HUBBELL® TiPS & NEWS

Vol. 6 No. 1 JANUARY 2001 http://www.hubbellpowersystems.com

To the Rescue

Fargo Deadends, Chance Anchors and Ohio Brass Insulators

Severe Storms Topple Towers

Tower guy dead end failures during severe winter ice storms in North Dakota in 1997 and 1999 led to tower structure failures on a crucial Minnkota Power Cooperative 345kV transmission line. Investigation showed that the guy wires were slipping through the vise-type deadends.

The Krogen line, extends 211 miles from power plants near Center, ND, just northwest of Bismarck, ND, to a transmission substation north of Fargo, ND. This line serves Minnkota's loads in eastern North Dakota and northwestern Minnesota and is a vital component in North Dakota's transmission grid. It was built in 1970 as a 230kV line and converted to 345kV in 1981. As part of the 230kV to 345kV upgrade, the existing lattice aluminum H-frame structures were strengthened and raised 7 ft. At 230kV, it utilized a single 1272 Bittern conductor. A second Bittern conductor was added in a vertical bundle when it was converted to 345kV operation. Also, in 1981, all guying was changed to $^{3}/_{4}$ inch steel strand.

Storm damage

Speaking of the first failure on this line, Ray Burnstad, transmission engineering manager, said, "The guy wires slipped through the strand vises when we had extreme loads on them. It happened twice, both times during severe ice and high wind conditions. The first time was in 1997 on April 4th, when we had at least two slip-throughs and there might have been more, possibly three or four. And this last one - we had eight slip-throughs on one stretch. That was April 1, 1999."

In the 1997 storm incident, at least two structures were affected. In one case, one mast of a three-legged aluminum structure failed, but with no cascading. In another case, one slip-through caused damage to three or four other structures. However, speaking of the more severe 1999 storm, Burnstad said, "We lost 62 structures due to cascading failure. There was a storm structure where eight of the sixteen guy wires slipped through the strand vises and the line cascaded in both directions to the next in-line deadends, about 4 miles one way and about 5 miles the other for a total of about 9 miles."

Investigation

Some of the failed deadends where guy wires pulled through during the storms were taken apart for investigation. These vise-type units have four sets of jaws with sharp teeth that form a kind of cone. The guy wire is inserted through the center and the jaws hold the wire. The stronger the tension, the harder it holds. Referring to the failed units, Burnstad said, "You could see where the sharp teeth of the jaws were actually worn down. You could see where the strands of the guy wire had pulled through and the teeth were just filed away where the strands went through. We opened up some units that hadn't failed and saw the same thing going on, where the teeth were already starting to wear away from the strands. The teeth weren't biting hard enough to hold the guy wire in place."

Units tested

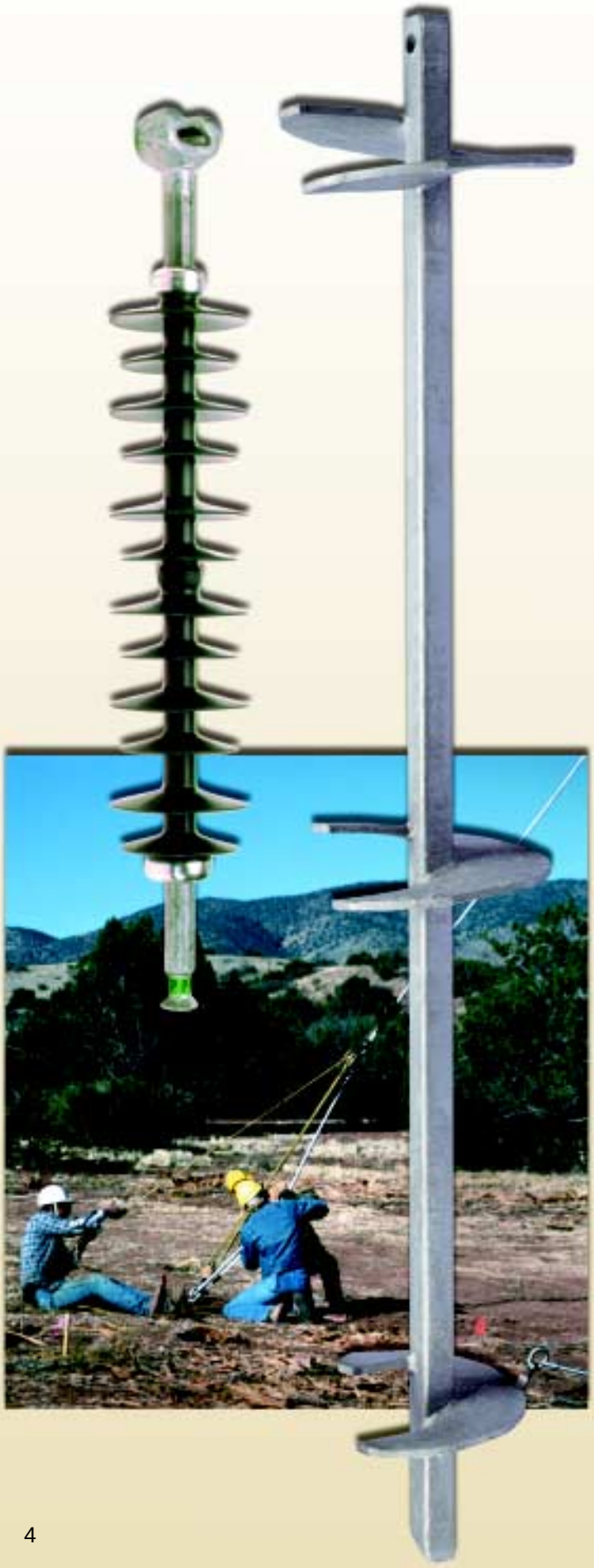
Although Minnkota Power engineers tested new and used deadends in an effort to understand the cause of the failures, the test results were not conclusive. The units were subjected to tension testing under slow pull conditions and in every case it was the guy wire itself that failed. Burnstad conjectured, "The conditions might have to be just right for them to fail. It could be that when you get galloping on the conductors, and in both of these storms there was galloping, you get a lot more severe impact loading that could cause premature failure. An exacerbating factor could have been from water and contaminants getting into the interior of the deadends. It was speculated that water would run down the guys and into the bodies of the deadends. This would encourage rusting and this condition along with freezing water could reduce the holding capacity of the jaws." The guy wire used was $^{3}/_{4}$-inch, 19-strand, extra-high-strength steel rated at 58,000 lb.

