

TEST REPORT

NO. 2315.2111120.0577

THS Industria e Comercio Ltda.
Rua Ernesto Biester, 59
CEP 04777-120 - Sao Paulo
BRAZIL

CLIENT

THS Industria e Comercio Ltda.

MANUFACTURER

Low-voltage fuses

TEST OBJECT

CEMIG Nr. THS-400C1-1.1
CEMIG Nr. THS-400C1-gG
CEMIG Nr. THS-250C1-gG

TYPE

Test samples

SERIAL NO.

Rated voltage
Rated current
Rated breaking current I1

550 V AC
400/250 A
120 kA

RATED
CHARACTERISTICS
GIVEN BY THE
CLIENT

IEC 60269-2 Edition 4: 2010-04

NORMATIVE
DOCUMENT

Verification of breaking capacity I1 at 600 V

RANGE OF TESTS
PERFORMED

15 September 2011

DATE OF TEST

See Sub-clause 4.6

TEST RESULT



H. GLABSCH
Senior engineer
Berlin, 06 October 2011



S. GEORGAS
Test engineer in charge



Contents	Sheet
1. Present at the test.....	3
2. Test performed.....	3
3. Identity of the test object.....	4
3.1 Technical specifications and characteristics.....	4
3.2 Identity documents.....	4
4. Verification of breaking capacity.....	5
4.1 Test laboratory.....	5
4.2 Normative document.....	5
4.3 Required test parameters.....	5
4.4 Test arrangement.....	5
4.5 Test and measuring circuits.....	6
4.6 Test results.....	7
5. Photos.....	10
6. Oscillograms.....	13
7. Drawings.....	23

This test document comprises 24 sheets.

Distribution

Copy No. 1

Copy No. 1 in English:

THS Industria e Comercio Ltda.

1. Present at the test

Mr. Georgias IPH test engineer in charge

2. Test performed

Verification of breaking capacity I1 at 600 V

3. Identity of the test object

3.1 Technical specifications and characteristics

The technical specifications and characteristics of the test object are defined by the following parameters and have been specified by the client

Test object:	Low-voltage fuses		
Type:	CEMIG Nr. THS-400C1-1.1 CEMIG Nr. THS-400C1-gG CEMIG Nr. THS-250C1-gG		
Manufacturer:	THS Industria e Comercio Ltda.		
Serial No.:	Test sample		
Year of manufacture:	2011		
Data:	Rated voltage		550 V AC
	Rated current		400/250 A
	Rated frequency		50 Hz
	Rated breaking current I1		120 kA

3.2 Identity documents

The manufacturer confirms that the test object has been manufactured in compliance with the drawings given in this document. IPH has verified this compliance, but not in every detail.

The identity of the test object is fixed by the following drawings and data submitted by the client:

Name of drawing	Drawing No.	Date of drawing	Author	Notes
LIMITRON FORMATO - C1	THS-400C1	02.06.11	THS Industria e Comercio Ltda.	Sheet 23
LIMITRON THS250C1	THS-250C1	02.06.11	THS Industria e Comercio Ltda.	Sheet 24

Test objects received by IPH on: 13 September 2011

4. Verification of breaking capacity

4.1 Test laboratory

High-power test laboratory, high-current test cell

4.2 Normative document

IEC 60269-2 Edition 4: 2010-04

4.3 Required test parameters

Test duty	1
Power-frequency recovery voltage	600 V
Prospective current	120 kA
Making angle after voltage zero	Not applicable
Initiation of arcing after voltage zero	1 sample 40 ... 65° el. 2 samples 65 ... 90° el.
Power factor $\cos \varphi$	0.1 ... 0.2
Test frequency	50 Hz

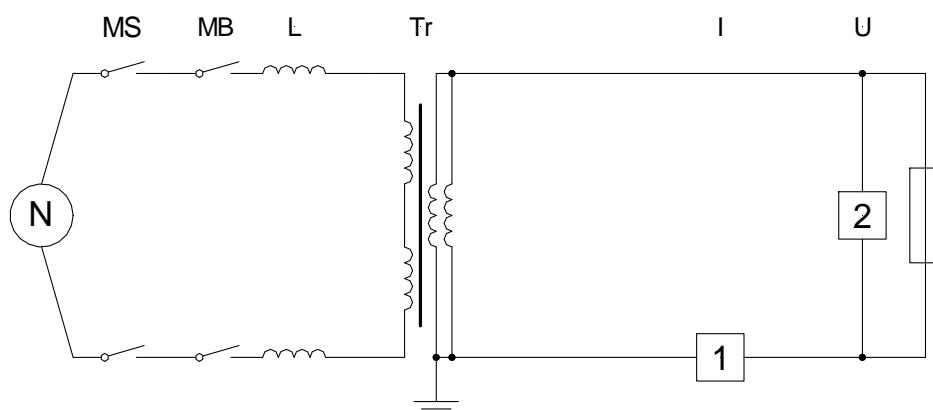
4.4 Test arrangement

According to IEC 60269-1 Edition 4.1: 2009-07

4.5 Test and measuring circuits

Technical data of test circuits

Test requirement	Verification of breaking capacity	
Test No.	111 5920 to 111 5929	
Number of phases (Test circuit)	2	
Number of poles/phases (Test object)	1	
Test frequency Hz	50	
Power factor $\cos \varphi$	< 0.2	
Earthing conditions	Grid	Not earthed
	Short-circuit transformer	Earthed
	Short-circuit point	--



N	Power supply (grid)	Tr	Short-circuit transformer
MS	Master breaker	I	Current measurement
MB	Making switch	U	Voltage measurement
L	Current limiting reactor	1, 2	Measuring points

Figure 1: Test circuits

Technical data of measuring circuits

Measuring point	Symbol	Measured quantity	Measuring sensor/device
1	i	Breaking current	Shunt
2	u	Voltage	RC divider
Recording instrument: BE 256 transient recorder system			

4.6 Test results

Test requirement: I1
 Condition of test object before test: New

Test No.		111 5920	111 5921	111 5922	111 5923
Test sample No.		-	1	2	3
Type		-	THS-400C1-gG	THS-400C1-gG	THS-400C1-gG
Rated current of fuse-link	A	-	400	400	400
Test voltage	V	600	600	600	600
Prospective peak current	kA	284	284	284	284
Prospective breaking current I _p	kA	124	124	124	124
Power factor cos φ		0.16	0.16	0.16	0.16
Making angle	°el.	-	48	62	62
Initiation of arcing after voltage zero	°el.	-	62	75	76
Melting current i _s	kA	-	34.4	35.3	35.6
Cut-off current	kA	-	35.4	36.4	36.4
Melting time	ms	-	0.78	0.73	0.77
Arcing time	ms	-	3.28	3.56	3.55
Operating time	ms	-	4.06	4.29	4.32
Melting integral	10 ³ A ² s	-	313	315	327
Arcing integral	10 ³ A ² s	-	647	707	695
Operating integral	10 ³ A ² s	-	948	1012	1009
Arcing energy	kVAs	-	28.8	29.9	29.9
Peak switching voltage	V	-	1151	1165	1161
Recovery voltage	V	-	618	618	616
Note		1)	-	-	-
Evaluation		-	OK	OK	OK

Notes:

1) Current setting

Behavior of test object during test:

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

Test results (continued)

Test requirement: I1
 Condition of test object before test: New

Test No.		111 5924	111 5925	111 5926
Test sample No.		4	5	6
Type		THS-400C1/1.1	THS-400C1/1.1	THS-400C1/1.1
Rated current of fuse-link	A	400	400	400
Test voltage	V	600	600	600
Prospective peak current	kA	284	284	284
Prospective breaking current I _p	kA	124	124	124
Power factor cos φ		0.16	0.16	0.16
Making angle	°el.	62	60.1	40
Initiation of arcing after voltage zero	°el.	75	72.7	54
Melting current I _s	kA	33.0	32.5	30.4
Cut-off current	kA	35.3	35.0	32.0
Melting time	ms	0.71	0.70	0.77
Arcing time	ms	3.16	2.44	2.86
Operating time	ms	3.87	3.14	3.63
Melting integral	10 ³ A ² s	254	239	230
Arcing integral	10 ³ A ² s	795	783	691
Operating integral	10 ³ A ² s	1039	1012	912
Arcing energy	kVAs	29.6	32.2	30.0
Peak switching voltage	V	1180	1389	1235
Recovery voltage	V	616	616	616
Note		-	-	-
Evaluation		OK	OK	OK

Notes:

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Behavior of test object during test:

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

Test results (continued)

Test requirement: I1
 Condition of test object before test: New

Test No.		111 5927	111 5928	111 5929
Test sample No.		7	8	9
Type		THS-250C1-gG	THS-250C1-gG	THS-250C1-gG
Rated current of fuse-link	A	250	250	250
Test voltage	V	600	600	600
Prospective peak current	kA	284	284	284
Prospective breaking current I _p	kA	124	124	124
Power factor cos φ		0.16	0.16	0.16
Making angle	°el.	49	60	66
Initiation of arcing after voltage zero	°el.	60	69	74
Melting current I _s	kA	22.5	23.3	23.1
Cut-off current	kA	23.3	24.4	24.6
Melting time	ms	0.53	0.49	0.45
Arcing time	ms	2.89	2.95	3.15
Operating time	ms	3.42	3.44	3.60
Melting integral	10 ³ A ² s	86.8	90.1	81.9
Arcing integral	10 ³ A ² s	216	258	286
Operating integral	10 ³ A ² s	298	343	363
Arcing energy	kVAs	15.4	17.7	19.0
Peak switching voltage	V	1234	1279	1286
Recovery voltage	V	616	621	621
Note		-	-	-
Evaluation		OK	OK	OK

Notes:

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Behavior of test object during test:

