Paris Session 2022

Experience with galloping countermeasures in Tepco PG

PS2/Group2:Conductor, Q.2.7

Would experts from other countries/utilities share their experience using LSs or other technologies against conductor galloping?

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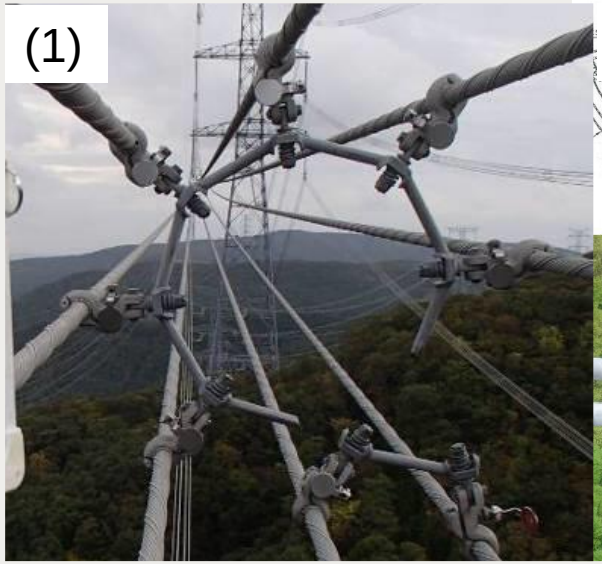
1. Environment and Galloping Coutermeasures in Tepco PG

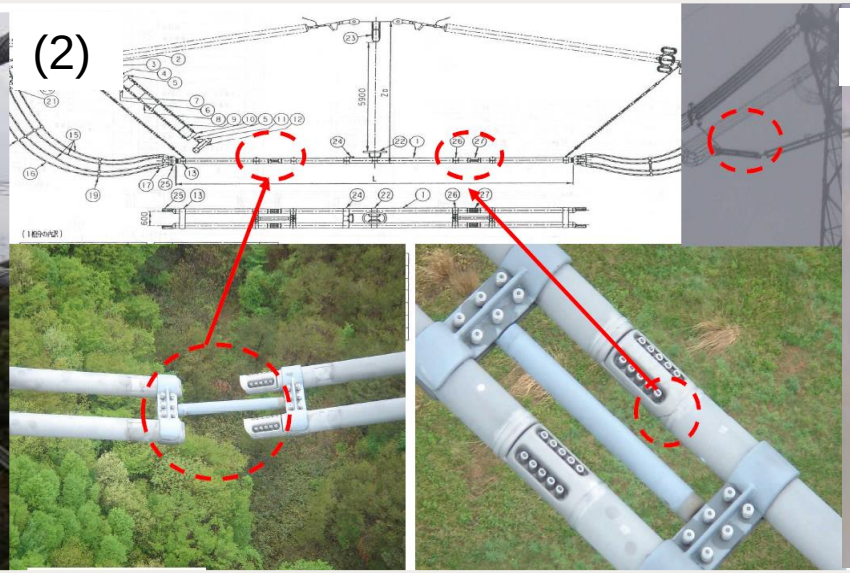
- Tepco PG is an electric power company in Japan.
- We own around 15,000km of overhead transmission lines, which include around 43,000 towers.
- Our voltage classes range from 66 to 500 kV, with design voltages up to 1,000 kV.
- **Our galloping countermeasures** are taken based on **post-measures**.
- Our company uses **three kinds of galloping countermeasures** as shown below.
- At 154 kV or less**, interphase spacers** are mainly used because many facilities use single conductors. In the 275 kV or more, **Rotatable spacers + eccentric weights** and **loose spacers**.

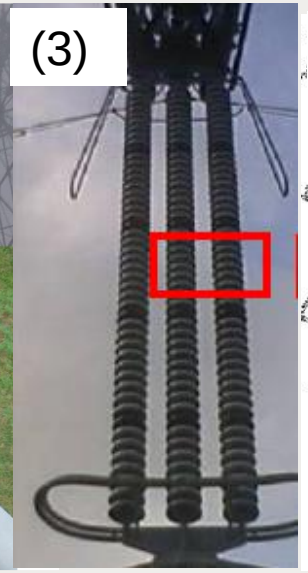
Item	Interphase Spacer	Rotatable spacers + Eccentric weights	Loose Spacers
Applicable Range	154kV or less (Single conductor, 2- bundle conductors)	275kV or more (4-bundle conductors)	275kV or more (2 ~ 8-bundle conductors)
Principle of suppression	Preventing wires from physically approaching each other	Preventing periodic vibrations by shifting the center of gravity of subconductors	Preventing periodic vibrations by shifting the rotational angle of subconductors
Advantages	Can prevent electrical accidents very effectively.	Can suppress vibration very effectively.	Low impact on equipment.
Disadvantages	Steel towers have to be reinforced due to the heavier conductors.	Steel towers have to be reinforced due to the heavier conductors.	Less effective than rotatable spacers + eccentric weights.

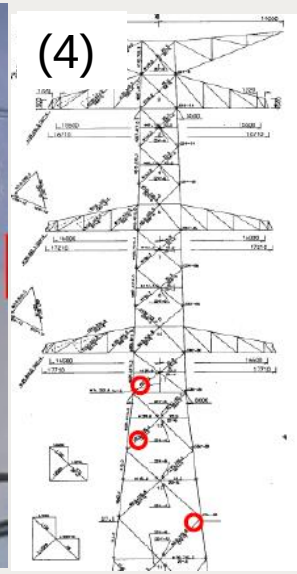
2. Examples of damage to equipment caused by galloping

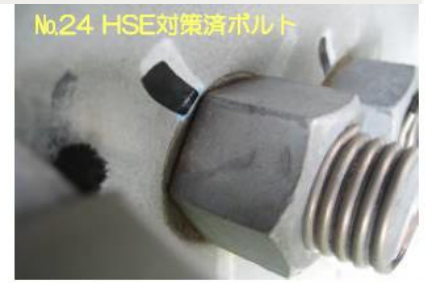
- Right Photo shows a **UHV-designed 500 kV transmission line** in northern area in Japan.
- The line suffered damage from galloping **in 2007 and 2012.**
  (1) The eight-bundle **spacers** were broken.
  (2) The pipe-type **jumpe**r was broken at the welded part.
  (3) The **insulators** were partially cracked.
  (4) Some steel tower **bolts** came loose.











3. Current situation of Galloping countermeasures at Tepco PG

- The ratio of facilities installed galloping countermeasures is **about 4%.**
- We developed a galloping countermeasure with loose spacers for a UHV design transmission line.
- **The loose spacer for eight-bundle conductors** was applied, focusing on ten spans known to have sustained significant galloping equipment damage in the past.
- No subsequent major damage to facilities was recorded.
- Additionally, we are developing a **new type of galloping countermeasure** for single conductors as alternatives to interphase spacers at 154 kV or less.

Voltage	Total Line length	Facilities with galloping countermeasures	Interphase - Spacer	Rotatable Spacers + Eccentric weights	Loose - Spacers
500kV	2,542km	66.8km (2.6%)	0%	51.6%	48.4%
275kV	1,175km	67.9km (5.8%)	16.6%	41.4%	42.0%
154kV	2,957km	47.1km (1.6%)	91.5%	0%	8.5%
66kV	7,738km	343.6km (4.4%)	98.4%	0%	1.6%