To start this article off I'd like to set a little background. I was managing an access control division for a wrought iron company, and 50% of our repeat service calls on brand new gate systems were because of inductance loops. It was frustrating to see our profit margin get consistently eaten up by repeat service calls, so I began to look for a reliable loop solution. After trying different wrapping techniques and materials, and most of the products that were on the market at the time, I decided that our best bet would be to design our own loop.

BD Loops got started a little over 15 years ago with the intent to improve the design of the inductance loop. What we discovered was that the gate and door industry were riddled with bad science and myths where inductance loops were involved. There were misconceptions on every aspect of inductance loops from what type of material causes a detection, which direction the wires should be wrapped in, whether or not lead-ins should be twisted, if it was ok to run lead-ins under the gate path, if splices were allowable, where loops should be placed in reference to a gate or door, and what sizes loops should (or should not) be.

Running into all these myths about loops was both amusing and frustrating, inductance loops are really very simple, but all the myths made them appear complex and difficult to understand.

To Splice or not to Splice, that is the question.

Shortly after coming out with our Direct Burial loop we were asked to design a Saw-Cut loop for existing roadways. The first myth we ran into about saw-cut loops was that the loop could not have any splices in it. We discovered the reason behind the splice myth is that the splice has to be water tight and have a good electrical connection. If either of these requirements are not met – the loop would likely fail. Unfortunately not all installers carry around a soldering iron and water tight splice kits, tools that are necessary to make the best possible splice. There are a few simple rules that need to be followed to create a splice

- Only splice or add length or repair damaged **loop lead-in**, do not attempt to repair a damaged loop or add length to the loop itself.
- All connections absolutely must be soldered. Soldering creates a strong electrical connection in many ways including preventing corrosion and oxidization of the wires after a short time.
- Use a water tight splice kit – these can be purchased through many distributors or electrical supply stores. Do not use Electrical tape or non-adhesive lined shrink tubing to cover your splices, water tight splice kits are more reliable and more likely to stand the test of time.

Lead-in: Twisted or Untwisted?

The second myth we ran into was that the loop lead-in has to be twisted between 3 to 8 twists per foot or the loop lead-in would not "cancel" and would detect a metal object above it. We spoke with several individuals that were certain lead-ins run under gates had resulted in the gate being detected as it tries to close.

A major reason this myth got started is when an outside loop lead-in was run under the gate path false detections would be attributed to the gate being detected by the untwisted lead-in.
This kind of issue is common when an installer uses a blade that is too narrow such as a 1/8" blade. Installers often choose to use narrower blade sizes because they are less expensive, easy to find, and cut faster than wider blades. Unfortunately 1/8" grooves are too narrow for sealant to flow around wrapped wires and fully encapsulate the wire, and forces the installer to lay the lead-in wire on top of each other with no twists. Which leaves an air pocket which allows the lead-in wire space to move ever so slightly in reference to the other wire. This slight movement will result in false detections; the movement can be caused by ground vibrations from nearby traffic, trains, or even the gate itself.

To correct this problem the installer cuts in a new loop and uses a wider ¼" blade or doubles up ⅛" blades to cut the lead-in run and twists the lead-in. The problem goes away – so the installer believed that twisting the lead-in was necessary to "cancel the fields" or prevent the gate from being detected. What is really happening is the sealant is better encapsulating the wire in the wider ¼" groove, and the twisted lead-in is preventing the wires from moving in reference to each other preventing false detections.

To really drive the twisted lead-in myth to bed both the U.S. Department of Transportation and the Texas Transportation Institute commissioned Texas A&M University to conduct a test that found crosstalk between lead-in wires, whether twisted or untwisted was not a problem. This report can be located at http://library.ctr.utexas.edu - Report No. FHWA/TX-94/1392-2 *Induction Loop Detector Systems Crosstalk.*

After doing this research we developed a Saw-Cut loop that does not have a twisted lead-in, instead the wires lay on top of each other secured together by a tough polyethylene outer jacket that prevents movement, and allows installers to use the same blade size for both the loop and lead-in.

Do installers still use 1/8" grooves and say they never have issues? Of course, when I come across such an installer I have made a challenge to them – Let me take a jackhammer to their loop site and do a ground vibration test with the detector set to max sensitivity. Unfortunately, no one has taken me up on this test. The main reason I think installers do not realize they are having issues related to blade width is

that this problem can be masked by setting the sensitivity of the detector to a lower setting – which makes the problem appear to go away.

