

Test Report

Document No.	12070-20-0664	Copy No.	1	Number of pages	18
Apparatus	High-voltage current-limiting fuse				
Designation	Back up Submersible Current - Limiting Fuses				
Serial Number	15/30, 15/80, 15/125, 15/160, 15/180				
Manufacturer	THS Industria e Comercio Ltda. Rua Sargento Francisco Rodrigues da Rosa, 534 Cajuru do Sul 18105-008 Sorocaba - Sao Paulo BRAZIL				
Client	THS Industria e Comercio Ltda. Rua Sargento Francisco Rodrigues da Rosa, 534 Cajuru do Sul 18105-008 Sorocaba - Sao Paulo BRAZIL				
Date(s) of test(s)	29 April 2020				
Tested by	IPH Institut „Prüffeld für elektrische Hochleistungstechnik“ GmbH Landsberger Allee 378A 12681 Berlin GERMANY				
Test(s) performed	Interrupting performance test series 1				

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: Client's instructions based on IEEE C37.41-2016

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.

27 January 2023

Date


Christian Kruscha
Test Engineer in charge


Stefan Schwanck
Approved by

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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 ($> 1 \text{ kV}_{ac}$; $> 1,5 \text{ kV}_{dc}$), 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 ($< 1 \text{ kV}_{ac}$; $< 1,5 \text{ kV}_{dc}$) 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

Decision rule for conformity assessment

The decision rule for conformity assessment is based on the 'simple acceptance method' according to ILAC-G8:09/2019 – Ch. 4.2.1.

Ratings and characteristics assigned by the manufacturer

Description	Rating
Rated voltage	15.5 kV
Rated current of the fuse-link	30 bis 180 A
Rated frequency	50 Hz
Rated breaking current	50 kA

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1. Present at the test

Mr. Kruscha IPH test engineer in charge

2. Test performed

Interrupting performance test series 1

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3. Identity of the test object

3.1 Technical data and characteristics

Test object: High-voltage current-limiting fuse
 Type: Back up Submersible Current - Limiting Fuses
 Manufacturer: THS Industria e Comercio Ltda., Brazil
 Serial No.: 15/30, 15/80, 15/125, 15/160, 15/180
 Year of manufacture: 2020

Characteristics and further data:
 see Data sheets

3.2 Identity documents

The manufacturer confirms that the test object has been manufactured in compliance with the drawings given in this document. IPH did not verify this compliance in 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
Backup type oil submersible current limiting fuse	--	--	THS	Sheet 16
Current limiting backup fuse	5803	28.01.2020	THS	Sheet 17

Entry of test object at IPH: April 2020

4. Breaking tests

4.1 Test laboratory

IPH, High-power test laboratory, test bay 7

4.2 Normative document

According to client's instructions based on IEEE C37.41-2016

4.3 Required test parameters

		Test duty
		1
Power-frequency recovery voltage	kV	15.5
Prospective current	kA	50 kA
Power factor		0.07 to 0.15
Test frequency	Hz	50
Prospective TRV	f kHz	3.2
	Peak factor p.u.	1.4
Maintained voltage after breaking	s	≥60

