

HUBBELL[®] TIPS & NEWS

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Protecta*Lite[®] Arresters reduce lightning outages to near zero on municipal 69-kV system

Improve your transmission reliability with supplemental arrester protection

By: *Rodney Simpson, Electric Superintendent
Frankfort Plant Board, Frankfort, Kentucky*

At Frankfort Plant Board (FPB) we continually strive to improve operations and reliability. So when our 69-kV transmission system was experiencing excessive lightning induced momentary outages in spite of an overhead shield wire protection, we started our research for a way to eliminate them. Ultimately, it was the installation of PROTECTA*LITE Lightning Arresters at selected points on the lines that solved the outage problem by effectively reducing the incidence of momentary outages to near zero over a 3-year period.

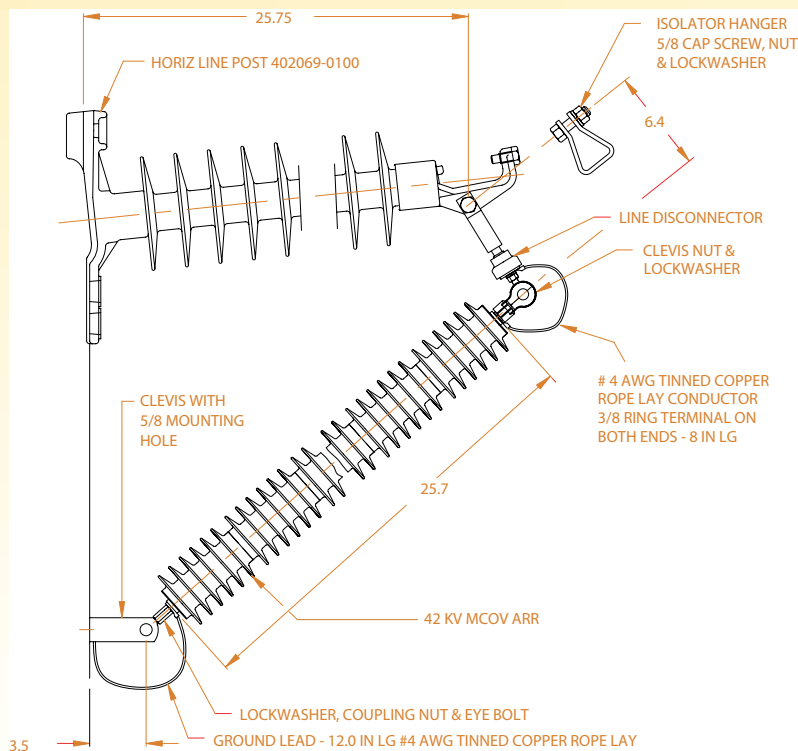
FPB is a municipal utility that operates in parts of three counties in Kentucky between Louisville and Lexington with about 21,000 meters including those in the city of Frankfort. Power is purchased from Kentucky/LG&E and distributed via 32 mi of 69-kV transmission lines mounted on a combination of wood and steel poles. Until recently, lightning protection consisted of the overhead static wire mounted 6 ft. above the top phase and tied to the structure ground plus lightning arrester protection at substations and switching stations.

Review of operations

In our regular review of operations we discovered that the transmission system was experiencing numerous lightning outages of short duration.



69-kV wood pole structure shows overhead ground wire and PROTECTA*LITE Arresters in parallel with insulators for lightning protection.



The worst performing was Line 3, 13 mi in length with up to five outages a year, with an average of three over a period of 11 years. We knew that what had once been acceptable performance was no longer acceptable because a momentary outage today can do as much harm to microprocessor circuits at commercial/ industrial customers as a sustained power outage would have done in the past. We needed better protection against lightning caused outages.

Corrective action taken

Our first corrective action was to install one to two ground rods at each pole along the entire length of Line 3. This regrounding effort, which took place in the spring of 1999, resulted in little or no effect on the reliability performance of the line during the summer thunderstorm season. Consequently, that fall we contacted Hubbell Power Systems for product information and assistance with the lightning problem. Hubbell's recommendation, after an engineering analysis, was to install OHIO BRASS PROTECTA*LITE Arresters along the

entire length of the line. They gave us several different scenarios to consider, including arresters at every pole. The FPB decision was to install the arresters at every 6 to 10 poles, at all hill-top poles, deadends, and all sharp turns in the line. Our original plans called for installing the arresters in the spring of 2000 on Line 3 and then reviewing the lightning performance of the entire line over the next 3 years. During the summer of 2000, however, we experienced six very intense thunderstorms that were much stronger than normal and all transmission lines on the system experienced numerous lightning strikes. Only Line 3, which had been our worst performing line, operated without any momentary outages.

