Test Report

Document No.	02617-22-0038	Copy No.	1	Number of pages	23

Apparatus	LV-Photovoltaic Fuse
Designation	1. NH03-630 A and 500 A gL/gG 2. NH02-400 A; 350 A; 315 A; 250 A and 200 A gL/gG 3. NH01-160 A gL/gG 4. NH00-160 A gL/gG
Serial Number	Test samples
Manufacturer	THS Industria e Comercio Ltda. Rua Sargento Francisco Rodrigues da Rosa, 534 - Cajuru do Sul Sorocaba – Sao Paulo, 18105-008 BRAZIL
Client	THS Industria e Comercio Ltda. R. Francisco Rodrigues da Rosa, 534 - Cajuru do Sul Sorocaba - Sao Paulo, 18105-008 BRAZIL
Date(s) of test(s)	07 February 2022
Tested by	IPH Institut „Prüffeld für elektrische Hochleistungstechnik“ GmbH Landsberger Allee 378A 12681 Berlin GERMANY
Test(s) performed	Verification of breaking capacity (Test duty I1) at 800 V a.c.

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this document has been subjected to the series of proving tests in accordance with:

IEC 60269-2: 2013+AMD1: 2016

The fuses were capable of correctly breaking.

The results are documented in this test report. The ratings assigned by the Manufacturer are listed on the ratings page.
The document applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same designations with that tested rests with the Manufacturer.

17 February 2022	Christian Kruscha	Stefan Schwanck
Date	Test Engineer in charge	Approved by

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CESI

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Notes

STL-Member

CESI Group members are founder members of the SHORT-CIRCUIT TESTING LIAISON (STL) which has been established in 1969. STL is a forum for voluntary international cooperation of testing organizations.

CESI Group Test Documents description

Type Test Certificate of .....

Issued for type tests of high voltage products (> 1 kV_{ac}; > 1,5 kV_{dc}), which have successfully been carried out in full compliance with the relevant specifications or standards and STL Guides valid at the time of the test. The Type Test Certificate consists of documents unequivocally identifying the test object and describes all conditions under which the tests were conducted. It gives evidence of the unobjectionable behavior of the test object during the tests in line with the normative documents applied as well as of the results of successful testing.

Test Certificate of (complete / selected) Type Tests

Issued if type tests of low voltage products (< 1 kV_{ac}; < 1,5 kV_{dc}) requested by the relevant product standard were passed. For these tests the equipment under test must be clearly identified by technical description, drawings, and additional specifications.

Certificate of Design Verification

Issued for passed design verification tests according to IEC 61439. For these tests the equipment under test must be clearly identified by technical description, drawings, and additional specifications.

Type Test Report

Issued for high and low voltage products if parts of selected type tests have been passed; those shall be carried out in full compliance with the relevant standards but (for high voltage products) do not fulfill all STL requirements for issuing a Type Test Certificate. For these tests the equipment under test must be clearly identified by technical description, drawings, and additional specifications.

Test Report

Issued for all other tests on high and low voltage products which have been carried out according to specifications, standards and/or client instructions

On-Site Test Record

Issued as a record of results acquired during the on-site tests / measurements

Test Award

Can be additionally issued for all named types of test documents above if the tests to be referenced were passed

Contents **Sheet**

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Copy No. 1 in English: THS Industria e Comercio Ltda.

1. Present at the test

Mr. Kruscha IPH test engineer in charge

2. Test performed

Verification of breaking capacity (Test duty I1) at 800 V a.c.

3. Verification of breaking capacity

3.1 Test laboratory

High-power test laboratory, high-current test bay

3.2 Normative document

IEC 60269-2: 2013+AMD1: 2016

3.3 Required test parameters

Power-frequency recovery voltage	V	800
Prospective current	kA	50
Initiation of arcing after voltage zero		65 … 90° el
Power factor		0.1 to 0.2
Test frequency	Hz	50
Maintained voltage after breaking	s	≥ 15
Number of tests		1 test for each test sample

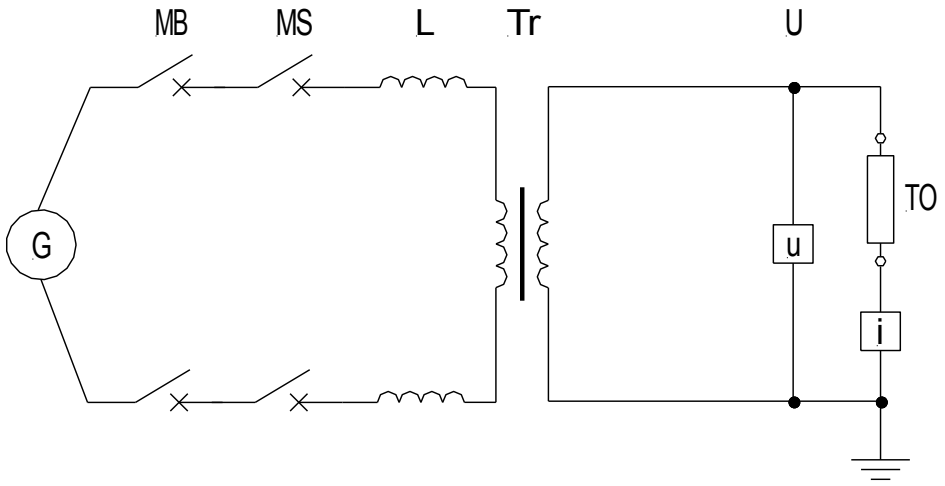
3.4 Test arrangement

The breaking tests were performed with single-phase alternating current and with a single fuse.
The fuse to be tested was mounted on a test rack in the normal service position.

3.5 Test and measuring circuits

Technical data of test circuits

Test requirement		Verification of breaking capacity
Test No.		122 0674 to 122 0684
Number of phases	(Test circuit)	2
Number of poles/phases	(Test object)	1
Test frequency	Hz	50
Earthing conditions	Generator, grid	Not earthed
	Short-circuit transformers	Earthed



E	Power supply	Tr	Short-circuit transformer
MB	Master breaker	i	Current measurement
MS	Making switch	u	Voltage measurement
L	Current limiting reactor		

Figure 1: Test circuit diagram

Technical data of measuring circuits

Measuring point	Symbol in the oscillograms	Measuring quantity	Measuring sensor/device
1	i	Breaking current	Rogowski measuring device
2	u	Voltage	RC divider
Recording instrument: AD3000 multichannel transient recorder system			

3.6 Test results

Test requirement: Test duty I1

Condition of test object before test: New

Type: NH00 63 A gG

Test No.			122	0675	0676	0677
Test sample No.				1	2	3
Type of of fuse-link				NH3	NH3	NH2
Rated current of fuse-link		A		630	500	350
Test voltage		V		800	800	800
Prospective peak current		kA		107	107	107
Prospective breaking current I_p		kA		51.9	51.9	51.9
Power factor cos φ				0.25	0.25	0.25
Making angle		°el.		62.6	51.6	47.2
Initiation of arcing after voltage zero		°el.		97.6	85.4	71.0
Melting current i_s		kA		41.5	38.5	25.9
Cut-off current		kA		41.9	39.0	25.6
Melting time		ms		1.93	1.87	1.32
Arcing time		ms		3.68	4.21	4.74
Operating time		ms		5.62	6.09	6.07
Melting integral	10^3	A^2s		1169	936	292
Arcing integral	10^3	A^2s		1760	1577	655
Operating integral	10^3	A^2s		2929	2513	947
Arcing energy		kVAs		93.9	93.8	57.8
Peak switching voltage		kV		1.77	1.81	1.71
Recovery voltage		V		823	819	818
Duration of power frequency recovery voltage		s		15	15	15
Fuse operated correct		y/n		y	y	y
Emission of flames or sand		y/n		n	n	n
Damages (external)		y/n		n	n	n
Operation of striker correct		y/n		y	y	y
Evaluation				OK	OK	OK