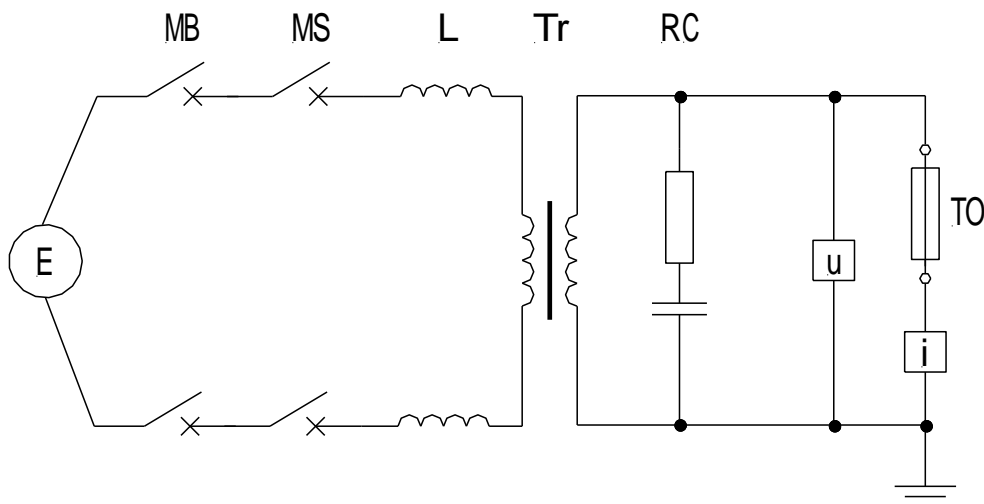
4.4 Test arrangement

The interrupting tests were performed with single-phase alternating current and with single fuses. The fuses to be tested were mounted on a rigid earthed metal structure in the normal service position.

4.5 Test and measuring circuits

Technical data of test circuits

Test requirement	Breaking tests in test duty 1	
Test No.	120 1345 to 120 1349	
Number of phases (Test circuit)	2	
Number of poles/phases (Test object)	1	
Test frequency Hz	50	
Power factor $\cos \varphi$	< 0.15	
Earthing conditions	Generator, grid	Not earthed
	Short-circuit transformers	Earthed
Short-circuit power of the test circuit	1300 MVA	



- | | | | |
|----|--------------------------|-----|---------------------------|
| E | Power supply | Tr | Short-circuit transformer |
| MB | Master breaker | R C | TRV elements |
| MS | Making switch | i | Current measurement |
| L | Current limiting reactor | u | Voltage measurement |
| TO | Test object | | |

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	Shunt
2	u	Voltage	RC divider
Recording instrument: AD3000 multichannel transient recorder system			

4.6 Test results

Test No.	120	1345	1346	1347	1348	1349
Test sample No.		15/30	15/80	15/125	15/160	15/180
Type		Back up 30A	Back up 80A	Back up 125A	Back up 160A	Back up 180A
Resistance	mΩ	37.0	16.1	9.59	10.1	8.70
Test voltage	kV	15.5	15.5	15.5	15.5	15.5
Prospective peak current	kA	136	136	136	136	136
Prospective breaking current	kA	51.0	51.0	51.0	51.0	51.0
Power factor cos φ		<0.1	<0.1	<0.1	<0.1	<0.1
Making angle	°el.	63	68	66	58	68
Initiation of arcing after voltage zero	°el.	68	78	79	74	85
Melting current i_s	kA	4.51	9.55	13.6	16.9	16.8
Cut-off current	kA	3.77	11.1	15.5	18.2	18.1
Melting time	ms	0.27	0.54	0.76	0.86	0.97
Arcing time	ms	5.00	4.62	4.73	4.57	4.14
Operating time	ms	5.27	5.15	5.49	5.43	5.11
Melting Joule integral	10 ³ A ² s	4.96	13.6	38.7	54.6	76.8
Arcing Joule integral	10 ³ A ² s	16.3	65.9	196	201	212
Operating Joule integral	10 ³ A ² s	21.3	79.5	235	256	289
Arcing energy	10 ⁶ VAs	68	237	503	443	474
Peak switching voltage	kV	34.4	37.8	35.3	37.6	40.9
Recovery voltage	kV	15.5	15.6	15.6	15.6	15.6
Duration of power frequency recovery voltage	s	60	60	60	60	60
Fuse operated correct	y/n	y	y	y	y	y
Switching voltage $u_s \leq$ permissive value	y/n	y	y	y	y	y
Current limiting: ($i_d \leq$ Cut-off characteristics)	y/n	y	y	y	y	y
Emission of flames or sand	y/n	n	n	n	n	n
Damages (external)	y/n	n	n	n	n	n
Operation of striker correct	y/n	y	y	y	y	y
Evaluation		OK	OK	OK	OK	OK

Notes:

