

Cooper Power Systems Expands Manufacturing Capabilities in Shanghai

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Cooper Power Systems is a world class manufacturer of screened cable accessories and has a worldwide reputation for making very high-quality products. Our experience encompasses 35 years in the design and manufacturing of ANSI load-break and dead-break screened separable connectors and 12 years in IEC/Cenelec-compliant screened connectors.

Cooper Power Systems has recently expanded its global manufacturing base by establishing a world class cable accessories factory in Shanghai to serve and meet the unique requirements of customers in China, Europe, and the Asia Pacific region, as well as other countries where IEC/Cenelec separable connectors are used. This facility is the culmination of the joint efforts of our global engineering resources to ensure that Cooper is manufacturing the right products with the high quality that Cooper's customers expect at a competitive price.

A Wide Range of Products—A Wide Range of Applications

Our Shanghai factory manufactures a complete range of screened dead-break connectors that are typically used in traditional European-style underground distribution systems. These products include Cooper's existing IEC-compliant product offerings—the 24 kV 250 A elbow and straight connectors and the 36 kV 630 A symmetrical tee and several new products developed in parallel with the factory construction—including two new 24 kV 630 A compact tee connectors for use in world markets. All of the dead-break connectors are available with a variety of compression connector options, including all-copper to GB/T standards, all-copper to European

standards, and bimetallic to European standards and deep indentation type. The screened connectors can be used on all configurations of polymeric cables, copper or aluminum conductors, single-core and three-core construction, with tape screen or wire screen. Accessories are available to provide watertight cable seals and screen earthing for all of these configurations. The 250 A products can be used on cable up to 120 sq mm, and the 630 A tees are suitable for cables up to 400 sq mm.

A 17 kV screened arrester has also been developed to meet the China surge arrester standard. This is an excellent example of Cooper's willingness to develop new products to meet customer requirements and our engineering expertise that enables us to develop products to respond to local market requirements.



IEC products made in Shanghai – 250 A elbow, 250 A straight, short tee, bushing tee, and bushing tee arrester.

The most common applications for screened dead-break connectors are connecting underground cable to compact Ring Main Unit (RMU) switchgear or transformers. Pictures of typical installations are shown here.

These application pictures illustrate one of the many benefits of screened



Typical application in RMU switchgear.



The new 17 kV arrester is used to protect the switchgear and the system from damaging overvoltages.

connectors—allowing for very compact installations with no minimum phase clearance requirements. Other benefits of screened connectors:

- Maintenance-free operation
- Immunity to contamination/atmospheric conditions
- Immunity to faults caused by small animals

- Ability to operate while submerged
- Safety

The outer surface of the connector is a semiconductive rubber connected to earth so that the live parts are not exposed. Unscreened connectors cannot offer these benefits. Use of unscreened products often results in an increased rate of outages and a decrease in reliability.

A History of Quality

Even though this facility is physically only one year old, it's heritage already includes 35 years of experience, inherited from Cooper's United States and Taiwan factories. Highly experienced teams from the United States and Taiwan design engineering, manufacturing engineering, and Quality Assurance departments guided the design and startup of the facility. These resources continue to be involved in the daily support and auditing of the facility, as well as training of the local staff. Because of this close cooperation and sharing of knowledge/technology, our customers can be assured that they are receiving the highest-quality products, regardless of the factory in which they are produced.

Other major factors that determine product quality are:

- Material formulation and mixing
- Molding process control
- A dedicated, well-trained workforce
- Design testing
- Quality assurance/quality control

The quality of the connectors starts with the raw materials. Shanghai uses the same proprietary Ethylene Propylene Diene Monomer (EPDM) formulations developed by Cooper that are used in the other factories. The rubber for all three facilities is mixed in the same computer-controlled mixer.

Computer-controlled, screw ram injection presses are used to ensure that consistent high quality is obtained from day to day, month to month, and year to year. This same type of equipment has successfully produced high-quality product used in both the Taiwan and United States markets for nearly 20 years. Experienced manufacturing



Computer-controlled mixer supplies EPDM insulation to all Cooper factories.

process engineers at Shanghai assure that the presses are programmed and functioning correctly.

Although not required by CENELEC, IEC, China, or other world standards, all Cooper separable connectors are 100% electrically tested prior to shipment. An example of a computer-controlled test station is shown. These tests are:

- AC Power Frequency Withstand test for one minute
- Partial discharge less than 3 pC
- Test point voltage test (if applicable)

100% routine testing virtually eliminates the possibility of problems in the field and is another indication of Cooper's very high commitment to quality. Many other manufacturers only perform routine tests on a small sample of product.

In addition to the 100% electrical tests, a sample of all products are inspected with x-ray equipment to detect any internal defects that are too small to be detected by other means. Any issues detected in the audit inspection results in the entire batch being held for 100% x-ray inspection. Like the routine electrical tests, this inspection is not required by any standard. It is another example of Cooper's commitment to quality.

