Guidelines for Repairing or Replacing an Electrical Harness 54-048

> Recreational Vehicle
> School Bus
> Shuttle Bus
> Walk-In Van
> S2

Freightliner Custom Chassis Service Bulletin

Description of Revisions: *This bulletin replaces the version dated February 2016. Sewing Seam Ripper tool part and TwistTube® part list are added in the bulletin and convolute tubing has been removed.*

General Information

Use the guidelines in this bulletin to determine if a damaged electrical harness should be repaired or replaced.

Refer to the wiring section in **Group 54** of the applicable workshop manual for detailed wire repair instructions.

Table 1 describes general guidelines for repairing or replacing a harness. There may be cases when more than one factor determines the course of action. For example, repairing a harness is recommended if shipping times for the replacement harness exceed one week. However, replacement may be the only option if damage to the harness is too extensive.

NOTE: When a harness is repaired, the source of the damage must also be identified and repaired.

Table 2 is a quick-reference for specific wire and terminal conditions.

IMPORTANT: Damaged connectors and seals can be replaced without replacing the harness. A drag test should be performed to make sure that the terminal can retain proper tension to the mating terminal. Refer to "Terminal Drag Test" in this bulletin for instructions. Discolored wires or melted insulation should be replaced before any other repairs are performed on the harness.

Repairing or Replacing a Harness	
Repair	**Replace**
Less than 20% of the harness is damaged. If the wire damage is greater than 6 inches (15 cm), an overlay harness can be added to replace the section of damaged wire.	More than 20% of the harness is damaged.
Wire is smaller than 12-gauge.	Wire is 12-gauge or larger.
The harness is not readily available, or shipping will take longer than one week.	The harness can be obtained in less than a week.
Wire insulation is cracked due to excessive heat from an external source. Repair is recommended if the damage is isolated to one section of the wire.	Wire insulation is cracked due to age, or damage is extensive and spread throughout the wire.
There is a clean cut to the wire, corrosion is wicked no more than 1 inch (2.5 cm) from the terminal end. If the damaged area is over 6 inches (15 cm), the harness can be repaired by adding overlay wiring over the damaged area. NOTE: If damage exceeds 1 inch (2.5 cm) from the terminal end, a quality repair may require adding a jumper wire to create enough slack in the wire. If adding extra splices stretches the wire too tightly it can degrade the integrity of the harness.	The harness is proprietary, such as a datalink with sheathing over a twisted pair, or a WABCO sensor and solenoid wiring.

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Repairing or Replacing a Harness	
Repair	**Replace**
Two harnesses are affected. For example, M2 24 pin lever lock connector (23-13144-010 and 23-13144-009) is corroded on both sides. Also, if the harness has minimal corrosion wicked up the wire, the connectors can be re-pinned. If the damaged area is over 6 inches (15 cm), the harness can be repaired by adding overlay wiring over the damaged area.	Extensive damage to the harness caused by foreign material such as DEF fluid, diesel fuel, or road/deicer fluid.

Table 1, Repairing or Replacing a Harness

Wire Damage Quick Reference	
Description	**Remedy**
Kinked Wire	Repair
Melted Insulation, Major.	Replace
Melted Insulation, Minor	Repair
Worn or Missing Insulation. See **Fig. 1**.	Repair
Discolored or Cracked Insulation, Major. See **Fig. 2**.	Replace
Discolored or Cracked Insulation, Minor.	Repair
Datalink, Twisted Wire NOTE: If only the terminals are damaged, the terminals can be replaced without replacing the twisted pair.	Replace
Corrosion in the Wire*	Repair
Corrosion in the Connector	Repair
Failed Terminal Pair Drag Test	Replace Terminal
Molded Cable†	Replace

* Corrosion is wicked no more than 1 inch (2.5 cm) from the terminal end, and no corrosion is wicked into the wire.
† An example is Meritor WABCO ABS sensor wiring.

Table 2, Wire Damage Quick Reference

How to Identify a Repairable Wire

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Fig. 1, Worn Insulation, Major

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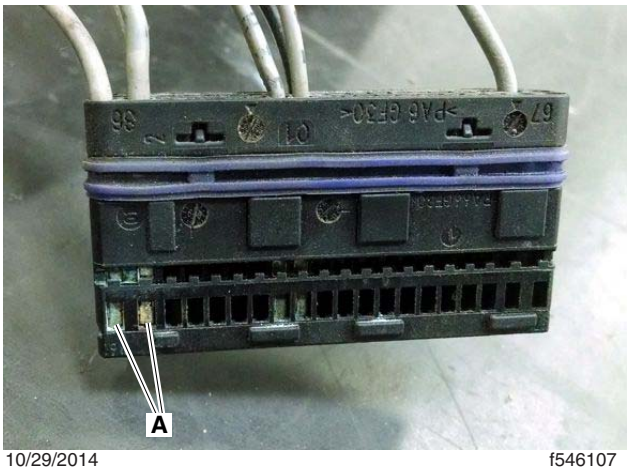
Fig. 2, Insulation Discoloration, Major

See **Table 3** to identify a repairable wire.

