

General Information

The on-highway environment places severe demands on a vehicle's electrical system. The following material describes the methods for repairing and sealing electrical connections that will provide the durability necessary for the automotive environment.

There are four distinct components for making a wire repair that will withstand:

- the mechanical demands of vibration, strain, and thermal cycling
- the electrical requirement of oxidation free conductivity
- the insulating properties to resist shorting to adjacent objects
- the ability to seal for corrosion protection

When troubleshooting electrical systems, consider body height and suspension travel. Interference and strain may be caused by normal frame flexing and body accessories that are not apparent when a vehicle is stationary.

Wire Repair and Splicing

Disconnect the batteries at the negative terminals before performing any repairs to the electrical system.

IMPORTANT: Before repairing or replacing any damaged electrical system components, locate and correct the cause of the damage before continuing with the repair.

Wire that is discolored or melted due to an external heat source may need to be re-routed or installation of a heat shield may be necessary. If wire length permits, a splice may be made with a single connector. Often a length of wire will need to be added and two splices are made. Carefully check damaged wire for signs of corrosion that has wicked up into the insulation and through the wire. If the wire conductor has become green or black, cut off the discolored wire and replace it with a new section.

Corrosion on battery cable terminals may be cleaned with a mild solution of baking soda and water, and scrubbed with a wire brush.

Wiring Repair Using Phillips STA-DRY® Solderless Connectors

Parts and Tools

Parts are available through the Parts Distribution Centers (PDCs) in packages of 25 connectors. Use the connectors and adhesive lined shrinkable tubing shown in [Table 1](#) when making a wiring splice.

Tools needed for wiring repair using solderless connectors include the following.

- A dimple-type crimp tool with a minimum 3/16 inch width. See [Fig. 1](#) for an example of a proper crimp tool. A typical manufacturer for this tool is Thomas & Betts.
- A heat gun rated at 1000°F (538°C).

Procedure

1. Dress the wires to be spliced by stripping the insulation to expose 1/4 inch of copper. Slide a 3-inch section of adhesive coated shrink tubing onto one of the wires.
2. Crimp the splice connector onto the wires. Use the type of crimp tool that makes a dimple in the connector. The dimple must be at least 3/16 inch wide or there will be too much space inside the connector and the solder will not flow into the wire. This crimp provides the mechanical retention needed. See [Fig. 2](#).
3. Pull test the wires by hand to ensure the crimp is mechanically solid.
4. A crimp tool that is too narrow will leave excessive air gaps in the crimp. The connection will not have the required amount of mechanical strength and the solder will not bond the wire to the connector. [Figure 3](#) shows an example of a bad crimp when the wrong tool is used.
5. Heat the properly crimped splice connector with the heat gun while slowly rotating the wire. The solder will take longer to flow than it will for the shrinkable insulation to contract. Heat until the solder band has completely melted into the connector. If the shrinkable insulation ruptures and a small amount of solder bubbles out, gently shake the splice to remove the solder. See [Fig. 4](#).
6. When the connector has cooled, center the shrinkable tubing over the splice and heat the tubing until it has completely sealed the splice and a small fillet of adhesive is visible at the ends of the shrink tube. See [Fig. 4](#).
7. A three-wire tap splice can be made following the same procedure. Use a connector that is large enough to fit all the strands of the wires. See [Fig. 5](#) for an example of the completed splice.

Solderless Connector 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 1, Solderless Connector Parts

