

## Body Repair Tech Note: Repairing Electrical Harnesses

Body Repair Tech Notes provide information about Tesla-approved methods and practices for body repair. These instructions assume knowledge of motor vehicle and high voltage electrical component repairs, and should only be executed by trained professionals. Tesla assumes no liability for injury or property damage due to a failure to properly follow these instructions or for repairs attempted by unqualified individuals.

**⚠ WARNING:** Only trained technicians are allowed to repair electrical connectors. Performing a repair of an electrical connector without proper training could result in injury to the technician and damage to the electrical components.

Repairing a damaged electrical harness can save significant time and material costs compared to replacing the harness. Every repair can affect reliability, so it is important to match factory-level quality. Use the procedures and best practices described in this document to perform a factory-level harness repair. If the repair cannot be completed to factory-level quality, replace the harness.

### Supplies

**⚠ CAUTION:** Use only the tools and supplies from the harness repair kit (1061177-00-B) and the soldering iron and heat tool kit (1060908-00-A for North America and APAC or 1060908-01-A for EMEA).

- Crimp tool: 1060842-00-A
- Replacement soldering tip: 1061312-00-A
- Wire cutting and stripping pliers: 1060844-00-A
- Solder (lead-free, no-clean flux, 96.5% Tin, 3% Silver, 0.5% Copper, .031 in diameter): 1061316-00-A
- Electrical tape (yellow): 1061317-00-A
- Harness tape (black): 1053847-00-A
- Cable ties: 1061321-00-A
- Crimp barrels: Refer to table below
- Heat shrink tube: Refer to table below

Wire Size on Circuit Diagram	Wire Gauge (AWG)	Crimp Barrel P/N	Heat Shrink Tube P/N	Heat Shrink Tube Diameter (mm)
0.13	26	1451044-00-A	1061319-01-A	4.0
0.35	22	1061313-00-A	1061319-01-A	4.0
0.5	20	1061313-00-A	1061319-01-A	4.0
0.75	18	1061313-00-A	1061319-02-A	4.5
0.8	18	1061313-00-A	1061319-02-A	4.5
1.0	16	1061314-00-A	1061319-02-A	4.5
2.0	14	1061314-00-A	1061319-02-A	4.5
3.0	12	1061315-00-A	1061319-03-A	6.0

Purchase the necessary primary wire from a local supplier. Refer to the above table for the proper size. The wire must meet the following specifications, unless otherwise specified on the harness wire label:

- Copper

- Stranded
- 60V
- Thin-wall PVC insulation (SAE TWP type or equivalent)

## Repair Guidelines

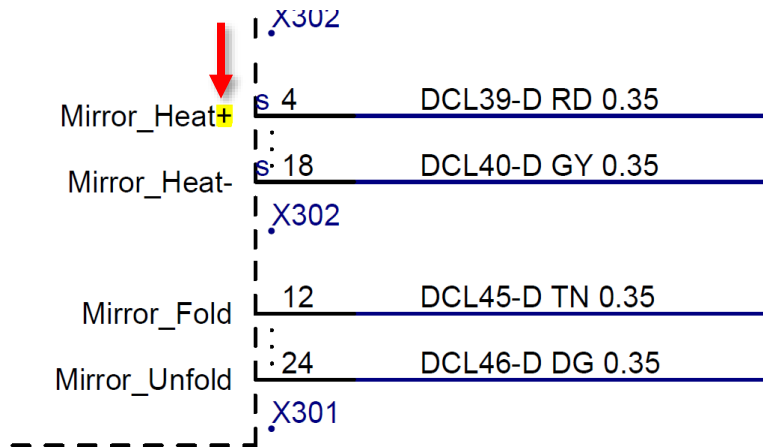
The wires listed below are not repairable. Replace the entire wiring harness if there is damage to any of these wires:

- Airbag sensor and seat sensor
- High Voltage (HV) circuits

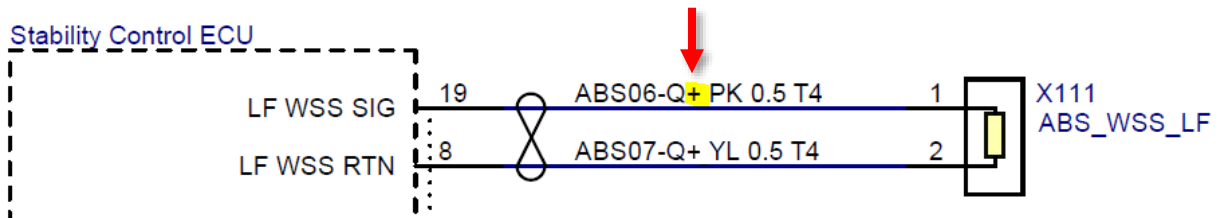
Contact Body Repair Support for support with repairs on:

- **Safety-related chassis circuits**, such as stability control, ABS, or parking brake
- **Powertrain circuits**, such as accelerator pedal signal, brake pedal signal, wheel speed sensors and motor encoder
- **Driver Assistance safety circuits**, such as parking sensors, radar assembly, cameras (forward-facing, rear-view, b-pillar, or side repeater)
- **Supplemental restraint system (SRS) circuits**, such as airbag and seatbelt.
- Any wire marked with a + sign on the wire in the circuit diagram; this indicates a safety-critical circuit (Figure 2).
- High Voltage Interlock Loop (HVIL)
- Wiring for any CAN or LIN Bus
- Coaxial cables
- Any wire sizes not listed in the “Supplies” section of this document
- Wires that have damage within 100 mm of a connector
- Terminals

**NOTE:** A + sign on the pin name in the circuit diagram indicates positive power (Figure 1). These circuits are repairable by a body shop if they do not have a + sign on the wire in the circuit diagram.



✓ Figure 1 (Circuit with positive power, repairable)

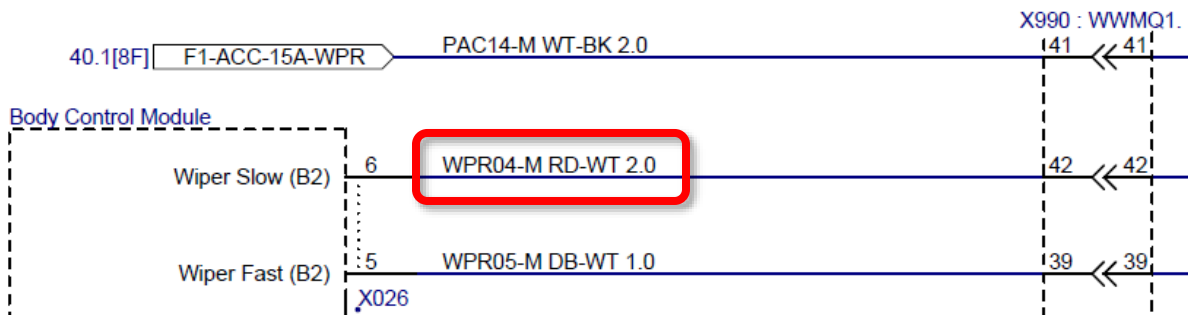


**✗ Figure 2 (Safety-critical circuit, not repairable by a body shop)**

**NOTE:** At this time, terminals can only be repaired by a Service Center.

When doing a repair to an electrical harness, provide the information listed below to local Body Repair Support:

- a. Subject: [Vehicle Identification Number (VIN)] Electrical Harness Repair.
- b. Body of the e-mail:
  - Description from the circuit diagram For example, “WPR04-M RD-WT 2.0” (Figure 3).
  - The circuit that is being repaired. For example, “Windshield wiper slow speed output from body control module to X990”.
  - Type of repair (single splice, double splice, number of wires affected).
  - If known, how the damage was caused.
  - Photographs of the damaged area. Include photos before, during and after the repair. Make sure that a photo that shows the original routing of the wire is included.



**Figure 3**

If more than 1 wire in a harness needs to be repaired, plan the locations of the repairs and mark each wire with the approximate location of the splice. Avoid placing the splices next to each other to minimize the increase in harness diameter. Stagger the splices as much as possible (Figure 4).



**Figure 4**

Avoid splices in areas that have movement, such as a hinge in a door or liftgate.

## Repair Using a Single Splice

Using a single splice to repair a wire shortens the length of the wire segment. A wire can be repaired with a single splice in the following circumstances (if any of these do not apply, refer to the “Repair Using a Double Splice” section of this document instead):

- The damage is to 1 wire in 1 location.
- The length of the damage is less than 10 mm.
- The harness is long and loose enough to be unaffected by the shortening caused by this repair.
- The repair will not put excess strain on the wire where it enters the connector or harness transition (Figure 5).



**Figure 5**

**⚠ CAUTION:** If the harness cannot be repaired to factory-level quality at any point in this procedure, discontinue this procedure and replace the harness.