Deadends replaced

Minnkota Power decided on total replacement of tower guy deadends on the entire Krogen line, and also decided to replace the same type of failing deadends on a 465-mile DC line that starts at Center, ND, and terminates near Duluth, MN.

The deadend replacement program on the Krogen line started in the fall of 1999 and involved 651 deadends. Each of the ground level deadends was replaced by Fargo TDS-1318 deadends that utilize a 100-ton compression connector. Asked for the reason for choosing the Fargo units, Burnstad said, "It looked like a more positive method of deadending to us. We've always specified compression type connectors on our conductors and have had good luck with them; we felt it was a more positive type of connection. With a compression type connector you're not relying on movement of internal jaws to grip the wire."

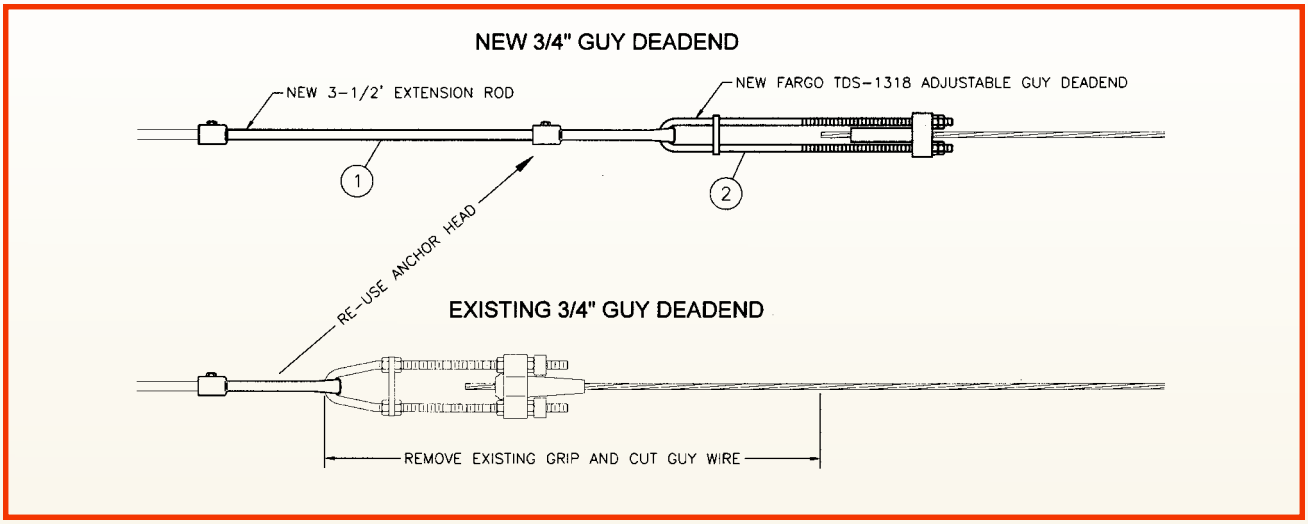
Minnkota Power hired two contractors and utilized one of their own crews as well in the work. The line crossed six counties in North Dakota and two counties apiece were assigned to each crew. Burnstad reported, "We



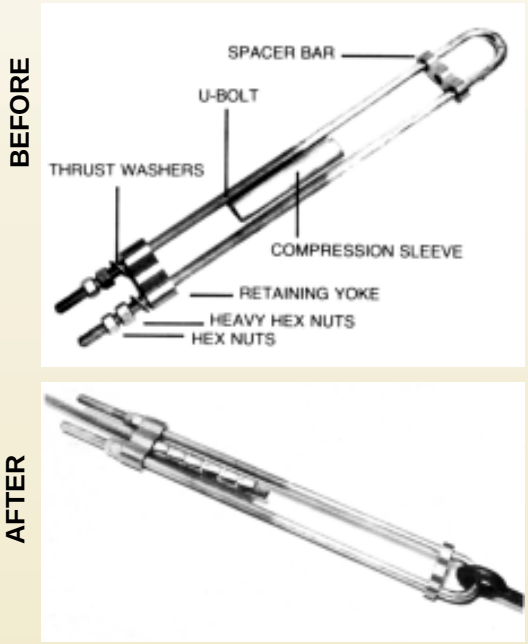
did all replacement in about 6 weeks time in November of 1999. We changed out 651 units out of the 667 that needed to be changed at that time. There was one structure where the down guys were in water. We'll go back and get these when it dries up. This completed the work on the bottom ends of all 211 miles of the line. We have the same type of vise-type deadends holding the top ends, but we couldn't get an outage to do the work. We never had a failure at the top, but on inspection we found some tops that were slipping too and so decided to do the tops as well. This work will be done in 2000." The plan, as described by Burnstad, is to use a factory-formed-type conductor at the top because of the difficulty of getting the compression press to the top of each structure. He said, "In the year 2000 we're going to do the DC line too, but we're going to do the tops and bottoms at the same time. We have about 950 guys to do on the DC line for a total of about 1900 deadends. We will replace these in the same manner as the 345 line, that is, the top will be factory formed and the bottom will be Fargo compression."

