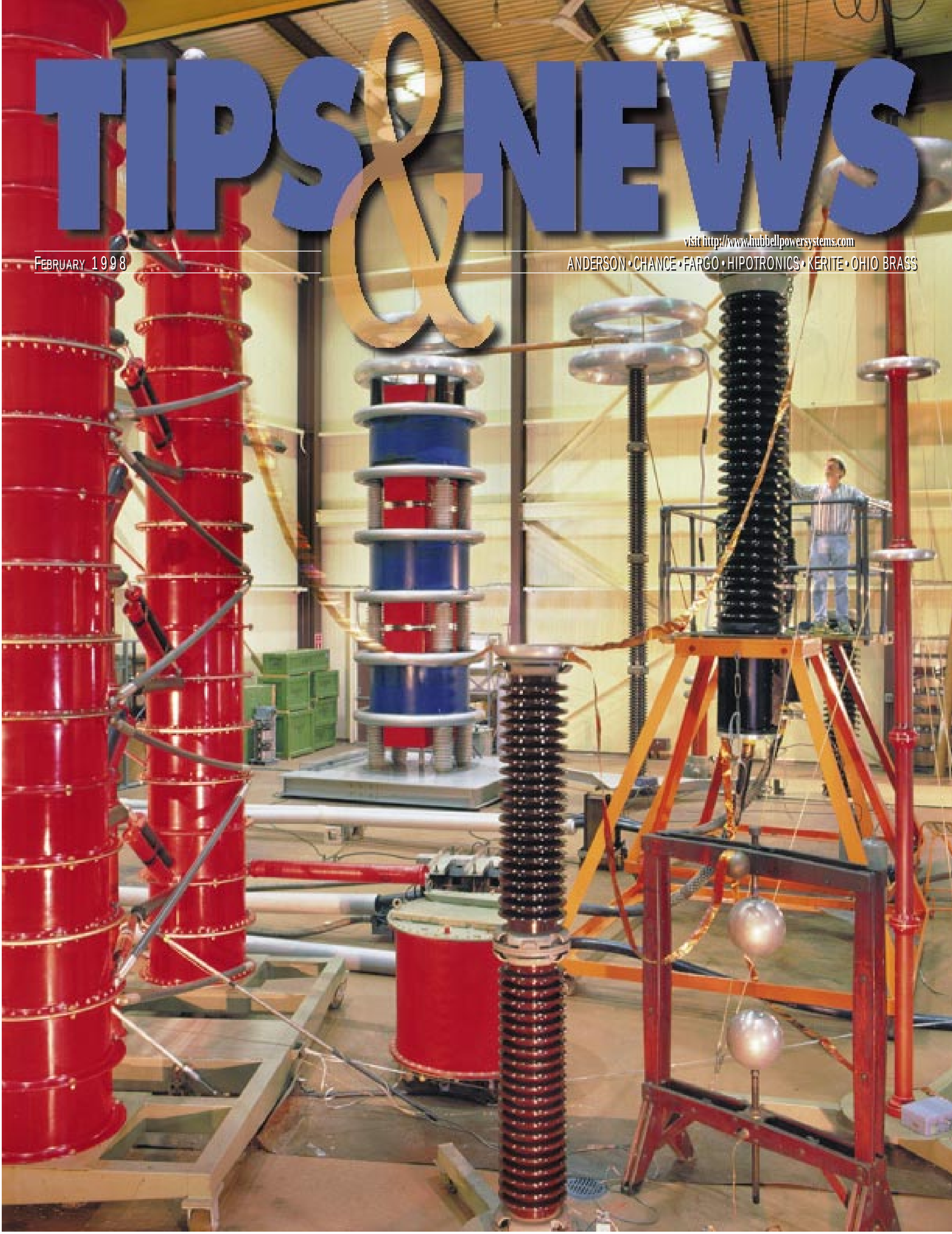
TIPS & NEWS

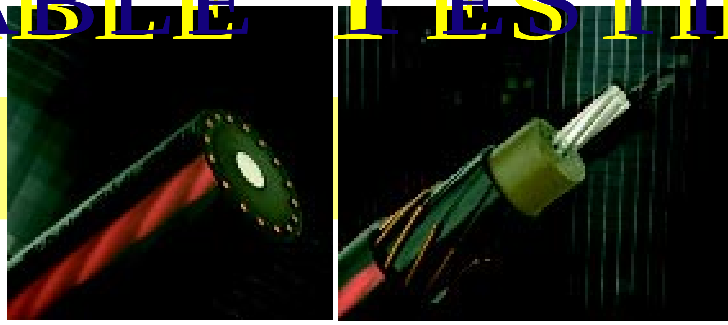
visit http://www.hubbellpowersystems.com

FEBRUARY 1998

ANDERSON • CHANCE • FARGO • HIPOTRONICS • KERITE • OHIO BRASS



ACCELERATED CABLE TESTING



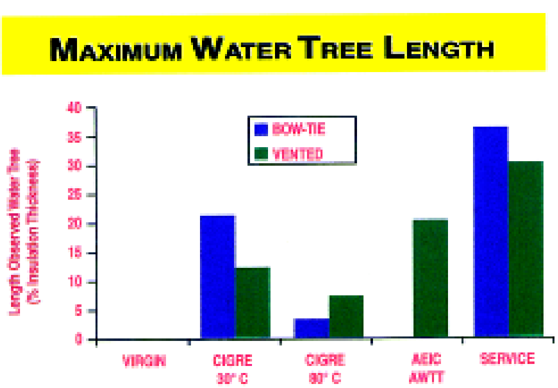
Beware of misleading data!

