



PROJECT  
**Autobody Repair**

## 1 MODULE A – DIAGNOSIS AND CORRECTION

Follow these directions, which guide you through the steps to take and the stop points required. Safe work practices must always be adhered to.

### DIAGNOSIS: SET-UP, MEASURE AND REPORT DAMAGE

The competitor will be provided with frame measuring equipment such as:

1. Tape measurer and/or tram bar frame measuring equipment.
2. Clipboard, assessment sheets, and pencil

**TASK** – To diagnose damage on the vehicle mounted on the cribbing and axle stands or scissor lift, if provided.

**A-1** Using the Audatex estimating software pull up the under body and upper body specifications for the 2020 RAV 4. Once you have pulled up the specifications, call over a judge who will give you a copy of the measurement sheet for the vehicle.

**A-2** Competitor must calibrate the measuring device or devices to the vehicle

**A-3** Measure and report the extent of misalignment measuring the indicated locations on the provided data sheet. **(You may ask a judge to hold the tram bar in a measurement location but, you must tell them where you want them to hold the pointer)** Write your measurements on the data sheet in the locations provided. **(The number of measurements will be divided between upper and lower measurements)**

**A-4** Write an explanation of the damage identified through your measurements and what your diagnosis/repair plan would be.

**A-5** The competitor must match the following terms to the definitions.

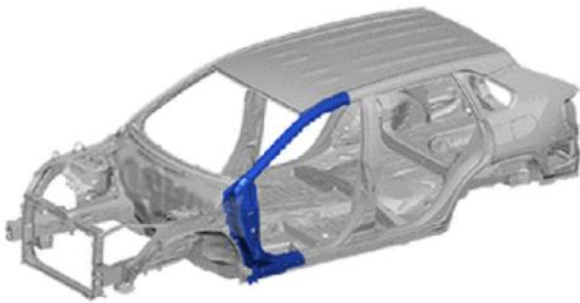
1. Side sway \_\_\_\_\_ rails are out of parallel when viewed from the side
2. Sag \_\_\_\_\_ rail has buckles on all sides length is shortened
3. Mash \_\_\_\_\_ rail has lateral misalignment, buckles are on one side of rail only
4. Twist \_\_\_\_\_ rails are in a parallelogram shape when viewed from the bottom
5. Diamond \_\_\_\_\_ rail has datum misalignment, buckles on top or bottom of rail only

## 2 MODULE C – NON-STRUCTURAL PART(S) REPLACEMENT

Along with these directions, which guide you through the steps to take and the stop points required, follow the Toyota RAV 4 procedures/methods to complete this module. Safe work practices must always be adhered to.

### C1 - PANEL REMOVAL AND INSTALLATION (FIT-UP)

- Replace the Left or right A-pillar



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- The following consumables and provided tools are required:
  - Material and Quantity;
  - Panel bonding adhesive, spatula, sandpaper, and cleaning agent)
  - Caulking/Applicator Gun
  - Weld-thru primer
  - Remove bolt-on parts for access as necessary (bag & tag).
  - Re• Perform the upper and lower cut lines as specified here and shown in the photo
  - Upper ??? mm ??? mm
  - Lower ??? mm ??? mm
  - Remove corrosion protection materials as necessary in areas where panels or panel flanges will be heated by any welding method during replacement part installation.
  - (different prep depending on attachment method)

- Straighten (repair) all deformation and remove spot weld remnants. Any accidental holes or tears to parts not to be replaced must not be welded until after inspection by Experts.
- If you do - you will lose all the points in this marking area!
- Drill or punch holes for plug welds on flanges as necessary.
- Install side panel. Fit up only. At this point, the door gap and the tailgate gap will not be measured.
- Important! No adhesives or welds at this point
- Adjust new part to fit without excessive tension / stress and secure with clamps.
- The A pillar upper and lower sill joint gap must be 0-1mm.
- Ensure the correct alignment of fold lines of the replacement parts to existing vehicle part locations.
- Produce flush mating flange fit-up.
- The panel must be fitted to suit manufacturer's measurements and gaps with adjacent panels.

C1 STOP Sign in when done for the judge(s) to mark your completion of the above operations.

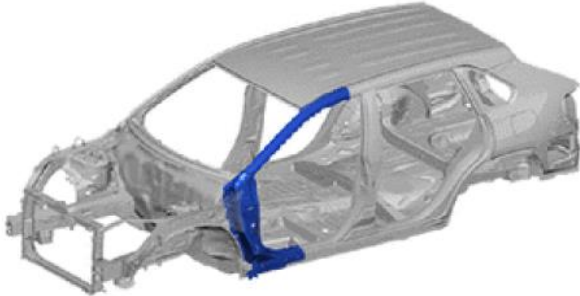
### **C2 - PANEL PREPARATION**

- Remove panel and prepare ALL materials, tools and parts for attaching permanently.
- Weld-Thru primer should be applied to all inside of weld area flanges.

**C2 STOP Sign in when done for judge(s) to mark your weld primer application.**

### **C3 - ATTACH REPLACEMENT PANEL/PARTS**

- Attach part(s) by performing the different types of methods (Mig plug, Mig seam, Spot welding adhesive bonding).



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- Install panel without the help of a partner.

Note: When installing panel, make sure there is sufficient adhesive on bonding surfaces

Note: No backing strip/insert to be fitted behind upper and lower butt joints

- Create alignment of body lines at replacement part to existing vehicle part locations.
- Produce flush mating flange fit-up.
- All welds must be marked before grinding takes place. Completed continuous welds must not be ground and re-welded.
- Welds will be tested for strength (random selection, but the same weld for each Competitor-to be determined by judging team). This will be done by judge(s) at the end of the competition. Butt welding and adhesive application will be marked after competition completion.

**C3 STOP Sign in when done for Experts to mark your above repair operations**

**C4 - DRESS/GRIND/SAND WELDS (MARKED WITH JUDGMENT CRITERIA) & PANEL GAPS**

- After MIG welding (plug or continuous welds) metal joining surfaces, the welds must be ground (if not all, as determined by the judge(s) at the competition) flat and finished. Any excess adhesive material must be cleaned up and/or removed.
- Welded areas must be finished in a state that would enable the areas to be chemically treated and primed (P80 grit or finer) with the exception of the upper and lower butt joints (prepared for filler, but filler will not be applied).
- Metal finishing areas - sand to P80g or finer.

- Paint edges feathered to P120g or finer.
  - Reinstall all parts removed for repair operations and adjust using manufacturers' specifications and tolerances.
- C4 STOP Sign in when done for Judges to mark your completion of the above operations.  
Marking of  
these tasks will typically be done at the end of the competition

### **3 MODULE D – PANEL REPAIR**

#### **D1- LARGE DENT**

- Repair the damage to the front door. (This repair is not designed to be a paintless repair)
- Safe work practices must always be adhered to.
- Restore repaired area to original contour and shape. (Any method is acceptable although use of a
- Hammer, dolly block, and metal file is the recommended practice)
- Panel shrinking must be done with electrical equipment or cold shrinking as needed and with equipment
- Provided by the sponsors only. (Same for dent pulling equipment-on IL)
- Repaired area is to be carried out without filler to a standard ready for chemical treatment and primer.
- Repaired areas must not have deep file or grinder marks/gouges.
- Sand your completed repair area to P80g-P120g.
- Sand the surrounding paint edges feathered to P120g – P240 (or higher as this is a guide line and will be
- Marked in judgment criteria - not measurement)
- The panel repair area must not be damaged or over thinned by excessive filing or sanding (example, file
- or grind through body lines and folds). (To be included in judgement criteria)

**D1 STOP Sign in to mark your completed repairs. Marking of the Panel will typically be done at the end of the competition**

#### **D2 - SMALL DENTS (Aluminum panel)**

- Repair the damage to the hood. (this repair is not designed to be a paintless repair)
- Safe work practices must always be adhered to.
- Restore repaired area to original contour and shape. (any method is acceptable although use of a
- hammer, dolly block, and metal file is the recommended practice)

- Panel shrinking must be done with electrical equipment or cold shrinking as needed and provided by the
- sponsors only. (same for dent pulling equipment-on IL)
- Repaired area is to be carried out without filler to a standard ready for chemical treatment and primer.
- Repaired areas must not have deep file or grinder marks/gouges.
- Sand your completed repair area to P80g-P120g.
- Sand paint edges feathered to P120g – P240 (or higher as this is a guide line and will be marked in
- judgment criteria - not measurement)
- The panel repair area must not be damaged or over thinned by excessive filing or sanding (example, file
- or grind through body lines and folds). (To be included in judgement criteria)

**D2 STOP Sign in to mark your completed repairs. Marking of the Panel will typically be done at the end of the competition**



#### 4 Module F - Plastic repair

*Photo with Repair Areas*

Provided tools and materials:

- 3M manual for Plastic Repair with Patch and Reinforcement cloth;
- 3M™ 08984 – Adhesive Cleaner;
- (3M™ 94520 – cleaning sponge; Self-adhesive Patch);
- 3M™ 05917 – Polyolefin Adhesion Primer;
- 3M™ 08190 - 3M™ Performance Manual Applicator, 50mL;
- 3M™ 05901- Two Part Epoxy Adhesive;
- 3M™ 03020 - Reinforcement cloth;

NOTE: You need to use your own sanding materials and tools to make a hole and “Dish out”.

Crack repair with Patch RPB1020-3: **LEFT SIDE DAMAGE**

- Clean the damaged area
- Drill the hole at the end of the crack to relieve tension 3-6 mm
- Prepare the “Dish out” 10-30 mm on both side from the gap, the gap size is 0.5-1 mm

Crack repair with Reinforcement cloth 3M™ 03020: **RIGHT SIDE DAMAGE**

- Clean the damaged area
- Drill a hole(s) at the end of the crack(s) to relieve tension 3-6 mm
- Prepare the “Dish out” 10-30 mm on both side from the gap, the gap size is 0.5-1 mm

#### **F1 STOP**

Sign in and write down the time of completion and for marking all your above completed operations. Experts will mark cleaning, crack stress relieve, crack gap, and the area preparation before applying 05901.

## **5 MODULE F2 – Repair material application**

Crack repair with Patch: **LEFT SIDE DAMAGE**

- Apply the Patch (3M™ 03020) on the back side of bumper
- Apply 3M™ 05901 on the front side
- Sand repaired area to original contour and shape to P180

Crack repair with Reinforcement cloth: **RIGHT SIDE DAMAGE**

- Apply the Reinforcement cloth on the back side of bumper
- Apply 3M™ 05901 on the back side
- Apply 3M™ 05901 on the front side
- Sand repaired area to original contour and shape to P180

### **F2 STOP**

Sign in and write down the time of completion and for marking all your above completed operations. Experts will mark: Material apply, surface and shape of repaired area.

