

Túlfeszültség korlátozók zárlati vizsgálatai



a DEKRA company



Várhelyi Zsolt

NTO osztályvezető-helyettes

zsolt.varhelyi@dekra.com / +36 30 565 3068

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Túlfeszültség korlátozó vizsgálatokra vonatkozó szabványok

Surge arresters –

Part 4: Metal-oxide surge arresters without gaps for a.c. systems
(IEC 60099-4:2014)

A szabvány címe magyarul:

Túlfeszültség-levezetők.

4. rész: Szikraköz nélküli fém-oxid túlfeszültség-levezetők
váltakozó áramú rendszerekhez
(MSZ EN 60099-4:2015)

A VEIKI-VNL laboratórium tagja az STL-nek (Short-Circuit Testing Liaison), amely nagyteljesítményű zárlatokra képes laboratóriumok nemzetközi egyesülete. Feladata a közép és nagyfeszültségű készülékekhez tartozó IEC szabványok közös, pontosított értelmezése. Tagjai számára az STL guide-ok követelményei mint kiegészítés használhatók a vizsgálatok során, amely segít a vizsgálatok egységes kivitelezésében és dokumentálásában.



A túlfeszültség korlátozók zárlati vizsgálatának alapvető céljai

- A megszóalást követő íves zárlat esetén élet és vagyonvédelmi kritériumok teljesülésének ellenőrzése;
- A megszóalást követő íves zárlat esetén a túlfeszültség korlátozók zárlati viselkedésére vonatkozó kritériumok teljesülésének ellenőrzés.



Vizsgálati szempontból a legfontosabb paraméterek

3.53

rated short-circuit current

I_s

highest tested power-frequency current that may develop in a failed arrester as a short-circuit current without causing violent shattering of the housing or any open flames for more than two minutes under the specified test conditions

3.54

rated voltage of an arrester

U_r

maximum permissible 10 s power frequency r.m.s. overvoltage that can be applied between the arrester, as verified in the TOV test and the operating duty test

Rated voltage - U_r ... kV

Continuous operating voltage - U_c ... kV

Rated frequency ... Hz

Arrester classification¹⁾

Nominal discharge current - I_n ... kA

Note 1) For station surge arresters: SH, SM or SL, for distribution surge arresters: DH, DM or DL

"Design A" arresters have a design in which a gas channel runs along the entire length of the arrester unit and fills ≥ 50 % of the internal volume not occupied by the internal active parts.

"Design B" arresters are of a solid design with no enclosed volume of gas or having an internal gas volume filling < 50 % of the internal volume not occupied by the internal active parts.

Table 7 – Required currents for short-circuit tests

Arrester class = nominal discharge current	Rated short-circuit current I_s	Reduced short-circuit currents ± 10 %		Low short-circuit current with a duration of 1 s ^a
kA	kA	kA		A
20 or 10	80	50	25	600 $\pm$ 200
20 or 10	63	25	12	600 $\pm$ 200
20 or 10	50	25	12	600 $\pm$ 200
20 or 10	40	25	12	600 $\pm$ 200
20 or 10	31,5	12	6	600 $\pm$ 200
20, 10 or 5	20	12	6	600 $\pm$ 200
10 or 5	16	6	3	600 $\pm$ 200
10, 5, or 2,5	10	6	3	600 $\pm$ 200
10, 5, or 2,5	5	3	1,5	600 $\pm$ 200
10, 5 or 2,5	2,5 kA	–	–	600 $\pm$ 200
10, 5 or 2,5	1 kA	–	–	Amplitude and time on agreement between user and manufacturer
10, 5 or 2,5	< 1 kA ^b	–	–	Amplitude and time on agreement between user and manufacturer

A vizsgálatok nagy részét jellemzően a két sárga vonal közötti tartományban végezzük, általában 1 kV – 90 kV névleges feszültségű korlátozókon.



