ENERGY

WE ENERGIZE
THE WORLD

DAMPING SYSTEMS

TO REDUCE CONDUCTOR VIBRATION
AND ENSURE UNINTERRUPTED
ENERGY SUPPLY

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CONDUCTOR VIBRATIONS

DANGER FOR THE RELIABLE AND EFFICIENT ENERGY TRANSMISSION

VIBRATION

Overhead lines are the backbone of the electricity supply. They transport electricity over long distances and must withstand extreme weather conditions.

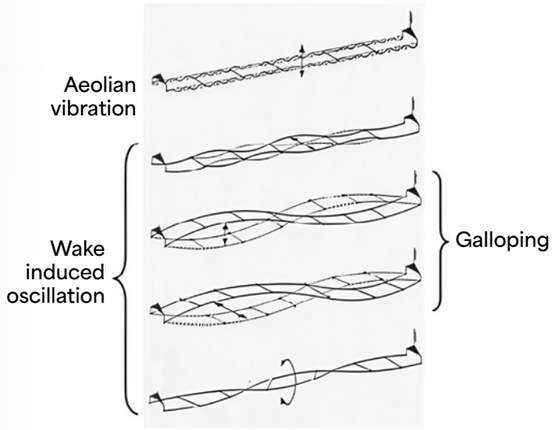
External influences such as temperature fluctuations, load changes and above all wind can cause unwanted vibrations in the conductors. Overhead line conductors experience both continuous and intermittent motions. The continuous movements consist of cyclic mechanical vibrations and oscillations, which derive their energy from the wind forces acting on the conductors. The intermittent movements are brief and result from a variety of causes. These conductor movements play a critical role in the design, safety, maintenance and lifespan of overhead conductor systems, and in some cases can even affect the stability of the supporting towers.

Aeolian vibration
is a form of high-frequency, low-amplitude motion that occurs in power line conductors due to wind. These vibrations typically occur in moderate wind conditions, with wind speeds ranging from 0.8 to 7 m/s, although the upper limit may be higher in flat regions. The frequency of these vibrations generally falls between 4 and 120 Hz, and the amplitude is usually smaller than the conductor's diameter.

! Fatigue due to aeolian vibrations is one of the most common types of damage observed in overhead power lines.

Wake-induced oscillation (Sub-span)
refers to various types of motion observed in conductor bundles due to the aerodynamic shielding effect of the windward conductors on those located downstream. This instability typically occurs at wind speeds from around 8 to 20 m/s, depending on the specific characteristics of the conductor bundle. The phenomenon is characterised by a low frequency ranging from 0.7 to 2 Hz.

! The vibrations can reach amplitudes sufficient to cause collisions between the subconductors, and they generate stresses on the spacer clamps. These forces can potentially cause damage to the subconductors.



Main categories of cyclic conductor motion

Galloping
is a highly visible and dramatic phenomenon that often causes significant damage, resulting in high costs. Galloping occurs in single or bundled conductors and is mainly caused by wind interacting with ice or wet snow accumulated on the conductors. Galloping frequencies generally range from 0.08 to 3 Hz, though higher frequencies can occur, typically at lower amplitudes. A minimum wind speed of approximately 25 km/h is required to initiate galloping.

! Damage can occur within a period of one to 48 hours due to the high dynamic loads and fatigue of conductors, hardware, insulators, and towers.

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CONSEQUENCES OF CONDUCTOR VIBRATIONS

WITHOUT DAMPING SYSTEM PROTECTION

IM
PACT

If not properly managed, it can lead to accelerated material degradation and, in extreme cases, damage to line components

Material fatigue of the conductor
The continuous movement causes microcracks, which impair the stability of the conductor in the long term.

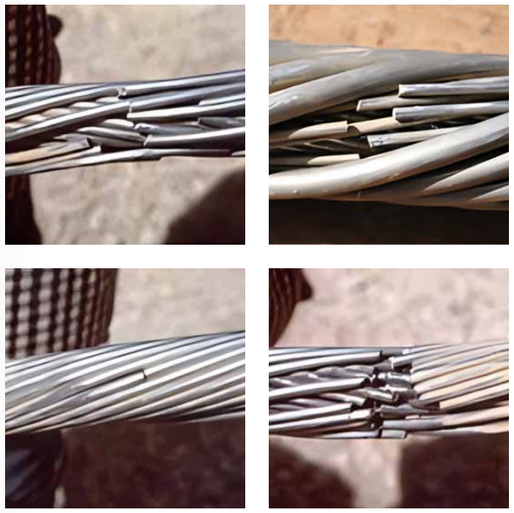
Damage to insulators and fittings
The vibrations also stresses the connections and brackets of the cables, which can lead to premature wear (cracks, loosened clamps on the conductor) and possible breakages.