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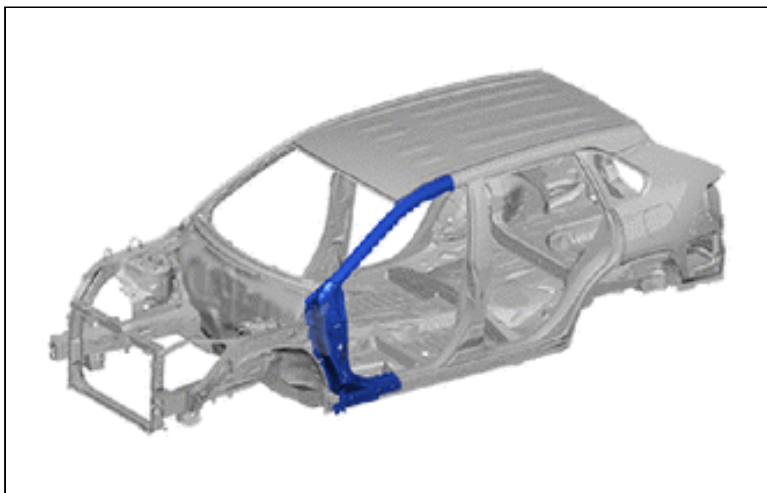
**Model Year Start:** 2019

**Model:** RAV4

**Prod Date Range:** [11/2018 - 01/2020]






**Title:** BODY PANEL: FRONT BODY PILLAR: CUT AND JOIN REPLACEMENT SECTIONS (PATTERN 2); 2019 - 2020 MY RAV4 RAV4 HV [11/2018 - 01/2020]

## CUT AND JOIN REPLACEMENT SECTIONS (PATTERN 2)



With the cowl top side upper panel assembly, center body pillar cut and join replacement sections and roof panel assembly removed.

### REMOVAL

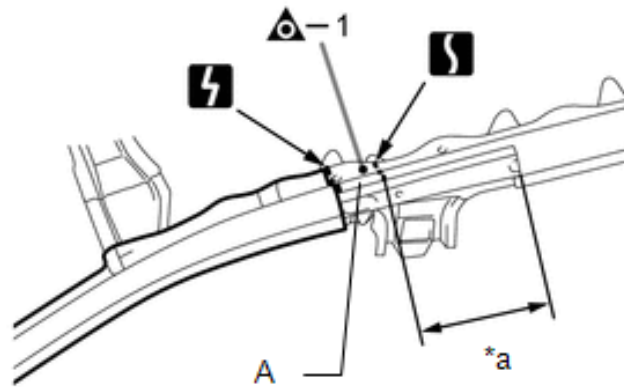
SYMBOL MEANING	
	Remove Weld Points
	Remove Weld Points
	Remove Weld Points
	Cut and Join Location
	Cut Location for Supply Parts

(a) Do not butt weld or heat repair because the heat decreases the strength of areas where ultra high strength steel is used. (See the introduction)

(b) Remove the A.

**HINT:**

A is reused.

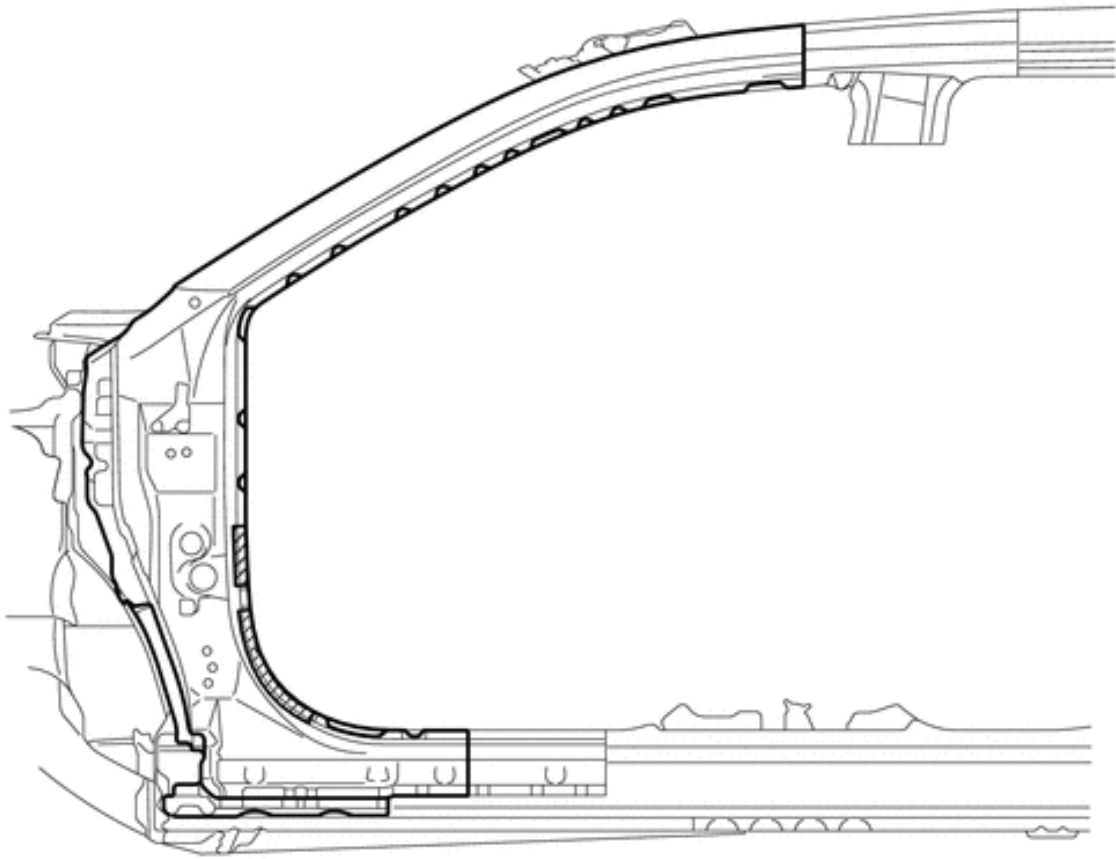


*a	260 mm (10.24 in.)	-	-
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(c) Roughly cut open the panel so that the adhesive can be reached. Cut through the adhesive with a cut chisel to remove the panel.

**HINT:**

In cases where the adhesive cannot be removed with a cut chisel, heat the adhesive with an industrial heater gun or gas burner taking care not to cause panel deformation by overheating.

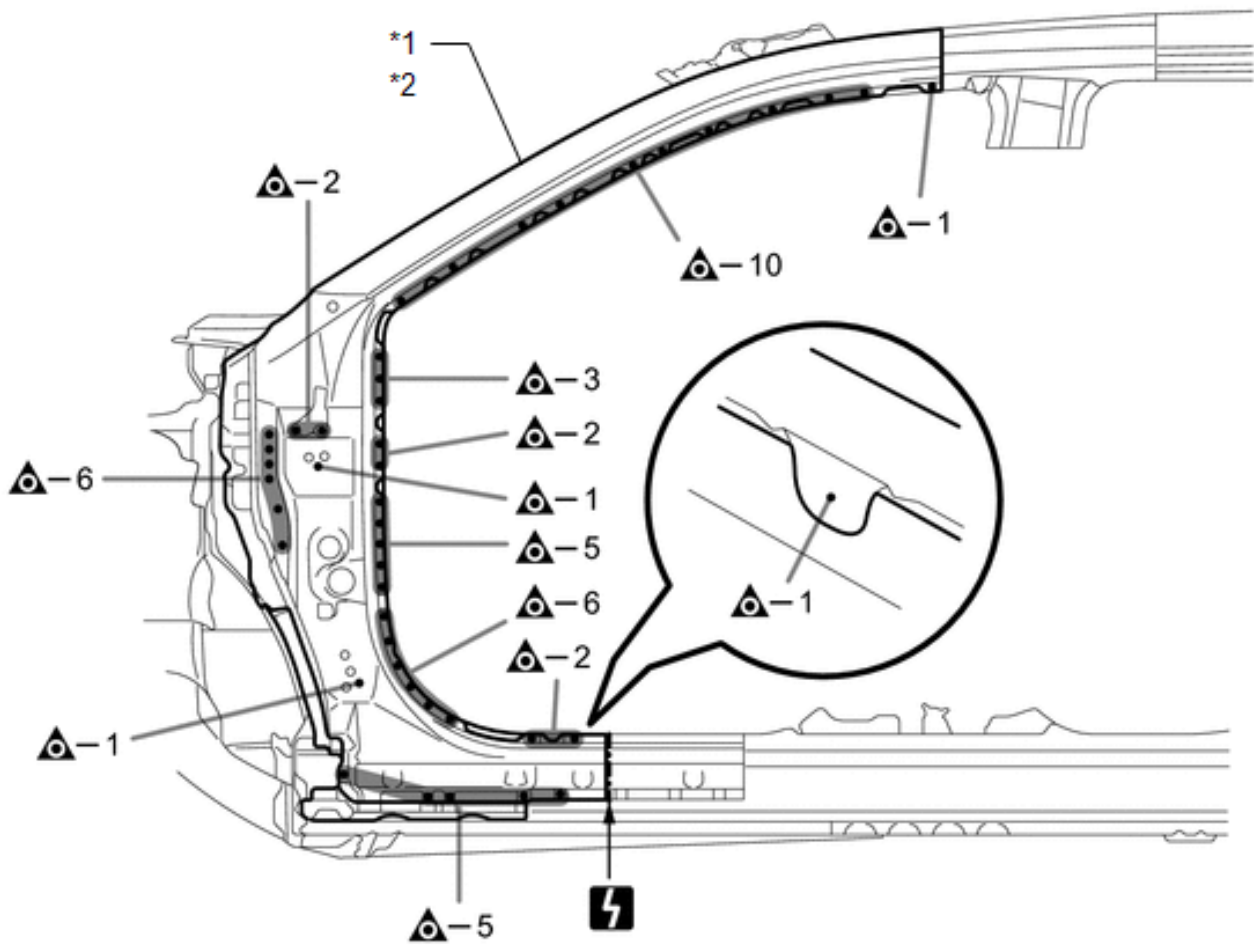


Adhesive

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(d) Remove the front body pillar upper outer or side panel sub-assembly.