Jellemző próbatárgy típusok

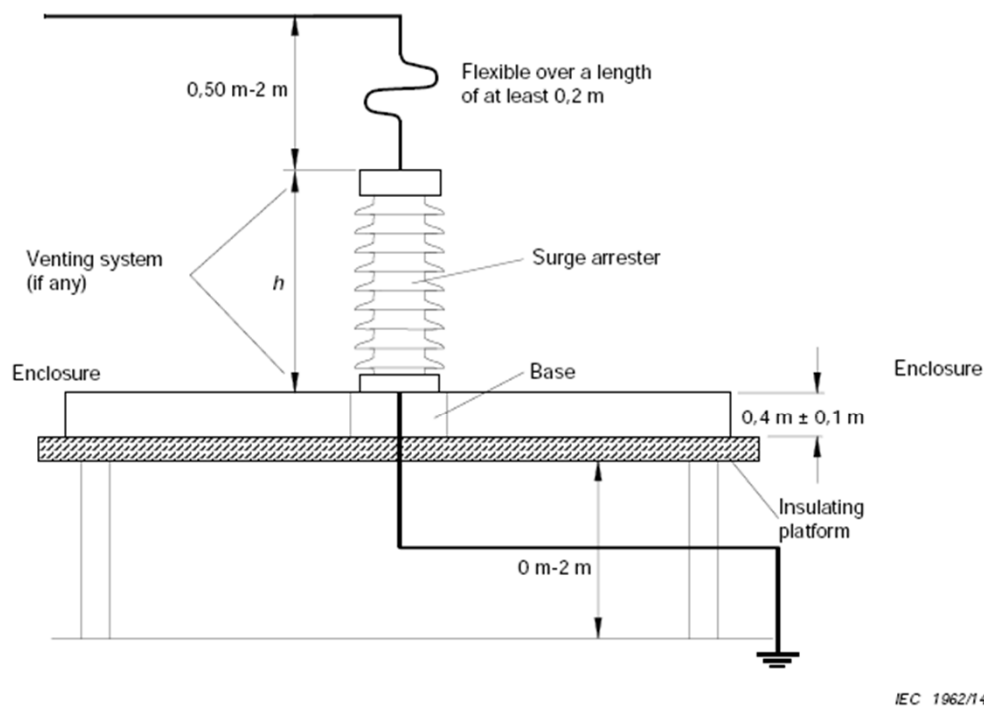
Polymer-housed surge arresters
Polymer-házaz túlfeszültség korlátozók



Separable and dead-front arresters
Kábelfejbe integrált túlfeszültség korlátozók

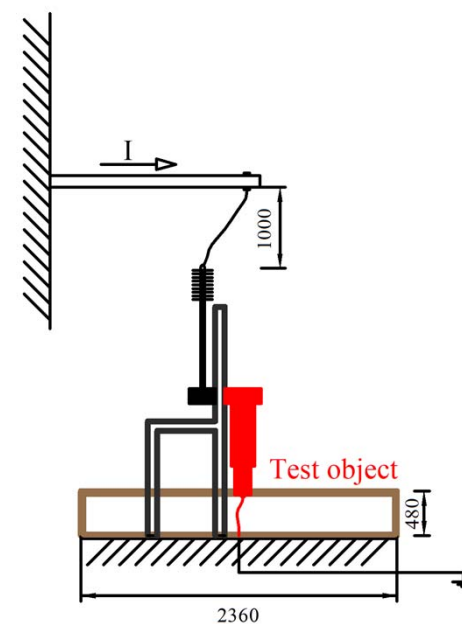
Porcelán házas korlátozók vizsgálatát nem vállaljuk mivel robbanás esetén a repülő porcelán szilánkok jelentős pusztítást végezhetnek a berendezéseinken. Mára szerencsére az iparban is kevésbé preferálják őket.

