

HUBBELL[®] TIPS & NEWS

www.hubbellpowersystems.com

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Water, ice and high winds force evacuation of 230kV line to higher ground

Bedeviled line serves Devils Lake, North Dakota

*By Chuck Lukkarila, Supervisor Transmission Design
Great River Energy, Elk River, MN*

Originally built in 1966 through what was then dry land with some wet areas just west of the town of Devils Lake, the 230kV transmission line for the Devils Lake region of North Dakota served as an outlet to Great River Energy's Stanton generation station. However, over the years the water in the lake kept rising, seriously endangering structure foundations. So, it then became imperative to move the line to higher, drier ground.

Historically, Devils Lake water level fluctuated from lake elevations of 1400 ft. above sea level to its record high of 1447 ft. In 1966 when the line was built, the lake elevation was only about 1412 ft. above sea level, and the line traversed dry ground except where it crossed a body of water called Six Mile Bay. By the late 1960s the lake elevation continued to drop to a point where a federal project was initiated to divert water from the Missouri Basin to Devils Lake. But, by the mid-1970s, the lake level was at a 1422 ft. elevation and in the spring of that year high winds moved a sheet of ice on the lake destroying a structure.

In 1995, severe flooding combined with the lack of a natural water outlet below 1457 ft. for the

lake caused water levels to rise to record levels of 1435 ft. above sea level. The clearances and structure integrity were in jeopardy and field crews reported that the once dry ground west of Six Mile Bay at the Minnewauken Flats end of the lake had experienced an onslaught of 3 to 6 ft. of water along approximately 10 mi of the line. In the winter of 1996, Great River Energy constructed a 9 mi reroute of the line in the area that was flooded because of water saturation and the resulting damage it caused to bearing capacity around the inundated structures. Great River Energy was facing a potential catastrophic



Transmission line in Devils Lake in 1995 at a lake elevation of 1435 ft.

destruction of the transmission line when spring ice would begin to move or when strong wind storms might occur. In this case, Great River Energy did successfully relocate the transmission line by April of 1996 before ice breakup.

Nonetheless the lake continued to rise following the rebuilding. Water levels reached an elevation of 1447 ft. above sea level, still below its 1457-ft. natural outlet. Again the line was in jeopardy, so in 2000 Great River Energy hired a consultant to reroute the line to a higher, drier elevation completely out of the lake. One week following approval of the reroute plan, Mother Nature underscored

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the urgency to move the line: A wind storm with recorded wind speeds of 110 miles per hour blew down 10 mi of the line into the lake. Thus, the line had to be rebuilt on a temporary basis pending a move to dry land.



Close-up of foundation prior to setting of 90-ft pole.



Setting 90-ft weathering steel pole on rerouted 230-kV line, Devils Lake, ND

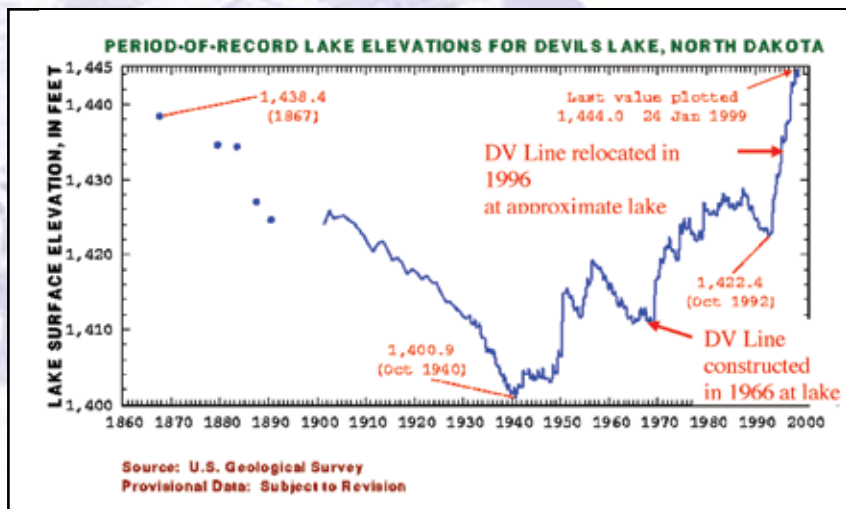
New line parameters

Designed to meet the 1457 ft. water elevation plane, the majority of the line is now on dry land. The rerouted line length is 36 mi whereas original line length was approximately 21 mi in the Devils Lake vicinity. The voltage was kept the same at 230 kV and the single-circuit weathering steel structures are 90 ft. tall. Conductor is 954 kcmil ACSR Rail (45 over 7 stranding) with a ruling span of 505 ft. The poles are embedded in the earth without a foundation to a depth of 10% of pole length plus 3 ft. An overhead ground wire provides lighting protection.