We were so impressed with the results of the performance of Line 3 that we abandoned our 3-year study plans, confident that the arresters were doing their job and doing it quite well. So we purchased enough PROTECTA*LITE Arresters to cover the entire transmission system and installed them during the winter and spring of 2000/2001.



... continued 



Two PROTECTA*LITE Arresters set; working on installing third arrester.

How the work was performed

Using our own crewmen, the lines were worked de-energized and grounded. Most of the time the crews used only one bucket truck, but at select locations they were able to use two in order to give even better access to the insulators. At several sites we had to use pole climbing linemen to install the arresters. It normally took only about 30-min to add three lightning arresters to a structure. Also, we added one 8-ft ground rod per pole and tied it to the structure ground.

PROTECTA*LITE Arresters, which can be installed on unshielded lines, or as in our case, as supplemental protection for shielded lines, work by placing a metal-oxide surge arrester in parallel with the line insulation. During a lightning surge, the arrester limits voltage across the insulation to a value below the insulator flashover voltage. Lightning surge current is diverted to ground in a controlled manner and service is not interrupted.

Results to date

As of the spring of 2004, Line 3 continues to operate well and to date we have recorded only one lightning related momentary outage in our entire transmission system. We have not experienced any failed units and continue to add additional arresters in between the locations of the previously installed units to strengthen our lightning protection.

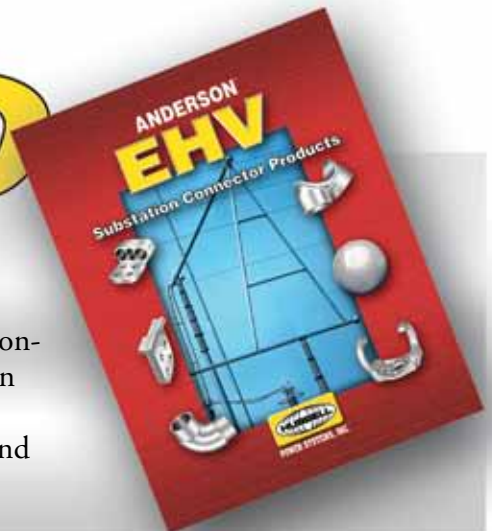
The FPB has adopted the OHIO BRASS PROTECTA*LITE System as the arrester of choice for the 69-kV transmission system. I have recommended these arresters to other municipal utility operators across the state and also to the newly formed state-wide power quality/reliability group during regularly scheduled meetings. We at FPB have always found Hubbell readily available to assist us. And Hubbell always backs up its recommendations with products of excellent quality. ■

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

UPDATED

ANDERSON EHV SUBSTATION CONNECTORS BULLETIN

The updated Anderson Bulletin AEC-16R puts EHV substation connector ordering information in one convenient brochure. Anderson is the leader in design, development and production of substation power connectors for EHV. This brochure will help you identify and order the substation connectors your customers need.





NEW

ANDERSON & FARGO CONNECTOR CATALOGS

These recently updated paperback connectors and fittings catalogs from Anderson and Fargo provide quick access to the complete family of Anderson and Fargo products including Anderson VERSA-CRIMP® tools. One catalog shows transmission and substation products. The other catalog shows distribution products. ■



The Hubbell Power Systems Video Library is now available on CD. More than fifty titles. Training and application videos are valuable tools for electric utilities. Each CD contains an MPEG file of the title which will play on Windows Media Player or Quicktime Player on your PC or Mac. Watch right at your desk. Once you have the CD, distribute the file amongst your colleagues by making duplicate CDs or store it on your network for easy retrieval. The CDs you request are yours to keep, no need to return. □

NEW

15/25kV
600A & 900A

DEADBREAK JUNCTIONS



Junctions sectionalize feeders or provide a lateral tap. Install in pad-mounted equipment or in subsurface vault applications. Fully-shielded and submersible. Mates with all standard 600A-class separable connectors. Conforms to requirements of IEEE Std. 386 and IEEE Std. 592. Production units subjected to AC Hi-Pot and Corona testing.