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

5. Photos



Photo 1: Test samples before tests



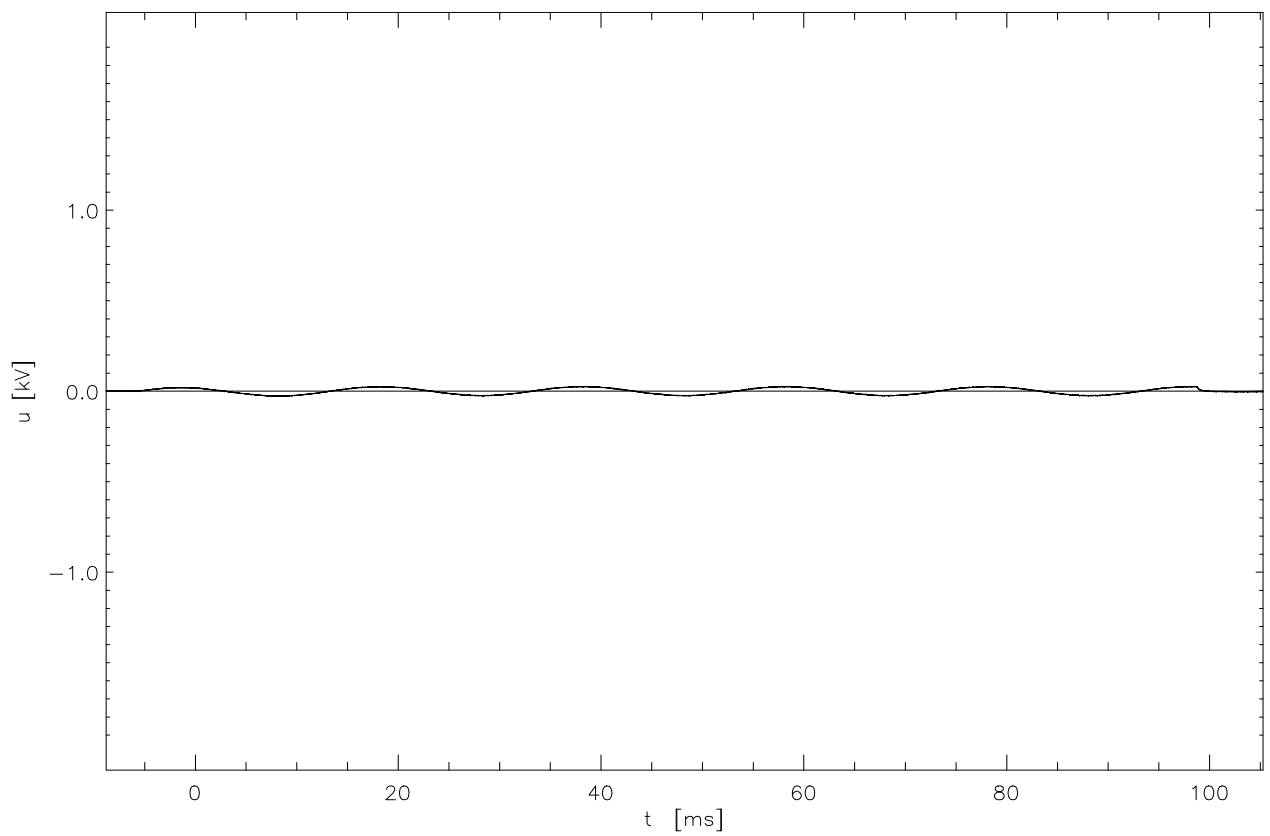
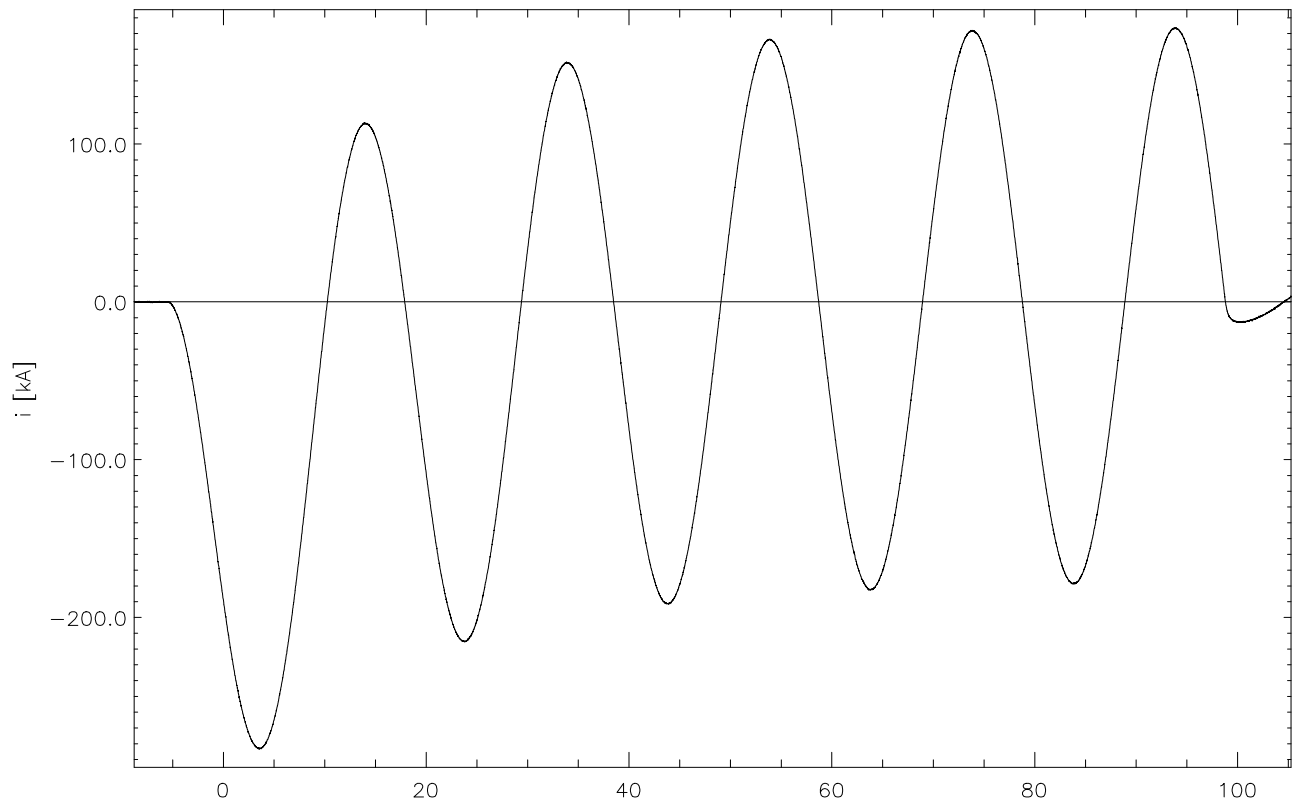
Photo 2: Test arrangement with fuse THS 400

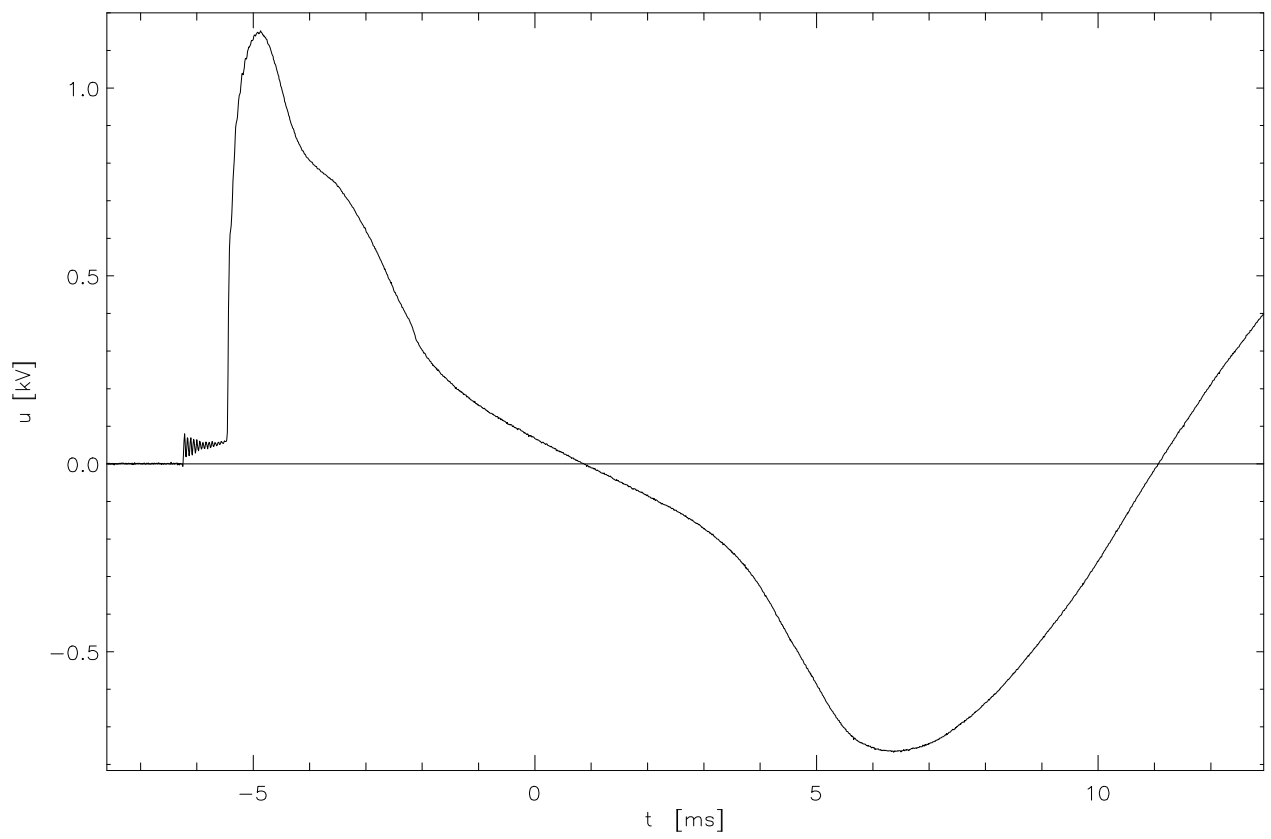
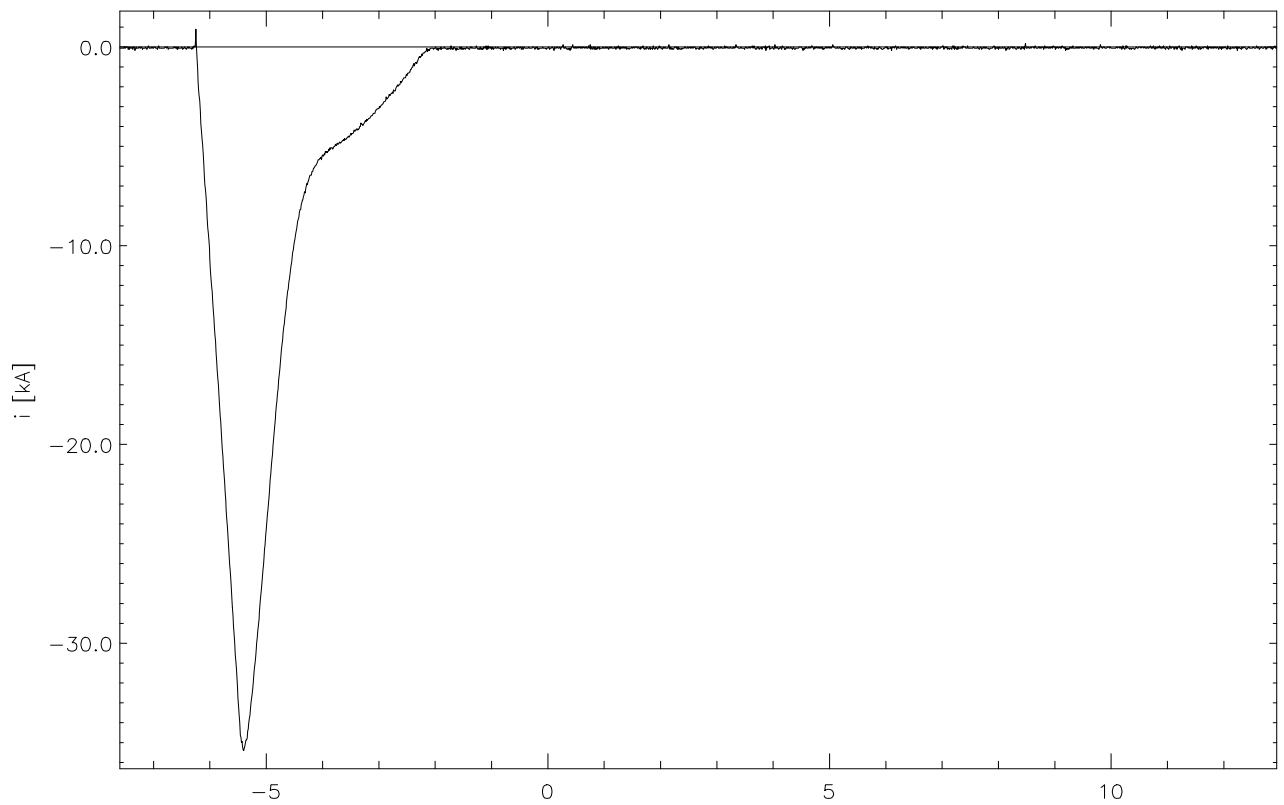


