

# HURBELL<sup>®</sup> TIPS & NEWS

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<http://www.hubbellpowersystems.com>



# Introducing

## HUBBELL TYPE C-POLYMER CUTOUTS

- Light in weight • Easy to handle
- Increased leakage distances • Durable

U.S. and International Patents Pending

**A** product of “natural evolution,” the Hubbell Type C-Polymer Cutout combines 50+ years of Chance cutout technology with 30+ years of Ohio Brass polymer insulator technology. The synergy of these two developments results in a product with time-proven benefits of both: The current-carrying components of our porcelain cutout mounted on the lightweight, durable ESP™ Polymer insulator.

### POLYMER INSULATOR UPGRADES CUTOUT PERFORMANCE

Type C-Polymer cutout insulators are manufactured with ESP™ silicone alloy rubber, the same material used in Ohio Brass PDV arresters and Hi\*Lite® Insulators. ESP is a polymer compound made by alloying silicone and EPDM rubber. This alloy offers the desirable toughness and resistance to tracking of our original EPR, with the hydrophobic characteristics derived from low molecular weight silicone oils.

The increased metal-to-metal leakage distance for a 15kV Type C-Polymer Cutout of 12.6" (319 mm) compares to its porcelain predecessor at 8.7" (220 mm).

Significantly lighter, Type C-Polymer Cutouts typically weigh approximately half of their porcelain counterparts. Their ergonomic shape adds another advantage that makes them easier to install, too. With only two fingers a lineworker can hold a Type C-Polymer Cutout whereas a porcelain cutout requires the

Hubbell Type C-Polymer Cutouts initially are available in 15kV (110 kV BIL) in Standard, Linkbreak, Loadbreak with arc chute interrupter, Electronic Sectionalizer, plus Cutout-Arrester Combinations for any of these kinds of cutout. Fuseholders with synthetic arc-quenching liners are available in 100-amp and 200-amp ratings, plus 300-amp solid blades.



# Anatomy of the Type C-Polymer Cutout

TWO-PLACE LOCKING TO PREVENT SIDE MOVEMENT OF HOOD, CONTACTS OR HOOKS

GALVANIZED-STEEL CHANNEL

STAINLESS STEEL BACKUP SPRING TO MAINTAIN CONTACT PRESSURE

SILVER-TO-SILVER CONTACTS

GALVANIZED STEEL HOOKS FOR LOADBREAK TOOL

CAST BRONZE TOP TUBE CASTING AND PULL RING

HIGH-STRENGTH FIBERGLASS FUSE TUBE COATED WITH ULTRA-VIOLET INHIBITOR

LARGE NUT TO FASTEN FUSELINK WITHOUT BREAKING STRANDS

HOT STICK HOLE IN TRUNNION CASTING

CAST BRONZE LOWER TUBE CASTING

STAINLESS-STEEL SPRING PROVIDES PROPER TOGGLE ACTION OF FUSELINK EJECTOR (CAST-BRONZE ON ALL 200-AMP AND LINKBREAK FUSEHOLDERS; STAINLESS-STEEL ON ALL 100A)

TIN-PLATED BRONZE TERMINALS FOR USE WITH COPPER OR ALUMINUM CONDUCTOR

COPPER CURRENT PATH

POLYMER INSULATOR

SYNTHETIC FUSE TUBE LINER

COPPER CURRENT PATH

CAST BRONZE HINGE FOR CORROSION RESISTANCE  
FUSEHOLDER TOGGLE LATCH LIMITS TENSION OF FUSELINK

full grasp of one hand. Also much more resistant to fractures than porcelain, the polymer insulator can reduce or eliminate losses from routine shipping, storage and handling.

## LESS IS MORE: BETTER LEAKAGE WITH LESS WEIGHT

Hubbell Type C-Polymer Cutouts have 45% more leakage (creepage) distance than their porcelain counterparts. This is achieved by the relationship between the outer weathershed diameter and that of the central shank, the polymer insulator's "form factor," which means it will dry faster even when contaminated. This stops the flow of leakage current and supports the system voltage across the dry bands.

Other advantages over traditional porcelain insulators are the polymer insulator's high strength-to-weight ratio, forgiving overmolded weathershed skirts, and fiberglass-reinforced pultruded center rod with high torsional and flexural strength as its rigid core.

## LAB TESTING KEY TO POLYMER-INSULATED APPARATUS

Hubbell Power Systems has research and development laboratories unmatched by any other polymer cutout manufacturer.

The Ohio Brass research laboratories perform extensive tests on the ESP™ polymer material, including tracking, QUV, corona cutting, salt fog, oxidative stability

Continued . . . 

and differential thermal analyses. These tests confirm the quality of the material. The OB laboratories also perform environmental and dielectric tests on various insulator designs.

The A.B. Chance Company research laboratories perform a full range of dielectric, high-current interruption and thermal tests on cutout designs as specified by applicable national and international standards.

**FUNCTION-DRIVEN DESIGN DETAILS**

Design characteristics essential to the Type C-Polymer Cutout’s superior mechanical and electrical performance include:

- Crimping of hardware onto rigid center fiberglass rod for tensile strength,
- Rounded hardware inserts to reduce electrical stress concentrations,
- Chemical bonding of center rod and hardware to polymer weathershed for electrical integrity,
- Interlocking square hardware and serrated fasteners on end fittings for secure assembly alignment,
- Sealed hardware, via polymer overmolding and blind end-fitting bolt holes, to exclude moisture.

**SURPASSES BOILING WATER/STEEP WAVE INDUSTRY TEST**

The above design features result in a cutout with insulation that can withstand 250% of ANSI C29.13 criteria for a boiling water/steep wave test requiring 10 positive and 10 negative impulses with a rate of rise of 1000 kV/micro-second.