Wiring Repair Using Phillips STA-DRY® Solderless Connectors

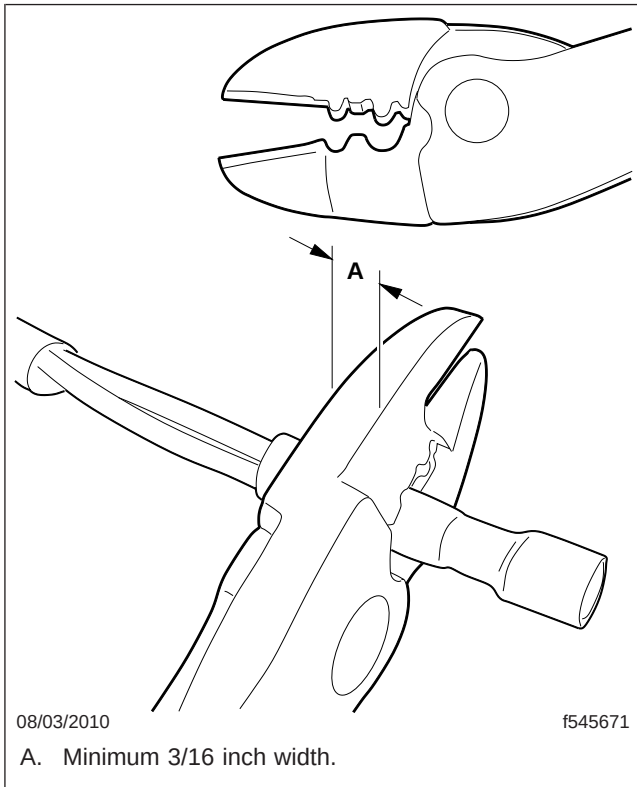


Fig. 1, Dimple-Type Crimp Tool

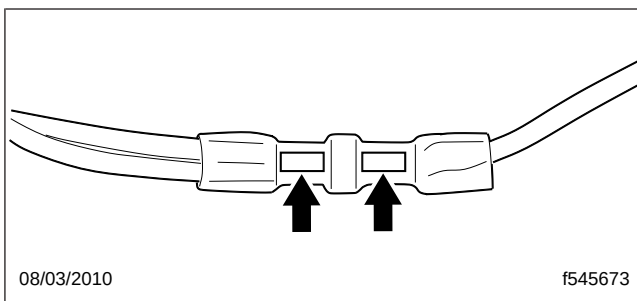


Fig. 2, Properly Crimped Splice

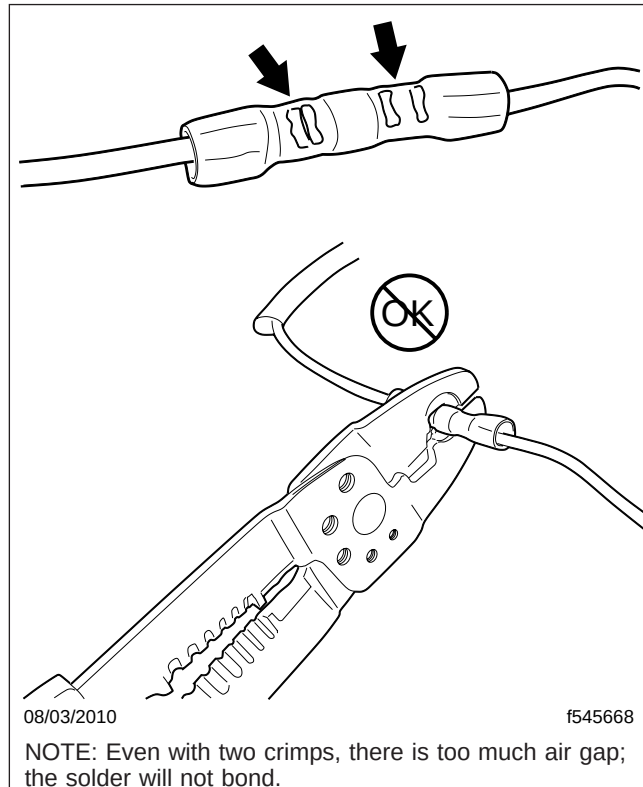


Fig. 3, Wrong Tool Being Used and a Crimp That Will Fail

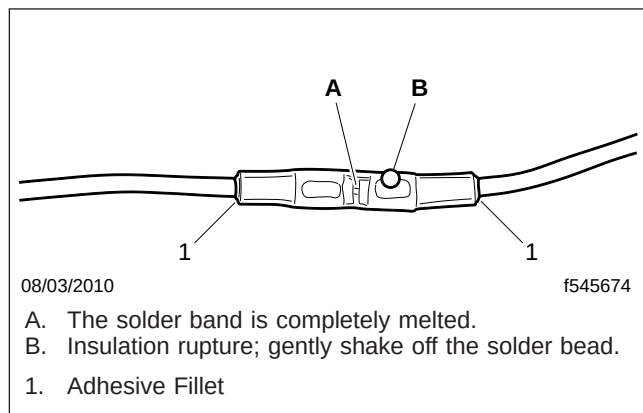
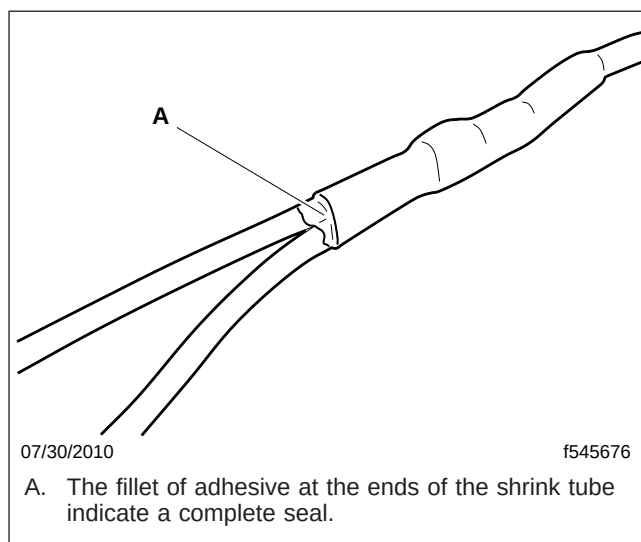


Fig. 4, Solder Bead Rupture

**Wiring Repair Using Phillips STA-DRY®
Solderless Connectors****Fig. 5, Completed Three-Wire Tap Splice**

Wiring Repair Using Daimler Trucks North America (DTNA) Kit ESY ES66 404

Parts and Tools

Parts are available through the Parts Distribution Centers (PDCs) in kits with material for 50 splices. This kit may be used on 16 to 14 gauge (1 to 2 mm) wire.

Tools needed for wiring repair using solderless connectors include the following.

- A dimple-type crimp tool with a minimum 3/16 inch width. See [Fig. 1](#) for an example of a proper crimp tool. A typical manufacturer for this tool is Thomas & Betts.
- A heat gun rated at 250°F (121°C).

