A collection of case studies for such as recycle design that contribute towards improving the ease of dismantling end-of-life vehicles

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Japan ELV Recycler's Association

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Introduction

Automobile recycle business operators have been making progress with efficient dismantling and the proper disposal of automobiles in accordance with the Act on Recycling, etc. of End-of-Life Vehicles (hereafter, Automobile Recycling Law) enacted from January 2005. However, public opinion for the effective use of resources has increased even more such that it is necessary to accelerate initiatives with the aim of further promoting the reuse of resources and the advancement of recycling. Under these circumstances, automobile manufacturers have been aiming for the advancement of automobile recycling and have been working towards a recycle design that takes into consideration the ease of dismantling automobiles from around the year 2000. It is speculated that the number of end of life vehicles (ELV) influenced by these initiatives has increased in recent years. When dismantling operators are extensively aware of and use this type of recycle design, which automobile manufacturers are working on, it is believed that it will lead to the effective use of resources.

In contrast, the Industrial Structure Council Industrial Technology and Environment Subcommittee Waste and Recycling Subcommittee Automobile Recycling WG/ Central Environment Council Recycling Society Subcommittee Automobile Recycling Special Committee Joint Meeting collated a “Report for the Assessment and Examination on the Enforcement of the Automobile Recycling System” at the 10th anniversary following the enactment of the Automobile Recycling Law. This report considered “3R promotion and quality improvement for automobiles” as one of the fundamental directions, and included the “Promotion of environment-friendly design and its use” as a specific initiative. This report shows that it is necessary for dismantling operators and automobile manufacturers and similar enterprises to cooperate and move forward with the efficient introduction of environment-friendly design (otherwise known as Design for Environment or DfE) and share their information, and then continuously conduct follow-up for these activities. Furthermore, in a report compiled by the “Investigation committee for the 3R promotion and quality improvement for automobile recycling” established after receiving the joint council report, it clearly states cooperative-based promotion between automobile manufacturers and dismantling operators, and includes the promotion of effective DfE introduction based on (1) raising awareness of DfE information with dismantling operators and promoting efficient dismantling by such operators, and (2) actual work conditions by providing feedback of opinions from the dismantling process to the design process.

Under these circumstances, with the assistance of J-FAR and the aim of building a common understanding for recycle design between dismantling operators and automobile manufacturers, JAERA has now decided to create a collection of recycle design case studies organized into good examples of recycle design and dismantling that can be easily used by dismantling operators. This document is a collection of recycle design information achieved with the cooperation of the Japan Automobile Manufacturers Association (JAMA) and provides information based on our investigation of recycle design awareness and good examples after conducting interviews and extensive questionnaires with many dismantling operators. We would like to take this opportunity to thank everyone who helped create this document, and hope that it will further stimulate communication between dismantling operators and automobile manufacturers.

Japan ELV Recycler’s Association

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1. Overview

1.1. About this project

This document was created as part of a grant project from the Japan Foundation for Advanced Auto Recycling (J-FAR). The aim of this project was to disseminate recycle design for automobiles and it included the investigation and sorting of recycle design examples for automobile manufacturers, questionnaire surveys concerning dismantling operator awareness and effectiveness of recycle design, and interviews with dismantling operators about recycle design. This document was then created based on these tasks.

We have selected items that companies need to be particularly very aware of from among initiatives concerning recycle design at automobile manufacturers, and have introduced these using diagrams and photos in this document. Furthermore, we have provided an overall picture of initiatives at automobile manufacturers on pages 8-9 where it was not possible to introduce the specifics of these initiatives so please refer to this page along with the rest of the document.

In addition to continuing our discussions with JAMA, which continues to be a partner, concerning issues relating to design and such matters identified during questionnaires and interviews with dismantling operators, we have also introduced good examples from dismantling operators on page 40 and onwards for examples in which individual dismantling operators have resolved some issues by means of their own initiative.

We hope that recycle design by automobile manufacturers and these initiatives from individual dismantling operators will be of use and lead to an improvement in dismantling efficiency.

Details of this project are scheduled to be published on the J-FAR website around June 2021 as a project report.

* Japan Foundation for Advanced Auto Recycling (J-FAR) website
https://j-far.or.jp/

<Investigation conducted for this project>

Content	Overview
Questionnaire Survey	[Survey period] Questionnaires collected during September 7, 2020 - December 4, 2020 [Survey method] Mail survey (responses were requested by telephone after sending) [Number of companies targeted] 3,476 operators registered in the automobile recycling system [Number of companies who responded] 447 (collection rate of 12.9%) [Survey content] (1) Awareness of recycle design design of automobile manufacturers (2) Effectiveness of recycle design of automobile manufacturers (3) Improvement requests for such as design that leads to improvements in ease of dismantling
Interviews	[Survey period] September 10, 2020 - November 16, 2020 (total of 9 times) [Survey method] Group interviews using web conferencing [Number of companies targeted] Total of 84 people from 71 companies who are Japan ELV Recycler's Association members [Question content] (1) Opinions on recycle design of automobile manufacturers (2) Improvement requests for such as design that leads to improvements in ease of dismantling (3) Initiatives from dismantling operators that leads to improvements in ease of dismantling

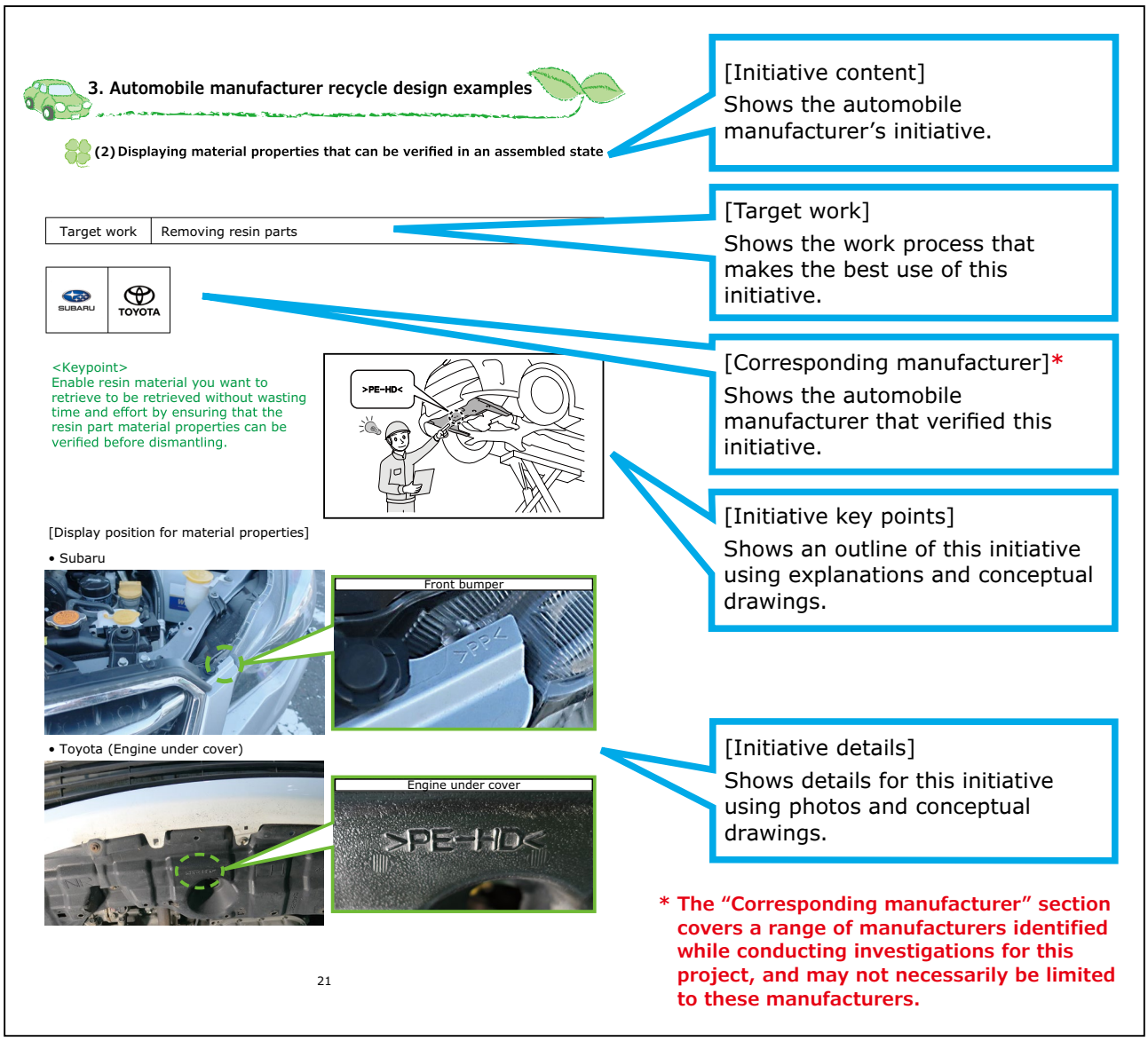
1.2. Structure of this document

An outline of the questionnaire for dismantling operators conducted during this project can be found in section “2. Recycle design by automobile manufacturers” (pages 8 to 13). This section lists improvement requests concerning such as automobile design, and recycle design awareness and effectiveness as provided in the responses from all dismantling operators.

Furthermore, section “3. Examples of recycle design by automobile manufacturers” (pages 14 to 38) lists items that companies need to be highly aware of in particular from among the recycle design examples collected during this project. Each example has been organized by the automobile manufacturer’s initiative content with such factors as the target work, corresponding manufacturer, initiative point, and images of initiative content.

Section “4. Good examples of dismantling operators” (pages 40 to 47) introduces examples where initiatives from individual operators resolved issues relating to such things as design for which we received opinions about during the questionnaire and interviews stage. Therefore, we hope you will take a look at this information. We would also like to take this opportunity to thank those operators who provided this information.

<How to read the recycle design examples>



2. Automobile manufacturer recycle design

2.1. Awareness and effectiveness of recycle design

The table below shows recycle design targeted by this project.

We investigated the “awareness” and “effectiveness” of each of these initiatives as part of this study.

<Recycle design targeted by this project>

No.	Initiative content	Target parts
1	Providing information by means of a service manual	Power control unit, wire harness, fuel tank, etc.
2	Providing information relating to secondary dismantling jigs	Various computers
3	Providing information relating to dismantling jigs & tools	Various compact motors
4	Providing information for dismantling methods	Traction battery/power storage system
5	Material properties markings based on ISO	Resin parts of 100 g or more, Rubber parts of 200 g or more
6	Displaying material properties in multiple locations on long resin parts	Bumper, instrument panel
7	Displaying material properties that can be verified in an assembled state	Engine under cover
8	Displaying positions where parts are easy to detach (Marks for improved dismantling)	Bumper, instrument panel, trims, fuel tank, air bag, traction battery, etc.
9	Displaying positions where parts are easy to detach (Tape for improved dismantling)	Wire harness
10	Clearly indicating locations to drain liquids	Waste oil and waste liquids
11	Setting labels for mounting positions	Lead-acid battery/traction battery/power storage system (HV, PHV and FCV only)
12	Improving visibility for installation areas	Fuel tank
13	Improving visibility for fastening areas	Heater unit, meter, radar, instrument panel, air bag
14	Improving visibility for extraction ports/valves	Fluorocarbon
15	Improving separability of plating parts	Bumper
16	Ability to retrieve just the motor unit	Various compact motors
17	Ability to directly remove the tank alone	Fuel tank
18	Improving the ease at which parts can be detached (such as the addition of slits)	Carpet
19	Displaying positions where parts are easy to detach (finger hook positions)	Door trims
20	Prohibiting fastening from the transverse direction (improving workability when tires are present)	Engine under cover
21	Using pads with no insertion	Front seat
22	Improving access to batch operation connectors	Air bag
23	Setting flat surface areas for leak prevention	Fuel tank
24	Secure demolition space	Various computers, heater unit, meter, air bag

<Investigation conducted for this project>

No.	Initiative content	Target parts
25	Maintaining extraction space	Fluorocarbon, waste oil and waste liquids
26	Setting the fastening areas at a position that is easy to see and access	Various compact motors
27	Setting wiring routes that consider detachment	Wire harness
28	Arranging Hi/Lo valves in close proximity	Fluorocarbon
29	Reducing the number of fastening points	Various interior parts, air bag, lead-acid battery, etc.
30	Improving the ease at which parts can be detached (such as reducing the thickness of fastening areas)	Bumper, instrument panel
31	Improving the ease at which parts can be detached (improving the structure of fastening areas)	Wire harness
32	Ability to remove without tools	Weather stripping, door glass run
33	Changing to fastening with clips	Bumper, back door
34	Prohibiting such as metal inserts and embedded bolts	Bumper, edge protection
35	Regulating the types of bolts and securing clips, etc.	Fender liner, Radiator grill, under cover, various trims, etc.
36	Setting securing bolt shapes that match the hub nut size	Spare tire
37	Avoiding bonded component parts and rivet fastened structures	Radiator grill
38	Not using adhesive when attaching such as different materials	Instrument panel, door trims, other trims, instrument cluster
39	Changing to fastening with fitting structures and clips, etc.	Cowl louver, door trims, center cluster
40	Standardize materials (change to single material)	Bumper, interior parts
41	Using general-purpose material for aluminum wheels used by other companies	Tires, wheels
42	Sealant and insulation material with same material properties as main body	Heater duct
43	Improving ability to drain liquids	Engine, power control unit
44	Regulating the volume and time for draining liquids	Waste oil and waste liquids
45	Ability to directly remove the rear bumper	Bumper
46	Structures that can be disassembled on the inside	Headlights
47	Binding with tubes and tape to prevent parts from unraveling or coming apart	Wire harness
48	Reducing the number of component parts (such as welding the defroster duct)	Instrument panel
49	No edges or burrs on the bottom of the seat	Front seat
50	Setting a notch in the frame unit pad for the frame integrated foam pad	Rear seat
51	Setting a position to grip for dismantling	Rear seat

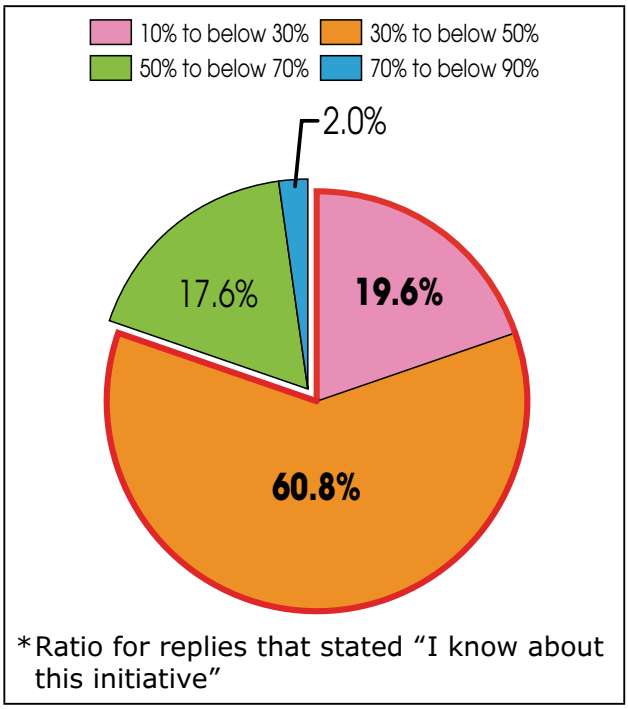
2. Automobile manufacturer recycle design

The investigation results clearly showed that dismantling operators are not always aware of automobile manufacturer recycle design. Out of the 51 initiatives that were investigated, no initiatives were below 10% for awareness, but 41 initiatives were under 50% for awareness, which was the majority of the initiatives.

