

Why is crimping preferred over soldering when joining wire to electrical connectors and why do American Boat and Yacht Council Standards specify that solder shall only be used in combination with crimping, except in the case of battery cables?

To be sure, this subject still provokes heated discussion, especially among those who see soldering of crimped joints as extra insurance of reliability.

Both mechanical and electrical integrity in the marine environment are essential to reliable connections. The crimped joint provides both, if properly done. Reliable crimps require that both wire and connector be of matching sizes, that proper tools are used, and that the materials (wire and connectors) be of marine grade quality to begin with. A combination wire cutter,stripper, and crimper is available at good hardware and marine dealers. The crimping part of the tool actually comprises dies which exert a swaging action on connector and wire, effectively created a "weld". The tool was designed to confine the connector and wire so that the pressure exerted by the die was concentrated at the joint. This is why ordinary pliers are not acceptable. They will crush the connector barrel alright, but both connector and wire will squish out to the side, making a joint which is mechanically weak, and electrically suspect.

A good crimping tool will have dies for both insulated and non-insulated connectors in at least three sizes: #8-10, #12-14, and #16-18. it is important to make the crimp with the right die.

If you are getting loose connections, or if you see cracks in the connector barrel or insulation, you are using the wrong die.

Get a marine rated connector a your dealer's and carefully examine the inside of the barrel which receives the stripped wire. Note the grooving which is designed to grip the wire, preventing stretching, and focus the crimping pressure to effect welding action. The crimp "work hardens" the copper of the connector so that the joint is mechanically sound.

Multi-stranded wire is required in marine applications (except when a heavy gauge, well-supported, dressed wire is used solely as a ground bus), made up of fine-stranded(e.g. 30 guage), pre-tinned wire for best results. Automotive hook-up wire is usually not pre-tinned, and bare copper oxidizes (corrodes) in salt air.

Once a good electrical/mechanical joint is made, it is essential to protect it from water or moist salt air. The best way to do this now is by using shrink tube insulation, especially the type which includes a heat activated adhesive on the inner surface. The shrink tubing is put on before the crimp is made, of sufficient length to overlap the wire insulation by a 1/2" or so. Application of heat (a heat gun used for striping paint will do) causes the adhesive to liquefy and the tubing to shrink tight to the wire and connector.

But soldering is a time-honored method. What's wrong with it now?

Good soldering requires a certain technique. A cold soldered joint may be worse than useless, since it may look OK to an unpracticed eye. Good soldering is especially difficult when making up a splice in a confined or limited access space. Using a proper tool, a good crimp is easy.

As mentioned, crimping action work hardens the connector barrel, making the joint mechanical strong and stable. If you solder a crimped joint, you may, in heating the connector, anneal(soften) the copper, making the joint loosen. Now it is the solder only which provides the strength of the joint. But if the joint is subjected to vibration, the solder, in absorbing mechanical energy over a period of time, may crystallize, and the joint may actually fail altogether.

Melted solder may flow through "wicking" action up the strands of wire, thus creating a stiff, solid section just behind a terminal. Since the terminal itself is made fast to a post or stud, the place where the solder stiffened section abruptly merges with the stranded, unsoldered wire is relatively unsupported. Vibrational flexing of the wire is concentrated at this interface, leading to hardening, embrittlement, and eventual failure.

Contrary to popular belief, solder is not impervious to corrosion. It is a composition of lead and tin. When connected to copper (wire and terminal) in a salt atmosphere, galvanic corrosion can occur, resulting in leaching out of the lead, leaving a powdery residue which is both electrically and mechanically worthless.

Whether crimped only or soldered and crimped, protection from salt atmosphere is important. For wiring splices, shrink tubing is the way to go. For terminal strips, there are liquid sealants available which can be painted on after a connection is made up.

Recently, connectors which incorporate shrink-tube insulation sleeves have been introduced to the consumer marine market. The connector-wire joint is first crimped, then a heat gun is used to seal the connector insulation to the wire cover making a waterproof joint. This would appear to be the best method for making up connections, especially below decks, or in other salt atmosphere spaces.

It is rare when convenience and reliability are served by the same process. But crimped connections, properly made up and protected from the environment offer the skipper both ease and dependability. The local yard has even been crimping battery cables for the past several years, using a special swaging tool.

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