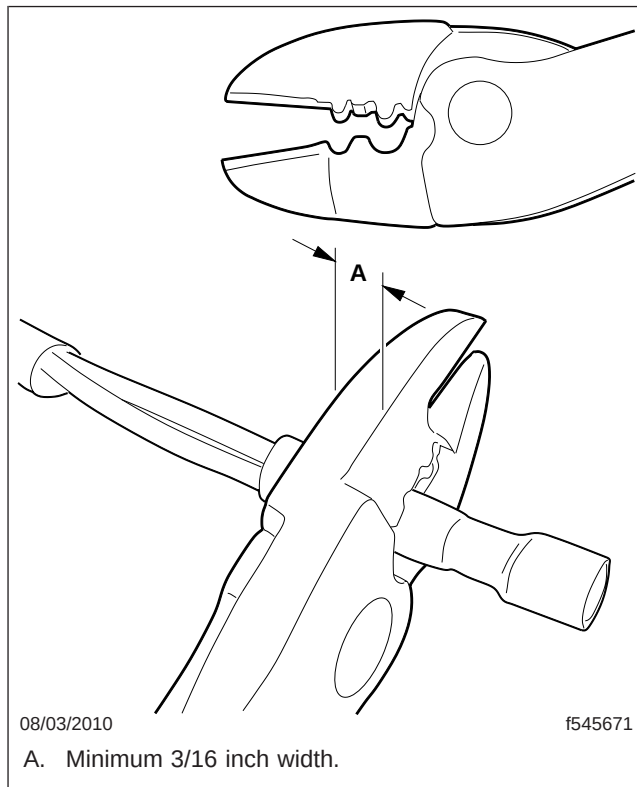


Fig. 1, Dimple-Type Crimp Tool

Procedure

1. Dress the wires to be spliced by stripping the insulation to expose 1/4 inch of copper. Slide a piece of the shrink tubing from the kit onto one of the wires.
2. Slide a shrinkable solder sleeve from the kit onto one of the wires.
3. Place the wires that will be spliced into each end of the barrel connector. See [Fig. 2](#) for an example of the splice.
4. Crimp each end of the barrel using a dimple-type crimp tool to secure the wires. See [Fig. 1](#) for an example of a proper crimp tool.
5. Pull test the wires by hand to ensure the crimp is mechanically solid.
6. Slide the shrinkable solder sleeve onto the barrel connector so the solder band is at the center of the barrel connector.
7. Heat the splice using a heat gun rated at 250°F (121°C) until the sleeve has completely shrunk against the wire and the solder flows into the barrel connector. A small fillet of adhesive may be visible at the ends of the connector. See [Fig. 3](#).
8. Slide the shrinkable tubing over the splice and apply heat with a heat gun rated at 250°F (121°C) until it has completely shrunk against the wire insulation. A small fillet of adhesive should be visible at the ends of the shrinkable tubing.