Meanwhile, for the effectiveness, 47 initiatives were evaluated to be more than 50% as effective initiatives by operators (or seemed to be effective initiatives), and it was considered highly likely that this contributed to efficient dismantling even though awareness was low.

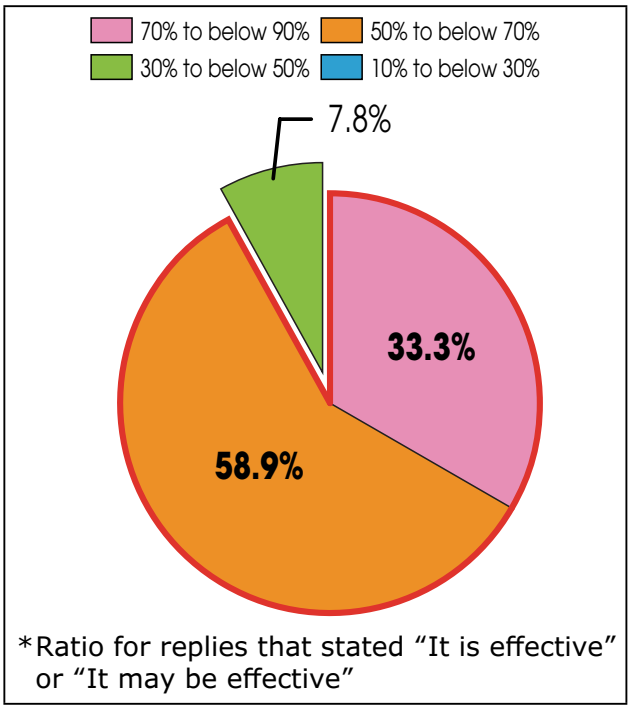
In particular, efforts to dismantle and dispose of parts that many businesses are required to dismantle and dispose of, such as fluorocarbon, air bags, waste oil and liquids, storage batteries, and wire harnesses tend to be highly evaluated.

<Awareness (Total of 51 initiatives)>



*Ratio for replies that stated “I know about this initiative”

<Effectiveness (Total of 51 initiatives)>



*Ratio for replies that stated “It is effective” or “It may be effective”

<Initiatives for which the reply was “It is effective” from dismantling operators (top 10 initiatives)>

No.	Initiative details	Target parts	Effec-tiveness
1	Maintaining extraction space	Fluorocarbon, waste oil and waste liquids	82.0%
2	Providing information for dismantling methods	Traction battery/power storage system	81.0%
3	Improving visibility for extraction ports/valves	Fluorocarbon	79.9%
4	Improving the ease at which parts can be detached (improving the structure of fastening areas)	Wire harness	79.2%
5	Arranging Hi/Lo valves in close proximity	Fluorocarbon	77.9%
6	Improving access to batch operation connectors	Air bag	77.6%
7	Setting wiring routes that consider detachment	Wire harness	77.5%
8	Setting labels for mounting positions	Lead-acid battery/traction battery/power storage system	76.4%
9	Improving the ease at which parts can be detached (such as reducing the thickness of fastening areas)	Bumper, instrument panel	75.7%
10	Ability to directly remove the rear bumper	Bumper	74.8%

2.2. Improvement requests for automobile design

There were many requests as shown mostly in the table below during the questionnaire. Similar requests were identified during interviews with dismantling operators so we believe that many dismantling operators have a shared awareness of the problems they face.

We intend to continue initiatives towards improving the ease of dismantling with each automobile manufacturer through JAMA for these improvement requests from dismantling operators.

Some specific examples that are issues when dismantling are introduced on the next page.

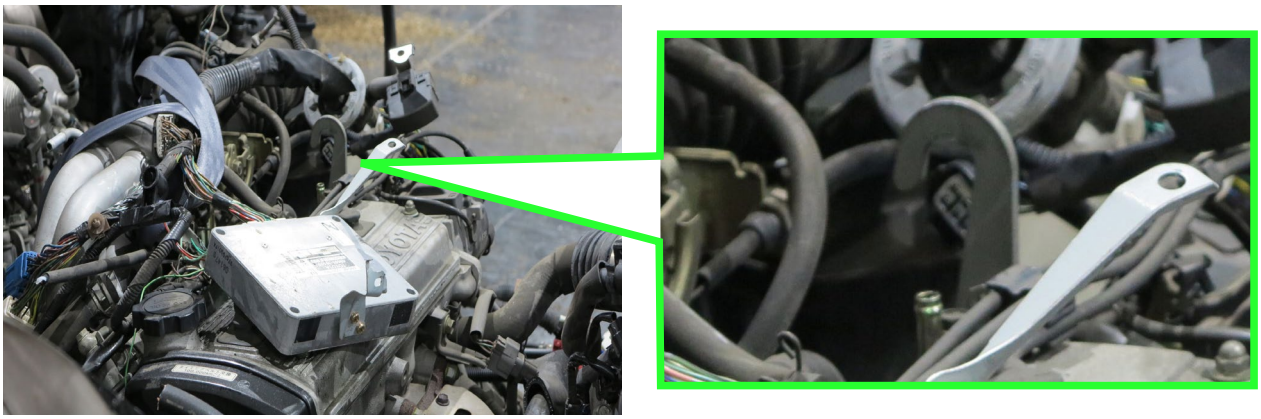
<Improvement requests from dismantling operators>

Target parts	Improvement requests
Bumper	Improve visibility of raw material information (enlarge the display, clarify and fix displayed positions, etc.)
	Design to ensure minimal damage during removal (break-off prevention, etc.)
	Strengthen installation and fitting areas
Bonnet hood	Clarify material properties information for such as iron and aluminum
	Reduce uneven surfaces (improve safety)
Headlights	Improve visibility of raw material information (enlarge the display, clarify and fix displayed positions, etc.)
	Improve separability of harnesses
Fender	Clarify material properties information for such as iron and aluminum
Back door	Improve separability of harnesses and motors
	Clarify material properties information for such as iron, aluminum and resins
Tires, wheels	Standardize screws and wheel nuts
Engine	Add engine hooks
	Improve separability of harnesses
	Improve separability of mounts
Catalyst	Display at positions where numbers are highly visible
	Set up as single parts (separate from pipes)
Various computers	Standardize installation positions
	Show part name on exterior
	Improve separability from electronic board
Various compact motors	Improve access
Wire harness	Provide measures for aluminum harnesses (make it easy to identify)
	Improve visibility for cover tube and tape colors
Instrument panel	Improve visibility of raw material information (enlarge the display, clarify and fix displayed positions, etc.)
	Improve separability of harnesses
Door trims	Improve visibility of raw material information (enlarge the display, clarify and fix displayed positions, etc.)
	Improve separability of harnesses when using heavy dismantling machinery
Fluorocarbon	Improve valve positions (easy to know positions)
Air bag	Improve access to air bag computer
	Standardize air bag computer installation position
	Improve the ease at which parts can be removed
Waste oil and waste liquids	Improve drain positions (easy to drain positions)
Traction battery	Devise a setup that is easy to lift (concern for dismantling using a forklift truck)
	Improve the ease at which parts can be removed
Caution plate	Standardize installation positions

2.3. Examples of improvement requests

(1) Add engine hooks

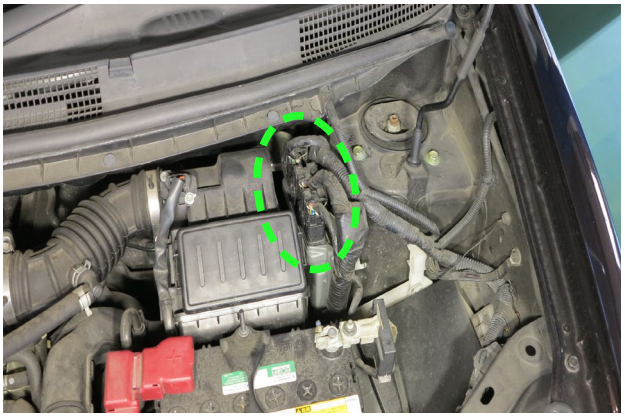
Vehicles that already have engine hooks installed on them from the start enable the engine to be transported from the vehicle more safely and efficiently when performing this task.



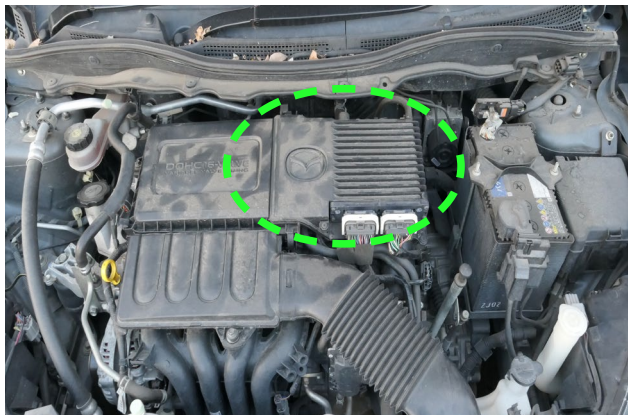
(2) Standardize the engine computer installation position

When the engine computer installation position has been standardized, it can be retrieved more efficiently.

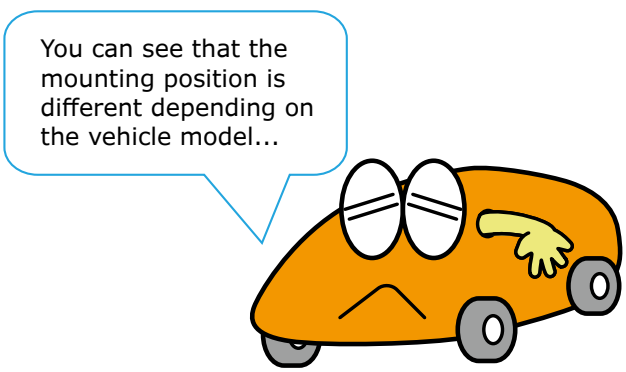
- Installation position; Inside engine room



- Installation position: Engine

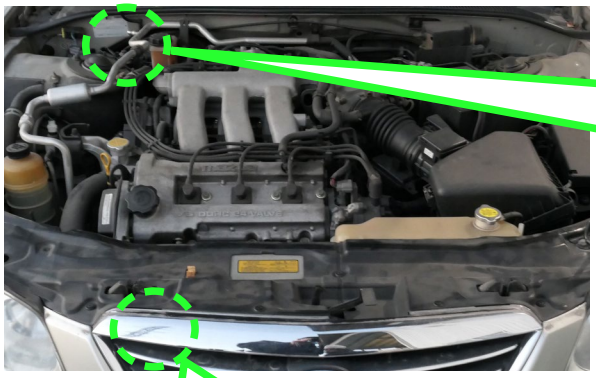


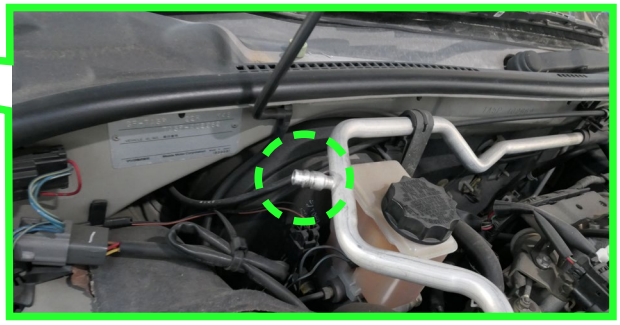
- Installation position; Inside dashboard (passenger seat side)

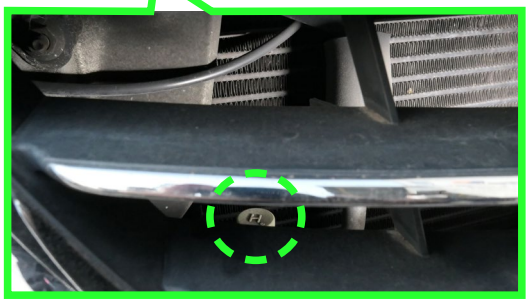


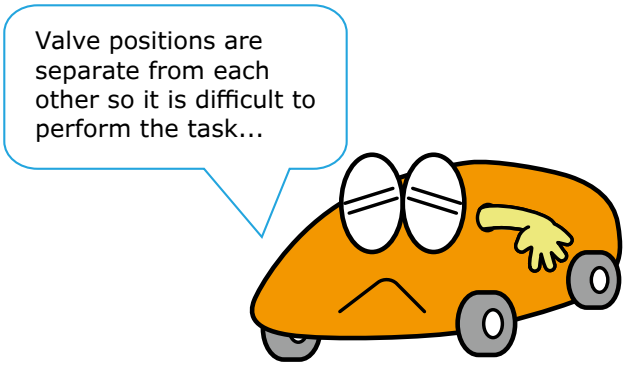
(3) Improve valve positions on the air conditioning pipes

When the high-pressure valve and low-pressure valve on the air conditioning pipes are set close to each other, the worker can simultaneously connect a collecting machine so this allows fluorocarbon to be collected efficiently.