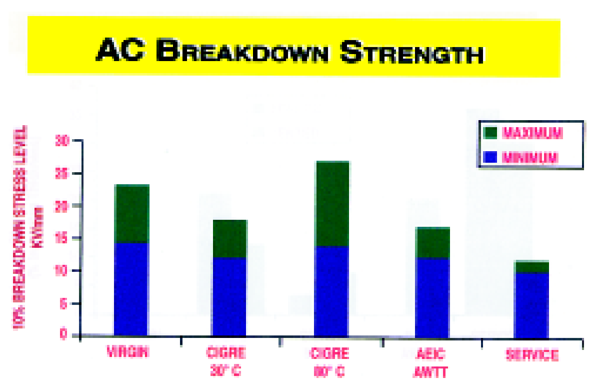
When it comes to medium voltage cables there are many choices of insulation materials, Crosslinked Polyethylene (XLPE), Tree-Retardant Crosslinked Polyethylene (TR-XLPE), and several different formulations of Ethylene Propylene Rubber (EPR), including Kerite. The challenge faced by today's utility engineers is sorting through the claims of cable manufacturers and material suppliers.

Accelerated cable tests have long been used to try to quantify the expected life of the various cable types. The goal of accelerated testing is to speed up the aging process in cables and obtain results that can be extrapolated to predict actual field performance. This is a noble goal but, unfortunately, one that has not yet been achieved! Engineers and scientists continue to search for the proper combination of electrical and environmental factors that will yield the same failure mechanisms as are found in field aged cables. (Graphs below)

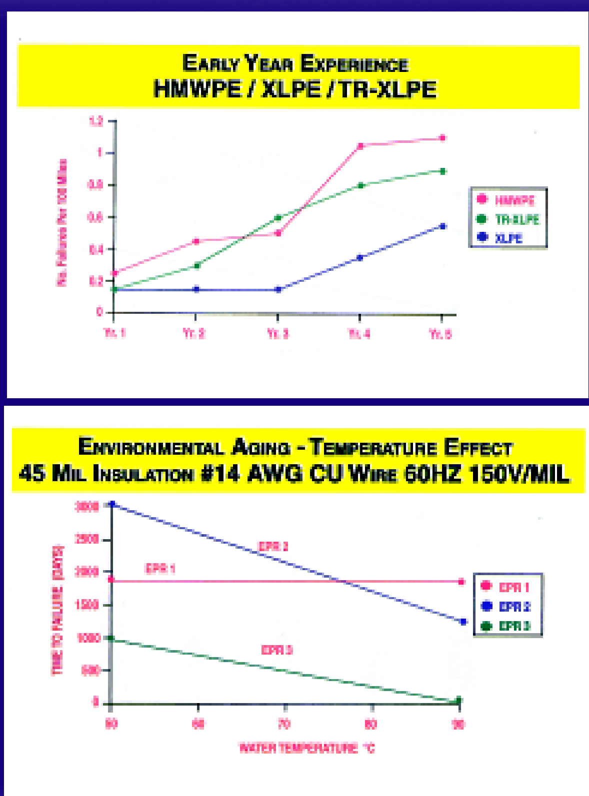
The fact that there is not a direct correlation between short-term test protocols and field performance[1] has not stopped cable and material suppliers from using these test results to promote their marketing claims. As a cable supplier, Kerite encourages engineers to evaluate all the available data in making specification/procurement decisions. History has proven the wrong decision can lead to unacceptable levels of system reliability resulting in expensive cable replacement programs.

Ironically, the cable designs that are now being replaced were selected based on what was believed to be excellent results in short-term tests. Retention of AC breakdown strength combined with low initial cost made High Molecular Weight Polyethylene (HMWPE) cables look attractive. Wide spread failures in less than 10 years of field service lead to the evolution of XLPE and, after its troubled field performance, to today's offering of TR-XLPE. Each generation claimed to correct the problems of the last. While improvements have been made, available field failure data show very similar curves when looking at the early history of each material[2].





EPR insulations have evolved concurrently with XLPE and TR-XLPE, and again short-term tests have been used to support claims of superiority over the polyethylene based cables. The attempt to combine XLPE, TR-XLPE and several different EPR formulations in a single accelerated test adds further complication to the accelerated testing debate. This is because XLPE, TR-XLPE and various ERP formulations each have very different mechanical, physical, electrical and aging properties. This makes it impossible to achieve a common accelerating criterion and, therefore, a specific test protocol may be biased for or against a specific insulation type.



There has been continuing work using higher and higher voltage levels, in fact many of the results published today are based on tests at four times the rated voltage. These higher stress levels can produce misleading results by introducing failure mechanisms not experienced in field-aged cables. Another factor that can lead to inappropriate conclusions is the role of water in the test protocol. Water is acknowledged to cause degradation in insulation materials and is present in virtually all accelerated test protocols. However, by testing products with filled (water-blocked) conductors and overall jackets, water will not migrate into the insulation during the normal test period (90-120 days). While these construction alternatives do slow the ingress of water in actual field applications, the cables will become wet within the first several years of service. This protocol is misleading as it only reduces the role of moisture in cable aging.