Wiring Repair Using Daimler Trucks North America (DTNA) Kit ESY ES66 404

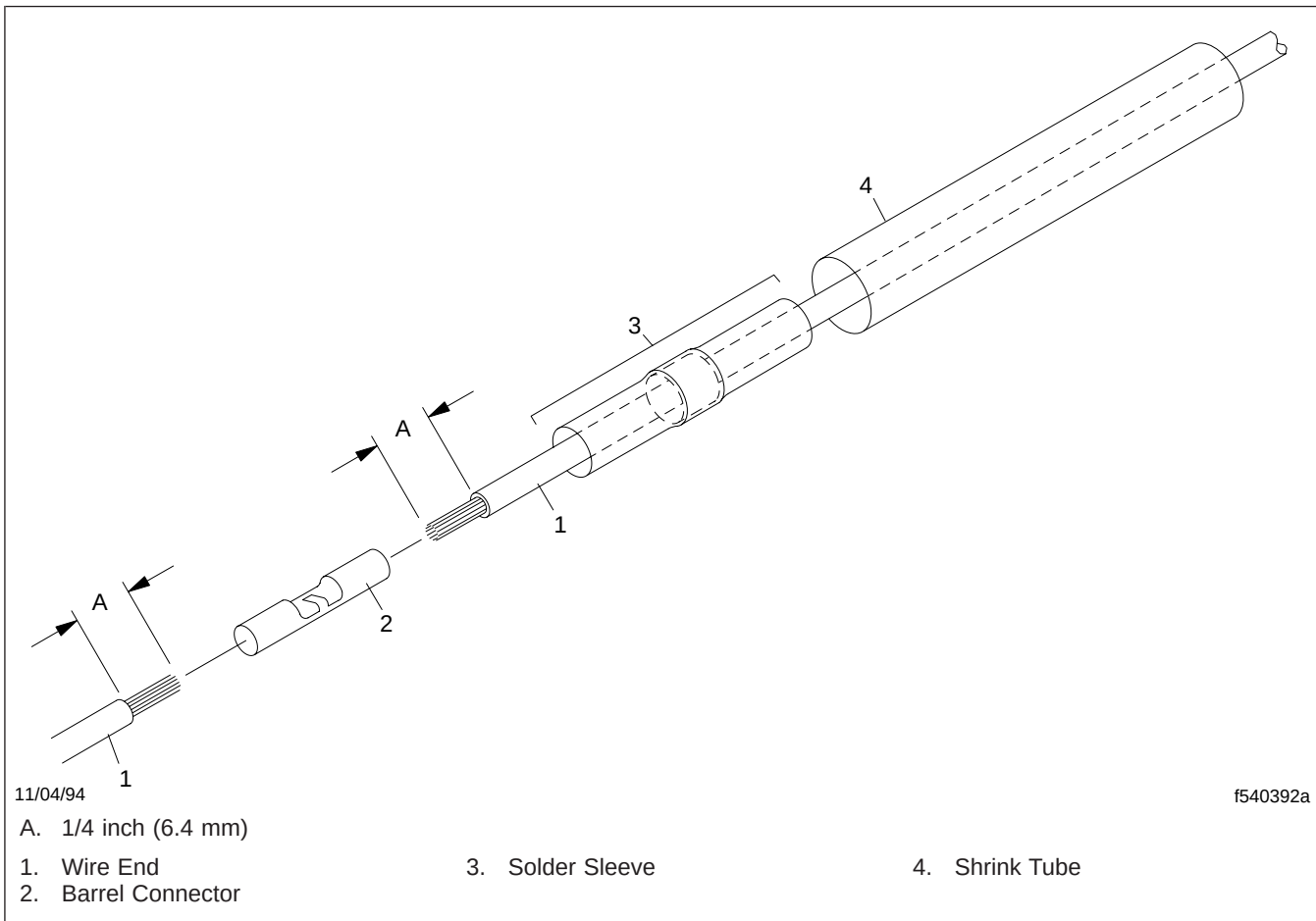


Fig. 2, Splice Prepared with Parts in Kit ESY ES66 404

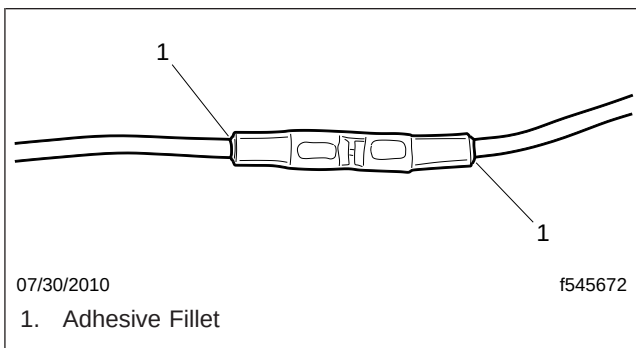


Fig. 3, Heated Solder Sleeve with Solder Band Melted into the Splice

Parts

Twisted-pair datalink wires may be spliced using a mating connector set. See [Table 1](#) for a typical set of datalink connector parts.

Datalink Connector Parts		
Description	Part Number	Quantity
Connector Body Plug	23-13148-204	1
Terminal Lock	23-13303-015	1
Terminals	23-13210-020	2
Connector Body Receptacle	23-13148-206	1
Terminal Lock	23-13303-013	1
Terminals	23-13210-030	2

Table 1, Datalink Connector Parts

Procedure

1. Cut out any damaged section of datalink wire, keeping the lengths of the two wires equal. See [Fig. 1](#) for an example of a damaged section of datalink wire that has been removed and the datalink prepared for repair.

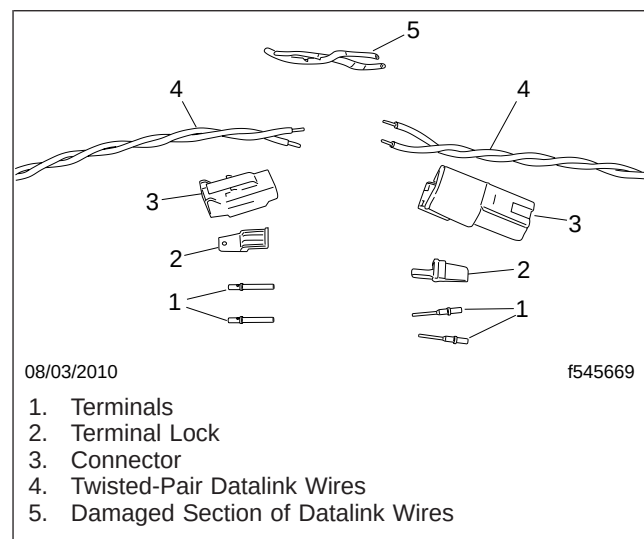


Fig. 1, Datalink Splice Parts

2. Crimp the terminals onto the wires using the proper crimp tool.

3. Pull test the terminals by hand to ensure the crimp is mechanically solid.
4. Insert the terminated wires into the connector body and install the terminal lock. The protocol for J1939 is for the yellow wire to be in cavity 1 and the green wire to be in cavity 2. Note that the lock is installed while holding the wires in position. Test the installation. If the wires slipped back during the lock installation, they will pull out of the connector.
5. Make certain the wires are twisted as close to the entry point of the connector as possible. Plug the two connector halves together. See [Fig. 2](#).

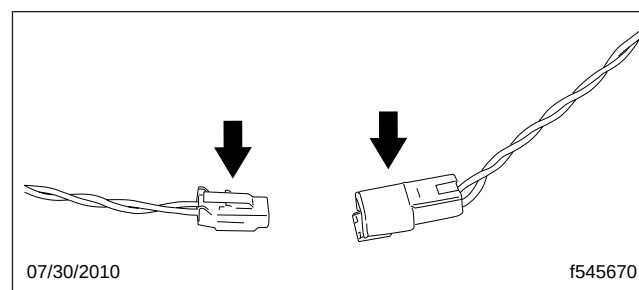


Fig. 2, Datalink Connectors

Electrical Connection Protection

Corrosion Protection

Use the dielectric protectants and procedures provided here to protect electrical connections from corrosion. A list of approved dielectric protectants is shown in **Table 1**.

The components listed in **Table 2** have electrical connections that need to be protected.

When disconnecting any of these circuits, clean the connection and remove the old dielectric material. Completely cover the exposed area after assembly using the product and procedure in this bulletin. Always follow the product manufacturers recommendations for work area ventilation.

Approved Dielectric Protectants			
Material	Type	Manufacturer	Product
Dielectric Red Enamel	Spray On	3M®	1602 IVI
		Glyptal	1201A
	Brush On	Glyptal	1201E 2100
Dielectric Grease	Lithium Base	Fiske Brothers Lubriplate® (FLP)	DS-ES
	Synthetic	Nye	Nyogel 760G

Table 1, Approved Dielectric Protectants

Electrical Component Protection and Procedure		
Protection	Component	Procedure
Dielectric Red Enamel	Starter - All Exposed Connections	Protect connections and cable terminals.
	Magnetic Switch	Protect connections and cable terminals.
	Alternator	Protect all connections. Do not allow dielectric material to enter the alternator.
	Bolt and Stud Ground Connections (outside cab)	Cover all terminals, studs, and nuts with dielectric enamel.
	Battery Cut-Off Switch Connections	Protect connections and cable terminals.
	Exposed Battery Cable Connections (located outside of the battery box)	Protect connections and cable terminals.
	Power Distribution Modules	Protect battery power studs on chassis mounted PDMs.
	Mega Fuses (when located outside of the battery box)	Place tape across the part of the fuse with the labeling, then apply the dielectric material. Remove the tape.