ESP™ Polymer Insulators pass a much more stringent standard imposed by Hubbell Power Systems laboratory testing: 25 each of such positive and negative Steep Waves. This confirms the validity of the design criteria of bonded interface, and rounded and crimped hardware.

**TIME-AND-LAB-PROVEN BENEFITS READY FOR SERVICE**

The Hubbell Type C-Polymer Cutout is an innovative new product which combines two technologies well proven in the lab and on the line: Ohio Brass polymer insulation and Chance cutouts.

It is a new product with a difference. Unlike some new products, you can confidently depend on previous experience with these proven technologies and bypass lengthy trial periods. It is a product ready to be installed on your system. ■

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

Serrated fasteners and interlocking square hardware maintain secure alignment of Type C-Polymer Cutouts.



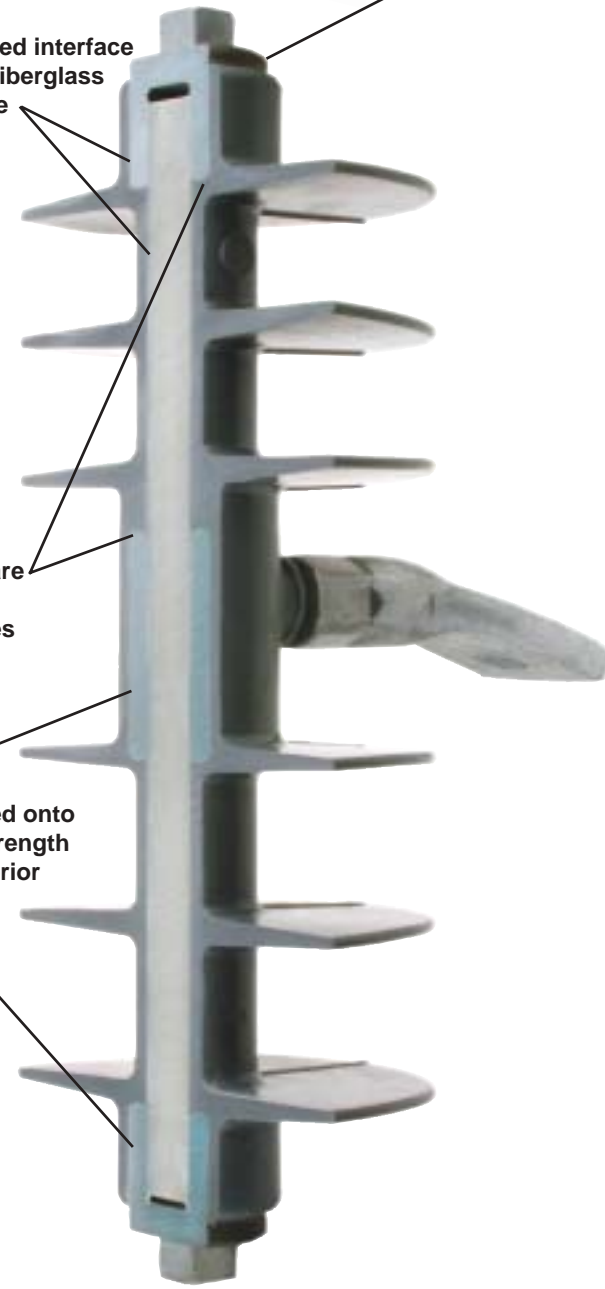
Watertight Seals

- Blind bolt hole in end fittings
- Polymer weathershed overmolded onto hardware

Chemically bonded interface of polymer with fiberglass rod and hardware

Rounded hardware edges reduce electrical stresses

Hardware crimped onto rod for tensile strength and uniform exterior geometry



# Lightning protection for transmission lines virtually eliminates lightning related breaker operations



**D**uring 1988, Ohio Brass (OB) introduced the Protecta\*Lite® system for virtually eliminating lightning-related breaker operations. Available in combination with an OB insulator for new construction or without an insulator for retrofit applications, the system uses metal-oxide varistor (MOV) technology

that has existed since 1976 and polymer arresters since 1986. OB Hi\*Lite® polymer insulators have proven polymer durability since 1976 thus giving the system a long history of outstanding polymer performance.

The concept of placing arresters on transmission lines is not new. Expulsion tubes have successfully protected transmission lines for decades. The Protecta\*Lite system can be used on a “need” basis in trouble zones only or throughout the line. Equivalent performance to overhead shield wire can usually be obtained by using an arrester on the top phase only with success dependent on a good ground. Performance superior to an OHSW can be obtained by using arresters on all three phases. Unlike shield wire, success is not limited by the requirement for a good ground. When the system is installed on all three phases, shielding failures and backflash problems are virtually eliminated.

With the OB Protecta\*Lite lightning protection system, electrical losses are minimal. The polymer material used has a life expectancy in excess of 50 years. The arresters can pass 100,000 amp discharges and remain in service. Plus, there is a no lockout feature when using the Protecta\*Lite arrester. The system adapts to existing structures, right-of-way, and in some instances, the same insulators. System appearance is clean and more aesthetically appealing than a taller structure with OHSW.

With lightning interruptions costing consumers and utilities millions of dollars, you can help prevent the loss with the cost effective protection of the Protecta\*Lite system for unshielded lines and supplemental protection for shielded transmission (and distribution) lines. The theory is simple and effective. A metal-oxide surge arrester used in parallel with the line insulation limits voltage across the insulation to a value below the insulator flashover voltage during a surge. Lightning surge current is diverted to ground in a controlled manner and service is not interrupted.