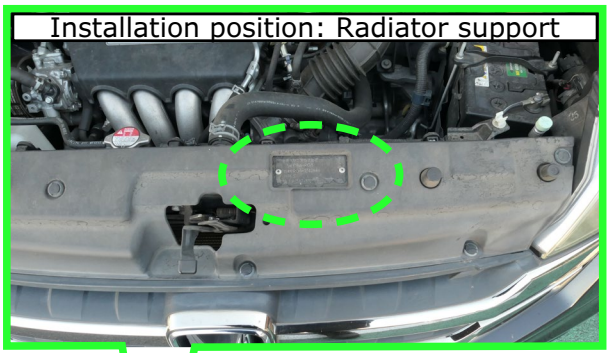


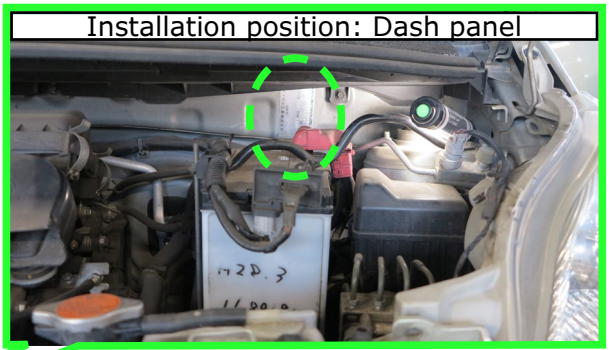


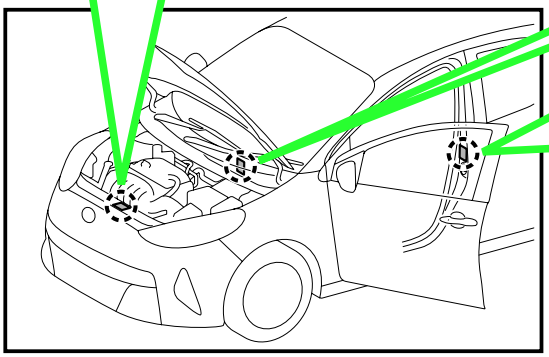


(4) Standardize caution plate installation positions

When caution plate installation positions have been standardized, this improves efficiency when identifying the vehicle model.







3. Automobile manufacturer recycle design examples

This section includes the following recycle design examples.

No.	Initiative details	Target parts
3.1.(1)	Providing information relating to secondary dismantling jigs & tools	Various computers
3.1.(2)	Providing information relating to dismantling jigs & tools	Various compact motors
3.1.(3)	Providing information for dismantling methods	Traction battery/power storage system
3.2.(1)	Displaying material properties in multiple locations on long resin parts	Bumper, instrument panel
3.2.(2)	Displaying material properties that can be verified in an assembled state	Bumper, engine under cover
3.2.(3)	Setting positions where parts are easy to detach (Marks for improved dismantling)	Bumper, instrument panel
3.2.(4)	Setting positions where parts are easy to detach (finger hook positions)	Door trims
3.2.(5)	Setting positions where parts are easy to detach (Tape for improved dismantling)	Wire harness
3.2.(6)	Clearly indicating locations to drain liquids	Waste oil and waste liquids
3.2.(7)	Setting labels for mounting positions	Lead-acid battery/traction battery/ power storage system
3.3.(1)	Ability to directly remove the tank alone	Fuel tank
3.3.(2)	Improving access to batch operation connectors	Air bag
3.4.(1)	Setting wiring routes that consider detachment	Wire harness
3.4.(2)	Arranging Hi/Lo valves in close proximity	Fluorocarbon
3.5.(1)	Improving the ease at which parts can be detached (such as reducing the thickness of fastening areas)	Bumper, instrument panel
3.5.(2)	Improving the ease at which parts can be detached (improving the structure of fastening areas)	Wire harness
3.5.(3)	Ability to remove without tools	Weather stripping, door glass run
3.5.(4)	Changing to fastening with clips	Bumper, back door
3.5.(5)	Setting securing bolt shapes that match the hub nut size	Spare tire
3.5.(6)	Changing to fastening with fitting structures and clips, etc.	Cowl louver, door trims, center cluster
3.6.(1)	Ability to directly remove the rear bumper	Bumper
3.6.(2)	Setting flat surface areas for leak prevention	Fuel tank

3. Automobile manufacturer recycle design examples

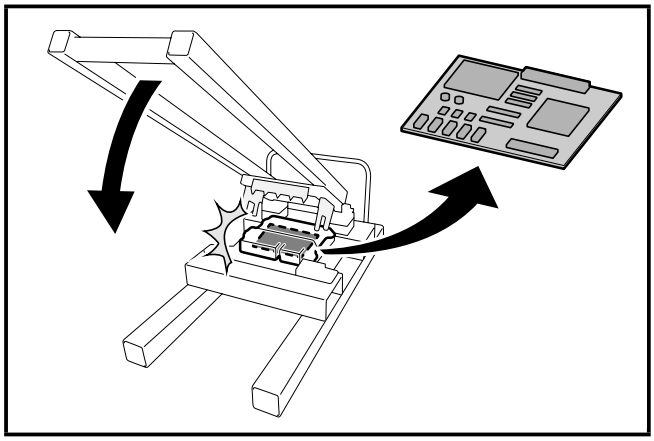
3.1. Providing information for dismantling methods

(1) Providing information relating to secondary dismantling jigs & tools

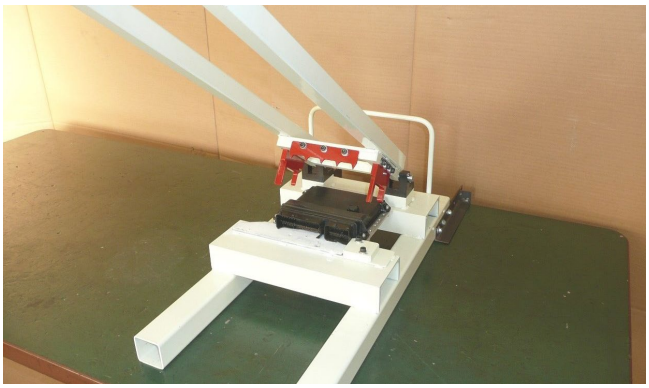
Target work	Removing the computer electronic board

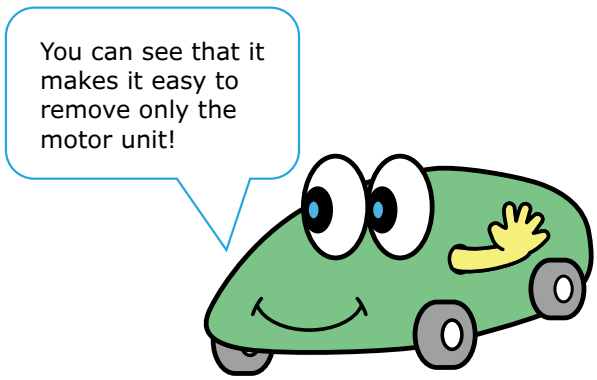
TOYOTA

<Keypoint>
Devise a jig that presses onto and cuts the bonded resin case using a single action so that the electronic board can be retrieved efficiently.

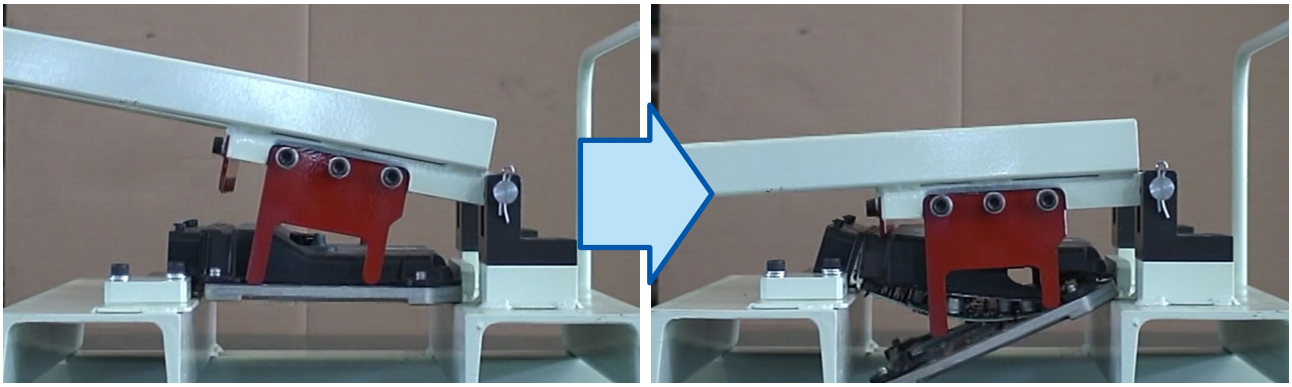


[Computer dismantling jig]





[Computer dismantling work]

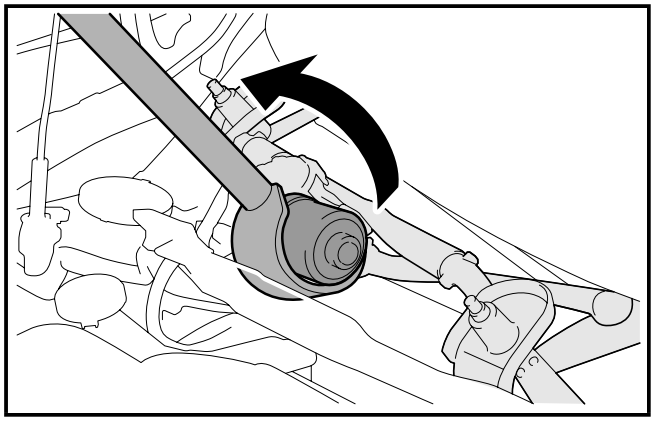


(2) Providing information relating to dismantling jigs & tools

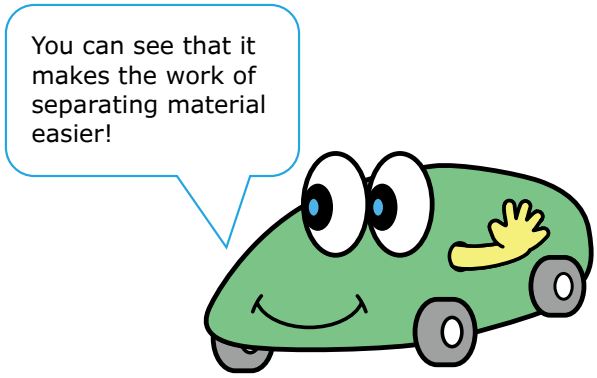
Target work	Removing compact motors

TOYOTA

<Keypoint>
Devise a dismantling jig that simply twists the motor unit from the wiper motor ASSY so that the copper wire coil can be retrieved efficiently.



[Compact motor dismantling jig]



[Compact motor dismantling work]

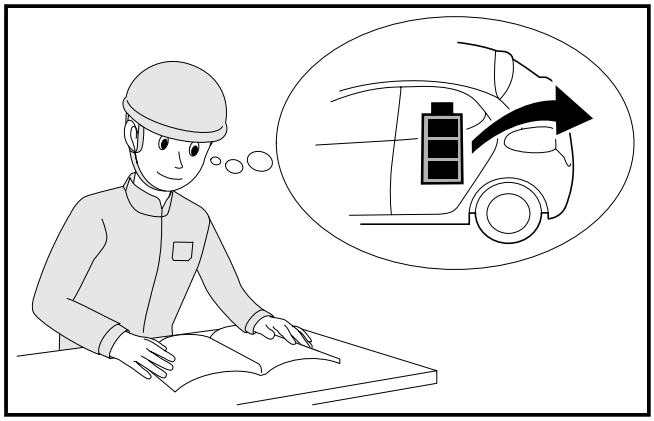
3. Automobile manufacturer recycle design examples

(3) Providing information for dismantling methods

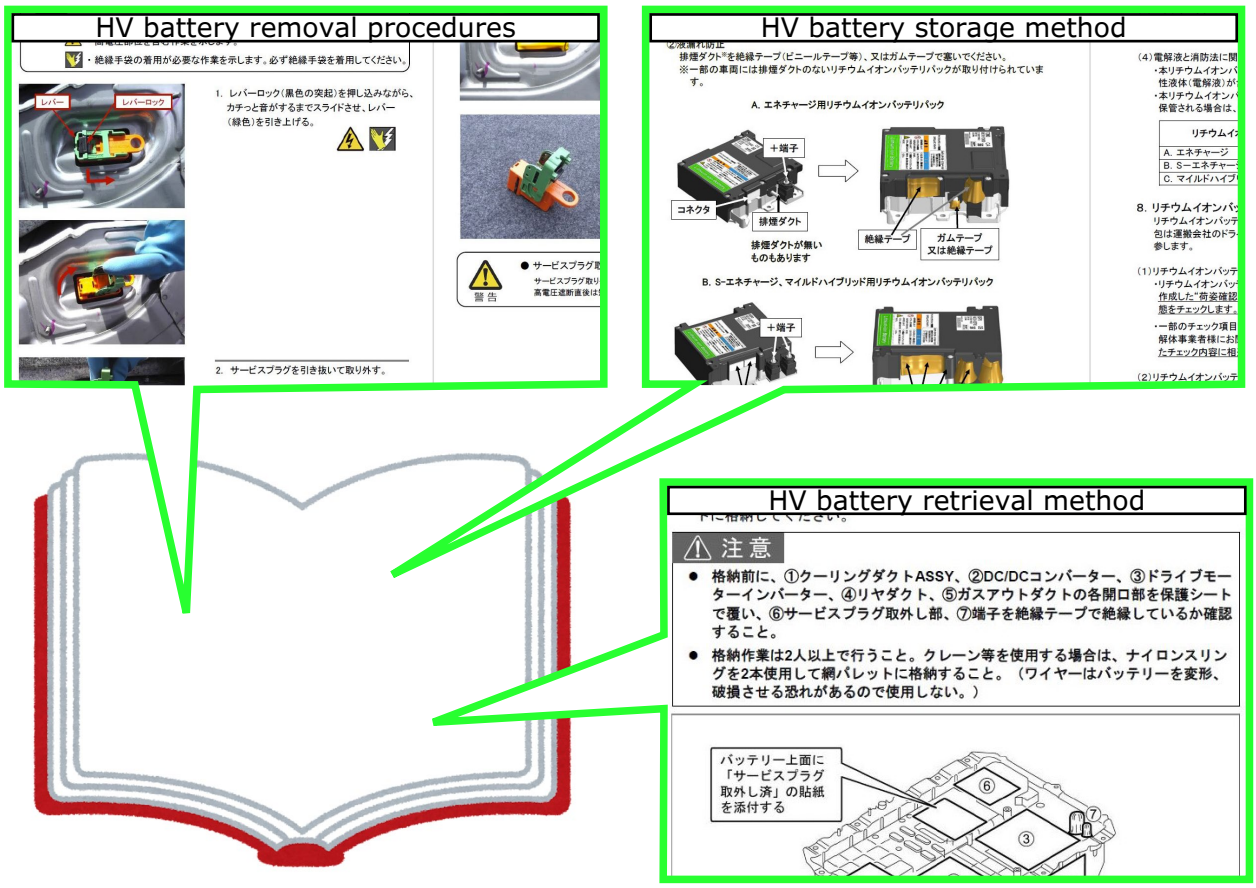
Target work	Removing the traction battery

SUZUKI | SUBARU | DAIHATSU | TOYOTA | NISSAN | HONDA | mazda | MITSUBISHI MOTORS | HINO

<Keypoint>
Issue a manual to retrieve the secondary traction battery so that it can be removed safely and reliably.