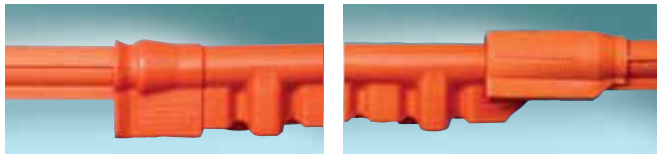
Pre-molded junctions available in two, three and four point configurations. Standard 600 A products contain an aluminum bus bar and mate with any 15kV/25kV rated separable connector. The 900 A version meets the same voltage requirements, but contains an all copper current path. Available with a stainless steel mounting bracket, which includes two integral parking stands, a ground lug, and a backplate. Can be furnished with only U-straps for surface mounting. A separate back plate is required for mounting on non-metallic surfaces. ■

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

The best all around cover up equipment

Rigid line cover fits rubber hose and more

Because it virtually surrounds live conductors is not the only reason Chance® rigid 25kV line cover is the best all around. Another is because it can couple with 25kV class line hose, other rigid 5-ft. lengths like it and their companion rigid insulator hoods and deadend covers.



Models for hotsticking and rubber gloving

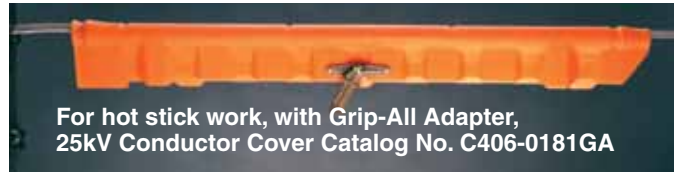
Each piece in the Chance rigid cover up line rated for 25kV phase-to-phase is offered two ways: With a Grip-All Adapter for hot-stick work or without such an adapter for rubber-glove work.

The special adapter has cogs for controlled handling on the end of a Grip-All Clampstick. For rubber-glove procedures, the absence of adapter hardware meets strict utility rules and reduces weight for handling ease. A third style of the conductor cover comes with a 4-ft. removable Epoxiglas® handle.

The line covers have a V-shaped bottom edge that makes them easy to place on conductors up to 666 kcmil ACSR maximum.

Rigid cover up for all distribution voltages

To cover all distribution voltages, Chance also offers a rigid cover up line rated for 36.6kV phase-to-



For hot stick work, with Grip-All Adapter, 25kV Conductor Cover Catalog No. C406-0181GA



All Chance® Rigid Covers: Tested to ASTM F712 and manufactured to ASTM F968 specifications.

For rubber glove work, without Grip-All Adapter, 25kV Conductor Cover Catalog No. P406-0184



25kV Deadend Cover C406-0164 fits over a maximum of two 10"-diameter deadend insulators. Grip-All Adapter included allows placement with a clampstick or rubber gloves and sleeves when work practices permit.

phase, ASTM Class 4. It also couples with Chance 25kV covers, Classes 2, 3 and 4 rubber line hose and major brands of rubber insulator hoods. The 36.6kV rigid cover up line includes two sizes of insulator hoods (12" and 16½" heights) and a deadend cover.

Durable weather-resistant construction

Of polyethylene for excellent dielectric/puncture strength and formulated with UV stabilizers to inhibit atmospheric degradation, all rigid covers perform well from -50° to 170° F. ■

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



25kV Insulator Covers with Grip-All Adapter:

6" height C406-0182
9" height C406-0182L

25kV Insulator Covers without Grip-All Adapter:
6" height P406-0185
9" height P406-0186



