A wide choice of Bushings and Accessories
We provide a wide choice of Elliott Apparatus Bushings for Air-Insulated Switchgear, as well as Apparatus Insulators, fuse clips, tools and special components. These bushings come in two mounting styles: Clamp-In and Bolt-In.

**Clamp-In Bushings**
Elliott “A” Series clamp-in Apparatus Bushings are designed to fit older-style equipment and used to upgrade or replace other manufacturer’s failed bushings on existing equipment in the field. Each clamp-in bushing uses a different mounting configuration.

**Bolt-In Bushings**
For new designs, we recommend our higher performance “B” Series (bolt-in) bushings, which offer superior electrical performance, much higher cantilever strength and numerous design advantages. The “B” Series includes bushing wells, bushings, thru-bushings, double bushing wells, double bushings, parking bushings, double parking bushings and insulators that fit the same mounting provisions.
Universal Mounting System

Punch a Standard Mounting hole pattern in your equipment mounting plate and you can install a wide variety of Elliott bushings, insulators and other components. Connect 200, 600 or 900 Amp Elbows on the front side and connect to your live terminal equipment on the back. If you need to connect to stress-cone-terminated cable or bus bars on both sides, install a Thru-Bushing. If you need to connect to an elbow on the front and back, install a Double Bushing Well or Double Bushing. Bushing-Style Insulators fit the Standard Mount and can be installed in place of a Bushing. This allows the end-user to upgrade the equipment in the field. The Elliott system allows you to:

- Build live-terminal equipment with Thru-Bushings and replace them with Bushing Wells in the future to convert the equipment to deadfront.
- Field upgrade equipment by changing the 200 Amp Bushing Wells and bus to 600 Amp Bushings and bus as the load increases.
- Add an additional terminal in the field by removing a Bushing-Style Insulator and replacing it with a Bushing.
History
Elbow-terminated, air-insulated pad-mounted switchgear was constructed with clamp-in bushings until both Elliott and S&C offered bolt-in air-insulated bushings in 1981. Failures of the early clamp-in bushings included flashover due to partial discharge at the mounting hole, cracking due to thermal stress, interface voids and other design deficiencies. Determined to eliminate these problems, in 1975 Elliott Industries began offering bushings and insulators molded from cycloaliphatic epoxy. Advances in electrical shielding, manufacturing technology, material technology and design have elevated the performance to a superior level and eliminated the earlier problems.

Limitations of the Clamp-In design
An ideal bushing has plenty of cantilever strength, leakage distance and a standard mounting hole. To increase cantilever strength, a larger diameter shank is needed. If you keep the same length skirts, your mounting hole must increase in size. To keep the same mounting hole, you are forced to use shorter skirts, resulting in less leakage distance. Less leakage distance means less resistance to contamination, resulting in more field failures.

If you want to increase leakage distance, the designer can use more and longer skirts. Longer skirts mean a larger mounting hole until you use a smaller shank. A smaller shank lowers cantilever and thermal shock strength. If the designer uses thinner skirts and uses more of them, leakage can be increased while holding the same cantilever strength. But thin skirts are fragile. If a thin skirt catches the edge of the mounting hole as the bushing is being installed, it will snap off. Our solution has been to increase the size of the hole to allow for adequate strength and leakage. This is why different model clamp-in bushings use different mounting holes and clamp rings.

The Elliott Solution
Elliott bolt-in bushings do not suffer from the design constraints of clamp-in bushings. Since the bushing installs from the back, only the interface must pass through the mounting hole. The shank and skirts can be of any diameter. This allows the bushing designer to use a large diameter shank for higher cantilever strength, while using lots of high leakage skirts for increased resistance to contamination. The design also provides for better electrical performance, a universal mounting hole and less chance of damage at installation.

The best clamp-in bushings add shielding to the shank, which greatly improves the situation. The bushing can still "see" the sharp edge, but its effects are minimized. Some manufacturers don't add this type of shielding to keep the price down. We believe this is false economy.