In replacing the bottom deadends, the contractors were able to utilize the same ground anchors, which were Chance three-helix, or four-helix (depending on soil conditions) square shaft (SS) screw anchors , with 1-$^1/_2$-inch square rods. As Burnstad explained, once the vise-type deadends clamp onto the guy wire, they cannot be removed except by cutting the guy wire. In this case, crew members cut the guy wire just above the unit, leaving the guy wire short. To compensate, a 3-$^1/_2$ ft. extension was added to each anchor rod and the new Fargo unit installed above that.

When installing a Fargo deadend unit, the retaining yoke is slid onto the strand followed by the compression sleeve so that a length equal to two strand diameters extends beyond the end of the sleeve. The first compression, in this case with a 100-ton press, is made at the end of the sleeve nearest the retaining yoke. Adjacent compressions are then made to the opposite end of the sleeve. A U-bolt is then inserted through the anchor eye and into the yoke/sleeve assembly. Nuts are installed on the threaded U-bolt and tightened to achieve the required guy wire tension.



Contractor specification and drawing for removing and replacing $^{3}/_{4}$-inch guy wire tower deadends on the Minnkota Power Cooperative 345kV line.



Parts of a Fargo tower guy deadend shown before and after compression.

Insulators replaced

The original insulators on the Krogen line were all porcelain that broke upon impact with the ground when the line failed. The original aluminum lattice structures were replaced with wood structures, and Ohio Brass (OB) polymer insulators were used. Burnstad explained, "In 1999, we had two storms. One caused the cascading failure. Then, unfortunately, we had another 8 miles go down, not through guy failures, but it was just a very severe storm again with cascading, and so these failed structures were all replaced with the wood/OB polymer insulator combination. Our storm related rebuilds were accelerated projects and wood was selected because it was more readily available. Now we have roughly 30 miles of wood construction, all with OB polymer insulators." The tangent structures have 30,000 lb. OB units; deadend insulators are 50,000 lb. OB units.

The lines have survived the 1999-2000 winter storms without further incident and there are plans to do further replacement of the guy wire deadends in the fall of 2000 in the hope of beating the bad weather. With this judicious replacement program, the line should last well into the 21st century without any guy failures. ■

Electrical Maintenance & Testing

At Fermi National Accelerator Laboratory

By:
Bart Curtin,
General Manager,
High Voltage Electric
Testing & Maintenance, Inc.
St. Charles, IL

All clients have different needs. Our client, the Fermi National Accelerator Laboratory in Batavia, Illinois has some very particular needs. Because it is the site of the highest energy particle accelerator in the world, a power failure is not acceptable.

Scientists from all over the world conduct experiments using Fermi's atom smasher. Many of these experiments are lengthy and costly. Therefore, it is imperative that the more than 100 miles of high voltage cable and approximately 200 substations distributing 13.8kV of energy be in perfect condition.

Fermi's main substation is fed by a 345,000 volt power line. Because this line doesn't have a regulator, the power company either has to load up or slow down the generator to control the voltage. Consequently, we were concerned about the surge arresters on this line because of the possibility of an overcurrent. You really have to have superior product in this situation.

We called Ohio Brass. We were assured Ohio Brass® Polymer PVN Station Class arresters could withstand an overcurrent of 100 amps for 2,000 hours before there would be any reason to be concerned. On the basis of that recommendation, we used the Ohio Brass surge arresters on each phase.

When we have a cable fault in this kind of operation, it is essential to be able to find the fault quickly. We use the Hipotronics® First Response™ URD Cable Fault Locator (radar) system. This equipment has helped tremendously in locating cable faults, particularly at a distance. The First Response™ locator puts us close to the faults, saves days of time and millions of dollars in labor. Because of the mobility of the unit, we can get into sites efficiently. The radar provides us with the location of the fault.

Much of the cable for the Fermi Accelerator Laboratory is buried under buildings and water, i.e., 'cooling ponds.' Some of the cable is buried in sand as deep as 15 feet below the surface. Many of the faults located are within direct bury cables in the sand. Since failing cable turns the sand to glass that insulates the thumping process, we use the Hipotronics HDAD Dual Acoustic Detector to detect faults. This sensitive equipment allows us to hear minute sounds and thereby find the faults even in this complicated situation.

The use of superior equipment provided by Hubbell Power Systems allows us to provide the best possible service to our client, Fermi National Accelerator laboratory — an important asset to the world's scientists. ■

For more information, contact your Hubbell Power Systems representative, fax 573-682-8714 or e-mail hpscontact@hpshubbell.com.

www.hubbellpowersystems.com

HUBBELL CAPACITOR RACKS

Five models for one to 12 capacitors! All shipped fully assembled to go up fast!

Strictly for mounting capacitors, these conservatively rated aluminum racks give you all the variations most distribution systems require. Five sizes in a single-pole style, accommodate one to twelve 200-kvar capacitors. Even the largest comes fully assembled to save installation time and money.

LIGHT IN WEIGHT FOR EASE, LONG ON STRENGTH FOR DUTY

All Hubbell aluminum capacitor rack sizes are designed for mounting only capacitors with a 15⅝" lug spacing and weighing up to 70 pounds each. The racks are notably light in weight compared to their strength ratings.

