Award Winning Product Innovation & Design

//Lightning Protection for Overhead Lines -TAG Triggered Arc Gaps

Allied Insulators

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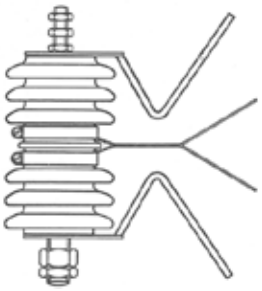
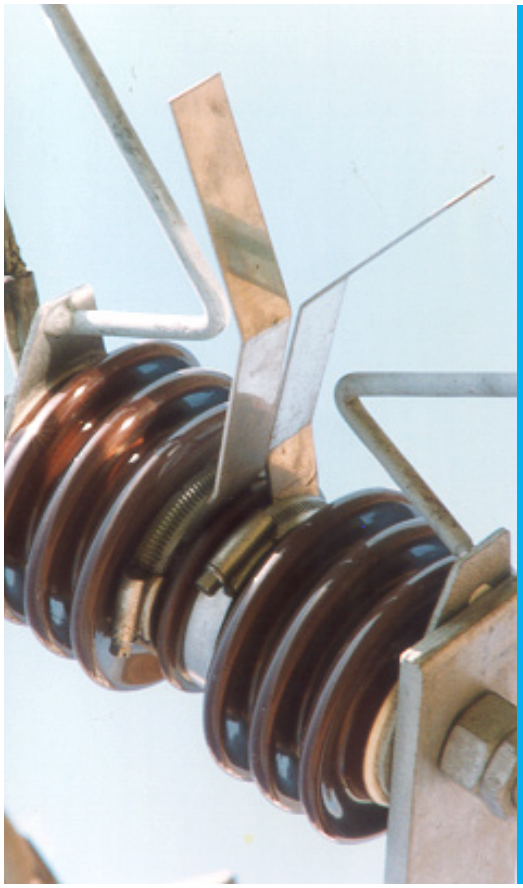


The transient overvoltages caused by the effects of lightning on an overhead line distribution network can be damaging to the system equipment, costly to the network operator carrying out the repairs and inconvenient to the customer suffering from a likely loss of supply.

The greatest source of overvoltage on the overhead distribution system is from lightning activity. Its effect on the lower voltage networks for example at 11kV & 33kV is very different from that on those operating at higher voltages due to magnitude of voltage from an indirect strike being lower than the basic insulation level of the higher voltage line. At these higher voltages, overvoltage is usually the result of direct strikes to the overhead conductors. At 11 & 33kV however most of the incidents of overvoltage due to direct strikes are far outnumbered by induced overvoltages resulting from lightning ground strikes in short proximity from the line; these are known as indirect strikes.

Induced overvoltage caused by the indirect strike is bipolar having a negative peak followed by a usually smaller positive peak the two flashovers are caused from conductor to earth on different phases of a three phase line and typically separated by about 0.7Km/s. Triggered Arc Gaps exploit this phenomena to provide inexpensive lightning protection for plant on 11kV & 33kV overhead lines. The widespread use of surge arresters has indeed reduced some of the lightning related incidents but mainly due to direct lightning strikes. A more cost effective and reliable way to reduce lightning incidents and damage by system generated power follow through is the rapid extinguish of overvoltages using the unique self-extinguishing properties of TAG's (Triggered Arc Gaps).



Triggered Arc Gap

The 11KV & 33kV TAG's consists of specially manufactured porcelain with a high potential, earth and two auxiliary electrodes forming a four capacitance bridge. The gap spacing ensures that its breakdown voltage is exceeded by a significant margin when an impulse of sufficient voltage to breakdown the main gap is applied. The overstressed auxiliary gap quickly breaks down with a copious source of electrons and irradiation at mid-gap.

The auxiliary arc is therefore quickly converted into a main gap arc and breakdown of the main gap is rapid. The response time of the TAG ensures that the main arc is extinguished on the first zero voltage crossing in the first half cycle or 10ms at most. This is sufficient to avoid upstream protection operation which will be in the region 100-200ms or 5 to 10 cycles.