1. Disconnect all of the necessary electrical connectors to electrically isolate the harness from the vehicle, or disconnect 12V power.
2. Use a multimeter to check for the absence of voltage on the circuit being repaired.

**⚠ WARNING:** Do not perform this procedure while the circuit is energized.

3. Make sure that there is enough room to work comfortably on the circuit being repaired. Protect all surfaces that can be damaged by heat in later steps.
4. Refer to the circuit diagram to find the correct wire size.
5. Refer to the “Supplies” section of this document to find the proper crimp barrel and heat shrink tube for the size of the wire.
6. Send “before” photographs of the repair to local Body Repair Support.

7. Cut out the damaged portion of the wire. Make sure that the original wire is preserved as much as possible.

**⚠ CAUTION:** If more than 1 wire in the harness needs to be repaired, cut only 1 wire at a time to eliminate the risk of joining the wrong circuits.

**NOTE:** If the damaged portion is over 10 mm, refer to the “Repair Using a Double Splice” section of this document instead.

8. Slide the heat shrink tube over one end of the wire.

**NOTE:** Do not skip this step. The procedure will have to be repeated if the wire is joined without installing the heat shrink tube.

9. Hold the wire near the cut area while stripping the ends of the wires so that there is enough exposed conductor to reach the center stop of the crimp barrel (Figure 6).

**⚠ CAUTION:** Do not hold the harness by a connector when stripping the wire. This can damage the crimped terminals inside the connector.



**Figure 6**

10. Inspect the wire for damaged or missing strands.

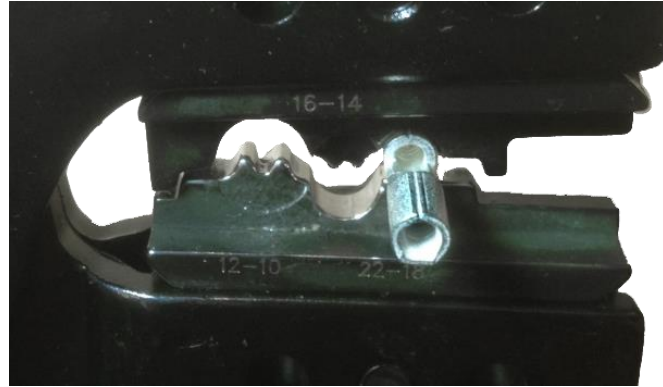
- If strands are damaged and the wire still has sufficient slack, cut the wire again and repeat steps 8 and 9, using a larger setting on the stripping pliers.
- If strands are damaged and the repair will shorten the wire enough to put strain on the wire where it enters the connector or harness transition, perform the procedure in the “Repair Using a Double Splice” section of this document, using a larger setting on the stripping pliers.

11. Inspect the wire for oxidation and corrosion.

- If brown or blue-green oxidation is present on the copper strands, cut out the entire section of oxidized wire, then perform the procedure in the “Repair Using a Double Splice” section of this document.

12. Confirm that the routing of the wire matches the original configuration.

13. Insert the crimp barrel into the proper channel of the crimp tool and squeeze the handle lightly to hold the barrel in place. The round part of the crimp die should hold the side of the crimp with the seam (Figure 7).



**Figure 7**

14. Insert the exposed copper wire into the barrel. Make sure that the wires are fully inserted, no strands extend from the side of the barrel, and no insulation is present inside the barrel.
15. Fully squeeze the handle to crimp the barrel. The crimp tool releases only when the barrel is fully crimped (Figures 8 and 9).



**Figure 8**



**Figure 9**

16. Repeat steps 13 – 15 on the other side of the barrel.
17. Apply tension to the wires and make sure that the crimp holds securely. If the wires come out of the barrel, do not attempt to re-insert them. Cut the wires, remove the barrel, and refer to the “Repair Using a Double Splice” section of this document.
18. Move the heat shrink tube at least 60 mm away from the joint to prevent it from shrinking during soldering.
19. Put on cut-resistant mechanic’s gloves or other heat-resistant gloves.
20. Protect all surfaces that can be damaged by heat from the soldering iron.

**⚠ WARNING:** Always read and understand the soldering iron operator’s manual before using it to solder or shrink heat shrink tubing.

**⚠ CAUTION:** Do not use the soldering iron in an area where surrounding surfaces, materials, or components could be damaged by hot air.

