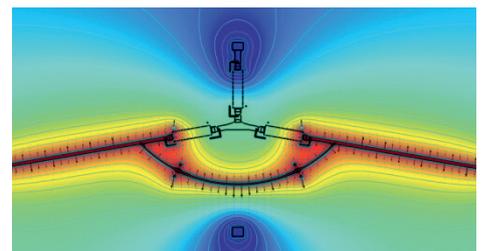


Cost-effective
solutions for
modifying
overhead lines

The Insulated Suspension Chain ISC

is a straightforward solution for increasing the operating voltage of power lines fast and simple. Voltage increases can mean lengthy planning approval processes and high investment costs if the towers need to be changed. With Insulated Suspension Chain ISC (german: iTAK – isolierte Tragabspannkette), the tower and suspension points remain the same. The existing infrastructure (poles) can still be used. Furthermore the ISC is an excellent solution to fulfill the requirements of bird protection.

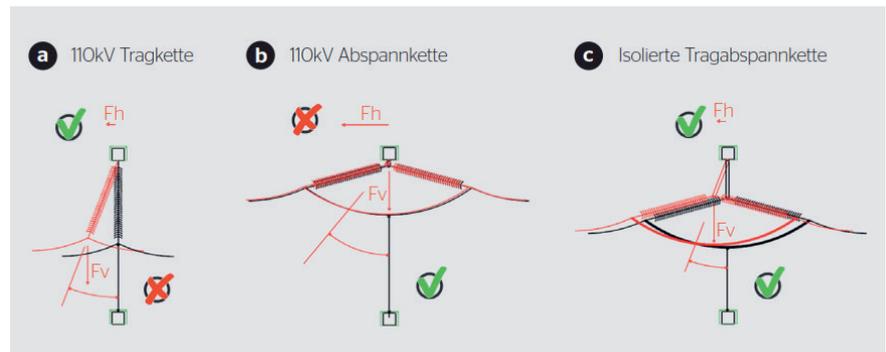
- | | |
|---------------------|---|
| Applications | <ul style="list-style-type: none"> · Overhead lines that are to be upgraded to a higher voltage level |
| Product | <ul style="list-style-type: none"> · One Y suspension chain with three insulators in a Y shape (porcelain or silicone) · Insulated conductor loop · Matching protective fittings |
| Advantages | <ul style="list-style-type: none"> · Cost-effective · Environmentally friendly · Durable · Easy to fit · Tested connection · Bird protection |
| Testing | <ul style="list-style-type: none"> · Type test in line with IEC 60071 · Lightning impulse withstand voltage of 550 kV positive/negative · Power-frequency withstand voltage test 230 kV dry/wet · Switching impulse withstand voltage test 742 kV · Bird protection test |



Simulation of the electric field.

Design

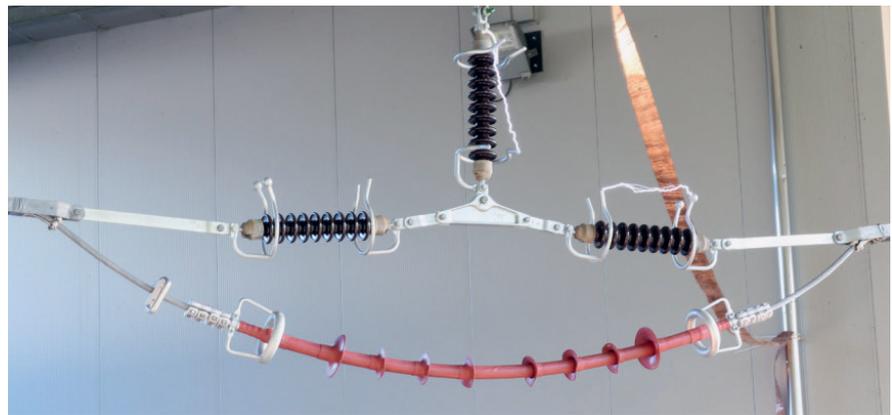
The insulated Y suspension chain consists of three insulators arranged in a Y shape and an insulated jumper. This inherently complex design is necessary in order to absorb horizontal cross-forces. Although a single 110 kV insulator could absorb these forces, the required distance from the pole or crossarm could no longer be guaranteed in this case. This problem could be solved with a tension string, but the cross-forces on the crossarm would then be too high. By combining the Y suspension chain with the insulated jumper, the problems relating to static forces and electrical distances can be resolved. The insulated jumper also offers protection for large birds which come between the ISC and the crossarm and will only be scared away and will not risk their life.



Static forces and electrical distances.

Type Test

The insulated suspension chain has undergone type testing by the High Voltage Testing and Engineering Commission (Fachkommission für Hochspannungsfragen, FKH) in Däniken, Switzerland. It passed the tests for lightning impulse withstand voltage of 550 kV (positive/negative) and standard power-frequency withstand voltage of 230 kV in both dry and wet weather conditions. In the event of a switching impulse, the



Test setup for electrical tests.

flashovers are transmitted to the arcing rings. The arcing rings are aligned so that the flashovers occur at the top rings, and not over the jumper. This system can reliably sustain an impulse voltage of ± 550 kV. Even at the maximum switching impulse voltage of $+742$ kV applied at the test site, flashovers only occurred at the top arcing rings. In a typical situation for a bird on a high-voltage pole, discharges of 2 pC were measured. This level is harmless to birds.

Developed and manufactured in Switzerland

The concept of the insulated suspension chain was developed by Axpo, one of Switzerland's leading distribution grid operators. In order to increase the voltage in its distribution network from 50 kV to 110 kV quickly and cost-effectively, Axpo worked with various partners to develop the insulated suspension chain and hold a patent for this solution. Since 2020 the ISC is in operation on existing lines in the grid of the Axpo Grid AG without any problems.

Sefag Components produces the insulated suspension chain for Axpo and exclusively distributes it. Together with our customers, we want to design project-specific solutions with the ISC as the centrepiece.

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