NEW



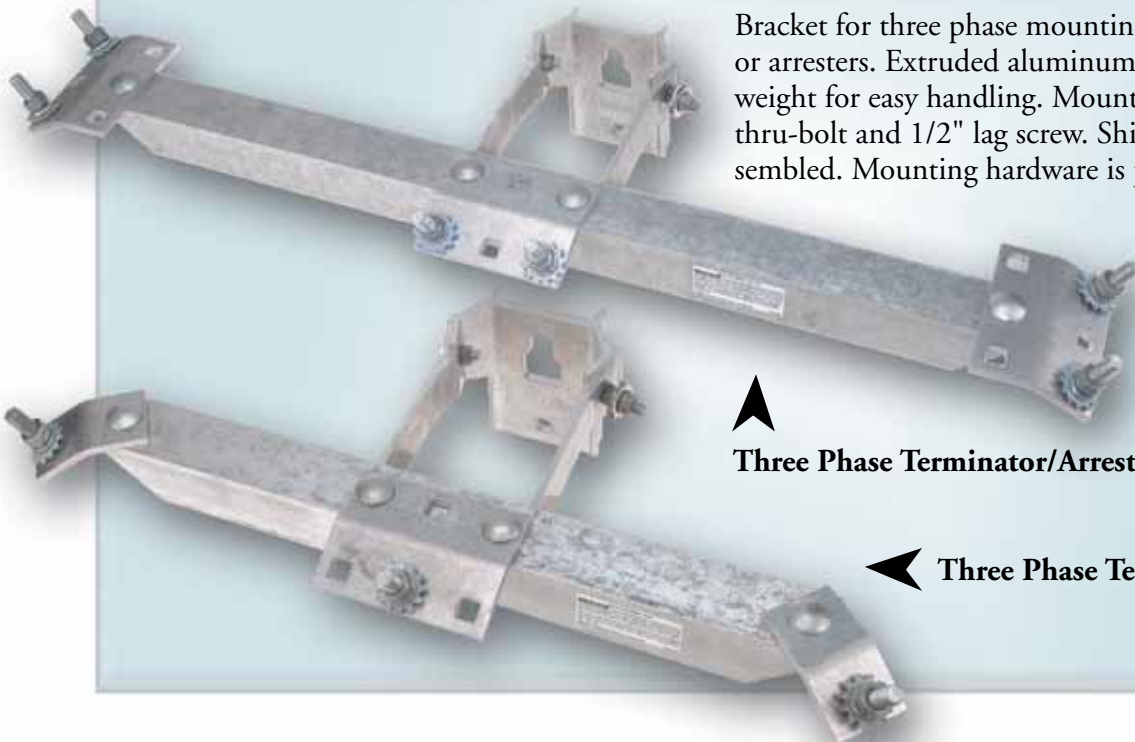
FARGO COMPRESSION CLAMP

Our GC-268 vise-type bolted compression clamp works on 5/8" copper and galvanized ground rods and #12 - #6 AWG conductor. With two times more conductor contact area, customers get superior electrical grounding and the best mechanical hold. Assembly is easy

thanks to the side-opening vise jaws with access from any angle. Bulletin AE-2014 gives a quick overview.

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

ALUMINUM BRACKET Terminator and Arrester



Bracket for three phase mounting of terminators and/or arresters. Extruded aluminum material offers light-weight for easy handling. Mounts to pole with 5/8" thru-bolt and 1/2" lag screw. Shipped completely assembled. Mounting hardware is purchased separately.



Three Phase Terminator/Arrester Bracket



Three Phase Terminator Bracket



Systems Key to Massive Storm Response

Effective teamwork helped Nova Scotia Power rebuild its devastated distribution system following the effects of Hurricane Juan

The night of Sunday, September 28, 2003 will long be remembered by many as the time when the strongest hurricane since 1893 – Hurricane Juan – flattened trees, power lines and buildings in a broad swath through the center of Nova Scotia, Canada. Three hours was all it took for Juan to tear north through the province from the Atlantic coast. By the time it reached Prince Edward Island, about 300,000 homes and businesses were without power, a figure representing about half of Nova Scotia's population. The storm hit the Halifax Regional Municipality (HRM) head on with high winds and an enormous storm surge that inflicted considerable damage on the Halifax-Dartmouth waterfronts. Highest sustained winds were about 94 mi/h with gusts to 109 mi/h. Hurricanes routinely come close to the shores of Nova Scotia but usually lose strength as they encounter the colder water of the North Atlantic. Few expected this storm to strike with such fury, but Juan gathered strength as it neared the coastline because the ocean water



was still relatively warm that fall. By the morning following the advent of Hurricane Juan, Nova Scotia Power (NSPI) was hit with the largest outage in the company's history. Speaking of the storm and its damage, Dan McPhee, manager procurement/distribution center for NSPI, said, "We didn't have a good feel for what we were getting into at first but once the storm hit at about midnight on Sunday, September 28, we realized how strong it was. We had line crews out patrolling but they had to be pulled off the streets about 1:30 am. By 2:00 am on Monday, September 29, every feeder in Halifax was out. And that's unprecedented."