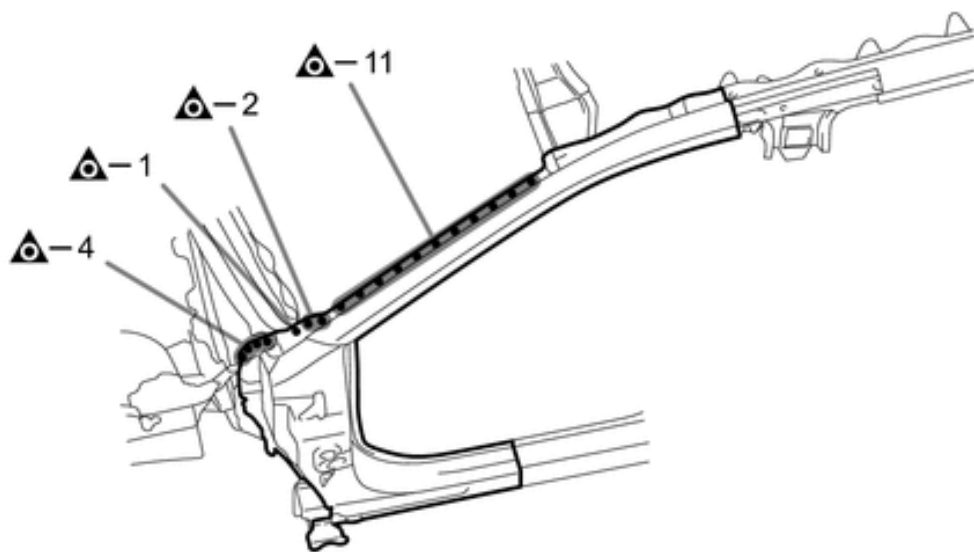
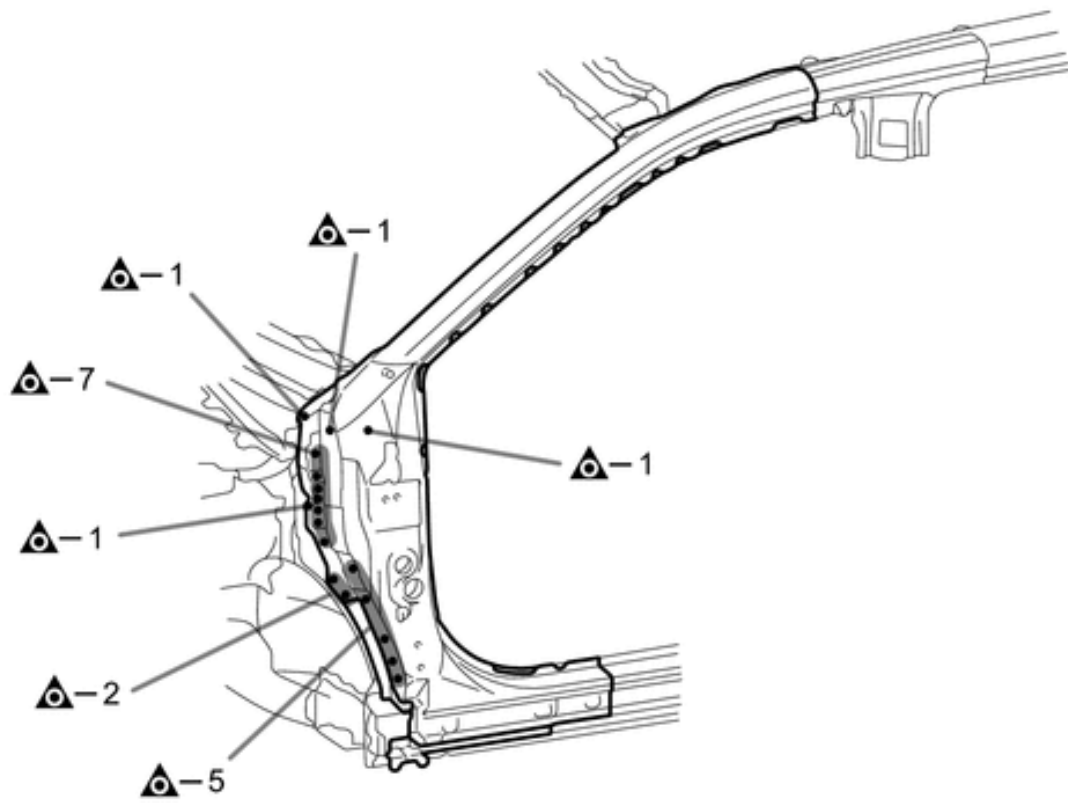


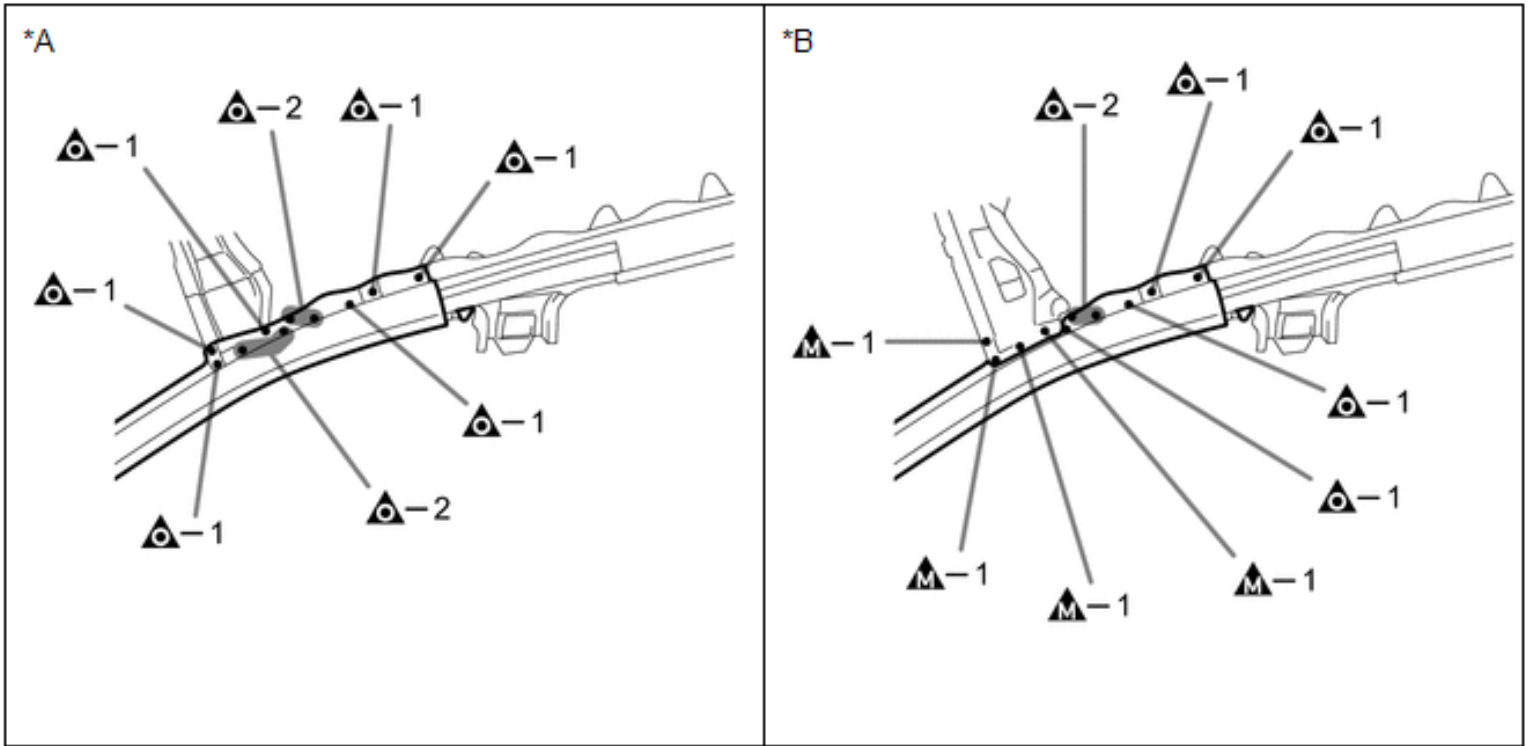
\*1

FRONT BODY PILLAR UPPER OUTER  
(for TMC Made)

\*2

SIDE PANEL SUB-ASSEMBLY (for  
TMMC Made)



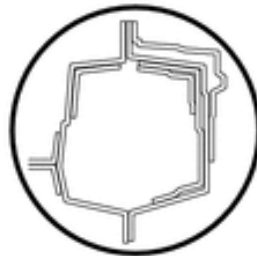
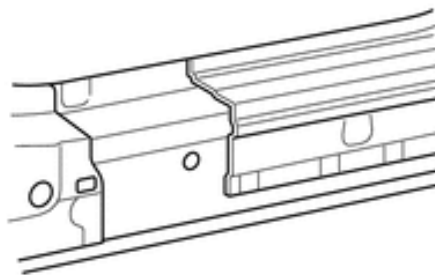


\*A

except Panoramic Moon Roof

\*B

for Panoramic Moon Roof

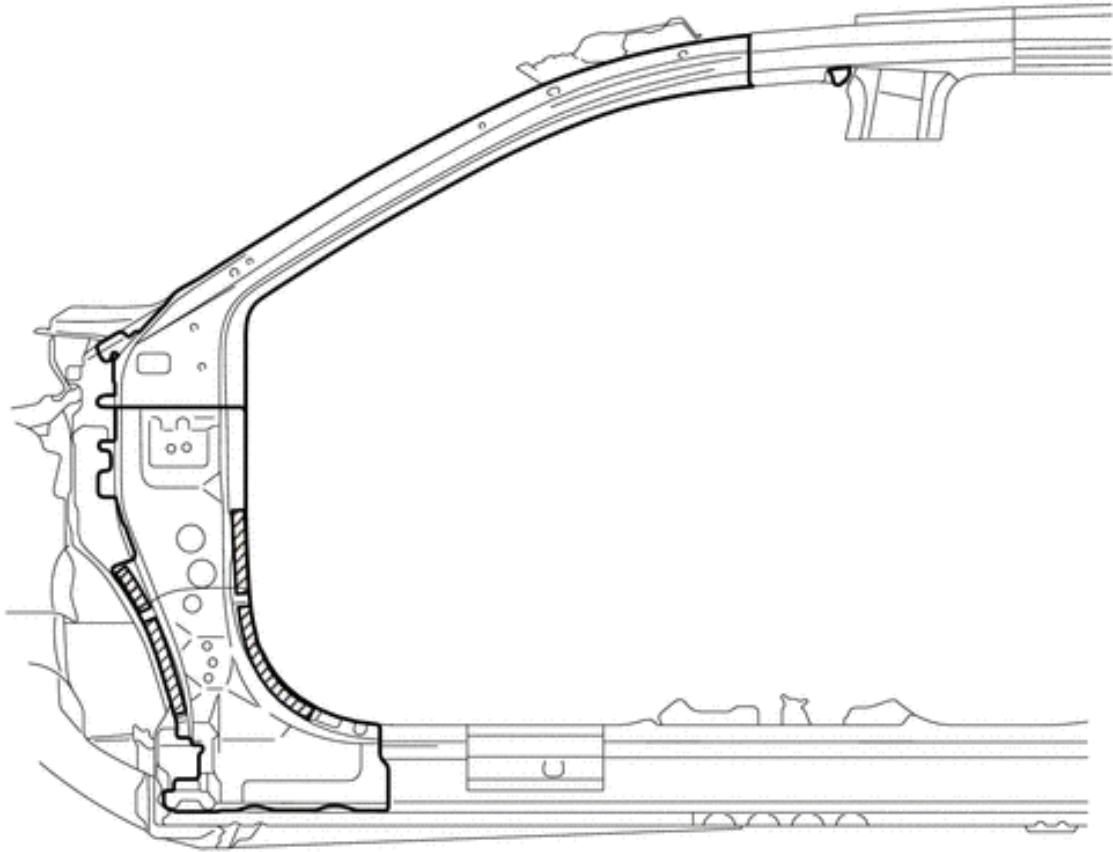


(e) Roughly cut open the panel so that the adhesive can be reached. Cut through the adhesive with a cut chisel to remove the panel.

**HINT:**

In cases where the adhesive cannot be removed with a cut chisel, heat the adhesive with an industrial heater gun or gas burner taking care not to cause panel deformation by overheating.





