

Connectors, Clamps, and ClampStar® - How are they different?

Connectors: A connector can be defined as a device for joining two or more conductors to provide a continuous electrical current path. Connectors generally fall into four types; automatic, compression, wedge, and bolted. The electrical and mechanical requirements for all are defined in ANSI C-119.4, "American National Standard for Electric Connectors – Connectors for Use between Aluminum-to-Aluminum and Aluminum-to-Copper Conductors Designed for Normal Operation at or Below 93°C and Copper-to-Copper Conductors Designed for Normal Operation at or Below 100°C".

That Standard consists of four current classes:

- Class AA (Extra Heavy Duty) – High current cycle test duration
- Class A (Heavy Duty) – High current cycle test duration
- Class B (Medium Duty) – Moderate current cycle test duration
- Class C (Light Duty) – Low current cycle test duration

And four tension classes:

- Class 1 – Full tension, 95% rated conductor strength
- Class 1A – Normal tension, 60% rated conductor strength
- Class 2 – Partial tension, 40% rated conductor strength
- Class 3 – Minimum tension, 5% rated conductor strength

Current Class AA is intended for applications on aged conductor while Class A is for application on new conductor. Most automatic and compression connectors for transmission conductors will be rated Class A current and Class 1 tension. Some wedge connectors will be rated Class AA current and Class 1 tension. Bolted connectors will normally be rated Class A current and Class 1A tension for ACSR conductors, for example, because they cannot directly grip the steel core and any core gripping force must be transferred through the outer aluminum strands.

In addition to ANSI C119.4, specifications for bolted clamps and connectors are also discussed in IEEE C135.100.

Clamps: Clamps are primarily intended to support conductors, as dead ends, jumpers, and suspension supports. Clamps are usually outside the electrical current path. IEEE C135.100 covers quadrant and straight line bolted dead end and suspension clamp ultimate and slip strength requirements.

ClampStar®: ClampStar Connector Correctors are indeed different. They are engineered electrical and mechanical shunts that are primarily designed to reinforce and permanently restore the integrity of aged and degraded connectors, clamps, and damaged conductors thereby returning them to better than original condition.

Shunts, such as ClampStar are not presently covered by any American or International standards, but they are anticipated to be covered in a forthcoming Annex to ANSI C-119.4. Another ANSI C119.7 Subcommittee is working on a standard for "Connectors for Use Between Aluminum-to-Aluminum Connectors Operating Above 93°C", and it is expected that shunts will be an Annex in that standard as well. That standard is aimed at HTLS (High Temperature Low Sag) conductors that can operate at temperatures up to 250°C continuously. There are several questions about the connector test temperature for use on HTLS conductors by connector manufacturers. However, there is no question about ClampStar. Several ClampStar units have successfully completed 500 cycle current cycle tests at conductor temperatures of 390°C and all will do so. ClampStar units for larger conductors can also be tailored to meet Class 1 full tension requirements alone.



Although ClampStar is designed to be used in conjunction with a primary connector (or damaged conductor) that is holding line tension at the time it is normally installed, ClampStar is tested alone, without a primary connector, conductor, or other device in place. Under those conditions all ClampStar units are designed and tested to hold a minimum of 60% of the rated breaking strength (RBS) of the largest and strongest conductor within its clamping range. Thus, they have a minimum tension rating of C119.4 Class 1A normal tension, which is a class, intended primarily for bolted connectors. That 60% rating can be compared to normal operating line tension ranging from approximately 15% – 30%.

ClampStar is installed mechanically in series and electrically in parallel with a hot splice or other compromised connector, conductor, clamp, or other device and by shunting the majority of the electrical current around that device, the device temperature will immediately return to near ambient. Further thermal degradation is prevented, and any slip that may have occurred prior to ClampStar is halted and further slip prevented by the mechanical reinforcement provided by ClampStar.

Because the mechanical tests are conducted without a primary connector in place, albeit one which is degraded, ClampStar holding strength alone is somewhat superfluous because it does not truly represent actual field applications. However, the combination of a primary connector and ClampStar will result in ANSI C119.4 Class AA current and Class 1 (95% minimum) tension.