[Retrieval manual]



3. Automobile manufacturer recycle design examples

You can find detailed information at the URLs shown below for recycling traction batteries that require proper disposal from automobile manufacturers.

<Recycle information for traction batteries>

* Information is current as of the end of February 2021

Manufacturer	URL
Suzuki	https://www.suzuki.co.jp/about/csr/recycle/traders/
Subaru	https://www.subaru.co.jp/products/recycle-lithium.html
Daihatsu	https://www.daihatsu.com/jp/csr/environment/recycle/hv-recycle.html
Toyota	https://global.toyota/jp/sustainability/esg/challenge2050/challenge5/proper-disposal/
Nissan	https://www.nissan-global.com/JP/ENVIRONMENT/A_RECYCLE/BATTERY/
Honda	https://www.honda.co.jp/auto-recycle/recycle_07.html
Mazda	https://www.mazda.com/ja/csr/recycle/lithium/
Mitsubishi	https://www.mitsubishi-motors.com/jp/sustainability/environment/recyclelow/battery.html
Hino	https://www.hino.co.jp/ts/after_service/hv_battery_recycle/

<Reference> You can also use the following web page to check the manufacturer URLs.
JARP website http://www.jarp.org/duties/lib/

3. Automobile manufacturer recycle design examples

We also provide a rescue manual as reference information to perform dismantling work safely on vehicles that were involved in an accident.

You can find rescue manuals from automobile manufacturers at the URLs shown below.

<Rescue manual information>

* Information is current as of the end of February 2021

Manufacturer	URL
Suzuki	https://www.suzuki.co.jp/car/afterservice/rescuemanual/
Subaru	https://www.subaru.co.jp/products/rescue-hybrid.html
Toyota	https://global.toyota/jp/your-vehicle/quick-reference-sheet/
Nissan	https://www.nissan-global.com/JP/SAFETY/RESCUE/
Honda	https://www.honda.co.jp/rescue-auto/
Mazda	https://www.mazda.co.jp/carlife/owner/advice/rescue/
Mitsubishi	https://www.mitsubishi-motors.co.jp/support/rescue/
Hino	https://www.hino.co.jp/ts/after_service/hv_resucue/

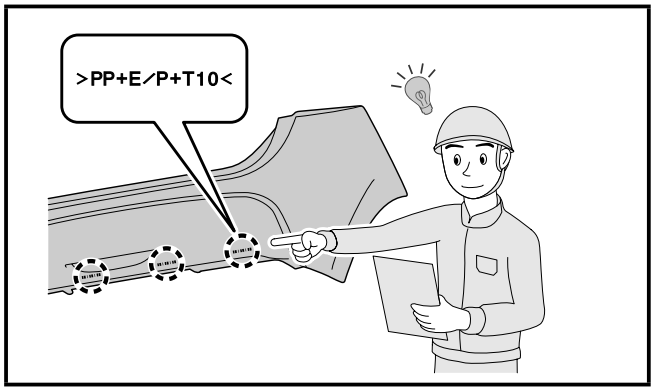
3.2. Improving visibility for when separating parts from vehicles

(1) Displaying material properties in multiple locations on long resin parts

Target work	Removing resin parts

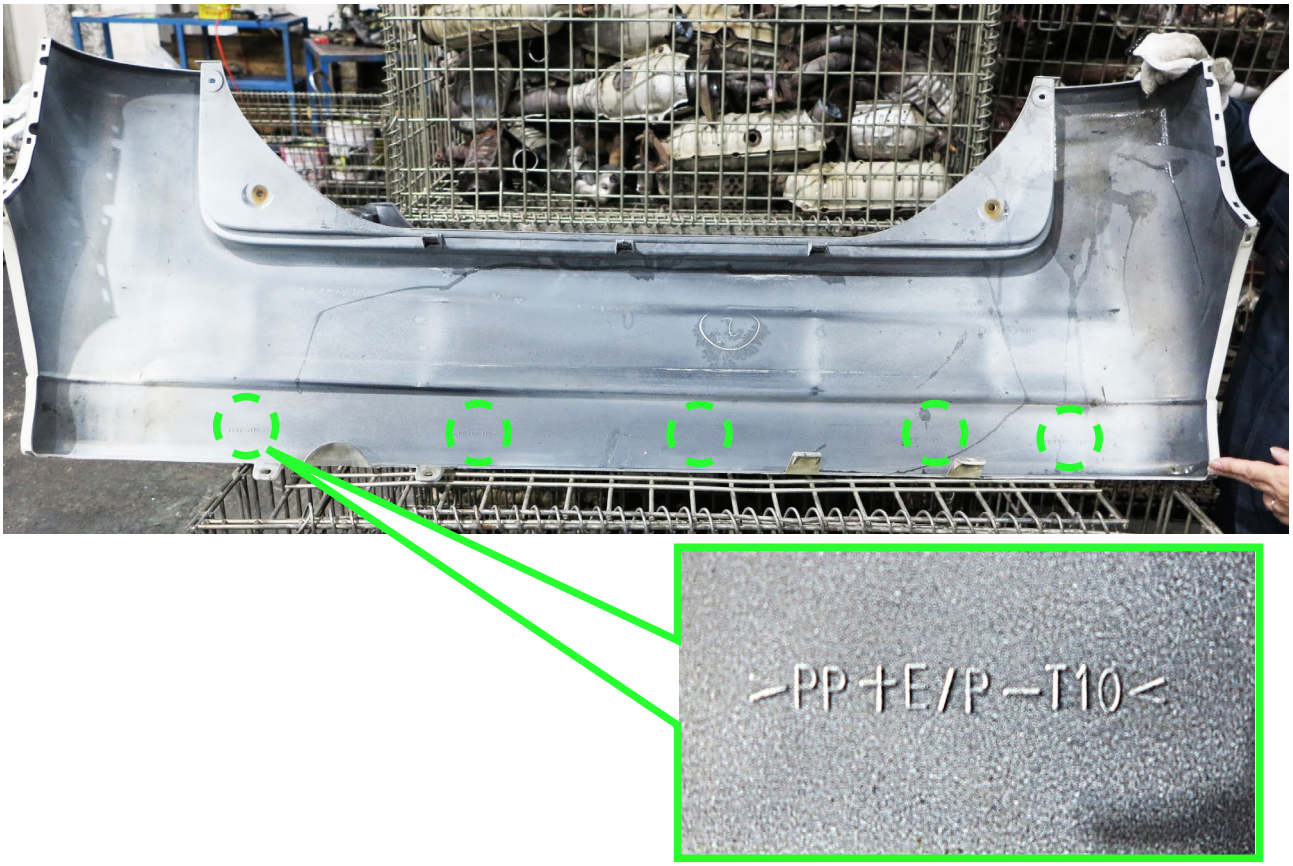
SUBARU | DAIHATSU | TOYOTA | HONDA

<Keypoint>
Set material properties indicators so that the material properties of retrieved resin parts can be easily verified by displaying such indicators at regular intervals on the flat surface of the part.



[Display position for material properties]

- Rear bumper

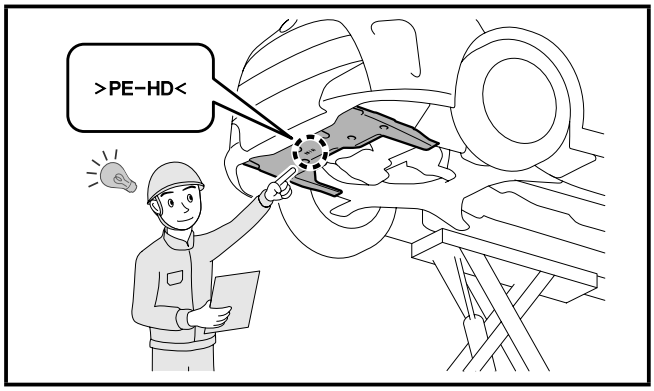


(2) Displaying material properties that can be verified in an assembled state

Target work	Removing resin parts

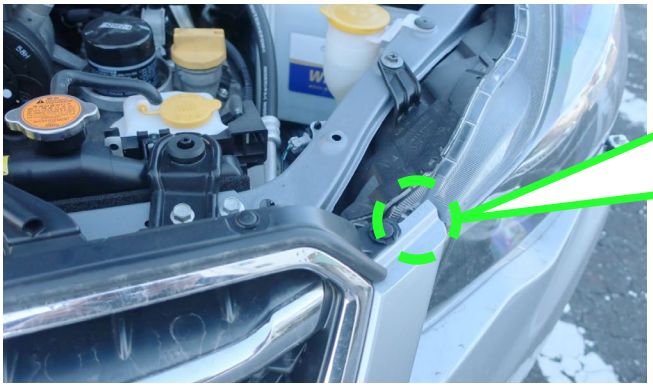
SUBARU | TOYOTA

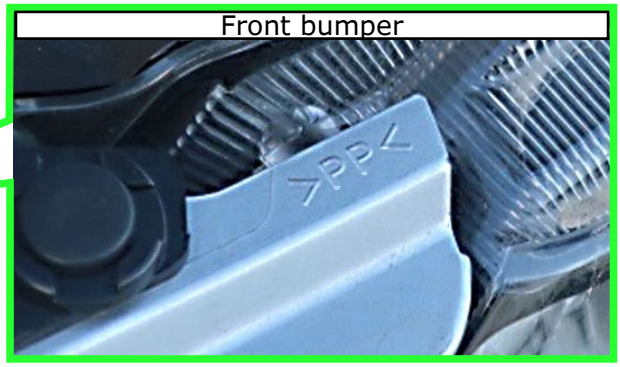
<Keypoint>
Enable resin material you want to retrieve to be retrieved without wasting time and effort by ensuring that the resin part material properties can be verified before dismantling.



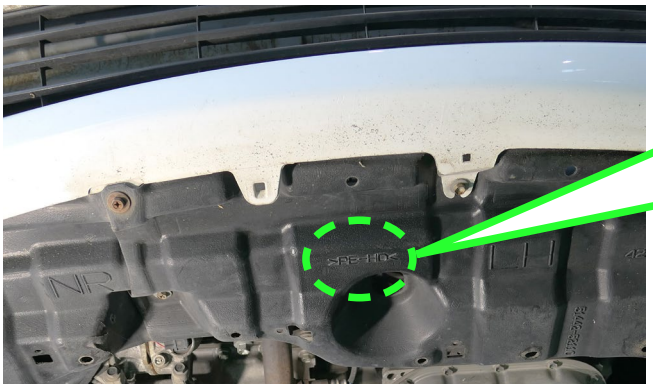
[Display position for material properties]

• Subaru





• Toyota (Engine under cover)

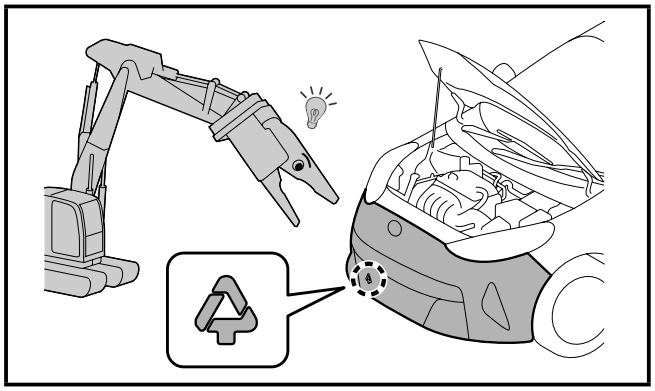


(3) Displaying positions where parts are easy to detach (marks for improved dismantling)

Target work	Removing bumpers

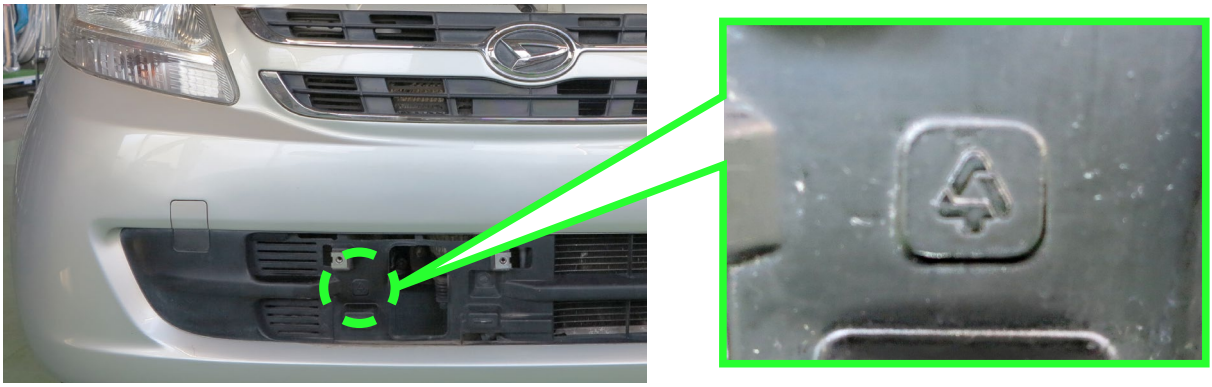
DAIHATSU TOYOTA

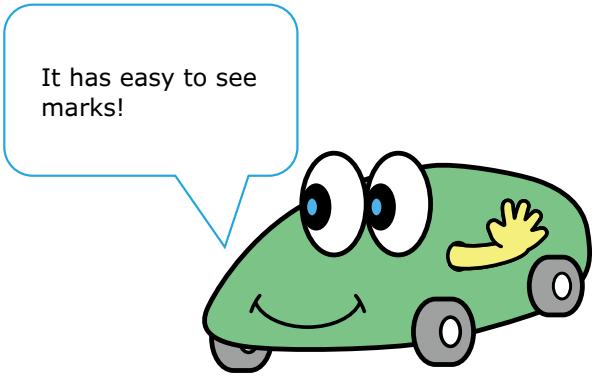
<Keypoint>
Set marks for improved dismantling to indicate the position where parts can be easily retrieved by detaching them or similar action.



