



Overhead Pilot-Wire Splice Procedure

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Revision

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APPROVAL: *Dave Redding*

A. GENERAL

Pilot-wire cable splices must be made with much more care than typical 600 volt splices since the cable carries critical tripping signals for high-speed transmission line relays at the substation on each end of the line. Poor splices can and occasionally will cause transmission line outages, and, under certain conditions, widespread area power outages. In contrast to 600 volt cable, this cable is designed to withstand 10kV AC wire-to-wire for one minute, and splices must be carefully made to maintain this high dielectric strength. Careful splicing insures that induced voltage surges during power line faults and substation ground-mat voltage rises will not fail splices and cause false line tripping or prevent line tripping when needed.

B. MOISTURE

Although the basic splice procedure normally insures adequate dielectric strength, the most important concern is to make sure the splice is fully waterproofed. Any moisture inside will seriously weaken dielectric strength and cause splice failure during hi-pot tests. This aspect cannot be stressed too strongly.

C. SPLICE LOCATIONS

Since moisture is the single greatest enemy of the pilot-wire splice, every attempt should be made during construction to avoid placing splices where water will normally accumulate. Never place a splice at the bottom of a drip-loop.

Unless absolutely necessary, splices must never be made in any underground vault, manhole or pit. Any pilot-wire run into an underground section should be continuous without splices from entrance to exit to insure high reliability. Where underground splices do become necessary, special instructions should be requested for additional water proofing and liquid-sealing of outer jacket. During new pilot-wire construction, a sufficient length of extra continuous cable should be left coiled at the substation pilot-wire riser pole to allow it to be later pulled into the substation pilot-wire cabinet without need for another splice at the riser pole. Do not cut off the cable at the riser pole. To avoid mechanical damage, splices must never be placed directly within preformed dead-end grips or preformed armor rod insulator ties. Avoid any splice covering within three feet of the end of preformed armor rod or dead-end.

D. CABLE JACKET "CREEP"

Inspection of failed splices and field reports indicate that once the continuity of the cable jacket is interrupted at a splice location, the jacket apparently tends to "creep" very slowly back away from the splice by slipping on the transparent "stripping" covering on the two conductors. This creep appears to be caused by the pulling tension on the jacket, which keeps the cable tensioned up, although other possible causes such as conductor elongation, or "stretch" at the splice due to loss of additional jacket strength, or possible inherent long-term jacket shrinkage characteristic, have not been fully ruled out.

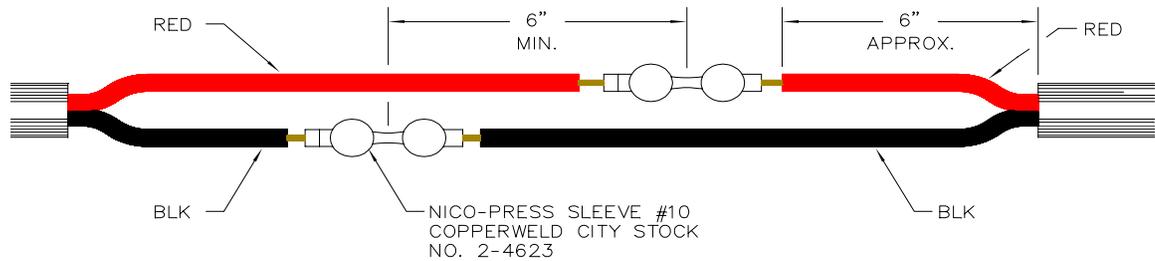
The net result of this creep is to stretch the splice insulation material, which contacts both the jacket and conductors. Although a possible field remedy might be to avoid any splices under tension by dead-ending each good section of cable and making splice jumpers between dead-ends, this would substantially increase costs and material in the long run as the number of splices on each line continue to increase.

The following splice procedure attempts to compensate for this creep by using sealing-insulating strip material that is flexible.

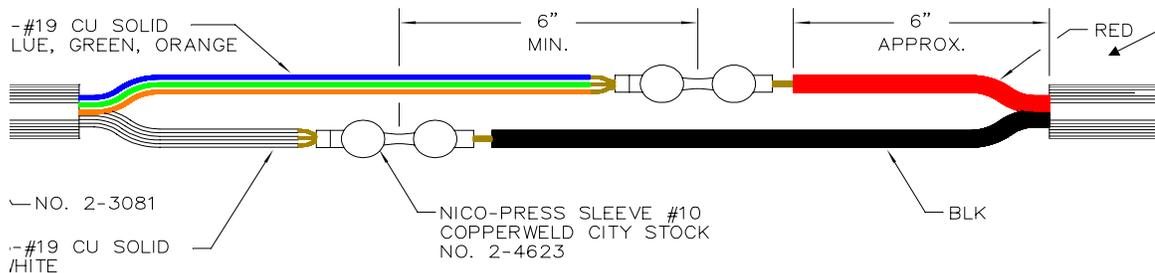
Warning. Do Not Over-Tension The Cable. Use proper sags as specified in sag table for 2 /C #10 pilot-wire cable.

E. SPLICING PROCEDURE

1. At splice location, pull up both loose ends of cable with coffin-hoist and coated preformed dead-end grips. **Warning: Do not** use mechanical grips directly on the cable since this will smash the two conductors inside or ruin the jacket.
2. On each cable end, carefully cut back cable jacket far enough to allow one conductor to be cut six inches minimum shorter than the other and still leave sufficient length between the short conductor and jacket for taping. Since the jacket is very hard, exercise special care to avoid nicking the conductor insulation.
3. a) Strip back conductor insulation and install and crimp "Nico-press" No. 10 copper-weld sleeve on each conductor (Stock No. 2-4623). Always match red-on-red and black-on-black to facilitate testing and trouble isolation.