OK - Passed

Condition of test object after test:

It was possible to remove the fuse-link in one piece after operation.
(See Photo 1, Sheet 10)

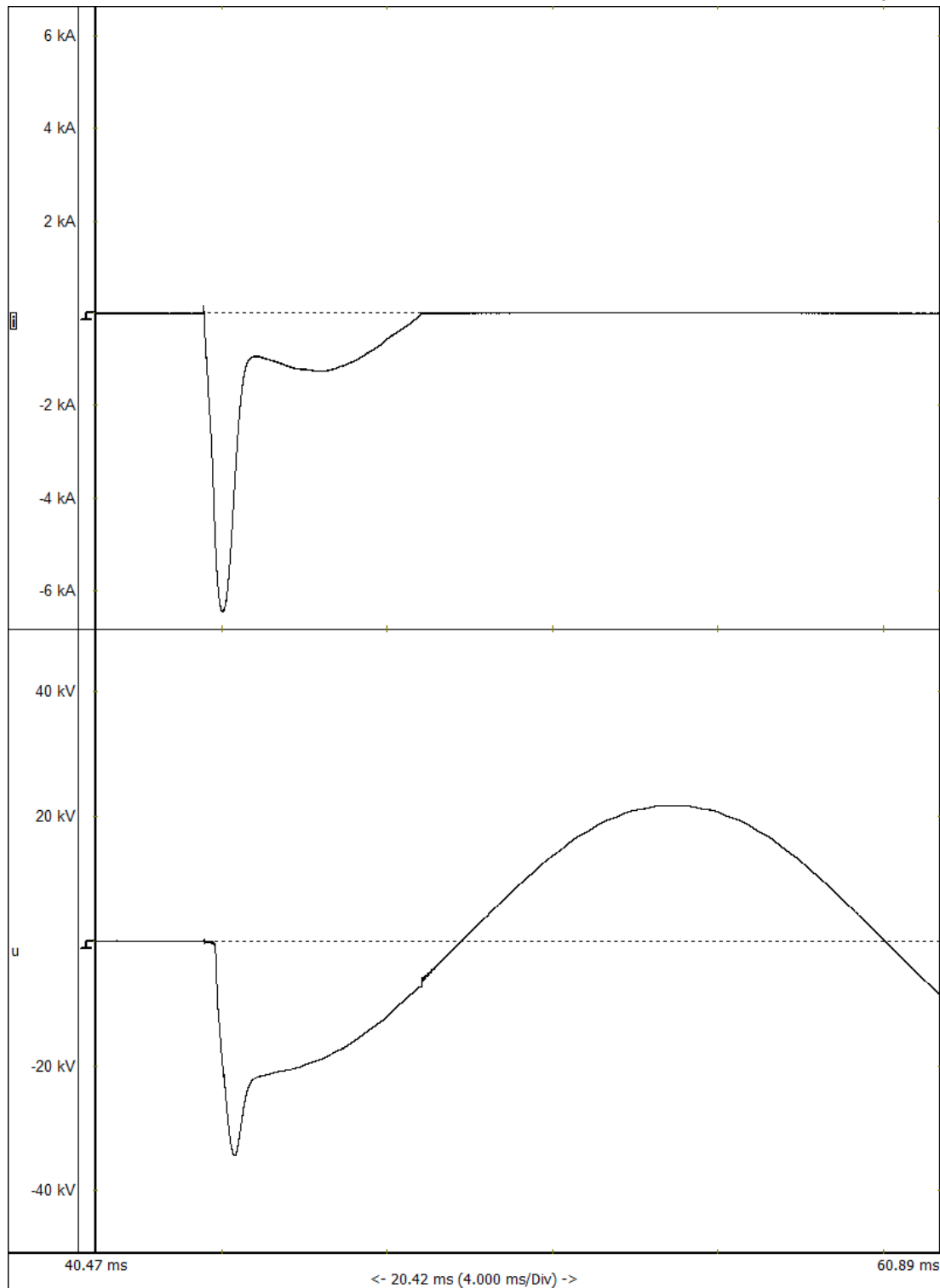
5. Photos

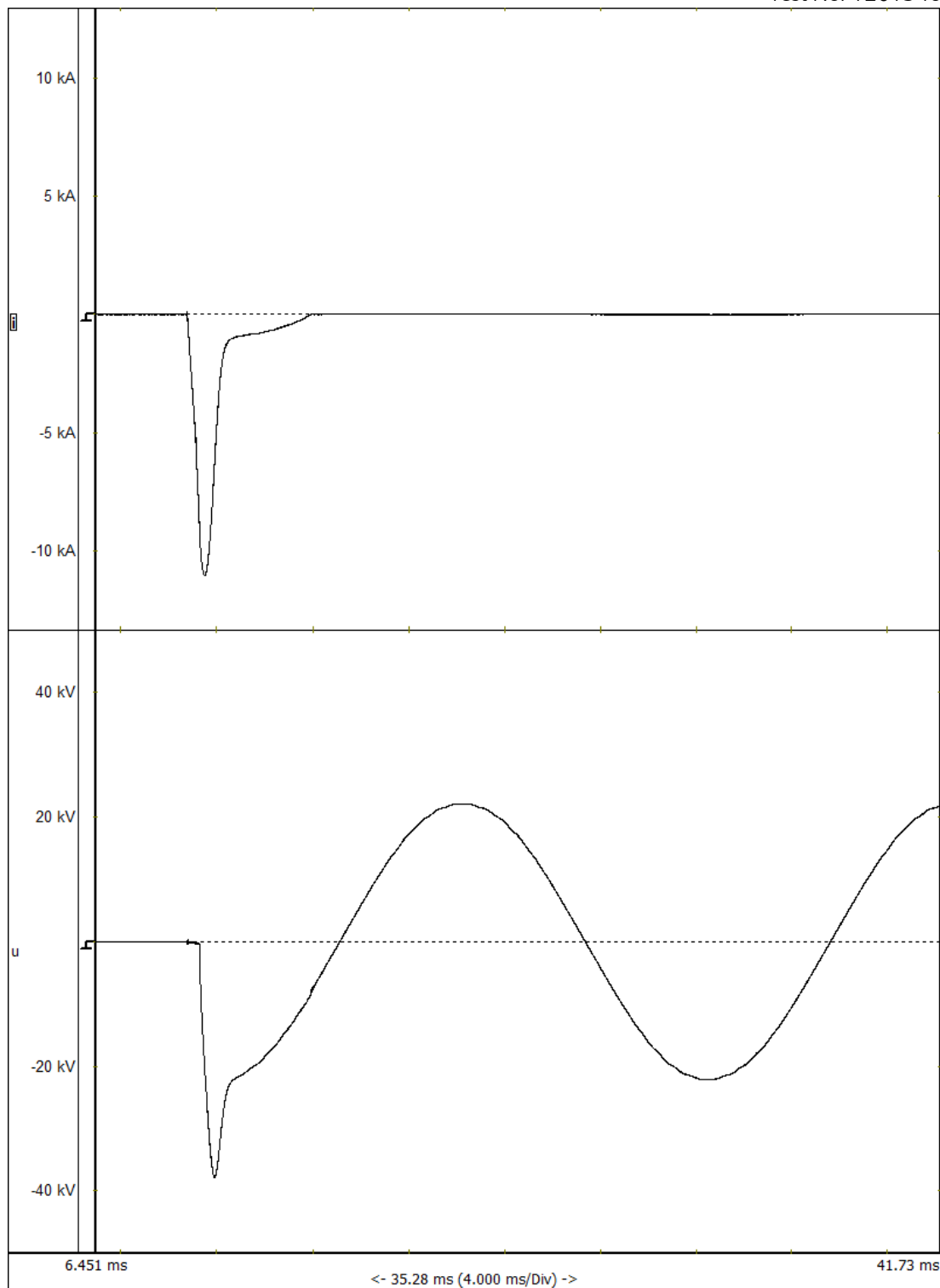


