping cavities may be worn or deformed. The tool's crimping performance should be checked in accordance with JIS C 2805.



Slide a piece of heat shrinkable tube over the wire on one side, then strip the plastic insulation off the wire ends on both sides.
(See "5. Stripping insulation off wires" in P1-20.)

The heat shrinkable tube is available in the following two types:

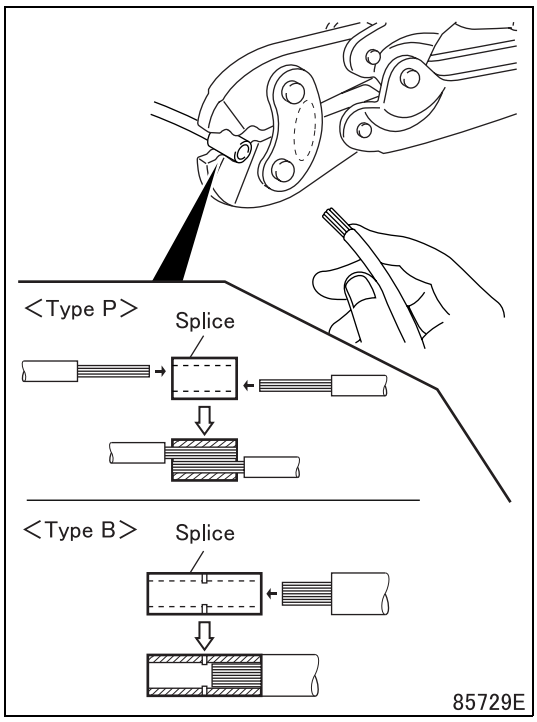
Heat shrinkable tube
MC037692 (Inner diameter: 7.4mm)
MK410770 (Inner diameter: 7.5mm)



- Open the jaws of the wire clamping tool to a sufficient width.
- Place the splice sleeve on the crimping section of the wire clamping tool as described below, then gradually close the handles until the sleeve is held securely.

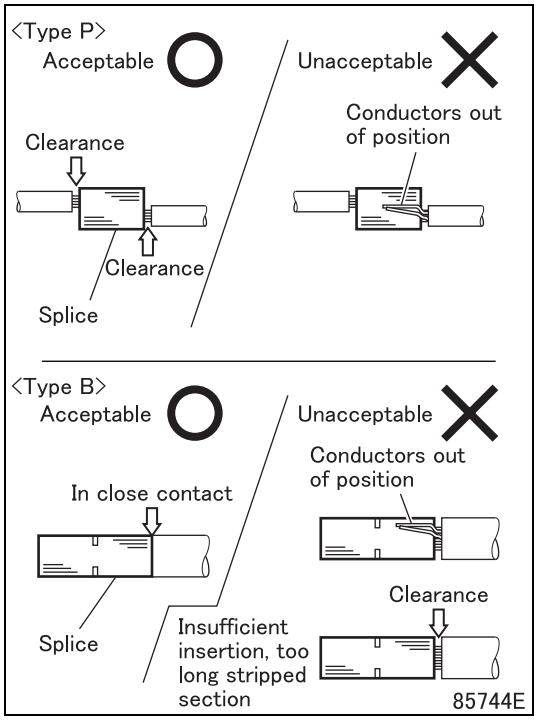
<Type P>
Center the splice on the crimping section of the tool.

<Type B>
Align the midpoint of one sleeve segment (section from sleeve end to center slit) with the longitudinal centerline of the tool.