Tree-Retardant Crosslinked Polyethylene (TR-XLPE) is claimed to provide improved performance with respect to water treeing. Examination of service aged cables, (table below) however, reveals the presence of bow tie and vented trees on cables less than five years old[3]. The

TR-XLPE Water Tree Count

Years of Service	Bow-Tie Trees Max Length (mm)	Vented Trees Max Length (mm)
5	0.50	0.12
6	0.47	0.12
7	0.40	—

growth of trees in TR-XLPE is consistent with data and tests conducted on XLPE service age cables (eight to 10 years old[4]). The XLPE cables also showed there was no significant difference in remaining AC breakdown strength between good and poor performers. Small bow-tie water trees (initiated inside the insulation wall) were found in almost all cable installed in a wet environment. The only difference between good and bad service performers was the size and population of vented water trees (initiated between the conductor shield and insulation interface).

In conclusion, if an accelerated test is to be of value, the test conditions must be sufficient to obtain results in a reasonable time period but must not be so severe that the failure mechanism in the lab is not representative of field service. It must be understood that different insulation materials may require different accelerating factors. Just as selection of conditions will affect the outcome, the specific evaluation criteria (time to first failure, mean time to failure, retention of physical and or electrical values) can alter the conclusions[5]. The ultimate meaningful test is field proven performance. ■

References
1. E.F. Steennis, Water Treeing - the Behavior of Water Trees in Extruded Cable Insulation. Thesis, University Delft, KEMA, 1989

2. A. Kong, Cable Operations Report. Insulated Conductors Committee, Power Engineering Society, IEEE, Minutes of the 87th Meeting Fall, 1990

3. S.R. Szaniszlo, Performance of Field Aged TR-XLPE, Insulated Conductors Committee, Power Engineering Society, IEEE, Minutes of the 96th Meeting Spring, 1990

4. J.E McBride, V.S. Harper, L.T. Coffeen, F.T. Stanley, H.W Ng, Examination and Location of Partial Discharge Sites In Severely Aged Underground Distribution Cables. IEEE Summer Power Meeting 1993

5. W.D. Wilkens, Environment Effects of the ate of Aging of EP-Insulated Power Cable, IEEE Trans. Electrical Insulation, December 1981, p.521

For more information, contact your Hubbell representative or fax 573-682-8714.

Wildlife Protectors

Guard Bushings & Equipment

Moulded from track-resistant polypropylene and stabilized with inhibitors to resist deterioration from ultra violet, tracking and weather, these Fargo protection devices shield wildlife from accidental contact with equipment. Use them on distribution transformers, reclosers, regulators and pot head bushings. Great for protecting substation transformers and circuit breakers, too.

Install by hand or hot line tool. Hinged one-piece construction makes for a quick and easy installation. No need to disconnect the equipment tap wire during installation. "Fingers" on cable entry ports close around tap conductor and cover unused ports. Protectors fit snugly on various size bushings. A locking action is provided by the combination of protrusions under the top skirt and rolled edges that captivate the conductor to maintain the protector's position. ■

For more information, contact your Hubbell representative or fax (914) 471-8073.

Now Moisture Eater II

The easy way for hot-line crews to form a good daily habit for tool care

IS HANDY AS YOUR POCKET!

Take care of your tools and they'll take care of you. This has been the rule of thumb for veteran line-workers. It's the same message now being sent by OSHA. It's just as wise. Now we're making it easier.

Every day. That's exactly how often insulated hot-line tools should be cleaned. This makes good sense – especially from your end of the stick.

In the past, daily cleaning has meant trying to keep a jug of liquid onboard your truck along with some clean, soft cloths. And that's made the "every day rule" a tough one to follow for any line crew.

Now, Moisture Eater II Wipes make it convenient for line crews to keep their sticks safe. *Every day!*

Catalog No. C400-2538 designates one dispenser box of 50 Moisture Eater II Wipes.

Hang a dispenser box on every line truck

Just zip open a foil packet, pull out the wet towel and clean any brand of hotstick. No more rags to store or try to keep clean in the field. No more big spills, evaporation losses in storage or wasteful excesses just to wet large cloths.