[Display position for material properties]

- Front bumper



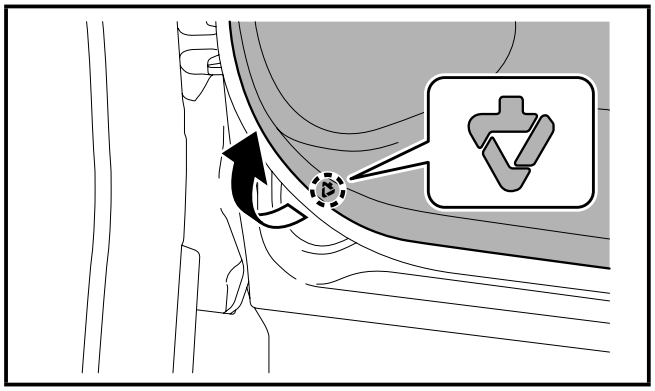


(4) Displaying positions where parts are easy to detach (finger hook positions)

Target work	Detaching door trims

DAIHATSU TOYOTA

<Keypoint>
Clearly indicate locations where there is sufficient space for fingers to enter to start detaching door trims when performing this task.



[Display finger hook positions]

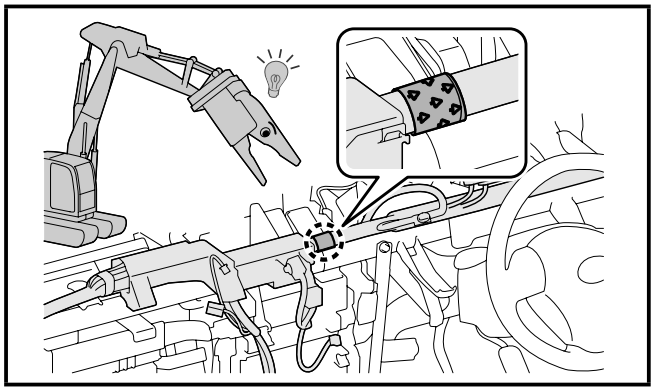
[When performing work to detach parts]

(5) Displaying positions where parts are easy to detach (tape for improved dismantling)

Target work	Detaching wire harnesses

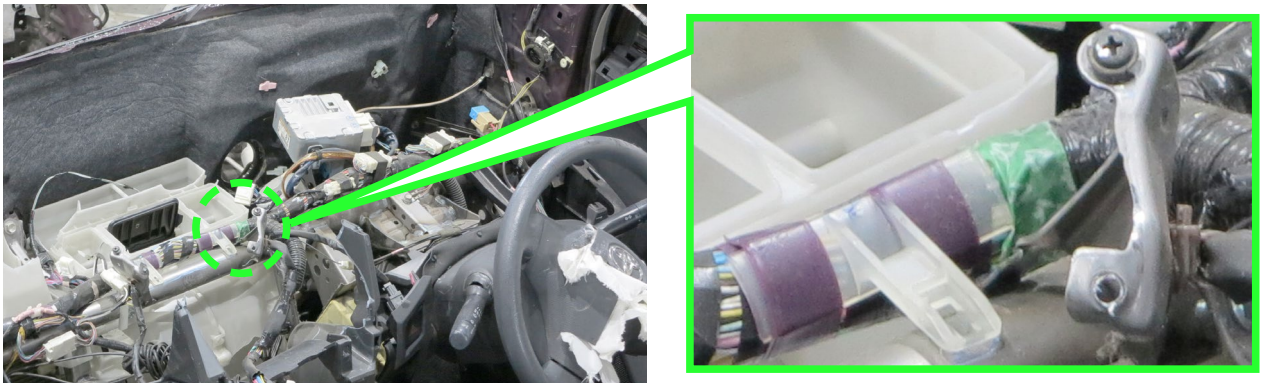
TOYOTA

<Keypoint>
Set green tape on points where it is the easiest to retrieve wire harnesses.



[Tape position]

• Instrument panel wire



[When performing work to detach parts]

<Hold the section where tape is affixed>

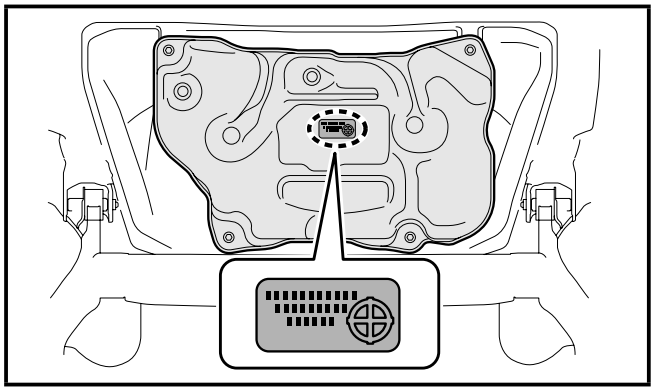
<Detach while maintain the hold on the part>

(6) Clearly indicating locations to drain liquids

Target work	Extracting fuel

DAIHATSU | TOYOTA | mazda

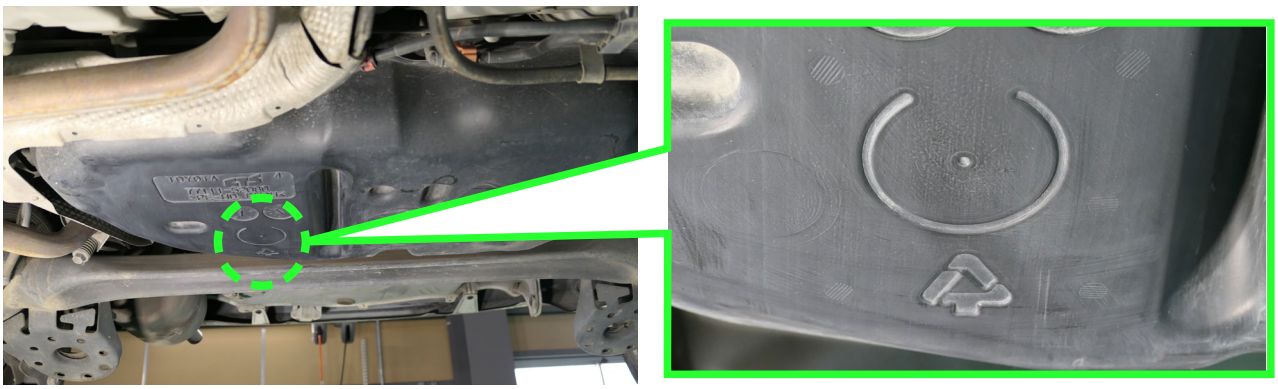
<Keypoint>
Clearly indicate the lowest position that will not interfere with the built-in elements of the fuel tank as the position to drill a hole when extracting the fuel.



[Display position for location to drain liquids]

- Mazda

- Toyota

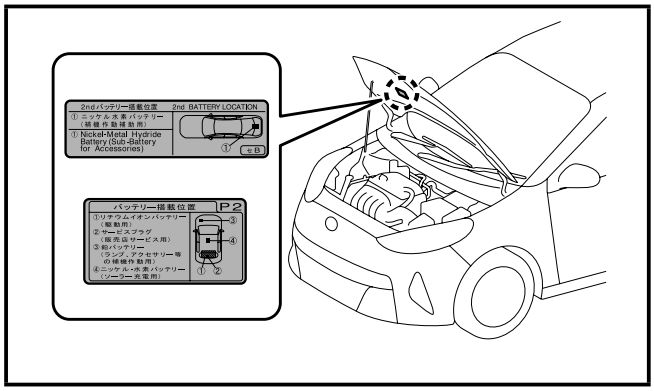


(7) Setting labels for mounting positions

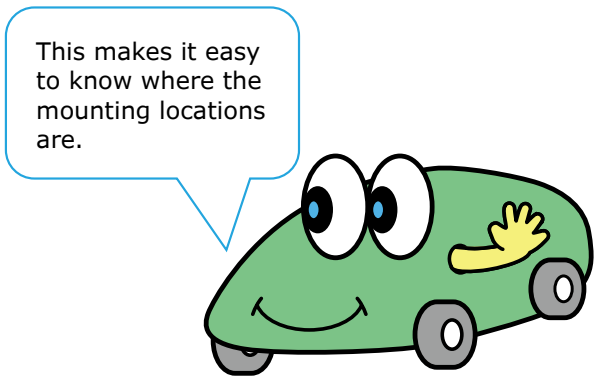
Target work	Removing traction battery and power storage system parts

SUZUKI | TOYOTA | mazda

<Keypoint>
Set and display mounting position labels on vehicles so that it is easy to see the mounting position of traction battery and power storage system parts at the work site



[Display position for mounting position labels]



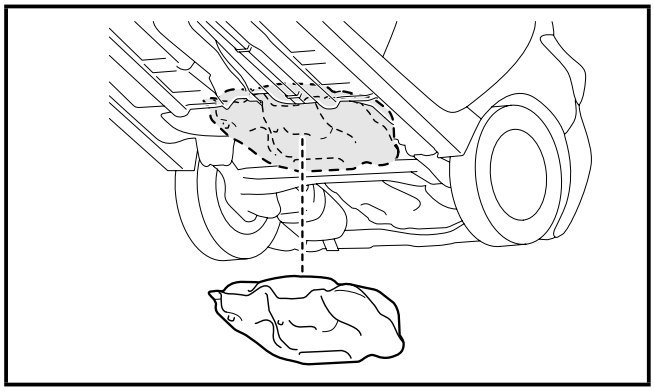
3.3. Improving the structure to reduce the work

(1) Ability to directly remove the tank alone

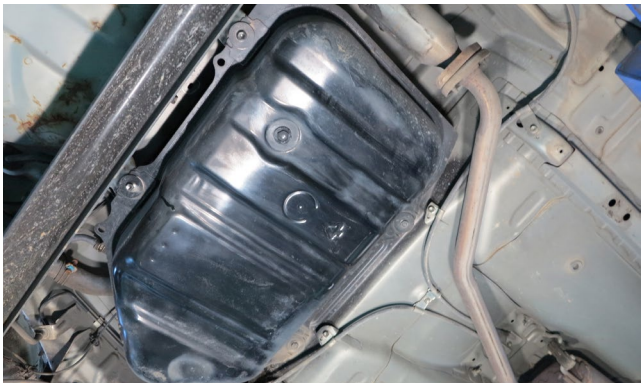
Target work	Removing the fuel tank

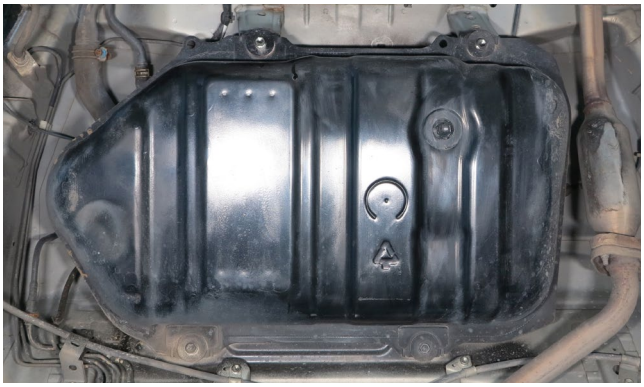
DAIHATSU

<Keypoint>
Improve the placement of peripheral parts so that the fuel tank can be directly removed with the goal of improving work efficiency.



[Installed state]





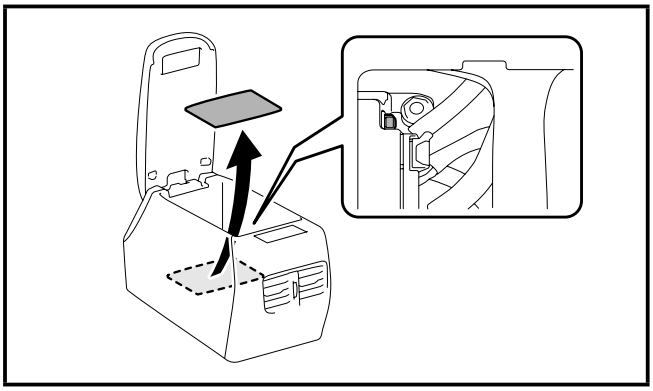
[When removing]

(2) Improving access to batch operation connectors

Target work	Air bag batch operation processing

DAIHATSU | TOYOTA | NISSAN | mazda | MITSUBISHI MOTORS | HINO

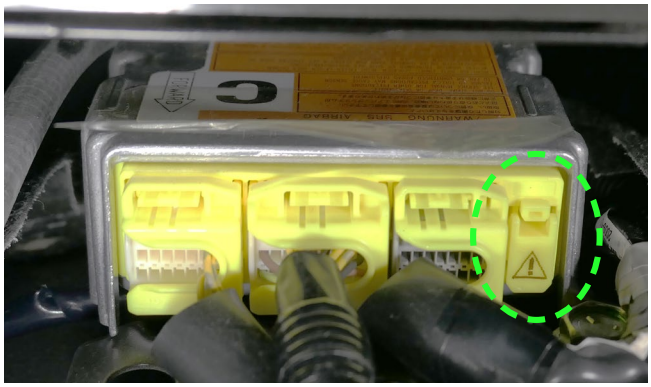
<Keypoint>
Improve the design to enable easy access to the airbag computer by installing a service hole cover, etc.