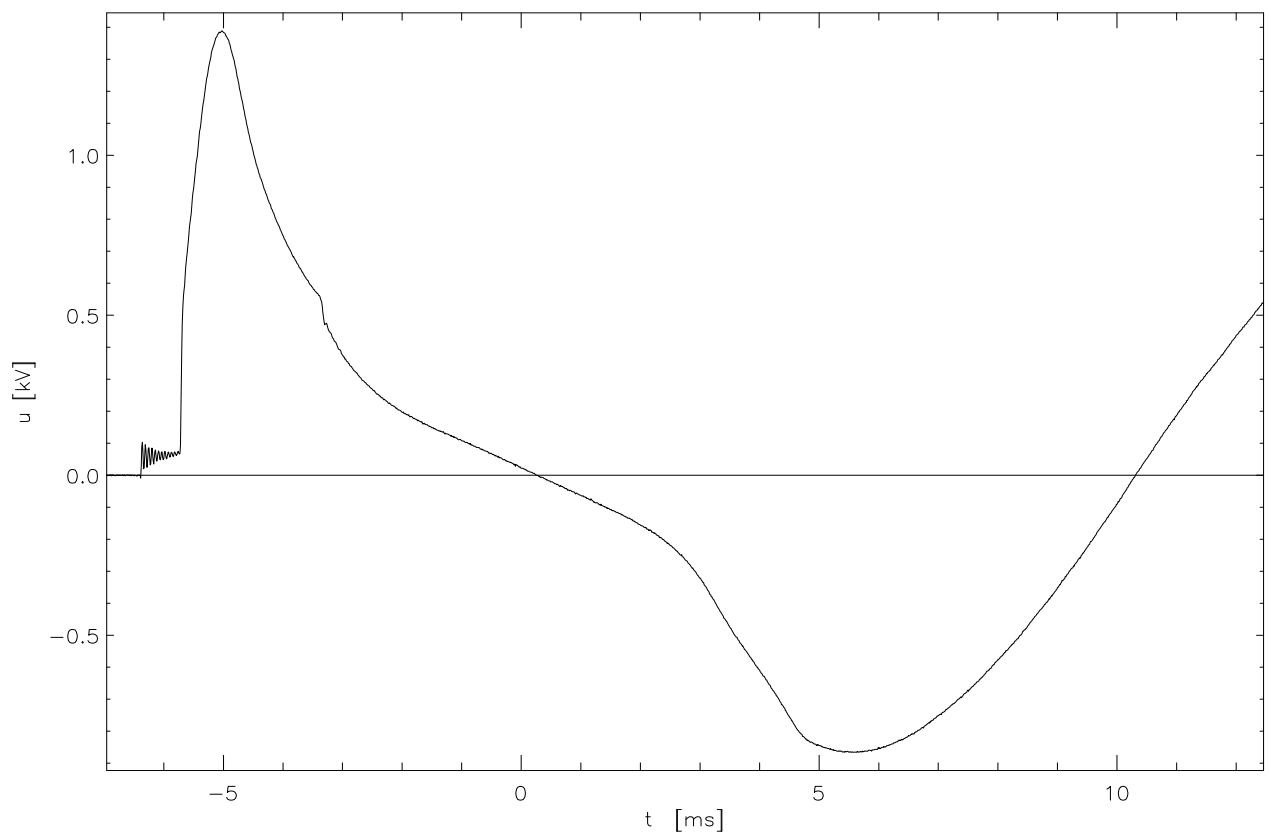
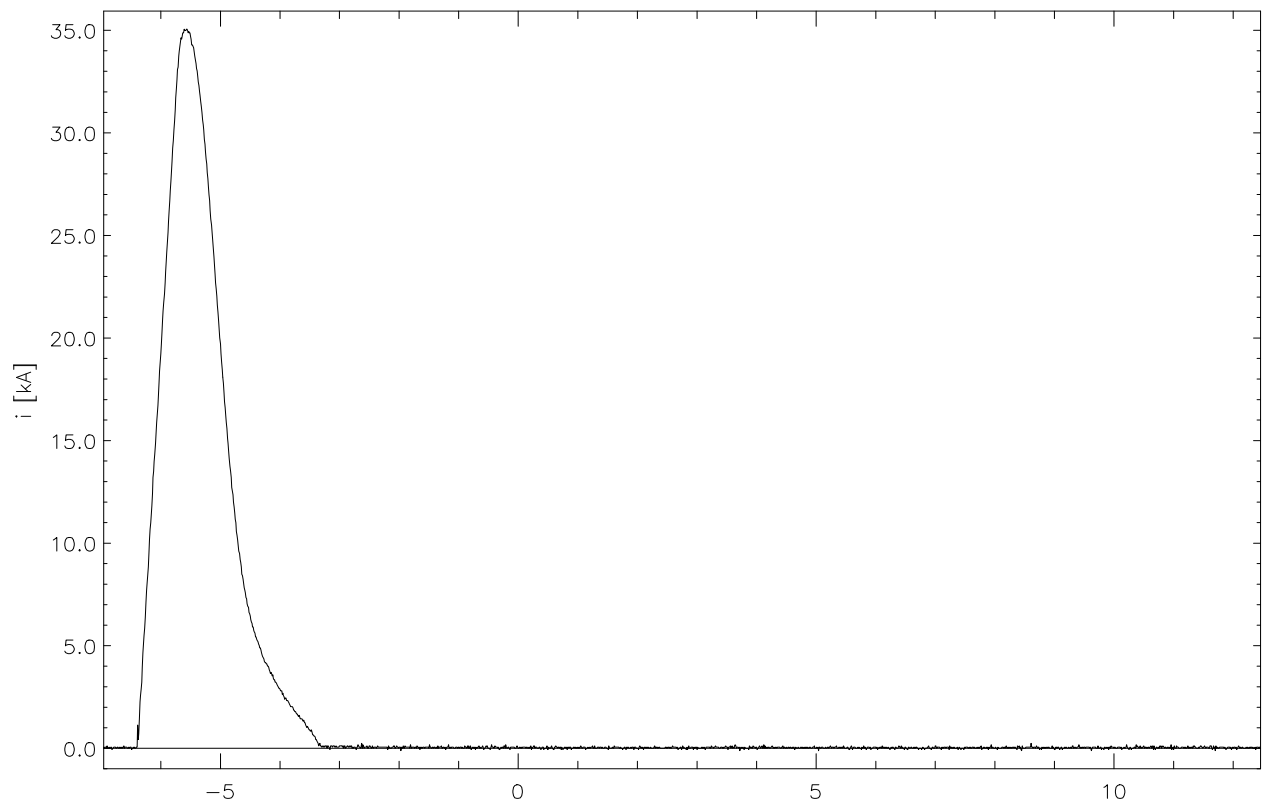
Photo 3: Test arrangement with fuse THS 250