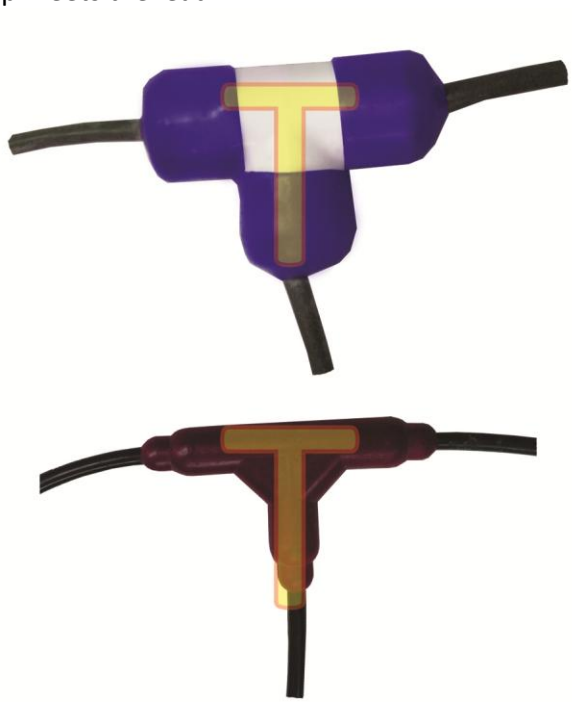
The only issue with setting the detector to a lower setting is that high bed vehicles and motorcycles might have a harder time being detected. We often find that installers who use 1/8" blades also often make the short leg of their loop at least 6'. The better detection height offered by a 6' short leg verses a 4' short leg can help mask the issue of air pockets as well as cover for the detector being set to a lower sensitivity. In fact several installation schools teach that the short leg of a loop should never be less than 6'.

The best solution for air pockets is to use a 3/16" or larger blade if you are wrapping your own loop, or to use a preformed loop that is wrapped in a continuous flow outer jacket that prevents movement of the wire. Even when installers use the proper sized blade, air pockets can still form when wrapping a loop by hand, but they are smaller and less likely to cause false detections than wires run through a narrower 1/8" groove.

I mention a continual flow outer jacket because some installers and preformed loops manufacturers wrap wires with tape to try to hold the wire together. The tape can easily become unraveled during the installation process which makes getting the loops into the groove more difficult and can also lead to intermittent loop problems caused by air pockets.

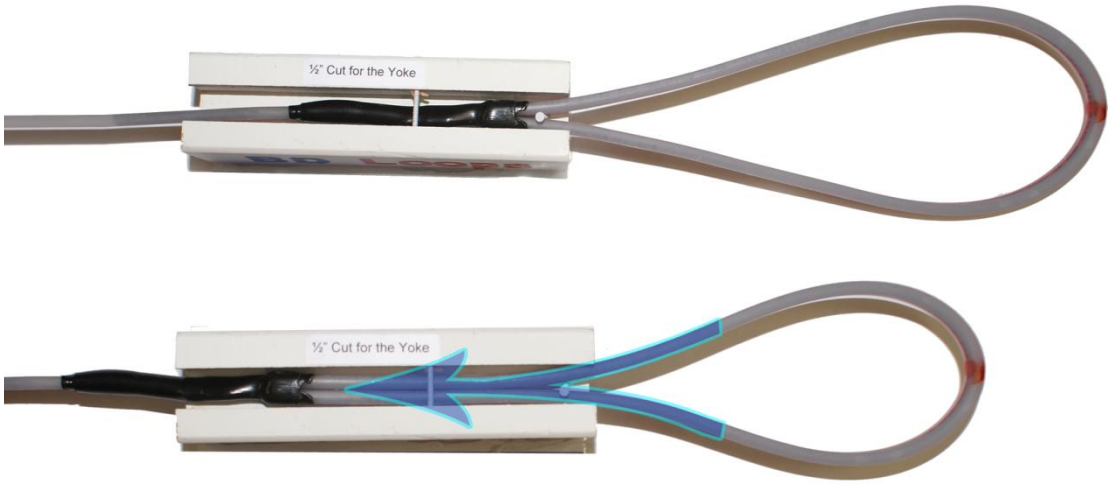
Do you have to cut an exact size groove for a preformed loop?

Moving on to other myths about preformed Saw-Cut loops, the biggest myth is the Saw-Cut pattern has to be exact size in order for the loop to fit. This is true where the preformed loop has a "T" junction where the loop meets the lead-in.



But if the preformed loop has a "Y" yoke then the loop has the ability to be flexible in size. You can't make a preformed loop any larger, but if it has a Y yoke you can make it smaller by taking up loop excess in

the lead-in run. For every inch of excess loop you pull into the lead-in run you shrink the loop by two inches. This type of design makes it easy to fit a preformed loop into a saw-cut groove that is not exact size. A preformed loop with a "Y" yoke will fit every time as long groove is slightly smaller than the loop.