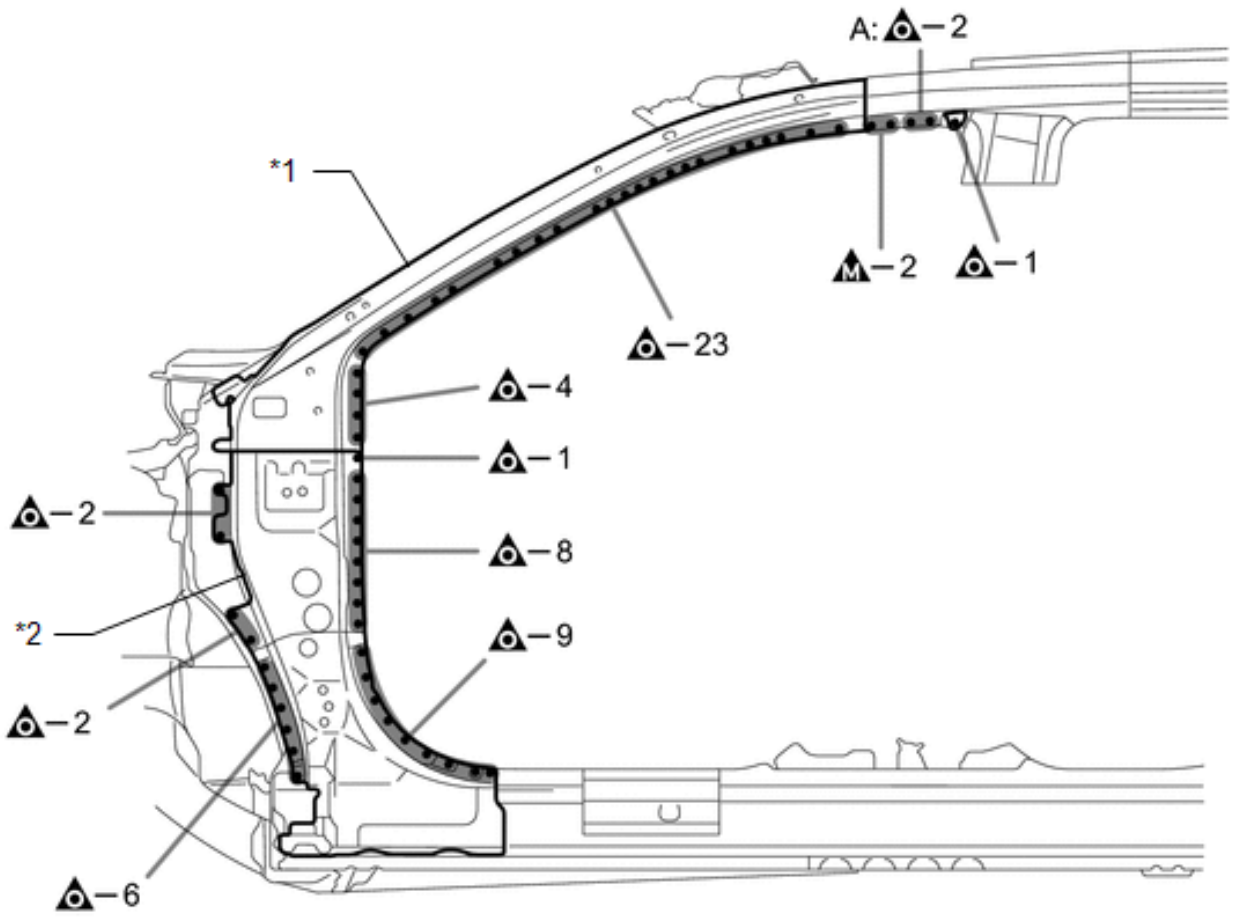
Adhesive

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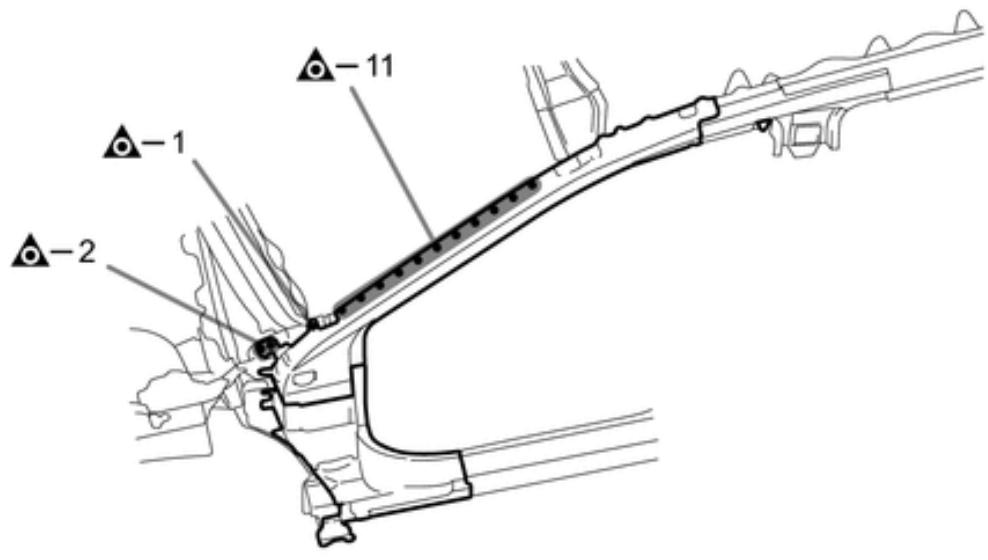
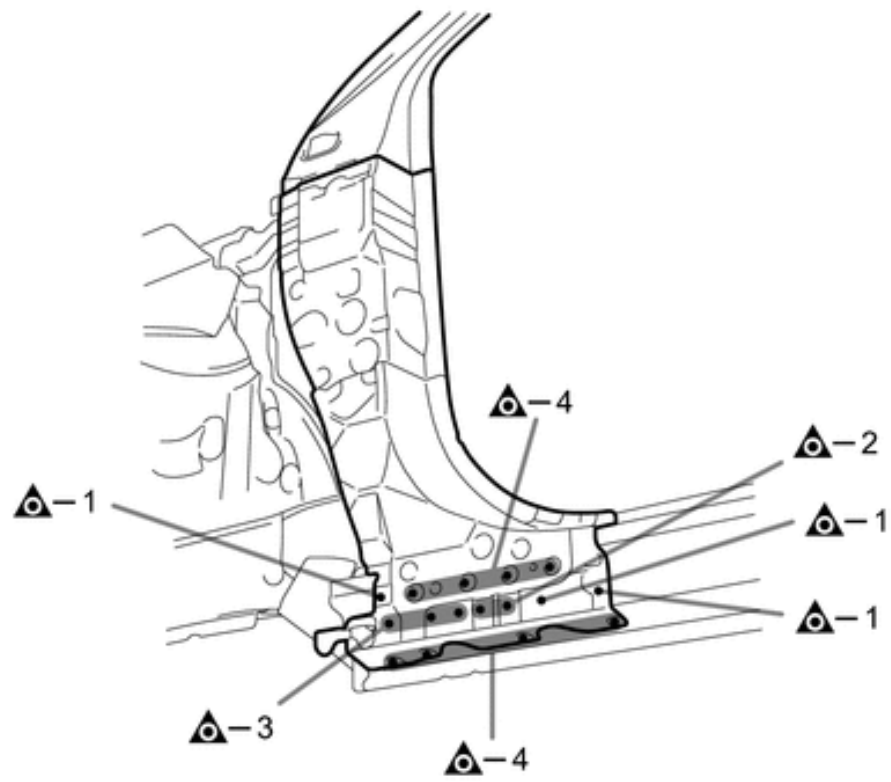
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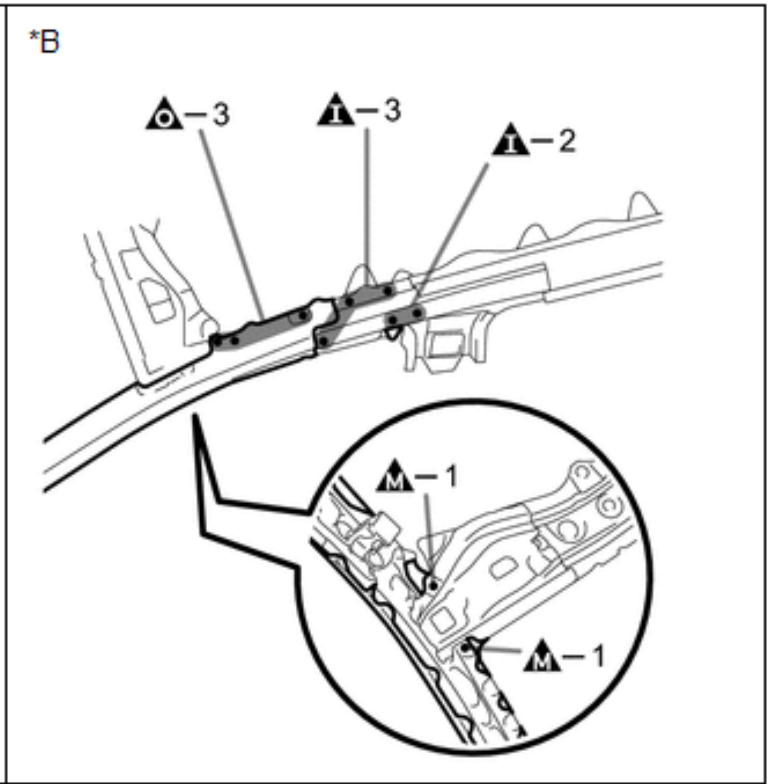
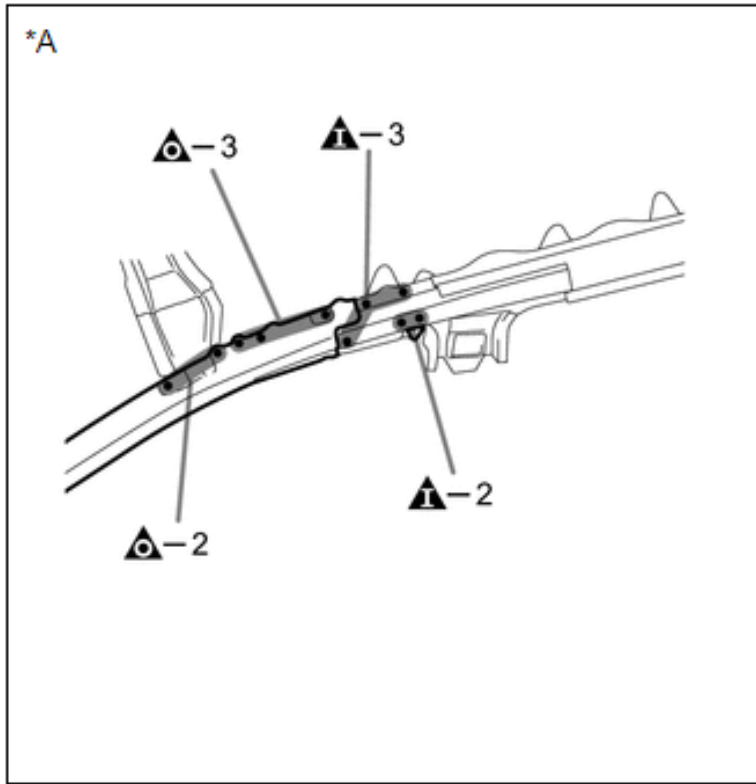
(f) Remove the roof side rail sub-assembly and front body pillar reinforce sub-assembly lower.

(g) A indicates welds to remove for easier removal.