Model	Weight	Rated Capacity	
CCR-1	4.5 lb.	for 1 capacitor	70 lb.
CCR-3	17 lb.	up to 3 capacitors	210 lb.
CCR-3/4	18 lb.	up to 4 capacitors	280 lb.
CCR-6	22.5 lb.	up to 6 capacitors	420 lb.
CCR-9/12	85 lb.	up to 12 capacitors	840 lb.

GROUNDING PROVISION AND INSTALLATION EASE

Each capacitor rack is furnished complete with a ground wire clamp secured by a ⅜" bolt. The single-unit rack mounts the capacitor 6" from the pole; the largest rack mounts the capacitors 9½" from the pole; and each of the other three racks mounts capacitors 3¼" from the pole.

Mounting bolts are not included. The single-unit rack requires a ⅝" through bolt and a lag bolt; the largest rack requires two ¾" through bolts; and each of other three racks requires two ⅝" through bolts. All come with illustrated mounting instructions.

ADJUSTABILITY OF MULTI-UNIT MODELS

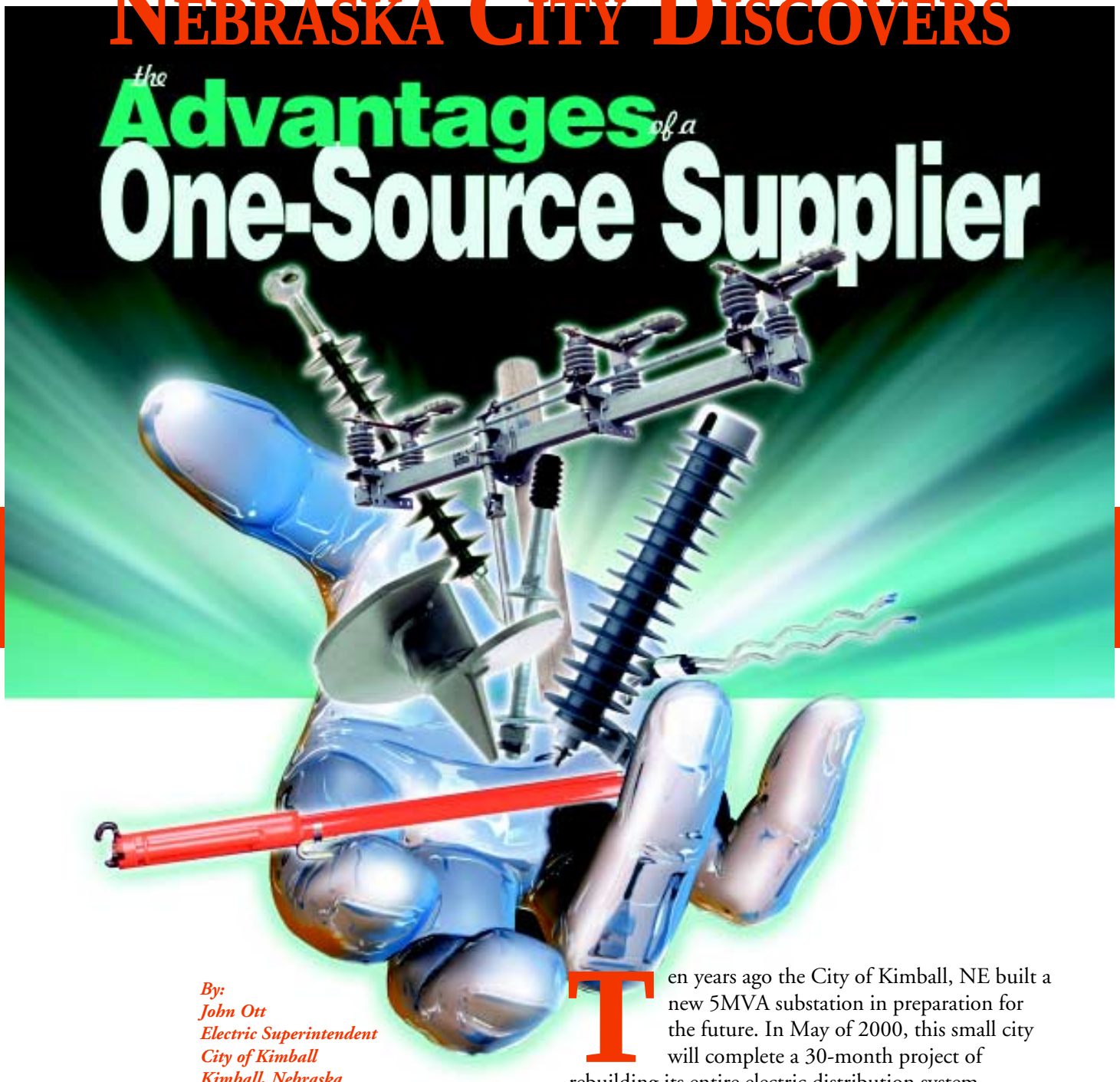
Every unit comes with two pre-spaced ⅜" hold-down bolts (each with a flat washer, a lockwasher and a nut) per capacitor, up to the rack's maximum.

These hold-down bolt heads are trapped in the T-slot channel to ensure proper spacing for mounting. Whether mounting the maximum or fewer capacitors, they must be evenly spaced in the rack for proper load distribution. ■

For more information, contact your Hubbell Power Systems representative, fax 573-682-8714 or e-mail hpscontact@hpshubbell.com.

www.hubbellpowersystems.com

NEBRASKA CITY DISCOVERS the Advantages of a One-Source Supplier



By:
John Ott
Electric Superintendent
City of Kimball
Kimball, Nebraska

Ten years ago the City of Kimball, NE built a new 5MVA substation in preparation for the future. In May of 2000, this small city will complete a 30-month project of rebuilding its entire electric distribution system.