Notes:

OK - The fuse is capable of correctly breaking the prospective current

Test No. 122 0674: Current setting

Test results (continued)

Test requirement: Test duty I1

Condition of test object before test: New

Type: NH00 63 A gG

Test No.			122	0678	0679	0680
Test sample No.				4	5	6
Type of of fuse-link				NH2	NH2	NH2
Rated current of fuse-link		A		315	400	250
Test voltage		V		800	800	800
Prospective peak current		kA		107	107	107
Prospective breaking current I_p		kA		51.9	51.9	51.9
Power factor cos φ				0.25	0.25	0.25
Making angle		°el.		57.8	58.1	51.8
Initiation of arcing after voltage zero		°el.		78.4	82.8	70.2
Melting current i_s		kA		24.4	29.4	20.5
Cut-off current		kA		25.0	29.1	20.9
Melting time		ms		1.14	1.37	1.02
Arcing time		ms		4.46	4.26	4.68
Operating time		ms		5.60	5.63	5.69
Melting integral	10^3	A^2s		229	400	141
Arcing integral	10^3	A^2s		624	866	396
Operating integral	10^3	A^2s		853	1266	537
Arcing energy		kVAs		53.5	65.2	42.5
Peak switching voltage		kV		1.67	1.74	1.64
Recovery voltage		V		820	821	819
Duration of power frequency recovery voltage		s		15	15	15
Fuse operated correct		y/n		y	y	y
Emission of flames or sand		y/n		n	n	n
Damages (external)		y/n		n	n	n
Operation of striker correct		y/n		y	y	y
Evaluation				OK	OK	OK

Notes:

OK - The fuse is capable of correctly breaking the prospective current

Test results (continued)

Test requirement: Test duty I1

Condition of test object before test: New

Type: NH00 63 A gG

Test No.			122	0681	0682	0683
Test sample No.				7	8	9
Type of of fuse-link				NH2	NH1	NH00
Rated current of fuse-link		A		200	160	160
Test voltage		V		800	800	800
Prospective peak current		kA		107	107	107
Prospective breaking current I_p		kA		51.9	51.9	51.9
Power factor cos φ				0.25	0.25	0.25
Making angle		°el.		47.8	68.3	72.9
Initiation of arcing after voltage zero		°el.		65.4	79.6	84.5
Melting current i_s		kA		15.8	14.4	14.7
Cut-off current		kA		16.4	15.0	15.1
Melting time		ms		0.81	0.63	0.64
Arcing time		ms		5.06	4.27	4.26
Operating time		ms		5.88	4.89	490
Melting integral	10^3	A^2s		66.8	43.5	47.8
Arcing integral	10^3	A^2s		230	120	118
Operating integral	10^3	A^2s		297	164	166
Arcing energy		kVAs		31.1	20.0	20.7
Peak switching voltage		kV		1.57	1.82	1.82
Recovery voltage		V		816	823	825
Duration of power frequency recovery voltage		s		15	15	15
Fuse operated correct		y/n		y	y	y
Emission of flames or sand		y/n		n	n	n
Damages (external)		y/n		n	n	n
Operation of striker correct		y/n		y	y	y
Evaluation				OK	OK	OK

Notes:

OK - The fuse is capable of correctly breaking the prospective current

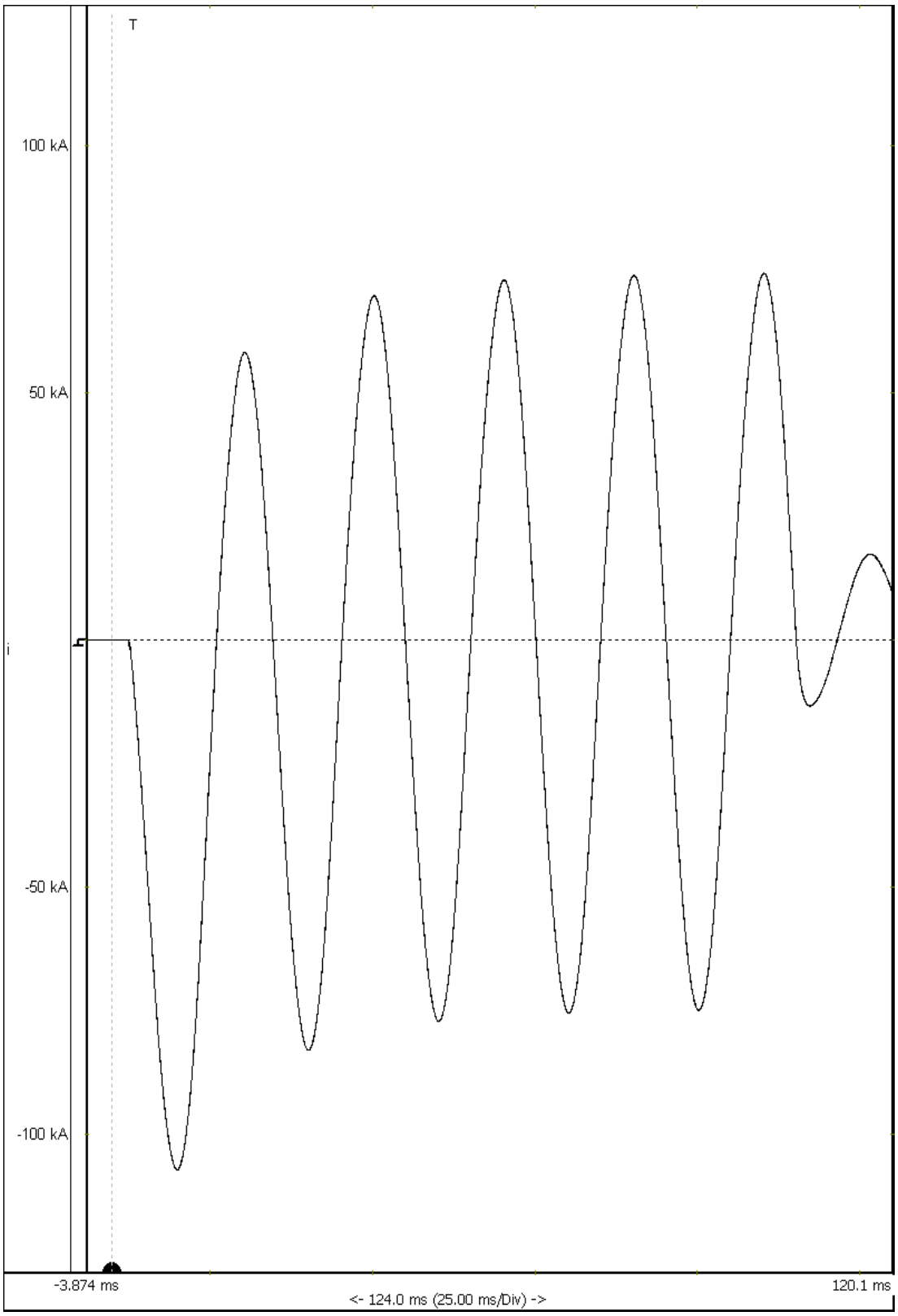
4. Photographs

Photo 1: Fuses after all tests, name plates

Photo 2: Fuses after all tests, rating plates