*1	ROOF SIDE RAIL SUB-ASSEMBLY	*2	FRONT BODY PILLAR REINFORCE SUB-ASSEMBLY LOWER
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*A	except Panoramic Moon Roof	*B	for Panoramic Moon Roof
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- (h) When replace only the outer panel, please cut off a necessary range depending on a damage range.
- (1) Carefully cut the outer panel so not to damage the reinforcement.
  - (2) Make sure that butt welding does not heat-affect the reinforcement when welding the outer panel.

**INSTALLATION**

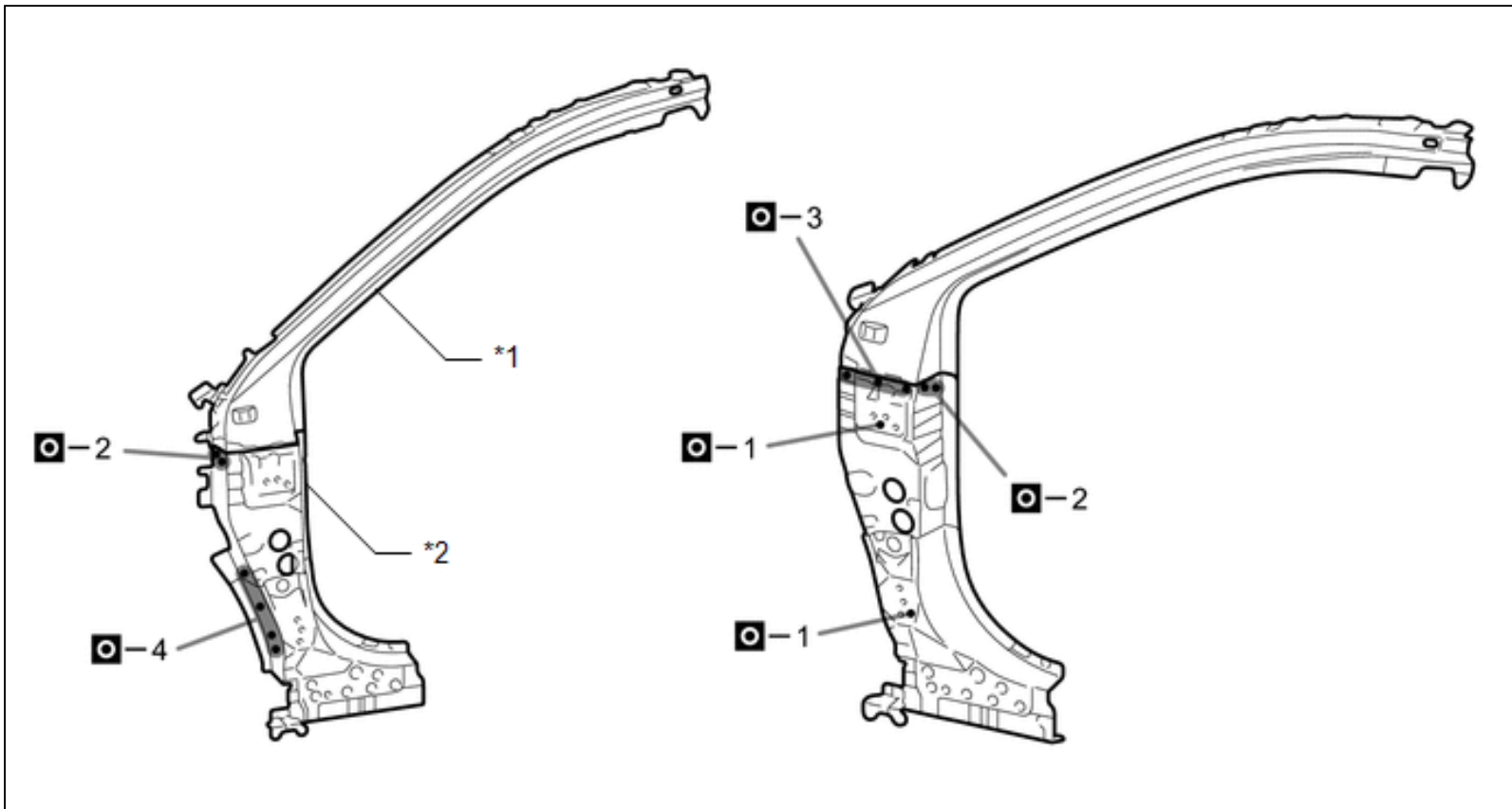
SYMBOL MEANING	
	Plug Weld
	Plug Weld
	Plug Weld
	Butt Weld

SYMBOL MEANING



Body Sealer

- (a) Inspect the fitting of the related parts around the new parts before welding. This affects the appearance of the finish.
- (b) Temporarily install the new parts and measure each part of the new parts in accordance with the body dimension diagram. (See the body dimensions)
- (c) Before temporarily installing the new parts, weld the roof side rail sub-assembly and front body pillar reinforce sub-assembly lower with the standard number of welding points.

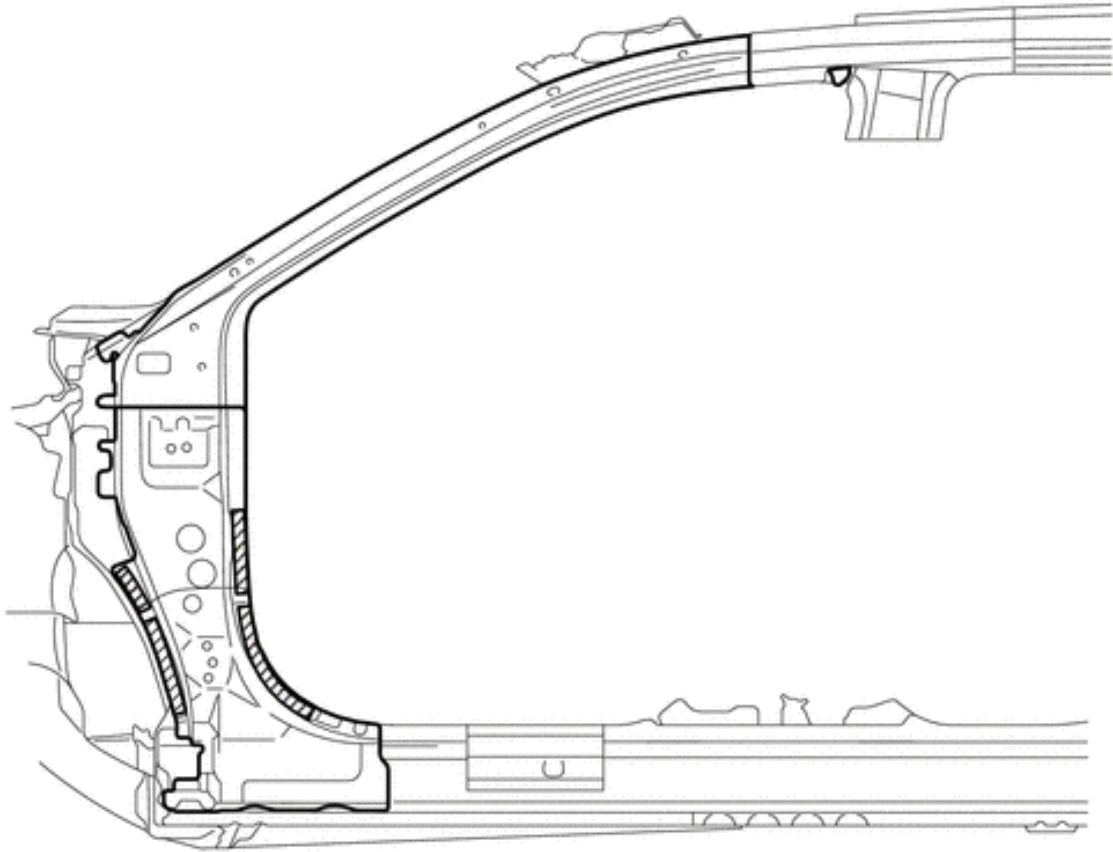


*1	ROOF SIDE RAIL SUB-ASSEMBLY	*2	FRONT BODY PILLAR REINFORCE SUB-ASSEMBLY LOWER
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(d) Apply adhesive (3M™ Automix™ Panel Bonding Adhesive #8115).

**HINT:**

- Do not apply adhesive around the plug welding points.
- Minimize squeeze out in plug welding areas.

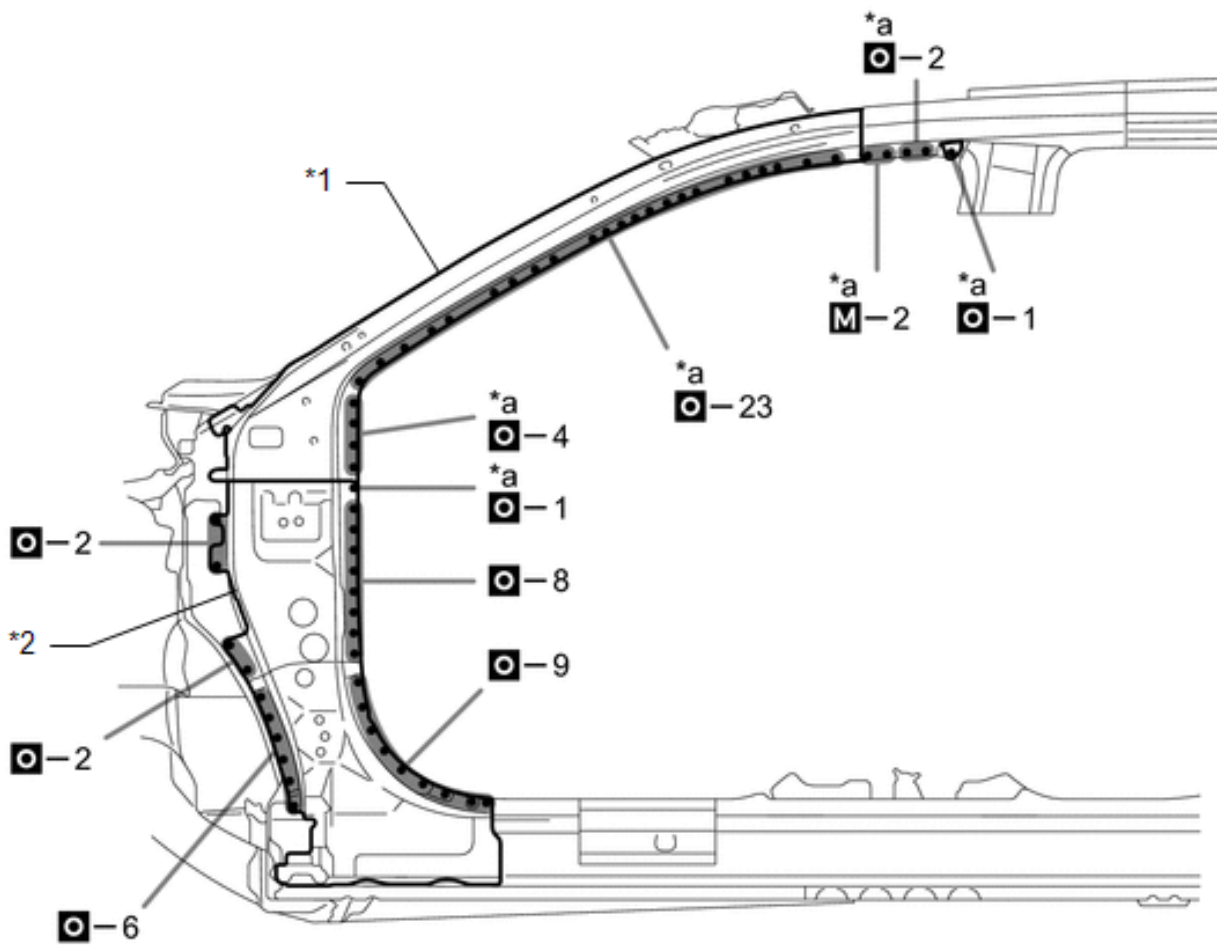


Adhesive

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(e) Weld the roof side rail sub-assembly and front body pillar reinforce sub-assembly lower to the vehicle side.