The city of 2,500 residents upgraded 27 miles of in-town distribution lines from 4kV to 15kV by working with the products of primarily one supplier — Hubbell Power Systems.

The $2.7 million project included products such as Chance anchors and cutouts to Ohio Brass arresters and insulators along with Automation-Ready (AR) distribution switches. AR switches have several advantages: reduced installation time; positive open-close

action; and 900-amp continuous/interrupt rating. These features mean improved efficiency and safety. Because we have a small system, we did not previously have an opportunity to use these switches. We have discovered that they are particularly effective during outages.

Hamlin Electric of Fort Morgan, CO, the contractor on the project, used Hubbell Power System products because of their reliability. Besides receiving excellent customer service, we have been pleased with the fact that when we needed a part, the distributor had it in stock. Another advantage to working with a one-source supplier, such as Hubbell, is that all the products are uniform and work well together. The use of one supplier means you don't end up with a "hodgepodge" of different products.

Hamlin Electric also used Chance "Hot Arms" (extension arms) throughout the project. These products allow the contractor to work while a system is energized.

The rebuilt system has made a difference in maintenance — essentially no maintenance so far. We expect to pay off our loan in 10 to 15 years due to improved efficiency and less maintenance cost.

Using a one-source supplier such as Hubbell Power Systems has made this project easier, quicker and more cost-effective. ■

For more information, contact your Hubbell Power Systems representative, fax 573-682-8714 or e-mail hpscontact@hpshubbell.com.

SAFER
Retrofit Porcelain with Polymer Units
COST EFFECTIVE

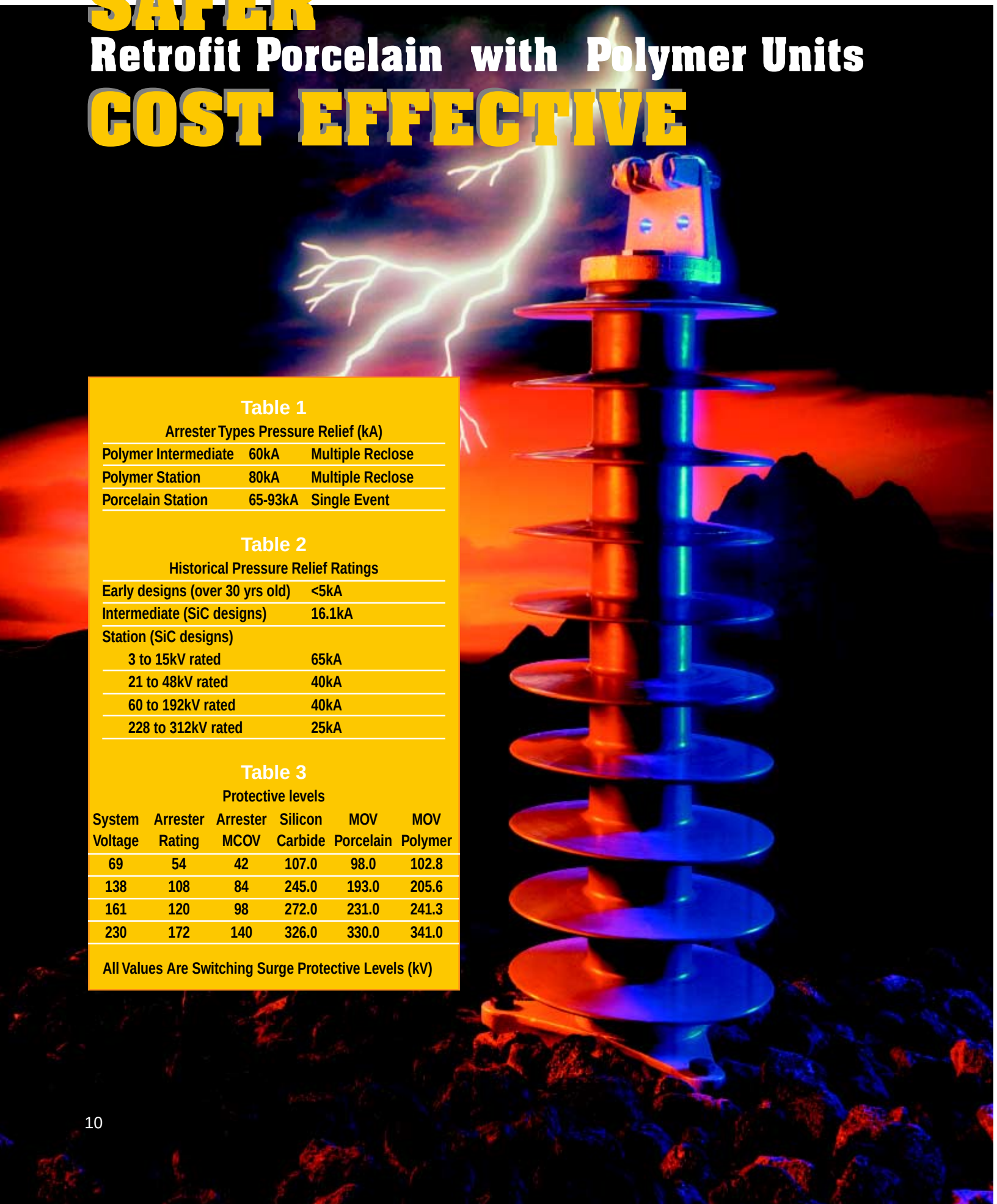


Table 1

Arrester Types Pressure Relief (kA)

Polymer Intermediate	60kA	Multiple Reclose
Polymer Station	80kA	Multiple Reclose
Porcelain Station	65-93kA	Single Event