5. Oscillograms

Test No: 1220673



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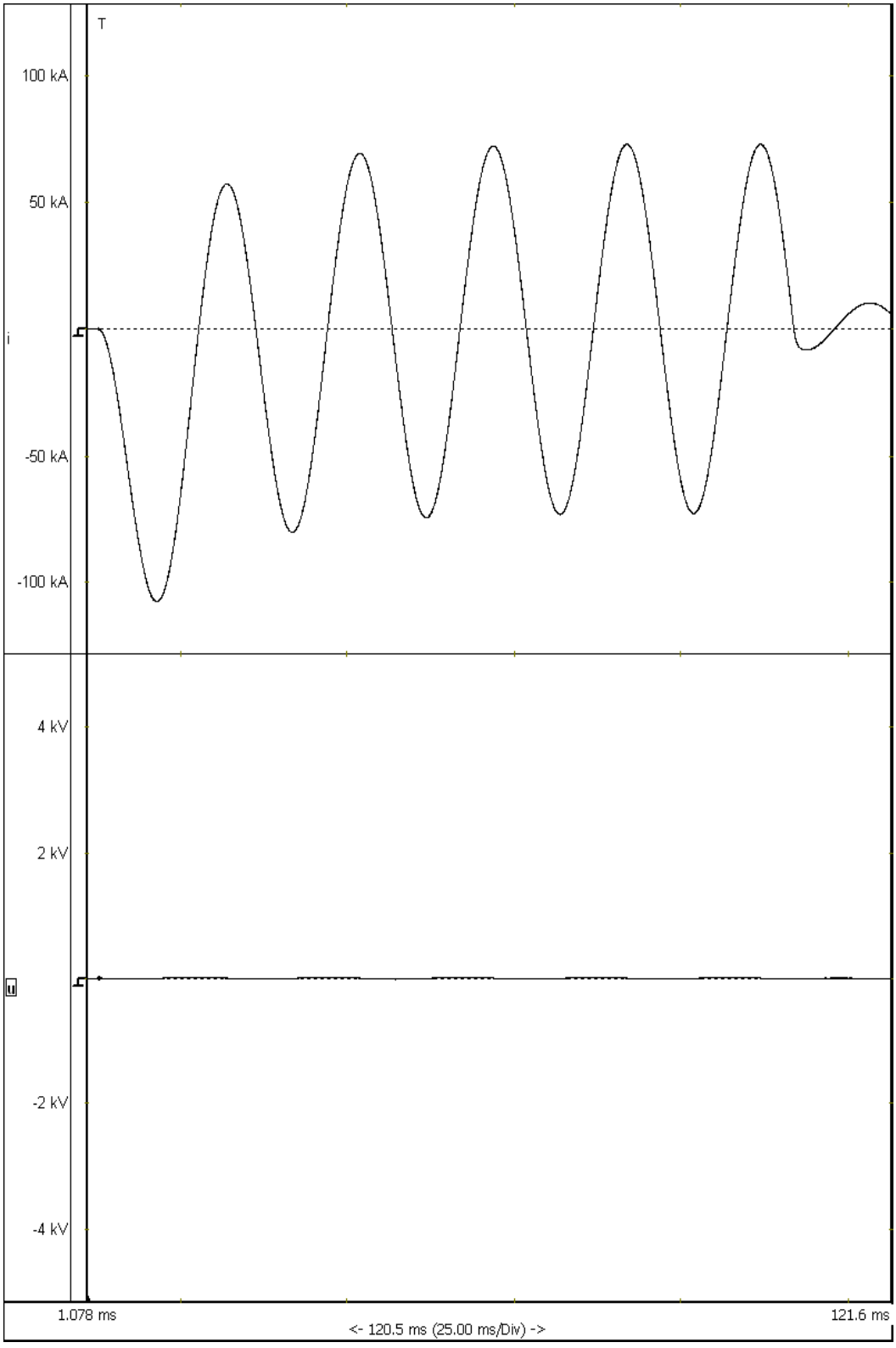

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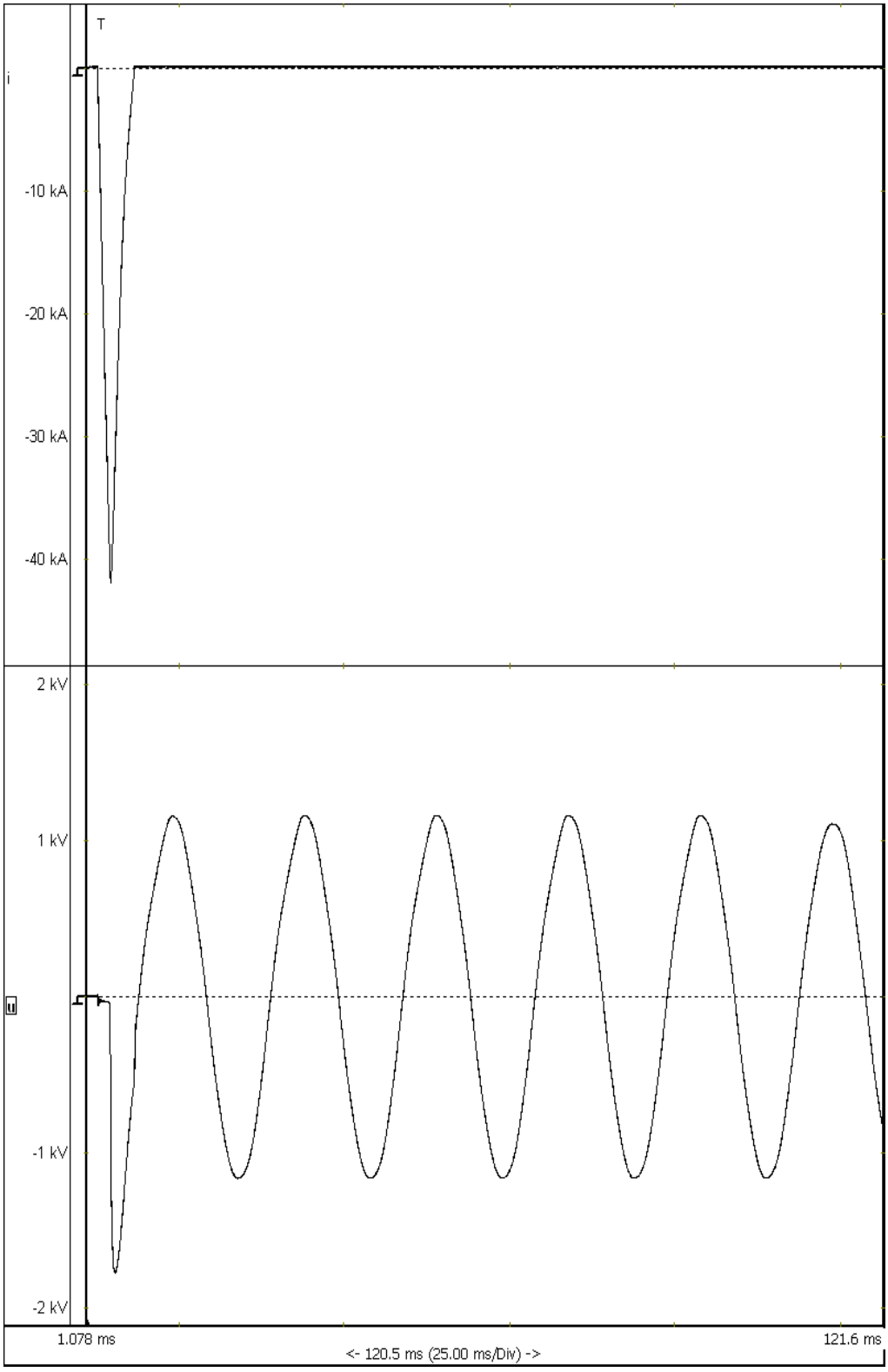