Electrical Connection Protection

Electrical Component Protection and Procedure		
Protection	Component	Procedure
Dielectric Grease, Lithium Base	Tail Lamp Bulb Sockets (non LED)	Remove the bulb, apply grease to the inside of socket. Replace the bulb.
	Battery Terminals	Apply grease to battery terminals before connecting interconnect cables.
	Battery Interconnect Cable Connections	Apply grease to connection studs and pads before connecting battery cables.
	Parked HVAC Power Connections	Disconnect the two power and one ground cable where they enter the basket on the underside of the cab. Apply grease, then connect.
	Inverter Power Connections	Disconnect the power and ground feeds at the cab pass through. Apply grease, then connect.
	Mega Fuses (if located in the battery box)	Apply grease to protect exposed terminals and connections.
Dielectric Grease, Synthetic	Connections with serial data circuits or with very low voltage signals.	Apply synthetic grease to the terminals inside the connector.

Table 2, Electrical Component Protection and Procedure

General Specifications

See [Table 2](#) for standard wiring circuit numbers and descriptions.

See [Table 1](#) for standard wiring color-coding.

Standard Wiring Color-Coding		
Color	Abbr	Typical Usage
Black	BK	Ground, General
Black-White	BK-W	Ground, Clean or Isolated
Blue DK	DKBL	Backup/Windshield Wiper/Trailer Auxiliary
Blue LT	LTBL	HVAC/Circulation Fans/1922+
Blue LT-White	LTBL-W	Water, Oil Gauge and Indicator (Engine and Transmission)
Brown	BR	Marker, Tail and Panel Lamps
Gray	GY	Electronic Engine (or TXL Insulation)
Green DK	DKG	Turn Signal, RH/Driver's Display/Data Record/1587+/1939–
Green DK-White	DKG-W	Starting Aids/Fuel Heaters/Material Control/Winch/Tailgate
Green LT	LTG	Headlamp/Roadlamp/DRL
Green LT-White	LTG-W	Axle Controls and Indicators/Suspension/Fifth Wheel
Orange	O	ABS/EBS/1587–
Pink	PK	Start Control/Ignition/Charging/Volt and Ammeter/1922–
Pink-White	PK-W	Fuel Control and Indicators/Shutdown/Speed Limiter
Purple	PRP	Engine Fan/PTO/Auto Lube and Oil
Purple-White	PRP-W	Utility/Spot/Ad/Interior/Emergency Lighting
Red	R	Power Distribution, Constant
Red-White	R-W	Brake/Pneumatic/Hydraulic/Retarder/Stop
Tan	T	MPH, RPM Signals/Horn/Flasher/Pyro/Turbo
Tan-White	T-W	Audio/Video/Security/Window/Computer/Seat/Mirror/Cab-Tilt
White	W	Transmission (or SXL Insulation)
Yellow	Y	Turn Signal, LH/1939+ (or GXL Insulation)
Yellow-White	Y-W	Air Bag and SPACE

Table 1, Standard Wiring Color-Coding

Circuit Numbers		
Circuit Number	Description	Modules
1	Battery Cable, Ground	156 286 291
6	Battery Cable, Positive	224 281 291 292 293 295
14	Cab Power, Main	156 224 277 281 285 286 291 292 293 295 306 320 321
15	Starter, Crank Circuit	146 155 156 157 158 286 291 320 895
16	Alternator, Main Power	124 125 286 320 836 846

Specifications

Circuit Numbers		
Circuit Number	Description	Modules
18	Air Pressure Warning	320 486 838 840 877 880 882
19	Voltmeter	286 320 836 846
20	Headlamp, Left	27D 288 304 312 320 659
21	Headlamp, Right	27D 288 304 312 320 659
22	Headlamp, Low and High Beam	27D 288 304 312 320 659
23	Tail Lamps	288 294 296 301 302 304 30A 320 335
24	Horn, Electric	288 320 321 726
25	Horn, Air	288 320 321 726
27	Road Lamp	288 313 314 320
28	Fog Lamp	288 313 314 320
29	Instrument Panel Lamps	27D 288 296 302 304 30A 312 320 335 659 732 811 81B
30	Transmission Temperature and Filter	286 320 343 345 34B 34C 353 355 863 864
31	Transmission Aux Controls and Temp	286 320 343 345 34B 34C 353 355 863 864
34	Engine Oil Pressure	165 286 320 852
35	Engine Oil Temperature	286 320 854
36	Stop Lamps	288 294 296 301 320 335 486 838 840 877 880 882
38	Turn Signal	288 294 296 298 299 300 301 320 335 811
39	Stop/Turn Combination Lamp	288 294 296 301 320 335 880
40	Fan, Windshield/Sleeper	287 320 716 718
41	Dome/Interior Lamp	271 287 294 300 302 305 311 312 314 316 318 319 31A 31B 31C 31D 31E 320 322 324 325 327 328 32B 32C 469 470
42	Axle Oil Temperature, Forward	288 320 865 866
43	Axle Oil Temperature, Rear	288 320 865 866
44	Axle Oil Temperature, Center	288 320 865 866
45	Receptacle, Trailer	173 285 296 297 303 306 307 308 309 310 320 321 331 334 335
46	Marker Lamps	288 296 302 304 30A 320 335
47	Fuel Level	288 320 844 847
48	Fuel Control and Level, Natural Gas	148 150 152 162 164 283 286 288 320 811 814 844 847 860
52	Ignition Switch	156 285 306 320 321
55	Data Recorder	283 286 320 343 810 817
57	12V Power Outlet/Lighter	284 287 320 785
58	Heater, Auxiliary	130 287 320 700 703 70A 70C 723
73	Utility Lamps	287 288 318 31J 320 327 329 57W
74	Starter Mag Switch, Solenoid	155 156 157 158 286 320 895