Table 2

Historical Pressure Relief Ratings

Early designs (over 30 yrs old)	<5kA
Intermediate (SiC designs)	16.1kA
Station (SiC designs)	
3 to 15kV rated	65kA
21 to 48kV rated	40kA
60 to 192kV rated	40kA
228 to 312kV rated	25kA

Table 3

Protective levels

System Voltage	Arrester Rating	Arrester MCOV	Silicon Carbide	MOV Porcelain	MOV Polymer
69	54	42	107.0	98.0	102.8
138	108	84	245.0	193.0	205.6
161	120	98	272.0	231.0	241.3
230	172	140	326.0	330.0	341.0

All Values Are Switching Surge Protective Levels (kV)

In this era of deregulation, utilities are concerned with issues of system reliability and safety for employees and equipment protection and reliability. With the aging of arresters already in use and technological advancement of today's arresters, there is increasing emphasis given to retrofitting existing porcelain housed SiC (Silicon Carbide) station arresters. Some utilities are embarking on major changeout programs.

There are several factors that need to be taken into consideration when pursuing this option. These factors include the fault current rating and protective levels of the arresters as well as the mixing of SiC and MOV arresters on various phases. The ability to evaluate the performance of an existing arrester in the field also needs to be explored. After these factors are given proper consideration, a decision can be made to provide the safest, most efficient and cost effective retrofit option.

The first consideration when comparing existing porcelain arresters to polymer arresters, is how arresters handle the short circuit fault current of the substation in the unlikely event of an arrester failure. Today's arresters have the ability to withstand high levels of fault currents. Table 1 summarizes these levels.

However, the reclose operation which is encountered in a real world scenario must be taken into consideration. When station breakers reclose in the hope that the fault has cleared, the station arrester is subjected to a second fault current. The initial fault current event has already weakened the porcelain housing, which allows for a much greater possibility of a violent failure during the second exposure to the fault current. The porcelain arrester may fail violently. This type of failure can cause damage to equipment and jeopardize the safety of personnel. Due to the ability of a polymer station arrester to vent out the side, the housing is not weakened when exposed to the fault current. Therefore a polymer arrester can be reclosed on multiple times without the fear of a violent failure. This feature allows the polymer arrester to provide a higher level of safety.

Early arrester designs (which were state of the art at that time) did not have the same levels of fault current withstand as today's arresters. This means that a 30-40 year old arrester that is still in service could represent a safety issue if it failed. Table 2 shows the fault current ratings typical of early SiC designs.

A second factor when considering retrofit is that existing porcelain SiC arresters may no longer provide the same level of protection as when originally installed. As an arrester operates, it is likely the gap sparkover of the arrester may increase. At the same time the system insulation levels deteriorate with time. These factors can cause a dramatic reduction in the protection level being provided by the arrester. Replacing the existing SiC arrester with a better protecting MOV arrester can return the protective margins to acceptable levels. Table 3 shows typical protective levels for MOV and SiC arresters.

While it is preferred that all arresters be changed to polymer MOV at the same time, financial concerns sometimes prevent this option. Therefore, when replacing an existing porcelain SiC arrester it is necessary to determine if polymer MOV arresters and porcelain SiC can be safely mixed on the system.

If all arresters on one phase of a three-phase system are retrofitted with MOV polymer arresters, the other two phases may continue to use the existing SiC porcelain arresters. However, it may be prudent to replace the existing SiC arresters on the other two phases for other reasons, such as pressure relief rating, housing integrity and energy concerns.

Mixing arresters on the high and low sides of the same phase presents more concerns. The high side arrester may be replaced while leaving the existing SiC arrester on the low side with no interaction concerns.

An MOV arrester should not be placed on the low side of a transformer while a SiC arrester is protecting the high side. This is due to the concept of a transferred surge. An arrester that appears as lowest impedance will take the bulk of the energy of a surge. It is likely that a switching surge from the high side will transfer to the low side arrester. This results from the relatively high sparkover voltage of the SiC arrester. This results in the low side arrester having more duty than it can handle and thus failing.

. . . continued

The idea of the SiC arrester having a higher sparkover voltage than the discharge voltage of the MOV arrester also applies to the use of station entrance arresters. If such an arrester is in use and it is of the SiC type it will not operate because the transformer mounted MOV will take the surge. Having the SiC arrester at the entrance does no harm unless it fails and then it represents a reliability issue.

When considering a retrofit of a system, it also is important to consider the failure modes of SiC to MOV arresters. SiC arresters are vulnerable to moisture ingress, which leads to failure due to reduction in sparkover. Contamination also can upset voltage distribution resulting in sparkover reduction. Over time, excessive energy input can destroy the ability of blocks and gaps to interrupt follow current leading to failure of SiC arresters.

In MOV arresters, moisture ingress should not occur in a well-sealed polymer unit. Also, excessive energy input is not likely due to the higher energy capacity of MOV arresters. System generated temporary overvoltage may thermally fail the blocks, but in this case the arrester acts to try to limit the voltage.

To determine if a retrofit of an existing system is warranted, you need to diagnose the condition of existing arresters status by field testing. Determining the protective level of an arrester is an ideal way to determine its condition. Unfortunately, an impulse generator is needed. This is not practical in the real world. An effective method to use on SiC arresters is to measure their power loss. This helps determine if moisture ingress is an issue.