Hence no system interruption.

The Application

Fitted approximately every 1km the TAG's are connected to the centre phase of three phase lines and are earthed to a value of earth resistance less than 20 ohms for the most effective protection of equipment.
The induced overvoltage caused by a present on all three conductors of a three phase line and is sustained by the capacitance to earth of each conductor. The capacitance between conductors is not changed.
If a flashover to earth can be instigated on the centre conductor the effect is to connect this conductor to earth discharging the conductor to earth capacitance at the same time. The change in potential of the centre conductor can take place only by charging the capacitance between the centre and outer conductors.
The charge required for this is derived from the outer conductor to earth capacitances which, being of about the same value, deliver about half of their charge hence the potentials of the outer conductors fall to about one half of their value.

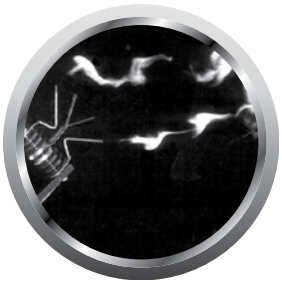
The Benefits

Over 25 years of operational experience in the United Kingdom with over 8000 units now in service, the TAG has proved to be an effective, reliable and inexpensive means of overvoltage protection, potentially reducing lightning related incidents by up to 30%.

- Lower cost option to surge arresters
- Unaffected by Rain & Pollution
- Excellent Reliability
- Provides better protective level than surge arresters
- Simple to install (and can be installed live)
- Maintenance Free

Availability

Allied Insulators TAG - Triggered Arc Gaps are made in England and available in both 11kV & 33kV complete with mounting bracket and line connection kit.



Installation Guide

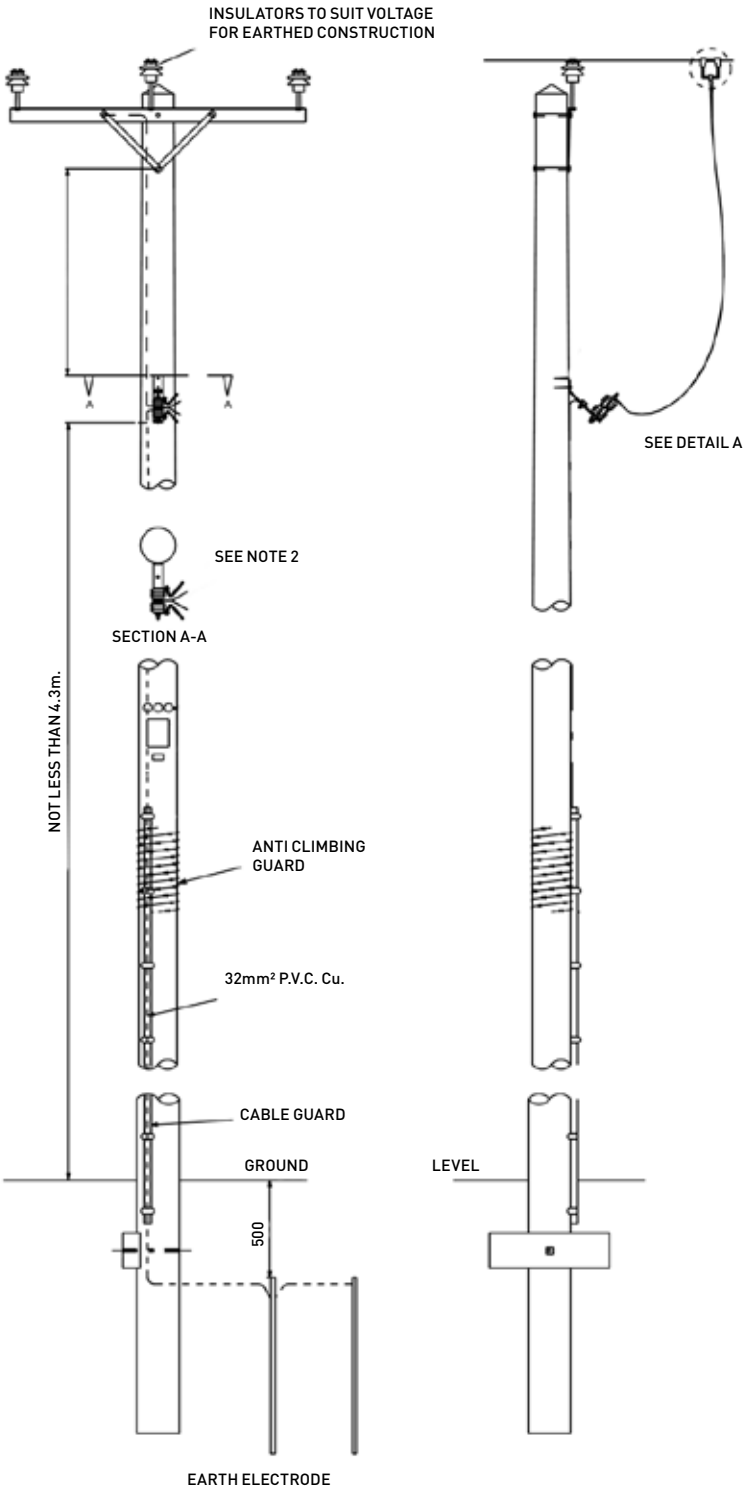
Triggered Arc Gaps are installed to protect transformers subject to induced over voltages from lightning strikes to the ground near to the line being damaged. Triggered spark gaps will not protect equipment from direct lightning strikes.