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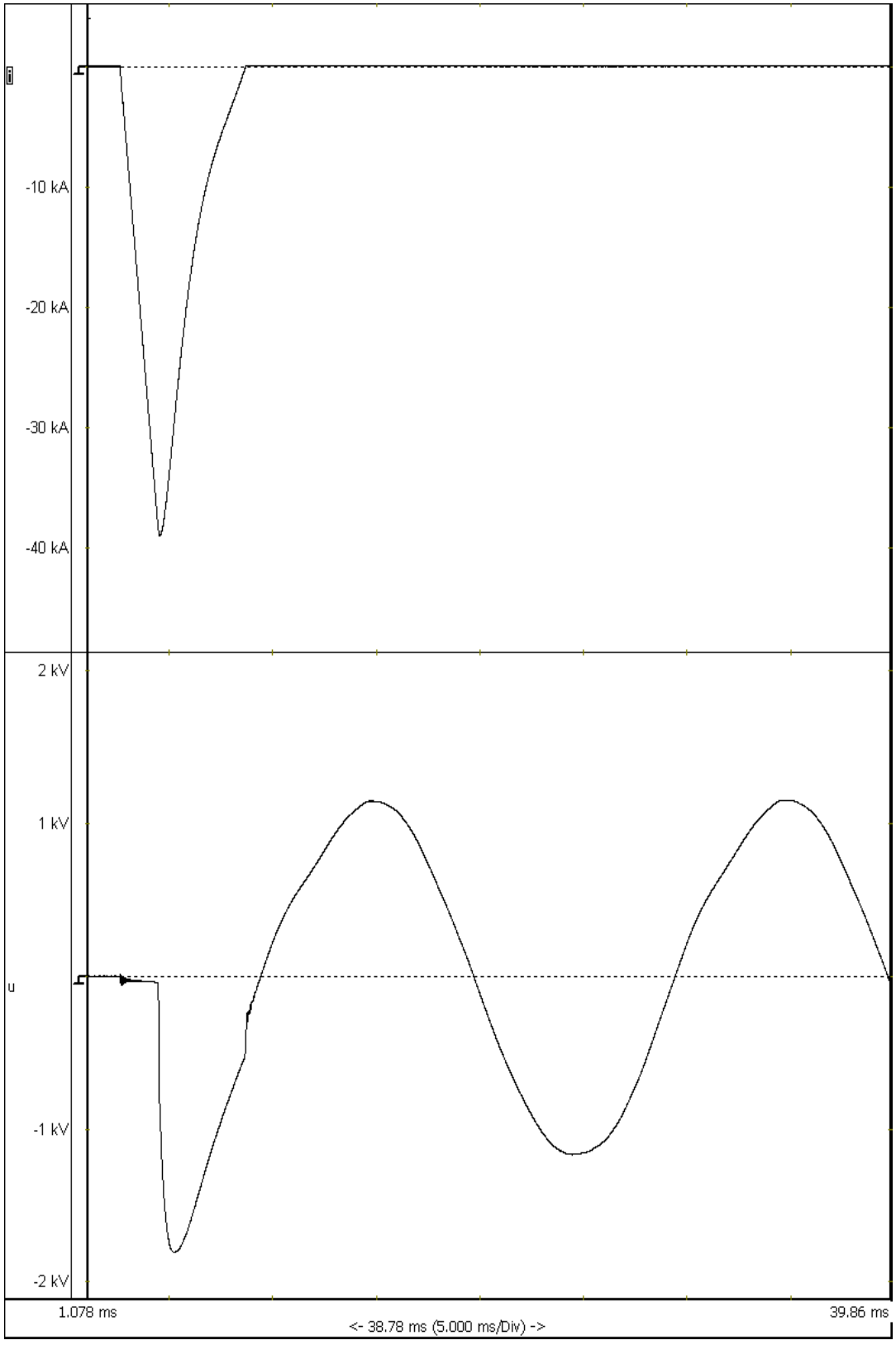

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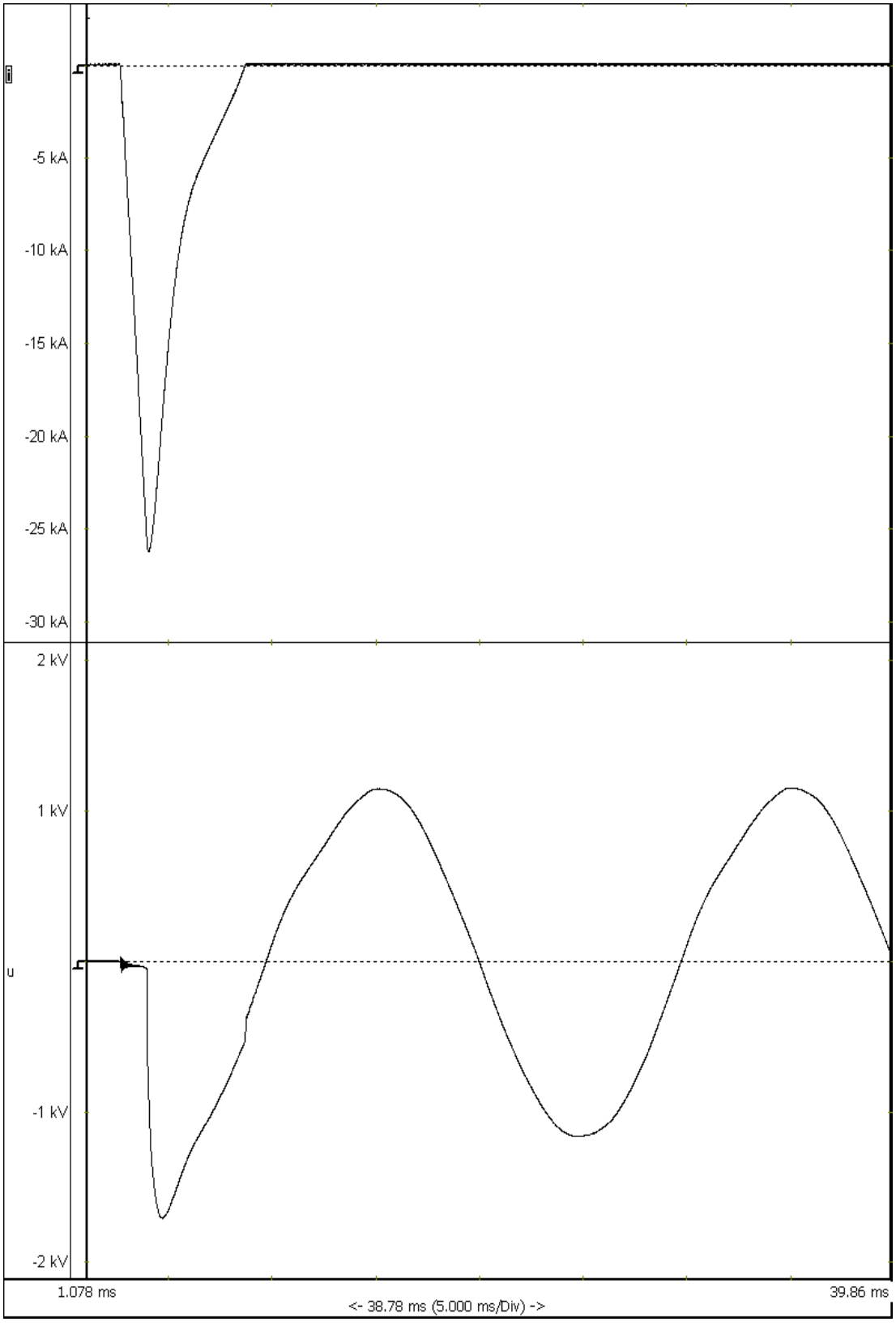