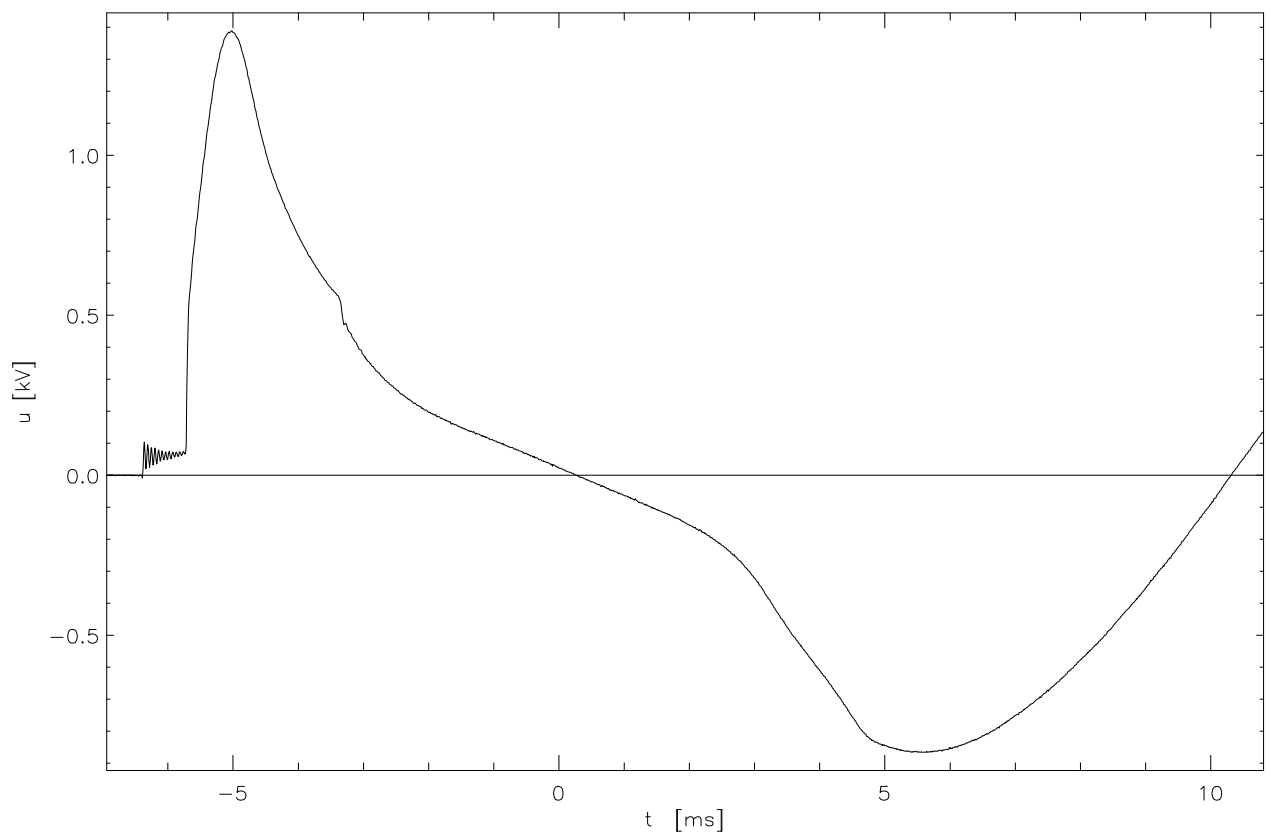
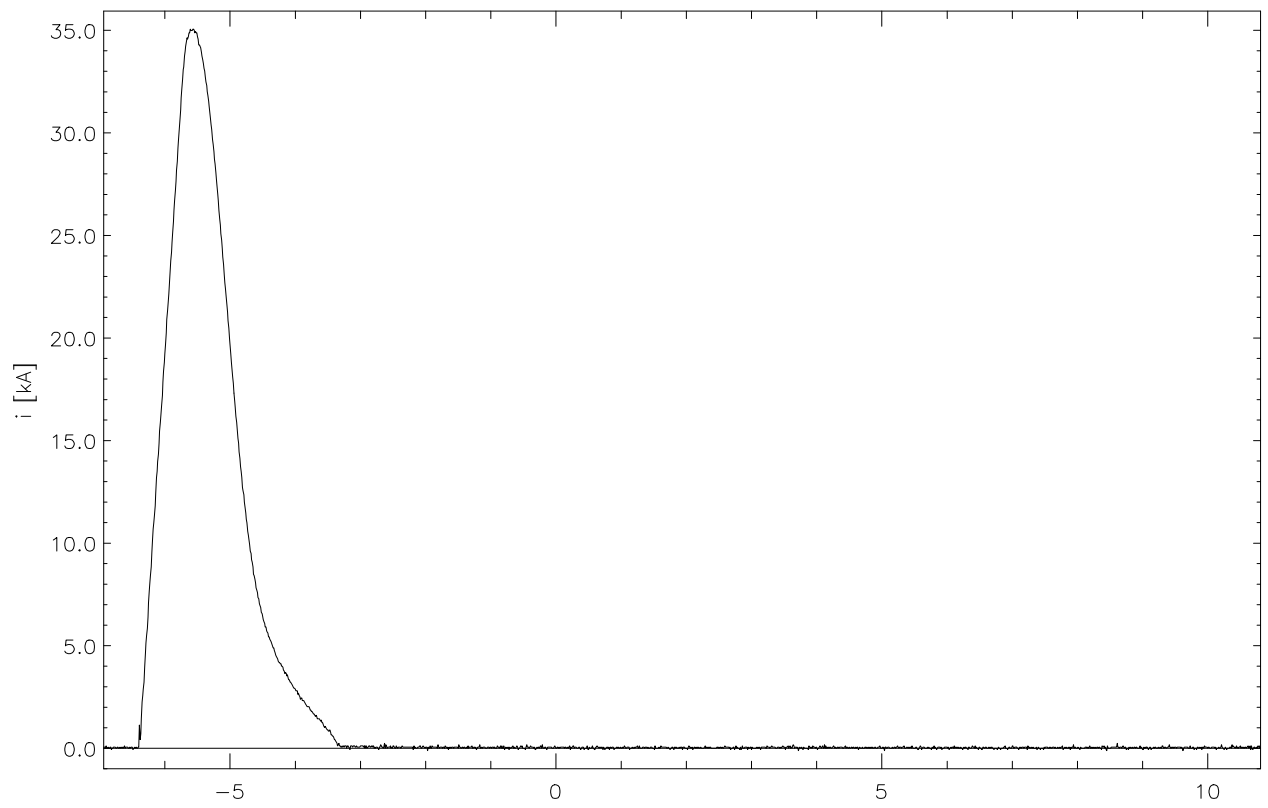
6. Oscillograms

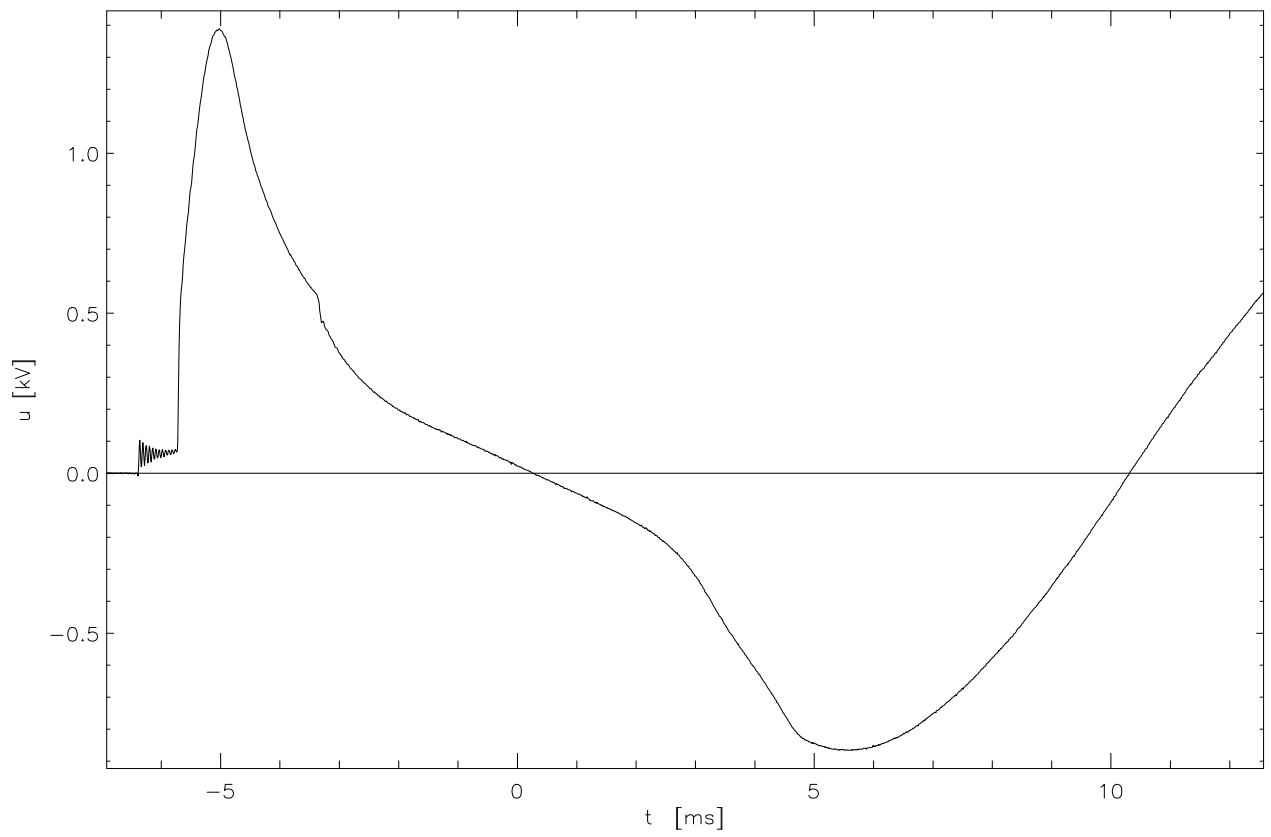
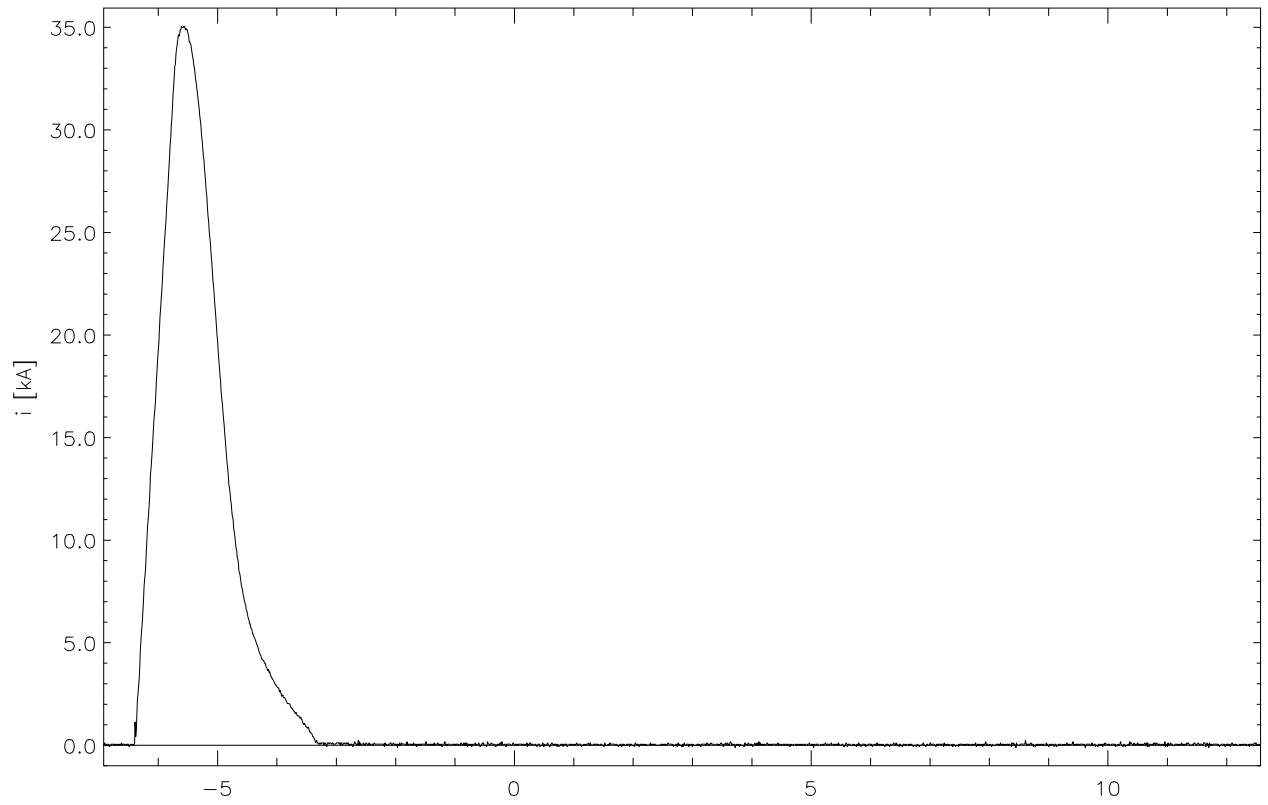
Test-No. 1115920