*1	ROOF SIDE RAIL SUB-ASSEMBLY	*2	FRONT BODY PILLAR REINFORCE SUB-ASSEMBLY LOWER
*a	Ultra High Strength Steel Welding Point	-	-

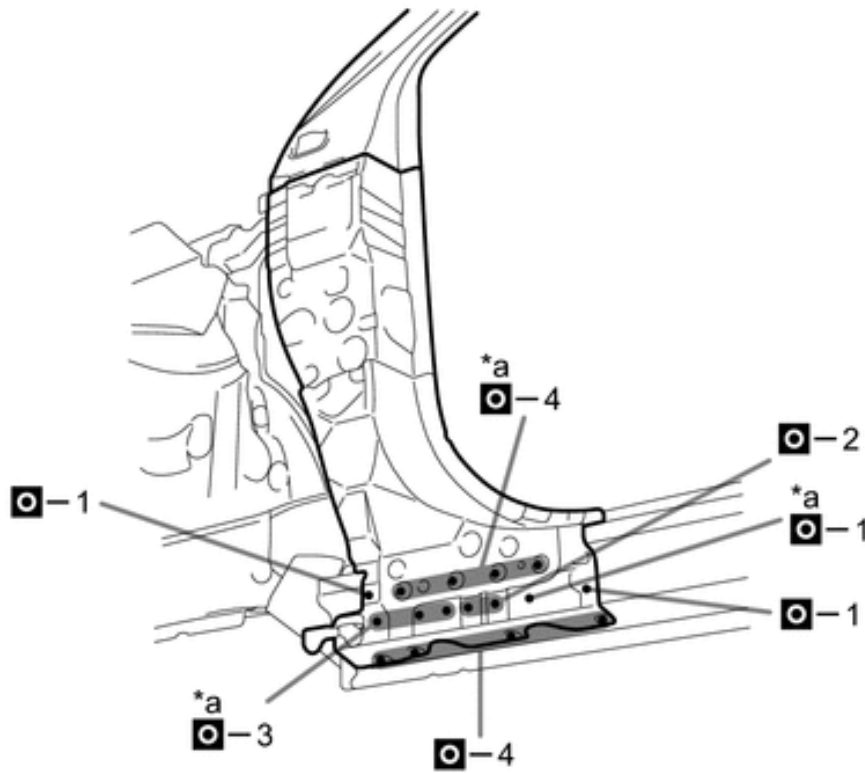
**Follow the welding conditions below when welding ultra high strength steel to assure sufficient weld strength. (When repairing this model)**

When welding 2 panels together including 1500 MPa or 1180 MPa ultra high strength steel.

*a: Plug weld	Plug diameter	10 mm (0.39 in.)
	Wire type	AWS A5.18 ER70S-3
	Shield gas	Metal active gas

**NOTICE:**

Be sure to use Metal active gas (Ar 80% + CO<sub>2</sub> 20%) as the shield gas when plug welding. Sufficient weld strength cannot be assured when using 100% CO<sub>2</sub> shield gas.



*a	Ultra High Strength Steel Welding Point	-	-
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**Follow the welding conditions below when welding ultra high strength steel to assure sufficient weld strength. (When repairing this model)**

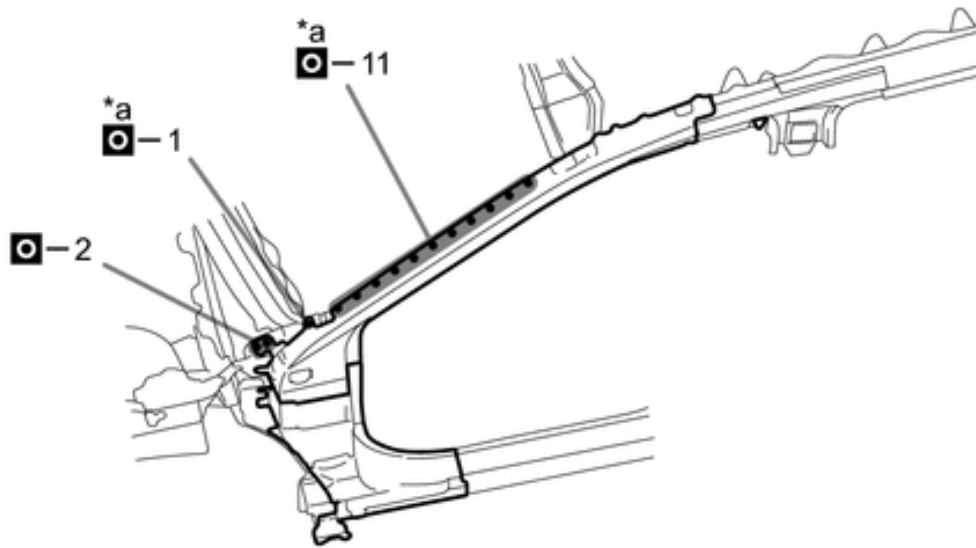
When welding 2 panels together including 980 MPa ultra high strength steel.

*a: Plug weld	Plug diameter	10 mm (0.39 in.)
	Wire type	AWS A5.18 ER70S-3
	Shield gas	Metal active gas

**NOTICE:**

Be sure to use Metal active gas (Ar 80% + CO<sub>2</sub> 20%) as the shield gas when plug welding. Sufficient weld strength cannot be assured when using 100% CO<sub>2</sub> shield gas.





*a	Ultra High Strength Steel Welding Point	-	-
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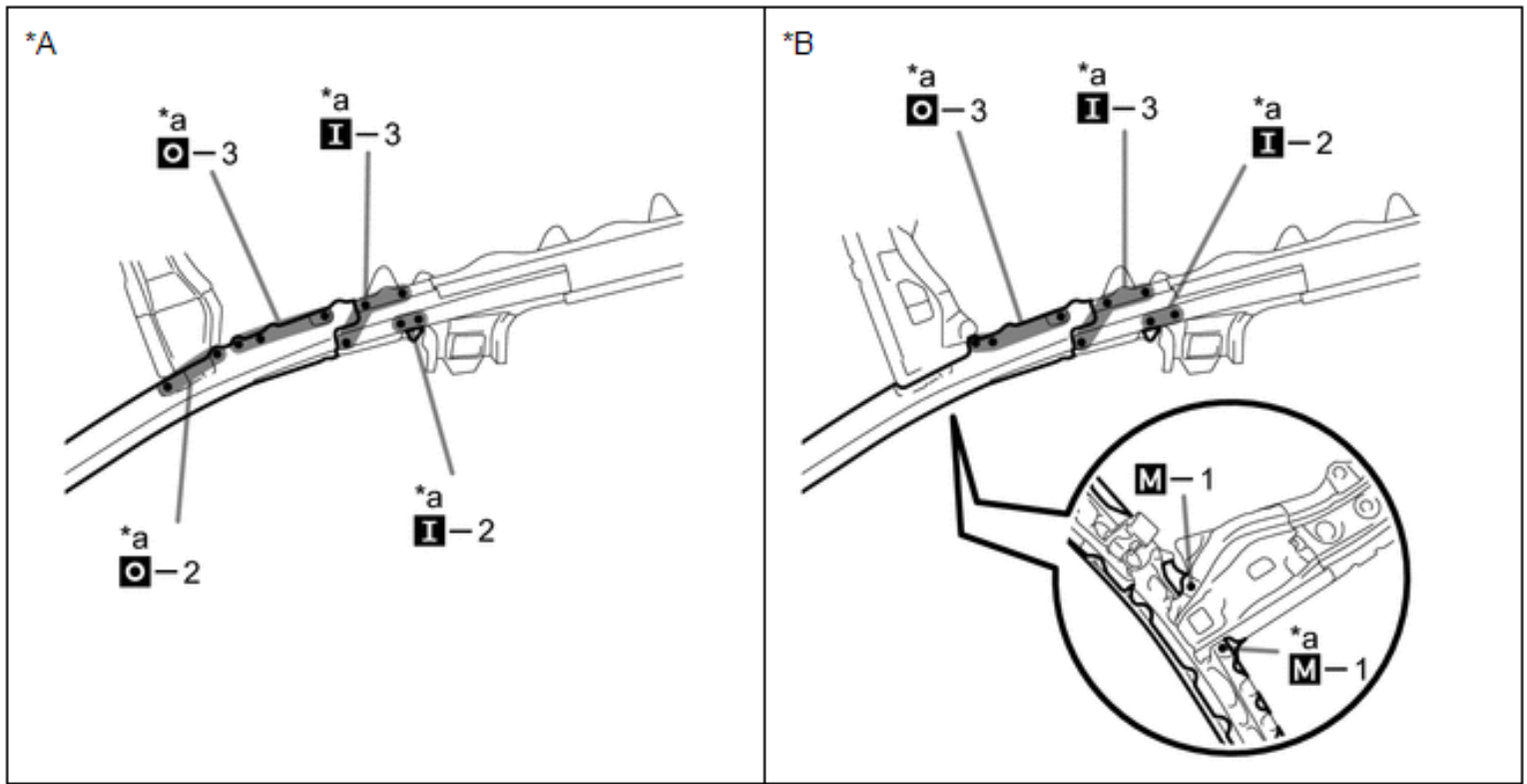
**Follow the welding conditions below when welding ultra high strength steel to assure sufficient weld strength. (When repairing this model)**

When welding 2 panels together including 1500 MPa ultra high strength steel.

*a: Plug weld	Plug diameter	10 mm (0.39 in.)
	Wire type	AWS A5.18 ER70S-3
	Shield gas	Metal active gas

**NOTICE:**

Be sure to use Metal active gas (Ar 80% + CO<sub>2</sub> 20%) as the shield gas when plug welding. Sufficient weld strength cannot be assured when using 100% CO<sub>2</sub> shield gas.



*A	except Panoramic Moon Roof	*B	for Panoramic Moon Roof
*a	Ultra High Strength Steel Welding Point	-	-

**Follow the welding conditions below when welding ultra high strength steel to assure sufficient weld strength. (When repairing this model)**

When welding 2 panels together including 1500 MPa or 1180 MPa ultra high strength steel.