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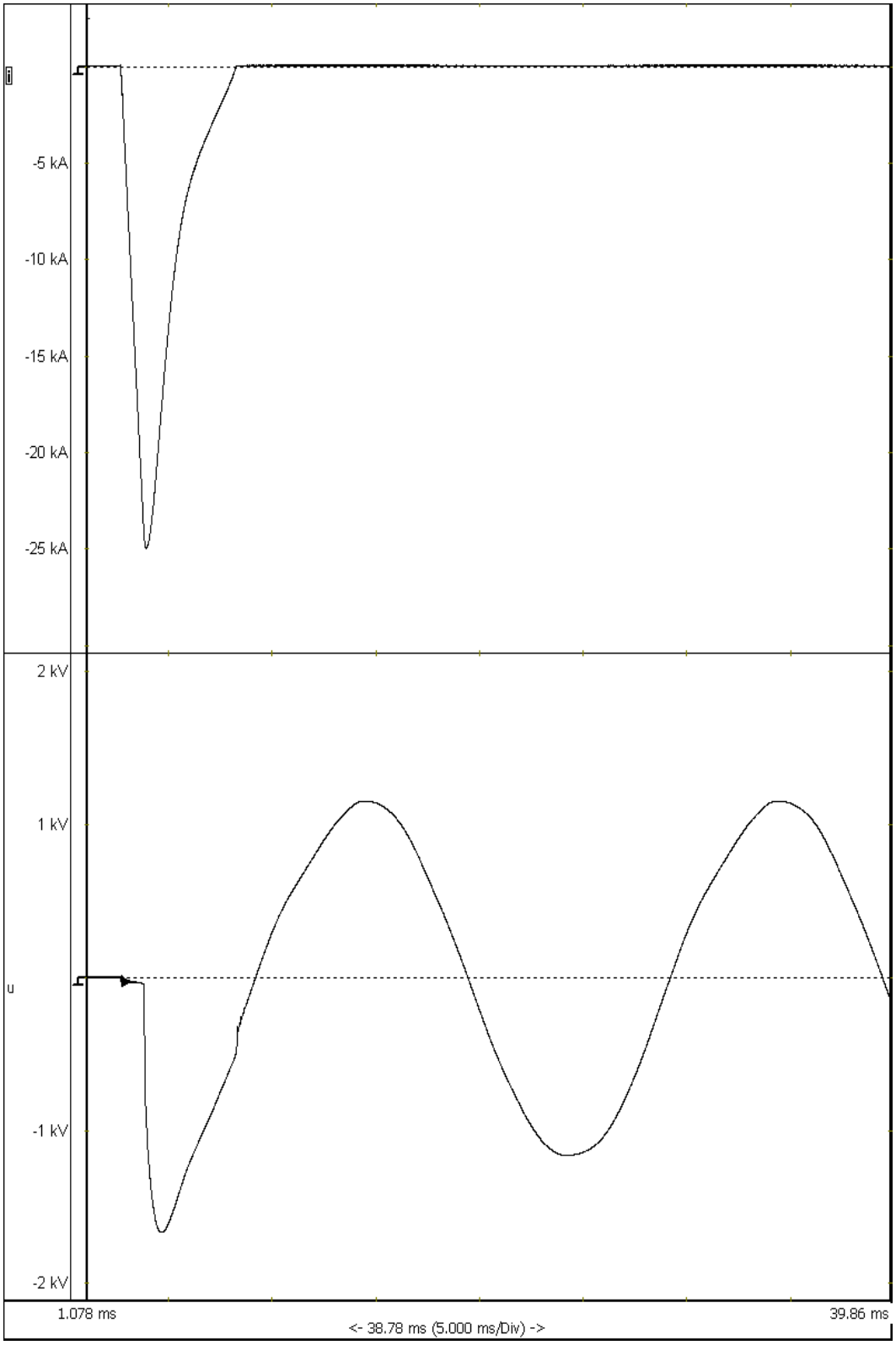
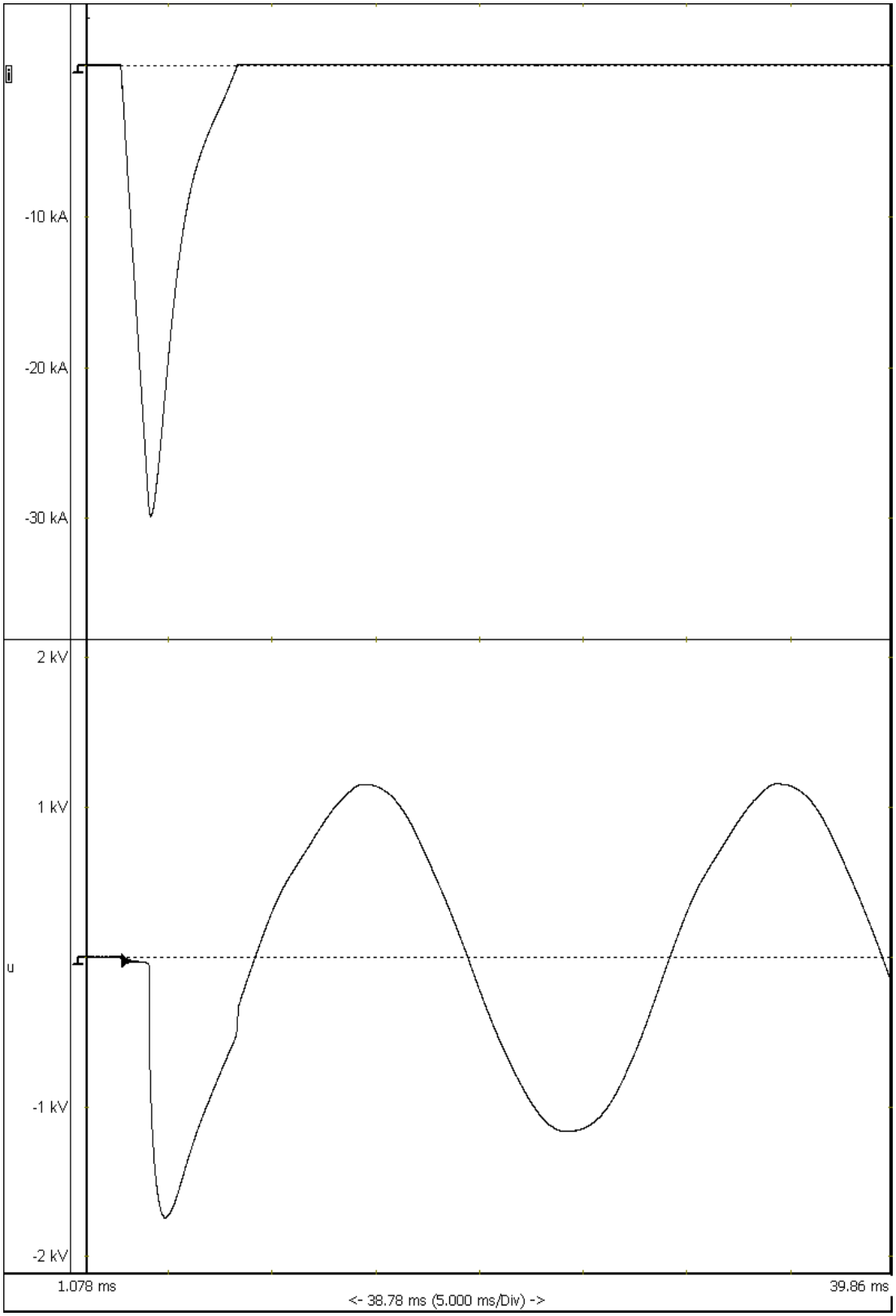
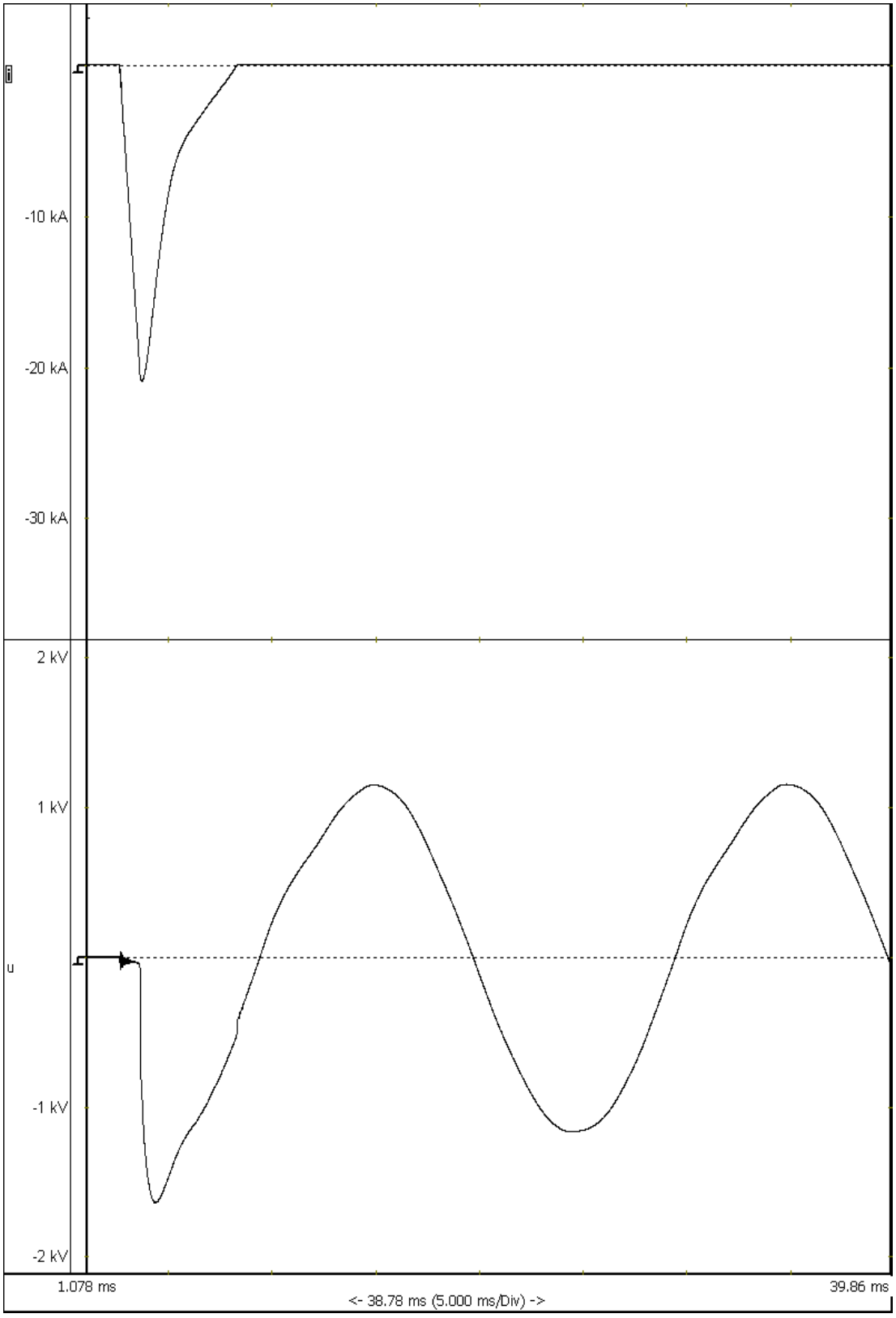


