

DPS Preliminary Review:  
Verizon FIOS Customer Premises Installation NEC Compliance  
Issues

OVERVIEW

A key aspect of providing telecommunications services is the provision of those services in a safe and reliable manner. In the last several months there has been concern regarding Verizon's FiOS outside plant installations. Outside plant concerns have been expressed by competitors, municipal governments, among others. To evaluate those concerns Department of Public Service (DPS) field staff conducted several independent investigations. DPS technical staff recently undertook an inspection of a modest sample of Verizon FiOS customer premises installations with regard to appropriate construction practice and compliance with the National Electrical Code. Code compliance is essential to providing safe and reliable service to customer premises.

After review of the applicable codes and field staff findings, DPS Staff feel additional discussion with Verizon New York is required to ensure FiOS-related installations are indeed safe.

IMPORTANCE OF GROUNDING AND BONDING

Historically, the safety of installations involving connections to electrical appliances within premises is of great concern. The risks of fire or electrocution on a customer premise are well known and compliance with the National Electrical Code (NEC) has been a long accepted, often mandated, requirement throughout most of the last century. In the case of telecommunications circuits the risks are unique, equipment failures or lightning strikes can pose a life threatening risk or fire risk unless protective measures are taken. To that end specific portions of the NEC have been created that are appropriate for the various types of telecommunications facilities and other installations.

The recent New York State Public Service Commission (NYPSC) directive regarding protection of the public from stray voltage conditions on telephone and telecommunications services reinforces the need for companies to make their facilities and service comply with the NEC. The NYPSC has expressed its concern that this

plant be NEC and NESC compliant to protect the public from "stray voltage" and the potential of electrocution. In addition, the compliance of premises wiring with NEC is also referenced within the NY State and local building and fire code requirements as well. It is thus certain that NEC applies to any telecommunications carrier or cable television company in this State which provides a physical service interconnection to a customer premises.

VERIZION FiOS: Conductivity and Network Interface Unit

Verizon's FiOS product is technically a form of fiber to the premises or "FTTP"). We tentatively conclude that FiOS may form an electrically conductive path both to the "outside world" as well as other electrically powered devices inside the building. The use of an electrically powered "network interface unit" at the terminal end of the fiber is also subject to electrical damage or failure. That device is powered by the AC power line from the building and typically has a safety ground terminal installed for the purpose of attaching the safety ground. Such network interface equipment is directly connected to a host of equipment in the building, including signal carrying conductors such as twisted pair copper, LAN computer cables and CATV type coaxial cables to appliances, computers and TV sets throughout the customer premise. It is important to note that should any of these devices fail they are capable of creating an electrical hazard condition not unlike a conventional CATV coaxial cable installation. It is reasonable to assume that any FTTP installation lacking a service entrance or "network interface unit" ground is a potential safety risk to the premises and its occupants.

ELECTRICAL CODE REQUIREMENTS

The NEC's articles and associated requirements take into consideration the different physical characteristics of electrical facilities. Two key sections that appear most applicable to FiOS are Article 800 for Communications Circuits and Article 820 CATV systems. Article 820 specifically addresses cable television networks because of their unique application of coaxial cables which incorporate an outer conductive shield. Article 800 was devised to address the unique physical characteristics of communications circuits and contains specific requirements for their safe and reliable

installation and maintenance. Both contain well established practices regarding grounding and bonding.

Article 770 pertains to Optical Fiber Cables and may provide some guidance for certain kinds of conductive and nonconductor optical fiber cables. Article 770 of the code specifically deals with Optical Fiber Cables but does not deal with the other aspects of premises equipment, notably an AC powered "network interface unit" germane to Verizon's FiOS.<sup>1</sup>

Article 830, for Network-Powered Broadband Communication Systems, is similar to Article 820 and considers the employment of unique powering arrangement. However, since FiOS, as we currently understand its physical implementation, is not "network powered" as defined in that section, but rather powered from the premises AC power wiring, it does not clearly fall within its criteria. An Article 830 type service does however use a "network interface unit" similar to if not identical in form and function to premises hardware used in FiOS installations. Article 830 also requires an incoming service entrance or "network interface unit" grounded and bonded.