Circuit Numbers		
Circuit Number	Description	Modules
75	Starter Mag Switch, Ground	146 155 156 157 158 286 895
76	Mirror Heat	320 656 744 74E
78	Spot Lamp	316 320 57V
81	Ignition Switch Control Devices	156 285 304 306 320 811 814 860
82	Starter Mag Switch Power	155 156 157 158 286 320 895
86	Axle Lock Solenoid	288 320 452 874 878 87A 87B 87F 896 900
87	Axle Lock	288 320 452 865 866 874 878 87A 87B 87F 896 900
88	Lubrication System, Automatic	288 594
90	Sander, Road	288 320 329
91	Heater, Diesel Fired Auxiliary	130 132 138 140 141 154 166 286 287 288 320 467 700 703 70A 70C 723
94	Air Dryer, Heated	288 480 48A 880
95	Speaker, Radio	287 320 746 74D 750 751 753 75B 75C 79F 79G
97	Air Conditioner	130 287 320 700 703 70A 70B 723
98	Heater – A/C Motor, Blower	130 156 283 285 286 287 320 321 700 703 70A 70B 70C 723
99	Fuel Solenoid, Engine Run	148 150 152 162 164 283 286 320
102	Parking Lamps	288 296 302 304 30A 320 335
108	Door Activated Lamps Courtesy/ Footwell/Door	320 324 325 32B 675 676 677 67E 67F 811 814 860
113	Baggage Compartment Lamps	287 320 322 324 325 32C
117	Speed Sensor +	283 286 320 343 810 817
118	Speed Sensor –	283 286 320 343 810 817
119	Coolant Temperature, Engine	198 199 286 320 732 810 812 830 836 838 83A 840 841 842 843 844 845 846 847 852 854 856 858 862 864 865 866 867 868 869
120	Back-Up Lamps	288 294 320 471 721
121	Brake, Engine	128 129 164 283 286
122	Back-Up Alarm	288 294 320 471 721
123	Alternator, Voltage Regulation/ Rectifier	124 125 156 286 836
125	Park Brake Indicator/Warning	288 294 296 301 320 335 486 838 840 877 880 882
132	Alternator Charge Monitor	124 125 156 286 836
137	Alternator Indicator/Relay	124 125 156 286 836
140	Oil Pressure, Engine	286 320 852
149	Fan Manual Controls, Engine	273 276 286 320
154	Auxiliary Air Pressure	288 320 486 838 840 865 866 877 880 882
155	Axle Lift Controls	288 320 452 874 878 87A 87B 87F 896 900
157	Power Mirror Controls	320 656 744 74E

Specifications

Circuit Numbers		
Circuit Number	Description	Modules
162	Tachometer Sensor +	283 286 320 812 819
163	Tachometer Sensor –	283 286 320 812 819
166	Engine Starting Aid, Ether	132 154 286 320 467
168	Hour Meter, Engine	286 320 812 813 81A 837 852
170	Fifth Wheel Slide Lock and Controls	173 296 297 303 307 308 309 310 331 334 581 87E
171	Brakesaver, Cat	128 129 286 343 34B 34C 34W 353
172	Clock	287 320 687 738
173	Coolant Level, Engine	152 286 320 856
182	Fuel Pressure	320 841 843 845
183	Air Cleaner Restriction, Engine	329 472
193	Cab Tilt Pump	288 320 670
196	Fuel Water Separator Heater	110 127 220 288
200	PTO Controls	148 283 286 288 320 372
203	Exhaust Brake	128 129 164 283 286
204	Seat Belt Indicator/Warning	320 74F 756 760 763
208	Axle Control, Tri Axle, Steer Lock	288 320 376 452 865 866 874 876 878 87A 87B 87C 87F 896 898 900
209	Axle, Two Speed Shift Control	283 286 288 320 343 376 810 817 876 87C 898
210	Power Distribution Module, Outside Cab	224 281 285 286 291 292 293 295 306 320 321
211	Security System, Rockwell	287 320 656 787
214	Generator, Auxiliary	124 125 286 599
218	Pyrometer	286 320 858
219	Turbo Pressure	286 320 842
221	Suspension Dump Controls	288 320 87D 888 910
222	Headlamp Dimmer Controls	27D 288 304 312 320 659
223	Transmission Controls, Auto Shift	160 283 285 286 288 320 330 343 345 34B 34C 355 376 732 736 810 811 813 814 817 876 87C 898
224	Transmission Controls	286 288 320 343 345 34B 34C 353 355 376 876 87C 898
225	Air Pressure Gauge, Primary	320 486 838 840 877 880 882
226	Air Pressure Gauge, Secondary	320 486 838 840 877 880 882
227	Air Pressure Gauge, Application	320 486 838 840 877 880 882
232	Transmission Controls Power Supply	160 283 285 286 320 330 343 345 34B 34C 353 355 732 736 811 813 814
234	Engine Fan Controls	273 276 286 320
236	Transmission Neutral Indicator	286 320 343 345 34B 34C 353 355
242	Seat Controls	320 74F 756 760 763