The Elliott bolt-in bushing completely shields the hole. The conductor cannot "see" the edge of the hole and is completely unaffected.
Sharp threads
In early bushing designs, live parts were mounted on a threaded stud on the shank. The stud was easily broken and its length limited the thickness of live parts. It also caused the flow of current to pass from the conductor, through a nut, flat washer and then to the bus bar. That’s a lot of current flowing through a lot of small connections. In such a connection, it is extremely important to achieve proper clamping pressure—difficult to achieve on a fragile copper stud. Worse, the exposed sharp threads can cause corona.

We prevent those problems with a simple solution—female threads on a large diameter conductor. This design allows direct bus-to-conductor contact, eliminates all the extra fasteners and eliminates the corona-causing sharp threads. The installer can easily break a copper stud but is unlikely to break a bolt.

Interface voids
Due to the nature of the molding process, it is quite normal for a small percentage of production to have some imperfections. Often, the imperfections cause no performance problems. Usually, when such a flaw exists on the interface, the part is visually rejected before final electrical testing. Sometimes a void exists where it is nearly impossible to see. Proper electrical testing is needed to find these voids.

Some vendors cut their testing costs by using a non-solid insulation in the interface (like oil). While quicker and cheaper, the electrical stresses are different; and we have found that oil can fill hidden voids and allow a defective bushing to pass testing. To insure our testing is meaningful, we use solid rubber interface plugs (or caps) that fit just like an elbow or insert. This accurately simulates operating conditions and allows an interface void to fail the test, just like it should.

Contamination
No matter how good a bushing is, excessive contamination can cause it to fail. However, there are a number of design features that can extend its life, even under severe duty. A design with greater leakage distance, no corona and lower electrical stress will serve considerably longer. Elliott bushings are designed with a generous amount of leakage (creep) distance. Our skirt design features a vertical-to-horizontal ratio of over 3.1. Our low stress designs operate corona-free and perform well even with significant contamination.

Elliott Cycloaliphatic Epoxy
Elliott’s experience with cycloaliphatic epoxy dates back to 1975 when cycloaliphatic epoxy bushing wells and insulators were utilized in 35 kV elbow-terminated pad-mounted switchgear. Successful field operating experience soon led to greatly expanded use of cycloaliphatic epoxy components.

Elliott bushings are manufactured with a liquid resin cycloaliphatic epoxy compound, which includes silica. This compound is pressure injected into a preheated, controlled temperature, precision shaped mold. Low viscosity and pressure injection allow the manufacture of bushings with multiple square-edge skirts and greater leakage distance for superior performance in contaminated environments.

Cast-in-place threaded and knurled brass inserts in the heavy-duty flange provides exceptionally high cantilever strength. Elliott “B” Series (bolt-in) bushings can be used to provide physical support for energized parts.

Elliott cycloaliphatic epoxy bushings are homogeneous. If chipped by rough handling or vandalism, the exposed surface will provide the same performance characteristics of the un-chipped surface.

Electrical Characteristics
Nontracking, self-scouring and nonweathering performance is characteristic of Elliott cycloaliphatic epoxy bushings. Pyrolysis of cycloaliphatic epoxy bushings produces gaseous by-products such as water vapor and carbon dioxide that leave a virtually residue-free nontracking surface. A high temperature arc decomposes minute amounts of cycloaliphatic epoxy liberating water as steam that scours the surface of the bushing in the path of the arc. The bushings are resistant to ultraviolet radiation and do not react with water or contaminants due to the nonweathering qualities.

Test and Field Experience
Elliott cycloaliphatic epoxy bushings have been tested to confirm impulse withstand ratings, corona extinction voltage, low frequency withstand dry and low frequency withstand wet. Mechanical testing confirms cantilever strength, tensile strength, torsion strength and compression strength. Thermal cycling withstand tests from +200°F to -200°F assure trouble-free field service for cycling loads in the most severe climatic conditions. In addition to the in-house testing, various utilities have tested bushings, apparatus insulators and line post insulators in their most severe outdoor test facilities to substantiate the superior performance of cycloaliphatic epoxy.