Reduced service life of the infrastructure
Without suitable countermeasures, vibrations can lead to faster ageing of the entire line. There have already been cases where fractures on the transmission system have occurred after a few days because no appropriate damping system was applied. This is why damping systems shall be installed the latest 24 hours after tensioning on earth wire. There is usually a rule to install the damping system within a certain maximum time (24 hours) after tensioning on earth wire.

Danger to the power supply
In the worst case, rope breakages can occur, leading to power failures and high repair costs.

Additional high costs
due to the reduced service life of the components.

Damaged conductor due to fatigue



To prevent damage and ensure the continuity of electric service, it is crucial to fully understand the mechanisms behind wind-induced vibrations and adopt effective solutions to mitigate their effects, while ensuring the reliability and safety of the infrastructure.

DAMPING SYSTEMS

PROTECT YOUR ASSETS

CON
TROL

Damp Spacer Dampers

Our damping systems are essential for protecting the line from the effects of conductor vibration. Spacer dampers and vibration dampers are the key components of these systems, which we customize to meet specific line design request.

The primary function of the spacer damper is to preserve the configuration of conductor bundles within the design limits under normal operating conditions. These are spacing devices with inertial, elastic, and damping properties that are specifically designed and coordinated to reduce aeolian vibrations. Correctly positioned along the span, it keeps the wake induced oscillation (Sub-span) under control.

Metal-to-metal bolted clamp cantilever
to exactly accommodate the specified conductor size, not for a range of diameters. The nut is captive in the clamp.

Bolted clamp cantilever with Rubber lined clamp
with an added rubber line placed between the clamp cap and body, ensuring the conductor does not directly contact them, providing extra safeguarding.

Helical fixation (with armour rods)
clamp eliminates the need for screws. The connection is made with armour rods, a rubber liner in the clamp body prevents direct cable contact on metal clamp.

Nutcracker rubber lined with latch (boltless)
clamp eliminates the need for screws and can be tightened on conductor turning 90 ° a latch.

Vibration Damper

Vibration dampers such as Stockbridge type
Absorb high frequency vibrations efficiently (to the maximum allowed level) and reduce material fatigue. Since conductor vibration frequency fluctuates with wind speed, the damper's effectiveness depends on its ability to provide damping across the expected range of vibration frequencies.

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DAMPING STUDIES

SOFTWARE SIMULATIONS AND VIBRATION TEST SPANS

EXPERTISE

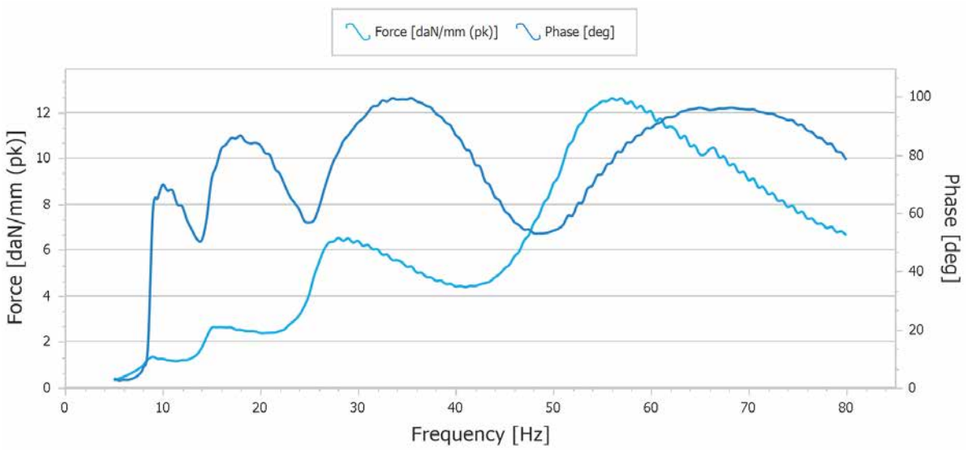
Vibration studies

We analyse each overhead line individually to ensure effective vibration protection. Through comprehensive damping studies, we determine the optimum system solution for maximum safety and longevity of the infrastructure.