Damage

Hurricane Juan followed the backbone of NSPI's transmission system from Halifax to Truro in the northeast and on to the Pictou County area. It lost speed along the way but maintained hurricane force winds. A total of 24 transmission lines were knocked out, including one 345-kV line. Every single transmission line running into HRM was put out of



commission. Massive damage to the distribution system from broken poles and downed trees occurred throughout the path of the storm. Forty-five major substations were affected and 145 distribution feeders were damaged or tripped off, including 106 in HRM.

Rebuilding

Restoration of power and rebuilding of the NSPI transmission and distribution system began as soon as the storm passed, aided by many NSPI suppliers including Hubbell Power Systems and its Nova Scotia distributor, Harris & Roome Supply Ltd., a Graybar affiliated company (H&R). McPhee and the procurement team started ordering material first thing Monday morning, anticipating what would most likely be needed for service drops and conductor splicing. Although NSPI has a rolling forecast of material received on a monthly basis from Hubbell through its distributor and inventory is routinely topped up in anticipation of the winter storm season, restoration requirements following Hurricane Juan exceeded by far what was on hand. “H&R talked to Hubbell and started to get things on the road. A lot came in by truck transport, but we ended up flying a lot of it in as the week went on,” McPhee said.

Powerline technicians and forestry crews from within NSPI, from neighboring utilities, from private contractors, and from the Armed Services worked on rebuilding the power system. Other utility crews came from New Brunswick Power, Saint John Energy, Bangor-Hydro Electric, and Central Maine Power. Crews worked around the clock in the beginning, then 16-hour days. Personnel from H&R also worked 16-hour days to keep the work crews supplied with needed materials. Mike Cloran, H&R account manager for NSPI, said, “We were basically 24/7 for the first week and then for the second week it was probably 12 hour days trying to source materials and make sure everything came in on time.” Overall, in a two week period, NSPI replaced 275 transformers and 760 power poles, and restrung 125,000 m (410,000 ft) of conductor.

Materials and Teamwork

By noon of the second day after the storm, 50% of customers had their power restored. Within five days, 95% of customers were back on line. To accomplish this level of restoration took dedication and teamwork from all NSPI suppliers and distributors including Hubbell Power Systems and Harris & Roome. Hubbell supplies the majority of NSPI’s

poleline hardware items. “Hubbell is our main supplier of approximately 200 of our highest turnover items,” said McPhee. These include Fargo automatic splices, Chance cutouts, current limiting fuses and fuse links, Chance pole line hardware, anchors and anchor rods, Anderson connectors, and Ohio-Brass arresters.

Cloran of H&R said, “One of the biggest issues for us was to make sure NSPI had enough pole line hardware items, cut-outs and arresters and to arrange that all materials got to the NSPI Central Warehouse. We checked daily to make sure everything was coming in on a timely schedule. We really didn’t have anything backed up that we couldn’t get. Hubbell helped us out in every way they could and kept us advised of all the material and where it was and how it was coming, with waybill numbers and other information. One of the biggest tasks was to get enough Fargo automatic sleeves. They were using a lot of automatic sleeves to get distribution conductors repaired and restrung, and Hubbell came through as needed.” Materials were shipped from the Pickering (Toronto), Ontario headquarters of Hubbell Canada and Centuria, MO.

An example of how Hubbell came through and how teamwork played a crucial role is recounted by Jim Kirby, district sales manager, Atlantic, Hubbell Canada, based in Halifax: “In the second week a request came through from NSPI for additional automatic splices, of which they were running short. NSPI wanted to know if Hubbell could make some splices and how soon could they be available. After determining there were none available in the Hubbell inventory, I contacted Andy Bennett, director, Hubbell Canada, Toronto, who helped set up a conference call involving Hubbell Canada in Pickering and people from marketing and engineering in the Hub-

bell Power Systems connector group in Leeds, AL. In very short time they suggested an alternate product. It didn’t have all the same markings of the ones NSPI was using, but they assured us it would work. This information was conveyed to Dan McPhee of NSPI who gave the go-ahead. Within an hour we had this ordered. This was an example of a North American network of resources that we had utilized in order to get the material needed to the customer.”