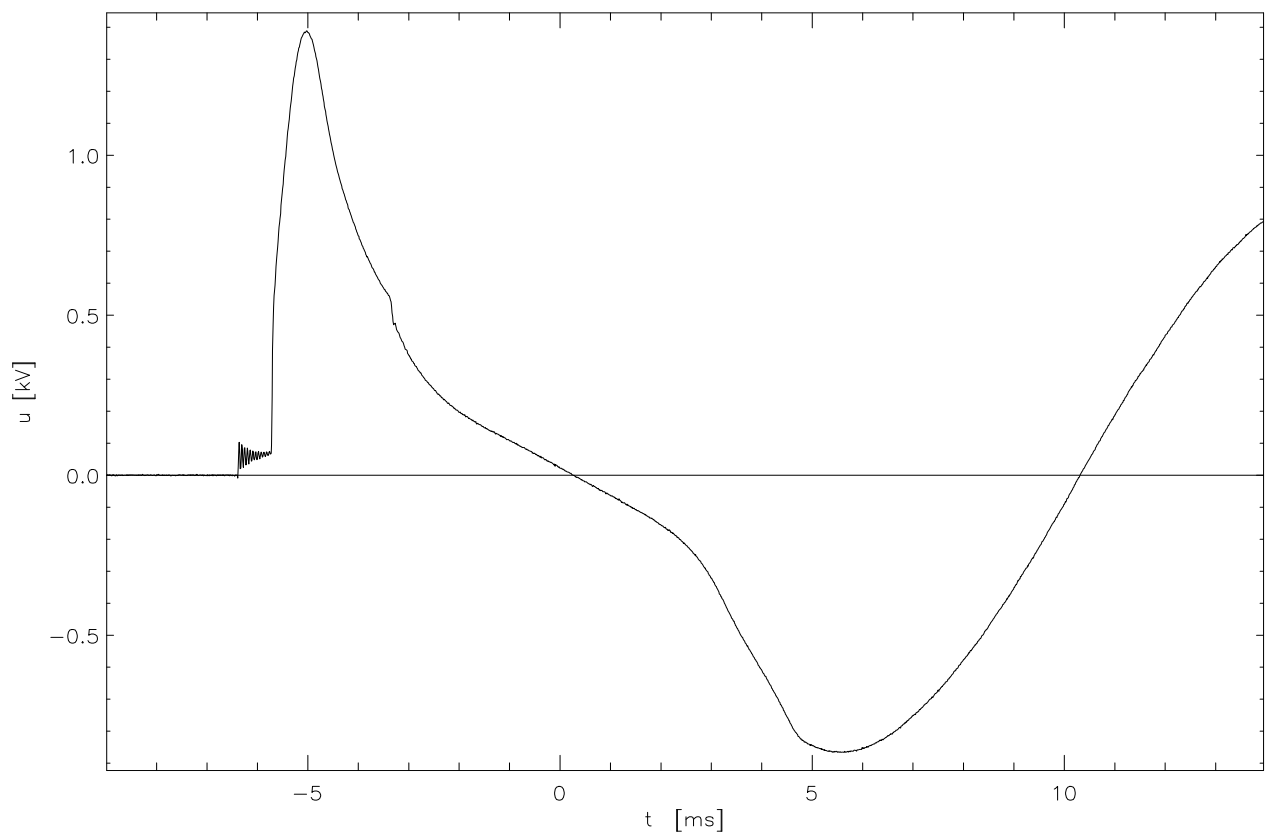
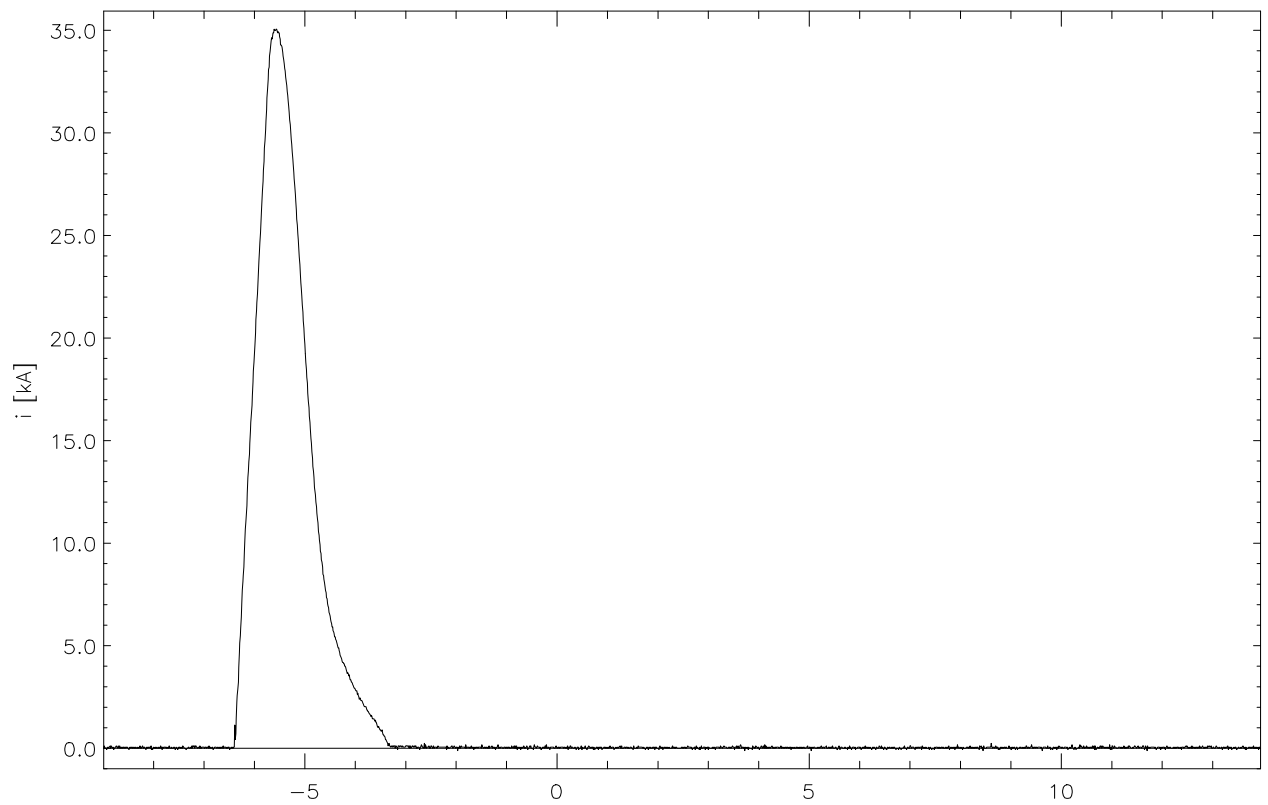


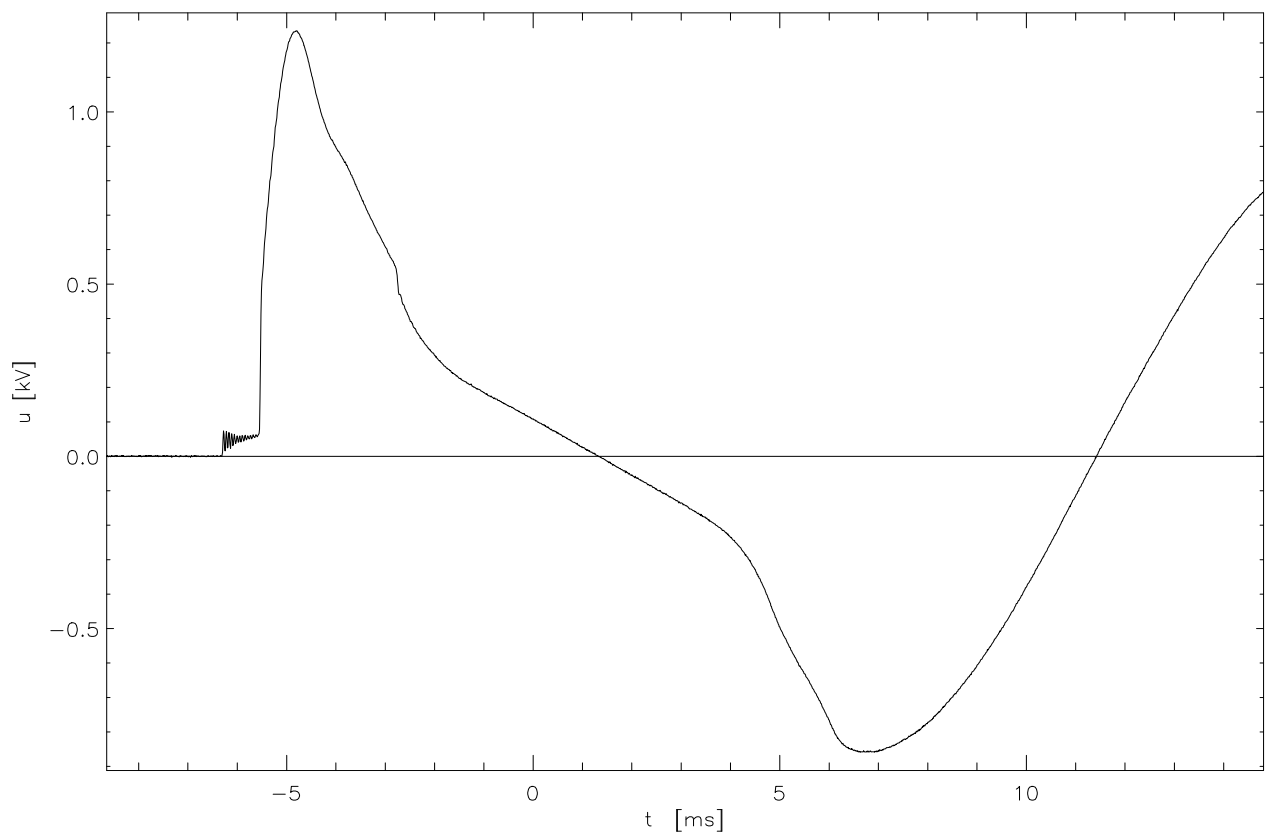
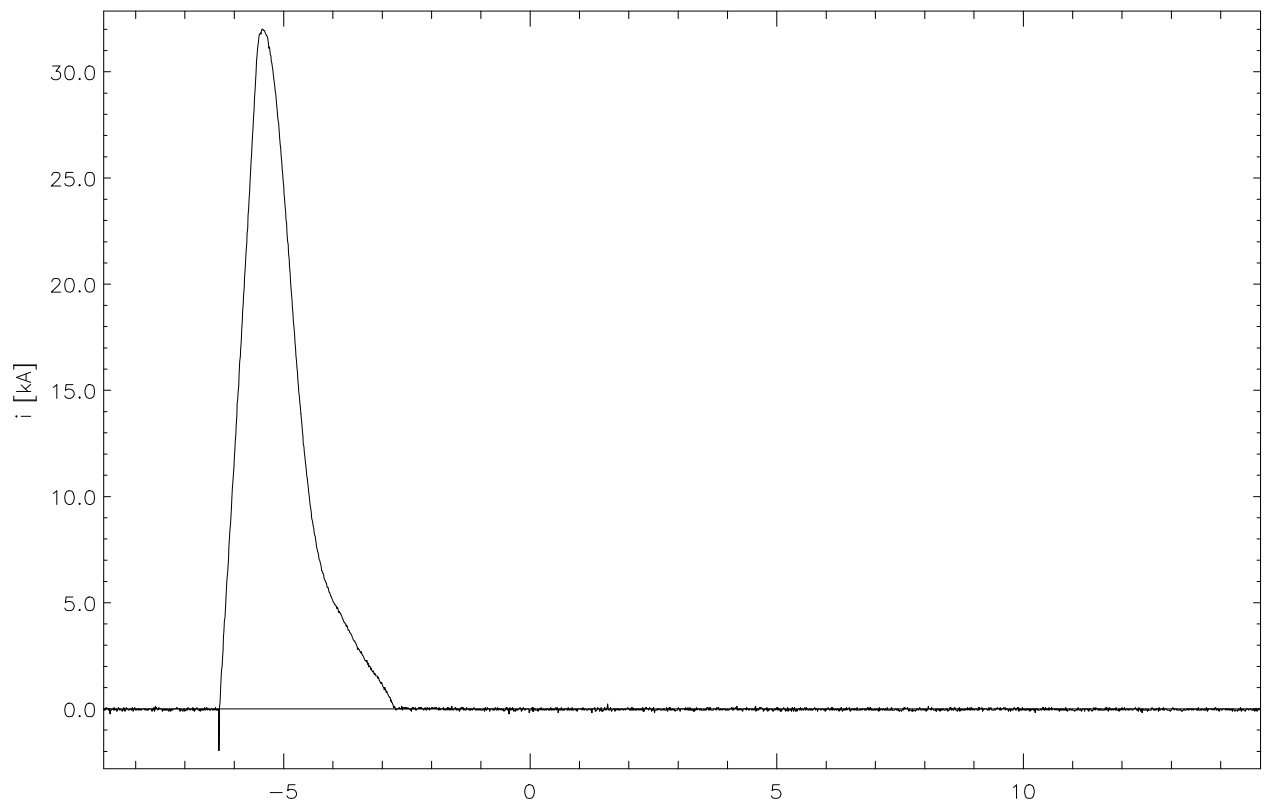


