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Repairing Electrical Wiring

BY MIKE ALLEN**Photographs by James Westman**

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It starts as a smell. The unmistakable odor of burning insulation. Shortly thereafter a wisp of smoke curls out from under the dash. Then comes the similarly unmistakable pop of a fuse blowing. At which point your radio cuts out.

Or maybe it's the windshield wipers that stop--or the engine itself. No doubt about it, you have a short circuit.

DEGREE OF DIFFICULTY

**EASY**

NOW WHAT?

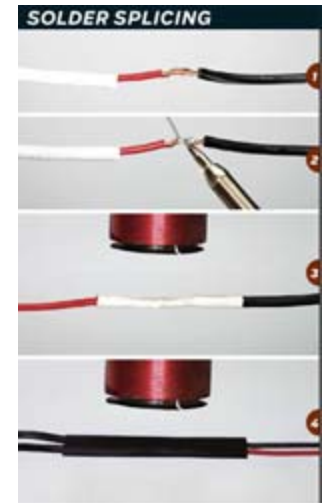
It may well be that the source of the short is obvious, like that wiring dangling under the dash. On the other hand, you may need to do some serious troubleshooting to find the source of the problem. A short circuit occurs when an energized conductor touches either the frame or body of the car or another wire. Shorts to ground usually will have low enough resistance to draw sufficient current to blow the fuse. If the short is to another circuit, you may see things like the dome light coming on when you hit the turn signals. You may discover a wiring harness or multiprong connector meltdown, caused by the heat liberated from a short or high-resistance connection. Moreover, not all wiring problems are shorts: Open and intermittent connections also can make your life difficult.

BASIC DON'TS

Never use solid wire. Solid wire is for stationary household use; the vibration in your car or truck will eventually break it. Use automotive-grade stranded wire, not pieces salvaged from an old extension cord. You'll need to find some automotive-grade wire of the same gauge as the wiring you're replacing. Try to follow the color codes on the factory wiring harness if possible, because in two or five years you may very well be tearing back into your repair-and there's nothing more daunting than troubleshooting a bundle of a half-dozen or more wires that are all the same color. At least use tags that identify the circuit and the original wire color.

Never use wire nuts. They, too, are intended for stationary wiring and will unscrew themselves--usually late at night on a bad stretch of road far from cellphone coverage.

Never use electrical tape to make a splice on automotive wiring. The extremes of heat and moisture degrade the adhesive, and the tape will unwind.



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(1) **Strip the wires** of about 1/2 in. of insulation. Slip PVC shrink tube over one wire. Twist the two sections of bare wire around each other. (2) **Heat the joint** with a soldering iron or pencil from underneath. Apply solder to the top until molten solder wicks into the joint. Let this cool undisturbed to avoid a "cold" solder joint. (3) **Heat the shrink tube** to make it shrink down around the wire. (4) **Use more shrink tube** to bundle multiple connections.

SOLDERING ON

The most secure and durable way to splice two wires together is to solder them. Period. Use nothing but 60-40 rosin-core solder intended for electrical wiring. You'll also need some PVC shrink tube. If you're not an old hand at soldering, practice for a dozen or so joints before you try to do it under the dash with hot solder dripping on your cheek.



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(1) **New spade-lug connector** should be slid over stripped wire just far enough to cover bare wire. Don't crimp over insulation. (2) **Crimping tool** is then used to crush connector onto the bared wire. This pro-grade crimper has an overcenter mechanism that won't under- or overcrimp. (3) **Finished product** is solid mechanically and electrically.

Don't have a heat gun and your wife's hair dryer is off-limits? I've made do with a lighter. Be careful not to leave a smudge of conductive carbon over the tubing-and try not to set your dashboard or engine compartment on fire.