Contact us to conduct a line performance and cost savings estimate on your circuit. ■

**For more information, contact your Hubbell Power Systems representative, fax 573-682-8714 or e-mail [hpscontact@hps.hubbell.com](mailto:hpscontact@hps.hubbell.com).**

# XCEL ENERGY DRAMATICALLY CUTS LIGHTNING INDUCED TRIPS

Number falls from a high of 20 to 30  
per 100 line miles to 8 to 10 trips

By:

Steve LaCasse  
Consulting Engineer, Transmission  
XCEL Energy  
Minneapolis, MN



**W**e were faced with several hundred miles of unshielded lines with unacceptable service levels because of lightning induced outages. The basic issue was one of reliability that we needed to resolve. In past years we tried several different arrester types to try to solve the problem (expulsion tubes, gap type) but the results were unacceptable. We also used shield wire on metal bayonets on one line but this was costly. Most lines did not have adequate pole strength. The choice came down to installing shield wires across several 69kV lines or find a more economical approach. We looked to Ohio Brass (OB) for a solution.

During the three year period of 1994-1996, we installed about 6,000 Ohio Brass Protecta\*Lite® systems to help protect the troubled 69kV lines. The program has met with great success. From a high of 20 to 30 trips per year per 100 line miles, we've cut the number to eight to 10.

The first 1,000 OB Protecta\*Lite systems we installed consisted of polymer insulator and arrester combinations. Installations included mostly posts with some suspension applications.

... continued 



*Protecta\*Lite polymer life expectancy exceeds 50 years.*

*Nuisance outages on unshielded lines dropped from a high of 30 per 100 line miles to eight to 10 on the XCEL Energy transmission lines once Protecta\*Lite arresters were installed.*

*The arresters can be installed "as needed" in trouble zones. Result is less maintenance and service reliability.*

*Protecta\*Lite arresters can be used on existing structures and right-of-way and in some cases the same insulators. Or, in combination with new polymer transmission insulators as a complete assembly.*

The results were completely satisfactory. In fact, after the first installations, we simply began using the Protecta\*Lite arresters alone suspended from conductors. OB makes it easy to use the system because you can get it from the factory already in combination with an insulator (as we originally began) or without an insulator. The Protecta\*Lite system simply consists of a metal-oxide surge arrester used in parallel with the line insulation. During a surge, the lightning current goes to ground in a controlled fashion and the insulation remains sound.

We installed the arresters on all tangent structures but not on some corners. The result was immediate with few outages once the installations were made.

During installation, we took the lines out of service. Even though we used the protection system on existing lines, another option is to use the product on new construction. Typical installation time per Protecta\*Lite assembly was two to three hours depending on terrain. Because it is polymer, the product is light and easy to handle. ■

**For more information, contact your Hubbell Power Systems representative, fax 573-682-8714 or e-mail [hpscontact@hps.hubbell.com](mailto:hpscontact@hps.hubbell.com).**

# NEW

◆ HOT LINE TOOLS ◆

[www.hubbellpowersystems.com](http://www.hubbellpowersystems.com)

## CHANCE<sup>®</sup> NOW 'BLANKETS'

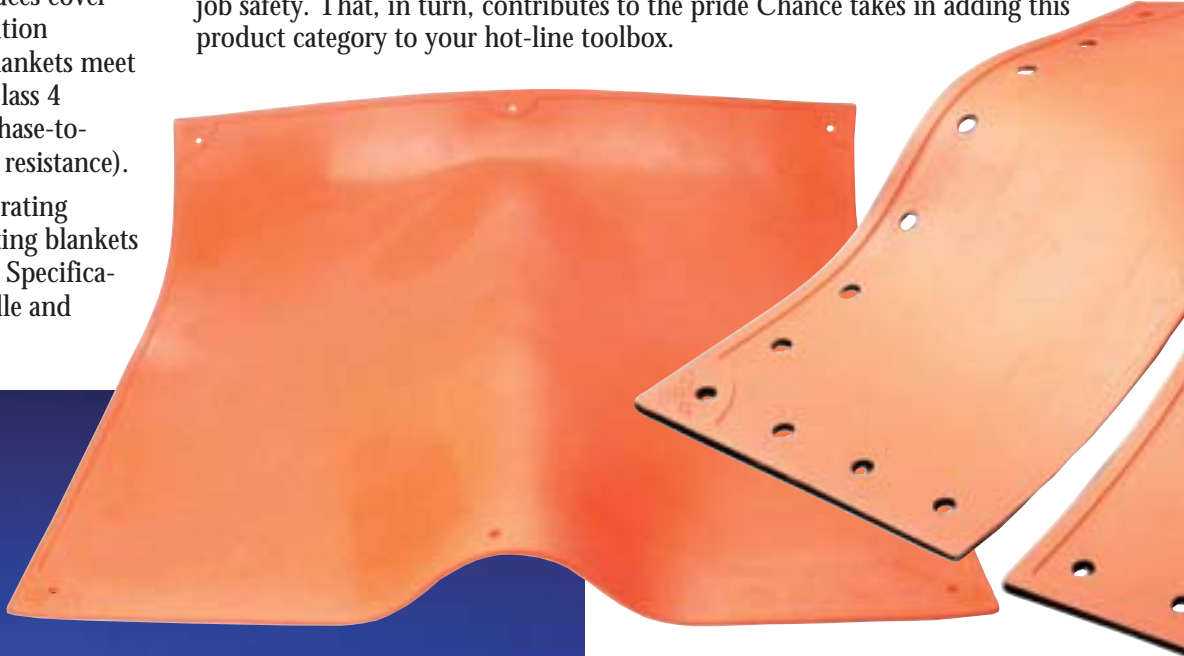
*Class 4 cover up for 36 kV complies with ASTM D 1048*

## ALL DISTRIBUTION VOLTAGES

**A**s you'd expect from the top-of-the-line supplier of hot-line tools, Chance proudly introduces cover-up blankets for **all** distribution voltages. Chance rubber blankets meet ASTM requirements for Class 4 (maximum use at 36 kV phase-to-phase) and Type II (ozone resistance).