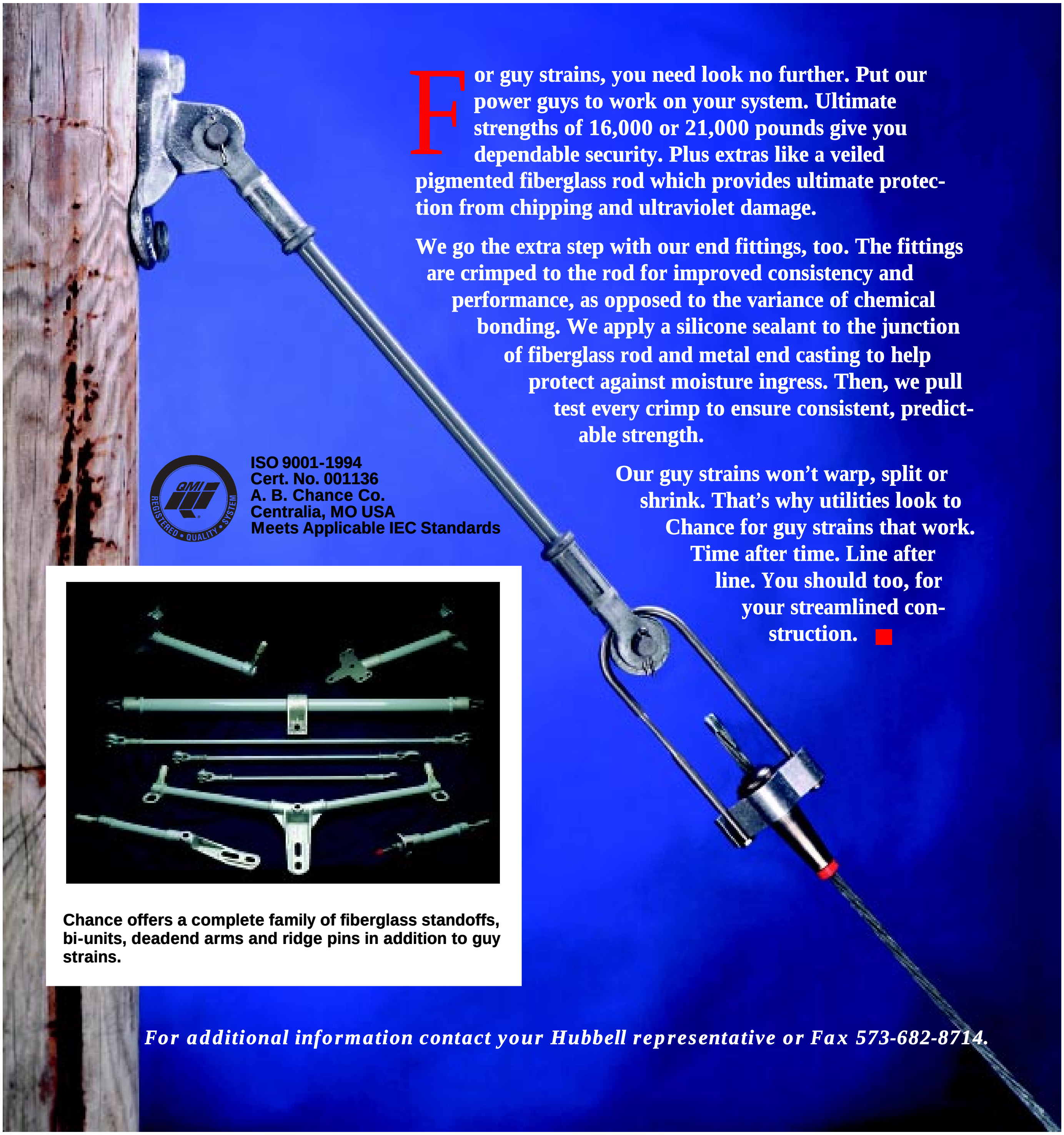
Individually-sealed, each wipe is saturated with a half ounce of our patented orange-scented Moisture Eater II solvent. It's specially formulated to effectively clean contaminated fiberglass-reinforced plastic products. Now, pre-applied to a lint-free disposable towel, its compact convenience encourages daily use.

To remind everyone of the "every day rule," the hanger box lets you put 50 wipes in reach right where they're needed: In crew bays, on trailers, in trucks, wherever hot-line tools are used. The dispenser slot and message on front – "You can comply with OSHA!" – urge everyone to use a Moisture Eater II Wipe one at a time, *every day*. ■

For more information, contact your Hubbell representative or fax 573-682-8714.

Fiberglass Guy Strain Insulators

16,000 or 21,000 Pounds of Power



For guy strains, you need look no further. Put our power guys to work on your system. Ultimate strengths of 16,000 or 21,000 pounds give you dependable security. Plus extras like a veiled pigmented fiberglass rod which provides ultimate protection from chipping and ultraviolet damage.

We go the extra step with our end fittings, too. The fittings are crimped to the rod for improved consistency and performance, as opposed to the variance of chemical bonding. We apply a silicone sealant to the junction of fiberglass rod and metal end casting to help protect against moisture ingress. Then, we pull test every crimp to ensure consistent, predictable strength.

Our guy strains won't warp, split or shrink. That's why utilities look to Chance for guy strains that work. Time after time. Line after line. You should too, for your streamlined construction. ■

ISO 9001-1994
Cert. No. 001136
A. B. Chance Co.
Centralia, MO USA
Meets Applicable IEC Standards

Chance offers a complete family of fiberglass standoffs, bi-units, deadend arms and ridge pins in addition to guy strains.

For additional information contact your Hubbell representative or Fax 573-682-8714.

NEW VIDEO

Foundation and guy anchoring methods for transmission structures

Here's the latest addition to our lending library of videotapes. It gives details on crew safety, tools and installing techniques for compression foundations and tension-guy anchors used to support power transmission structures.