Photo 1: Test samples after test duty 1

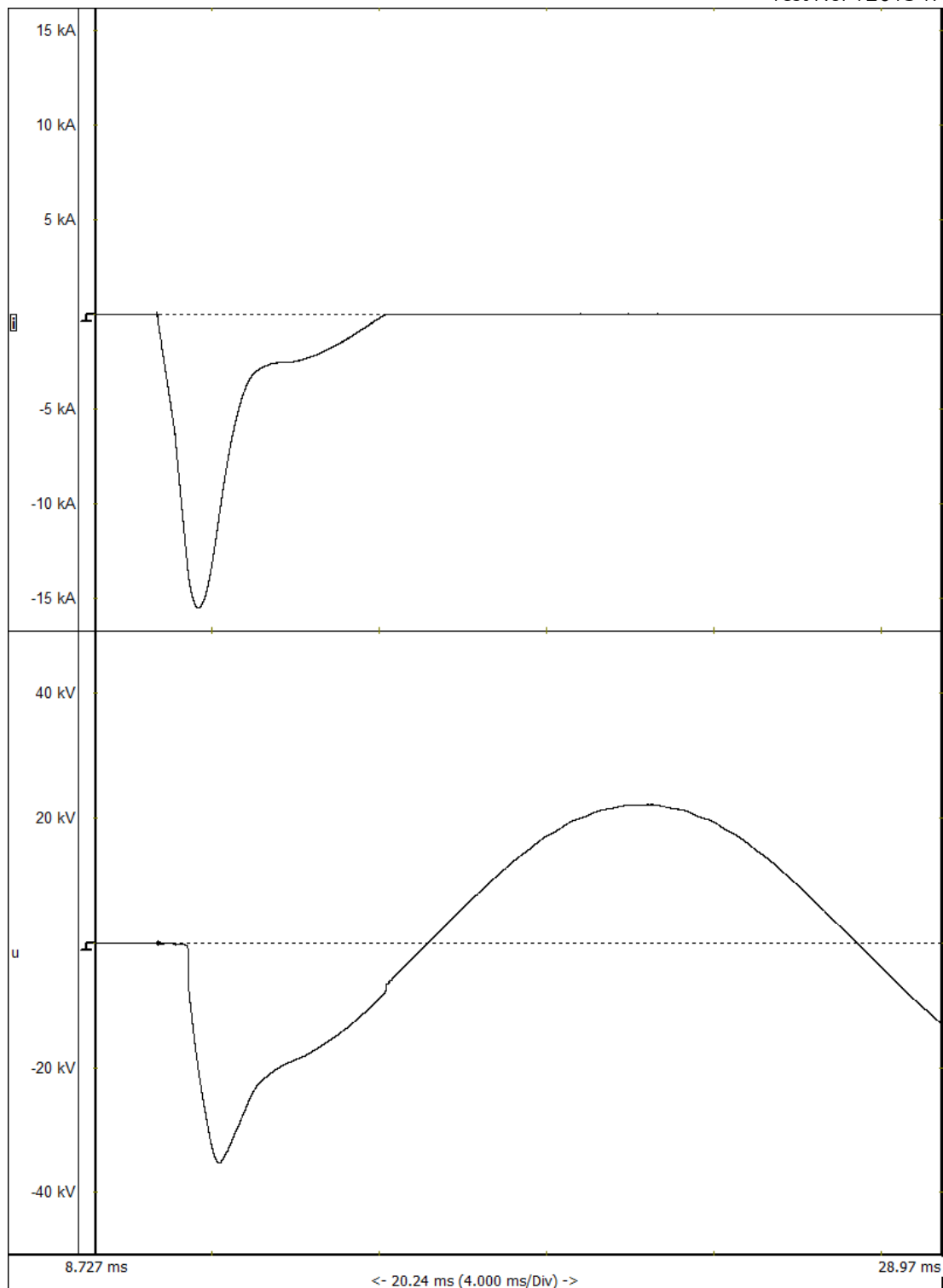