A vizsgálati elrendezés



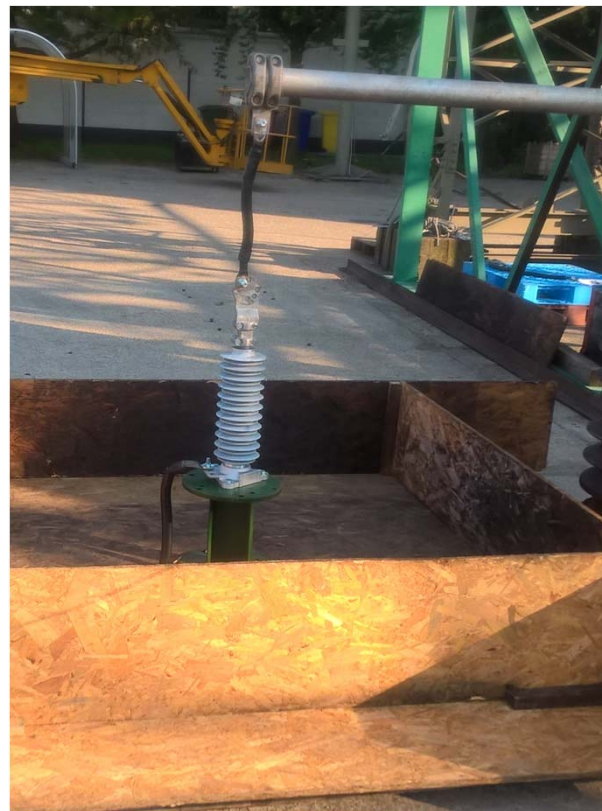
NOTE All leads and venting systems in the same plane.

Figure 9 – Short-circuit test setup for polymer-housed arresters



Wooden square enclosure
Metal support structure

A vizsgálati elrendezés



Vizsgálati paraméterekre vonatkozó előírások

10.8.10.2.3 "Design B" arresters

Replacement of Subclause 8.10.2.3:

No special preparation is necessary. Standard arrester units shall be used. The arrester units shall be electrically pre-failed with a power frequency overvoltage. The overvoltage shall be run on completely assembled test units. No physical modification shall be made to the units between pre-failing and the actual short-circuit current test.

The overvoltage given by the manufacturer shall be a voltage exceeding 1,15 times U_C . The voltage shall cause the arrester to fail within (5 ± 3) min. The MO resistors are considered to have failed when the voltage across the MO resistors falls below 10 % of the originally applied voltage. The short-circuit current of the pre-failing test circuit shall not exceed 30 A.