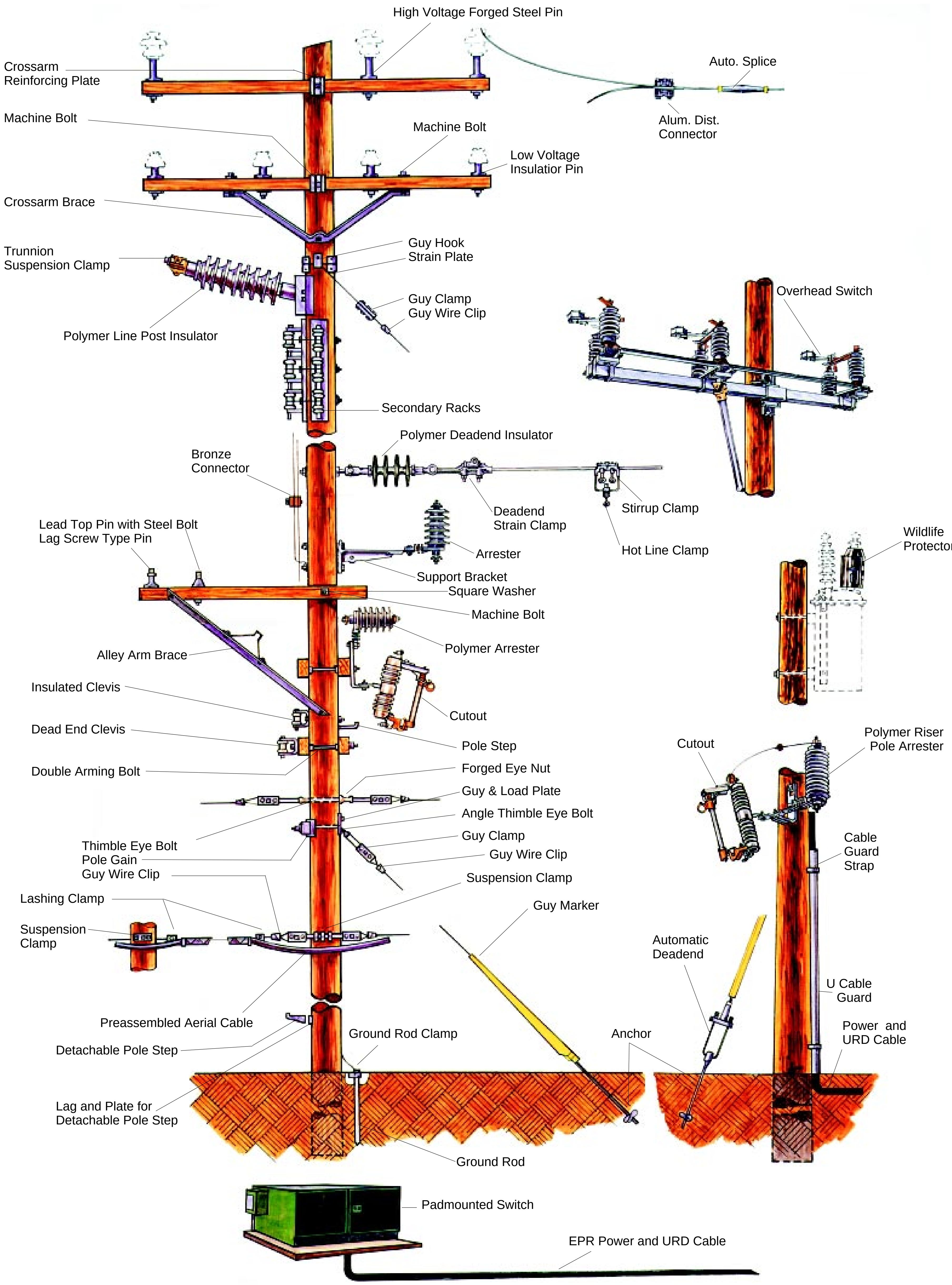
In just 13 minutes, it condenses valuable key elements for proper field

procedures from demonstrations by the Chance anchor engineering staff.

New and experienced crews alike can learn from this brief, yet definitive, instructional aid. ■

To borrow a copy of Video No. 65, "Transmission Structures: Power-Installed Foundations and Guy Anchors," fax your request to 573-682-8714.