Construction

The biggest problem to overcome in construction was acquiring permits and rights-of-way in a very short time frame of late August of 2000 to October of 2001. Because it took approximately a year to acquire all of the land needed for all 36 miles, less time was available for construction. Another problem to be met occurred when some poles were set in a high water table area and water in the excavated hole caused these poles to actually float. To stabilize the structure, a hole was cut toward

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USGS graph for the lake elevations at Devils Lake, ND March 1998 - October 1999.

the bottom of the pole, allowing the lower end to be filled with concrete as ballast. As a result of this solution the poles have remained stable.

Hubbell products installed

The new line, called the Balta Ramsey line, completed in April 2002, utilized Hubbell products including Ohio Brass polymer suspension insulators that figured prominently in the success of this project. They are on all tangent structures (Part No. 511013-1201) with corona rings on the energized end of these insulators (Part No. 271761-30011). On deadend structures, porcelain bell insulators were used with an OB polymer post insulator (Part No. 522015-1102) to carry the jumper wire across. Some heavy duty deadend structures required guying, for which A.B. Chance anchors were used. Various Hubbell hardware items contribute to the reliability of the line: Fargo compression deadends (Part No. 12122), Anderson wye clevis balls (Part No. YDC-30) and Anderson bolted deadends for shield wires (Part No. SWDE-55N).

When Hubbell products had been used on other projects by Great River Energy they were found to be an economical choice, as they proved to be on this job. Moreover, of great importance to the success of this critical project was holding to a fast and rigid schedule and Hubbell provided excellent delivery with all equipment on site well ahead of construction, and, Hubbell was very successful in getting materials to the construction site as needed. The job actually was completed ahead of schedule and met our energization goal of June of 2002. ■

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

CATALOG CROSS REFERENCE




New Catalog Cross-Reference Now Ready at www.hubbellpowersystems.com

For instant catalog number comparisons among the 100 manufacturers shown including the top 25 utility manufacturers/suppliers to the utility industry. With more than 100,000 catalog number comparisons in the data base, you'll have ready access to Hubbell Power Systems construction, switching and protection products, tools, insulators, arresters, connectors and cable accessory numbers. Search by part numbers to find the equivalent Hubbell Power Systems catalog numbers. If you don't have complete catalog information, use the wildcard (*) at the beginning or end of any given number to find the equivalent Hubbell catalog number. Once you find a cross reference, click on the Hubbell catalog number hyperlink, and you'll be linked to our E-Catalog for complete product information.

The new Hubbell Power Systems cross reference feature is there 24/7 to assist you. It's fast. User friendly. Quick and convenient. Available to everyone. No password or user identification required. ■



New Copper Bonded Ground Rods



The Chance line of copper bonded ground rods is now offered in addition to our existing line of galvanized rods. The new copper rods are manufactured by molecularly bonding 99.95 pure electrolytic copper to high-strength steel core rod. The core rod is rated for 80,000 lbs tensile strength for driving into hard soils. Meets UL and NEMA GR-1 specifications. Threaded and non-threaded ground rods are offered in both 10 and 13 mil plating thickness. Accessories to the rods include couplers, drive heads, drive tips, ground rod clamps and conductive paste.

We also have a complete line of bronze Anderson ground rod clamps for connecting copper cable in parallel with the copper bonded ground rods.

For a complete family of ground rods and accessories, look to Chance. ■

Visit our web site at www.hubbellpowersystems.com to use our Interactive e-Catalog and browse through the wide assortment of products offered.