Although there are some technical differences as to how these different services are technically provisioned, the code consistently imposes similar requirements regarding grounding and bonding of service entrances and installation of protective devices, as well as requirements for workmanship, routing of cables, and proximity to energized power conductors. Regardless of the type of services offered, the physical characteristics of the facilities require compliance with applicable NEC requirements.

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<sup>1</sup> It is important to note that Article 770 does place restrictions on use and location of "conducting" type fiber optic cables (and we conclude this also applies to fiber optic cables with conductive metallic messengers). Absent any strict requirements for the use of purely nonconductor optical fiber cables in all of the FiOS type distribution plant, it is reasonable to assume a conductive type fiber optic cable could be used to provide service in some cases. This potentially "conductive" fiber optic cable would provide an electrical path from the outside plant into the customer premise and incident with it, a potential lightning or electrical fault shocking potential.

Along with NEC Articles 770, 800, 820, and 830 there are also other portions of the code that are referenced within and which would also apply. One of the key requirements referenced is Article 250 which pertains to acceptable electrical grounds, bonding methods, as well as prohibited practices.

FIELD INSPECTION OF FiOS INSTALLATIONS

Review of the DPS field staff report data collected at several locations this past spring included some Verizon FiOS customer installations. That data reveals a number of issues. A high proportion of the customer installations inspected were not compliant with the National Electrical Code as defined above, particularly its requirements for bonding and grounding.<sup>2</sup> Examples of the installation practices that were identified as problematic included but were not limited to; trying to electrically ground FiOS equipment to a premise's heating fuel vent pipe, ground wire connected to a plastic pipe elbow, and several that had no ground present at all. We tentatively conclude these conditions are unacceptable under the code and to constitute a potential safety hazard. While these inspections constitute a modest sample of relatively recent installations of a new service offering, the high degree of non-compliance raises a concern that should be addressed in the early stages of the FiOS/FTTP deployment.<sup>3</sup>

The fact that a relatively high percentage appears noncompliant with electrical safety code requirements indicates there may be some general issues related to Verizon's staff and/or contractor training and company oversight of installation quality. While an occasional problem might be encountered regarding NEC code compliance in any review, it is not normal to encounter a significant rate of problems in a sample of installations. The cause of such problems might be improper employee training, contractor performance problems, or the lack of an effective installation quality oversight

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<sup>2</sup> While a hard count is not possible due to the manner in which the customer drop data was collected, individual inspectors consistently relate that roughly one-half of the customer installations they were able to fully inspect failed to comply with the NEC.

<sup>3</sup> The "non-compliant" FiOS installations were recently transmitted to Verizon for follow-up (August 16, 2006 e-mail from Ruvain Kudan to Julie LaCava).

program. Given the gravity of the potential safety problems involving noncompliance with NEC code requirements and the rapid roll out of Verizon FiOS premises installations more generally, there is a need to bring this issue to Verizon's attention immediately. It also seems wise to use this discussion to consider other questions raised by the DPS field review regarding abandoned "twisted pair" and existing cable connections where FiOS has been installed.

NEXT STEPS

A meeting between Verizon technical staff responsible for FiOS field installation supervision and DPS OT technical staff should be conducted to outline the nature of the perceived problem and the essential nature of full NEC compliance. At this meeting, Verizon should address the concerns raised and provide answers to the following questions:

- A.) What are Verizon's standard installation practices regarding FiOS and compliance with the current (2005) National Electrical Code grounding and bonding safety requirements in Article 820 and other applicable sections of the code?
- B.) Should unused twisted pair copper installations which are not compliant with current NEC codes be removed or brought into full compliance with the current (2005) NEC requirements?
- C.) Are FiOS installers removing or causing improper ground connections to competitor (CATV installed) safety grounds with consequent safety consequences for the premises occupants and CATV staff?

SUMMARY

It is critical that customers be afforded the degree of protection that proper NEC code compliance can afford. While few things can ensure absolute safety under all conditions, FiOS installations that are NEC code compliant provide an important measure of protection for customers as well as improve the reliability of service. After a review of the NEC code, staff has tentatively concluded that Articles 250, 770, 800, 820,

and 830 of the NEC code are most relevant. Staff having reviewed a sample of FiOS customer installations has found a surprisingly high degree of non-compliance with the standards we believe applicable.

The next step is to invite Verizon to meet with us to gain the perspective of its views of the Staff analysis and to address the specific questions outline above.