Landscape Light Connections

Contents

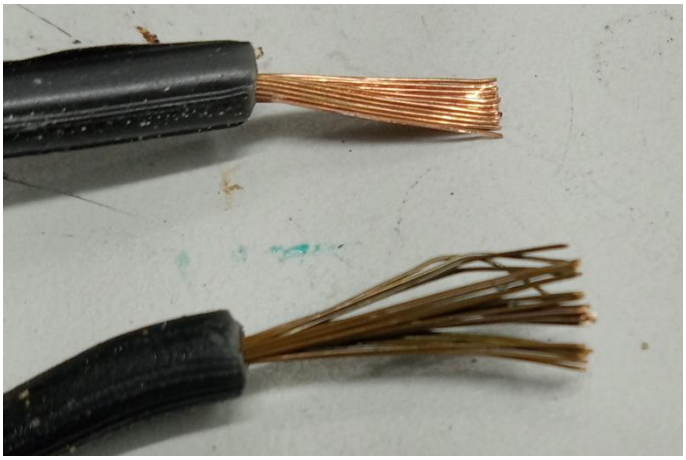
Purpose

This document describes some of the more subtle long-term issues related to landscape lighting.

Wiring

Wiring typically consists of runs of dual conductor 12-14awg copper wire specifically constructed with insulation that will withstand the outdoor elements (sun, rain, etc.)

When the wire is new, it will be clean and shiny (as shown in the upper wire below) and as it ages it will become tarnished and dull (as shown in the lower wire below.)



The tarnish (or oxidation) introduces resistance into any connection with the wire reducing the capacity of the connection to carry electricity to the lamps and thus causing the lamp to dim. In an extreme case the oxidation can become so great as to completely block the flow of electricity causing the lamp to turn off.

Connectors

Typical landscape lighting installation uses connectors to attach the lamp wires to the underground wiring. These connectors are typically made out of plastic and various metal “prongs” that “poke” into the wires to make contact.

As will be shown in the following sections, these connectors are quick-and-easy and allow you to rapidly add a lamp into the circuit. However, over time they tend to fail and you will end up with the incredibly annoying scenario where your lights start flickering or failing completely one moment and working the next.

Underground Wire Connection

Below you can see examples of such connectors – a brand new one on the left and a used worn one on the right. The red arrow is pointing to where one of the prongs corroded over time and fell off causing the connector to fail. To the right is a close up of the corroded prong where you can clearly see a green oxide area showing where the prong once existed.

Lamp Connection

The lamp wiring connects to the connector via the two tabs that fold into the connector – see illustration below. You can see the indentation in the wire below (red arrow) where the metal prong in the connector gets "jammed" into the wire when you insert the wire into the tab hole and close the tab.

As you can see in the image above this connection is less than ideal and deteriorates over time. Temperature changes, vibration, introduced water freezing, and oxidation all contribute to this connection failure.

Additionally, although it would appear that you can re-open the tabs and put new wires in, this is not practical in reality because the metal prong often gets ripped out when you open the tab. So, for all practical purposes these connectors are single use only.

Connection Tip

Since the connectors are basically single use, the best way to install them is as follows:

1. Turn the lighting transformer so that there is 12VAC running in the underground cable.
2. Position the connector on the underground cable so that the prongs go into the center of the cable – and thus have the best chance of hitting the actual wire.
3. Squeeze the connector so that it latches around the underground cable.
4. With a volt meter, check that you see 12VAC on the metal prongs inside the folding lamp wire tabs. If no voltage is seen you will need to release the connector and re-position it on the underground cable until you see voltage.
5. Now, you can safely insert the lamp wires and close the folding lamp wire tabs knowing that they will have power.

Crappy Wire Joints

If you are working with a lighting installation that has already been installed, you will likely need to look for where the installer joined the different pieces of wire together – as the full run is rarely made from a single long piece of wire.

These joints could be anywhere, but typically follow common sense and occur at the end of a run of lights, or sometimes where an extra light was added later.

Here is a typical wire joint made with wire nuts and electrical tape. Needless to say, this sort of joint will decay rapidly over time as moisture gets into the wire nuts and causes corrosion.

Or, you may see even more strange connections – like this example where two runs of wire were joined by a connector meant to attach lights to the wire run. Needless to say, these should ideally all be converted to soldered joints to improve reliability and increase light brightness.