Identifying a Repairable Wire		
Condition	**Description**	**Example**
Corroded Terminal	If there is no further corrosion in the wire, and it is not blackened from corrosion, the wire can be repaired by cutting off the corroded terminal and stripping away the wire insulation. A new terminal can then be installed and inserted into the connector. NOTE: If the repair causes the wire to be pulled tight, or results in tension at the connector, a short piece of wire and new terminal can be added to reduce the tension. Otherwise, all terminals *must* be replaced.	 10/29/2014 f546107 A. Corroded terminal.

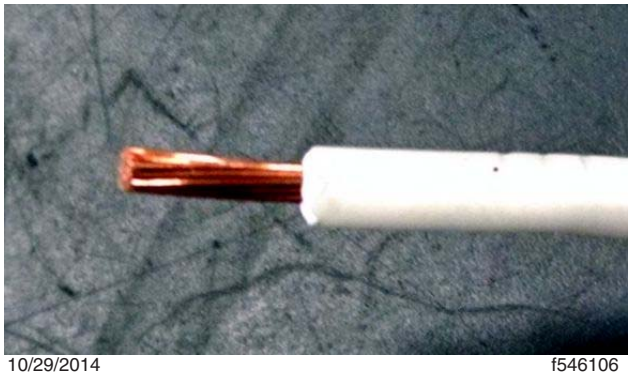
Identifying a Repairable Wire		
Condition	**Description**	**Example**
Corroded Wire	Corroded wires can be repaired by cutting out the damaged section. The wire needs to be cut until only clean wire is found for repair. It may be necessary to add a jumper wire to create slack and avoid wire tension. Refer to the instructions in this bulletin to install a jumper wire. The example shows a small amount of corrosion at the end of the wire.	 12/16/2014 f546117
Cut Wire (clean) **or** **Worn Insulation**	If the wire shows no sign of corrosion, the wire can be repaired with a splice kit.	 10/29/2014 f546106

Table 3, Identifying a Repairable Wire

Broken or Corroded Wires

Whether or not a broken or corroded wire, or cracked insulation should be repaired or replaced depends on the extent of the damage.

A broken wire can be soldered together only if enough slack remains to avoid wire tension. If there is not sufficient slack, a new section of wire must be soldered between the two broken ends. This technique can also be used with small sections of corroded wire. Overlay wiring can also be used in the damaged area, however the entire harness must be replaced if the corrosion exceeds 6 inches (15 cm).

If terminals are corroded at the connector, the terminal can be replaced. However, the entire wire must be overlayed if corrosion exceeds 6 inches (15 cm). A jumper wire can be used in the case, if necessary.

Installing a Jumper Wire

1. Remove the terminal from the connector.
2. Cut out the damaged section of wire.

3. Crimp and solder the new terminal with a new seal (if required) on to the new section of wire.

NOTE: Make sure the wire is the same gauge and quality as the wire being replaced.

4. Insert the terminal into the connector. See **Fig. 3**.
5. Run the wire along the harness up to the section of wire that is being replaced. See **Fig. 4**.
6. Splice the wires using a Daimler splice kit ESY ES66 404, or Phillips STA-DRY® Crimp and Solder connector parts. See **Fig. 5**. Refer to **Table 4** for a list of connector parts.
7. Inspect the harness and make sure there is enough slack. See **Fig. 6**.
8. Wrap the harness with TwistTube® fiber wrap. See **Fig. 7**.

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Fig. 3, Terminal Inserted Into the Connector

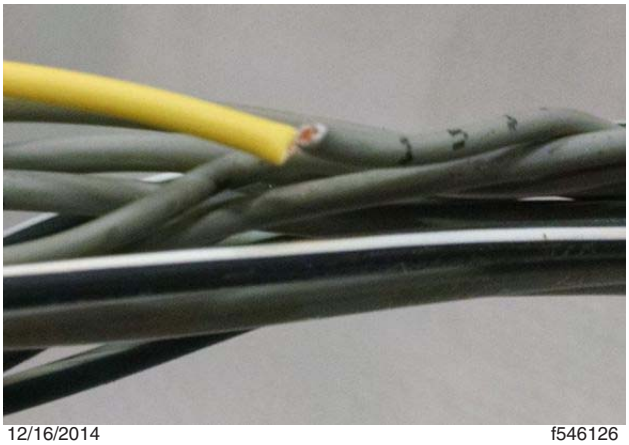

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Fig. 4, Section of Wire to be Replaced