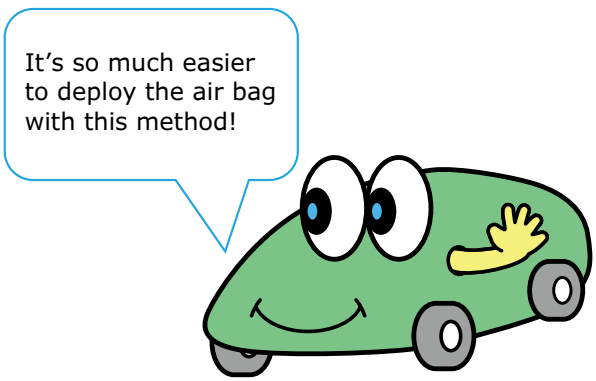


[Mounting positions for batch operation connectors]

- Service hole cover

- Batch operation connector





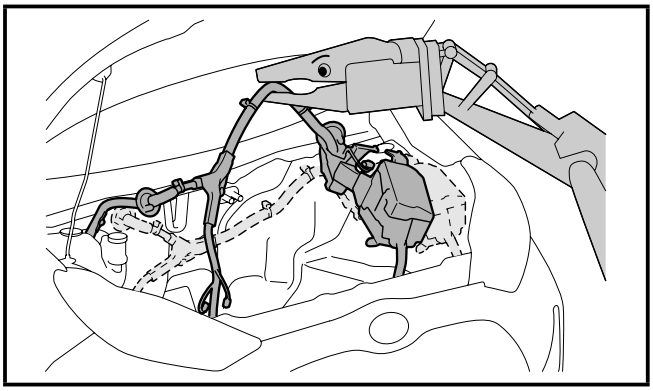
3.4. Improving installation positions

(1) Setting wiring routes that consider detachment

Target work	Detaching wire harnesses

SUZUKI | SUBARU | DAIHATSU | TOYOTA | NISSAN | HONDA | mazda | MITSUBISHI MOTORS | HINO

<Keypoint>
Improve the harness route so that the wire harness is easy to grab and does not interfere with other parts when detaching it using heavy dismantling machinery.

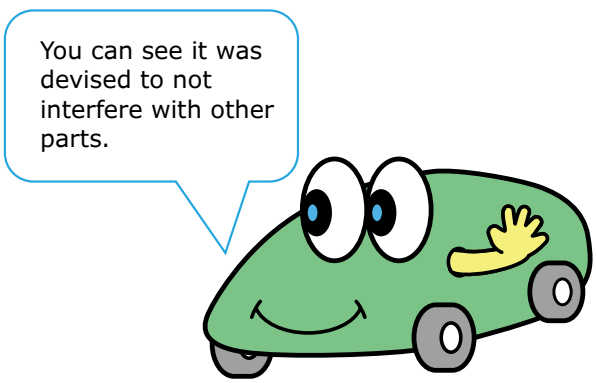


[Wire harness routing]

- Toyota

- Nissan

- Mitsubishi

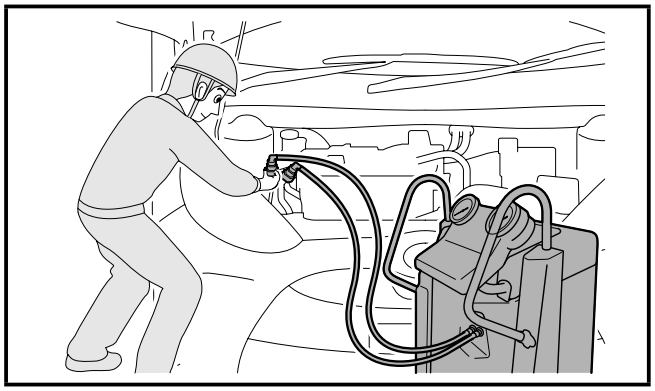


(2) Arranging Hi/Lo valves in close proximity

Target work	Collecting fluorocarbon gas

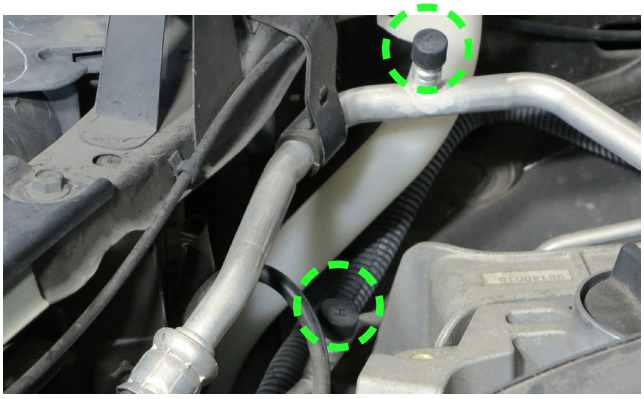
SUZUKI | SUBARU | TOYOTA | NISSAN | HONDA | mazda

<Keypoint>
The high pressure side and low pressure side valves on the refrigerant piping are located inside the engine compartment, allowing the worker to connect the refrigerant recovery device without moving.

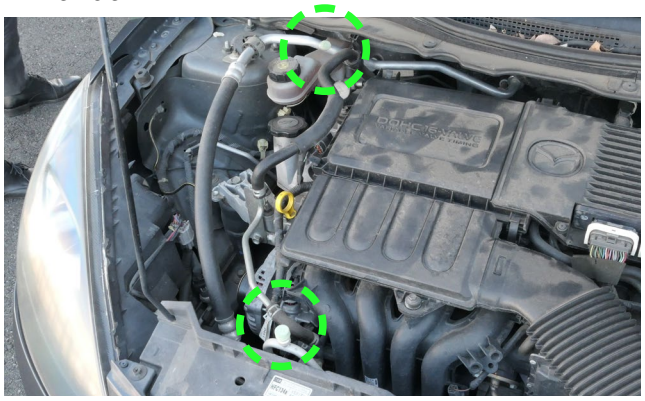


[Fastening bolts installed state]

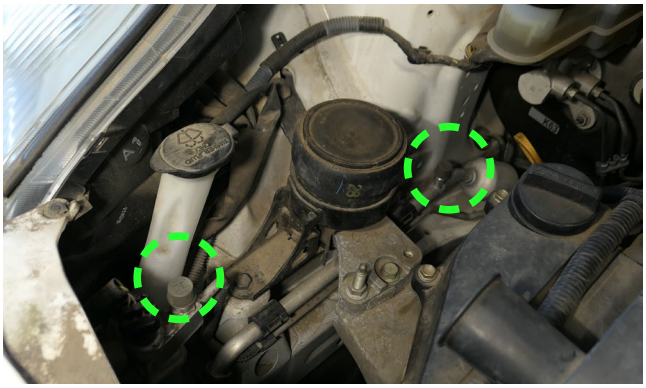
• Nissan



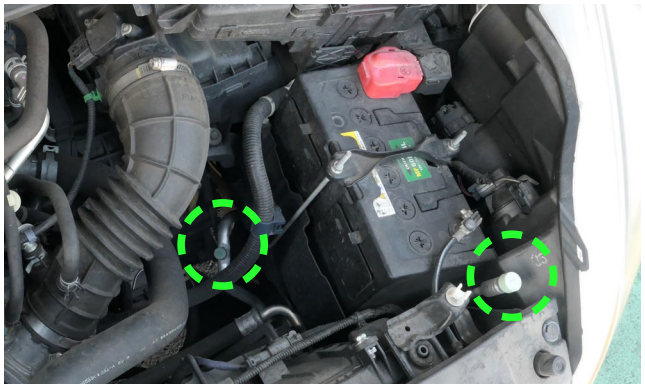
• Mazda



• Toyota



• Honda



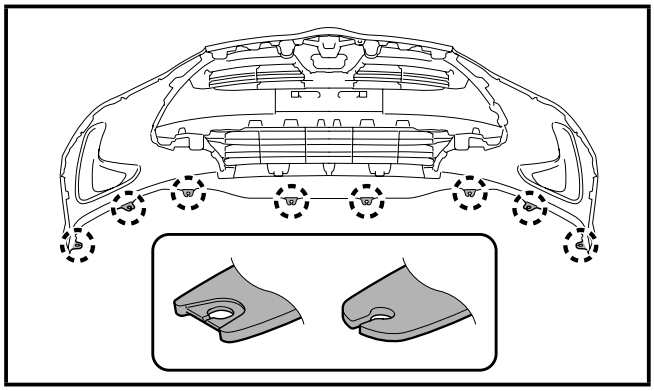
3.5. Changing fastening structures

(1) Improving the ease at which parts can be detached (such as reducing the thickness of fastening areas)

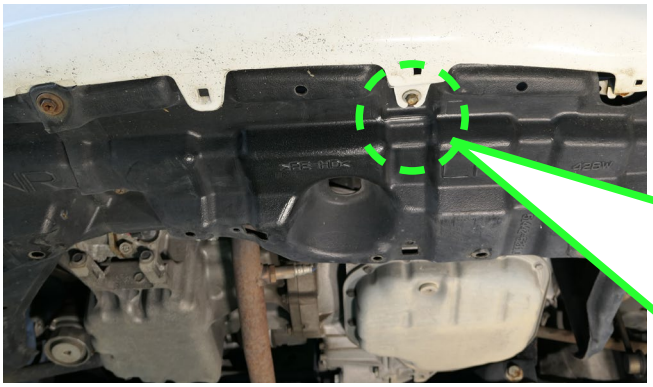
Target work	Detaching bumpers

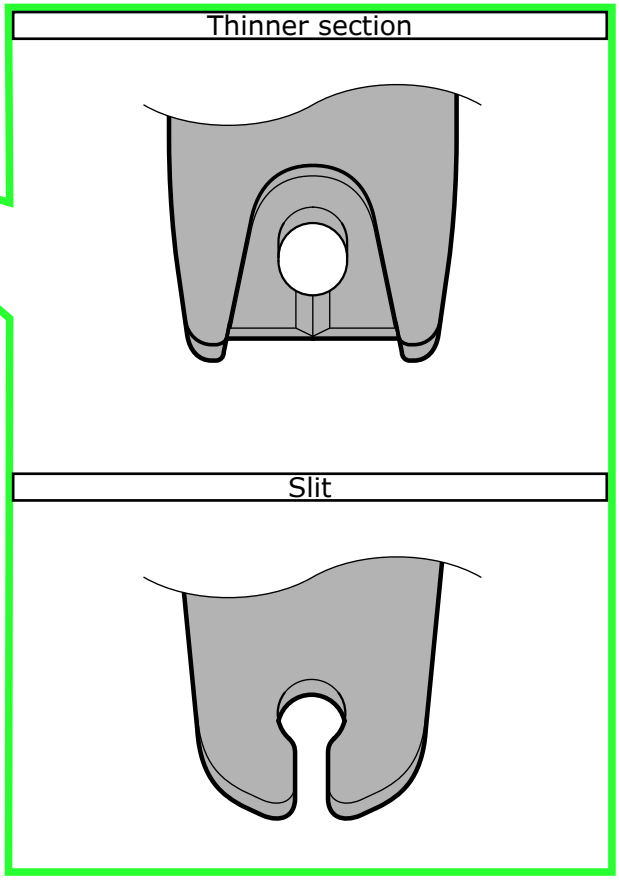
DAIHATSU | TOYOTA | mazda

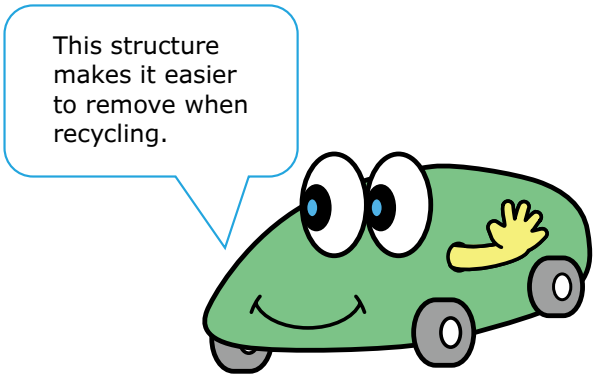
<Keypoint>
Improve the structure to allow for easy detachment when pulling in the detachment direction because the bumper fastening area has a thinner section and a slit.



[Front bumper fastening area]





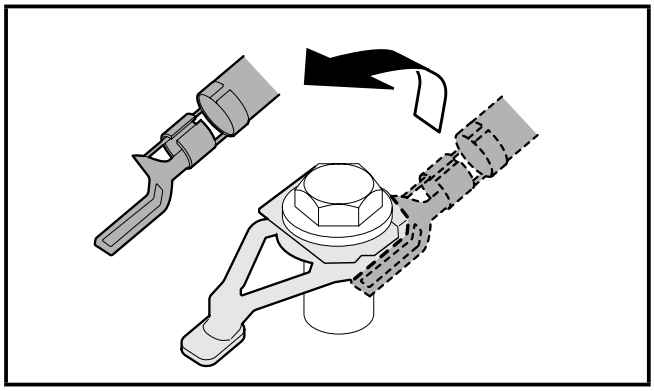


(2) Improving the ease at which parts can be detached (improving the structure of fastening areas)

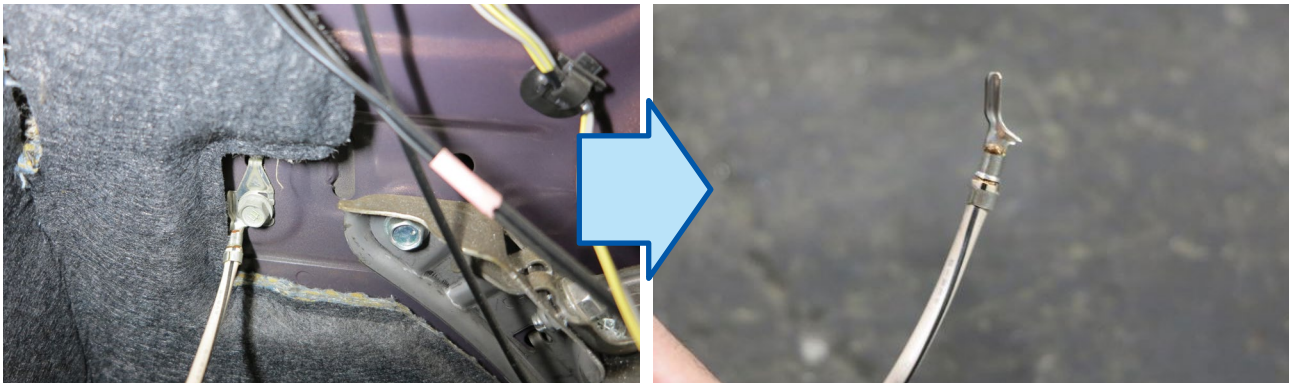
Target work	Detaching wire harnesses (grounding terminal)

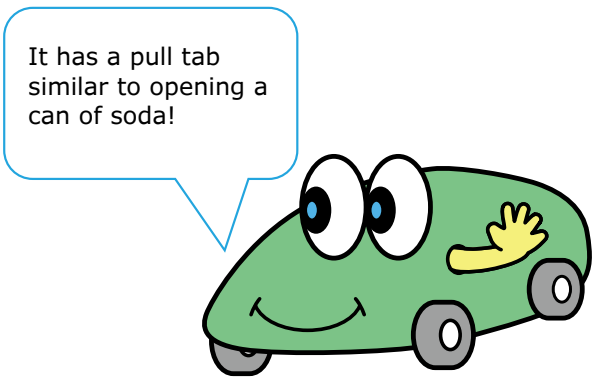
SUBARU | DAIHATSU | TOYOTA | mazda | MITSUBISHI MOTORS | HINO

<Keypoint>
Improve the structure to allow for easy detachment when pulling in the detachment direction because the grounding terminal has a thinner section.



