Braced Post Insulators

Transmission line design must take into account economics, right-of-way, aesthetics, construction efficiency, and reliability. The composite braced post design is the clear choice to achieve each of these sometimes conflicting objectives. Composite Braced Posts allow the use of monopole structures vs. traditional lattice and H-frame construction significantly reducing the visual impact of the line as well as the right-of-way required to construct it.

Composite Braced Posts vastly improve the vertical loading capability of conventional line posts allowing for greater span lengths and less total structures. Because they are composite and are made of silicone rubber, they also offer advantages of light weight, vandal resistance, and contamination performance unmatched by other insulator designs.

Braced Post Assemblies are used effectively at system voltages from 69kv to 345kv. The composite braced post offers both urban aesthetics as well as a low environmental impact.

Upper Left: Double Circuit Braced Post Structure
Below: Braced Post vs. V-String Design
Lower Left: Lattice Structure

Braced Post Smart Catalog Number Definition

B2	90	1	057	B	1	1	068	MX
LP OD	Tower EF	Line EF	Section Length	Hardware Type	Brace SML	Brace EF	Height	Custom #
B1 = 2.0" B2 = 2.5" B3 = 3.0" B4 = 3.5"	10 = Flat Base Upswept 11 = Flat Base 0 Deg. 1C = Flat Base Fixed 50 = 5" BC 6_ - Swivel Base 80 = Anchor Only 90 = Gain Base Upswept 91 = Gain Base 0 Deg.	1 = Drop Tongue 5 = 5" Bolt Circle C = Ext. Drop Tongue E = High Strength Bracket F = Vert. RAM Bracket H = Horiz. RAM Bracket	Pole to Conductor CL	B = Basic Hdwr T = Turnbuckle P = Adj. Plate X = None	1 = 25-27k 5 = 30k 6 = 36k 2 = 50k	1 = Eye / Eye 2 = Y / Ball 3 = Eye / Ball 4 = Y / Eye 5 = Y / Y 6 = Sock/Ball	Base to Vang Distance	M = Molded V = Modular X = No CR A = 8" CR B = 12" CR

Dimensions in inches unless otherwise noted

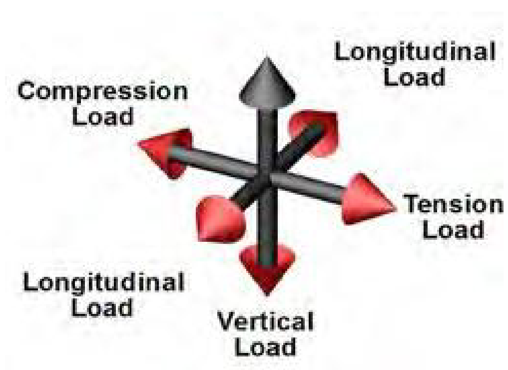
Braced Post: Unique insulator design that combines the cantilever properties of a horizontal line post with the tension strength of a suspension insulator to make a high strength insulator assembly. The suspension insulator, or brace, is attached to the line post and to the tower via connection hardware. When loaded, the brace goes into tension, and is the primary support mechanism for the assembly. The line post provides stability for transverse (tension & compression) & longitudinal loads exerted onto the assembly.

Connection Hardware: The hardware used to connect the brace to the post and tower can be supplied in a variety of combinations. Typically, the hardware used is greater than or equal to the SML rating of the brace insulator, and the type of connection is determined by the end fittings supplied on the suspension. Options for connection hardware discussed in later sections.

Vertical Load: (MDCL) Downward load applied to the assembly, usually determined by the weight of the conductor.

Tension Load: Transverse load pulling perpendicularly away from the tower, essentially putting the line post in tension.

Compression Load: Transverse load pulling perpendicularly into the tower, compressing the line post towards the tower.



Longitudinal Load: Side load applied to the assembly. Ideally, the load on each side of the assembly will be equal / balanced, resulting in no longitudinal load. Longitudinal loading is critical when loads are unbalanced and for broken conductor consideration.