*a: Plug weld	Plug diameter	10 mm (0.39 in.)
	Wire type	AWS A5.18 ER70S-3
	Shield gas	Metal active gas

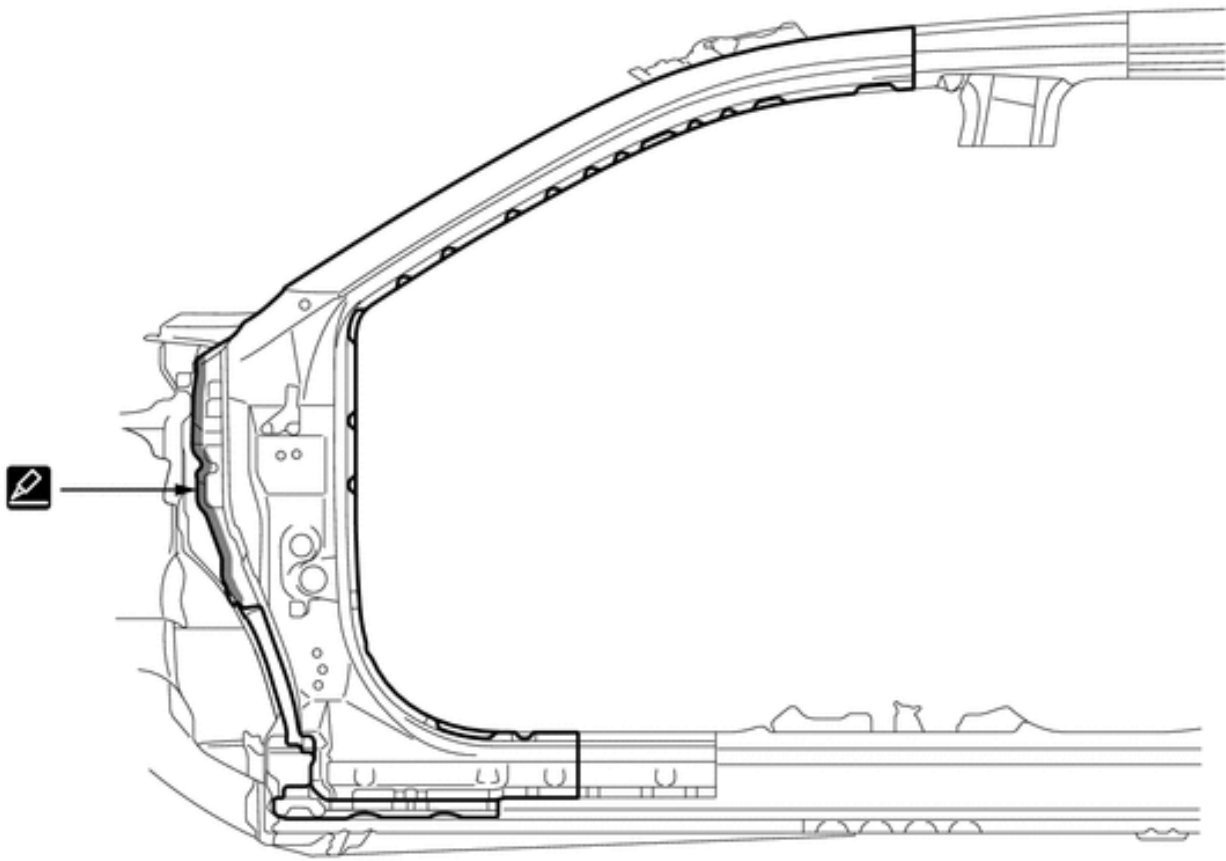
**NOTICE:**

Be sure to use Metal active gas (Ar 80% + CO<sub>2</sub> 20%) as the shield gas when plug welding. Sufficient weld strength cannot be assured when using 100% CO<sub>2</sub> shield gas.

(f) Before installing a new part, apply body sealer.

**HINT:**

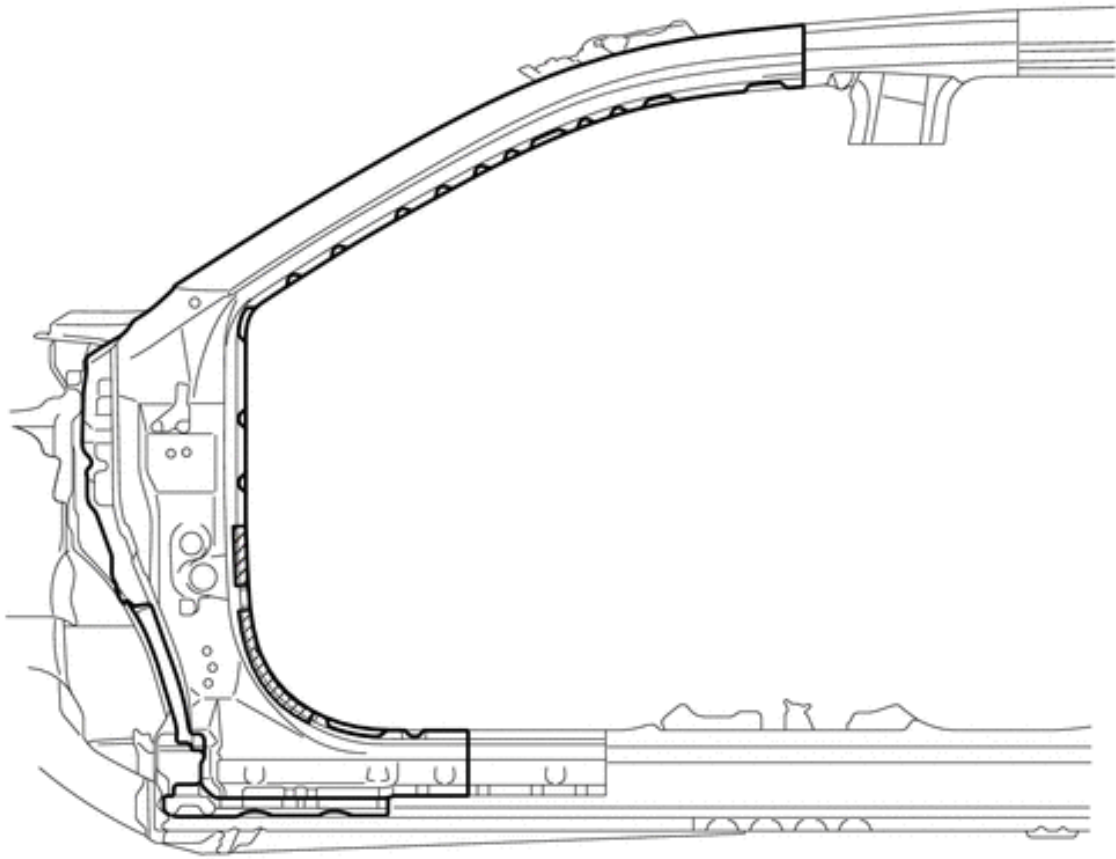
Apply body sealer in an even, continuous bead.



(g) Apply adhesive (3M™ Automix™ Panel Bonding Adhesive #8115).

**HINT:**

- Do not apply adhesive around the plug welding points.
- Minimize squeeze out in plug welding areas.

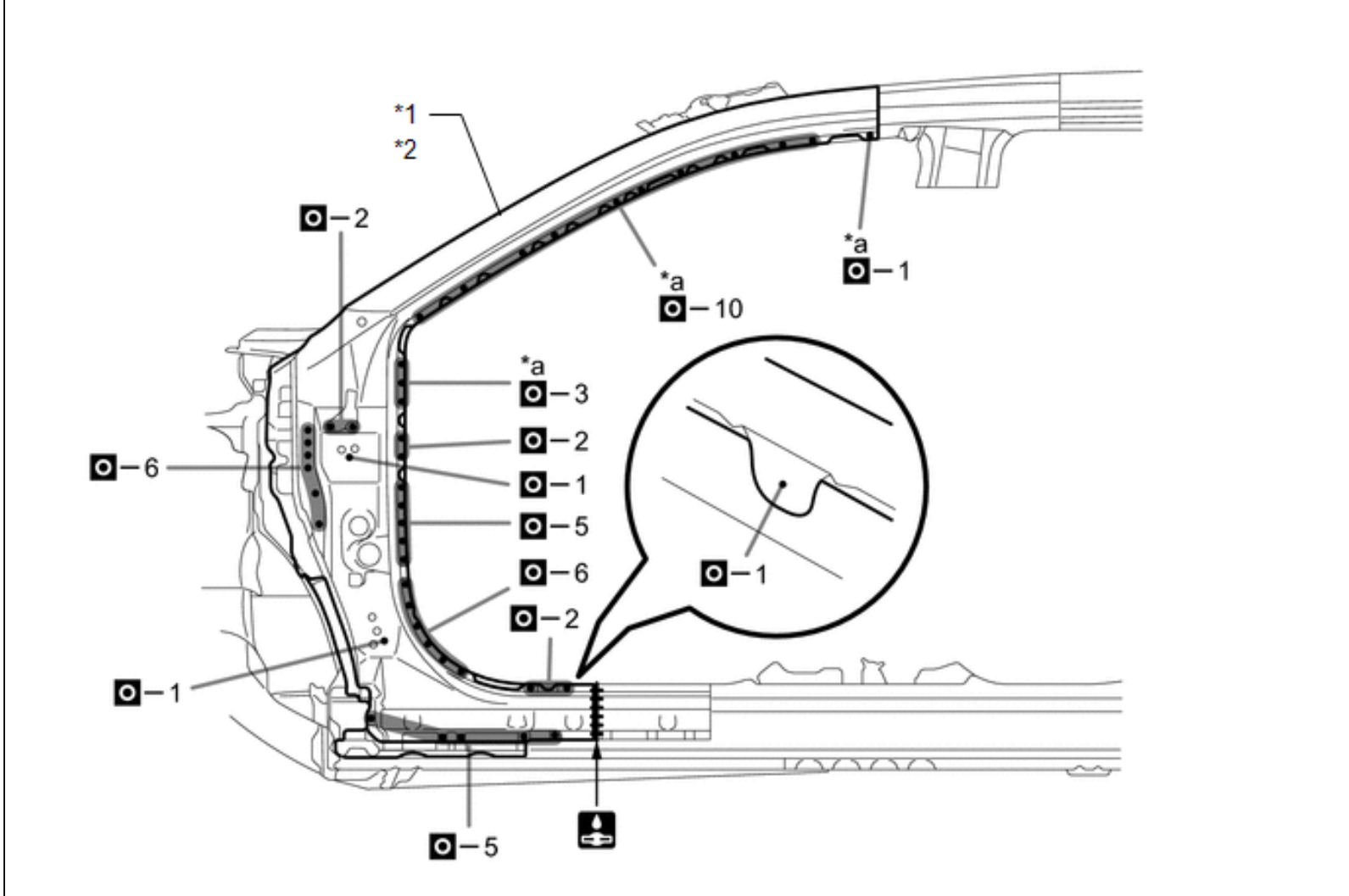


Adhesive

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(h) Weld the front body pillar upper outer or side panel sub-assembly to the vehicle side.