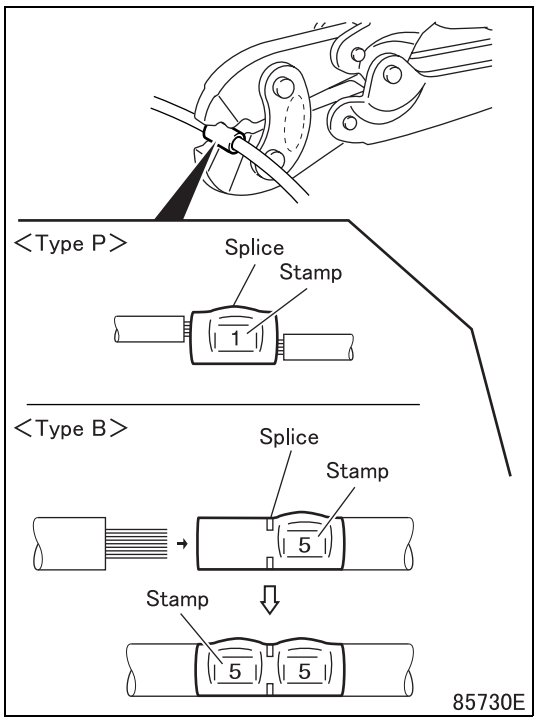


<Type P>
With the splice sleeve held in this position, insert the wires to be joined into the sleeve, one from each end, until the insulation-stripped sections of the wires overlap each other up to their root.

<Type B>
With the splice sleeve held in this position, insert each of the wires to be joined into the sleeve until the insulation comes in contact with the sleeve end face.



Condition judgment of wires inserted in splice.



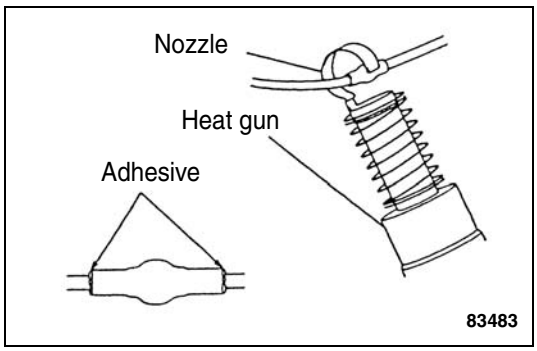
- Fully close the handles of the wire clamping tool. The handles will then come open again and the crimping operation will be complete.
- The area crimped with the wire clamping tool is stamped on the splice.

Area crimped	Stamp
1.25	1
2	2
5.5	5

- Make sure that the wire clamping force satisfies the values in the table below.

Wire size	0.5	0.85	1.25	2	3	5
Wire clamping force (N {kgf} or more)	88 {9}	125 {13}	165 {17}	245 {25}	345 {35}	390 {40}

<Type B>
Insert the other wire into the opposite end of the splice sleeve to crimp it in the same manner.



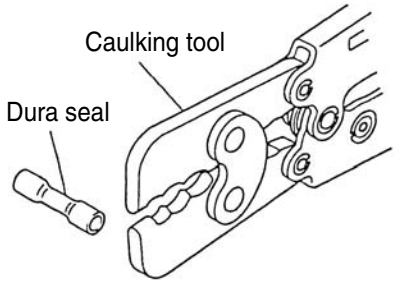
- Set the heat shrinkable tube at the center of the crimp cavity. Heat it with a heat gun (See Special tools on P2-2.) to shrink the heat shrinkable tube.

CAUTION ⚠

- **Heat the heat shrinkable tube until adhesive comes out from both ends of the tube.**
- **Since the nozzle temperature is high during heating, never touch the nozzle.**
- **Be sure to set the heat gun switch to "COLD" after heating to change hot air to cold air. After cooling the heat gun sufficiently, turn it "OFF".**

After crimping, check the following items:
- Check if the wire insulation is inside the heat shrinkable tube.
- Check if adhesive is coming out from the ends of the heat shrinkable tube.
- Check if the heat shrinkable tube is shrunk completely to the wire.
- Check if there is any damage or crack on the heat shrinkable tube.
- Check if the wire is deformed by heating.

2. Connection using crimp joint terminal with heat shrinkable tube <Dura seal>



The nylon heat shrinkable tube of the crimp joint terminal with heat shrinkable tube (hereinafter referred to as Dura seal. See Other supplied parts on P2-4.) has application of waterproof adhesive inside. It has functions of insulation from the external parts, sealing of water and protections from impact or friction.

- Select an appropriate Dura seal and the crimping cavity of the caulking tool (See Special tool on P2-2.) from the table below.
- The caulking tool has 3 crimping cavities. The cavity varies depending on the wire combination used for crimp. There are 3 types of Dura seals for each combination of the crimp wire

CAUTION ⚠

Use the Dura seal only for connection of wires with the same cross-section area.