Combined Load Curves: Load curve that combines the effects of the various loads and plots working and ultimate strength of the assembly. Load curves are supplied upon request.

Working Load Curve: The maximum load that can be applied to the insulator for long periods of time, without damaging or fatiguing the insulator.

Ultimate Load Curve: The load at which the assembly approaches its ultimate strength, point of failure.

Braced Post Load Application: The maximum load (or worst case load) of a specific application should fall below the working load curve for that respective design. This max load is determined by the customer, and should take into account environmental influences (wind, ice, etc) along with the utilities safety factor practice. Max load applications that surpass the working curve require upgrades in strength for the braced post.

Strength Upgrades: Depending on the specific loading requirements, there are many ways to upgrade the strength of a braced post, listed below are a few of the most common upgrades.

- Increase the SML of the brace insulator [~ increase Vertical Loading Capability]
- Increase the rod diameter of the line post [~ higher Vertical / Transverse Loading Capability]
- Change from fixed base to swivel base [~ improves Longitudinal Loading Capability]
- Dimensional design changes (Changes to upsweep angle, brace angle, height, etc.)

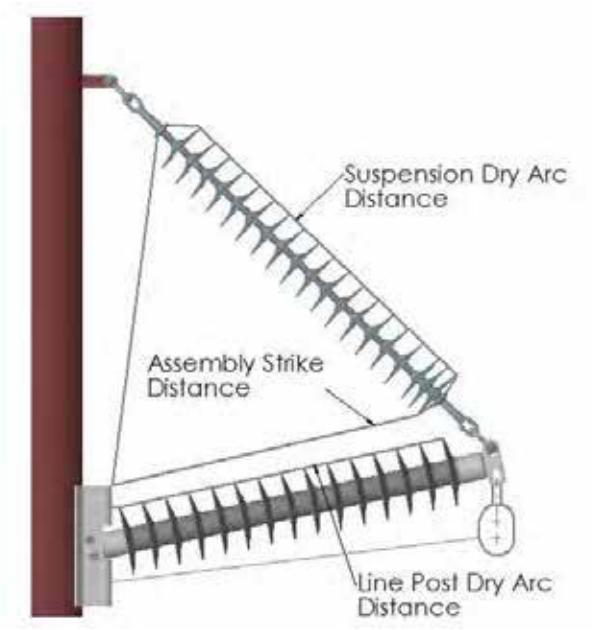
Insulator Electrical Performance: The electrical values of an insulator are driven by the dry arc distance, and the insulators' contamination performance is dictated by the leakage distance.

Dry Arc Distance: The shortest distance metal to metal up and along the insulator tangent to the sheds. The electrical values for 60Hz & critical impulse flashovers are statistically derived by the dry arc distance of the insulator.

Assembly Strike Distance: In a combination assembly, the individual dry arc distances of each insulator are usually not the shortest paths metal to metal. This shorter path or dry arc for the assembly is called the strike distance, which could be the distance from the post base to the brace end fitting or corona ring, or it could be the distance to the conductor hardware, especially on double bundled assemblies with horizontal yoke plates. The strike distance drives the electrical values of the braced post assembly.

Leakage Distance: The continuous path across the insulator from metal to metal, measured across the profile of each shed. The leakage distance is controlled by the number of sheds on the insulator.

Assembly Leakage Distance: The leakage distance for a braced post assembly is the shortest leakage distance of the 2 insulators that make up the assembly. If the post has 230" of leakage, and the brace has 180" of leakage, the braced post leakage distance is 180".



The strike distance of the braced post assembly is typically shorter than the dry arc distances of either the post or brace insulators. Therefore, the electrical values of the individual insulators are greater than the electrical values of the assembly. The sketch above shows the various strike distances of the assembly, the shortest of which determines the electrical values.