Your source for distribution products



HUBBELL® POWER SYSTEMS

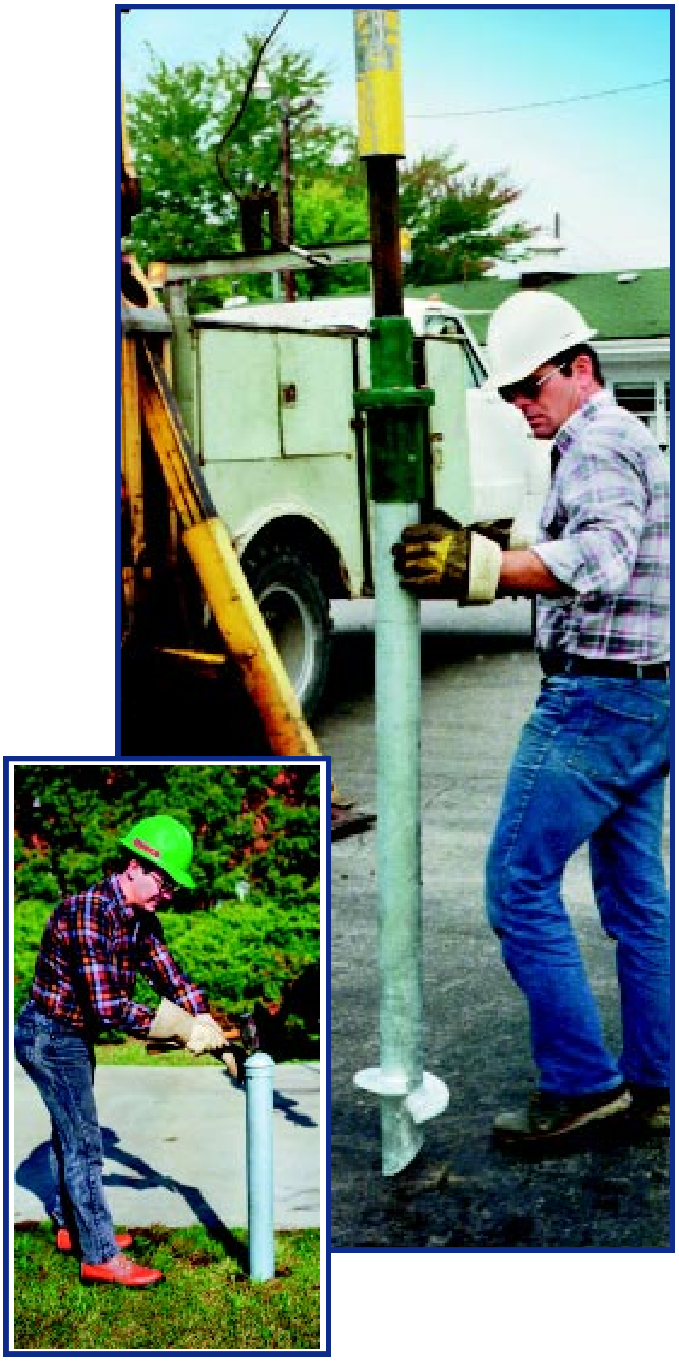
The Companies of Hubbell Power Systems

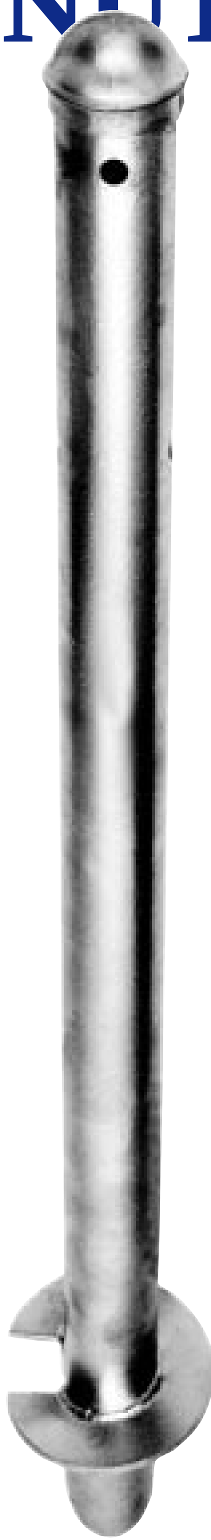
ANDERSON™ CHANCE® FARGO® HIPOTRONICS® Kerite® OHIO BRASS®

Bumper Posts

Long-term protection with power-installed speed

TAKE 10 MINUTES





Savings as high as 50% versus other methods.

No mess, no fuss and tremendous savings are advantages of Chance power-installed bumper posts. These galvanized posts provide instant protection for transformers, switchgear, guys and poles.

Installation takes just minutes rather than the hours for traditional concrete methods. Power diggers quickly install Chance bumper posts, even through blacktop surfaces, and in any weather!

Each 3-inch-diameter bumper post has an 8-inch helix. Available lengths are 60, 75 and 84 inches. Installing torque of 3,000 to 4,000 ft.-lb. is typical. Customers have found the posts impervious to frost dislocation.

In many instances, installing Chance bumper posts does not require additional tools. The Kelly bar can be inserted into the bumper post and pinned with a throughbolt for direct driving. Other methods available from Chance include tools that bolt to Kelly bar adapters or couple with locking dog assemblies. ■

For more information, contact your Hubbell representative or fax 573-682-8714.

OHIO BRASS SURGE ARRESTERS

In recognition of the increased pressures the utility industry is experiencing today, Ohio Brass is introducing three additions to its cost effective line of polymer housed intermediate class surge arresters (Type PVI). These products will allow utilities to get adequate surge protection while controlling costs.

Higher Voltage Ratings

In the past, the PVI product line has been available only for voltage up to 84kV MCOV (For application on systems up to 138kV). The PVI now is available in four new ratings:

Catalog Number	MCOV (kV)
300088	88
300098	98
300106	106
300115	115

Lower Profile Design

The PVI surge arrester has excellent pressure relief properties and mechanical strength. However, it does have a relatively large outside diameter (7.6") which makes it difficult to use in some applications. The new PVI-LP™ (low profile) design addresses

CONTINUED, NEXT PAGE

this issue. The PVI-LP arrester is available in voltages up to 34.5 kV system.

Integral Blade Cap

In the past, the only way to get a blade type cap on a polymer intermediate arrester was to use the bolt on terminal number 273373. We now are making the blade cap (formerly only available on the polymer station class arrester Type PVN) available on the PVI arresters. This can be ordered by specifying the arrester by Part Number 304xxx-3001, where the xxx indicates the arrester MCOV.

Benefits of New Options

Higher Voltage Ratings

Many utilities use intermediate class surge arresters in their substations to provide acceptable levels of protection at a lower cost than station class arresters. In the past, using these arresters was limited by the maximum voltage rating of 84 kV. The new higher ratings available will allow utilities to control costs in substations where station class surge arresters are not warranted due to reliability and/or system requirements.