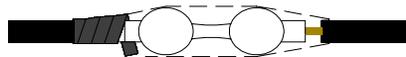


- b) Strip three pairs of #19 Cu. Solid conductors. Bundle the white conductors together and crimp "Nico-press" No. 10 copper-weld sleeve (Stock No. 2-4623) to black #10 conductor. Strip the blue, green, and orange conductors. Bundle them together and crimp "Nico-press" No. 10 copper weld-sleeve to red #10 conductor. Follow the remaining splicing instructions to complete the splice.



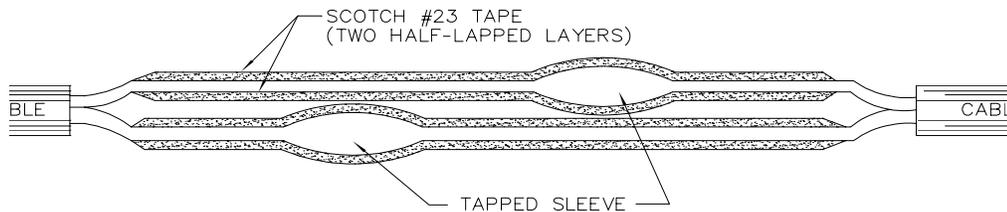
- Unwrap the thin layer of clear polyethylene paper-like tape around each conductor insulation back to the cable jacket and cut this off. This layer is used only to protect the conductor insulation during assembly and to make stripping of the cable jacket easier. It must be removed to allow subsequent taping to adhere well to the conductor insulation.
- Wrap one half-lapped layer of all-weather Scotch No. 88 tape (City Stock No. 2-6606) around each “Nico-press” sleeve to cover all bare sleeve and conductor. This hard covering will insure that after a long period under tension, one sleeve cannot eventually grind its way entirely into adjacent conductor for metal-to-metal contact.

SCOTCH #88 TAPE

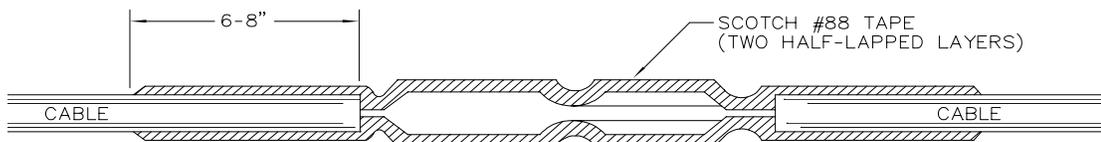


EACH CONDUCTOR SPLICE

- Wrap two layers of half-lapped self-fusing Scotch No. 23 tape (City Stock No. 2-6604) over **entire length** of each splice and conductor, extending out as close to cable jacket as possible. This provides high-voltage insulation and helps cover any inadvertent nicks in conductor insulation.



- Wrap one half-lapped final layer of Scotch #88 tape over entire length of each conductor splice, also extending out as close to cable jacket as possible. This layer helps prevent excessive distortion of underlying Scotch #23 when the conductors pull together under tension.
- Release tension grips allowing splices to pull together well.
- Wrap one half-lapped layer of Scotch No. 88 tape around both splices as a pair and extend the tape put 6-8 inches over cable jacket.



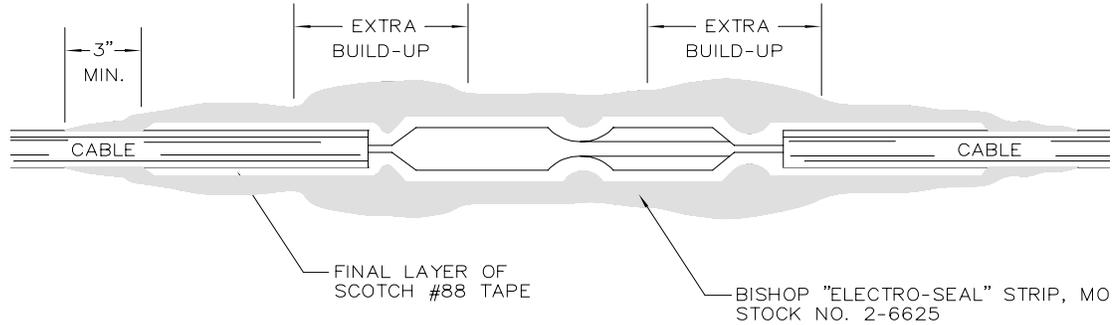
- Lay a flattened out strip of self-fusing, four-inch wide “Electro-Seal” roll (City Stock No. 2-6625) over entire length of splice and extending out over cable jacket at least three inches **past** Scotch No. 88 tape layer. Pinch the strip together around the entire splice and mold thoroughly to completely seal the splice and outer layer of Scotch No. 88 from moisture. If the splice is too bulky, two strips of “Electro-Seal” may be used to completely surround the cable and splice. At both points where the cable jacket stops and splice starts, add additional “Electro-Seal” build-up around the joint so that if jacket “creep” away from the splicing occurs, sufficient “Electro-Seal” remains to “yoke” down and keep joint water-tight.

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11. Wrap over entire splice and "Electro-Seal" cover with four passes of Scotch No. 88 tape. Wrap first layer **very lightly** to avoid squeezing out or distorting under-lying "Electro-Seal".