This gives you the highest rating available for rubber insulating blankets in accordance with ASTM Specification D 1048. Easy to handle and

clean, they deliver all the performance you've come to expect in the tools you prefer. For protection against accidental contact with system components during energized maintenance procedures, Chance rubber blankets contribute to lineworkers' on-the-job safety. That, in turn, contributes to the pride Chance takes in adding this product category to your hot-line toolbox.



*Chance solid and slotted blankets come in 36" x 36". Slotted blankets have a 1½"-diameter center hole to fit easily around common hardware.*



*Flexible to cover many irregular shapes, rubber blankets typically are used with conductor covers (flexible or rigid) on deadends, apparatus, secondary racks, poletop pins and crossarms.*

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

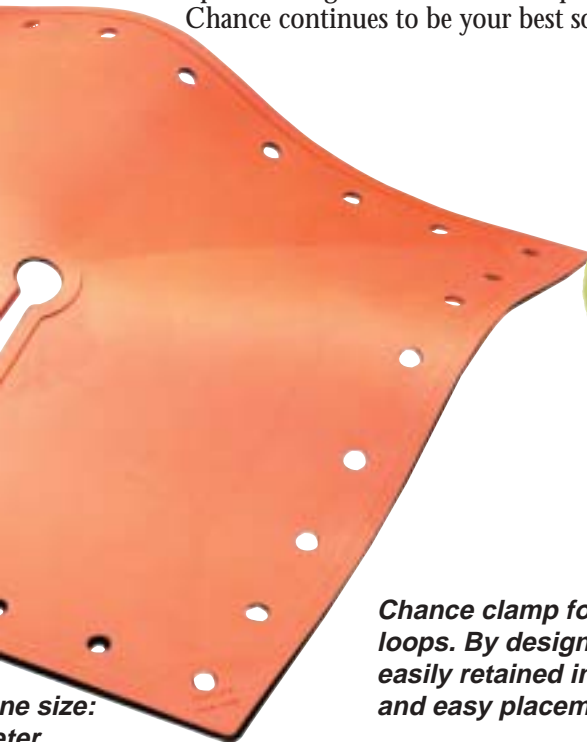
**MORE OF THE BEST TOOLS FOR THE JOB**

The complete Chance rubber blanket package includes clamp pins and buttons to help keep the blankets in place. Designed for your convenience, either of two types of Chance spring-loaded pins can be installed by either hotstick or rubber-glove working methods. The buttons help close up blanket gaps to keep your jobsite neat for your safe, efficient work practices.

Chance now offers you rubber blankets and line hose as well as the tools to install them, if that's your method. These tools now complement the Chance tool line for all your distribution maintenance needs: Rigid cover-up, insulated platforms, nylon stap hoists, insulated link sticks and conductor support tools, grounding and jumpering. Plus there's the Chance construction tool line up, including chain hoists and capstan hoists. All of these because Chance continues to be your best source for hot-line tools. ■



*For proper rolled storage and easy handling, cannisters are available with or without a molded carrying handle.*



*One size:  
meter  
hardware.*



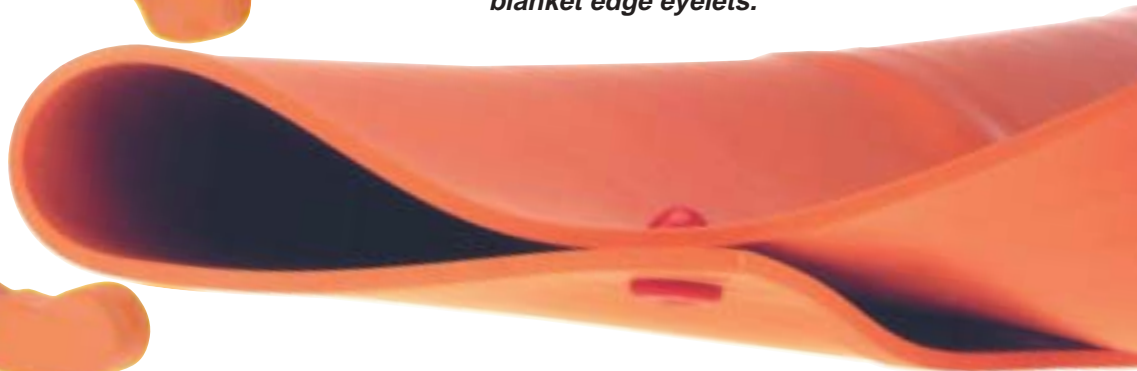
*Chance clamp for Rubber Gloves has no loops. By design, the handles also are easily retained in a clampstick for quick and easy placement.*



*Blanket buttons of nylon are available to secure connections of blanket edge eyelets.*



*Chance clamp for Hotstick applications has rod loops for clampstick to capture and retract. Placement is easy and exact by either hot-line tool or rubber-glove method.*



# HUBBELL

## Completes Acquisition of Cooper Pole Line Hardware Assets

**H**ubbell Power Systems, Inc., a subsidiary of Hubbell Incorporated announces the completion of its acquisition of the assets of the pole line hardware business of Cooper Power Systems, Inc., a subsidiary of Cooper Industries, Ltd. The purchase price was \$9.5 million in cash subject to customary post-closing adjustments.