In a report to the Nova Scotia Utility and Review Board, NSPI stated that there was always sufficient material in the supply chain to meet all requirements. At no time, it said, during the Hurricane Juan restoration period were work crews held up due to lack of materials. Commenting on the Hubbell/Harris & Roome response, McPhee said, “They came through very well for us when we needed them. If they didn’t have an item, they would source it from elsewhere.” In an acknowledgment letter to Harris & Roome subsequent to the restoration, Dan McPhee wrote, “Big events such as Juan present difficult and constantly changing circumstances for power utilities. Harris & Roome’s quick and

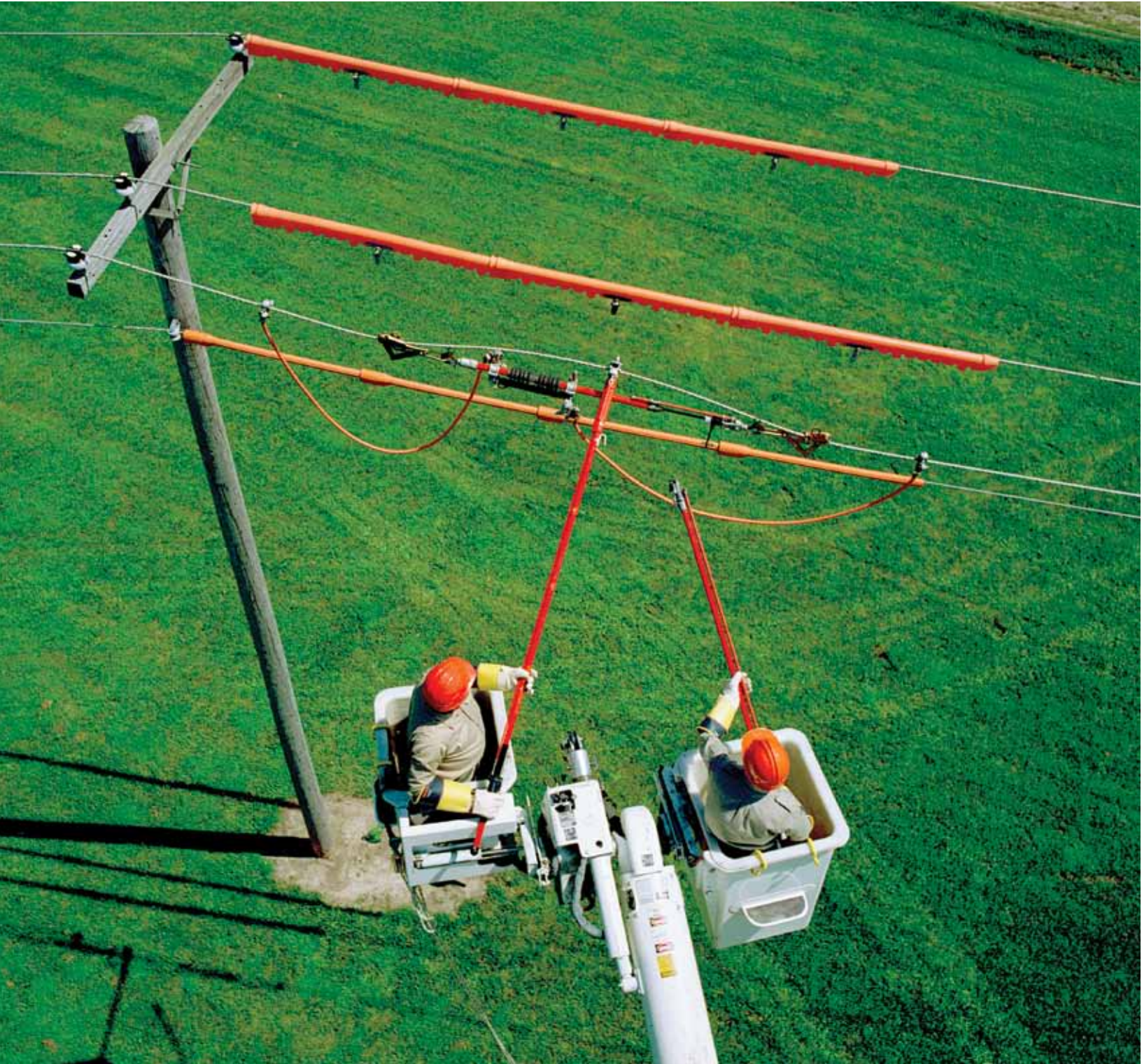
committed response to help us meet these challenges was a major contributor to NSPI’s successful storm response. NSPI is grateful for the contribution you made throughout this unprecedented situation and we salute the professionalism and dedication that was so earnestly demonstrated.”

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CHANCE[®]

Tension Puller Switching Tool



Cut hot lines and keep the power with Tension Puller Switching Tool

Design enables portable temporary distribution sectionalizing

Two tools in one is an understatement about this one.