Soldering

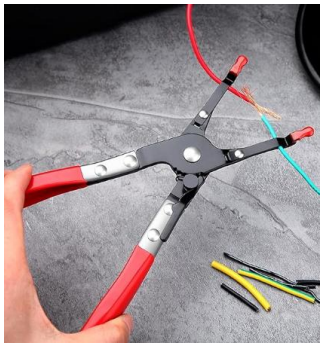
Soldering is the way to go once your lighting design has stabilized and you no longer think about moving lights from one spot to another.

Soldered connections last virtually forever and never deteriorate if done properly. The drawback, of course, is that it involves more work.

Requirements

You will need some basic equipment (shown below) and at least beginner soldering skills:

- 260W solder gun – smaller wattage doesn't work well with 12/14awg wire
- Spare tips for your solder gun (as they break after a few hours of use)
- Oatey No.5 Paste Flux
- Oatey 29024 0.117" silver solder
- Optional – Wire welding clamp tool
- 3:1 ¾" Marine Grade Heat Shrink, adhesive lined, oil-proof, wear-resistant (not shown)

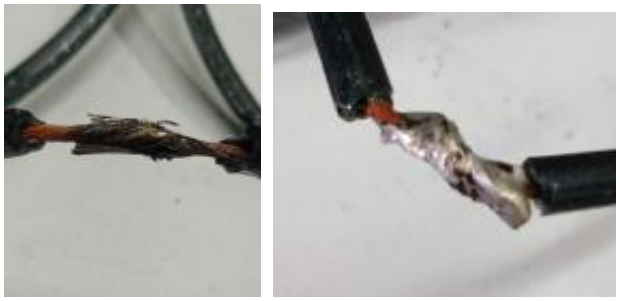


Flux

Unless your wires are brand spanking new – literally right off the production line – you are always better off using flux. Flux will burn off all of the dirt and oxidation on the wire so that a good solder joint can form.

Flux (and it's resulting smoke) is generally (depending on the type) somewhat toxic so you should always refrain from getting it on your skin or breathing the smoke. The best way to apply it is to use a tiny paint brush designed for flux – but you can also use a piece of paper, a toothpick, etc.

Below are examples of a wire soldered with NO flux (on the left) and after using flux (on the right.)



You can see (on the left) that the no flux solder connection is very poor, and that (on the right) the flux connection looks very nice and shiny.

When it comes to flux, the more the better. Put as much flux as reasonably possible on your wires before soldering them.

Then heat the wire(s) until all of the flux has burnt off (this is where the toxic gas comes off so don't breathe it or get it in your eyes) – this generally takes 5-10 seconds. The wires should look bright and shiny at this point.

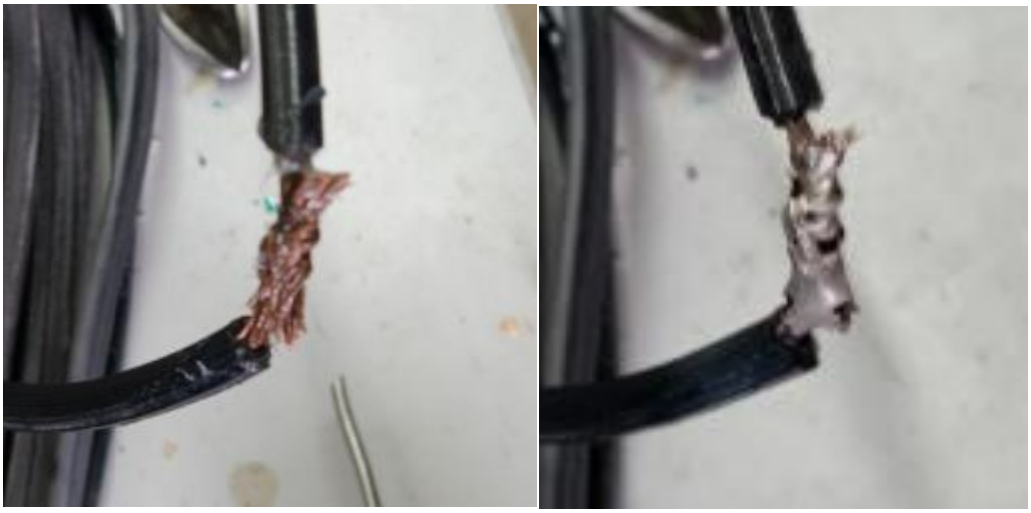
Continue to heat the wire(s) and apply the solder to the wire until the solder starts melting and flows into the wire – this generally takes about 15-20 seconds. Some practice may be required here if you have never soldered before.