Pole line hardware products are used in the construction and maintenance of electric utility transmission and distribution lines. They include anchors and accessories, fasteners, pole and crossarm accessories, insulator pins, cable clamps, mounting brackets, wireholders, and insulators. Hubbell Power Systems has acquired product inventories and materials, production equipment, tools, dies, and related equipment. No facilities or real estate were included in the purchase.

Timothy H. Powers, President and Chief Executive Officer of Hubbell Incorporated, cited the products' fit within the Company's strategic plan. "Electric utility products are a core business for Hubbell, and a market to which Hubbell Power Systems is a leading supplier. The completion of this transaction broadens both our product offering and our opportunities."

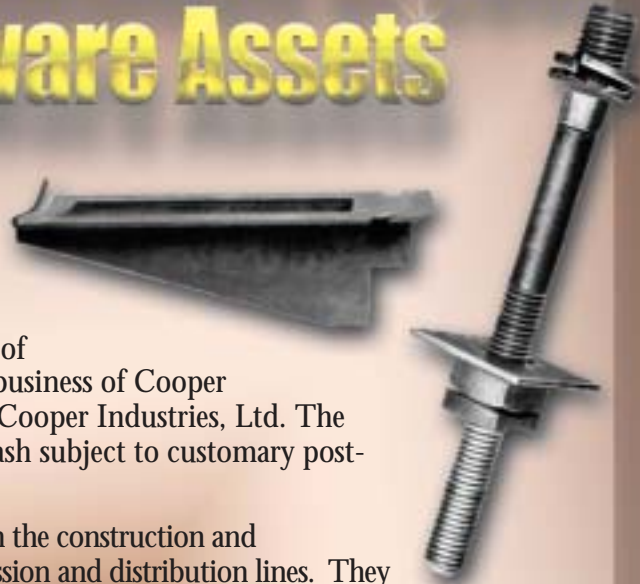
The assets included in the purchase will be relocated and integrated into the Hubbell Pole Line Hardware operations located in Centralia, Missouri.

According to Tom Smith, Group Vice President of Hubbell Power Systems, "This acquisition further establishes Hubbell Power Systems' commitment to support and grow our position as the premier supplier of Pole Line Hardware to the electric distribution and transmission industry."

In anticipation of this acquisition, the Centralia operations of Hubbell Power Systems has been increasing its staffing to facilitate the transition of this additional production with the goal of minimal disruption.

The Centralia operations of Hubbell Power Systems employs over 650 hourly production, distribution, and maintenance employees in addition to 225 salaried employees. ■

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



# 250°C ACSS

## ANDERSON High-temperature Suspension clamps



CFSHT series  
(EHV or Std. Voltage)

**D**esignated CFSHT (Corona-Free Suspension, High-Temperature), these clamps are designed with an aluminum alloy which retains its strength at temperatures well above the 93 degree Centigrade anneal temperature limit for standard alloy (A356-T6) aluminum clamps.

CFSHT clamps are rated for operation on ACSS and similar high capacity conductors with continuous operating temperatures up to 250 degrees C.

In addition to industry standard markings for connectors, CFSHT suspension clamps are permanently marked with the IEC standard symbol for hot surfaces. This marking allows line construction inspectors to easily verify that the installed clamps are high-temperature rated.

High current, heat rise testing was used to determine maximum clamp operating temperature. Conductor and clamp samples were tested with armor rods, with line guards and without conductor protection. In-service conditions were simulated using 1,500-lb vertical load and full-sag-angle conductor contact with clamp seat.

Load current was applied and adjusted to raise

conductor span temperature to its 250°C rating. Heat radiation effects resulted in maximum clamp temperatures ranging from 140°C with full armor rods to 180°C with clamps installed directly on bare conductor. Because utility standard practice with ACSS cable is to use armor rods or line guards, 150°C was selected as our design temperature for the next phase of development testing— Life-cycle strength evaluation via time-load testing at elevated temperature.