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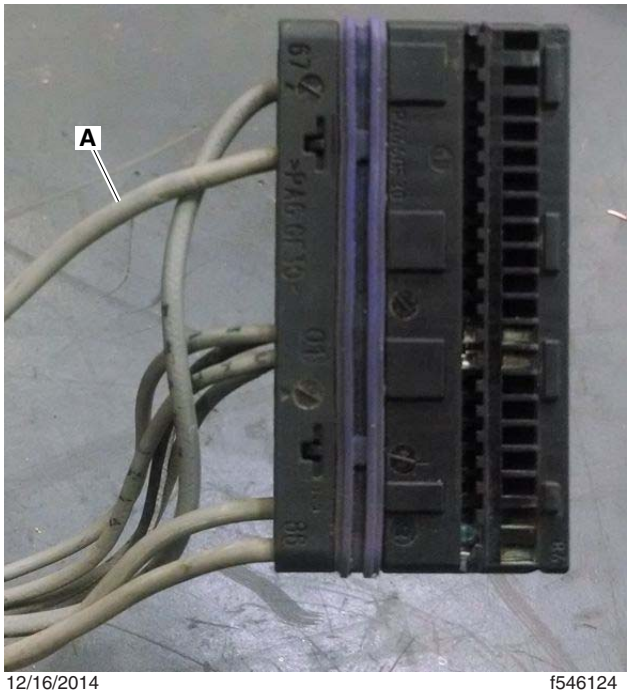
Fig. 5, Splicing the Wires



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A. The wire should be slack so that there is no tension.

Fig. 6, Slack in the Connector

Repairing a Harness Wrapped in Fiber

IMPORTANT: Do not use a hook razor blade to cut fiber wrap. Use a sewing seam ripper to cut the fiber tape (**Fig. 8**), taking care not to cut the harness wires.

1. Locate damaged area and carefully make an opening in the fiber wrap using a sewing seam ripper. See **Fig. 10**.

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Fig. 7, Harness Wrapped with TwistTube®

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Fig. 8, Sewing Seam Ripper

2. Flip the tool over so the blunt end is facing wiring, then cut enough length to allow the fiber to be unwrapped. See **Fig. 9**.

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Fig. 9, Cutting an Opening into the Fiber Wrap

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Fig. 10, Cutting the Fiber Using the Blunt End of the Seam Cutter

3. Unwrap the fiber until a sufficient area is exposed to make the repair. See **Fig. 11**.
4. If an overlay is necessary, remove just enough fiber to allow for a splice into the damaged wire. See **Fig. 12**.

Fig. 11, Unwrapping the Harness

Fig. 12, Overlay Added to the Damaged Area of the Harness

5. Overlay the wire, then wrap the entire length to cover the overlay and integrate it with the harness.
6. Repair the wire as necessary. See **Fig. 13**.

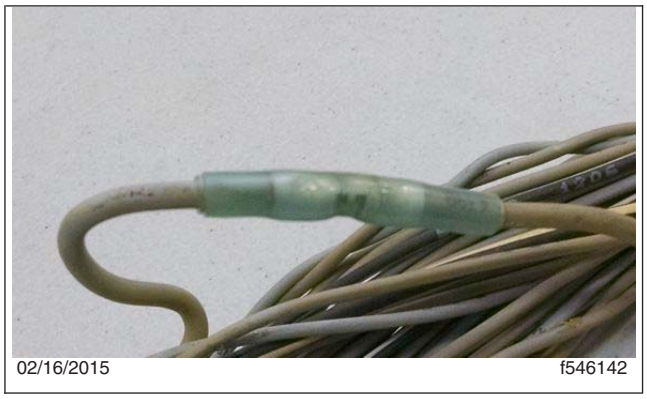

Fig. 13, Wire Repaired with Shrink Tubing

7. Wrap the harness with fiber tape. Refer to **Table 5**. Make sure enough tape is used to overlap the starting point. See **Fig. 14**.
8. When the harness is completely wrapped, secure both ends of the fiber wrap with electrical tape. See **Fig. 15**.