*1	FRONT BODY PILLAR UPPER OUTER (for TMC Made)	*2	SIDE PANEL SUB-ASSEMBLY (for TMMC Made)
*a	Ultra High Strength Steel Welding Point	-	-

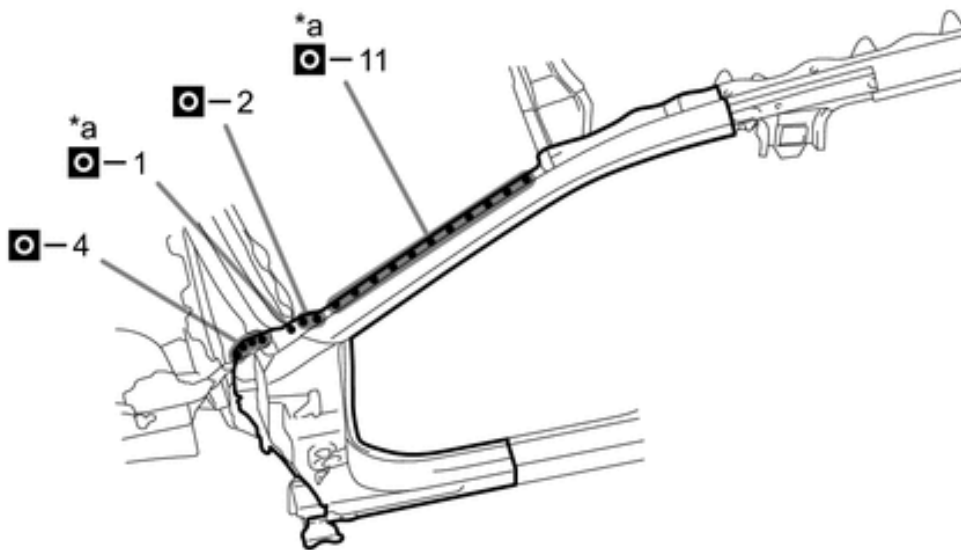
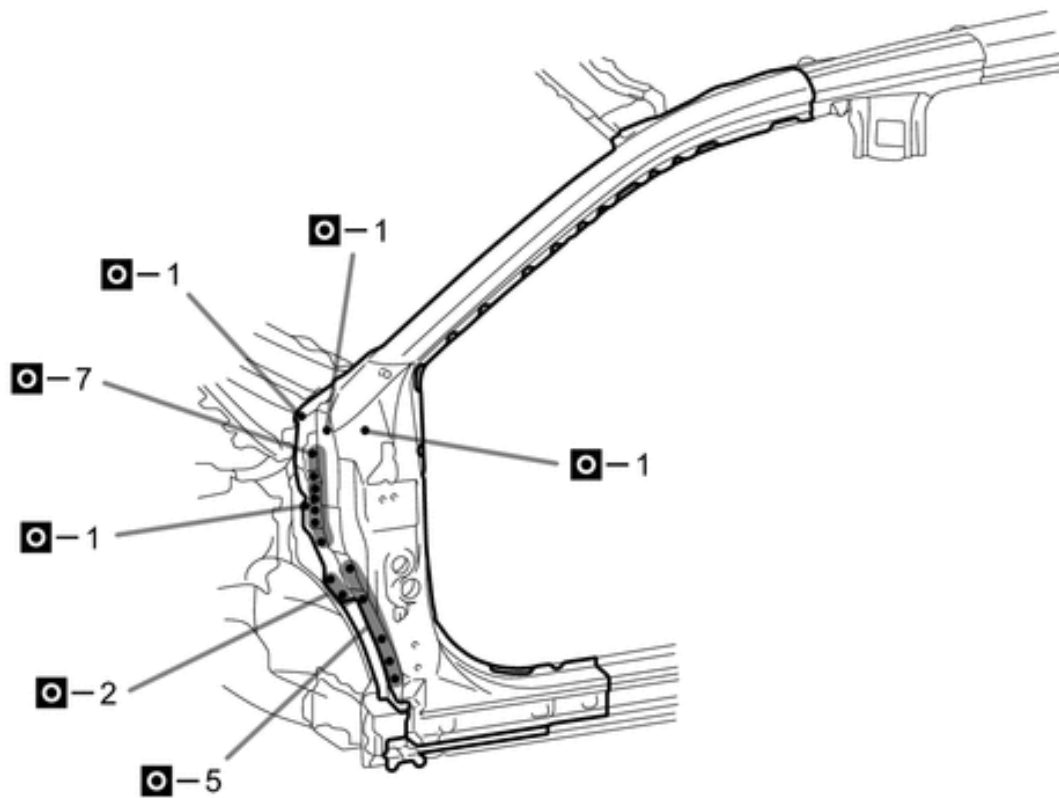
**Follow the welding conditions below when welding ultra high strength steel to assure sufficient weld strength. (When repairing this model)**

When welding 3 panels or more together including 1500 MPa or 1180 MPa ultra high strength steel.  
(When plug welding a third panel to 2 panels which are welded under the conditions described above.)

*a: Plug weld	Plug diameter	Same as the standard method (See the introduction)
	Wire type	AWS A5.18 ER70S-3
	Shield gas	Metal active gas

**NOTICE:**

Be sure to use Metal active gas (Ar 80% + CO<sub>2</sub> 20%) as the shield gas when plug welding. Sufficient weld strength cannot be assured when using 100% CO<sub>2</sub> shield gas.



*a	Ultra High Strength Steel Welding Point	-	-
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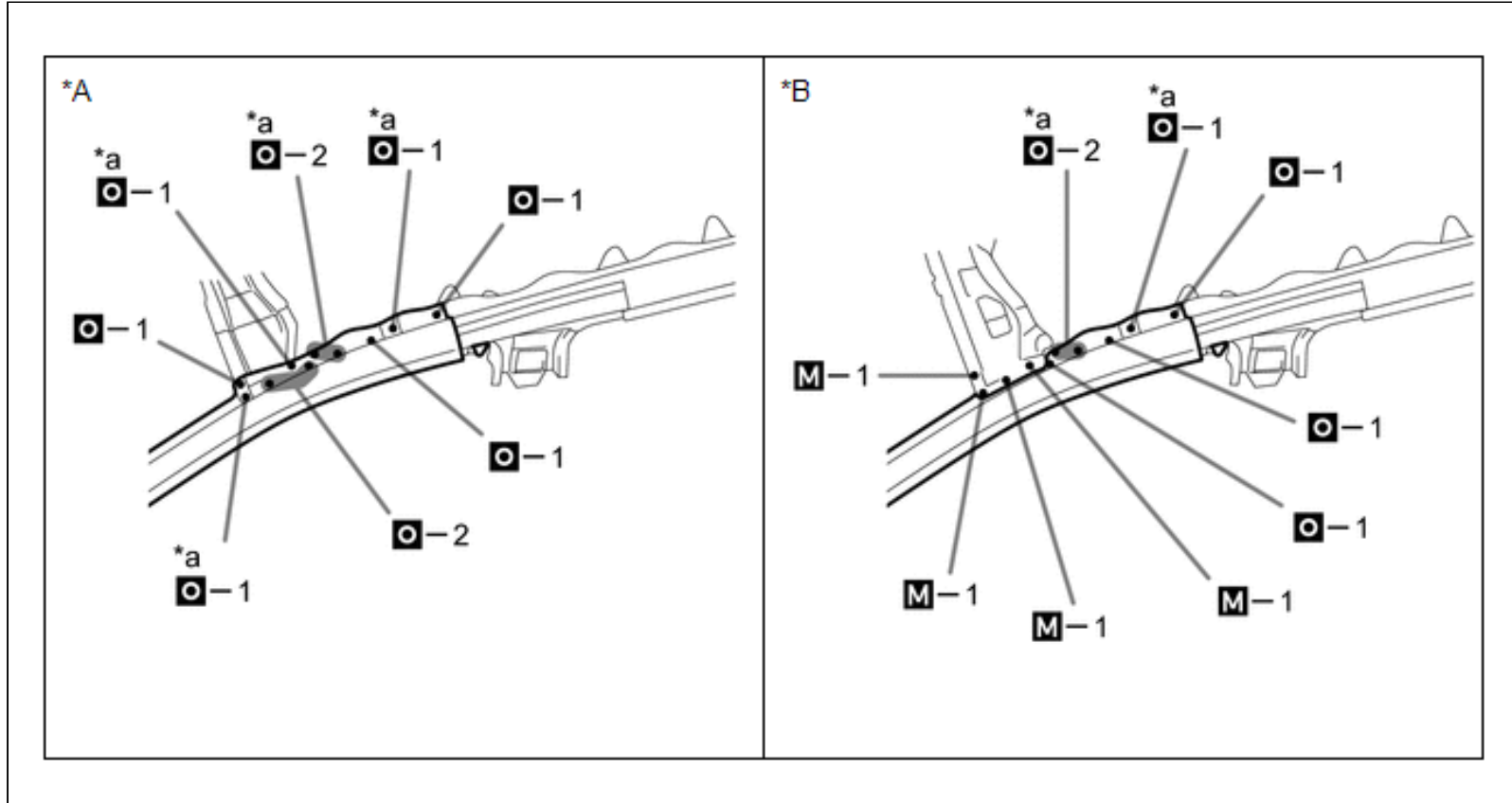
**Follow the welding conditions below when welding ultra high strength steel to assure sufficient weld strength. (When repairing this model)**

When welding 3 panels or more together including 1500 MPa ultra high strength steel. (When plug welding a third panel to 2 panels which are welded under the conditions described above.)

*a: Plug weld	Plug diameter	Same as the standard method (See the introduction)
	Wire type	AWS A5.18 ER70S-3
	Shield gas	Metal active gas

**NOTICE:**

Be sure to use Metal active gas (Ar 80% + CO<sub>2</sub> 20%) as the shield gas when plug welding. Sufficient weld strength cannot be assured when using 100% CO<sub>2</sub> shield gas.



*A	except Panoramic Moon Roof	*B	for Panoramic Moon Roof
*a	Ultra High Strength Steel Welding Point	-	-

**Follow the welding conditions below when welding ultra high strength steel to assure sufficient weld strength. (When repairing this model)**

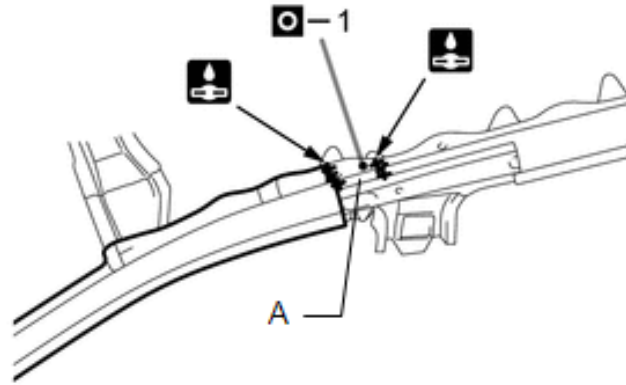
When welding 3 panels or more together including 1500 MPa ultra high strength steel. (When plug welding a third panel to 2 panels which are welded under the conditions described above.)

*a: Plug weld	Plug diameter	Same as the standard method (See the introduction)
	Wire type	AWS A5.18 ER70S-3
	Shield gas	Metal active gas

**NOTICE:**

Be sure to use Metal active gas (Ar 80% + CO<sub>2</sub> 20%) as the shield gas when plug welding. Sufficient weld strength cannot be assured when using 100% CO<sub>2</sub> shield gas.

(i) Weld the A to the vehicle side.



- (j) After welding, apply the foamed sealing material to the corresponding parts. (See the painting/coating)
- (k) After welding, apply body sealer to the corresponding parts. (See the painting/coating)
- (l) After applying the top coat, apply anti-rust agent to the internal panel portion of the closed section structural weld points.