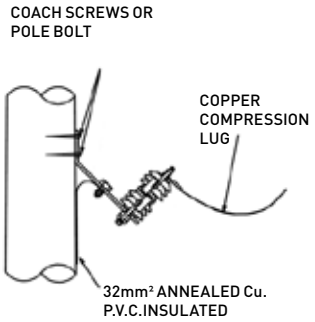
Usually, transformers are installed in groups to supply villages or small communities. Such groups of transformers should be protected by a triggered spark gap installed as near as possible to the centre of a circle of diameter 1km which encloses as many transformers as possible.

Where there are single transformers on or near the main line, then triggered spark gaps should be installed approximately every kilometre of the main overhead line. The triggered spark gaps are connected to the centre phase of three phase lines, and are earthed to driven rods adjacent to the pole. The earth resistance should be less than 20 ohms for the most effective protection of transformers. As resistance above 40 ohms significantly reduces the effectiveness of the triggered spark gaps, reasonable efforts should be used to get a resistance of less than 40 ohms.

On single phase lines (i.e. with two conductors) the triggered spark gaps should be installed preferably on the conductor that is the centre phase of the main three phase line of which it is a spur. If a choice of site is possible within the criteria above, then the triggered spark gap should be on the three phase line rather than the single phase line.

Isolated transformers should be protected by a triggered spark gap on the first pole away from the transformer.





DETAIL A

MATERIALS

BAIL CLAMP TO SUIT CONDUCTOR
LIVE LINE TAP
TRIGGERED ARC GAP
32mm² ANNEALED Cu.P.V.C.INSULATED GREEN
EARTH ELECTRODE
EARTH WIRE CAPPING
32mm² 7/2.46 H.D.B.Cu.JUMPER
COMPRESSION LUG-EARTH LEAD
BARBED WIRE
MOUNTING BRACKET
EARTH ELECTRODE CLAMP

NOTES.

1. INSULATOR TO BE MOUNTED WITH ARCING HORNS AT RIGHT ANGLES TO THE FIXING BRACKET SO THAT THE CONDITION OF THE TIPS CAN BE SEEN FROM THE GROUND
2. TRIGGER GAP TO BE SET TO 3mm. FOR 11kV. UNIT AND 10mm.FOR 20kV.UNIT.
3. ARC HORN GAP TO BE SET TO 50mm. FOR 11kV.UNIT AND 65mm.FOR 20kV.UNIT.
4. INSULATORS MAY REQUIRE UPRATING FOR EARTHED CONSTRUCTION

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