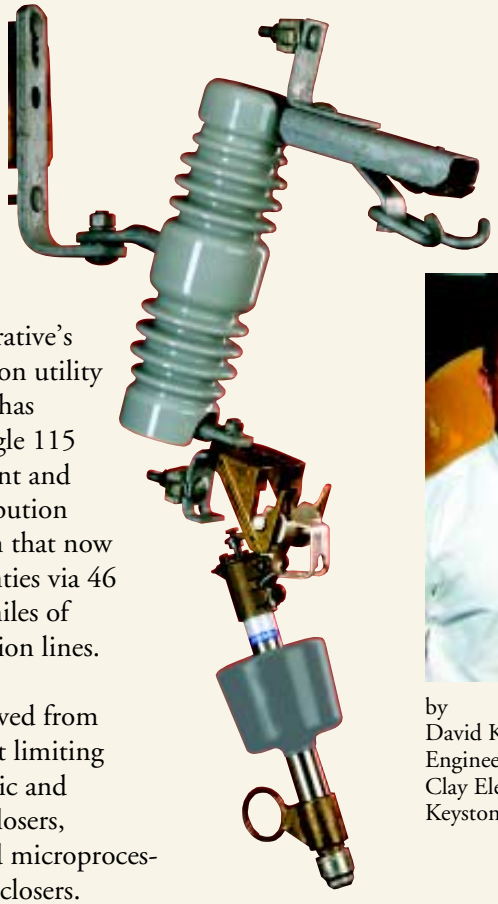
Once the decision is made to embark on a retrofit program, in nearly all cases, polymer arresters represent a safer, cost effective alternative. They provide superior pressure relief over porcelain arresters, which reduces the possibility of a violent failure. MOV polymer arresters provide the most effective protective levels to the system due to lower discharge voltage than aged SiC arresters. Also, the polymer arresters ability to resist damage during installation and provide effective seals to prevent moisture ingress are key factors in considering them the most reliable retrofit options available.

For more information, contact your Hubbell Power Systems representative, fax 573-682-8714 or e-mail hpscontact@hpshubbell.com.

10 YEARS OF ON-LINE EXPERIENCE With CHANCE ELECTRONIC SECTIONALIZERS

Reduce nuisance outages and isolate smaller segments of a faulted circuit

Clay Electric Cooperative's electrical distribution utility system since 1936 has evolved from a single 115 kilowatt power plant and 100 miles of distribution line to a complex distribution system that now stretches into 14 North Florida counties via 46 substations and more than 10,000 miles of overhead and underground distribution lines.



Sectionalizer in open position

photo by Wayne Mattox, Clay Electric Coop

by
David Kirkland,
Engineer
Clay Electric Cooperative
Keystone Heights, FL

Overcurrent protection also has evolved from expulsion fusing to the use of current limiting fuses, single and three-phase hydraulic and electronically-controlled vacuum reclosers, Chance Electronic Sectionalizers and microprocessor-controlled pole and substation reclosers.

Fault finding easier for crews

Clay Electric Cooperative, Inc. started using Chance Electronic Sectionalizers in 1990. Some of our District Operations service restoration personnel had reservations about its ability to discriminate between permanent and transient faults in conjunction with pole or station-

. . . continued

photo by Wayne Mattox, Clay Electric Coop

Overhead lateral tap application of Chance Electronic Sectionalizers eliminates nuisance outages.

photo by Wayne Mattox, Clay Electric Coop

Underground tap application of Chance Electronic Sectionalizers enhances protection coordination and improves utilization of cable ampacity.

mounted reclosers. These seasoned veterans had worked outages where there was no obvious indication of a fault yet a fused cutout had operated. Such a "phantom" or "sneakout" operation of the fused cutout was a nuisance outage that was perplexing to the service person trouble-shooting the circuit.

After replacing many of these fused cutouts with Sectionalizers, our service restoration personnel quickly learned that when they came upon an open Sectionalizer, they knew it was caused by a permanent fault, because the Sectionalizer already had eliminated the nuisance outage.

Additional zones of overcurrent protection

For permanent faults, our goal is to remove only the smallest segment of the circuit that contains the faulted section, thereby minimizing the number of customers experiencing an outage from the fault.

The majority of our distribution system is in rural areas with numerous long single- and multi-phase lateral taps off the main feeder. Typically, fuses or a combination of reclosers and fuses protect these lateral taps, although there are many taps we have wanted to further sectionalize.

Adding an additional recloser in most cases was not feasible due to coordination difficulties and economics. Utilizing a Sectionalizer in place of a recloser or fused cutout at the takeoff creates the option to install fused cutouts to additional downline taps, thereby increasing the reliability zones of overcurrent protection.

Overhead and Underground Applications

Three-count Sectionalizers are utilized on our overhead distribution circuits. Typically, our reclosers are set to lockout after four trips. A three-count Sectionalizer provides isolation of the faulted section before locking out the recloser. Faults on a fused lateral tap downline of the recloser and the three-count Sectionalizer can be cleared prior to lockout or opening of the upline devices.

One-count Sectionalizers are utilized on our underground lateral taps to eliminate multiple shots of fault current that potentially could damage the cable.

www.hubbellpowersystems.com

New for 2001 — Digital Testers

• *Auto-Ranging Voltage Indicator 600V to 69kV*
• *Phasing Testers 16kV & 40kV, go up to 80kV*
• *Kits in handy storage cases*

State-of-the-art electronics now make hot-line testing easier than ever. New-generation Chance hot-line testers for overhead and underground automatically display line voltage. Each unit gives you direct readings for various tests with simple procedures to help speed your maintenance and construction work.

ARVI (Auto-Ranging Voltage Indicator)

A bright red light and audible tone indicate the phase-to-phase voltage class sensed by the ARVI (Cat. No. C403-3374). It automatically begins detecting at 480 Volts and displays one of these voltage classes: 600V, 4kV, 15kV, 25kV, 35kV or 69kV.