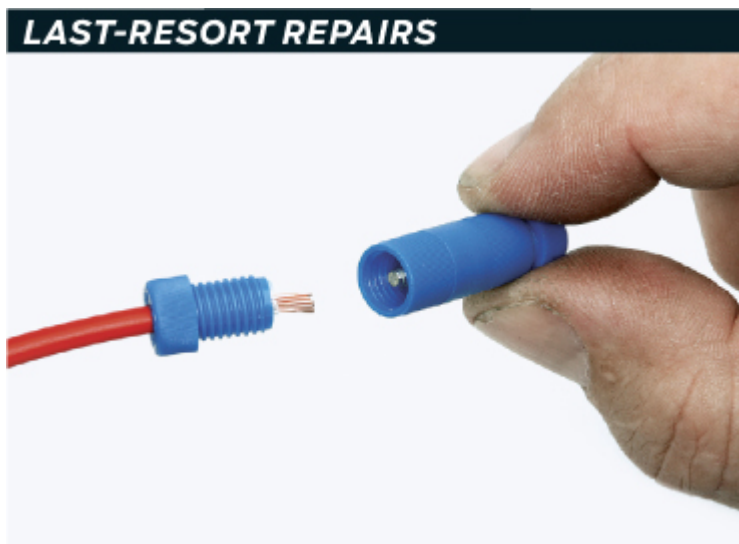


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(1) **Insert terminal tool** into connector block far enough to depress locking tang. Wiggle the tool in a circle slightly as you (2) **pull the wire** gently to remove the connector pin from the block. Having three hands helps. (3) **Crimp tool** has one small anvil to crimp wire directly to the metal connector pin. Once this is accomplished, use the larger anvil to crimp the strain relief over the insulated portion of the wire. (4, 5) **Final crimp** leaves connector pin ready to reinstall into plastic block. Just push it back into the block until the tangs seat with a click.

MAKING CONNECTIONS

Most of the wire harness on your car or truck terminates in the standard spade-lug connector. You can pick up a crimping tool almost anywhere in a kit with a selection of spade-lug, round and bullet-style connectors for under 10 bucks. Match the connector to the wire size, but most automotive wiring uses 12- or 14-ga. wire and customarily the corresponding connector has a blue insulator. Larger wires will use a connector with a yellow insulator and can be identified by the larger width of the spade lug. Just use common sense. If you have to trim some strands from the wire to make it fit into the connector ferrule, a light should go on in your head saying there's something wrong. Simply strip the wire, insert it into the barrel of the connector and crimp. Be sure the handle of the crimper bottoms out when you squeeze, which should guarantee the crimp is solid. If you do this type of thing more than occasionally, you'll want to spring for the pro-grade tool we show in the photo on page 120. It has a compound-leverage over-center mechanism that ensures a correct squeeze. It costs about \$50.



(1) **We carry some of these Posi-Lock** electrical connectors around for quick repairs and temporary trailer connections. Strip the wire, then insert it through the collar and tighten. *posi-lock.com*

Splicing and crimping wires is easy. But what about that multiconductor connector that melted, or the Weatherpak connector under the hood that carries data from some fuel-injection sensor? Unlike the wiring that runs the headlights, these connections carry millivolt-level information at low current. Any resistance will make your engine management computer unhappy. These connectors are sealed-up to a point. Inauspicious use of pressure washers can drive water past the seals, resulting in corrosion. You'll need to

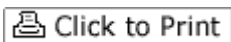
depress a tab to disconnect this style of connector. If the plastic block is damaged but the pins are okay, you can replace the block. If the block is fine but the connectors are corroded or the wires have been torn loose from the connector pins, you can replace just the pins.

To remove the pins from the block, you'll need to depress a small locking tang. There are inexpensive tools available to do this. Square pins use a small, flat probe, while round pins use a hollow, round one. Insert the probe and wiggle it around a little and the pin should easily pull out of the block. This maneuver might require three hands-to pull on the wire, wiggle the probe and hold the block simultaneously. Don't pull too hard-if the pin doesn't pull out fairly easily, wiggle the probe again. No special tool? You can use a small screwdriver or even a paper clip-but you run the risk of damaging the tang. Crimping on a new pin is done with a special tool, and it's not cheap. We paid close to a hundred bucks for the one shown above, including a rather complete set of replacement pins. (No, the \$2.95 set of wire crimpers you got at Wal-Mart won't do.) There are two crimps to make, one on the stranded wire itself and a second over the insulation. This crimp is fussy to perform even with the right tool. I recommend practicing on a piece of scrap. Don't forget to install the rubber seal on Weatherpak connectors before you crimp.

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