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

NEW GENERATION

Designed to
IEEE 495 Standard



Catalog Number AR 4

AutoRANGER™

Improve System-wide Reliability With the Next Generation of Fault Indicators

Features and Benefits

- Separate, distinct trip levels from 50 to 1200 Amps
- Trip level self-adjusts based on load current sampling
- Overhead and underground “Unit-in-One”
- Distinct permanent and temporary fault indications
- Inrush restraint protection
- High visibility, self-adjusting LED display
- Immediate activation upon installation
- High quality materials
 - *Reliable electrical components
 - *U.V. stabilized plastics and resins
 - *Stainless steel hardware
- Simple installation and zero maintenance
 - *No clamps, screws, or adjustments
 - *Single hotstick installation
- State-of-the-art microprocessor technology with “Ramp Down Restraint” memory
- The industry’s best battery-saving technology

Applications

Overhead Applications

- Leads line crews quickly to faults on single or three phase lines.
- Offers current inrush restraint protection.
- Allows line crews to easily distinguish between a temporary and permanent fault.

Underground Applications

- Leads line crews quickly to faults on single phase lines.
- Conserves battery life in underground mode.

Rural Applications

- Provides a fault indicating solution in 50A and 100A settings.
- Allows sufficient time (8 hour flash clearing time at 50A and 100A trip levels) for line crews to find faults on remote lines.

Troubleshooting Applications

- Helps crews troubleshoot problematic sections of overhead and underground lines.
- Makes identifying temporary faults simple: the yellow LED on the display flashes.

Operation

Autoconfiguration

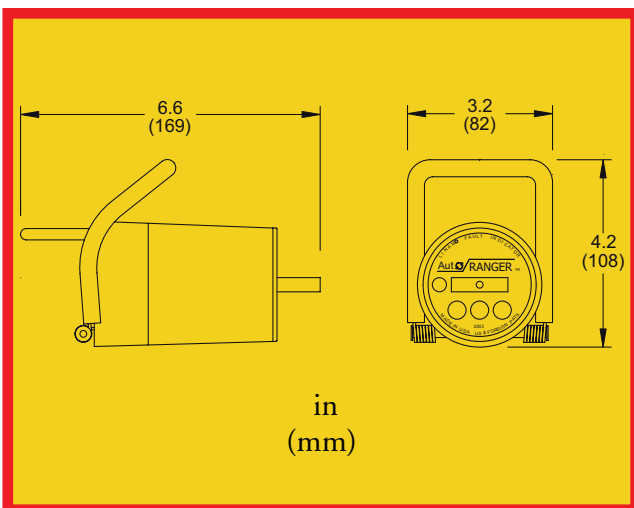
Install EOS AutoRANGER fault indicators on overhead or single phase underground lines. The AutoRANGER will autoconfigure to the correct application, overhead or underground, by sensing for the presence of a high voltage electric field. The AutoRANGER constantly monitors the load current and automatically adjusts its trip value based on these measurements.

Temporary and Permanent Fault Indications

When a fault occurs, two of the AutoRANGER's red LEDs will begin to flash. After one minute, the indicator will measure the system current. If it detects load current, the AutoRANGER's yellow LED will start flashing and the red LEDs will turn off indicating the fault was temporary. However, if the fault indicator does not detect a load, its two red LEDs will continue to flash for the flash clearing period.

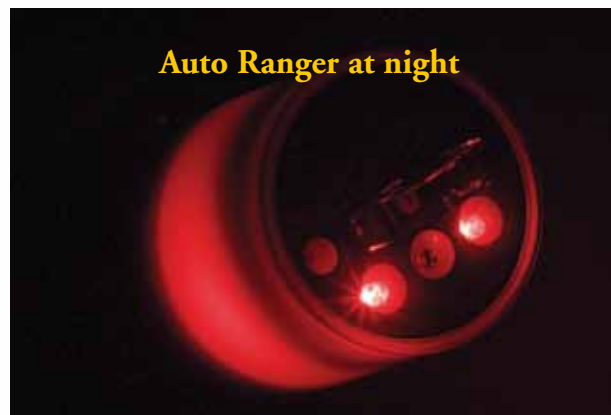
Daytime and Nighttime Modes

The AutoRANGER's photo sensor measures the amount of ambient light present. Bright light conditions cause the indicator to go into its full-power, bright LED "Daytime Mode." The AutoRANGER responds to darker light conditions by going into "Nighttime Mode," conserving energy when less LED light is required. In this low-energy nighttime mode, the illuminated housing has 360 degree viewability from a distance of at least 1,000 feet. ■