Type of Wire

Many years ago using TFFN or THHN for wrapping loops was the standard. Now we know that TFFN/THHN is not a good choice for inductance loops for a variety of reasons including:

- The insulation absorbs water – This can lead to intermittent loop failures caused by circuit drift. Loops wrapped with TFFN/THHN will often short to ground after heavy rain or morning sprinklers, when the groove dries out the loop will resume working again.
- The insulation is easy to nick
- The insulation breaks down in hot weather and shorts to ground. After the temperature decreases the shorting effect goes away, causing intermittent problems.
- These types of wires are designed for home/building electrical wiring run through conduit, they were not designed for direct burial.
- Visit http://www.bdloops.com/bdloops_lab.html to view our THHN / TFFN Wire Test.

Many of the issues caused by TFFN/THHN wire can lead to frustrating repeat service calls for issues that are difficult to diagnose.

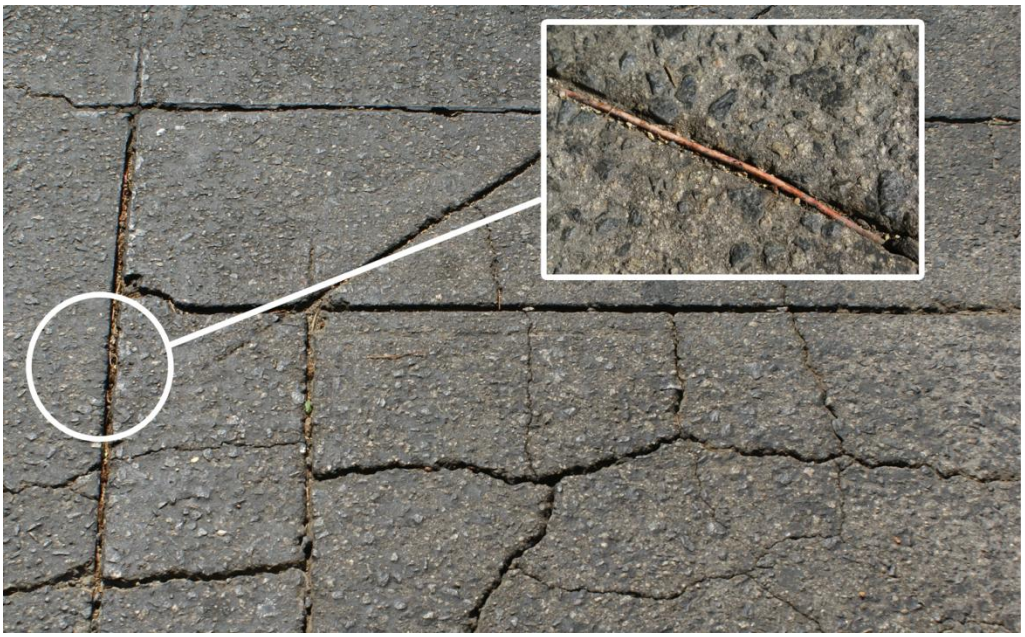
The best wire options for loops are:

- A preformed loop with a continuous flow outer jacket that prevents air pocket issues by not allowing wire movement.
- XLPE or XLP (Cross-linked polyethylene) this is the best wire to use for wrapping loops by hand.

Marginal Surface Area – Should a Loop be installed?

I think we've all had nerve wracking loop installation jobs where we were expected to cut a loop into terribly cracked up asphalt or concrete. Sometimes these jobs have even had loops installed previously that have failed within the first year.
This type of application was something we considered when designing our saw-cut loop. We found that a loop with a thick and durable independent outer jacket made out of a tough material such as polyethylene offers the best protection against a marginal surface.

The independent outer jacket is essentially an additional layer of protection that helps prevent the wire insulation from tearing. The outer jacket also holds all the wire together and is more likely to stay at the bottom of the groove which will prevent individual wraps of wire from rising to the surface as the ground cracks and shifts.



We've packed so much information into this article and have barely scratched the surface when it comes to saw-cut loops. Be on the lookout for a follow up article that contains just as much information on loop size (What is the largest size loop you can install?), placement (How far should loops be installed from the gate? How about the curb? Or other loops?), sealant (What should you really be using?), and more.

Ted Dickson is the Owner of BD Loops, a designer of preformed direct burial and saw-cut inductance loops for the gate, door, and parking industries. With over 15 years in business the quality of our loops is unparalleled. BD Loops products are available through over 400 distributors in the U.S. and Canada. BD Loops offers 58 standard preformed loop sizes, all standard and custom loop sizes are ready to be shipped the same day. The company has several letters of recommendation testifying their professionalism and design, and is a member of the following associations: AFA, IDA, NOMMA, IPI, CODA and IMSA. Visit www.bdloops.com and use the distributor locator to find a distributor near you. If you have any questions about this article please give us a call at 714-723-0946.