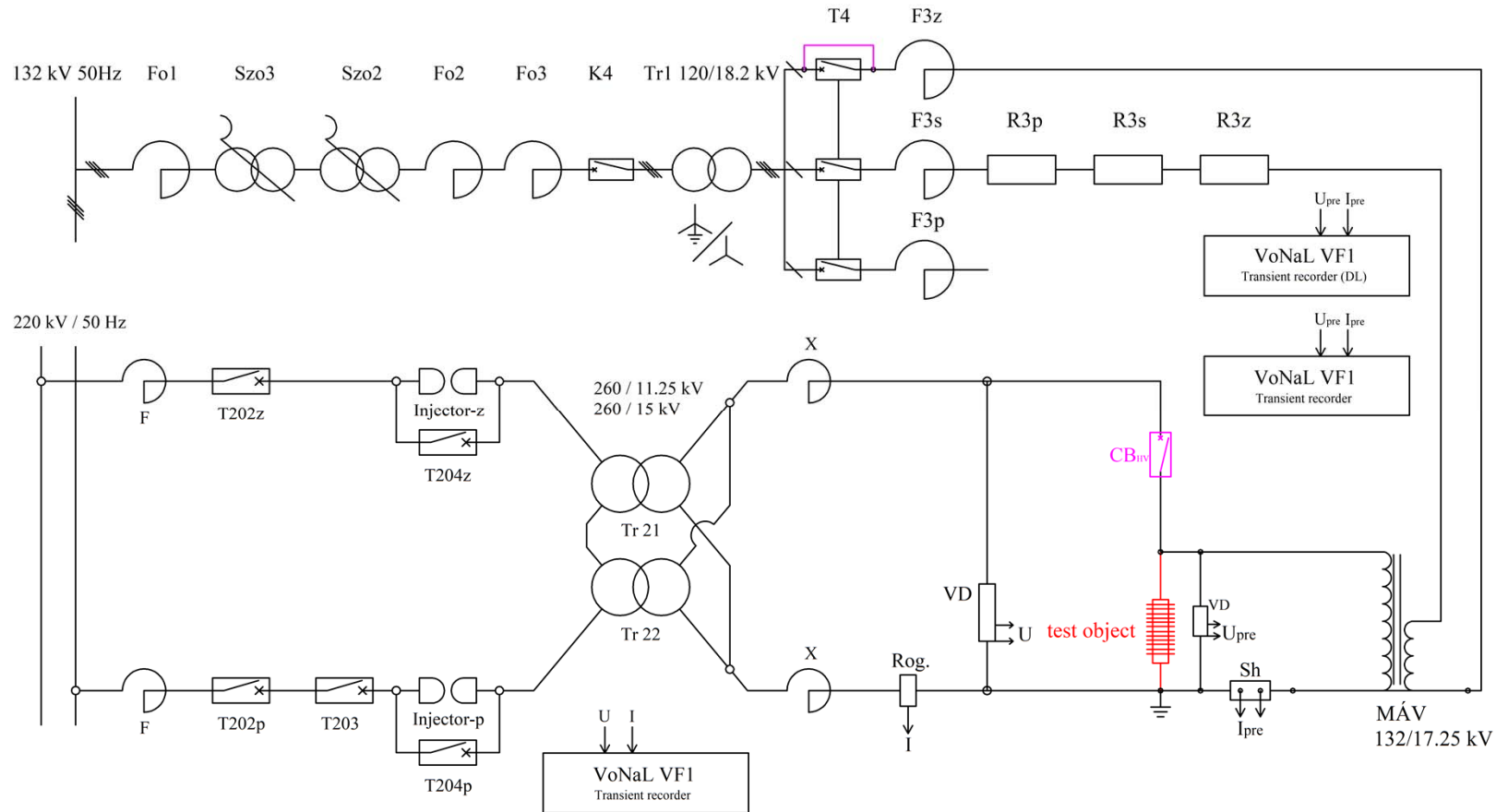
The time between pre-failure and the rated short-circuit current test shall not exceed 15 min.