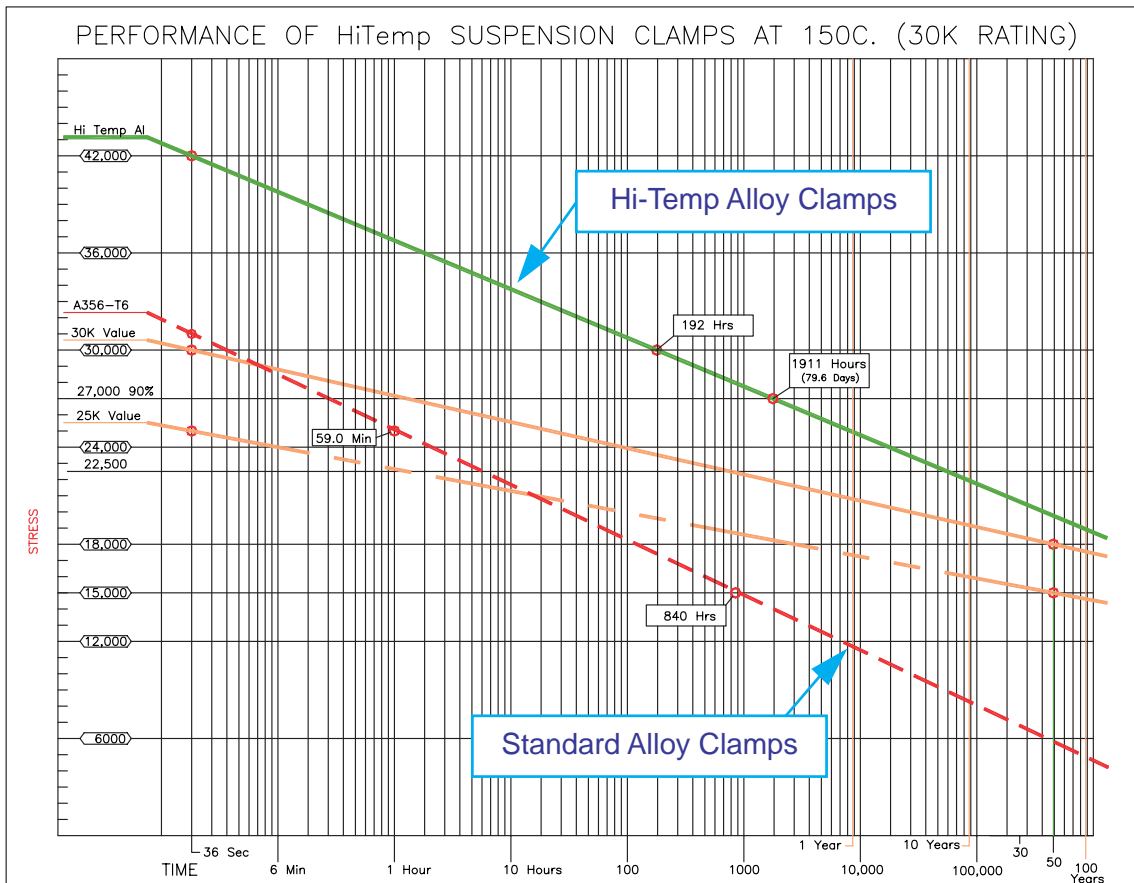
**STRONG WHEN  
the  
HEAT IS ON**

Continued . . . 

### Heat Rise Test Fixture



## Hi-Temperature vs. Standard Alloy Time-Load strength at 150° C Clamp Temperature



### Time-Load Test Fixture



Time-load testing of mechanically stressed samples is an accelerated test method commonly used for projecting long-term strength of load-bearing materials. With this method, high stress levels for relatively short time periods cause cumulative strength loss that would otherwise be expected to accumulate slowly under low-stress design loads expected during a product's useful life.

The test fixture shown here takes the traditional time-load test method one step further by combining the mechanical and thermal stresses seen by suspension clamps in-service on ACSS conductor.

Acceptable performance requires time-load characteristic that predicts 50-year strength retention at 60% or more of short-term ultimate strength. As indicated by the green test results curve, the CFSHT hi-temp clamp projects 60% strength well beyond 50 years in service at 150°C. In-contrast, the dashed red test results curve for standard alloy (A356-T6) clamps projects 60% strength retention for only 35 days (840 hour test point) when operated at this elevated temperature.

With Anderson high-temperature alloy suspension clamps and FARGO compression fittings for deadending, splicing and terminating ACSS conductors, Hubbell Power Systems is your complete package source for transmission connectors for ACSS conductor applications. ■

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

# Industry Standards

based on CHANCE®  
multi-helix anchor specs

State-of-the-Art:

*R&D history of inter-helix spacing  
traces application of technical principles*



**T**he helical screw anchor is not a sophisticated product in the 21st century of cell phones, the Internet and High-Definition TV. A low-tech product in a high-tech world, it continues to serve ever-expanding roles for utilities and in civil construction. In fact, the screw anchor's elegant simplicity is its greatest asset: An uncomplicated product with multiple uses.

## Historical Perspective: Low-tech to high-tech designs

Helical screw anchors may be simple in concept, but they come in many forms. Take out your copy of the CHANCE® *Encyclopedia of Anchoring* and look through the Anchor Product Section. It shows you these types: PISA® (Power Installed Screw Anchors), Tough One®, Square-Shaft (or SS), Round-Rod (or RR), and No-Wrench screw anchors. If you also have an A.B. Chance Co. Civil Construction SA Catalog, you can find Types HS, T/C, Street Light Foundations (SLF), Area Lighting Foundations (ALF), and HELICAL PULLDOWN™ Micropiles (HPM). These anchor types all have three things in common:

1. At least one helically shaped bearing plate,
2. A central steel shaft,
3. An appropriate structural connection at the top.

Yet each different anchor type serves different applications. And new uses seemingly come to light every day.

## Answers to FAQs (Frequently Asked Questions):

This array of screw anchor types has led many to ask why so many? What requirements or design constraints have led to their current forms? Can the current design be improved?

In the case of multi-helix screw anchors, particularly Type SS, how far apart should the helix plates be spaced along the shaft? Is there an optimum spacing that provides the best performance in terms of installation and load carrying capacity? Answering these questions requires looking back over some 40 years to just before A.B. Chance Company developed Type SS screw anchors.

