DEEDS

Wired for Wire

By **Mike Parilac, Publisher**

Every now and then, someone asks me if I know where they can obtain installation standards for tracer wire systems. I have never been able to forward any information to them. That is until now. Courtesy of Frank West, you can download these standards at www.underspace.com under the "White Papers" heading.

Frank is a civilian GIS Specialist at Edwards Air Force Base in California. He combines being the underground Utility Locate Lead with the ongoing maintenance and updating of Civil Engineering records. With a background in urban planning and in data management and collection in the USA and Europe, he has a strong interest in the design and implementation of practical standards in the engineering and architectural fields.

Many non-metallic utility systems have an estimated 80-year life, but a locatable life that ranges from zero to twenty years. Getting more locating years out of a tracer system involves proper construction and testing of the wire. The reduction of avoidable utility damages requires many things. One of them is easier access to good information. Thanks, Frank, for enabling Underground Focus to do our job in providing this information.

Background

The primary focus of these design guidelines is to ensure that the tracer wire installation on underground utilities meets requirements for the effective use of pipe and cable locating equipment. For best locating results over the entire system, the tracer wire needs to be continuous, insulated from the earth and grounded on its ends. The weak links of any tracer wire system are: the below-ground connections, the end points and anywhere the wire have become discontinuous due to excavation damage.

The Wire

Tracer wire will be chosen appropriate to the expected life of the utility, the soil's corrosive factors and the distance that a utility section may need to be traced. Since the characteristic electrical properties of the tracer wire will at best remain constant (if not degrade from a locating perspective), the choice of a tracer wire has critical long-term implications.

The wire should have a minimum 12 AWG size, constructed of solid copper and have a minimum 30 mil polyethylene jacket designed specifically for buried use. The quality of the jacket should be appropriate to the degree of soil moisture, contaminants and other known potential corrosive effects limiting the effective use of the wire as a conductor. The use of solid copper wire type THHN or THWN VW-1 600 V, gasoline and oil resistant insulated is the minimum requirement for tracer wire.

Since every tracer wire system installed should have been designed to match the life of the utility it accompanies, the major addressable problem is immediate breakage caused by excavation. Therefore, consideration should be given to utilizing 10 or 9 AWG size wire.

Installation in the Trench

Assuming that new utilities are placed at conventional depths and spacing from other utilities, then the following design principles are to be applied. Extreme depth or close packing of utilities will require case-by-case application of these general design principles and may require extensive modifications.

The wire should not float "somewhere in the trench." The tracer wire will not be wrapped around the pipe in a spiral as this is a source of signal degradation and adds physical stress to the wire. The wire will be placed on top of the utility pipe and will be fastened in place at approximately every 8 to 12 feet to secure it in place when the trench is backfilled. Metallic fasteners are not to be used. The wire on fuel pipelines and on gas lines will not be fastened to the top of the pipe. Instead, the wire will be fastened to the pipe with the use of a spacer to keep the wire at a set distance from the pipe.

The wire will be allowed some slack to allow for bends in laying and for future installation of joints, splices, tapping saddles, etc. The slack should also be sufficient to allow for small earth movements occurring in compacting trench fill or through natural subsidence.

If it is necessary to join the tracer wire below ground, the wire should be joined in a permanent bond (braising, cad welding or equivalent) and the joined area insulated and rendered watertight in order to prevent corrosion. Where the cable is designed specifically for use as tracer wire, the corresponding connectors should be used.

Installation of Tracer Wire Access Points

Any tracer wire system will be accessible at a minimum of two points, the beginning and the end of the wire. (Exceptions to this, see section on: Termination of Tracer Wire). In practice, there will usually be multiple points of access.

The general design of access points to tracer wire is that the wire will be brought to ground level and a connection point provided for a locator to clip equipment onto the wire. In the simplest case, the wire is brought up a valve box tube as a continuous loop that extends three feet above ground. The loop is coiled and placed in the valve box tube. The

loop preserves the continuity of the line, and the loop of wire is reasonably accessible at the top of the valve tube. Use of the valve by the utility owner can be achieved by first pulling the wire out, then using a valve key. If the contractor laying the new utility needs to join sections of tracer wire, these access points are considered an above ground join and do not need to be extensively insulated. Split bolts (preferred) and wire nuts are options. The join can be taped.

Tracer wires in valve boxes are vulnerable to being twisted around valve keys and snapped, or pushed to the bottom of the valve box where they are out of reach and inaccessible to the locator. The problem can be mitigated by correctly installing the tracer wire so it enters the valve box near the top where it can be coiled just under the valve cap. This way the utility worker can easily pull the loop out of the way before using the valve.

Distance between Access Points

Access to tracer wire will in general be at every point the utility has another physical access point. On water, gas and fuel lines all valves below ground are considered access points and tracer wire should be accessible at these points. Access points' distance from each other will thus vary from a few feet up to hundreds of feet depending on the utility and the project. Concentrations of multiple valves on one utility within 10 feet of each other may be simplified to one access point if this is made explicit in the tracer wire submission drawings.

There normally should be an access point at least every 500 feet. On long utility runs that exceed 500 feet there should be an intermediate access point provided by bringing the tracer wire to the ground level and installing an above ground accessible junction box. Where this is a problem the tracer wire system may be initially designed with cable that can be demonstrated to carry an adequate signal over longer distances.

Termination of Tracer Wire

The beginning and end of a tracer wire are equally logical places to be brought to the surface. Above ground tracer wire termination points will be clearly tagged or labeled as end points. If possible, an as-built point-to-point wiring diagram will be provided and mounted next to the termination point.

The end points of any tracer wire system are also suitable points to place anodes. Anodes have the dual function of providing cathodic protection for the tracer wire (thus increasing its life expectancy) and for providing high quality ground points.

Where a new non-metallic utility line taps into an existing metal utility line, the tracer wire should be either terminated at an anode next to the metallic utility or be permanently attached to the metallic line. A tracer wire will not be terminated to or on another tracer wire or metallic utility line unless the two systems are demonstrably compatible. This is to reduce the potential for rapid corrosion of one system due to a 'reverse' cathodic effect.

Lateral connections will be designed to be compatible with the tracer wire on the main line. If the termination of the lateral at the main line tracer wire is underground, the join will meet all requirements for underground joins applicable to the main line tracer wire. If the join is 'above ground', e.g. at a valve for the lateral line, the joint will be a permanent one (split bolt or better) to the main line tracer wire and will be accessible.

Where the lateral line effectively terminates/interfaces with a building, the lateral tracer line section will be terminated in an appropriate manner for the utility. Where the utility enters a meter, junction box or similar point outside the building, the tracer wire should be brought to the surface and terminated by attaching it to the appropriate utility with a suitable fastener so that it is clearly visible as part of the utility installation (no dangling wires). When the utility access is only available inside the building, the tracer wire will be terminated in a neat manner inside the building and clearly labeled or tagged. It will also need to be grounded.

Testing of Tracer Wire Systems

All tracer wire for new utility installations will be tested before acceptance. The test will take the following form:

1. A standard 5 watt generator will be used to provide an AC current on the wire.
2. The frequency of the signal from the generator will be initially restricted to 33 kHz or less.
3. A standard hand held detector will be used to trace the signal.

The installed tracer wire will be deemed to pass the test if using this set up:

1. The tracer wire is accessible at all access points.
2. The tracer wire can be traced from access point to access point.
3. Widely-spaced access points can be traced out in the worst case from each 'end' to a common meeting point between them.
4. Depth readings are consistent and accurate to within a 15:1 depth to diameter ratio. **UF**

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