Table 8 – Test requirements for polymer-housed arresters

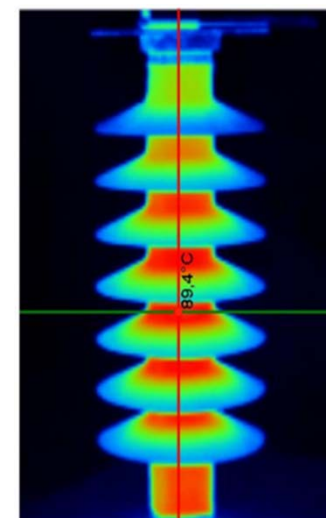
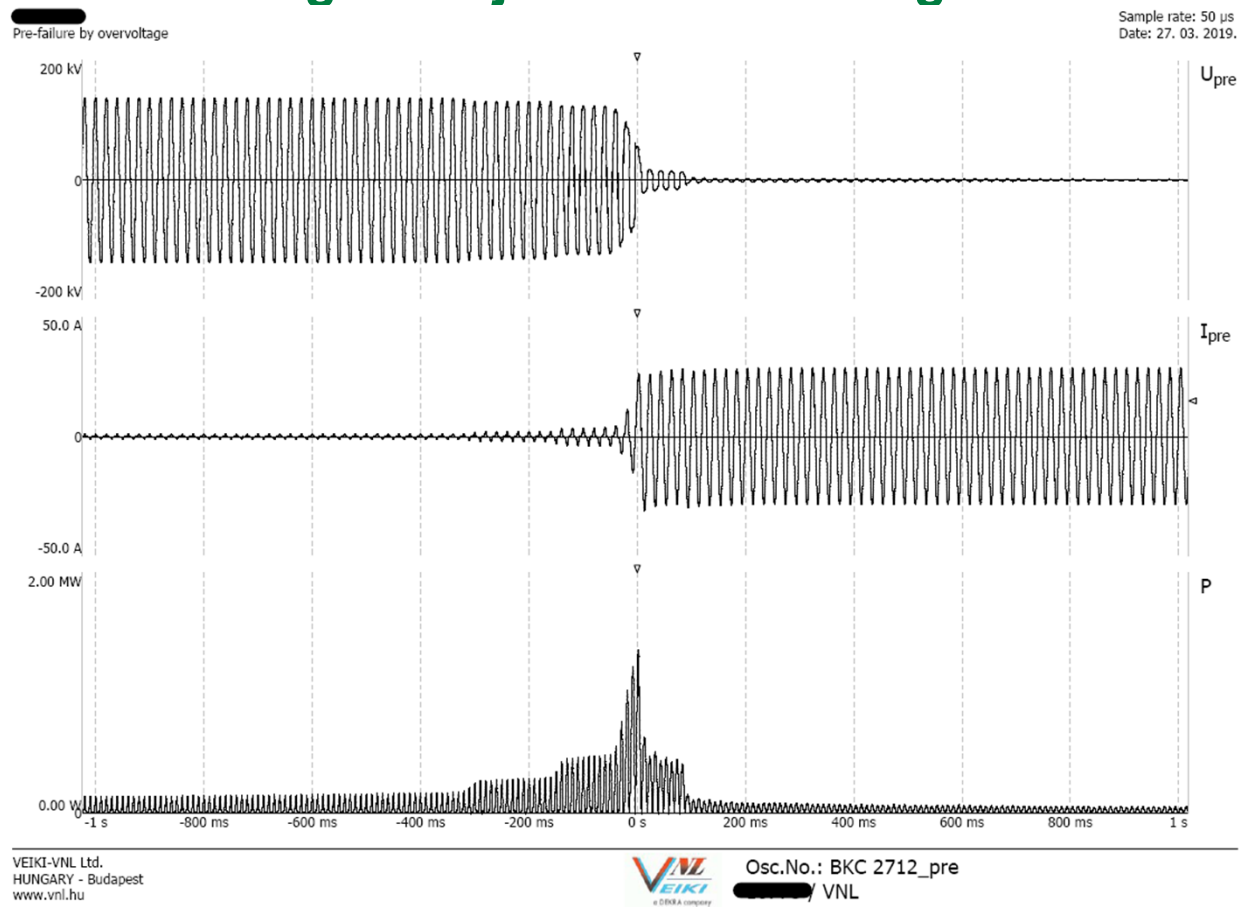
	Required number of test samples	Initiation of short-circuit current	Ratio of first current peak value to r.m.s. value of required short-circuit current taken from Table 7					
			Test voltage: 77 % to 107 % of U_r			Test voltage: < 77 % of U_r		
			Rated short-circuit current	Reduced short-circuit current	Low short-circuit current	Rated short-circuit current	Reduced short-circuit current	Low short-circuit current
"Design A"	4 or 5	Fuse wire along surface of MO resistors; within, or as close as possible to, the gas channel	Prospective: $\geq 2,5$ Actual: no requirement	Prospective: $\geq \sqrt{2}$ Actual: no requirement	Actual: $\geq \sqrt{2}$	Actual: $\geq 2,5$ or: Actual: $\geq \sqrt{2}$ on longest unit and Actual: $\geq 2,5$ on a unit with $U_r \geq 150$ kV	Actual: $\geq \sqrt{2}$	Actual: $\geq \sqrt{2}$
"Design B"	4	Pre-failing by constant voltage or constant current source	Prospective: $\geq \sqrt{2}$ Actual: no requirement	Prospective: $\geq \sqrt{2}$ Actual: no requirement	Actual: $\geq \sqrt{2}$	Actual: $\geq \sqrt{2}$	Actual: $\geq \sqrt{2}$	Actual: $\geq \sqrt{2}$



