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„INZP 10 kA medium voltage surge limiters, switch type, in polymer protective cover, manufactured by ETI Polam „

Sparkles over-voltage limiters have very essential functions in the medium voltage electro-energetic lines. They must react on different kinds of surges, act in adequately short time to protect the line and supplying devices. They must be weather resistant, to not cause unnecessary operations. They should signal the internal varistors damages. These INZP 10 kA surge limiters, in the polymer protection cover, manufactured by ETI Polam comply to all this requirements.

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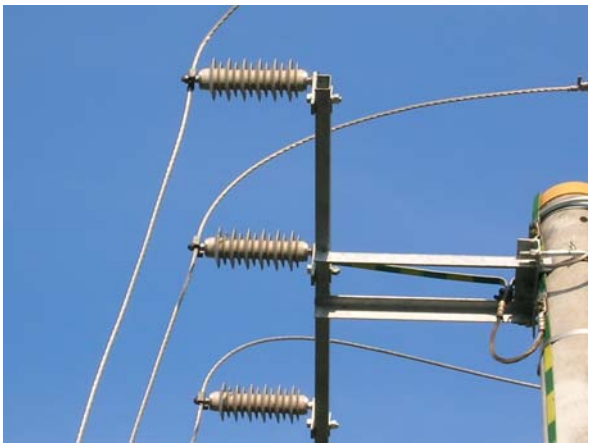
Rys. 2 Ogranicznik INZP w wersji standardowej S

Fig. 1 INZP limiter with bracket and disconnector



Structure:

Sparkles over-voltage limiters type INZP are equipped with varistor heaps, made from zinc oxide varistors. The mixture with addition of metal oxides is pressed in the form of tablets and then annealed in the stove in the temperature above 1000 C°. After the end of the manufacturing process varistors are compactly selected in respect of electric parameters and measurements. Varistor heaps are putting together in such way, that all parameters of the limiter are satisfied. They are the subject to the initial test of electric parameters. The varistor heap is fastened on the epoxy glass grate, which assures the very permanent construction of the limiter. Silicone protection is made by the immediate injection of material on the grate, in which varistors are secured. This warrants the ideal tightness, the lack of empty spaces inside the module and large resistance on mechanical tensions. In the case of heap damage, the lack of empty spaces causes, that there is no danger of the voltaic arc. Silicone protection is made in hot vulcanization technology (HTV). Performed in such way isolating protection has very good isolating properties and also shows the very large resistance on the activity of weather conditions. Silicon protection made in this technology keeps its insulating proprieties over long years of the exploitation.
Protection cover has strong hydrophobic proprieties. This means, that water is pushed away from the protection cover surface and does not accumulate on the limiter surface. Contaminations aggregated over the time will never gather the conductive properties, because water disappears from the surface of the protection cover, what is secured by the lack of conductible paths. The protection cover is also erosion resistant. Forms used to the silicone vulcanization process are made in such way, that the protection cover together with shades creates solid and seamless corpus. Sloping

shades accomplished in the system alternately small-large warrant, that the outflow way from the protection cove is extended. Limiters can be used also as bracket insulators. For rated voltage of the network 15 kV the limiter accomplishes requirements for pollution zone IV. Detailed data of the HTV technology and the motor protection cover are described in the further parts of this chapter. Strongly non-linear voltage-current characteristics of varistors, enable the quick surge limitation and their inactivation through directing the percussive current down to the ground. The suitable varistors and limiter construction, causes that there is the absorption possibility of large amount of energy without the whole module destruction.
Limiters have assured perfect isolation, are easy in the transport, storage and exploitation.
INZP type limiters comply requirements of norms ANSI/IEC 62.11-1993, PN - IEC60099 - 4:2004 for the discharge line 1 class.

Signaling the limiter failures

Version with a signaling switch Fig. 1(a) is intended to the varistor heap failure signaling. Very large value of the percussive current flow through the limiter can lead to the varistor structure damages and in the varistor heap can arise the conductible path. The transfluent short-circuit ground current is broken by the switch through the rejection of the flexible line connecting the limiter with an earth. This version of the limiter can serve in power networks with insulating zero point. In this type of the network, after the varistor heap damage, through the limiter flows the small value capacitive current, which does not cause any changes to the network operation. Detection of such current in the circuit is difficult and takes a lot of time. The switch In this instance, switch is responsible for earthing separation of the damaged limiter and the visual signaling about necessity of its exchange. In consideration of the shape of time-current characteristics of the switch, he does not cause getting down to work any protections of terrestrial-short-circuit and the signaling of the earth short-circuit. In this version, when the switch start to operate, on the lower part of the limiter can appear the phase voltage.