Soldering Steps

General

You can strip (1), flux (2) and solder (3) the wires first and then join them (4 see below.)

Or you can strip, twist and flux (1) the wires and then solder them (2 see below.)

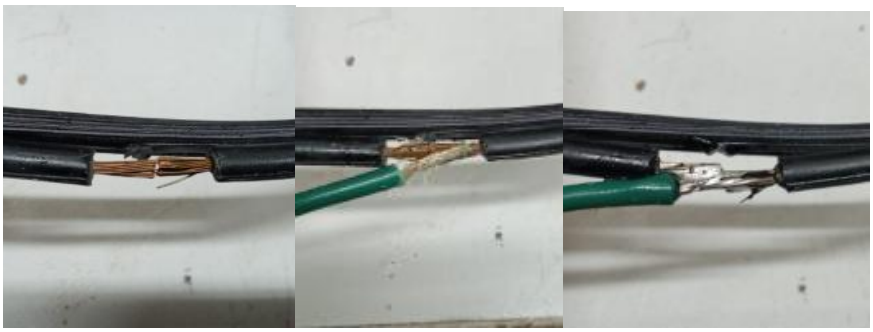


Either way works fine, but generally the second method is quicker and easier.

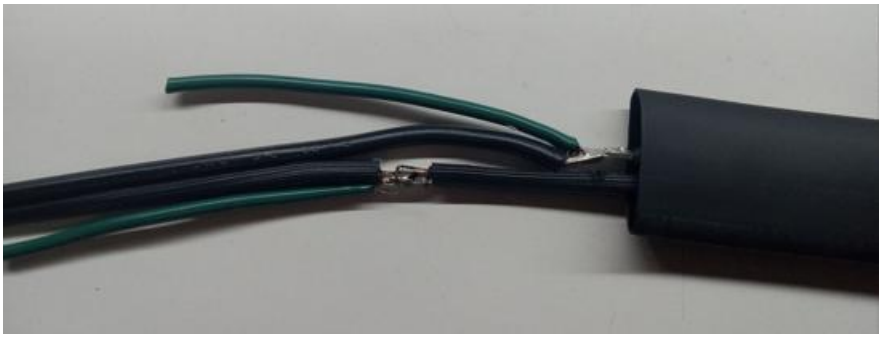
Attaching Lamp Wire to Underground Cable

Since you are most likely doing this after the cable is in the ground you will need to sever the underground cable to get the heat shrink over the cable on the OPPOSITE side of the lamp wires BEFORE you attach the lamp wires.

Here are the basic steps (1 strip, 2 flux, 3 solder) to connect one lamp wire.



You should then repeat the steps (making sure the lamp wires exit on the same side)



Finally slide the heat shrink over the connections and permanently apply it using a heat gun.

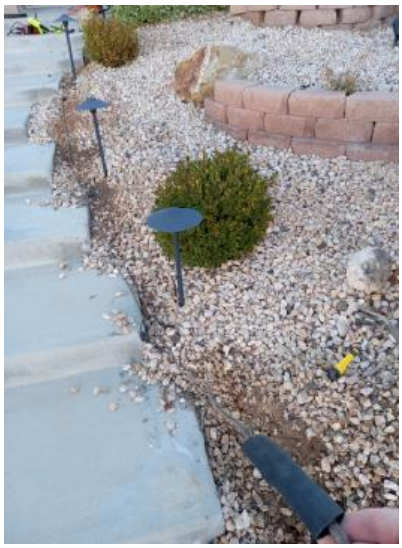
You now have an extremely reliable electrical and mechanical connection for your lamp.

Attaching Lamp Wire to Underground Cable (Special Case)

If you are lucky enough to have a row of lamps that are right next to each other (like walkway lights) then you can take a shortcut and only cut the underground wire once (instead of once for every lamp.)

Uncover the whole run of underground wire (left below) and cut the wire at the end of the run and slide the heat sink tube from the bottom up to each lamp (middle and right below.)





You can then use a wire stripper tool to pull back the wire insulation (without cutting the wire) on the two locations (below left.) Then flux, solder and heat shrink seal as before. Repeat for each lamp.