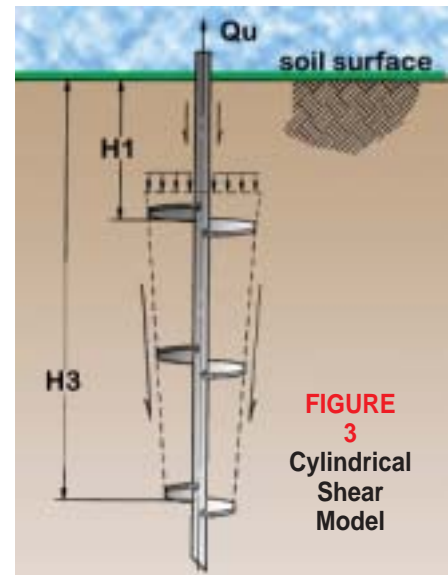
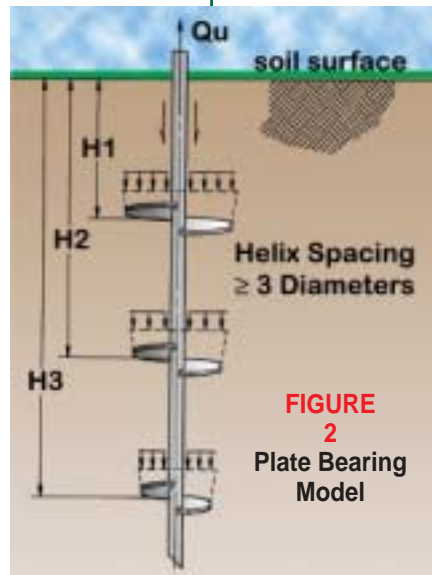
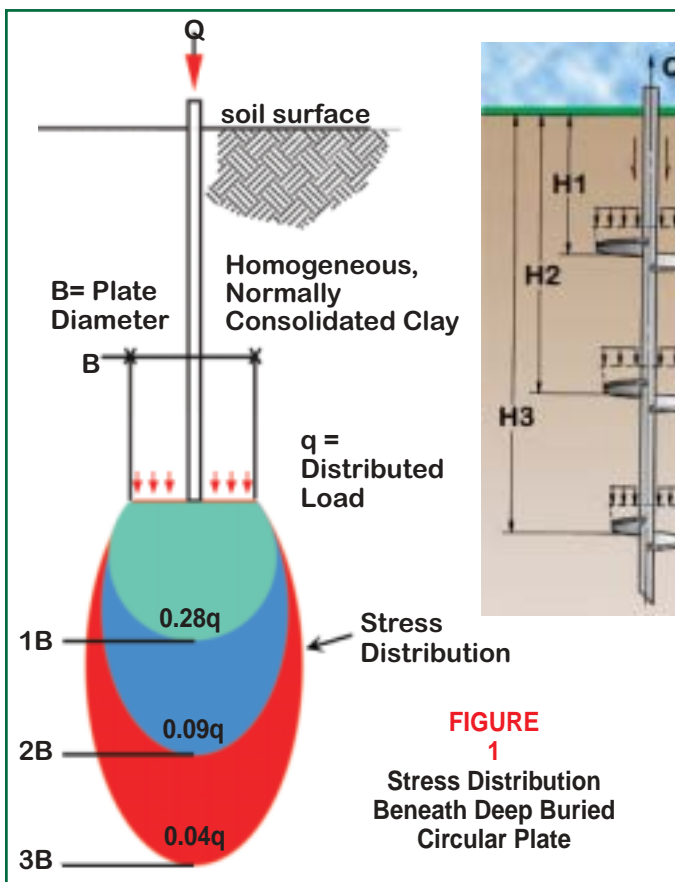
Introduced in 1959, PISA anchors were well known and in widespread use by the early 1960's. They were available in single and twin-helix configurations (twin 8" and twin 10"). Their inter-helix spacing changed often over the years, but always has been in the 15- to 30-inch range. Their standard rod length was 7 ft. As the following quote from the 1966 edition of the *Encyclopedia of Anchoring* indicates, the chief advantage of multi-helix anchors was already known: *"Installed in place of larger single helix Type PISA. Higher holding powers can be obtained with the two helix anchors."*

Where two helices are better than one, logic indicates three or more helices would be better than two. This reasoning was put to good use in 1961, when the Chance Company developed extendable Type RR multi-helix anchors. The original application for multi-helix RR anchors was as tiedowns for underground pipelines in poor soil conditions along coastal regions of the Gulf of Mexico. Type



*continued . . .*





applied load to the soil in end bearing (bearing capacity theory).

This transfer of load results in a “stress zone” within a defined soil volume immediately above or below the helix depending on the direction of the load (tension - above helix, compression - below helix). A necessary condition for this method to work is that the helices must be spaced far enough apart to avoid overlapping their stress zones.

The Boussinesq (circa 1885) Equation has described the stress distribution in soil resulting from a load applied via a buried plate/footing as shown in Figure 1. For a multi-helix anchor installed into uniform, homogeneous soil, spacing helix plates too close together can result in overlapping stress distributions, which may lead to unexpected failure.

Likewise, spacing helix plates too far apart prevents soil stress overlap, but results in a screw anchor that is unnecessarily long. As can be seen in Figure 1, the magnitude of stress one diameter away from the buried plate is 28% the magnitude of stress at the plate. Note the magnitude of stress three diameters away from the buried plate is only 4% the magnitude of stress at the plate. Greater distance from the plate results in stress magnitude reduction, but at a significantly reduced rate.

### What inter-helix spacing is optimum?

**The Boussinesq Equation** suggests a spacing of three-helix diameters as a practical solution based on stress distribution. The design question posed by the above discussion also has been answered by two other accepted principles.

**The bearing capacity theory** (Figure 2, plate bearing model) suggests the capacity of a multi-helix screw anchor is equal to the sum of the capacities of the individual helix plates. Calculating the unit bearing capacity of the soil and multiplying by the individual helix areas determine the total end-bearing capacity.

RR anchors worked well in weak surficial soils, but their 1¼" diameter shaft did not provide enough torque strength to penetrate very far into firm bearing soils.

Development of a high torque multi-helix anchor began in 1963, culminating in the Chance Company's introduction of Type SS 1½" square shaft multi-helix anchors in 1964-65.

Inter-helix spacing was 36" for both Types RR and SS anchors. Why 36 inches? Remember that the 7-ft. length of standard PISA rods was established as a length for a worker to reach when using the wrench-driven PISA system. Since Types RR and SS anchors also were driven by tooling attached to a torque motor, this same practical length applied to them as well.