Recommended Corona Ring Application for the Braced Post

8" Corona Ring

12" Corona Ring

	230 kV	345 kV
Brace	8" Ring	12" Ring
Post	None	6" Ring

High voltages can result in unwanted noise (RIV) and corona. To minimize the effects of corona, corona rings are applied to one or both of the insulators of the assembly. Typically, for system voltages 230kV and above a corona ring or combination of rings is necessary. However, some applications may require rings at lower system voltages. The table above shows the recommended corona ring applications for 230kV & 345kV. The ultimate decision of corona ring application is determined by the customer and by the environmental factors where the assembly will be used.

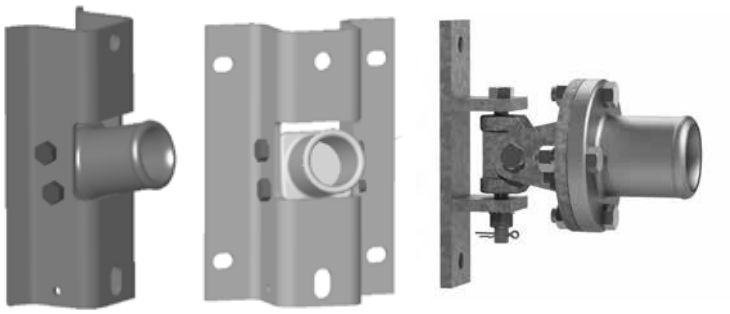
Dimensions in inches unless otherwise noted

Braced Post Design Options

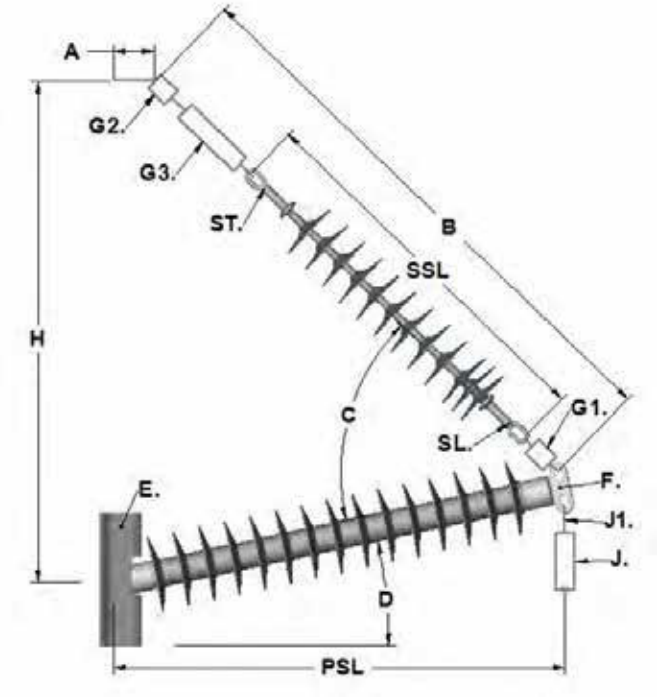
Insulator Options

Line Post: Typically, the line post of the braced post assembly will have a tongue line end fitting (F), and a bendable base tower connection (E). The bendable base is available as a gain or flat design type, or it can be replaced with a swivel or pivoting base, depending on the requirements of the application.

Brace Insulator: The suspension insulator that makes up the brace can be comprised of many end fitting combinations, per customer preference. The Eye / Eye combination is a commonly used design, it offers a greater degree of articulation when combined with anchor shackles.



Bendable Gain **Bendable Flat** **Swivel Base**



Bendable Base – Formed steel base that mates with an anchor end fitting on the insulator via 2 mounting bolts. These bases provide some vertical articulation of the post, which offers adjustment for the brace and connection hardware to the pole. Bendable bases come in gain and flat designs, with 0° & 12° up-sweep angles, as required for by application.

Gain Base – Base design used to mate the insulator to a round pole surface. This base is attached to the pole through the center bolt mount holes.