21. Solder the connection:

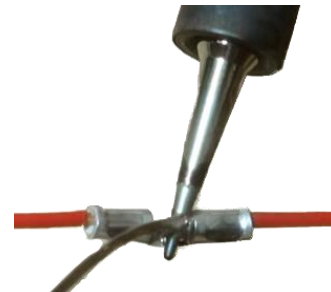
- a) Make sure that the barrel and wire are free of dirt and grease.
- b) Install the soldering tip on the soldering iron.
- c) Allow the soldering iron to fully warm up.
- d) Clean the tip of the soldering iron on a damp sponge.

**NOTE:** Replace the tip if it does not have a shiny appearance, or if solder does not melt on the tip when it is fully warmed up.

- e) Apply a small amount of solder to the tip of the soldering iron.
- f) Use the soldering iron to apply heat to the center of the barrel for a few seconds (Figure 10), then apply solder into the center window (Figure 11).



**Figure 10**



**Figure 11**

- g) Stop applying solder when it fills the inner opening of the center window (Figure 12).



**Figure 12**

- h) Remove the soldering iron from the barrel before the solder wicks into the wire insulation or the soldering iron overheats the insulation.

22. Hold the joint still while returning the soldering iron to a safe location.

23. Turn off the soldering iron and allow it to cool.

**NOTE:** Heating the soldering iron unnecessarily degrades the surface of the soldering tip.

24. Inspect the solder joint. If the solder is in a spherical shape, the soldering iron was not hot enough (Figure 13). Repeat step 21.



**✗ Figure 13 (Spherical solder, soldering iron not hot enough)**

25. Slide the heat shrink tube over the barrel, aligning the center of the heat shrink tube with the center of the barrel.

26. Once the soldering tip has cooled, remove it from the soldering iron and install the flame tip and deflector tip.

**⚠ WARNING:** Make sure that the soldering tip has cooled completely before removing it.

27. Use the soldering iron to affix the heat shrink tube to the wire (Figure 14).

**⚠ CAUTION:** Continuously move the soldering iron to avoid overheating any specific section of the heat shrink tube or wiring. Any discoloration of the wiring insulation indicates overheating.



**Figure 14**

28. Turn off the soldering iron and return it to a safe location.

29. Allow the heat shrink tube and wire to cool.

30. Inspect the heat shrink tube to make sure that it is fully sealed to the wire and that the adhesive is bonded to the wire insulation.



31. Hold the repaired area against the rest of the harness, then wrap the harness with the electrical tape that is supplied with the wire harness repair kit. Apply tape to 50 mm of the harness on each side of the splice (Figure 15).

**⚠ CAUTION:** Do not apply tape within 50 mm of a connector.

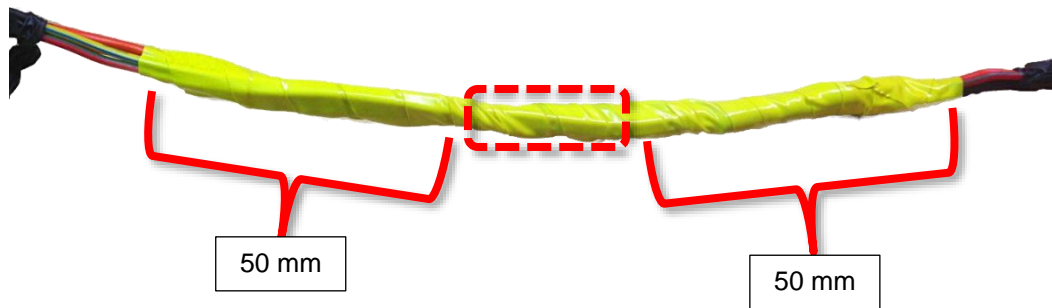


Figure 15

32. Re-apply any harness coverings, tape, or conduit that was in place prior to the repair (Figure 16). Apply new harness tape, if necessary.

**NOTE:** If the repaired wire is routed incorrectly, do not leave it as-is. Cut the wire and repeat this procedure to restore the wire to the way it was routed from the factory.



Figure 16

33. Send “after” photographs of the repair to [BodyRepar@Tesla.com](mailto:BodyRepar@Tesla.com).

34. If the damage was caused by the harness contacting another part of the vehicle, make sure that the harness is adequately supported or restrained to prevent future damage.

## Repair Using a Double Splice

A wire should be repaired with 2 splices in either of the following circumstances:

- Damage to 1 wire in 1 location that affects more than 10 mm of the wire.
- Damage to 1 wire in more than 1 location, requiring a new section of wire.

**⚠ CAUTION:** Do not perform this procedure if the wire section extends through grommets or other seals. These seals can be damaged by the new wire section.