Specifications

Fault Sensing Range	50 to 1200A Overhead 200 to 1200A URD 50 to 1200A URD avail.
Voltage Range (P-P)	4160V to 34.5kV
Maximum Fault Current	25kA for 10 cycles
Temperature Range	-40°C to 85°C
Trip Response Time	1ms Underground 24ms Overhead Additional times avail.
Flash Clearing Times	
50A Range Overhead	8 Hours Standard
100A Range Overhead	8 Hours Standard
200 - 1200A Range Overhead	4 Hours Standard
All Underground Ranges	4 Hours Standard Additional times avail.
Clamping Range Options	0.30" to 1.5" O.D.
Power Supply	3.6V High Capacity Lithium Battery with a 15 year life expectancy
Flash Life	
Overhead	>2500 Hours (650 4-hour events)
Underground	>3500 Hours (875 4-hour events, or 1 event every 4 days for 10 years!)



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

Utilities Around Rely on Anderson C

Anderson dieless VERSA-CRIMP® compression tools were originally introduced in 1961. These versatile tools, used in conjunction with Anderson distribution connectors, have truly passed the test of time and give testimony to the strength of the original product design. What this means to users is a simplified, more flexible way of minimizing connector inventories, maximizing productivity and reducing costs.

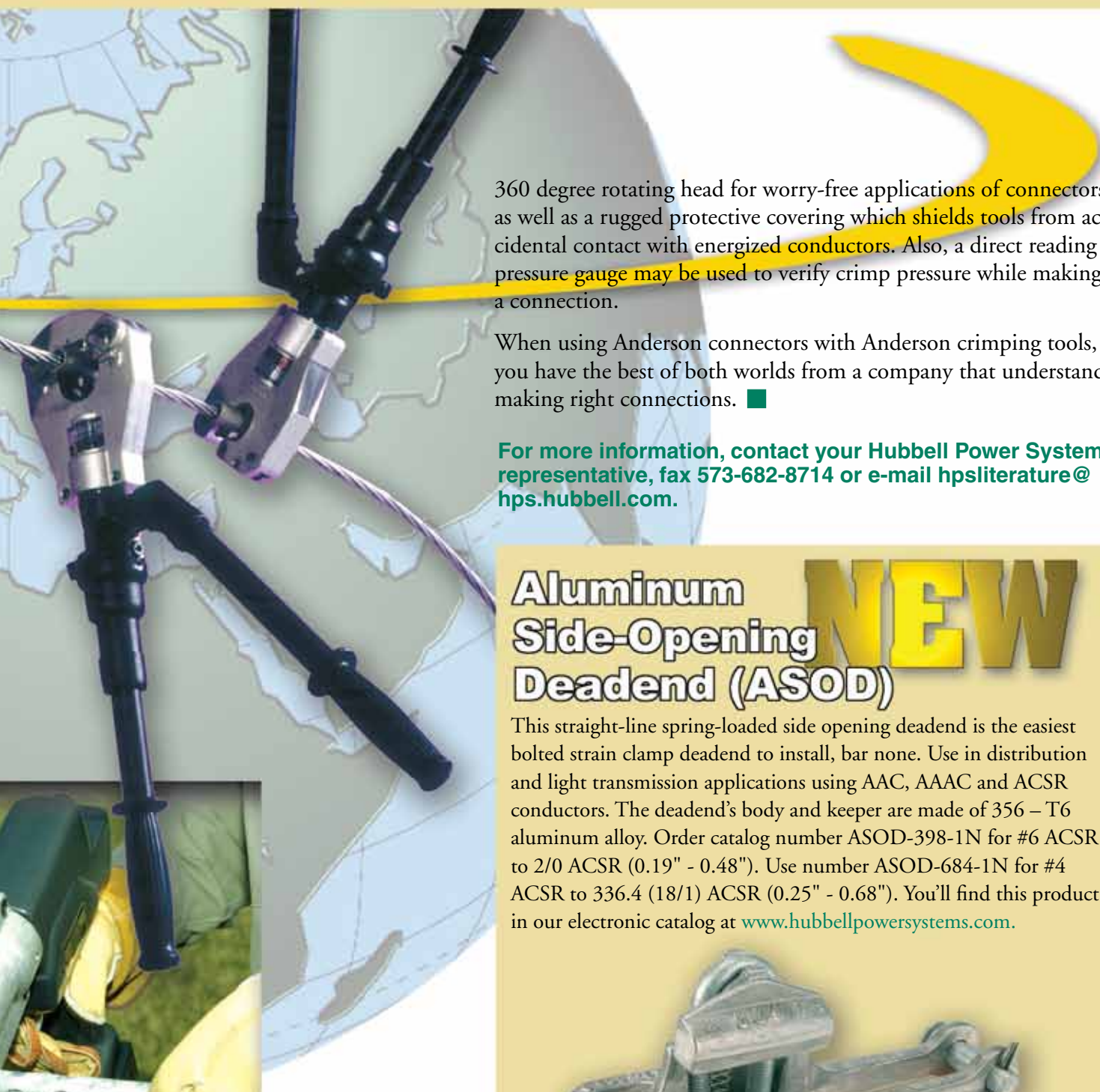
Anderson introduced the industry's most important change in compression tool technology. With its unique pressure-response system, utilizing self-contained crimping nibs, VERSA-CRIMP tools eliminate the need for die-type compression systems. The unique design of the tool nibs allows a continuous action from the largest to the smallest opening. Instead of constantly matching dies, connectors and conductors for proper connections, the dieless designed nibs allow the user to advance the tool opening in a continuous movement, compressing the connectors and conductor until the proper pressure for the crimp is achieved as determined by a pre-set hydraulic valve. This major advantage over all other compression systems on the market allows a single VERSA-CRIMP tool to accommodate a range of #10 STR aluminum through 750 MCM aluminum/copper without tedious die set changes or other tool modifications. Nibs can retain a pre-set desired position to help avoid the hassle of ongoing adjustments. While making connections, the nib design produces an indent crimp with minimum resistance and no relaxation or creep. This results in a connection with maximum conductivity.