Flat Base – Base design used to mate the insulator to a flat surface, using either the 4 bolt holes along the ears of the base, or the 2 center mount bolt holes.

Swivel Base or Pivoting Base – This base provides articulation in the vertical and longitudinal directions. This design is typically used in areas where high longitudinal loading is required to compensate for unbalanced loads or broken conductor conditions.

Pole Band Assemblies – Another method of attaching a braced post assembly to a tower is by means of a pole band assembly. Pole bands are used on poles when mount holes are not available and cannot be drilled, or for maintenance / emergency response applications. Contact MPS for additional details.

Brace Connection Hardware Options

The brace of the braced post assembly can be made up of many different insulator and hardware combinations, depending on customer preference and design.

- The suspension insulator can make up the entire length of the brace, connected to the post and tower via anchor shackles. This is the simplest and more cost efficient design.
- The brace can consist of an electrically proportionate length suspension, combined with shackles for G1. & G2, and some form of steel hardware for item G3 (turnbuckle, straps, links, etc).

Options for G1	Options for G2	Options for G3	EF Options for SSL
Anchor Shackle (SL = Eye) Socket/Clevis (SL = Y-Clevis	Anchor Shackle (SL = Eye)	Turnbuckle Steel Strap Chain Link	Eye / Eye Eye / Ball Y-Clevis / Ball

Dimensions in inches unless otherwise noted

Custom Braced Post Designs

The MPS "Braced Post" section of this catalog has many standard designs available for system voltages 69kV through 230kV. If the designs shown in the catalog do not exactly satisfy the requirements of an application, custom braced post designs are available. At the end of the braced post section is a braced post worksheet, designed to communicate the specific details of a custom braced post design to MPS. The information provided on this sheet is used by MPS Design Engineering to develop the best fit design per customer request. In order to properly develop these designs, it is important to know the specific requirements of the application along with clarification about which details are most critical and which have some flexibility within the design. More Information = better designs and faster response time.

Braced Post Assembly Details: This section outlines the geometric/dimensional requirements of the assembly, including assembly height, section length, and angles. Ideally, the dimensions required would be expressed as a nominal value, with some +/- tolerances. When a specific dimension is absolutely required, it should be identified as "critical". Not every dimension can be critical, as some dimensions of the assembly are driven by others, therefore only 2-3 dimensions should be marked as critical.

Mechanical Loading Requirements: This section identifies the loading characteristics of the application. These values should be ultimate loads the assembly will be expected to withstand over long periods of time, and should fit within the working load curve of the assembly.

Electrical Requirements: This section determines the minimal requirement of the assembly with respect to electrical performance.

- Minimum leakage distance (and / or description of contamination level for the application)
- Minimum strike distance / dry arc
- Minimum requirements for 2 of the 4 electrical values (ex. Dry FO & CIFO+)
- Corona ring requirement

Assembly Details: The remaining sections identify the various options of the assembly

- Line post base requirement
- Suspension end fitting requirements
- Hardware attachments
- Extension hardware
- Conductor information (armor rod)
- Conductor attachment hardware

Hardware Assemblies and Packaging

MPS provides a single catalog number & drawing for each braced post assembly, whether it is a standard catalog item, or a custom design. The catalog number includes all the insulators, connection hardware, and conductor hardware as required, with all the various catalog numbers of the individual components bundled into one catalog number.

Packaging: There are several options for packaging insulator assemblies. Typically, the individual components are bulk packed separately and mated in the field by the customer. Custom packs and tower packs are available upon request. These value added options reduce costs in the field, help minimize lost or missing parts, and reduce the time from receipt of goods to installation.

Tower Packs: Unique packaging where each component of the assembly is packed into one crate, usually in quantities of 3, 6, or 9. MPS verifies fit and quantity of the components of the assembly. The crate can be marshaled out to the job site and dropped at the tower, where it can then be assembled and installed.

Custom Packs: MPS packages components together as required by the customer.

For additional information about braced post assemblies, contact your local MPS Sales Representative