[Detaching the wire harness]



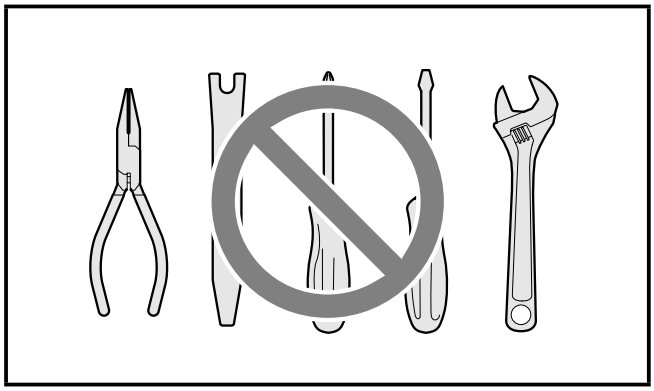


(3) Ability to remove without tools

Target work	Removing weather stripping and door glass run

SUZUKI | DAIHATSU | TOYOTA | HONDA | HINO

<Keypoint>
Enable these parts to be removed easily without using tools when performing this task.



[Weather stripping]

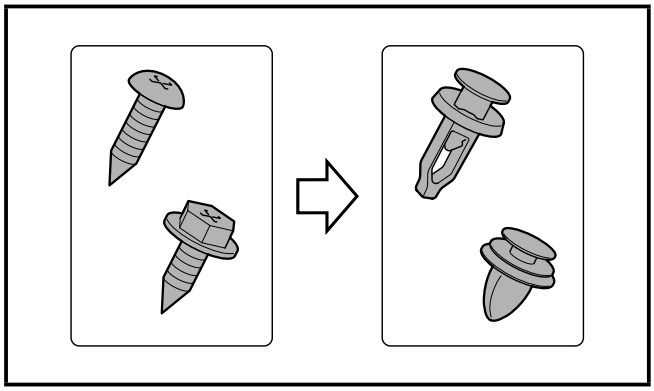
[Door glass run]

(4) Changing to fastening with clips

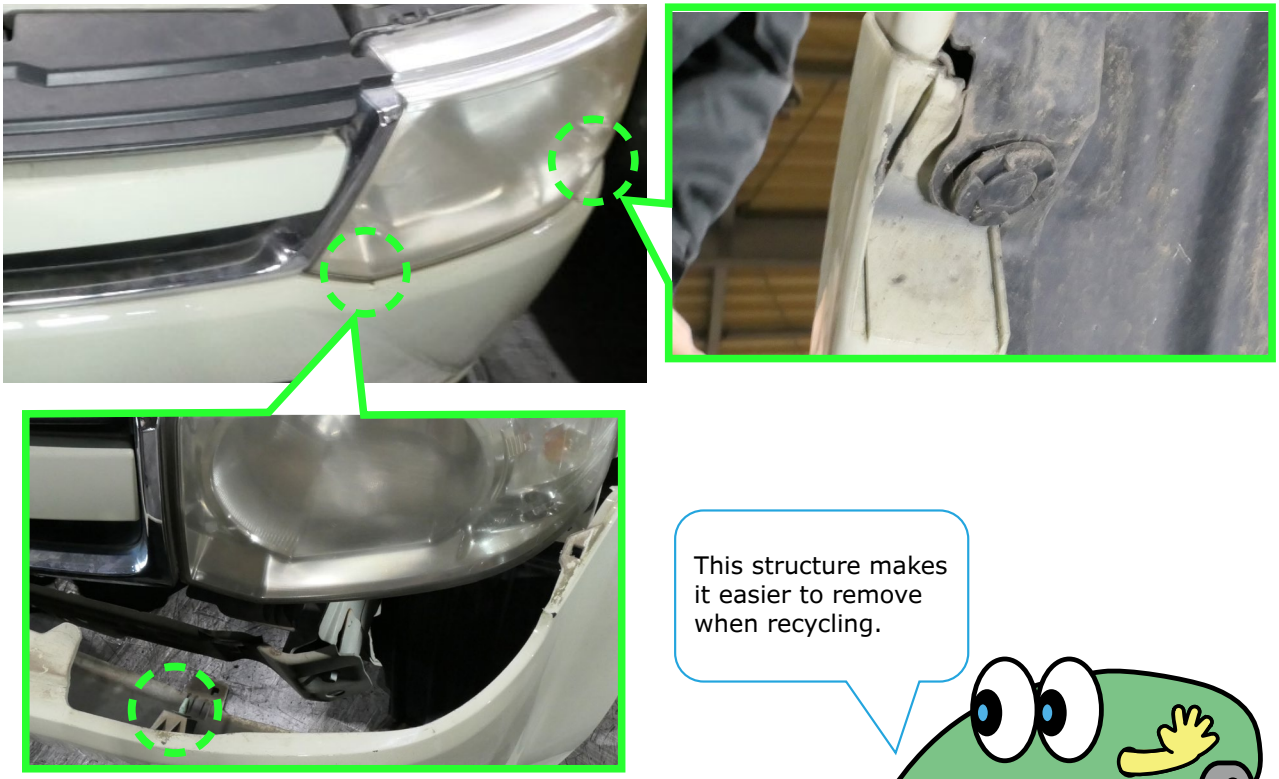
Target work	Removing bumpers

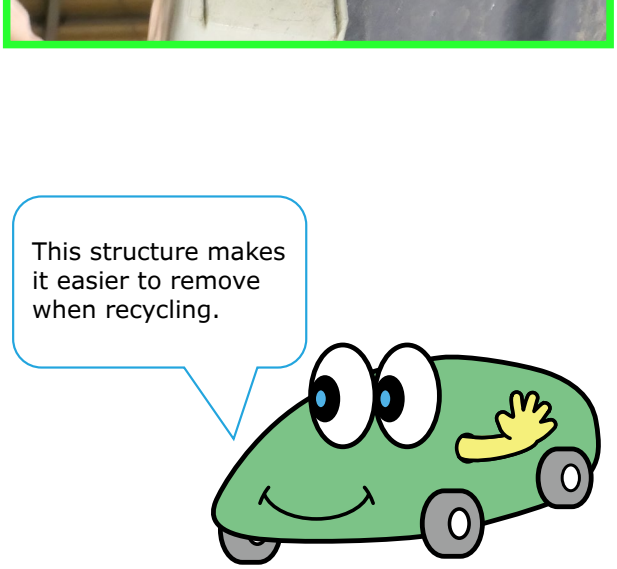
SUBARU | HONDA

<Keypoint>
Enable this part to be removed easily even when using heavy dismantling machinery by changing to fittings that use hooks and clips instead of bolts and screws that were used at fastening areas.



[Front bumper installed state]





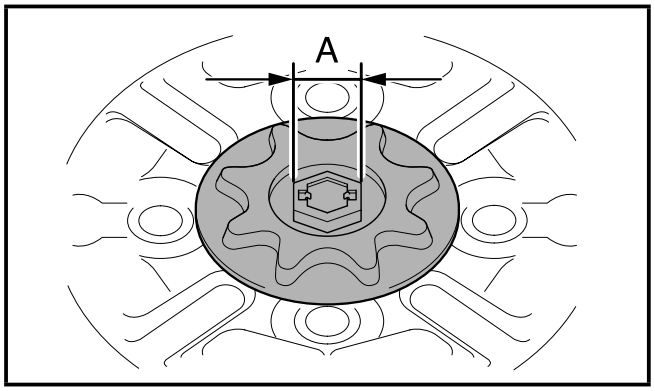
(5) Setting securing bolt shapes that match the hub nut size

Target work	Removing the spare tire

TOYOTA

<Keypoint>
Enable installation/removal using power tools by setting a bolt shape with the same size as the hub nut at the top of the spare tire securing bolt.

<A is the same size as the hub nut>



[Conventional part]

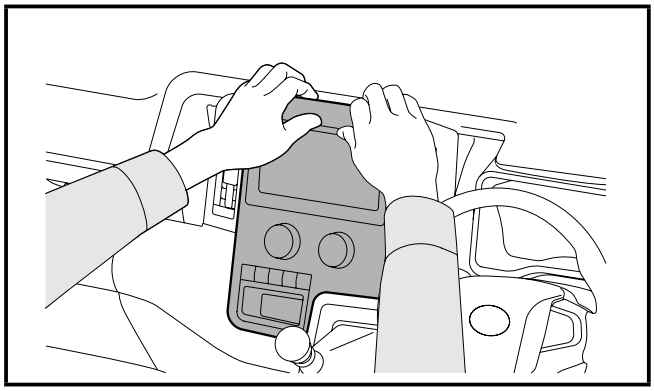
[Recycle designed part]

(6) Changing to fastening with fitting structures and clips, etc.

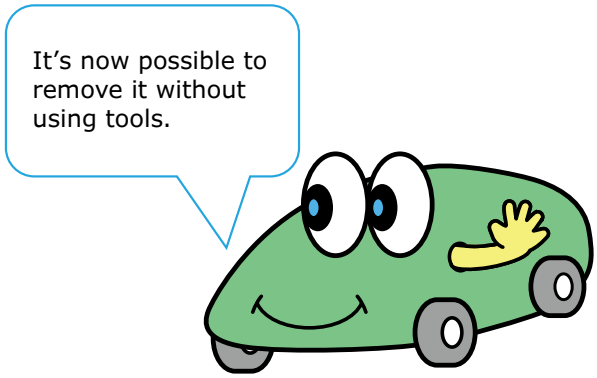
Target work	Removing the center cluster panel, etc.

SUZUKI | DAIHATSU | TOYOTA | MITSUBISHI MOTORS | HINO

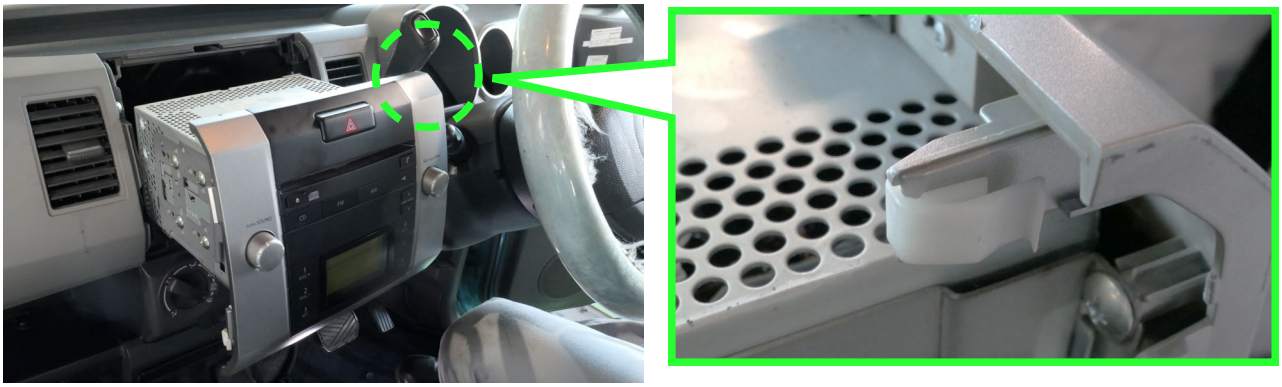
<Keypoint>
Enable this part to be removed easily by changing screw fastenings that uses bolts and screws to a fitting structure that uses clips.



[Installed state]



[Removed state]



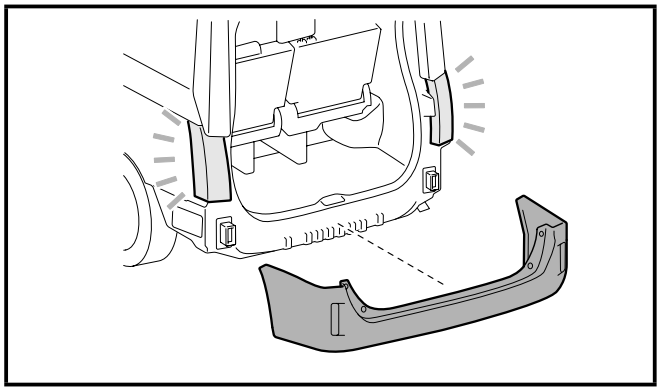
3.6. Other considerations

(1) Ability to directly remove the rear bumper

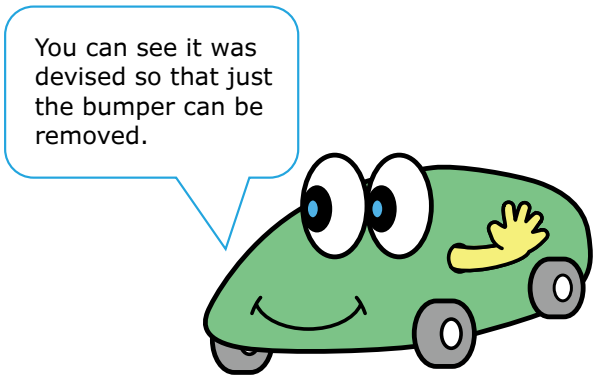
Target work	Detaching rear bumpers

SUZUKI | DAIHATSU | NISSAN | HONDA

<Keypoint>
Enable the rear bumper to be removed without needing to remove other parts such as the rear combination lamp.