Circuit Numbers		
Circuit Number	Description	Modules
243	Shore Power, Power Inverter	274 277 284 287 307 320 336 337 33C 785
244	Speed Limiter, Vehicle, Hewitt	150 164 283 286
246	Electric Fuel Pump	148 150 152 162 164 283 286 320
250	Predictive Cruise Control	149 283 286
253	Cab Tilt Indicator	288 320 670
254	Roof Mounted Emergency Lamp/ Strobe	264 271 275 27A 27B 27C 27E 288 31A 31B 31C 31D 31G 320 327 33A
255	Advertising/Identification Lamp	288 296 302 304 30A 319 320 335
256	Optional Power Wire	285 286 306 320 321
261	Axle Lock, Controlled Differential	288 320 865 866
262	Retarder, Allison Transmission	128 129 286 343 34B 34C 34W 353
281	Oil Filter Change Indicator	165 286 320 852
285	Suspension Electric and Air Controls	288 320 87D 888 910
286	Fuel Water Separator Indicator	122 127 288 320 80F 844 845 847
294	Air Tank Auto Drain Valve	288 480 48A 880
295	Radio, AM/FM/CB/Disc	287 320 746 748 74D 750 751 752 753 75B 75C 79F 79G
299	Air Temperature, Exterior	320 860 867
300	Radio, Audio Signal	287 320 746 74D 750 751 753 75B 75C 79F 79G
303	Low Air Pressure	322 486 838 840 877 880 882
315	Windshield Wipers and Controls	320 321 660 66B
320	Windshield Washer	320 321 660 66B
331	Diagnostic Connector Power/Tach Ext Test	160 283 286 320 32A 330 338 343 725 732 733 736 811 812 813 819 835 888
338	HVAC Controls	130 287 320 700 703 70A 70B 70C 723
339	LBCU/ICU/Gauge Power/Data	320 732 811 814 860
347	Shutter, Engine Fan	273 276 286 320
359	Headlamp On Signal, LBCU/ICU	27D 288 304 312 320 659
363	Power Windows	320 654 656 66A
364	Power Windows, Rear	320 654 656 66A
372	Receptacle # 2, Trailer 7-Way, ISO 3731	173 296 297 303 307 308 309 310 331 334 335
376	Antilock Brake Controls	160 283 285 286 296 308 320 330 331 332 333 335 343 34B 414 447 44G 44H 454 490 493 732 736 811 813 814
377	Antilock Brake Sensors	308 330 331 332 333 414 447 44G 44H 454 490 493
378	Antilock Brake Valves	160 283 285 286 308 320 330 331 332 333 343 34B 414 447 44G 44H 454 490 493 732 736 811 813 814

Specifications

Circuit Numbers		
Circuit Number	Description	Modules
379	Daytime Running Lamps (DRL)	271 27D 288 294 300 302 304 305 311 312 314 316 318 319 31A 31B 31C 31D 31E 31F 320 322 324 325 327 328 469 470 659
388	Hydraulic Brake Power/Controls	288 320 486 49A 880
399	Optional Circuit, Cab/Chassis, Customer Specified	160 283 285 286 306 320 321 329 330 343 34B 472 732 736 811 813 814 860
400	Optional Circuit, Cab/Chassis, Customer Specified	329 472
402	Engine Start/Stop System, TAS	152 156 162 283 285 286 287 320 321
406	Emergency Lamp, Alternating, Access	264 271 275 27A 27B 27C 27E 287 288 318 31A 31B 31C 31D 31G 31J 320 327 33A 57W
407	—	—
408	Emergency Vehicle Accessory and Warning Lights	264 271 275 27A 27B 27C 27E 288 31A 31B 31C 31D 31G 320 327 33A
410	Emergency Siren and Bells	288 320 321 726
416	Refrigerator/Video Power	284 287 320 737 75B 785
417	Mobile Phone Power	320 789 79C
424	Headlamp Wiper/Washer	288 304 312 320
425	PNDB/CLDS Controls	224 277 281 285 291 292 293 295 306
427	Satellite Tracking System	287 320 786 78A 79H 80D
428	Battery Isolator Protection System	124 125 156 224 277 281 285 286 291 292 293 295 306 836
430	Windshield Wiper Heater	320 321 660 66B
431	Starting Aid, Engine Preheater	132 154 286 320 467
432	Seat Controls	320 74F 756 760 763
433	Data Recorder	160 286 320 813
434	Suspension Controls, ECAS	283 286 288 320 343 810 817 87D 888 910
435	Seat Belt Indicator/Warning	320 74F 756 760 763
436	Camera, Rear and Side View	160 288 320 736
437	Instrument Control Unit/LBCU	320 486 732 811 814 838 840 860 877 880 882
439	Engine ECU and Controls	106 128 129 148 152 156 162 164 283 286 372
440	Engine ECU and Controls	106 128 129 148 149 152 156 160 162 164 273 276 283 285 286 301 320 330 343 34B 732 736 811 813 814 856 880
441	Engine ECU and Controls	106 148 164 165 283 286 320 852
442	Data Recorder/Data Logger	160 286 320 813
443	Door Locks	320 655 656 787
444	Obstacle Detection System/VORAD	160 288 320 736 73B 73C
445	Body Controls/Dump Lock	288 320 329
446	Tire Pressure Monitor System	288 320 489