Short-circuit endurance of the limiters

This parameter defines the endurance of over-voltage limiters in the moment of flow through it the short circuit current after its damage. At the short circuit current in the network point, wherein the limiter is installed with the smaller current value from value of the short-circuit endurance , its structure does not pull apart, consequently not creating any threats for other devices and strangers. Time-current characteristics of the limiter switch (Fig. 4) permits to define the duration of the short-circuit, and consequently permits to choose the suitable terrestrial-short-circuit protections.

Fig. 4 t-I characteristics of the limiter

Table page. 11 Fig.5

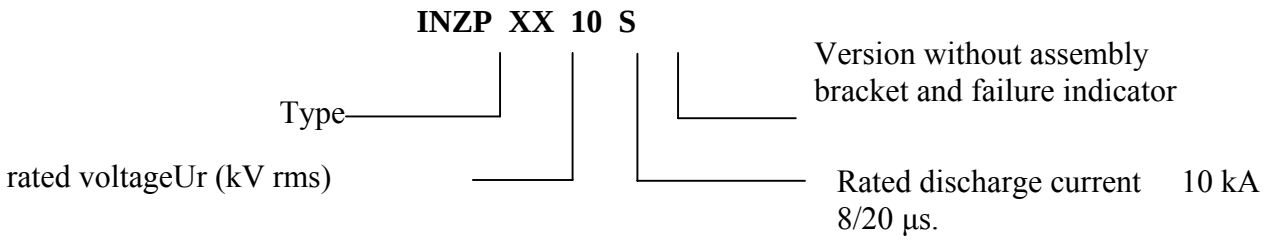
Electrical endurance of the limiters

Sparkles medium voltage surge limiters are subject to following tests :
- Short impulse current test : 2 discharges with the peak- current 100 kA
- Prolonged impulse current test: 20 impulse-discharges with current of 250 A over 2000 μs
Cyclical discharges Endurance: 20 impulse-discharges with current of 10 kA and 2 impulse-discharges with current of 40 kA with 8/20 μs shape.
After each test, INZP limiter must stay thermally stable and the voltage lowered during the flow of the discharge current cannot increase more than 10 %.
INZP limiters are also subject to the test by 5000 hours tests, according to the senescence of silicone protection cove in compliance with an appendix C of the IEC 1109 norm.

Features of the INZP limiters

Great absorptive power of the energy
Stable protective characteristic
High pollution resistance
High dynamic surges resistance
Possibility of operation in horizontal or vertical position
High resistance on the formation of erosive paths- a good outflow way
Good tightness
High safety degree, even in case of the damage and the flow large value short-circuit current - lack of occurrence of the explosive discerption of the protection cover
Version with the failure signaling module - visible discontinuity
Unattended operation
Vulcanization technology of the protection cover with shades - HTV, seamless
Possibility of operation as the bracket insulator

Marking methodology



Accessories of the INZP limiters

Table 1 Basic parameters of the INZP limiters

Basic parameters	
Rated discharge current 8/20 μs	10 kA
Boundary stroke endurance 4/10 μs	100 kA
Long-time rectangular strokes endurance - 2000 μs	250 A
Maximum discharge current endurance 8/20 μs	40 kA
Line discharge class	1
Energy absorption	3,5 kJ/kV Ur (4 kJ/1kV Uc
Short-circuit endurance	20 kA
Mechanical endurance (Bending moment)	250 Nm
Bracket mechanical endurance (Bending moment)	80 Nm
Mechanical endurance (twisting moment)	90 Nm
Extension endurance	625 N
Operational temperature - range	$-50^{o}C$ - $+45^{o}C$
Maximum operating high	1000 m n.p.m.
Operating voltage frequency – range	48-62 Hz
Maximum diameter of the connected line	70 mm^2