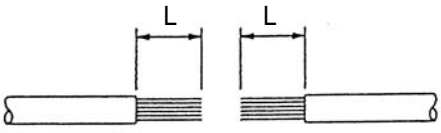
<Combination of wires and applicable Dura seal>

Wire size	0.5	0.85	1.25	2	3	5
0.5	Red	×	×	×	×	×
0.85	×	Red	×	×	×	×
0.25	×	×	Blue	×	×	×
2	×	×	×	Blue	×	×
3	×	×	×	×	Yellow	×
5	×	×	×	×	×	Yellow

Dura seal		Identification at caulking tool crimp	
Sleeve color	Part No.	Identification of crimping sections	Part No.
Red	MC037689	22-18 (Color: Red)	MC 037990
Blue	MC037984	16-14 (Color: Blue)	
Yellow	MC037985	12-10 (Color: Yellow)	

CAUTION ⚠

If the caulking tool is used frequently or incorrectly, the crimping cavities may be worn or deformed. The tool's crimping performance should be checked in accordance with JIS C 2805.

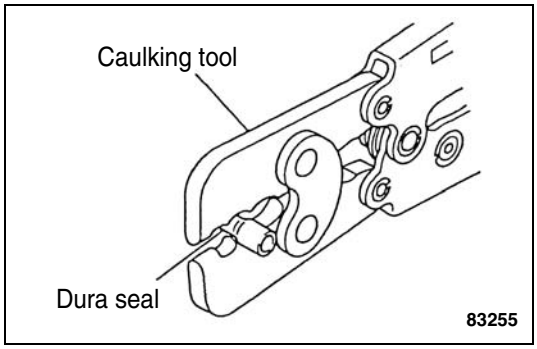


Stripe off the insulation of the wire.

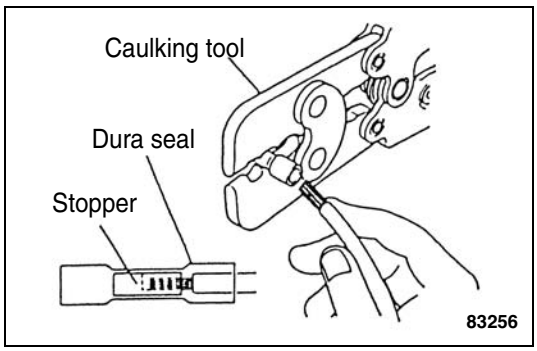
Wire size	L (mm)
0.5-2.0	7±0.5
3.0-5.0	8±0.5

CAUTION ⚠

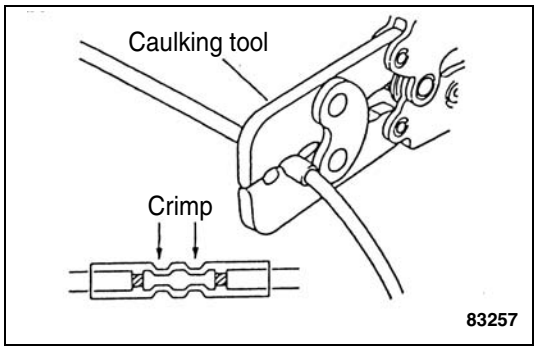
Be careful not to cut or damage any of the core strands when stripping off the insulation.



- Open the jaws of the wire clamping tool to a sufficient width.
- Place the Dura seal in the crimping cavity of the caulking tool with the same color, then gradually close the handles until the terminal is held securely.

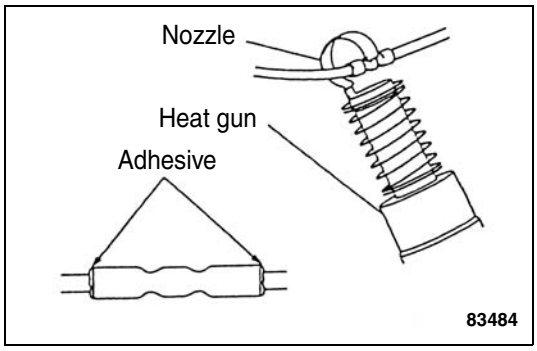


Insert the wires to be joined into the end of the Dura seal until the wire comes in contact with the stopper in the Dura seal.



