BREAKING DOWN INDUSTRY JARGON, PART IV

In this issue we continue our description of how the system works. In the last issue we talked about the submarine cable(s) and how they are terminated in sectionalizing cabinets. From these sectionalizing cabinets the cables travel under Green Bay Road to a fuse cabinet and then underground through a series of additional sectionalizing cabinets all the way to the substation.

The Fuse Cabinet

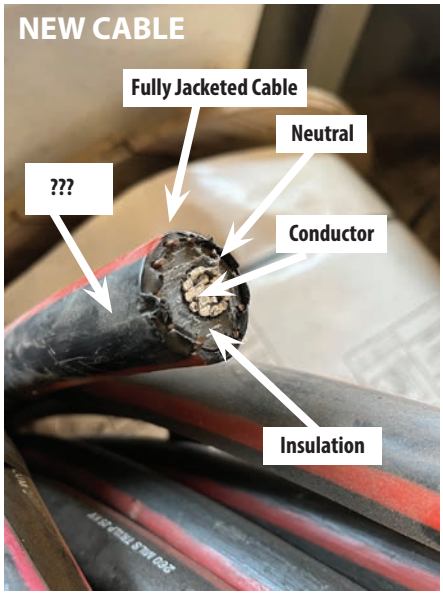
The fuse cabinet is a termination point where each phase runs through a 200-amp fuse (remember, our voltage here is still 14,400 volts phase to ground and 24,900 volts phase to phase). These fuses protect the submarine cables and WPS from a large fault between the cabinet and the substation. In addition, on each phase (as well as on each phase in the sectionalizing cabinets) we have a fault indicator. These indicators blink when they see a fault and help us narrow down a problem if one occurs. We also have similar fault indicators hanging from distribution lines around the Island to accomplish the same thing, but more on them when we get to that part of the system.

Underground Cable

The three phases travel approximately 3.5 miles underground, through that series of sectionalizing cabinets to the substation, where they come up and enter the substation equipment. Of note, like everywhere on the Island, the installation of the underground faced varying soil and rock conditions. In fact, where the cable crosses the Green Bay Woods area, a trench had to be blasted for roughly 1,200 feet in order to get the cable deep enough.

When it was first installed, it was direct buried cable with a bare copper neutral wrapped concentrically around the conductor. There were only three sectionalizing cabinets between the shore landing and the substation, making troubleshooting more extensive and difficult. Our rocky and acidic soil took its toll on the cable and the neutrals dissolved away in numerous locations, eventually causing faults. In addition, some of the underground splices that were used to join lengths of cable were problematic. All this led to a whole lot of time on engines while faults were located and repaired, usually with the help of WPS crews.

In 2004 and 2005 the worst section of the cable was replaced. This ran from the shore landing all the way to



the Community Center. Sectionalizing cabinets were placed roughly every 1,000 feet in order to improve troubleshooting and the cable used was very different. Rather than direct buried bare concentric neutral cable, it is fully jacketed neutral cable in conduit, which should protect it well from the elements. There can still be problems with the cable as condensation and water intrusion into the conduit can cause failure over time, but since it was installed, there have been no issues.

In 2016 the balance of the underground feeder from the Community Center to the substation was replaced.

Substation Transformer

Once the cable reaches the cooperative, it is routed to insulated connectors and through a ground-operated three-phase switch. From there it enters the substation transformer where the voltage received from WPS (14,400v/24,900v) is stepped down to our distribution voltage (12,470v/7,200v). The transformer we are currently using was installed in 2016 during the last phase of the underground feeder project. It replaced the transformer that was installed in 1981 (and rebuilt in 1983 just after the warranty ran out). While this transformer was working fine, under certain lower load conditions if there was a loss of a single phase from the mainland, because of its construction, it was actually the source of a backfeed situation, which could be extremely dangerous as well as damaging for equipment on the lost phase. When investigating the problem with WPS, who initially thought it was something on their side of the system, we determined that we were actually at fault and it answered a whole lot of questions over the years for both us and the lineworkers at WPS.