6. Oscillograms

Test No: 1201345

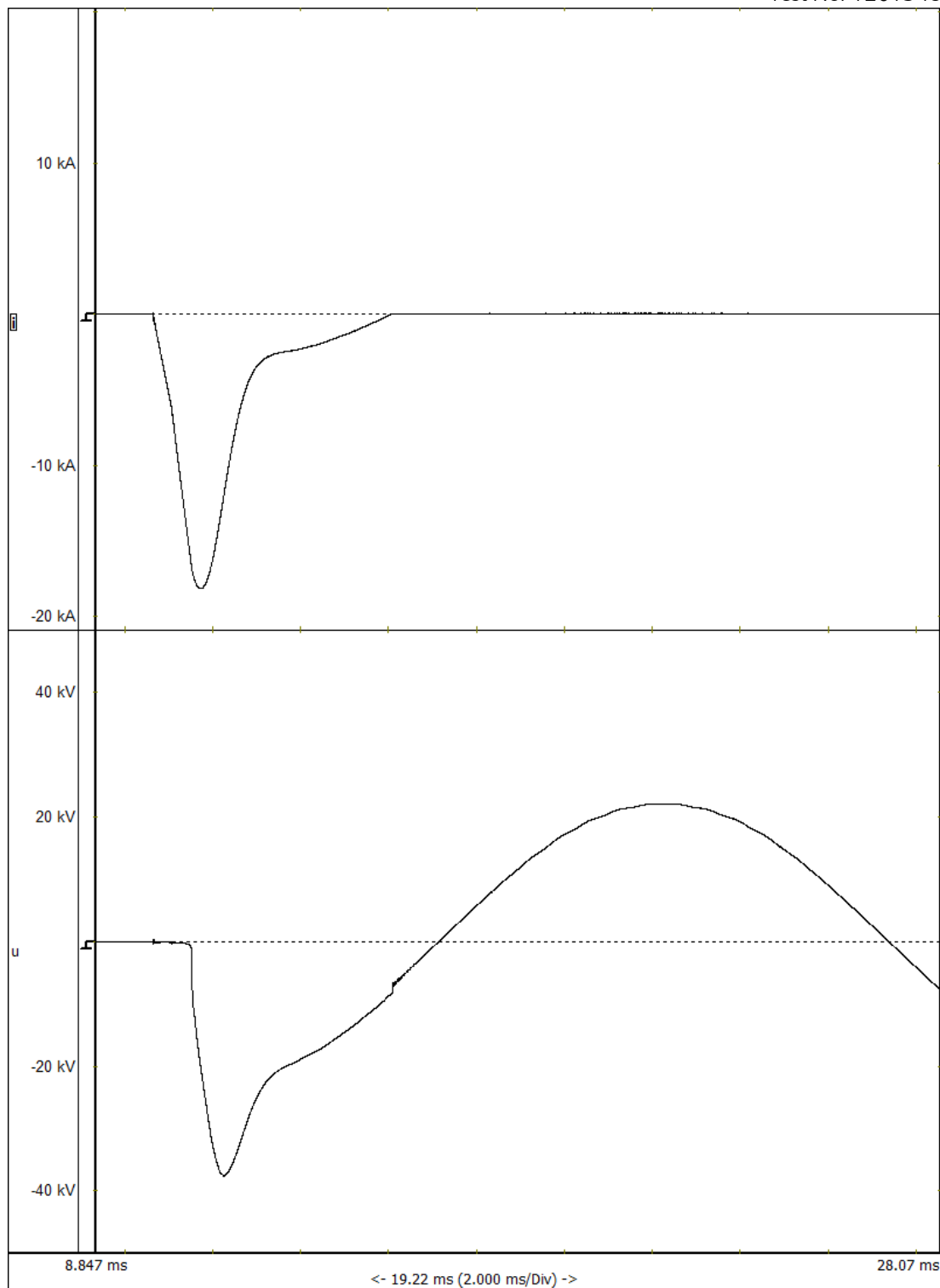




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