



High Voltage Underground Cable Ideal for Substation Expansions with Space Constraints

Turnkey approach ensures a successful project

Substation expansions can become extremely complicated when space is limited. That's when use of high voltage underground cable comes into its own as a viable option. What makes the option even more favorable is a turnkey approach, in which the high voltage underground cable manufacturer installs the cable and terminations, then tests the cable installation and delivers complete project documentation.

At a recent substation expansion project near Buffalo, NY, where expansion of a substation yard and extension of an overhead 115 kV bus was impracticable, and relocating facilities within the substation was expensive and time-consuming, Seymour, CT-based Kerite provided turnkey underground cable installation services that allowed new capacitor banks to be installed and energized in a short amount of time with no disruption to other circuits in the substation.

Buffalo area project full of complex challenges

New York State Electric and Gas Corporation (NYSEG), a subsidiary of Iberdrola USA, needed to add capacitor banks to improve the electrical system to handle load growth in the Buffalo, NY area. The utility, which serves 877,000 electricity customers and 261,000 natural gas customers across more than 40 percent of upstate New York, chose to install two new 115 kV, 25 MVAR switched capacitor banks at Big Tree Substation, an older facility constructed in the 1940s. The substation feeds the Ralph Wilson Stadium, home of the Buffalo Bills, and new capacitor banks were important for ensuring overall system improvements and supporting system voltage in the area.

Consulting engineers Laramore, Douglass and Popham were brought in to design the project. The company provides engineering for investor-owned and cooperative utilities, and works on everything from wind farms to industrial clients. Senior substation engineer Stan Bail explains that, while the Big Tree Substation seemed large, it was actually impossible to add both banks above ground as is commonly done with substation expansions. There was a wide-open space on the south side, but the north side was very close to a fence, with a house and a residential area just outside the fence.

Novel solution to go underground

There was only one way to go. “We came to the conclusion that the banks had to be underground because transmission lines were in the way,” said Bail. “We couldn’t place the capacitor banks off the existing bus, because it was 35 feet in the air. And there was no room to place the capacitor banks under the existing structure.” According to Bail, they had room within the substation fence if they could have gotten the overhead wire bus extended to the area where the capacitor banks would fit. The issue was that NYSEG needed two capacitor banks and two breakers.

Since the bus was split, with one on the north end and one on the south end of the substation, the best solution would be taking the two locations from overhead to underground. They then ran the underground cable, coming up at one central location, terminating the underground cable and connecting to two different circuit breakers



and two different capacitor banks. The solution was an uncommon one for a substation: underground cable transmission lines are more frequently used when an airport is nearby and it is important to keep circuits from interfering with airport operations.

After deciding on the engineering approach, Bail began looking for a company that could supply the cable, terminations, and testing components. He consulted with the client about their existing relationships with suppliers of high voltage underground cable, and then began discussions with Kerite, given their reputation for high-quality high voltage underground cable and a great deal of recent installation experience. After talking with Ed Sleight, Northeast Sales VP for Kerite, Bail decided that Kerite was a good fit. “I explained the substation project and found it was a perfect match – we needed high voltage underground cable and they had services to provide.”

Turnkey approach selected for cable runs

The design included a conduit system to facilitate cable pulling from the bus area to the capacitor bank, including a conduit plan showing how and where to place the 6-inch PVC conduit, with one conduit per cable per phase. After the conduit system was installed, Kerite brought the cable to the site for electrical subcontractor Northline Utilities to do the cable pulls. Instead of working

with one large 1300 foot reel, which makes the cable pull a little cumbersome, Kerite cut each run individually to length on smaller reels, which are easier to store and make pulling the individual runs much faster and simpler. This allowed the subcontractor the flexibility of pulling one phase and leaving it if necessary, then returning the next morning to pull the next phase.

The north end connection cable was about 275 feet, while the south bus connection underground cable link was approximately 150 feet. Each end of the connections requires three terminations (one for each phase), so there were a total of 12 terminations at the substation. The terminations for the end of the Kerite cable are 6.5 feet tall, and each termination takes approximately eight hours to complete.

Because of the complexity of the project, Bail was especially attracted by the turnkey installation offered by Kerite Cable Services (KCS), including supplying the cable, doing the terminations, and conducting the testing. The testing included both high voltage DC high potential testing at the factory to ensure that there were no defects, and additional lower voltage testing in the field.

According to Bail, the project went so smoothly that they have now written into their standard specifications for similar projects that the electrical contractors are required to hire Kerite for cable and terminations.

“There was a great deal of cooperation between Kerite and Northline Utilities onsite,” said Bail. “When you are terminating cables it is extremely important to avoid any wet conditions. Each one of the terminations took hours of sanding and dressing the cable after it was pulled, and Kerite needed a shelter to keep the wind, mist, and rain off while doing the terminations. Northline built a shelter to keep them dry so they could keep working through whatever conditions the weather threw out there.”



He adds that he plans to use Kerite for another capacitor bank in the Rochester, NY area, where underground cable is needed because there is no space to expand the substation. “When you are limited by space, underground high voltage cable is a viable option when compared to other more expensive substation expansion alternatives.”