- Fully close the handles of the caulking tool. The handles will then come open again and the crimping operation will be complete.
- Carry out the same steps at the opposite end.
- Make sure that the wire clamping force satisfies the values in the table below.

Wire size	0.5	0.85	1.25	2	3	5
Wire clamping force (N {kgf} or more)	88 {9}	125 {13}	165 {17}	245 {25}	345 {35}	390 {40}



Heat the Dura seal with a heat gun (See Special tools on P2-2.) for shrinking.

CAUTION ⚠

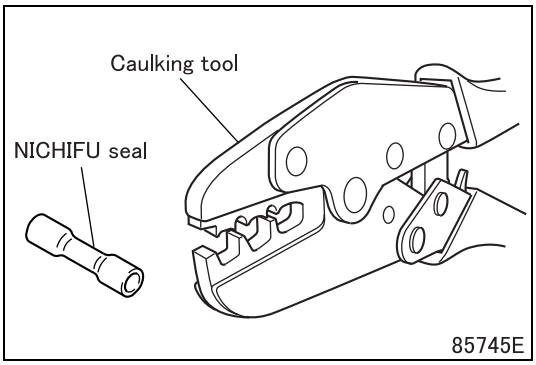
- **Heat the Dura seal until adhesive comes out from both ends of the Dura seal.**
- **Since the nozzle temperature is high during heating, never touch the nozzle.**
- **Be sure to set the heat gun switch to "COLD" after heating to change hot air to cold air. After cooling the heat gun sufficiently, turn it "OFF".**

After crimping, check the following items:
- Check if the wire insulation is inside the Dura seal.
- Check if adhesive is coming out from the ends of the Dura seal.
- Check if the Dura seal is shrunk completely to the wire.
- Check if there is any damage or crack on the Dura seal.
- Check if the Dura seal color is brown due to excessive heating.
- Check if the wire is deformed by heating.

REPAIR WORK

3. Connection using crimp joint terminal with heat shrinkable tube <NICHIFU seal>

• When caulking tool MH063570 is used:



The nylon heat shrinkable tube of the crimp joint terminal with heat shrinkable tube (hereinafter referred to as NICHIFU seal. See Other supplied parts on P2-4.) has application of waterproof adhesive inside. It has functions of insulation from the external parts, sealing of water and protections from impact or friction.

- Select an appropriate NICHIFU seal and the crimping cavity of the caulking tool (See Special tool on P2-2.) from the table below.
- The caulking tool has 3 crimping cavities. The cavity varies depending on the wire combination used for crimp. There are 3 types of NICHIFU seals for each combination of the crimp wire.

CAUTION ⚠

Use the NICHIFU seal only for connection of wires with the same cross-section area.

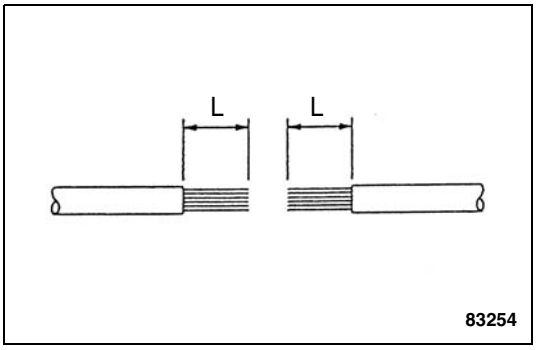
<Combination of wires and applicable NICHIFU seal>

Wire size	0.5	0.85	1.25	2
0.5	Yellow	×	×	×
0.85	×	Red	×	×
1.25	×	×	Red	×
2	×	×	×	Blue

Seal		Identification at caulking tool crimp	
Sleeve color	Part No.	Identification of crimping sections	Part No.
Yellow	MH063571	Color: Yellow	MH063570
Red	MH063572	Color: Red	
Blue	MH063573	Color: Blue	

CAUTION ⚠

If the caulking tool is used frequently or incorrectly, the crimping cavities may be worn or deformed. The tool's crimping performance should be checked in accordance with JIS C 2805.



Stripe off the insulation of the wire.

Wire size	L (mm)
0.5-2.0	7±0.5

CAUTION ⚠

Be careful not to cut or damage any of the core strands when stripping off the insulation.