With no selector switch to set, this smart tester features automatic hold of the readings, a confirming self-test, a low-battery indication and an energy-saving sleep mode.

ARVI holds voltage display from overhead line for operator below to read.

ARVI holds reading for voltage-indication tests on switch bushing (above) and cable (at right, using a feed-thru device).

ARVI(Auto-Ranging Voltage Indicator)

Digital Phasing Testers

16kV (C403-3369) and 40kV (C403-3370) Phasing Testers present large direct-reading displays with backlight and hold features and an energy-saving sleep mode.

The 16kV Kit (C403-3402) includes two bushing adapters, elbow adapter, shepherd hook, pigtail hook, two universal poles with storage bag, voltmeter tester, and DC hi-pot adapter. The 40kV Kit (C403-3403) includes the same components except the hi-pot adapter.

Phasing Tester lets you quickly identify overhead phases and read voltage for Ø-G and Ø-Ø tests.

Digital Phasing Testers

(Above left) Phase-phase voltage test, (above right) hi-pot test of cable with 16kV Kit's DC Hi-Pot Adapter between meter and bushing adapter (feed-thru device not included) and (at left) phase-to-ground test.

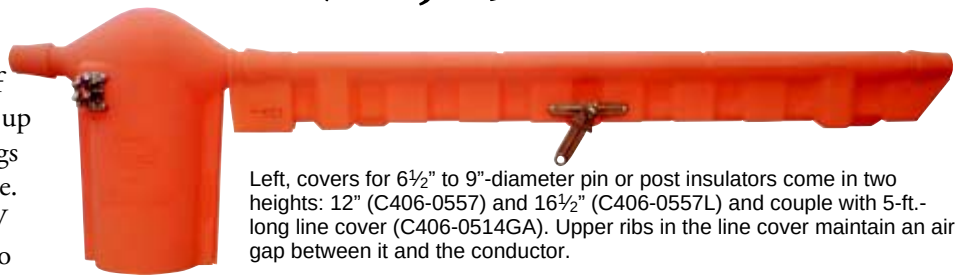
To extend duty through 80kV, Extension Resistors (Cat. No. C403-3371) are available as accessories. Use on systems above 40kV requires Universal Poles longer than the 6-ft. poles furnished with each Kit.

For more information, contact your Hubbell Power Systems representative, fax 573-682-8714 or e-mail hpscontact@hps.hubbell.com.

NEW SET OF CLASS 4 COVER UP

For up to 36.6 kV phase-to-phase applications, meets or exceeds ASTM F712, F968

Now the advantages of Chance® rigid cover up are available in ratings for up to 36 kV phase-to-phase. Larger than our popular 25 kV covers, these Class 4 covers also are a high-density polyethylene. All feature a uniform wall thickness in this material for excellent dielectric/puncture strength. It performs well from -50° to 170°F and UV stabilizers guard against atmospheric exposure.



Left, covers for 6½" to 9"-diameter pin or post insulators come in two heights: 12" (C406-0557) and 16½" (C406-0557L) and couple with 5-ft.-long line cover (C406-0514GA). Upper ribs in the line cover maintain an air gap between it and the conductor.

Deadend cover for three 10"-diameter porcelain bells or polymer deadend insulators (C406-0537) couples with 5-ft.-long line cover (C406-0514GA).

To meet the class 4 rating, this cover must be used in conjunction with a rubber insulating blanket covering the coupler to the line cover. Failure to use a blanket to cover the coupler may result in electrical shock, severe injury, or death by electrocution.

For easy application, the unique V-shape bottom edge of the line cover and deadend cover and special slits in the insulator covers help locate the conductor and hardware. A positive coupling mechanism lets you completely surround a variety of configurations with this system of only four pieces. For convenience on either rubber-glove or hot-stick jobs, each piece comes with an adapter for multi-position handling by a Grip-All clampstick. ■

For more information, contact your Hubbell Power Systems representative, fax 573-682-8714 or e-mail hpscontact@hpshubbell.com.

NOTE: Because we have a policy of continuous product improvement, we reserve the right to change design and specifications without notice.

Vol. 6 No. 1 **JANUARY 2001**

HUBBELL TIPS & NEWS
210 N. Allen Street
Centralia, MO 65240-1395 USA

ADDRESS SERVICE REQUESTED

BULK RATE
U.S. POSTAGE PAID

Hubbell

visit http://www.hubbellpowersystems.com

HUBBELL® POWER SYSTEMS, INC.

ANDERSON CHANCE® FARGO® HUBBELL® OHIO BRASS®

UNITED STATES • 210 N. Allen • Centralia, Mo 65240 • Phone: 573-682-5521 • Fax: 573-682-8714 • e-mail: hpscontact@hps.hubbell.com
CANADA • 870 Brock Road South • Pickering, Ontario L1W 1Z8 • Phone: 905-839-1138 • Fax: 905-831-6353 • e-mail: jpearl@hubbell-canada.com
MEXICO • Av. Coyoacan No. 1051 • Col. Del Valle • 03100 Mexico, D.F. • Phone: 525-575-2022 • Fax: 525-559-8626 • e-mail: vtasdf@hubbell.com.mx
EUROPE • Ronald Close Woburn Rd. Indust. Est.• Kempston, Bedford • MK42 7SH, England • Phone: 44-1-234-843632 • Fax: 44-1-234-841435 • jhopwood1@aol.com
ASIA • 159 Sin Ming Rd. • #05-08 Amtech Bldg. • Singapore 575625 • Phone: 65-45447772 • Fax: 65-4544775 • e-mail: sajeev@hubbell.com.sg