WHEN "BUILDING STEEL" GROUNDS ARE NOT ENOUGH

By Dave Rizzo

Are you a gambler? So much so that you'd be willing to bet the company's capital assets and reputation, customer data, or maybe even your career against the odds that a lightning strike could instantaneously wipe it all out?

Few engineers would consciously take such a chance. Yet, by relying on inadequate grounding, many facility managers and contractors unknowingly roll the dice in hopes that a marginally passable ground system will hold up. Good luck!

Instead, many engineers choose to take risk out of the equation by turning to custom-designed external grounding systems that guarantee, through testing, the establishment of a secure connection to ground that ensures protection from lightning strikes — keeping data centers and transmit and receive sites operating flawlessly.

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"We just installed a custom-designed grounding system at our data center in Las Vegas that tested out at 0.9 ohms," says Mike Rossmiller, a network engineer for NextWave Wireless' Network Solutions Group (NSG). "With this system installed, I have no worries whatsoever. Solid grounding can actually improve the performance of a communications system."

TAKING NO CHANCES

The false reliance on utility-grounding, building steel, Ufer grounds (such as rebar) can prove fatal to expensive equipment. Without a proper low-resistance ground, standard protection devices such as transient voltage-surge units lightning protection and other electrical protection devices can be rendered ineffective.

While heavy-duty mechanical equipment might survive a lightning strike with a 25 ohm ground — more than sufficient to protect humans — the increasing sensitivity and high-performance of today's computers, telecom and imaging equipment now drives the need for grounding well below five ohms. In fact, some communication equipment manufacturers such as Ericsson, Lucent, Motorola and Nortel may even void their equipment warranties at sites where the ground system performance does not meet explicit requirements — typically five ohms or less.

"Establishing a proper ground is important to make sure we don't lose mission critical equipment in the event of electrical anomalies," says NSG's Rossmiller. "With the construction of our new data center in the Las Vegas valley, we couldn't afford to risk having a summer lightning storm interrupt our service."

With locations throughout the world, NSG — a division of NextWave Wireless — offers service providers a broad range of wireless network design and implementation services. These include LAN/WAN network design, network implementation and optimization services, and complete back-office system solutions. The NSG has extensive experience developing advanced IP core networks and back-office systems designed specifically to enable the delivery of mobile broadband network services.

However, completion of the company's data center in Las Vegas hit a snag in early June 2007, when the project manager noted the lack of proper grounding.

"Because of the challenging soil conditions in this part of Nevada, trying to get a good ground is not always possible," continues Rossmiller. "We originally had put in standard copper rods, but still couldn't get a good test off the 'building steel', so the decision was made to contact Lyncole. Most of the major telecom companies go to them for their grounding needs. Our Senior Vice President of Engineering and Operations, Alan Cameron, had good results with them before, so he made the decision to call them."

For more than 20 years Lyncole Industries of Torrance, California, has focused specifically on grounding: from mobile communications equipment for

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the military to cell-site towers, computer clean rooms and more. Lyncole offers a wide array of technical and engineering services ranging from grounding system design, site surveys, ground testing and ground potential rise (GPR) studies. The company's patented active, Lyncole XIT Grounding System has been installed throughout the world with repeated success.

Since the Network Solutions Group facility was already under construction, engineers at Lyncole worked with the existing building contractor to fast-track the project.

Thorough grounding design begins with soil-resistivity measurements. This process requires measurements in three different directions, at 4-5 probe-spacings, as variations in soil resistivity can range from 200 ohm-cm in clay to 400,000 ohm-cm or higher in limestone.

The gathered data then gets fed into a sophisticated computer program that models the ideal grounding system and makes recommendations for the quantity, type, length, shape and placement of the rods.

"After the Lyncole engineer went back to his home office in Torrance, we got the final report the very next day," recalls Rossmiller. "It included their recommendations along with a list of materials. Once my finance team cut the POs (purchase orders) we got the new grounding system on site within three days.

Lyncole's XIT Grounding System starts as a 2" diameter copper pipe. The pipe is filled with a mixture of natural earth salts, Calsolyte. Breather holes get drilled near the top of the tube to provide access to air and moisture, a procedure that yields a highly conductive electrolytic solution that weeps out from additional holes near the bottom of the rod.

Typical installation involves trenching for the grounding conductors and, in this case, coring two 10-foot holes for installation of the XIT Grounding Systems. The ground electrodes were installed in 6-8 inch diameter holes and backfilled with Lynconite II — a material that remains moist, provides an electrical bond from the electrode to the surrounding earth and lowers ground resistance all while protecting the electrode from corrosion. The high conductivity of the Lynconite II, in conjunction of the weeping of the electrolytic solution ensures seasonable stability.

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The Network Solutions Group ground design required two 10-foot vertical XIT Grounding Systems connected via buried grounding conductor to meet their performance objective.

"I made arrangements with our electrical sub-contractor to do the actual work, but Lyncole sent up one of their people to help supervise," notes Rossmiller. "We started at 8 a.m. and by 1 p.m. the rods were in the ground and the cables were covered up with dirt."

Each step of any grounding project must be inspected for specification compliance. After installation, the verification process commences in order to ensure that the system achieves the desired performance level.

The most reliable post-installation test procedure involves the fall-of-potential (three point) method that utilizes a digital ground resistance meter and two auxiliary electrodes. An alternative, faster method enlists use of a clamp-on meter that takes advantage of the connection between the external ground and the utility neutral.

"The target was as close to three ohms as we could get; ideally, one ohm," says Rossmiller. "After taking the final readings, we definitely came in under one ohm — 0.9 to be precise."

EXTERNAL GROUNDS, TAKING THE GAMBLE OUT OF THE FUTURE

Properly designed and installed, an external ground system will provide high-quality performance from the start and eliminate the need for future rework or enhancement. In the case of Lyncole, each system is designed with an expected life of more than 50 years and is warranted to be maintenance-free for 30 years.

"Once I get everything up and operating at my data center, I won't have to worry about that portion of the system," concludes Rossmiller.

Dave Rizzo is a technical writer based in Fullerton, California.