**⚠ CAUTION:** If the harness cannot be repaired to factory-level quality at any point in this procedure, discontinue this procedure and replace the harness.

1. Disconnect all of the necessary electrical connectors to electrically isolate the harness from the vehicle, or disconnect 12V power.

2. Use a multimeter to check for voltage on the circuit being repaired.

**⚠ WARNING:** Do not perform this procedure while the circuit is energized.

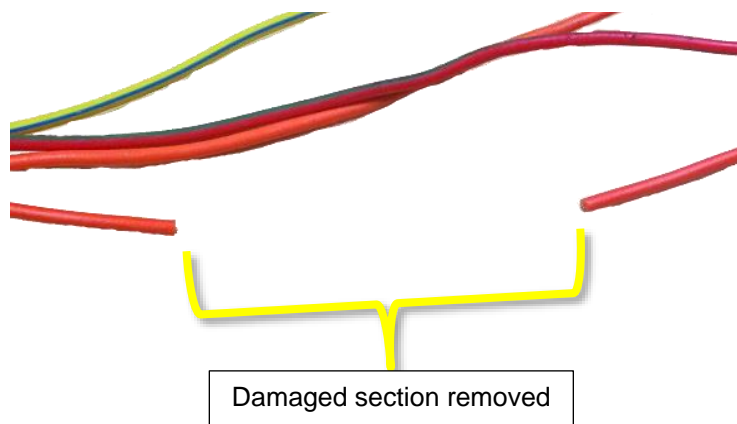
3. Make sure that there is enough room to work comfortably on the circuit being repaired. Protect all surfaces that can be damaged by heat in later steps.

4. Photograph the damaged area. Note the original routing of the wire.

5. Refer to the circuit diagram to find the correct wire size.

6. Refer to the “Supplies” section of this document to find the proper crimp barrel and heat shrink tube for the size of the wire.

7. Cut the wire to remove the damaged portion (Figure 17). Minimize the amount of wire removed.



**Figure 17**

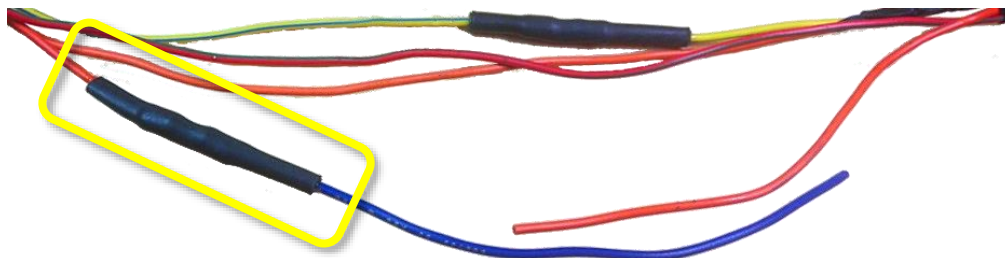
8. Cut a section of new wire that is at least 100 mm longer than the damaged portion.

**NOTE:** Make sure that there is at least 100 mm of new wire to enable adequate slack when the second end of the wire is spliced.

9. Slide the heat shrink tube over one end of the wire.

**NOTE:** Do not skip this step. The procedure will have to be repeated if the wire is joined before installing the heat shrink tube.

10. Complete the first splice, using the applicable steps in the “Repair Using a Single Splice” section of this document (Figure 18).



**Figure 18**

11. Cut the repair section to the required length (Figure 19).

**⚠ CAUTION:** Leave enough length to properly insert the stripped ends into the crimp barrel. Wires that are too short put excess strain on the wire where it enters the connector or harness transition.



**Figure 19**

12. Slide the heat shrink tube over one end of the wire.

**NOTE:** Do not skip this step. The procedure will have to be repeated if the wire is joined without installing the heat shrink tube.

13. Complete the second splice, using the applicable steps in the “Repair Using a Single Splice” section of this document.

*For further assistance, email your local Body Repair Support team:*

- North America: [bodyrepair@tesla.com](mailto:bodyrepair@tesla.com)
- Europe, Middle East, and Africa: [EMEAbodyrepair@tesla.com](mailto:EMEAbodyrepair@tesla.com)
- Australia and New Zealand: [DL-ANZ-BodyRepairProject@tesla.com](mailto:DL-ANZ-BodyRepairProject@tesla.com)
- Asia Pacific: [bodyrepair-china@tesla.com](mailto:bodyrepair-china@tesla.com)