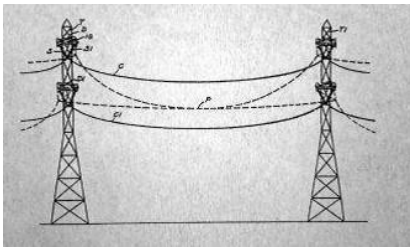
AR Products
Solutions for Galloping and Vibration Control

Galloping Mitigation of Transmission Lines



What is galloping?
Galloping occurs in high voltage lines when steady winds and freezing rain creates a crude airfoil along the leeward side of the conductor. Increasing winds at a 45° angle to the conductor create lift on the cable, not unlike an airplane wing. This wind effect causes the line to gallop up and down in single, double and triple loops. Not only does this motion create wear and stress on the structures, but if left uncontrolled, the power lines can touch, creating a fault in the system and power outages.

How can you mitigate galloping in power lines?
The most effective method to mitigate galloping is to cause the cable or conductor to twist by changing the wind angle of attack. Twisting can be achieved either aerodynamically or by eccentric weight. In wind conditions, the natural frequency of the conductor (and tension of the line) will allow the cable to rotate (torsion). Torsional motion initially resists the lift. Soon, usually at 6-8 mph, the aerodynamic forces by the wind are sufficient to overcome drag. Increasing steady winds (20-30 mph) cause increasing galloping amplitude by the conductor; motion that can travel span to span.

What is the most effective method to mitigate galloping?
In its *State of the Art of Conductor Galloping,* CIGRE reports mitigation measures (anti-galloping dampers) that cause a conductor to twist and change the wind angle of attack are the most effective way. Twisting reverses the wind forces and dumps off vertical aerodynamic lift. Other methods (like interphase spacers) may avoid clashing, yet tend to *synchronize* the galloping. Spoilers use aerodynamics to vary the wind angle, but without twisting the conductor. Neither method mitigates high amplitude motion. Dampers that twist the conductor by eccentric weight or other aerodynamic means are effective at mitigating galloping motion.

How high can a conductor galloping?
A conductor can gallop up to 100% of sag, which means that decreasing galloping amplitude by a certain factor (i.e. 20%) will not provide an adequate galloping solution. Interrupting galloping motion early by dampers that twist the conductor will significantly limit vertical amplitude to less than 5-7 ft., which is considered safe.

Can you predict galloping and what spans are at risk for galloping?
Most engineers use PLS-CADD to evaluate transmission systems. These programs identify spans that are at risk to gallop, clash or cause a flash-over (galloping violations). Galloping is a phenomenon. It cannot be predicted, however in recent years, field experience has shown galloping is more frequent and extreme in the following conditions:

- Flat terrain
- Sleet-belt, upper Midwest and in the states of Colorado, Kansas, Oklahoma, Texas, Iowa, Minnesota, Nebraska
- Spans running East/West
- Adjacent spans of the same span length
- Environmental conditions of 32° with 0.25” ice, with steady winds 12-35 mph.

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How does AR Products evaluate transmission lines for galloping violations?

AR uses proprietary software to evaluate a transmission line and to recommend the appropriate application of anti-galloping dampers. AR software calculates:

- The likelihood for flash-over or phase clashing,
- Critical wind speed where galloping initiates and where the aerodynamic lift is dumped,
- The predicted ellipses in galloping conditions.

How does AR Products mitigate galloping by high voltage lines?

AR Products solutions mitigate galloping using a 4 part solution:

- identifying spans at risk for galloping by evaluating the transmission line design and phase clearance
- selecting the appropriate anti-galloping damper for the transmission system (conductor, kV, span length, tower configuration)
- maximizing the damper's ability to twist the conductor by installing dampers over custom armor rods
- specifying the application on each span. AR uses a patented application that mitigates single and double loop galloping

Is there a way to observe galloping mitigation in action?

Transmission systems are often located on agricultural land and away from populated areas. It is rare to have observers in the places (individual spans) where galloping starts. **Watch this short video** that shows two side-by-side circuits during galloping conditions. Even though the video is grainy, it is clear that one circuit has uncontrolled galloping while galloping is mitigated on the other circuit. This video illustrates the galloping mitigation performance of the Windamper, an AR Product which has been in service on single conductors since 1968.

What can I do if our utility has experienced galloping power lines or if our PLS-CADD line design indicates galloping violations?

AR Products offers a No-Cost Analysis for utility customers or design engineers. For more information or to receive a No-Cost Analysis, complete the **Request for Recommendation form**.