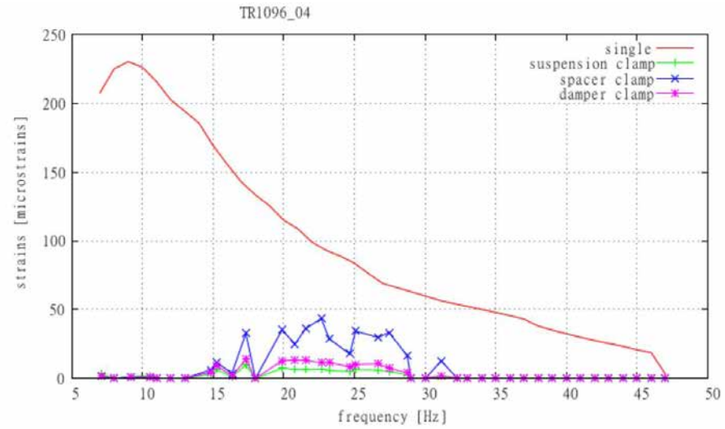
Our vibration studies consider all relevant influencing factors, including

- Route and terrain
- Climatic conditions
- Cable data and voltage
- Configuration and spans
- Self-damping properties of the line (if known)

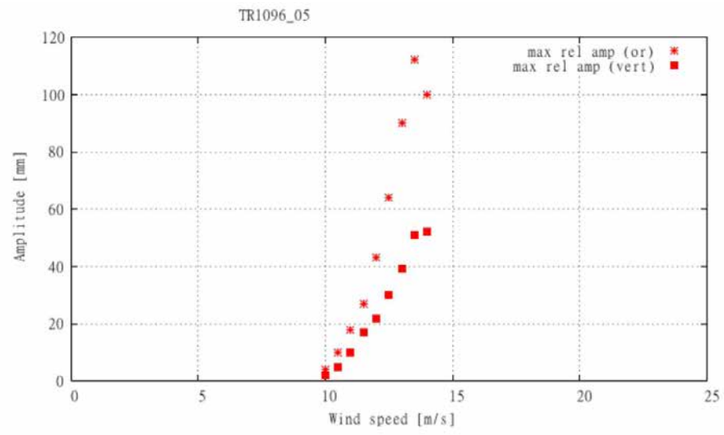
Based on these parameters, we determine the optimum damper solution, the required number and the ideal position within the span for long-term protection of the system.



The selection of the right damper is made during tender stage selecting the best frequency reply with a specific damping study



Example of Aeolian Vibration Level – Strains (in microstrains 0-peak)



Example of Subspan oscillation amplitude (conductor approaching mm).

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VIBRATION MEASUREMENT

SIMULATION AND FIELD TESTS

COMPE
TENCE

We test and validate all damping systems on our own vibration test bench. Our damping systems for single conductors and bundled conductors are developed using state-of-the-art computer vibration analyses.
This enables us to simulate the behaviour of conductors under real wind conditions and carry out field tests using vibration recording devices.

Continuous vibration measurement in real time
With the vibration sensor, we offer a solution for evaluating vibration characteristics and dynamics directly on the conductor in real time. Utilising advanced technology, this sensor redefines the standards of motion monitoring with its exceptional features. In real time you get:

- Vibration characteristics of conductor
- Heat map of motion
- Amplitude/frequency spectrum
- Seasonal vibration pattern
- Real-time movement of conductor

Reliable Partner

We offer customised solutions that sustainably protect the overhead line system from damage caused by conductor vibrations.

Our experience
- of more than 75 years in transmission line systems
- our competency in the field of damping protection
- our modern production and high production capacities
- and damping solutions installed all over the world make us a reliable partner.

Our Innovation Department is constantly exploring new ideas and projects to better meet the needs of the OHTL market worldwide.

We receive positive customer satisfaction feedback not only regarding the performance of our installed devices but also in terms of techno-commercial assistance, data supply, and service quality.

A good project is not primarily remembered for the resources spent, but for the efficiency and reliability demonstrated over time.

>5 MILLION
DAMPING SYSTEMS INSTALLED
WORLDWIDE **110 TO 1,000 KV**

DAMP
SPACER DAMPER
SINCE **1974**

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