Lower Profile Design

The overall diameter of the original PVI design is 7.6". The new PVI-LP arrester has an overall diameter of only 4.25". Both profiles are shown on the preceding page. The smaller profile makes this new product especially suited to applications requiring tighter clearances, such as in enclosures. The original PVI design is still available if your application requires a high mechanical strength or pressure relief rating.

Integral Blade Cap

The introduction of the integral cap greatly simplifies the installation of conductors to the line end of the arrester. This will result in a labor savings to the utility.

Differences Between Station and Intermediate Class Surge Arresters

There is sometimes confusion about which arrester is best to use for a given application. The main differences between station and intermediate class surge arresters center on the following characteristics:

1. Protection level
2. Energy capability
3. Pressure relief rating
4. Mechanical strength

Protection Level

The only reason to buy an arrester is to provide surge protection. In this respect, the arrester acts as an insurance policy for electrical equipment. Just like insurance policies that provide different levels of protection, different surge arresters provide different levels of protection.

The level of protection of surge arresters is defined by the discharge voltage which is in the catalog information. The discharge voltage of arresters is listed for various levels of surge currents. The lower the discharge voltage, the better the level of protection. The discharge voltage of the arrester is the product of the resistance of the arrester times the surge current (V=IR) and is often referred to as the IR of the arrester.

The table below shows the relative IR levels of selected ratings of PVI (Intermediate Class) and PVN (Station Class) arresters.

Type	Catalog No.	MCOV (kV)	Switching Surge	10kA IR (kV)
Intermediate	300042	42	105.0	144.0
Station	314042	42	102.8	131.3
Intermediate	300115	115	291.0	384.0
Station	314115	115	285.0	351.0

This summary shows that the polymer station class surge arrester provides a better level of protection

Energy Capability

Station and intermediate class surge arresters typically are used in substation applications where the possibility of high energy discharges exist. These discharges can be from line switching or other system generated causes. The PVI arrester can absorb 3.4 kJ/kV-MCOV and the value of the PVN station class surge arrester is 4.9 kJ/kV-MCOV. But what do these values mean in the real world? Ohio Brass has a publication that will help to determine what the length of line that a given arrester can discharge. Ordering information for this is given below. Based on the informa-

Type	Catalog No.	MCOV (kV)	System Voltage (kV)	Max. Line Length (kM)
Interm.	300015	15.3	24.5	4,800
Station	314015	15.3	24.5	7,125
Interm.	300042	42	69	1,840
Station	314015	42	69	2,525
Interm.	300115	115	138 (Delta)	3,050
Station	314115	115	138 (Delta)	3,450

tion in this publication, the table below shows the length of line that can be discharged by specific station and intermediate arresters.

The foregoing makes it clear that the line lengths that would be sufficient to fail either a station or an intermediate arrester exceed the length of any line in the world. There would, of course, be special applications such as capacitor banks where a greater energy requirement would be dictated; but, in general, either arrester would give good performance.

Pressure Relief Rating

It is unlikely that a station or intermediate arrester will fail in service. However, if a failure does occur, the polymer arrester provides a higher level of safety to personnel and equipment. Porcelain station arrester pressure relief ratings are based on the current during only the initial failure. Because it is a common utility operating practice to reclose at least once into a fault, there is an excellent possibility that a porcelain arrester may violently fragment during a reclose operation.

The PVI arrester has a high level of pressure relief capability, but on some strong systems the rating may be exceeded. In this case, a station arrester would be the logical choice.

The polymer design Station and Intermediate arresters incorporate the ability to be reclosed upon repeatedly. The table below summarizes the pressure relief capabilities of Ohio Brass MOV arrester designs:

Type	Description	Symmetrical kA
Intermediate	Type VI 3-120 kV Rated (Porcelain)	25.0
Station	Type VL 3-48 kV Rated (Porcelain)	65.0
Station	Type VN 54-312 kV Rated (Porcelain)	93.0
Intermediate	Type PVI 3-144 kV Rated (Polymer)	25.0*
Station	Type PVN 3-144 kV Rated (Polymer)	80.0*

* Successfully withstood reclose operation.

CONTINUED, NEXT PAGE

More information on pressure relief capabilities of Station and Intermediate arresters can be found in the bulletins listed below.

Mechanical Strength

One of the advantages of polymer housed surge arresters is that they are more flexible than porcelain housed arresters. This makes them more resistant to such severe mechanical loading events as seismic activity. The ultimate mechanical strength of the PVI (Polymer Housed Intermediate) is 10,000 inch-pounds and for the PVN (Polymer Housed Station Class), 20,000 inch-pounds. The recommended maximum working load is 50% of ultimate strength.