Not only does it give you a way to both cut a live line and de-energize at will. It also can revert to a tension puller alone — for jobs that need just that — by quickly shedding its switch on the spot.

Two proven components

Hot parts of the Chance LTD[®] line-tension disconnect switch include: Silver-plated contacts, rigid H-frame copper switchblade and pull ring with pry-lever latch for easy opening and ice-breaking action.

For this special tool, weathershed skirts of a tough polymeric are bonded to the 1½"-dia. Epoxiglas[®] pole. To secure the removable switch hot parts, a compression clamp aligns on a locating pin at each end of the skirts.

A bypass stud (½"-dia.) added at



Tension Puller Switching Tool Catalog No. C400-1907 Specifications

Maximum Electrical Ratings

35 kV phase-to-phase system voltage
600 amps continuous current
150 kV BIL

Capacity Line tension up to 4,000 lb. (1,800 kg.)

Working Range 58 to 70 in. (1,473 to 1,778 mm)

Maximum Take-Up 12 in. (305 mm)

Insulation

Minimum 24 in. (610 mm)

Maximum 36 in. (914 mm)

Length 60 in. (1,524 mm)

Weight 22 lb. (9.9 kg.)



For applications wherever needed to temporarily sectionalize a line, properly opening the switch requires an approved portable loadbreak tool designed for use with switches. Galvanized-steel hooks on the switch provide for such operation.



1 Suspended from hot-line wire grips with the disconnect switch closed, the tension puller works like a jack. Operating the ratchet wrench brings the tool's two ends closer.



4 To hold the conductor to be cut, a tieback clamp is first secured to the long end of the jumpered section. Tieback clamp C400-0600 fits #4 to 397.4 kcmil ACSR.



2 With tension reduced on the conductor between the tool's hooks, hot-line jumpers sized to the application are installed on the tool's bypass studs.



5 To maintain control of the conductor, the clampstick secures the eyescrew of tieback clamp's second jaw while insulated hydraulic cutters are used on the conductor.



3 Both jumper sets create a parallel circuit alongside the switch.



6 Tieback clamp's second jaw secures open loop of conductor to itself. This completes preparations for the switch to perform its line-sectionalizing operation.

each end of the switch accepts clamps up to 3" wide.

Rubber gloves or hotsticks sectionalizing procedure

Equipped with handling rings, this tool may be installed by either hot-line tools or rubber-glove live-line techniques. Hooks are fixed so as not to swivel. Spring-loaded safety hook latch gates rotate 135° to open.

Illustrated instructions included with each unit give application considerations for installation, operation and maintenance.

For additional recommendations, refer to the ANSI C37.35 IEEE Guide for the Application, Installation, Operation and Maintenance of High Voltage Air Disconnecting and Load Interrupter Switches.

continued . . . ➤

Simple changeover for 'switchless' tensioning

Being able to convert this temporary hot-line sectionalizer tool to a standard tension puller makes this tool doubly effective. Being able to do that in the field makes it ideal for life on a line crew.

Here's how, when line sectionalizing is not part of a hot-line procedure, but line tensioning is: First, simply loosen the wing nut on both the pole clamps at the ends of the switch hot parts. Open the clamps with care, so as not to scar the Epoxiglas® pole.

It's just that simple. Like all Chance hot-line tools, it's designed to make difficult operations easier to perform. And built to exacting specifications to join the many other practical tool "members" on your most productive crews. ■



Locating pins in the Epoxiglas® pole ensure proper alignment of clamps for easy removal and replacement of switch hot parts.



Selector switch on ratchet wrench is extra large for easy operation by hotstick and rubber-glove methods.



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

NEW ANDERSON™

ASOD-570-1N

#6-4/0 ACSR side load deadend clamp



Save time and money by using quick install Anderson ASOD side load clamps. For use in distribution and light transmission applications. Each clamp is cast of high strength 356-T6 alloy, with high strength galvanized steel hardware. Captive nuts prevent loss of hardware during installation. ■

Catalog Number
ASOD-570-1EN
lift eye option



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

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

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HUBBELL TIPS & NEWS magazine is published to inform personnel of electric utilities and associated companies of new ideas and techniques in transmission and distribution practices. The magazine, under different titles and formats, has been published since 1932.

Your suggestions and editorial or photographic contributions are invited and may be submitted to **HUBBELL TIPS & NEWS**.

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