Tools offer a wide range of power sources including gas, electric, hydraulic and battery powered. And, Anderson tools can be used on any manufacturer's compression connectors that are qualified to ANSI C-119.4 Class A2, A3.

Superior features you find with these compression tools include a



and the World Compression Tools



360 degree rotating head for worry-free applications of connectors as well as a rugged protective covering which shields tools from accidental contact with energized conductors. Also, a direct reading pressure gauge may be used to verify crimp pressure while making a connection.

When using Anderson connectors with Anderson crimping tools, you have the best of both worlds from a company that understands making right connections. ■

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

Aluminum Side-Opening Deadend (ASOD)

NEW

This straight-line spring-loaded side opening deadend is the easiest bolted strain clamp deadend to install, bar none. Use in distribution and light transmission applications using AAC, AAAC and ACSR conductors. The deadend's body and keeper are made of 356 - T6 aluminum alloy. Order catalog number ASOD-398-1N for #6 ACSR to 2/0 ACSR (0.19" - 0.48"). Use number ASOD-684-1N for #4 ACSR to 336.4 (18/1) ACSR (0.25" - 0.68"). You'll find this product in our electronic catalog at www.hubbellpowersystems.com.



MEAG Drastically Cuts Lightning Surge Outages

Transmission line outages drop from 16 per 100 miles to 9 per 100 miles of line

By Larry Stephenson
Transmission Operations and
Maintenance Superintendent
Municipal Electric Authority of Georgia



*Poor grounding conditions in some parts of Georgia render the overhead shield wire less effective. Protecta*Lite arresters are installed in selected areas on 69 kV and 115 kV lines to improve lightning protection.*

The Municipal Electric Authority of Georgia (MEAG) was experiencing excessive lightning outages on some shielded and unshielded transmission lines. The state of Georgia has a lightning incidence level that ranges from 60 to 80 on the isokeraunic scale. This frequent lightning activity combined with poor grounding conditions in some parts of the state makes lightning protection of electric systems in Georgia a challenge. Our solution was to install the Ohio Brass Protecta*Lite® system for lightning surge protection; and in the three years since the installation began, our experience with the system has been excellent. We have seen a drastic drop in outages for lines on which these units have been installed.

MEAG electrical system

MEAG is a generation and transmission agency providing power to 49 Georgia communities. The statewide transmission grid, known as the Integrated Transmission System (ITS), is jointly owned by four power suppliers, including MEAG. Each member owns a percentage of the transmission system including transmission lines and substations according to the percentage of the total state

load. MEAG's share is presently at 8%. It is the third largest power supplier in the state with co-ownership of four generating plants with a generating capacity of 1566 MW. MEAG owns approximately 1300 miles of transmission line and 200 substations with full access to 15,000 miles of line. The agency can only serve municipal loads, not commercial or industrial, but MEAG does offer its municipalities marketing and other support services such as technical assistance, training and safety, and joint purchasing.