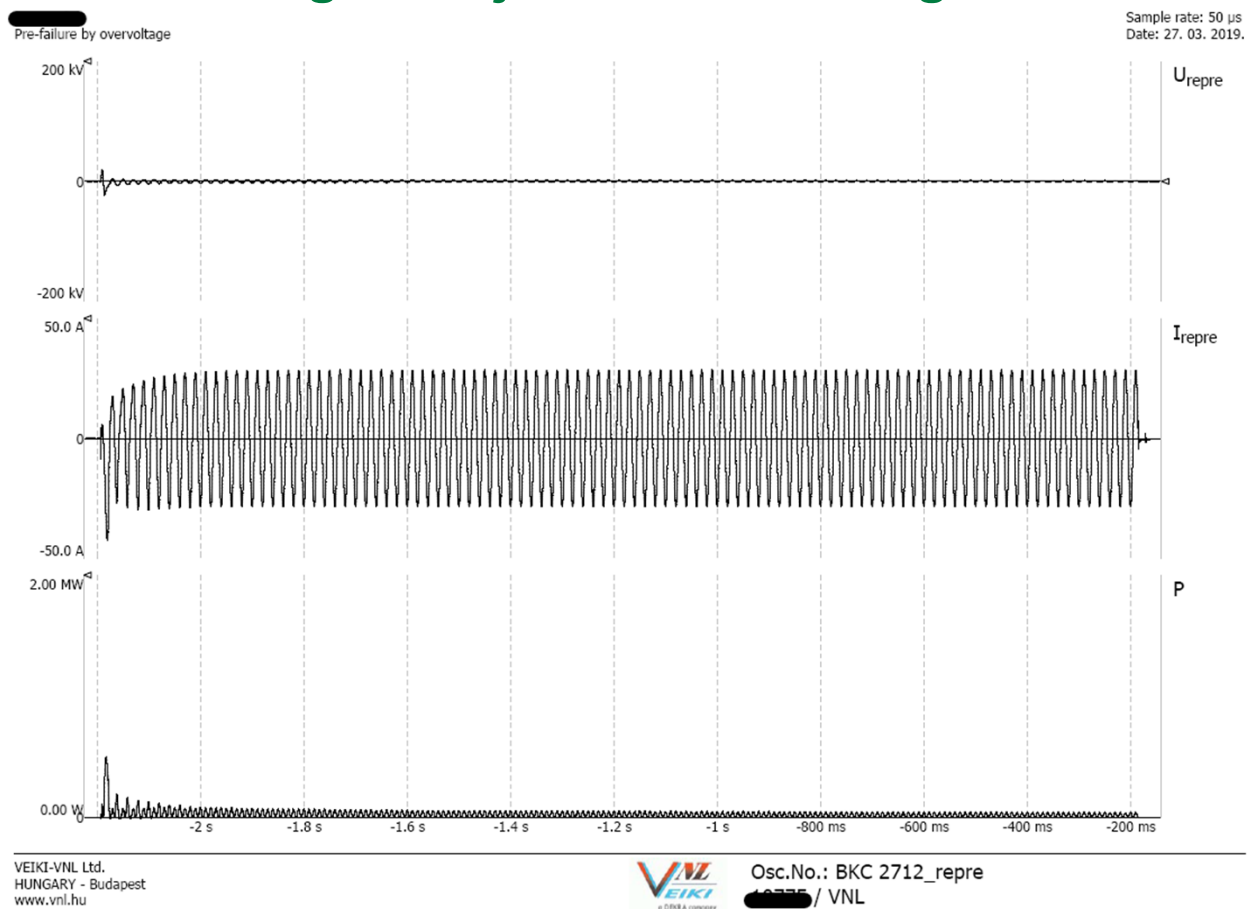
A zárlati vizsgálat során használt áramkör