Circuit Numbers		
Circuit Number	Description	Modules
447	Battery Cutoff Protection System	130 156 224 277 281 285 287 291 292 293 295 306 320 700 703 70A 70B 723
448	Tail Gate Controls	288 320 329
449	Fueling Data Recording and Transmitter	198 199 283 286 288 320 343 732 810 812 817 830 836 838 83A 840 841 842 843 844 845 846 847 852 854 856 858 862 864 865 866 867 868 869
450	Mirror Dimming Controls	320 656 744 74E
453	Optional Customer Specified Wiring	164 283 285 286 306 320 321 329 343 345 34B 34C 353 355 472
454	Inflatable Restraint and Seat Pretension	160 283 285 286 320 330 343 34B 725 732 736 811 813 814
455	Instrument Left/Right Side Selection	320
457	Dash Controls, Datalink, (BPU)	164 283 286
458	Step Deployment Unit, Passenger Side	320 675 676 677 67E 67F
459	Steering Pump Controls	539
460	Transmission-Automatic, Controls	286 320 343 345 34B 34C 353 355
461	Transmission-Automatic, Controls	286 320 343 345 34B 34C 353 355
462	Headlamps, Auxiliary	27D 288 304 312 313 314 320 659
463	Headlamps, Auxiliary Right	27D 288 304 312 313 314 320 659
464	Transmission, Smart Shift Control	286 320 343 345 34B 34C 353 355
465	Headlamp, Flashing Control	27D 288 304 312 320 659
466	Land Departure System	160 288 320 736
467	Engine Coolant Flow Systems	152 286 320 856
468	Obstacle Detection System/VORAD	160 288 320 736 73B 73C
469	Level Control, Body/Chassis	288 320 329
470	Datalink Transmit	287 320 786 78A 79H 80D
471	Datalink Receive	287 320 786 78A 79H 80D
472	Engine ECU and Controls	106 128 129 148 152 156 162 164 283 286 320 343 34B 34C 34W 353 856
473	Multifunction Stalk Switch	329 472
474	Smart Switch, Resistance Identified, MUX	329 472
475	Engine Idler Controls	152 156 162 283 286
476	Adjustable Pedal Controls	288 320 486 49A 880
477	Hazard Lights, USPS	320 327 329
478	E-Stroke Brake Monitoring System	320 486 838 840 877 880 882

Specifications

Circuit Numbers		
Circuit Number	Description	Modules
479	CB Radio Antenna Coaxial	320 748 751 752
480	Switched Auxiliary Air Pressure	288 320 486 49A 880
481	Chassis Expansion Module	160 283 285 286 320 329 330 343 34B 472 732 736 811 813 814
482	Firetruck Pump Controls	148 283 286 372
483	Engine ECU and Controls	106 148 152 156 160 162 164 283 285 286 320 330 343 34B 372 732 736 811 812 813 814 819
484	Tire Chains	288 320 452 874 878 87A 87B 87F 896 900
485	Public Address System	287 320 746 74D 750 751 753 75B 75C 79F 79G
486	Vehicle Information Center	283 286 288 320 732 74F 756 760 763 811 812 814 819 860 867 877 882
487	Engine Emissions Detection and Monitor	148 150 152 162 164 283 286 320 811 814 860
488	Brake Wear Indicator	320 486 838 840 877 880 882
490	Bus Door and Window Sensing and Warning	287 288 294 300 320 327 329 654 655 656 66A 675 676 677 67E 67F 700 703 723 787 811 814 860
491	Engine Compartment Lights/Buzzer	287 320 327 329 656 787 811 814 860
492	Engine ECU and Controls	148 150 152 162 164 283 286 320 372
493	All Wheel Drive Controls	288 320 452 874 878 87A 87B 87F 896 900
494	Transmission Shift Controls	286 320 343 345 34B 34C 353 355
495	Emergency Medical Service Accessories	264 271 275 27A 27B 27C 27E 288 31A 31B 31C 31D 31G 320 327 33A
496	Steering Wheel Controls	329 472
497	Transmission Controls	286 320 343 345 34B 34C 353 355
498	Transmission Controls	286 320 343 345 34B 34C 353 355
499	Engine ECU and Controls	164 283 286
504	Dome/Interior Lamp	287 320 322 324 325 32C
506	Aerial Equipment Systems	264 271 275 27A 27B 27C 27E 288 31A 31B 31C 31D 31G 320 327 33A
507	MUX Control, MSF/CGW	287 320 786 78A 79H 80D
508	CAN Datalink	287 320 786 78A 79H 80D
509	Firetruck Pump And Hose Controls	264 271 275 27A 27B 27C 27E 288 31A 31B 31C 31D 31G 320 327 33A
510	Firetruck Pump And Hose Controls	265 271 275 27A 27B 27C 27E 288 31A 31B 31C 31D 31G 320 327 33A
511	Bus Door and Window Sensing and Warning	146 155 156 157 158 286 895
512	Emergency Vehicle Auxilixry Switches	—
513	Emergency Vehicle Door Switches	—

Circuit Numbers		
Circuit Number	Description	Modules
514	Emergency Vehicle Lights and Alarm	288 294 320 471 721
515	Emergency Vehicle Tank Level Systems	—
518	Emergency Vehicle Ladder and Rack Systems	—
519	Emergency Vehicle Body Lighting	—
520	Emergency Vehicle Body Lighting	—
521	Emergency Vehicle Body Lighting	—
522	Emergency Vehicle Body Lighting	—
523	Emergency Vehicle Body Lighting	—
524	Emergency Vehicle Power Source	—
525	Emergency Vehicle Warning Lights	—
526	Emergency Vehicle Body Lighting	—
527	Firetruck Pump And Hose Controls	—
528	Emergency Vehicle AC Power System	—
529	Windshield Defroster Grid	287 320 716 718
532	Aftertreatment Systems, Exhaust	160 164 283 285 286 320 330 343 34B 732 736 811 813 814
533	Engine ECU and Controls, Alternative Fuel	106 148 152 164 283 286 320 856
1587	J1587/J1708 Datalink	160 283 286 320 32A 330 338 343 725 732 733 736 811 812 813 819 835 888
1922	J1922 Datalink	160 283 286 330 343
1939	J1939 CAN Datalink	160 283 286 320 330 343 725 732 736 811 813 888

Table 2, Circuit Numbers