MEAG's transmission line voltages are 500kV, 230kV, 115kV, 69kV, and 46kV. Participant member's distribution voltages are mainly 12kV with some 4kV and 25 kV.

Where Protecta*Lite used

We were introduced to the Protecta*Lite surge arrester system 12 years ago and started using them in 1991. They have been installed system-wide on transmission lines at 115kV and lower and on every transmission line entering and exiting substations built since 1991. For transmission, the arrester system is being used mainly on the 46kV lines where no shield wires are used, and selectively on some 69kV and 115kV lines where shield wire protection is normally used but on which we have had lightning induced outage problems. For all substations on the system we also use this type of arrester in parallel with the string of deadend insulators on every transmission line coming into and out of a substation. This arrangement provides lightning surge protection to equipment in the substation and cuts lightning induced breaker trips. Some of our substation switches are operated in the open position, at which point voltage doubling can occur from incoming switching surges. The arresters help mitigate the effects of switching surges.



*Protecta*Lite is used for all transmission substations. Units are placed in parallel with the string of deadend insulators.*

Experience

The Protecta*Lite system consists of a polymer housed metal-oxide varistor (MOV) surge arrester in parallel with a polymer line insulator. In operation, the MOV arrester limits the voltage to a value less than the insulator flashover voltage. The lightning surge voltage is clamped, the associated current is diverted to ground, and the insulator flashover voltage is not exceeded. Protecta*Lite can be obtained from the factory as an insulator-arrester combination or as an arrester only for retrofit situations. Both have been used on the MEAG system.

The units are easy to install on transmission structures because they are lightweight and easy to handle, unlike porcelain-housed arresters. In a substation, since they are installed on the deadend structures, we don't have the trouble of finding sufficient space for conventional large arresters. And the units have the added advantage of indicating whenever there is a failure. If a unit fails, the end of the arrester drops out and you can see it when you walk into a substation or along a line. This is in contrast to conventional arresters which give no outward indication of failure.

Continued . . . 

Some places in the state where very bad grounding conditions make the overhead shield wire on the 69kV and 115kV lines less effective, we install the Protecta*Lite units in selected areas. On 46kV, if we have a line that is experiencing above average lightning outages, we'll put the units on the entire length of the line. This practice has been very effective in drastically reducing the number of lightning related outages on these lines.

New substation

Designs are underway for a new 69kV substation at Thomasville, GA. As with all our substations, Protecta*Lite arresters will be installed. The substation will operate at 69kV, but is being insulated for future 115kV operation. For this reason the Protecta*Lite 69kV arresters will be shorter than the deadend insulators. OB has designed an extension on the arrester to make it fit with the 115kV insulator. The substation will be under construction this summer and is scheduled to come on line in November, 2003.

Over the past five years, we have not had any failures of the OB Protecta*Lite units. They have been very reliable for us. ■



*Protecta*Lite is used for all transmission substations. Units are placed in parallel with the string of deadend insulators.*



Substation Arrester Product Update

Ohio Brass has recently added two new polymer arrester products to the product line. These are the PVIA (ANSI-Intermediate) and PVNA (ANSI-Station). Both are light weight with smaller cross sections for applications where size is an issue. They are particularly suited for enclosure applications.

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

Cover Up for poles can be placed and removed from the ground

- *Rope lock secures pole covers for hot line work*
- *Covers made per ASTM F968, tested to ASTM F712*

During hot line work, poles of all materials must be considered conductive paths to ground. Whether made of concrete, steel, composite or wood, poles must be covered to help prevent accidental contact.

COVER SIZES FOR ALL POLE TYPES

Chance pole covers for up to 36 kV phase-to-phase come in three sizes:

6", 9" or 12" diameter poles. All meet Class 4 requirements, are manufactured per ASTM F968 and are tested to ASTM F712.

- 6" size fits many steel poles and comes in 4- and 6-ft. lengths.
- 9" size is available in lengths of 1-, 2-, 4- and 6-ft.
- 12" size is available in 2-, 4- and 6-ft. lengths.