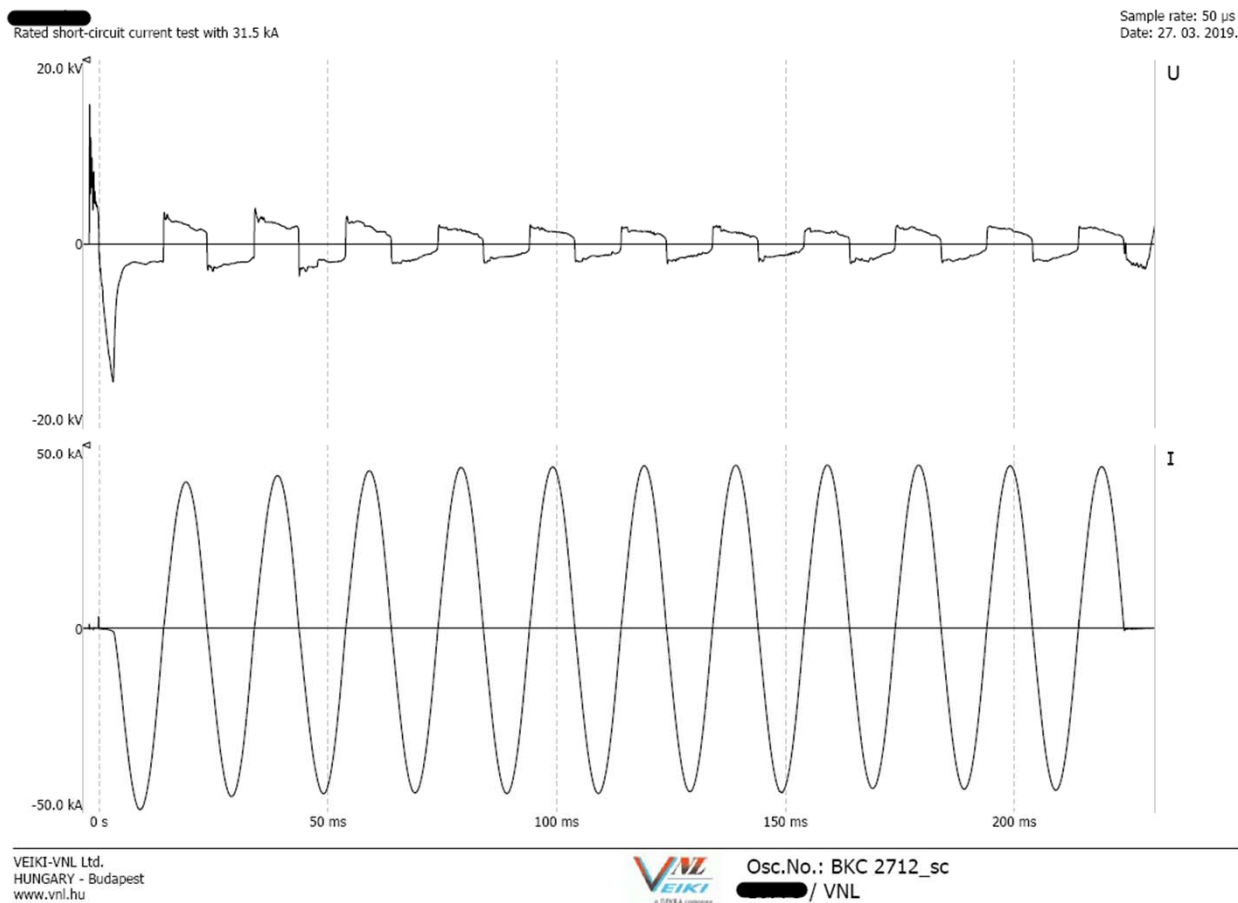
A Vizsgálatra jellemző oszcillogramok



A Vizsgálatra jellemző oszcillogramok



A Vizsgálatra jellemző oszcillogramok



A vizsgálati eredmények kiértékelése

8.10.6 Evaluation of test results

The test is considered successful if the following three criteria are met.