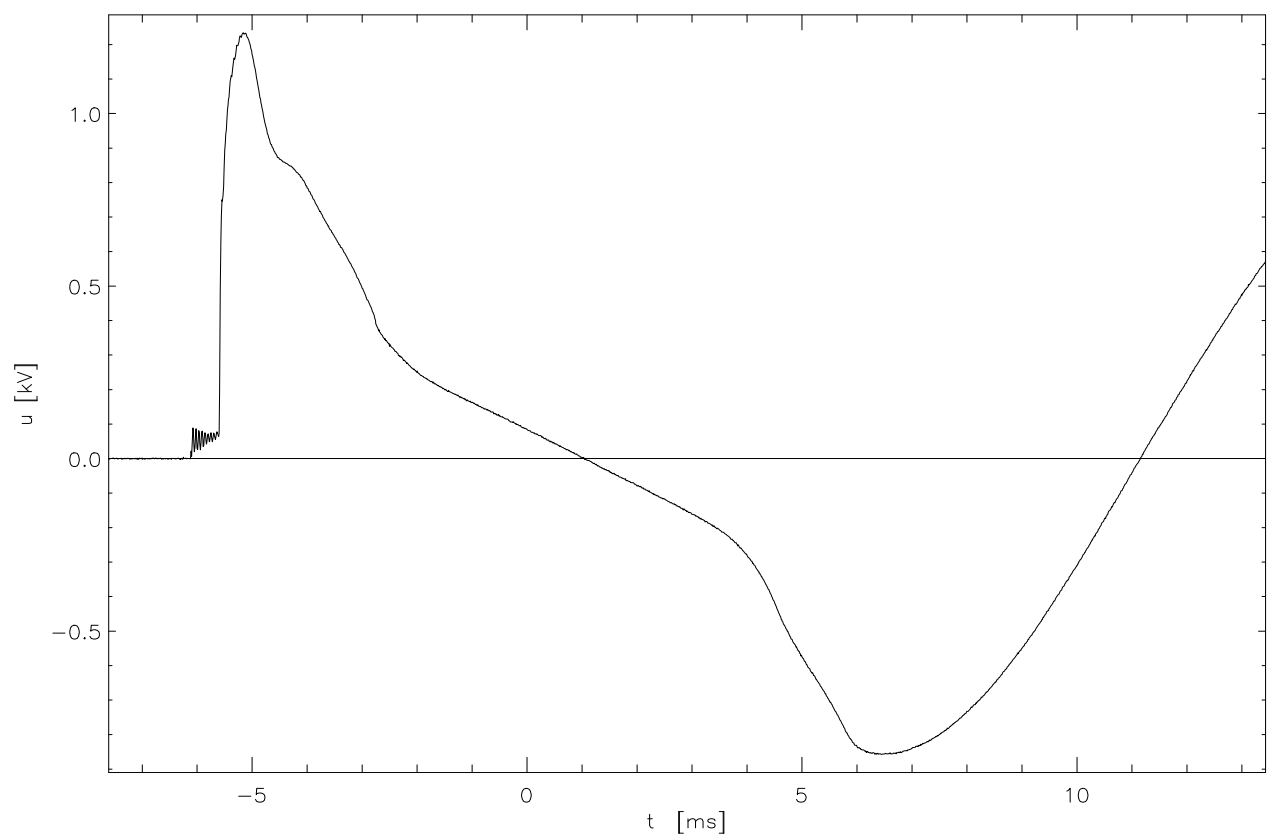
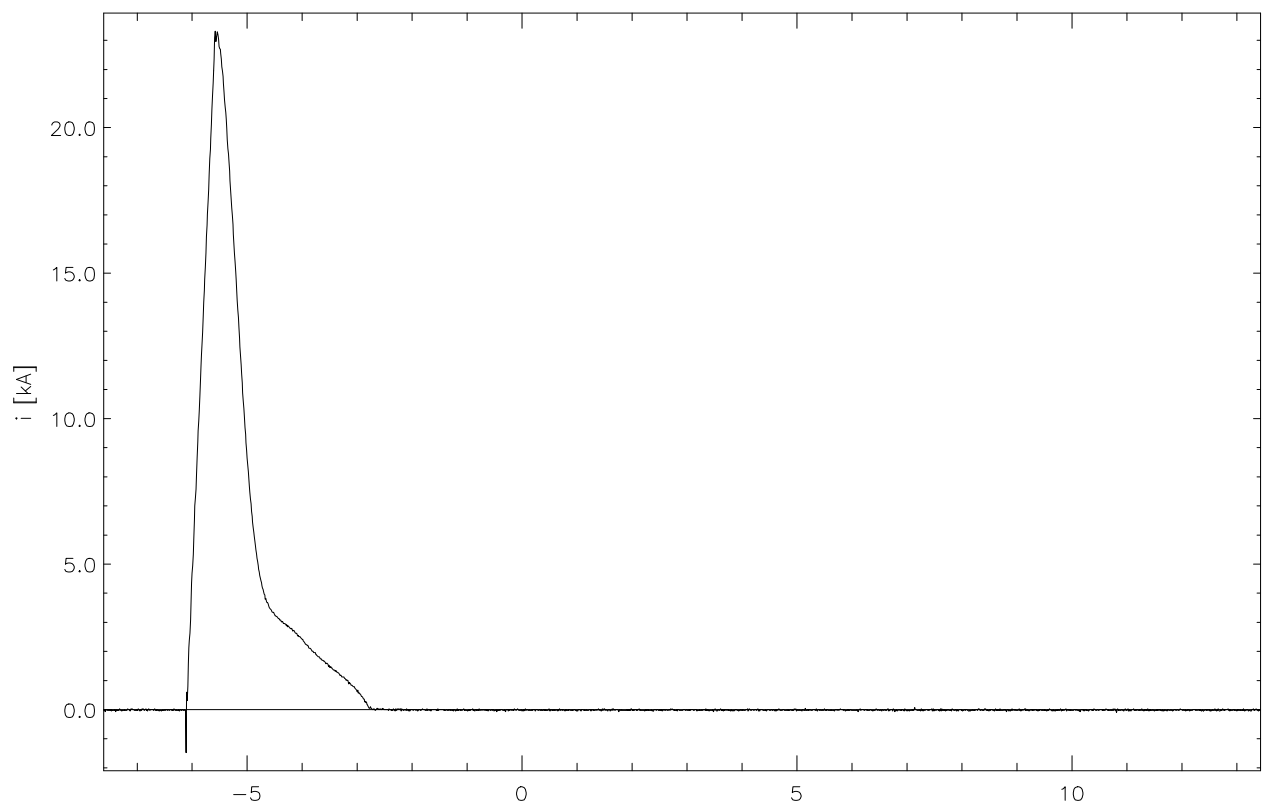