[Installed state]



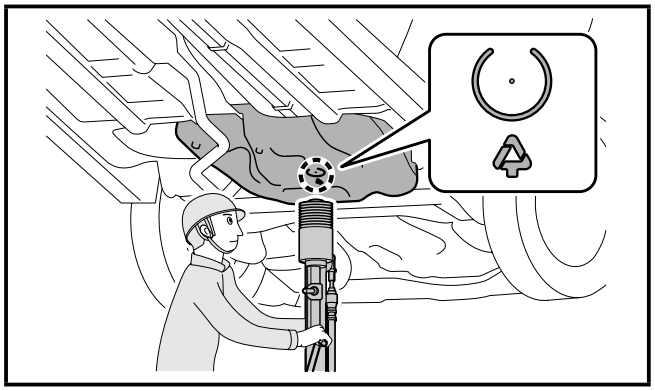
[Removed state]

(2) Setting flat surface areas for leak prevention

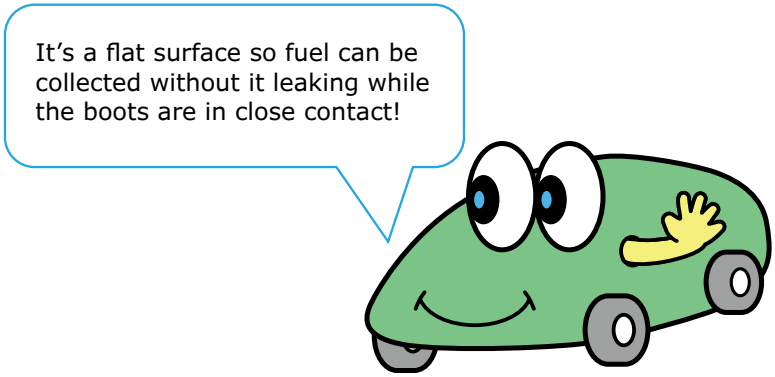
Target work	Extracting fuel

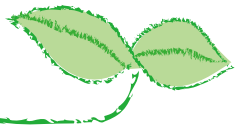
SUBARU | DAIHATSU | TOYOTA

<Keypoint>
Set a flat surface to enable a hole to be drilled easily by the fuel extraction device drill or to maintain the sealing properties with the boots.



[Indicator showing flat surface for fuel tank]





4. Good examples of dismantling operators

Personal initiatives from dismantling operators can also achieve improvements in both efficiency and safety of automobile dismantling, not just recycle design from automobile manufacturers. This section introduces some initiatives from all dismantling operators in response to issues that were revealed during the investigation conducted as part of this project.

No.	Operator who provided the information	Overview of good examples
1	Tochigi Parts Co., Ltd.	Using a chassis number stamping list
2	Okinawa Car Recycling Coop	Free lending of air bag batch operation tool
3	eco-R Co, Ltd.	Setting a drop-prevention bar when draining liquids
4	Carec Co., Ltd.	Removing the fuel tank pump
5	Auto Parts Izichi Co., Ltd.	Creating a procedure panel for HV battery removal
6	Carglee Comazen Co., Ltd.	Making a pre-processing manual to improve the amount of retrieved wire harnesses
7	Towa Co., Ltd.	Retrieving parts attached to harnesses using the feet of heavy dismantling machinery
8	Takunan Metal Trade Co., Ltd. Matec Corporation Kaiho Industry Co., Ltd.	Developing goods and art from automobile parts

4. Good examples of dismantling operators

4.1. Using a chassis number stamping list (optimizes chassis number verification)

Issue	Verifying caution plate installation positions

<Good example>
Tochigi Parts Co., Ltd. uses the stamping position of the chassis number published on the Internet to achieve optimization of chassis number verification work.

車台番号打刻位置一覧【国産車】

車台番号打刻位置一覧【国産車】

トヨタ	>>トヨタの車台番号打刻位置一覧とおもな型式
ニッサン	>>ニッサンの車台番号打刻位置一覧とおもな型式
ホンダ	>>ホンダの車台番号打刻位置一覧とおもな型式
三菱	>>三菱の車台番号打刻位置一覧とおもな型式
マツダ	>>マツダの車台番号打刻位置一覧とおもな型式
スバル	>>スバルの車台番号打刻位置一覧とおもな型式
いすず	>>いすずの車台番号打刻位置一覧とおもな型式
ダイハツ	>>ダイハツの車台番号打刻位置一覧とおもな型式
スズキ	>>スズキの車台番号打刻位置一覧とおもな型式

Source: Kurunavi website https://www.kurunavi.jp/index.html

4.2. Free lending of air bag batch operation tool

Issue	Popularizing the use of the air bag batch operation tool

<Good example>
Okinawa Car Recycling Coop has purchased a batch operation tool for their cooperative and lends this tool to its members and provides assistance to purchase the tool, including ISO methods that have not become mainstream.

[Batch operation tool method]

<JAMA method>

<ISO method>

4.3. Setting a drop-prevention bar when draining liquids

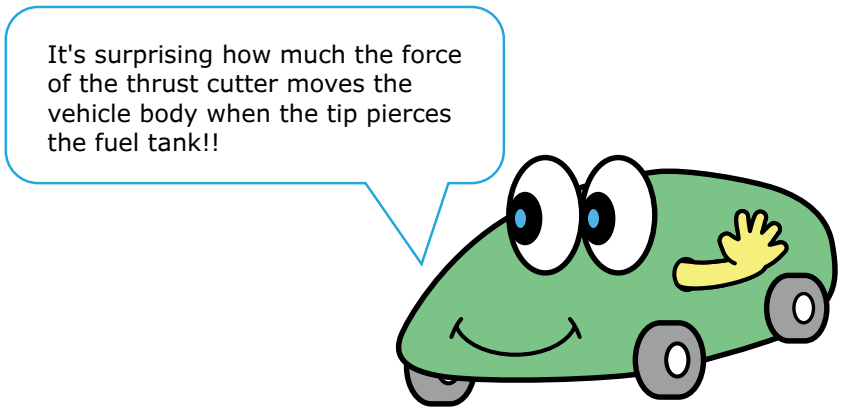
Issue	Risk of the vehicle falling down when draining liquids using a thrust cutter

<Good example>
eco-R Co, Ltd. Has set a drop-prevention bar to prevent the vehicle from falling down when the tip of the thrust cutter pierces the fuel tank.

[Drop-prevention bar]

<Drop-prevention bar not being used>

<Drop-prevention bar in use>



4.4. Removing the fuel tank pump

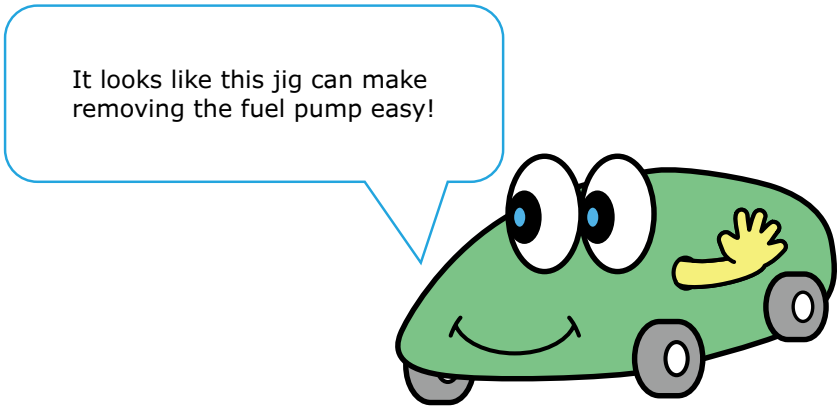
Issue	Removing the fuel pump from older model year vehicles

<Good example>
Carec Co., Ltd. Has devised a unique jig that they use when removing the fuel pump with the goal of improving safety and efficiency.

[Fuel pump removal jig]

<Before removing the pump retainer>

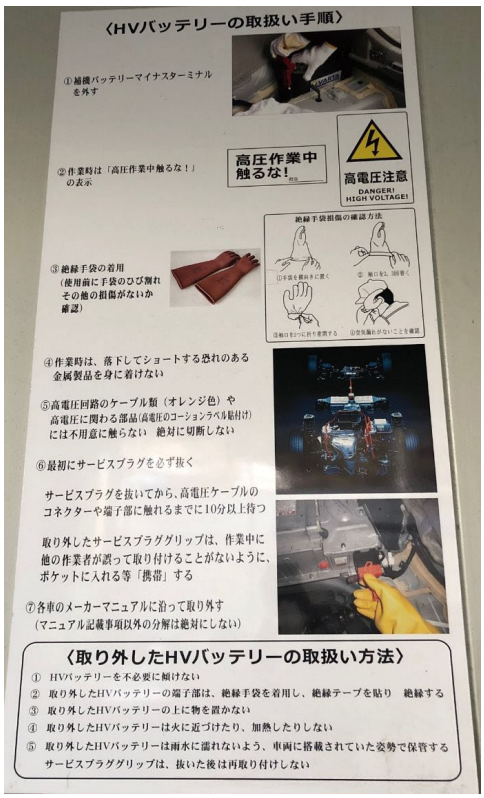
<After removing the pump retainer>



4.5. Creating a procedure panel for HV battery removal

Issue	Checking the method for removing the traction battery

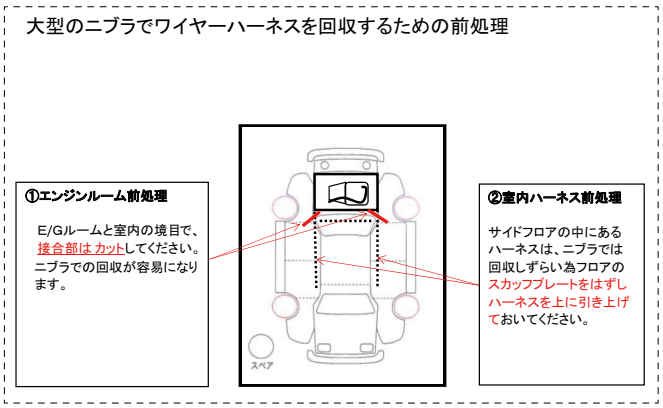
<Good example>
Auto Parts Izichi Co., Ltd. displays a panel listing the traction battery removal procedure in their factory with the goal of improving safety and making work instructions more efficient.



4.6. Making a pre-processing manual to improve the amount of retrieved wire harnesses

Issue	Optimizing the retrieval of wire harnesses

<Good example>
Carglee Comazen Co., Ltd. has created a manual for the pre-process stage of wire harness retrieval and shared this within their company with the goal of optimizing the retrieval of wire harnesses using heavy dismantling machinery.

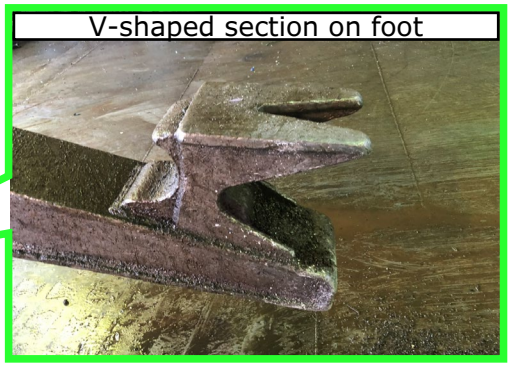


4.7. Retrieving parts attached to harnesses using the feet of heavy dismantling machinery

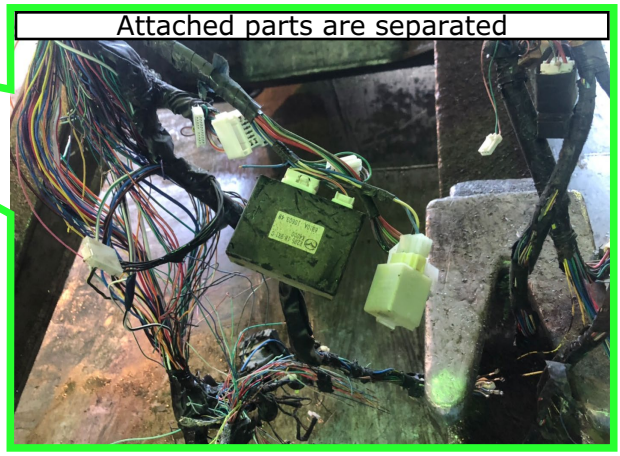
Issue	Separating parts attached to wire harnesses

<Good example>
Towa Co., Ltd. separates parts attached to wire harnesses with great efficiency using the V-shaped section on the foot of heavy dismantling machinery.

<Heavy dismantling machinery>



<When detaching the wire harness>



4.8. Developing recycled goods and art from automobile parts

Issue	Adding high value to parts and resources retrieved from automobiles

<Good example>
Some dismantling operators develop new products using parts and resources retrieved from automobiles.

[Recycled products]

- Takunan Metal Trade Co., Ltd.

<Glass>

<Tumblers>

<Seat belts>

<Tote bags>

4. Good examples of dismantling operators

- Matec Corporation

<Air bags>

<Leather seat covering>

<Teddy bears>

- Kaiho Industry Co., Ltd.

<Seats>

<Treasure chairs>

Conclusion

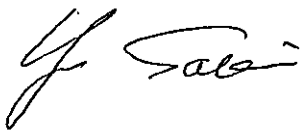
We consider this document to be something new for two main reasons.

The first is that it is our initial attempt to systematically collate together examples of environment-friendly design from each automobile manufacturer as well as information about easy dismantling techniques as seen from the level at the dismantling operator's workplace. From the perspective of promoting the 3Rs to create a Recycling-based Society, automobile manufacturers have been working hard to design products that consider the ability to recycle them from around the year 2000. However, the questionnaire used during our investigations clearly shows that this information has not been communicated well. Conversely, information such as the good and bad aspects of workability felt by dismantling operators as they work to dismantle vehicles was not systematically reported to automobile manufacturers. In this sense, we believe it is very significant that the initiatives shown in this document have shown the direction to resolve these problems.

The second is that we have created a stepping stone to a shared information platform through the work, in terms of summarizing information in this document by having dismantling operators (JAERA) cooperate with automobile manufacturers (JAMA). It is necessary to have parties concerned with manufacturing, selling, using, and recycling automobiles in the loop to create a recycling-orientated society. Among these, it is believed that achieving cooperation between both parties involved in manufacturing and recycling in particular is the key to success. Nonetheless, the Japanese economy has grown with a linear structure in terms of mass production, mass consumption, and mass disposal in its history so changing this situation is not as easy as it sounds.

This document was created with the full cooperation of automobile manufacturers, that is to say, it was completed through a collaborative process. It is the result of specific cooperation between manufacturers and recyclers and we have high expectations for its further development in the near future.

Japan ELV Recycler's Association
Yasuo Sakai, Representative Director



A collection of case studies for such as recycle design that contribute towards improving the ease of dismantling end-of-life vehicles

Japan ELV Recycler's Association

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(March of Japanese year 3 of Reiwa)