

Technical Report

ConQuest® Toneable Conduit™

Introduction

Traditional approaches to making underground facilities locatable required extra material and labor costs. Many system operators have even cited that sometimes the wire or tape was “forgotten” or they were “out of the material” during construction, making an expensive solution even more costly. Additionally these methods are not always reliable, subject to damage and degradation.

Now the solution is simple, reliable and most of all, affordable. CommScope’s revolutionary Toneable Conduit can provide you with confidence in knowing the location can easily be found.

CommScope’s Toneable Conduit is a unique product that combines a polyethylene conduit with an integrated toning wire. Buried toneable conduit is easily located using tone detection locating equipment. The toning wire has a novel feature that enables it to be ‘ripped’ or pulled out of the conduit wall with simple hand tools, enabling easy access for toning and/or splicing to subsequent lengths.

Product Discussion

CommScope toneable conduit is made from high quality high-density polyethylene (HDPE). The conduit meets industry standard wall thickness in ¾, 1, 1¼, 1½, and 2 inch diameters. The polyethylene is blended with a premium UV stabilization and protection package. Color concentrate chips can be added to produce the conduit in an array of colors.

Our unique toning wire is 18-gauge copper clad steel (CCS) coated with a fluoropolymer jacket. The wire is embedded in the wall of the conduit. An 18-gauge wire was selected to maintain wall thickness and provide optimal tone carrying characteristics. CCS provides the necessary amount of copper to carry a tone over long distances and a steel core that is more durable than a solid copper wire. CCS is easily ripped out of the wall without the wire breaking.

The fluoropolymer-coated wire is designed to be ‘ripped’ out of the conduit wall using simple hand tools. The fluoropolymer allows the wire to move independently of the conduit eliminating stresses on the wire and conduit, and eases the separation of the wire from the wall of the conduit. The fluoropolymer coating also provides critical insulative and corrosion protection to the ‘exposed’ wire.

Fluoropolymer, the polymer group that includes Teflon®, was ultimately selected because it offers higher resistance to chemicals, water, and abrasion relative to plastics.

Other composite materials, such as polyurethane/nylon, fail to offer the necessary resistance. Nylon, in particular, is subject to attack by strong mineral acids and has a high rate of water absorption.



ConQuest®
Toneable Conduit™
(Patented)

The Function of Toning

Toning is a method of using a generated signal, or ‘tone’, that is transmitted over a conductor so that the portion of the conductor buried below the earth’s surface can be located without digging.

The tone is produced at a very low frequency with a transmitter tuned to a particular frequency. The frequency range available on the transmitter varies between manufacturers but often ranges from 400Hz to about 80KHz. Transmission power is often variable and is usually controlled in a range of 0.033 watts up to 5.0 watts. A ‘radio’ receiver tuned to the transmit frequency is then used to precisely locate the energized wire.

The set-up requires that a transmitter be attached to the conductive material that will act as an ‘antenna’ and that a ground plane be established at the end of the antenna to close the circuit.

Installation Notes

Typical installations will consist of direct burial in an open trench, directional bores, static plowing or vibratory plowing. The design of this revolutionary conduit with the tone wire embedded within the conduit wall lends itself to all applications. The sturdy 18 AWG copper clad steel wire is protected by both the HDPE wall and the fluoropolymer insulation around the wire.

During a normal installation, the conduit may have several splice points either in the trench, pull box or in above ground enclosures. The tone wire can be spliced together at these locations for a longer tone length, possibly beyond 5 miles (depending on burial conditions and the toning equipment used).

Splicing the wire together can be accomplished in a variety of ways. As with any insulated wire some of the fluoropolymer jacket must be removed before crimping on the connector. A minimal amount of fluoropolymer jacket should be removed to make the connection, leaving the remainder of the jacket intact to protect the wire from corrosion.

- Simple wire splices for 18 AWG copper clad steel wire can be used and environmentally protected with a self-healing water proof tape.
- All splices below grade must be environmentally sealed against the elements.
- Splices above grade such as inside an enclosure should have the ends sealed with tape.
- At each end of the conduit, the wire should be ripped from the conduit to a length long enough for splicing or grounding.
- Using pliers and tubing cutter, ripping the wire from the conduit is simple and easy.
- Do not ground the 18 AWG copper clad steel wire within the system. Grounding of the tone wire should only be done for toning.

Note: Installations where the conduit is used as a riser to the strand and the wire is exposed may be subject to local authority.

Field Trial

Location	Catawba, NC (CommScope Test Site)
Date	February 15, 2002
Product	Two inch Schedule 40, Terra cotta with insulated 18 AWG copper clad steel
Length	2,200 feet
Equipment	DitchWitch® 950R/T 3M-753 Dynatel®

This trial was conducted to measure the performance abilities of the toneable conduit. The conduit was installed into an open trench at depths of one to three feet.

In the first test, a DitchWitch 950R/T was set at its lowest power settings (1 KHz at 0.033 watts) with only the transmitter end grounded. The 2,200 feet of conduit was easily located and the depth measured was accurate within three inches.



For toning, CommScope recommends equipment such as the DitchWitch 950R/T (shown above).

In the first test, a DitchWitch 950R/T was set at its lowest power settings (1 KHz at 0.033 watts) with only the transmitter end grounded. The 2,200 feet of conduit was easily located and the depth measured was accurate within three inches.

In the second test, approximately 2,000 feet of tone wire was attached to one end of the conduit above ground. Again, the DitchWitch 950R/T with the same settings (1 KHz at 0.033 watts) located and toned the 4,200 feet length.



ConQuest Toneable Conduit undergoes rigorous field testing to ensure the same quality as our other products.

The same results were achieved with the 3M® Dynatel unit.

There are ten power settings on each frequency on the DitchWitch 950R/T, 1 being the lowest at 0.033 watts and 10 being the highest at 3.0 watts. It is possible that a tone would be obtainable over 5 miles using higher levels.

Summary

Constructing networks that require provisioning for toneable locating can now be achieved using CommScope's Toneable Conduit. The conduit is designed to the same high standards used in all of CommScope's ConQuest conduit family. The unique design of the toneable conduit makes it easy to install and easy to locate.