EASY TO PLACE, SECURE AND REMOVE FROM GROUND LEVEL

A nylon button on 4- and 6-ft. lengths allows the pole covers to be joined together in tandem, where longer lengths require covering. The covers are made of high-dielectric linear polyethylene. Their rope handles permit personnel to easily spread the covers and snap them around the pole; rubber gloves must be worn during this procedure.

ROPE LOCK DEVICE HELPS HOLD POLE COVERS

To help keep pole covers in place, especially on smooth surfaces, our Rope Lock device is easy to place and remove. It may be applied midway or as a lower support on 6", 9" or 12" diameter pole covers. In many cases, the pole covers may be pushed up the pole into place using a hot stick. Releasing the rope lock also may be accomplished with a hot stick by pulling down on the Rope Lock ring. Instructions are included for simple installation by hand and removal from ground level with a hot stick. ■

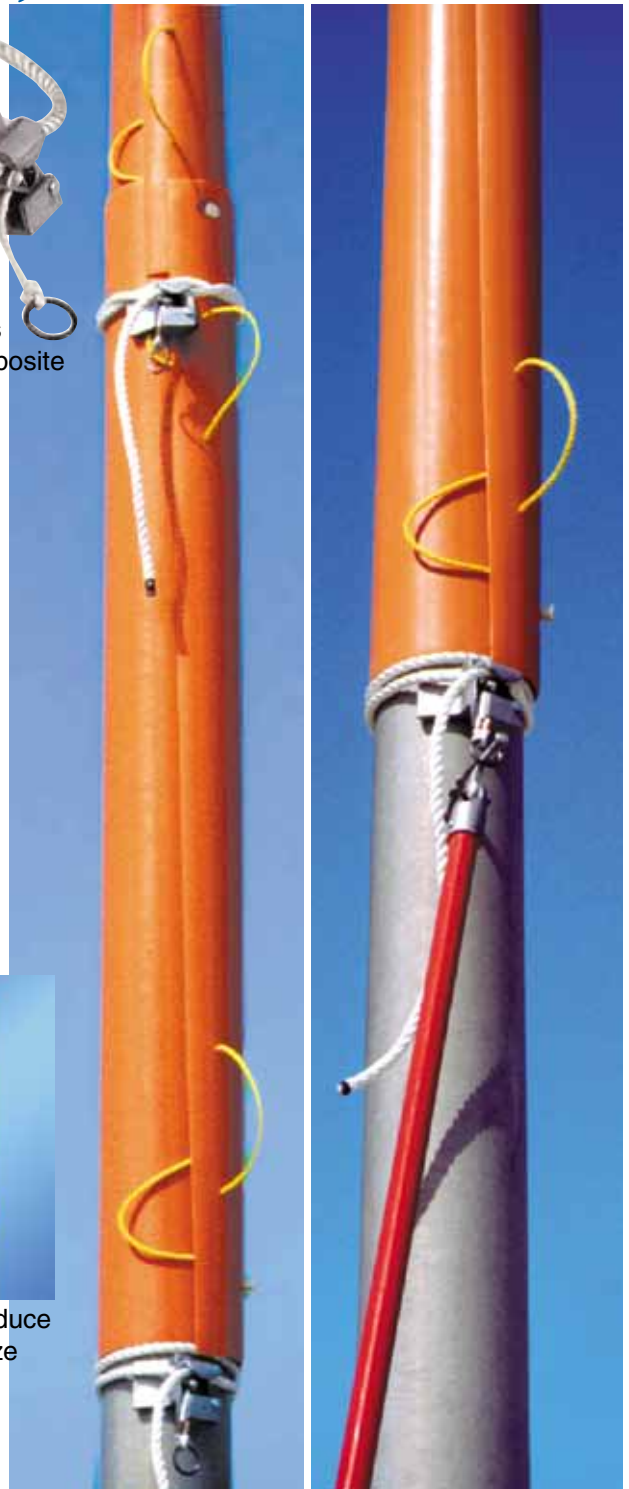


Rope Lock Assembly
Catalog No. C406-0547

- For securing pole covers on metal, concrete, composite or wood poles



Ribs inside the covers reduce pole contact and minimize creosote contamination.



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

GROUNDING-SET TESTER MEETS NEW ASTM STANDARD

- No math or tables due to electronic precision
- DC operation tests long cables when coiled
- Resettable thresholds make readout easy
- Probes accurately isolate trouble areas

This self-contained portable tester provides an easy way for an electric utility to check the resistance in protective grounding sets used by line personnel in compliance with ASTM Standard F 2249. Powered by 120 VAC, the tester applies Direct Current across the test specimen. A seven-minute videotape included with each unit shows how simple the tester is to use while procedure details are given in the instruction manual.

