WHAT'S IN YOUR SPEC - THE TRUTH ABOUT TRACE WIRE

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When a municipality modifies, updates or adopts a new section to a traditional standard specification for construction, there are a few key components in the process that are vital to ensure success. These key components — the design engineer, the construction inspector and the contractor — all need to understand what's changing, proper implementation of the change and the benefit of the required outcome.

The Trace Wire Specification Solution

This explanation is intended to do just that, with regard to the Minnesota Rural Water Association (MRWA) Trace Wire Specification, for the purpose of locating underground water and wastewater utilities for the entire lifecycle of the utility. The MRWA Trace Wire Specification was published for public use in March 2014, and is now being recognized as the new standard with numerous Minnesota municipalities, as well as municipalities across the country and outside of the U.S.

If any tenured design engineer, construction inspector or contractor was told that we have been installing trace wire on water and wastewater projects, for many, many years, that doesn't work, some disagreement is likely to ensue. But this is in fact the case, and now that the problem and a solution have been identified, it is imperative to get all involved parties on the same page and up to speed as quickly as possible.

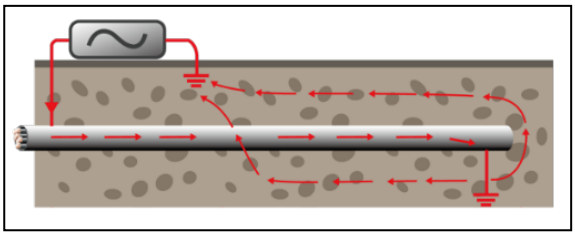
While there certainly are exceptions, it does seem fair to say that *most* engineers, inspectors and contractors have limited expertise in utility line locating. To understand the proper workings of a complete trace wire system, it is necessary to also understand a few basic principles of underground utility line locating and the equipment used.

The Basics of Underground Utility Line Locating

For the purpose of locating properly installed trace wire, the required locating equipment includes a:

- transmitter with connective leads (red & black),
- ground rod for the transmitter; and
- hand-held receiver used to locate the transmitted signal.

Most typical utility line locating equipment will offer a low frequency 512Hz signal, which will travel the greatest distance and have the lowest likelihood of bleed-off onto other adjacent utilities. The 512Hz frequency is not well suited for tolerating or negotiating poor conductivity, but is well suited for traveling desired distances on a perfect conductor such as trace wire. The loss of a locatable signal, using 512Hz frequency during a verification locate is a very likely indication of a wire damaged during installation. These are a few of the main reasons why the specification requires that verification testing be performed using only the 512Hz frequency.



The theory of locating requires a utility locator to complete a circuit, through a traceable system, and back to their transmitter for a locatable signal to exist. Simply put, when a complete circuit exists, the chosen frequency is traveling out of the transmitter through the red connective lead, and returning back into the transmitter through the black connective lead, by way of the chosen conductor or trace wire. It is not feasible to connect each of the transmitter's connective leads to opposite ends of the chosen conductor, so moist soils provide the return path for the signal to reenter the transmitter, through the black connective lead, via a ground probe placed in the ground at the transmitter connection point. If the chosen conductor does not go to ground in the earth, the alternating current (AC) locating signal will not follow the conductor and this return path will not be achievable. A locatable signal will not exist.

One of the main reasons that utility locators cannot locate previously installed trace wires is because they improperly terminate without going to ground. For example, at a hydrant or in a valve box or manhole, if the trace wire is not properly grounded, the AC current will not follow the trace wire, and will not have a return path back to the transmitter. A complete circuit does not exist; thus, a locatable signal cannot exist.

The New Trace Wire Specification Details

The MRWA Trace Wire Specification was published only after extensive research, including field testing and verification. For a trace wire system to meet expectations, it must not only be locatable, but continue to be locatable for the full lifecycle of the utility. Like many utilities, once a trace wire system is installed, the greatest threat to its integrity and longevity is corrosion. For a trace wire system to be corrosion-proof it must also be completely waterproof.

The specification covers the entire trace wire system, including wire, connectors, termination/access, grounding, procedures for installation and testing. All components specified are readily available from water and wastewater utility/contractor supply distributors.

Trace wire:

- Type shall be Copper Clad Steel (CCS), introduced to the market in 2004. CCS cost less than solid copper and has twice the strength. A perfect combination of strength and conductivity designed specifically for line tracing purposes.
- Size shall be 12 gauge (AWG), specified for strength to endure construction/installation. The size of the conductor does not have bearing on the conductivity or locatability. Damage during installation is the leading cause of failure. Wire specification includes installation methods; open trench/direct bury, directional boring and pipe bursting.

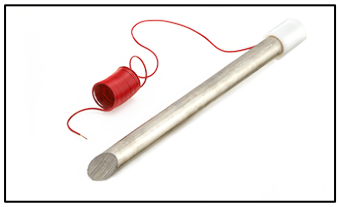
- Insulation/jacket shall be High Density Polyethylene (HDPE), designed for direct burial. Color coding shall follow American Public Works Association (APWA) Standards for each applicable utility.
- Installation shall be by method of strapping to the lower half of the pipe only. Installation on upper half of pipe significantly contributes to likelihood of breakage/damage during backfilling and compacting.

Connectors:

- Shall be moisture/corrosion displacement connectors and include only those approved as mainline-to-lateral lug connectors and 3-way connectors.
- Methods of twisting wires together and wrapping, or use of wire-nut style connectors are forbidden in the specification, as any exposure of the conductor will result is the loss of a locatable signal.

Grounding:

- Shall be provided using magnesium drivable grounding anodes only, driven into virgin soils at approximately the same elevation as the utility being installed. Grounding anode wire shall be connected directly to the trace wire, using a 3-way connector, where the beginning or end of an installation will occur within a roadway. Grounding anode wire shall terminate in a grade-level or above-grade access box, where wires terminate outside of a roadway, at the edge of or within the road right-of-way. A trace wire shall never be attached to an existing conductive utility pipe, hydrant, valve, fitting, etc.



Termination/Access:

- Shall be provided using grade level access boxes or above grade access boxes as specified by location. Both the trace wire and grounding anode wire shall terminate in each box and shall be linked together so as to properly ground each dead-end wire installation.

Testing:

- Shall be provided by means of a physical locate, performed both at the time of rough grade and just prior to final acceptance of the project, witnessed by the owner, engineer and contractor. As previously mentioned, all verification locates shall be performed using only 512Hz frequency equipment. Continuity/conductivity testing is not allowed on trace wire systems, because it does not prove locatability of the system.

Even if you have the best trace wire in the ground, its only as good as the sum of its parts, including connectors, grounding anodes, access boxes and quality workmanship.

For More Information
The MRWA Trace Wire Specification is intended to only reside on the Minnesota Rural Water Association website at www.mrwa.com. All other electronic references to the MRWA Trace Wire Specification are intended to be links back to the original on the MRWA website, so all references will be properly updated in the event that any modifications are made to the original specification in the future.

This specification was researched, developed and made public, by its authors, with no associated fees or liabilities.

The MRWA specification and this article were prepared mutually by Frank Stuemke, Jeff Dale and Joe Rubbelke.

Contact information:

frank.stuemke@mrwa.com

jeff.dale@mrwa.com

j.rubbelke@copperheadinnovations.com