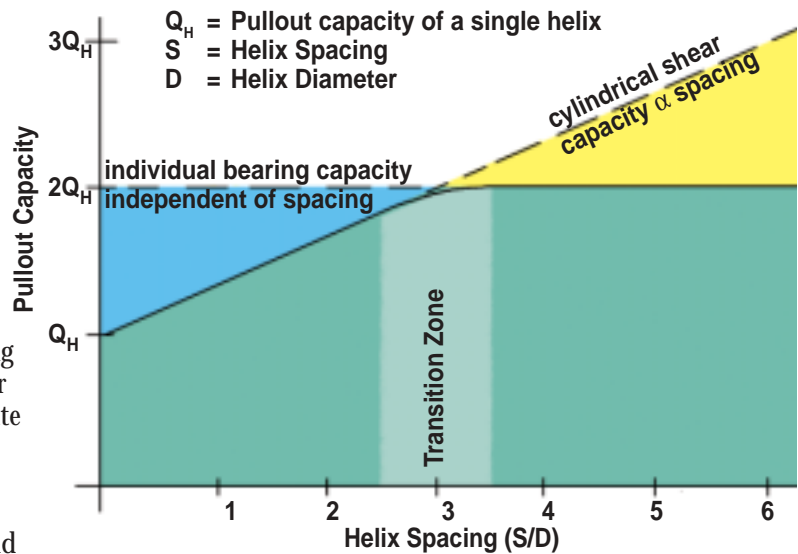
Based on proportion, three helices equally spaced 36" apart fit well on a 7'-0" shaft. Using the same 36" spacing, two helices were placed on a 5'-0" shaft (for bed-mounted diggers) and four helices were placed on a 10'-0" shaft. The three helix configuration quickly became the most popular Type SS lead section and remains so today. Three-foot (36") spacing remained the norm for Types RR and SS, as well as for HS-8, HS-11, and HS-14 High-Strength guy anchors developed later in the 1960s.

### Geotechnical science evolves changes

In the 1970s and early 1980s, a gradual change in the design philosophy at A.B. Chance Co. eventually led to changes in inter-helix spacing. Adopting generally accepted geotechnical engineering principles, it was recognized that a deep buried plate (i.e., screw anchor helix) transferred an

**The cylindrical shear theory** (Figure 3, cylindrical shear model) suggests the capacity of a multi-helix screw anchor is equal to the bearing capacity of the top-most helix (tension load), plus the friction capacity resulting from the shear strength of the soil along a cylinder bounded by the top and bottom helix with a diameter defined by the average of all helix diameters on a multi-helix anchor.

Both cylindrical shear and individual bearing represent permissible failure mechanisms for any inter-helix spacing, therefore the ultimate capacity associated with them are upper bounds of the actual ultimate capacity at all spacings (see Figure 4). At “small” spacings, cylindrical shear is the least upper bound and controls capacity, per the Least Upper-Bound Theorem. At “large” spacings, individual bearing becomes the least upper bound and controls capacity.



**FIGURE 4**  
Pullout Capacity of 2-Helix Anchor vs Helix Spacing

To determine where the transition occurs from cylindrical shear to individual bearing, data from late 1970’s field tests were analyzed. The interpreted results indicate that the transition spacing is about three diameters, as is indicated in Figure 4. This is consistent with the performance of multi-belled concrete piers (Bassett, 1977) and with the fact that the cylindrical shear and individual bearing methods usually give similar results for screw anchors with three-helix diameters spacing.

### Industry Standard derived from CHANCE® three-diameters spacing

It is important to understand that soils generally are not homogeneous mixtures exhibiting uniform strength properties. Spacing helix plates unnecessarily

far apart increases the possibility that one or more of them will not be located in the same soil layer as the others.

## ***The key is to space the helix plates just far enough apart to maximize the bearing capacity of a given soil.***

This works to reduce the overall length of the anchor and increases the likelihood for all helix plates to be located in the same soil layer. This leads to more predictable torque-to-capacity relationships and better creep (movement under load) characteristics.

Today, A.B. Chance Company manufactures helical screw anchors with three-helix-diameters spacing, the

space between any two helices being three times the diameter of the lower helix. This is the optimum spacing that historically has been sufficient to prevent one helix from significantly influencing the performance of another, while at the same time preventing the previously mentioned disadvantages of spacing helices too far apart.

## **INDUSTRY STANDARD**

### ***A Definition: Three-helix-diameter spacing –***

***The optimum space between any two helical plates on a screw anchor is three times the diameter of the lower helix.***

With the introduction of Chance Type SS150, SS175, SS200, and SS225 High Strength SS Anchors in the late 1970’s and early 1980’s, helix plates were located on the shaft using three-helix-diameters spacing. Type HS anchors were changed to this spacing in 1986. The standard-strength SS, known as the SS5 series, remained at 36 inch spacing until 1997, when it also was updated to the industry standard of three-diameters spacing, now common to other Chance shaft-driven multi-helix screw anchors. ■

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



## See our new interactive e-catalog at:

[www.hubbellpowersystems.com](http://www.hubbellpowersystems.com)

You are one mouse click away from our new interactive e-catalog. There are three dynamic ways to search by product number, product description or a step search feature that allows you to use design features to locate the products you want.

Frequently check the catalog for the most current information, new features, new products and updates. View products and specifications. See standard packaging, weights, UPC codes and dimensions. Side-by-side comparisons with similar products are easy. You can share product information with others. Copy and paste information into documents and Power Point presentations. Or, understand the kV rating of an insulator and much more.

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

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