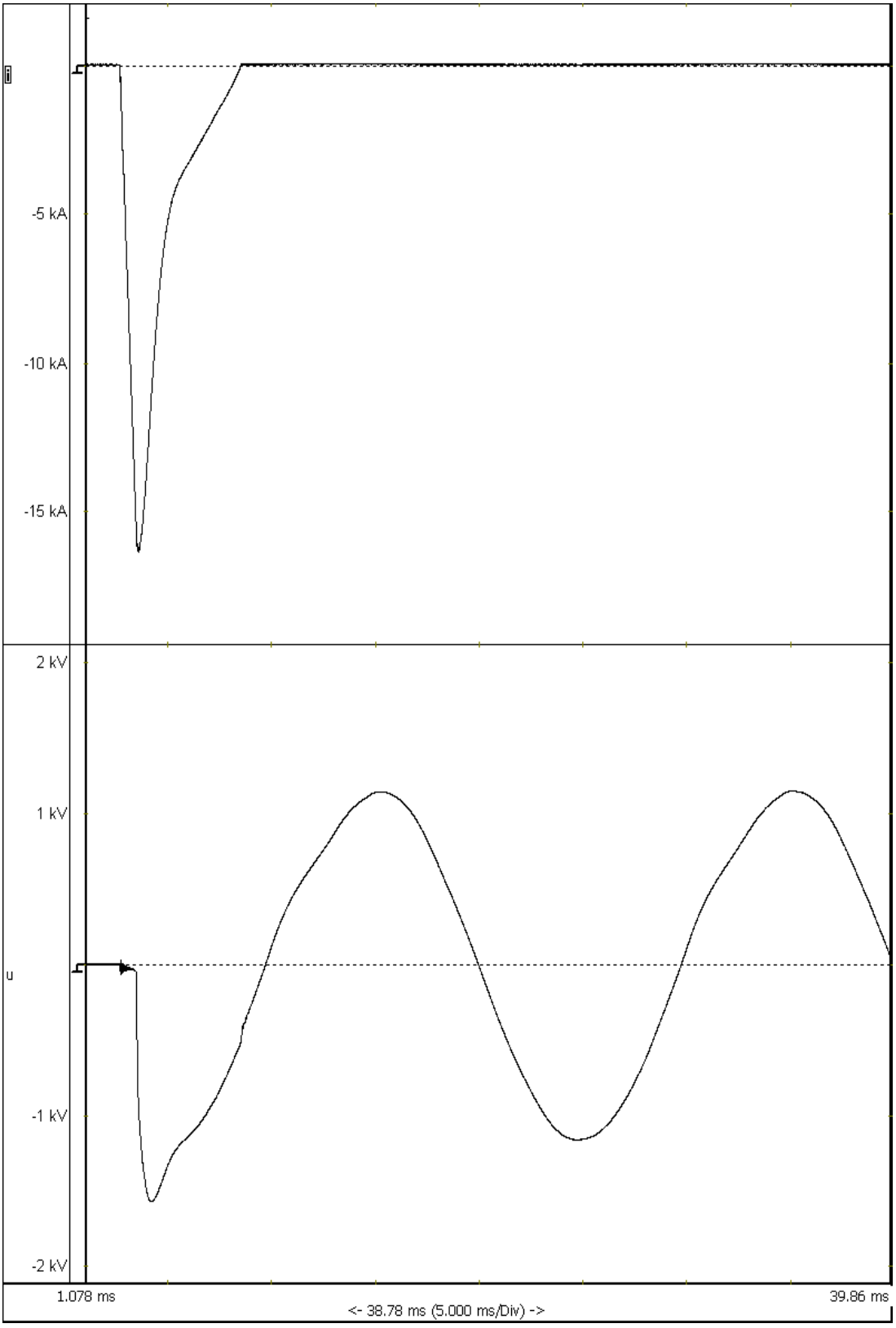
Test No: 1220680



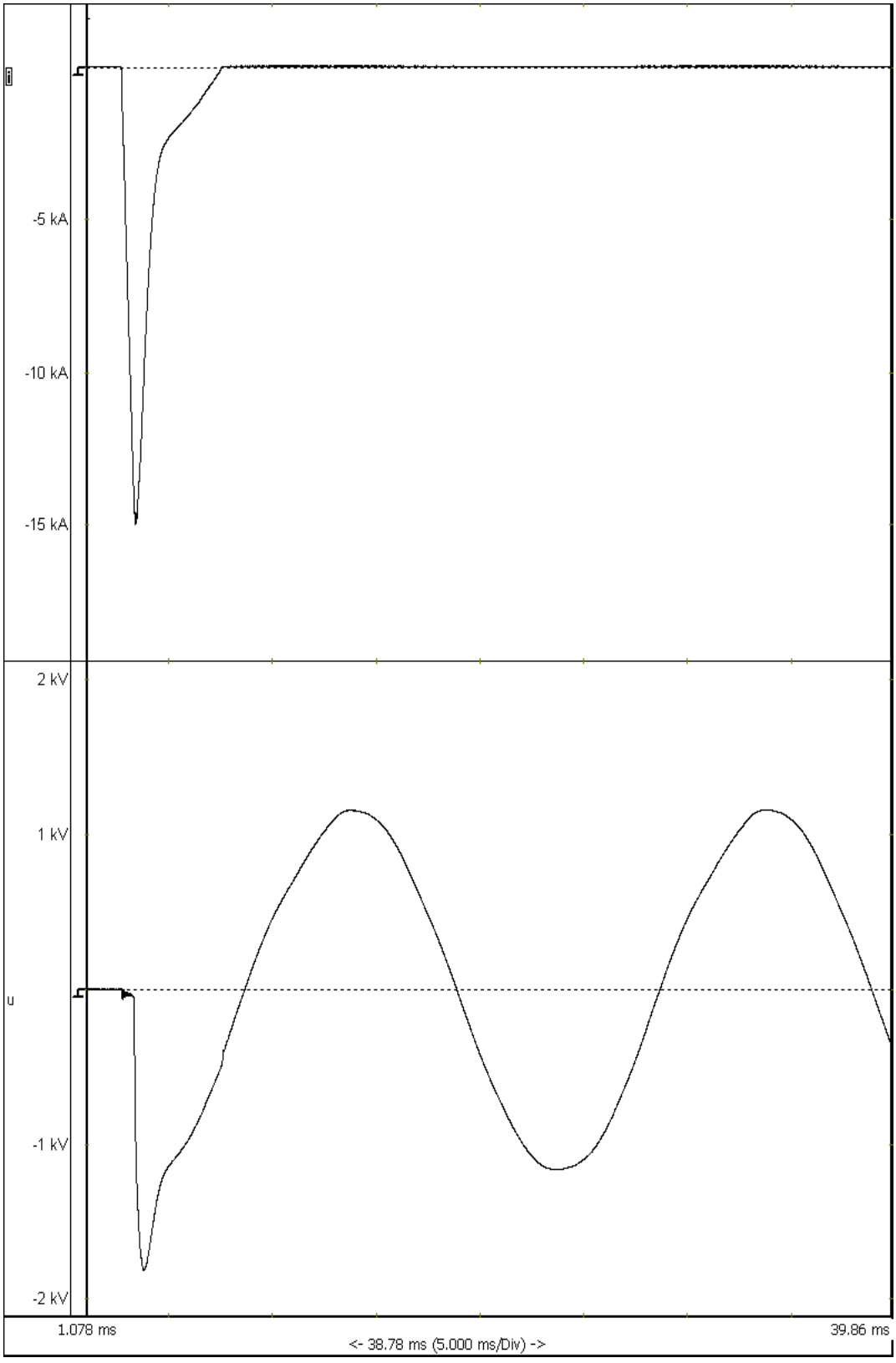
Test No: 1220681



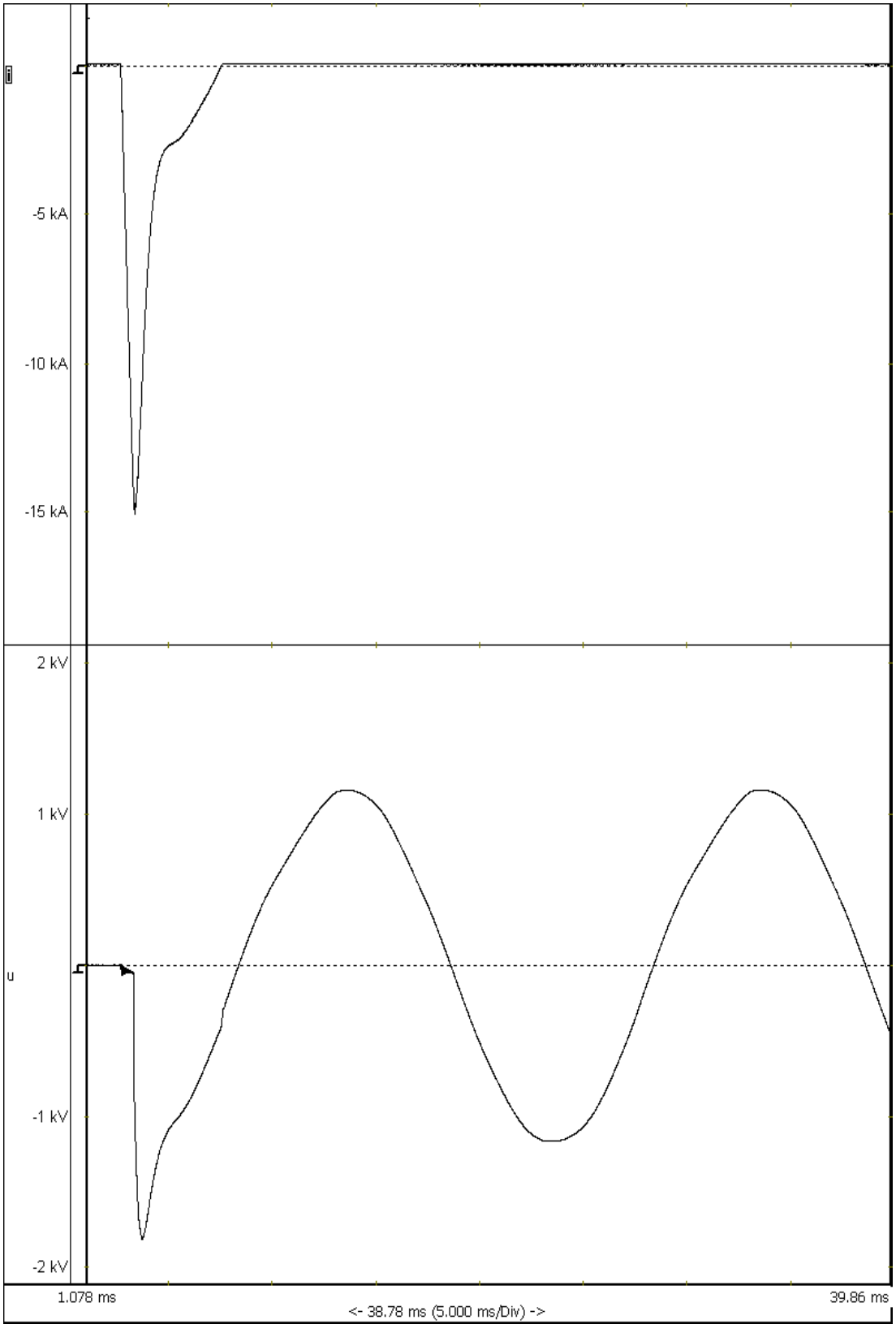
Test No: 1220682



Test No: 1220683



Test No: 1220684



6. Drawings / technical data sheets (provided by the client)

Categoria gG/gL

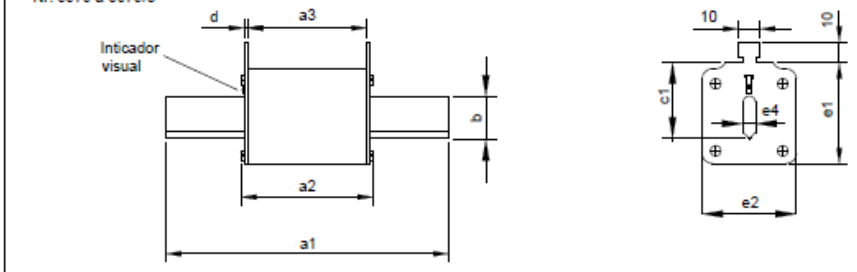
Fusiveis para Fotovoltaica de 800VAC

IEC 60269-1 e IEC 60269-6, DIN VDE 0636-2

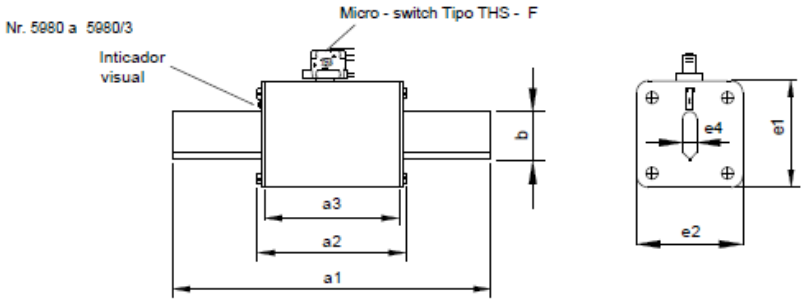
Fusivel NH Tam. 00,1,2,3, - Conf. DIN 43620

THS

Nr. 5979 a 5979/3



Nr. 5980 a 5980/3



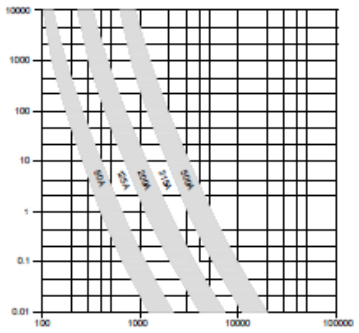
Dimensões

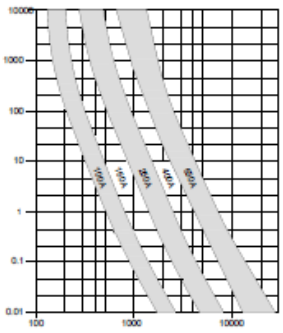
d = Tampa de Aço-Inox

Nr		Tamanho Size	Corrente max. Current	a1	a2	a3	b	c1	d	e1	e2	e4
5979	5980	00	160	80	49	46	15	35	2	48	28	6
5979/1	5980/1	1	250	135	72	62	20	40	2.5	53	45	6
5979/2	5980/2	2	400	150	72	62	25	48	2.5	61	60	6
5979/3	5980/3	3	630	150	72	62	35	60	3	76	72	6

As curvas caracteristicas Tempo x Corrente apresentadas estão de acordo com o estabelecido na NBR IEC 60269 - 2 - 1, VDE 0636/21. para Fusiveis categoria - gG/gL

Tempo / Corrente para fusivel NH de 10 a 630A, 50KA,