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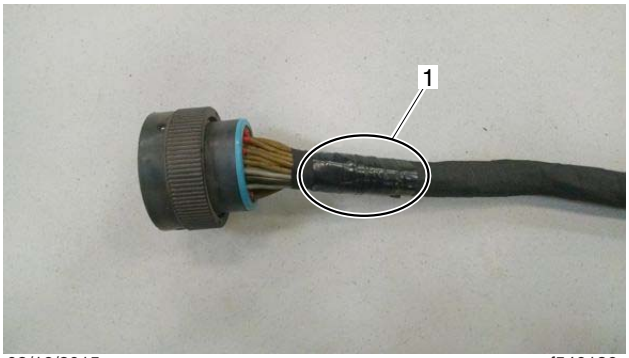
Fig. 14, Wrapping the Harness with Fiber Tape



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1. Fiber Wrap Secured with Electrical Tape

Fig. 15, Fiber Wrap Secured with Electrical Tape

Terminal Drag Test

A drag test is performed between a single male and female terminal to determine if the engagement and retention forces between them are sufficient. Individual terminals that fail the drag test can be replaced. If the repair causes the wire to be pulled tight, or results in tension at the connector, a short piece of wire and new terminal can be added to reduce the tension. Otherwise, all terminals *must* be replaced.

1. Perform a drag test on a known good terminal pair.
   - 1.1 Select a mating female and male terminal pair that have the same part numbers as the affected female and male terminal pair.
   - 1.2 Manually insert, and then remove, the test mating male terminal into the test female terminal three times. On the known good test terminal pair, the mating terminal will fit securely when inserted into the terminal in the connector. There will be significant resistance (drag) when the mating terminal is removed.
2. Compare the amount of resistance to the affected terminal pair by performing the same test on the affected terminal pair. If the mating terminal does not have the same resistance as the good terminal pair, the terminal pair and the seals (if required) should be replaced.

Parts

Repair wires using a Daimler splice kit ESY ES66 404, or Phillips STA-DRY Crimp and Solder Connectors Parts.

See **Table 4** for a list of STA-DRY solderless connector parts.

See **Table 5** for polyester cloth tape part numbers.

See **Table 6** for TwistTube® part list.

See **Table 7** for sewing seam ripper tool part number.

Phillips STA-DRY Crimp and Solder Connectors Parts		
Wire Size: gauge (mm)	**Connector Part Number***	**Shrinkable Tubing (Daimler Part Number)**
20 to 18 (0.5 to 0.8)	PHM 1 1863	1/4 inch with internal adhesive coating (48-02461-025)
16 10 14 (1 to 2)	PHM 1 1862	1/4 inch with internal adhesive coating (48-02461-025)
12 to 10 (3 to 5)	PHM 1 1861	3/8 inch with internal adhesive coating–4 foot length (48-02461-038)
8 or larger (5 or larger)	Replace the terminal or the entire cable	Use adhesive lined red for positive cables and black for negative cables.

* Twenty-five connectors per pack.

Table 4, Phillips STA-DRY Crimp and Solder Connectors Parts

Tape-Polyester Cloth, Adhesive Backed		
Roll Length	**Width**	**Part Number**
82 feet (25 meters)	0.75 inch (19 mm)	48-25910-002
82 feet (25 meters)	1 inch (25 mm)	48-25910-003
82 feet (25 meters)	2 inches (50 mm)	48-25910-004

Table 5, Tape-Polyester Cloth, Adhesive Backed

DTNA P/N	DTNA Description	Vendor (Bentley Harris / Federal Mogul Twist tube 2420) P/N	Reference Diameter	DTNA Recommended Bundle Size	
				Min	Max
48-26131-000	Tube-TwistTube®,PES,BK,DIA5	BEN 2421000503SCM	5 mm	1 mm_18GA Wire	6 mm_1/4"
48-26131-001	Tube-TwistTube®,PES,BK,DIA8	BEN 2421000803SCM	8 mm	6 mm_1/4"	9 mm_3/8"
48-26131-002	Tube-TwistTube®,PES,BK,DIA13	BEN 2421001303SCM	13 mm	8 mm_5/16"	14 mm_9/16"
48-26131-003	Tube-TwistTube®,PES,BK,DIA19	BEN 2421001903SCM	19 mm	14 mm_9/16"	22 mm_7/8"
48-26131-004	Tube-TwistTube®,PES,BK,DIA25	BEN 2421002503SCM	25 mm	21 mm_13/16"	31 mm_1 1/4"
48-26131-009	Tube-TwistTube®,PES,BK,DIA38	BEN 2421003803S	38 mm	31 mm_1 1/4"	45 mm_1 3/4"
48-26131-011	Tube-TwistTube®,PES,BK,DIA51	BEN 2421005103S	51 mm	45 mm_1 3/4"	60 mm_2 3/8"

Table 6, TwistTube® Chart

Tool Part Number	Description
DKI0CHA17002-13	Sewing Seam Ripper Tool

Table 7, Sewing Seam Ripper Tool

NOTE: The tool part number DKI0CHA17002-13 is a part of the tool kit DDE DKI0CHA17001. For more information refer to *Tool Letter 18TL-3*.

Warranty

This is an informational bulletin. Warranty does not apply.