Dedicated and knowledgeable personnel is a common trait to all Cooper facilities and the Shanghai facility is no exception. The personnel have been trained in the best practices from other cable accessories factories and have enthusiastically implemented them.

Global Standards

The performance of all Cooper dead-break products is tested to the applicable international standards—IEC 60502-4, CENELEC HD 629.1 S2, and China GB/T 12706.4—in leading independent laboratories. These tests are very severe tests for short-term dielectric performance, current-carrying capability, and short-circuit withstand. However, the standards do not include a long-term aging test to measure the insulation quality or degradation that may occur as a result of long-term exposure to the environment to which the connectors will be exposed, which includes heat, submersion in water, and overvoltage conditions. This is a very important consideration for customers who expect the product to perform for 30 or more years.

Cooper developed the Multi-Stress Test to quantify long-term performance of connectors under these conditions. The product is assembled on cable with a mating part, submerged in 90 °C water, and subjected to 1.5 times normal phase-earth voltage for 5000 hours. Experience indicates that products of questionable quality will fail in less than 1000 hours. Periodically, measurements of the tan delta (dissipation) factor of the insulation are made and the measurements are charted to identify the trend during the test. A stable tan delta over the duration of the test indicates that the insulating rubber is stable and a long life can be expected. A rising tan delta indicates an increase in resistive leakage current, an indication that the insulating rubber is degrading. The product with a steadily increasing tan delta will eventually suffer a dielectric failure.

All Cooper separable connectors, regardless of the manufacturing facility, are subjected to this design test and must exhibit a stable tan delta before they are released for customer shipments. Pictures of the test setup and



Set-up of the Multi-Stress Test developed by Cooper Power Systems to quantify long-term performance of connectors.



Connectors after testing.

the new short tees after completion of the test are shown above.

Shanghai has adopted the quality system and procedures that are in use at the United States and Taiwan factories. The involvement of the older factories includes transfer of procedures and methods, training of the Shanghai personnel, and ongoing auditing and continuous improvement initiatives. The Shanghai facility is certified to ISO 9001:2000 quality management system.

Quality and Consistency

The Cooper Shanghai factory is a world-class addition to Cooper's global manufacturing base for medium-voltage screened separable connectors. It shares Cooper's 35 years of experience in manufacturing separable connectors, utilizing the same product designs, manufacturing methods and procedures, the same QA/QC procedures, the same high quality EPDM materials, and, most importantly, the same focus on customer satisfaction. ■

Modern and Secure Networks from page 4.

- Utilities must identify critical cyber assets. Critical assets that communicate using a routable protocol or a dial-up modem are considered to be critical cyber assets.
- All personnel that can operate critical cyber assets need to be security screened.
- All critical cyber assets must be enclosed within a secure physical perimeter.
- All critical cyber assets must be enclosed within a secure "electronic perimeter" that limits access to authorized users only, blocks all unnecessary ports and services, and provides complete logging and monitoring services.
- No unauthorized user can access substation equipment, in person or electronically. More than that, utilities must be able to restrict access to previously authorized users quickly and efficiently.

Utilities must now also document:

- Who has access to which equipment.
- Whenever equipment such as an IED is accessed: a log must be kept of who connected to it, what commands were sent or changes were made to the equipment, and when the event happened.

NERC CIP applies to all utilities that possess critical assets. Even if they do not, they still need to provide an inventory of all their assets and demonstrate that none are critical cyber assets.

For more information on NERC CIP standards, visit NERC's web site at www.nerc.com.

Cybertec Products are NERC CIP-Compliant

Unlike other solution providers, Cybertec does not rely on third-party products and solutions to provide a complete, NERC CIP-compliant enterprise and substation security solution.

Cybertec's security solution is twofold: substation and enterprise. Cybertec Enterprise Solutions modules (Cybertec Security Server, IED Manager and Passthrough Manager) are installed at the corporate level and the Cybertec SMP Gateways are installed at the substation level.

At the enterprise level, Cybertec Enterprise Solutions is a suite of modules that perform centralized security, event reporting, user and IED management, as well as secure access to remote devices by users within the corporate LAN. Cybertec's Passthrough Manager supports SEL 20xx gateways, direct IED connections and the Cybertec SMP Gateways.

At the substation level, Cybertec's SMP Gateway product line provides NERC CIP-compliant, secure, single-access-point to substation equipment and data. SMP Gateways feature secure access and logging capabilities locally. They can also connect to Cybertec Enterprise Solutions for centralized security, enhanced logging and reporting.

All Cybertec products are compliant with applicable NERC-CIP standards. For a detailed list of Cybertec Solutions for NERC CIP standards, visit www.cooperpower.com/nerc and link to "Meeting NERC Requirements with Cybertec Solutions."