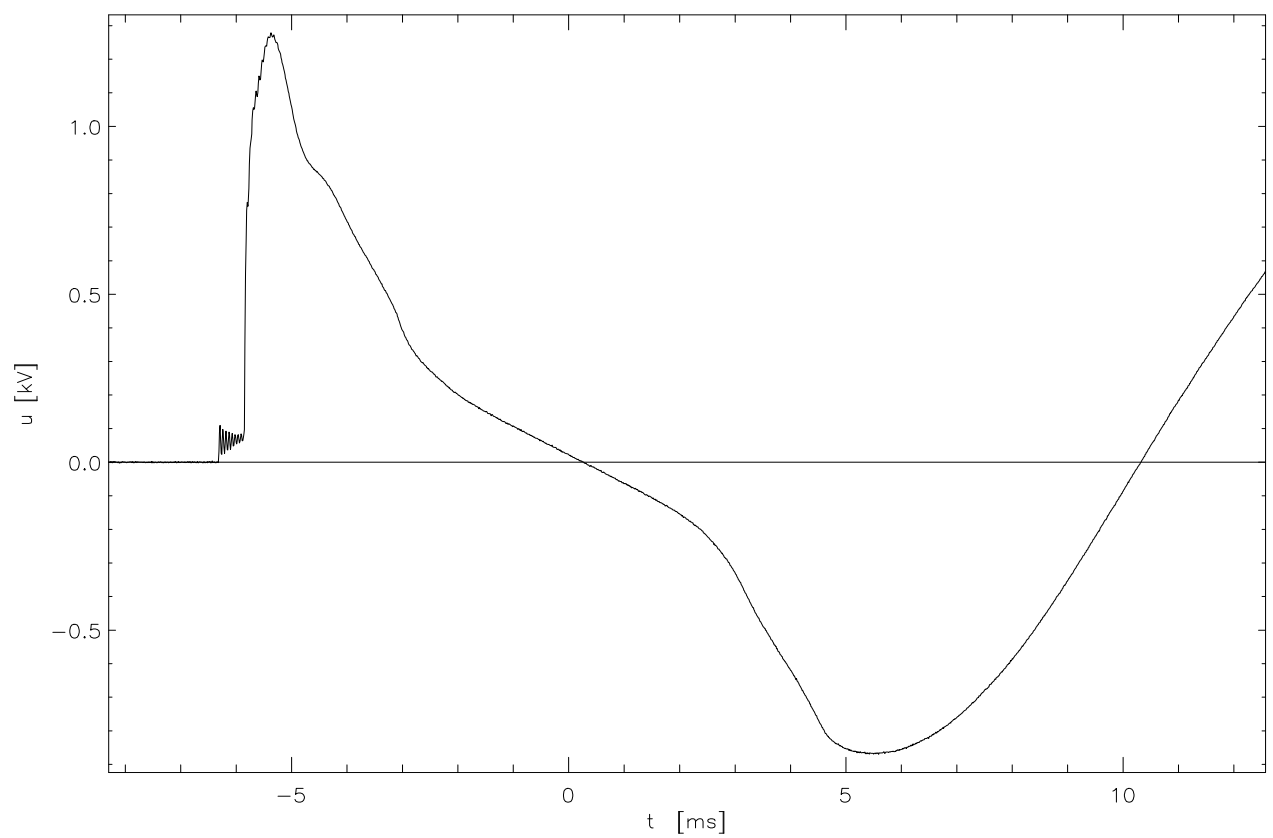
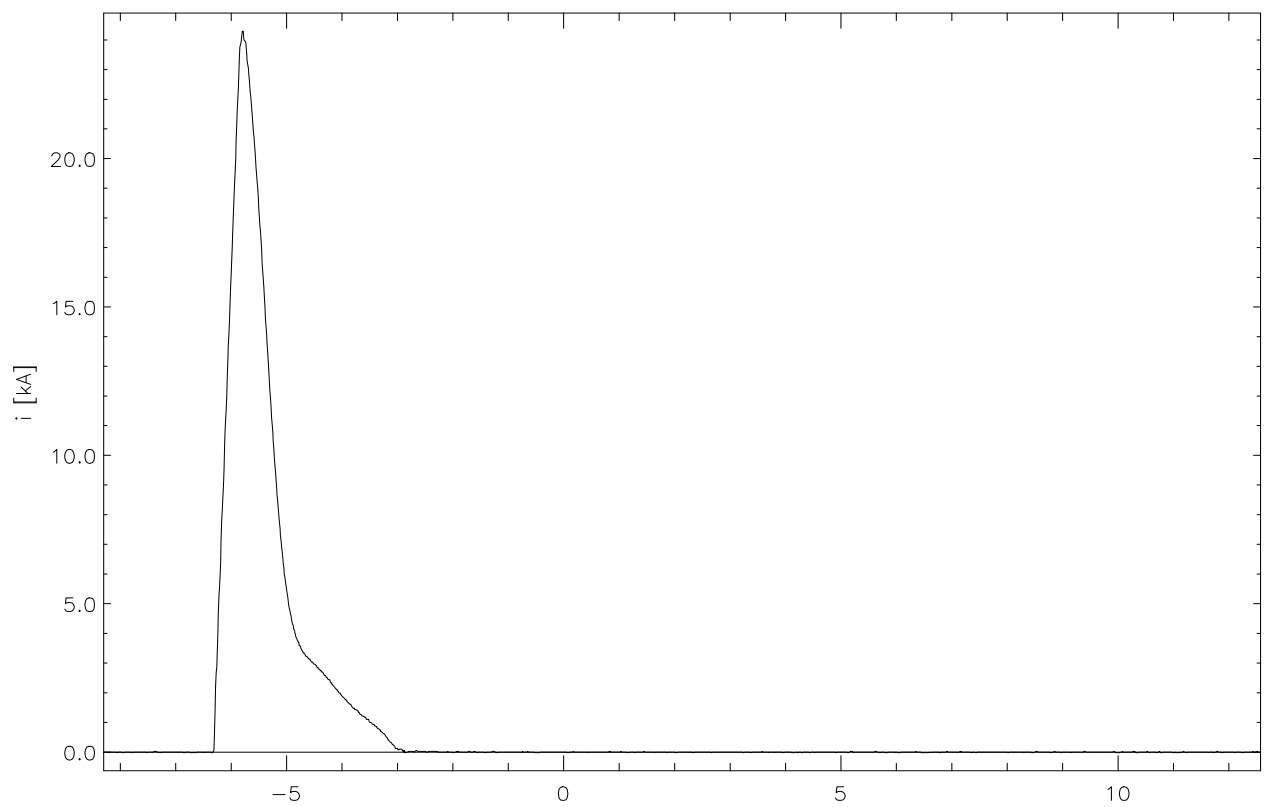


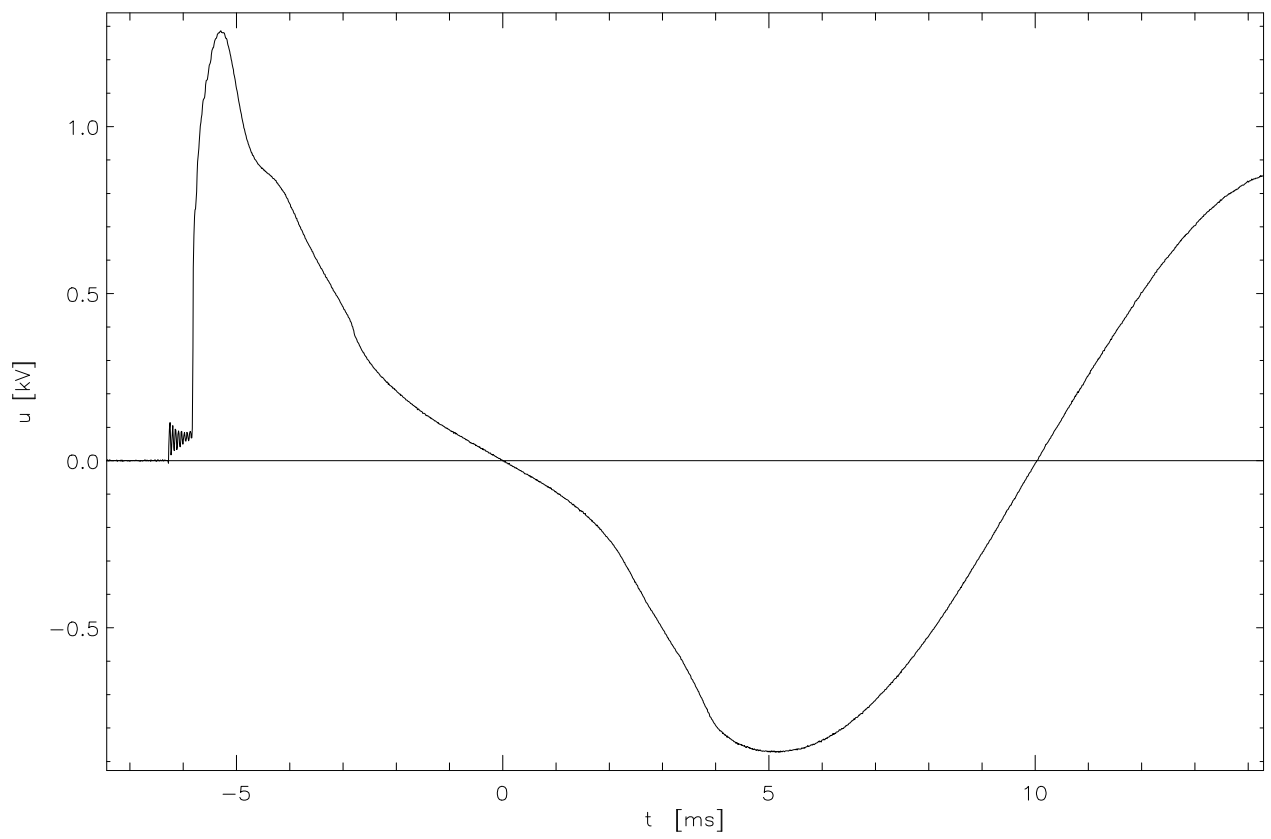
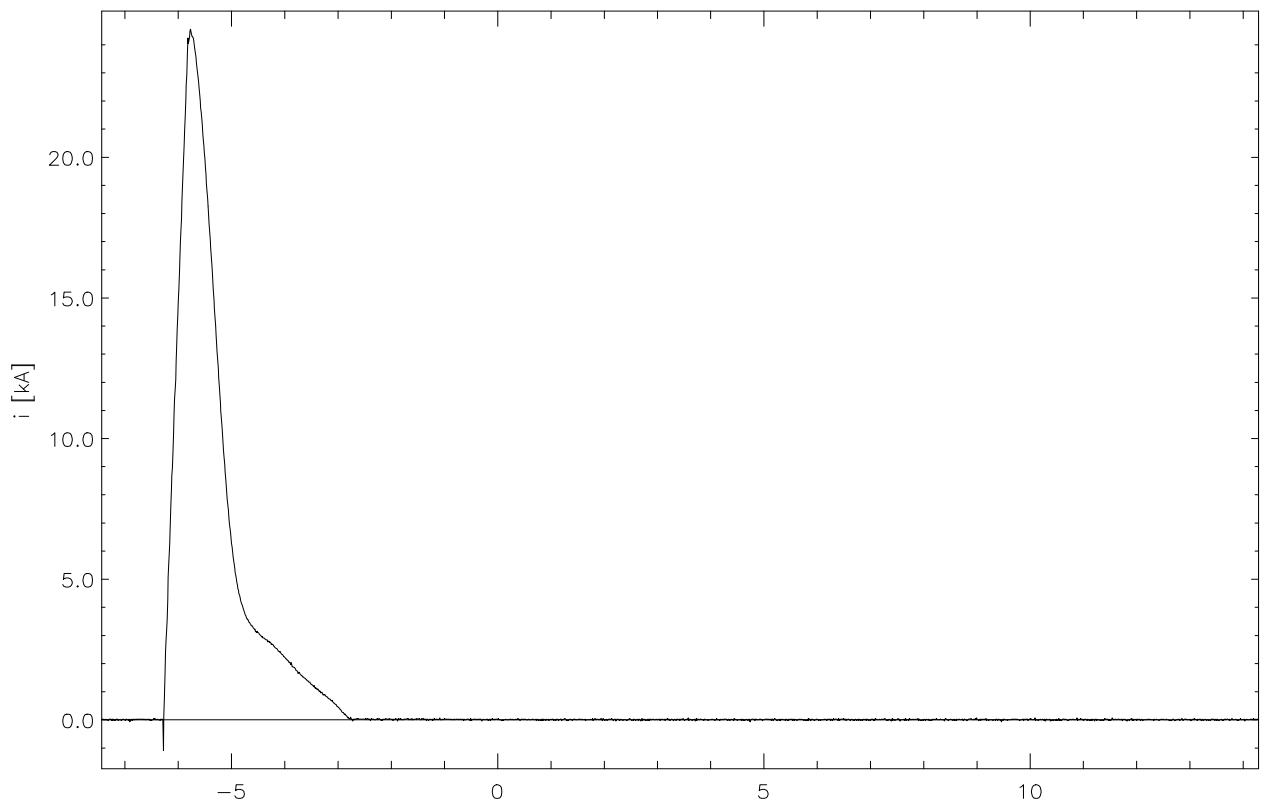