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SOLAR - gL/gG
THS
PHOTOVOLTAIC - FUSE
VDE 0636 - IEC 60269
630A – gL/gG
800VAC
NH3
50KA
Nr.5980
SOLAR - gL/gG
THS
PHOTOVOLTAIC - FUSE
VDE 0636 - IEC 60269
500A – gL/gG
800VAC
NH3
50KA
Nr.5980
SOLAR - gL/gG
THS
PHOTOVOLTAIC - FUSE
VDE 0636 - IEC 60269
400A – gL/gG
800VAC
NH2
50KA
Nr.5980
SOLAR - gL/gG
THS
PHOTOVOLTAIC - FUSE
VDE 0636 - IEC 60269
350A – gL/gG
800VAC
NH2
50KA
Nr.5980
SOLAR - gL/gG
THS
PHOTOVOLTAIC - FUSE
VDE 0636 - IEC 60269
315A – gL/gG
800VAC
NH2
50KA
Nr.5980
SOLAR - gL/gG
THS
PHOTOVOLTAIC - FUSE
VDE 0636 - IEC 60269
250A – gL/gG
800VAC
NH2
50KA
Nr.5980
SOLAR - gL/gG
THS
PHOTOVOLTAIC - FUSE
VDE 0636 - IEC 60269
200A – gL/gG
800VAC
NH2
50KA
Nr.5980
SOLAR - gL/gG
THS
PHOTOVOLTAIC - FUSE
VDE 0636 - IEC 60269
200A – gL/gG
800VAC
NH1
50KA
Nr.5980
SOLAR - gL/gG
THS
PHOTOVOLTAIC - FUSE
VDE 0636 - IEC 60269
160A – gL/gG
800VAC
NH1
50KA
Nr.5980
SOLAR - gL/gG
THS
PHOTOVOLTAIC
FUSE gL/gG
SOLAR - gL/gG
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FUSE gL/gG
SOLAR - gL/gG
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FUSE gL/gG