- a) No violent shattering. Structural failure of the sample is permitted as long as criteria b) and c) are met.
- b) No parts of the test sample shall be allowed to be found outside the enclosure, except for
 - fragments, less than 60 g each, of ceramic material such as MO resistors or porcelain;
 - pressure relief vent covers and diaphragms;
 - soft parts of polymeric materials.
- c) The arrester shall be able to self-extinguish open flames within 2 min after the end of the test. Any ejected part (in or out of the enclosure) must also self-extinguish open flames within 2 min. A shorter duration of self-extinguishing open flames for ejected parts may be agreed upon between the manufacturer and the user.

If the arrester has not visibly vented at the end of the test, caution should be exercised, as the housing may remain pressurized after the test. This is applicable to all levels of test current, but is of particular relevance to the low-current, short-circuit tests.

For arresters to be used in applications where mechanical integrity and a strength is required after failure, different test procedures and evaluations may be established between the manufacturer and the user (as an example, it may be required that after the tests the arrester should still be able to be lifted and removed by its top end).

12.8.10.6 Evaluation of test results

Replacement of Subclause 8.10.6:

Fracture of the housing with ejection of arrester parts through the body shall constitute failure of the arrester to pass this test. Ejection of arrester parts including MO resistors through the bottom with release of the bottom cap, or through other parts specifically designed for this purpose, is acceptable.

The arrester shall be able to self-extinguish open flames within 2 min after the end of the test. Any ejected part (in or out of the enclosure) must also self-extinguish open flames within 2 min.

A vizsgálati eredmények kiértékelése

Sample No. (See: Page 3)	Oscillogram no.	Time to breakdown during pre-failing [m:s]	Corresp. test circuit / arrang.	Value/duration/re-pre-failure charge [A / s / As]	Parameters of short-circuit current			Self-exting. open flames duration [m:s]	Photos/rem.
					First current peak value [A]	RMS value of the A.C. component [A]	Duration of short-circuit [ms]		
1.	BKC 2612_pre	No breakdown	1/2	-	-	-	-	-	1-3/a
2.	BKC 2706_pre/repre/sc	8:41	1/2	20.4/2.0/40.8	873.65	602.05	1012	0:25	2,-/a,c
3.	BKC 2707_pre/repre/sc	4:07	1/2	20.4/2.0/40.8	903.8	638.48	1003	1:08	2,4-5/c
4.	BKC 2712_pre/repre/sc	4:04	1/2	20.2/2.0/40.4	49.33k	31.41k	221	0:38	2,6-8/d,e,f
5.	BKC 2715_pre/repre/sc	4:00	1/2	20.3/2.0/40.6	28.74k	20.13k	224	0:17	2,9-11/d,e,f
6.	BKC 2716_pre/repre/sc	4:01	1/2	20.3/2.0/40.6	29.75k	20.30k	224	0:35	2,12-14/d,e,f
Remarks: a) The test object did not met the requirements of the prefailing procedure. b) The arrester did not self-extinguish open flames within 2 min after the end of the test. c) After the short-circuit tests violent shattering of the tested surge arresters could not be observed only the polymer-house damaged. d) After the short-circuit tests violent shattering of the tested surge arresters could be observed. e) Fragments, more then 60g could be found outside of the wooden enclosure f) Fracture of the housing with ejection of arrester parts through the body could be observed.									

Sikeres vizsgálat



Sikertelen vizsgálat



Köszönöm a figyelmet!



COMMITTED TO
SAFETY



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