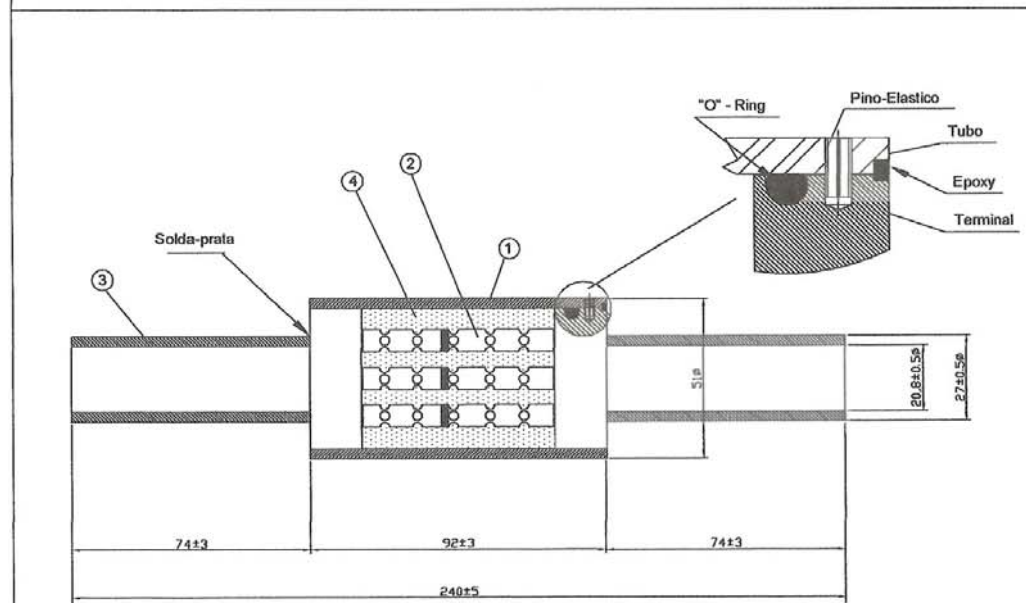
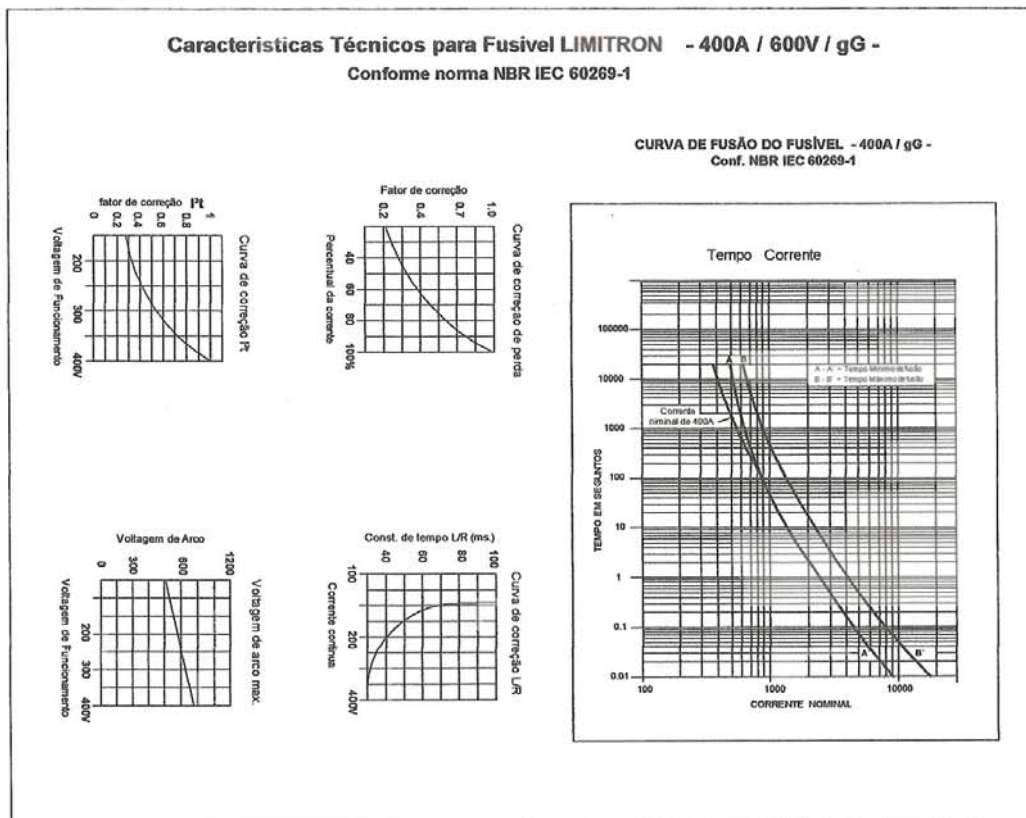








7. Drawings



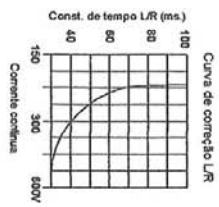
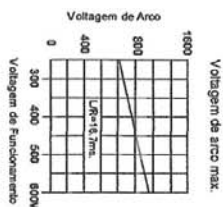
TIPO: - CEMIG - CONF. ANEXO B ITEM 1.1

IDEM	DESCRIÇÃO	QTD.	MEDIDAS	APLICAÇÃO
4	Areia de sílica H31	--	--	
3	Terminal de Latão prateado	2	2x3/8"x72	
2	Elemento	6	8x70x0.25	
1	Corpo em fibra de vidro Classe "H"	1	51Øx45Øx92	

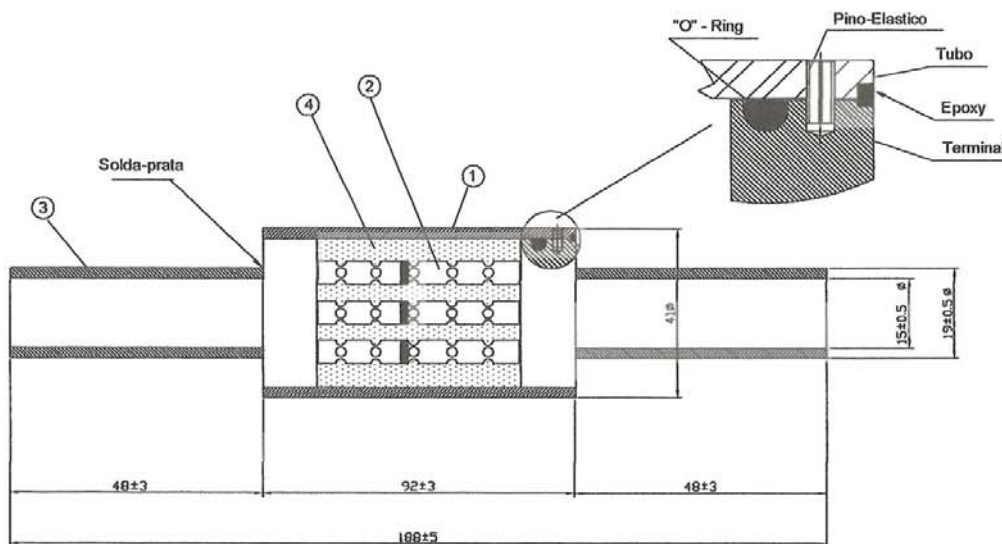
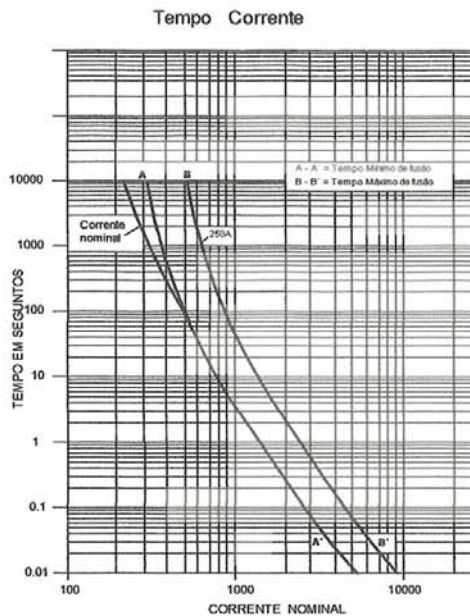
Cabo de Al ou Cu de 240mm², compactado

Revisão	1	2	3	4	5
THS INDUSTRIA E COMERCIO LTDA					
LIMITRON FORMATO - C1					
Data	2.06.11			CORRENTE	400 A
Des.	Hermann			VOLTAGEM	600V
Ver.	Saulo				
Esc.	1:1				
Nr. THS-400C1					

Características Técnicas para Fusível LIMITRON 250, 600V



CURVA DE FUSÃO DO FUSÍVEL LIMITRON - 250A / gG - Conf. NBR IEC 60289-1



Bitolo de Cabo 250MCM

Tipo: TUBO - TUBO

Revisão	1	2	3	4	5										
<p>THS INDUSTRIA E COMERCIO LTDA</p> <p>LIMITRON THS250C1</p>															
Data	2.06.11									CORRENTE	250 A				
Des.	Hermann									VOLTAGEM	600V				
Ver.	Saulo														
Esc.	1:1														
Desenho	<p>Nr. THS-250C1</p>														

IDEM	DESCRIÇÃO	QTD.	MEDIDAS	APLICAÇÃO
4	Areia de sílica H31	—	—	
3	Terminal de Latão prateado	2	2"x3/8"x72	
2	Elemento	28	7X70X0.25	
1	Corpo em fibra de vidro Classe "H"	1	51Øx45Øx92	