SIMPLE, ONE-BUTTON MICROPROCESSOR-TECHNOLOGY TESTING

From pushing a single button, the digital display shows the

resistance measured in milliohms compared with a preset threshold for the size grounding cable selected (#2, 1/0, 2/0 or 4/0). A green "Pass" or red "Fail" light also indicates the



Ball-studs accept grounding sets with standard clamps (above) and Chance ball-socket clamps (below).



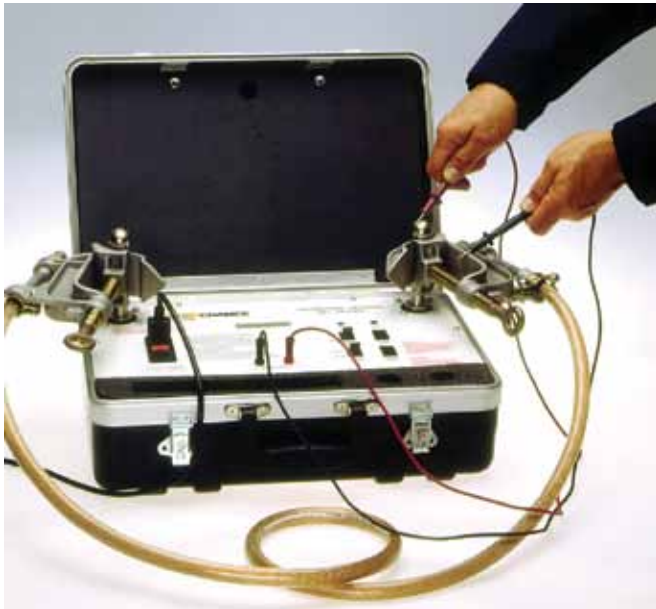
Protective-Grounding-Set Tester Catalog No. C403-3220



test result's relation to the threshold.

For system-specific requirements, the user can easily change the Tester's basis for voltage allowed across a lineworker, which comes factory preset at 50 Volts. Adjusting this limit automatically causes a corresponding shift in the resistance thresholds for all the grounding cable sizes.

Regardless of the voltage-allowed setting or cable size selected, the Tester displays the resistance of each specimen in milliohms with $\pm 1\%$ accuracy. (The Tester is capable of measuring resistance from 1 micro ohm to 6.5 ohms.)



Probes are used to calibrate before each test and to isolate cable trouble spots.

The utility must establish the maximum resistance allowed for protective grounding sets used on each specific area of its systems. How the utility calculates these values depends on several factors outlined in the Tester instructions. Reference examples are given in the manual.

TROUBLESHOOTING MODE ISOLATES CABLE PROBLEMS

If a ground set does not pass the initial test, the Tester can help isolate the problems. Often, the source of high resistance can be remedied by simple repairs to the cable set. Retesting then can quickly verify the effects of repairs.

For this troubleshooting mode, a pair of test probes are furnished to plug into the Tester. A switch activates them instead of the ball-stud terminals. The probes then are used to test across each contact interface in the ground set. The results display in milliohms, just as in the first test mode.

OPTIONAL TERMINALS FOR SPECIAL GROUND SETS

The Tester's standard ball-stud terminals accept most types of ground clamps, including Chance ball-socket clamps.

To test special-application grounding sets for underground-distribution transformers or switchgear, two optional adapters shown below are available as separate items. ■



Optional Straight Stud Terminal T403-3159 for testing grounded-parking-stand temporary grounding sets.



Optional Elbow Adapter C403-3449 for testing temporary grounding sets fitted with a grounding elbow.

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

FARGO Hi-Temperature and Low Resistance Joint Compound



This synthetic-based compound (type HTJC) was developed for use in conventional 2-die compression fittings on ACSS conductors rated 250° C.



Electrically and thermally conductive, HTJC compound is also ideal for use with standard aluminum conductor (AAC and ACSR) fittings including FARGO Uni-Grip® deadends, splices and terminals.

In either case, Hi-Temperature ACSS or standard AAC/ACSR conductors, compression and bolted joints have lower resistance and run up to 15% cooler when installed with FARGO type HTJC compound. ■



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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