Some applications lend themselves better to horizontal mounting of the arrester. The polymer arresters are more suited to this than the porcelain since the polymer arrester is much lighter than the equivalent porcelain. Much of the strength of a porcelain arrester is consumed by supporting its own weight. Weights of typical porcelain and polymer arresters are shown below:

Type	MCOV (kV)	Weight (lbs.)
Porcelain Intermediate	42	124
Polymer Intermediate	42	28
Porcelain Intermediate	84	214
Polymer Intermediate	84	54
Porcelain Station	42	180
Polymer Station	42	52.6
Porcelain Station	84	280
Polymer Station	84	98.9

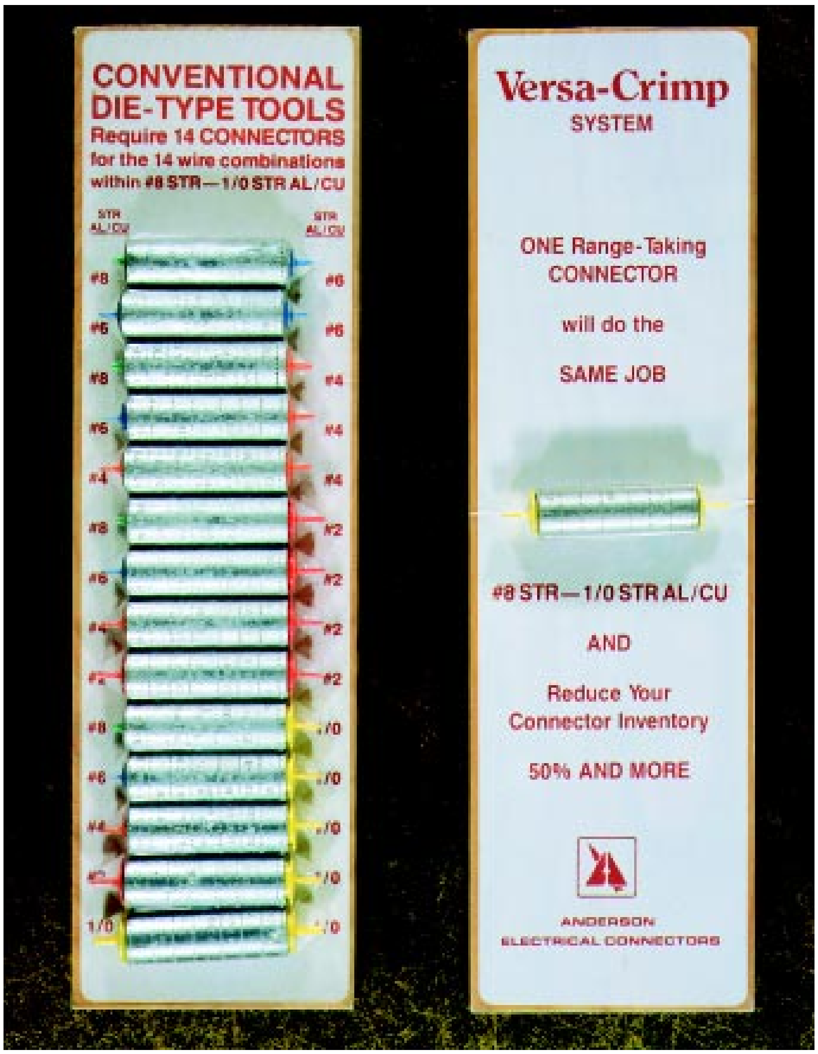
Summary

This provides only an overview of the differences between station and intermediate class arresters. For more information on this subject, request copies of the following publications:

Titles	Bulletin Numbers
Intermediate or Station Class Arresters	EU1094-H
Why Should You Replace Old Station & Intermediate Class Arresters?	EU1279-H
Porcelain Versus Polymer-Pressure Relief	EU1456-H
Calculation of Arrester Energy During Transmission Line Switching Surge Discharges	EU1426-H

For more information, contact your Hubbell representative or fax (573) 682-8714.

Replace 14 Conventional Die-Type Connectors with ONE Anderson VERSA-CRIMP® Range-Taking Connector



Look at the benefits:

1. Reduce connector inventory.
2. Reduce down-time/maintenance cost associated with improper die choices.
3. Reduce installation time.
4. Reduce cost by eliminating dies.
5. Reduce field errors due to incorrect die selection.
6. Reduce lineman fatigue with lightweight tool design.

NOTE: One connector only replaces 14 if crimped with a VERSA-CRIMP® compression tool.

For additional information, contact your Hubbell representative or fax (573) 682-8714.

VERSA-CRIMP® CUTTING TOOL SOLUTION FOR CONFINED WORK AREAS

Anderson offers a complete family of compression tools. These VERSA-CRIMP tools eliminate the need for die-type compression tools.

Ideal for aerial bucket and trench work

This Anderson battery-powered cutter is just what you need in confined areas. It's made for one-handed operations. Compact, 17" x 12" x 3"; light, only 14 pounds; tough, cuts ACSR, aluminum and copper conductors up to 1.50". Cuts standard guy wire and ground rod sizes up to 5/8".

To use, simply remove the pin latch, place cable into the jaw, reinsert the pin and press the trigger to cut. You're done. A built in by-pass will pop off if the material is beyond cutter's capacity.

Tool is shipped with high impact plastic carrying and shipping case, service manual, two batteries, AC charger and shoulder strap. Ask for Model VCACSRCC-BP. ■

For additional information, contact your Hubbell representative or fax (573) 682-8714.

Vol. 4 No. 1 **February 1998**

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.**

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

ADDRESS SERVICE REQUESTED
FORWARDING AND RETURN POSTAGE GUARANTEED

BULK RATE
U.S. POSTAGE PAID

Hubbell / Chance

HUBBELL® POWER SYSTEMS

visit http://www.hubbellpowersystems.com

ANDERSON™ CHANCE® FARGO® HIPOTRONICS® Kerite® OHIO BRASS®

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

Printed in USA
LM