As noted, this transformer was working fine at the time it was replaced and initially we planned to scrap it; however, the scrap value was exceeded by the transportation costs and since the issue only occurred under very specific circumstances (which we have since addressed with new recloser controls at Northport) we decided to keep it as a

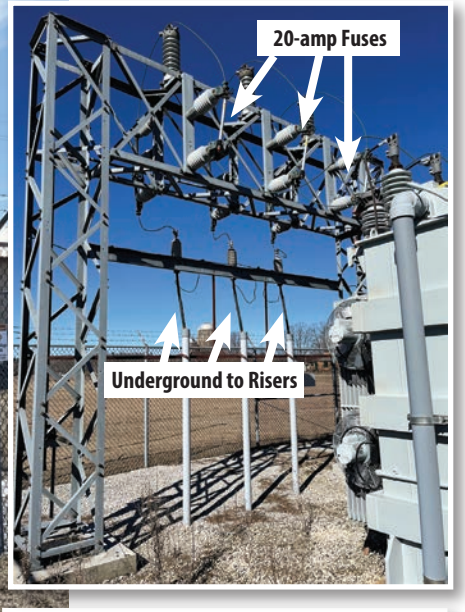
spare. This could someday turn out to be a very valuable decision since the lead times for substation transformers are literally out years.

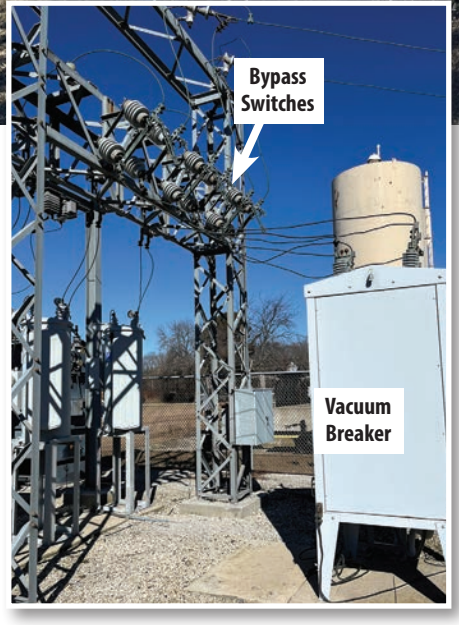
Regulators and Breakers

From this transformer, the stepped-down distribution power goes through three voltage regulators and a vacuum breaker before it enters the system.

The voltage regulators do exactly what their name suggests—based on varying loads and supply voltage, they help keep the distribution voltage steady as those issues can cause a fluctuation. The vacuum breaker is exactly what it sounds like—it's a safety device that not only protects the transformer but disconnects us when we are on engines. The ground-operated three-phase switch serves this function as well, but is manually operated. The vacuum breaker not only functions like the breakers in your house (with the contacts operating in a vacuum, hence the name), but it is also controlled by the engine room switch gear. The switch gear also monitors the system through the use of power transformers, which you can see in the photos. All of this equipment can be bypassed using switches shown as well.

Next month we will discuss the engine room, local generation, and the generator substation.





FIBER AND LINE MAINTENANCE UPDATE

WORK TO CONTINUE ON UNDERGROUND INSTALLATIONS

Quantum has returned from a four-week hiatus and Michels will have returned from a two-week one as well by the time you read this. At the time of this writing all distribution and feeder fiber as well as 90% of the drops along Detroit Harbor and Range Line Road in the lower section of area 1b are complete, and Quantum will have their work cut out for them splicing splitter cabinet, cases, NIDs and in home work.

Karcz will be off working elsewhere and when they return, we hope that ground conditions are conducive to installing conduit at those members who want service but are underground. We had to hold off on some of that work as frost and muddy conditions mean cleanup is not the easiest and we want to be as efficient as we can. We still have quite a number of underground installations that will be necessary in areas 1a and 3 as well as the ones we are adding in 1b (see previous editions of these pages on the website for the map).

MICHELS COMPLETES UNDERGROUND WORK ON SOUTH SHORE DRIVE

The Michels underground crew completed our planned work on South Shore Drive and honestly, they worked so quickly that we did not get any photos of the work happening. We will be sure to take some photos of fiber being pulled through the installed conduit and you can see the sectionalizing cabinets that we installed along the road for the primary underground power. Sorry about that! Everyone has a camera in their pocket with these modern phones, but you still have to remember to take it out and take a photo!

We have additional underground work that we intend to do ourselves on Woodland (and this will require the use of the rock saw, so we will definitely take photos of that) and some easy digging out in Jackson Harbor at the town dock (some of it will be easy and some of it we have no idea!).

NEW ONLINE BILLING SYSTEM COMING

By the time you read this, we should be eyeball deep in the implementation of our new online billing system. Once again, we need to remind everyone to be sure that email addresses we have are up to date as well as mailing addresses, and you will have had to re-enter any autopayment information in the new system. No system is without glitches, and we expect that there will be some with this one, but we hope that it is easier and more cost-effective than the previous one.

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