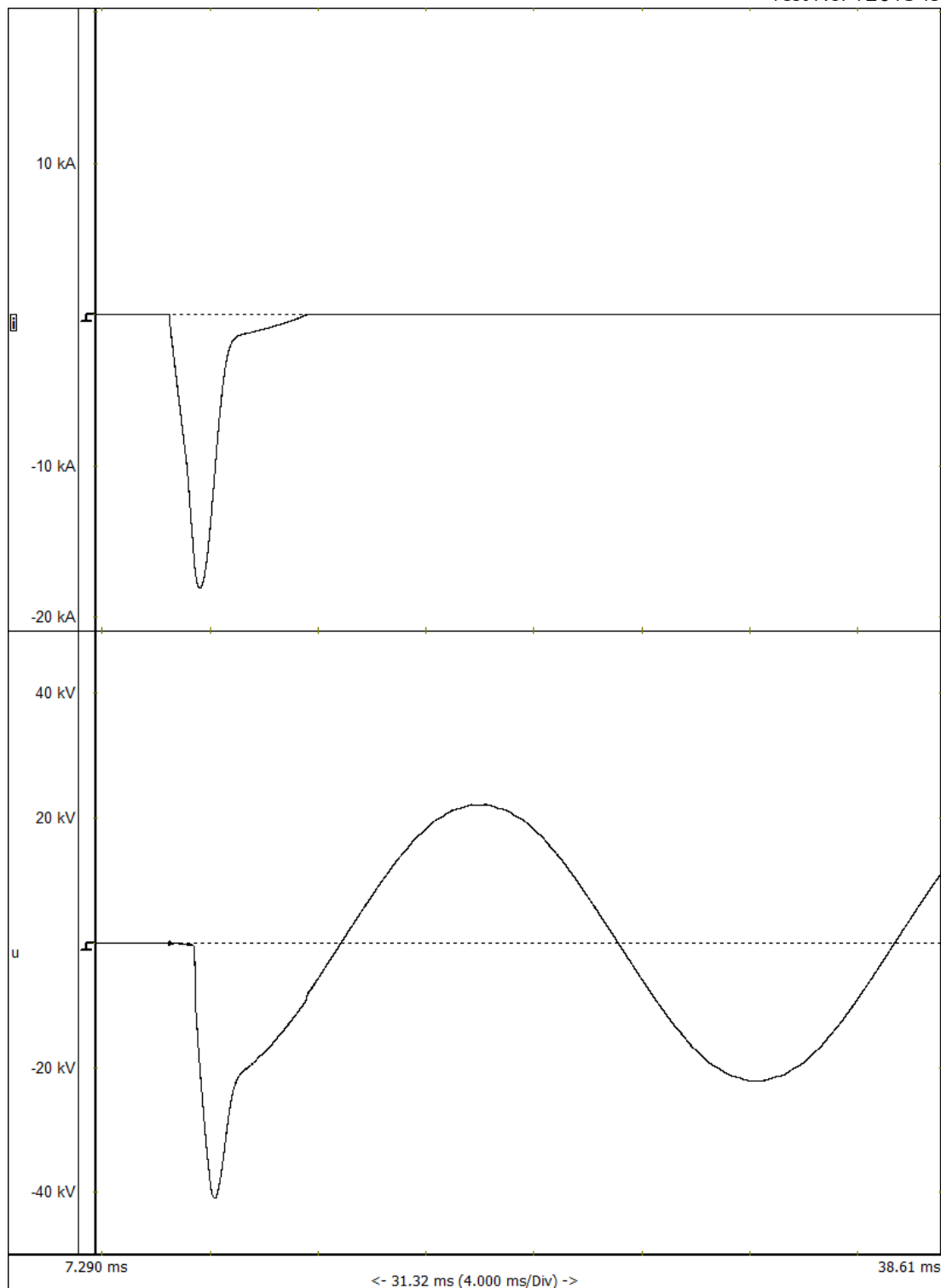


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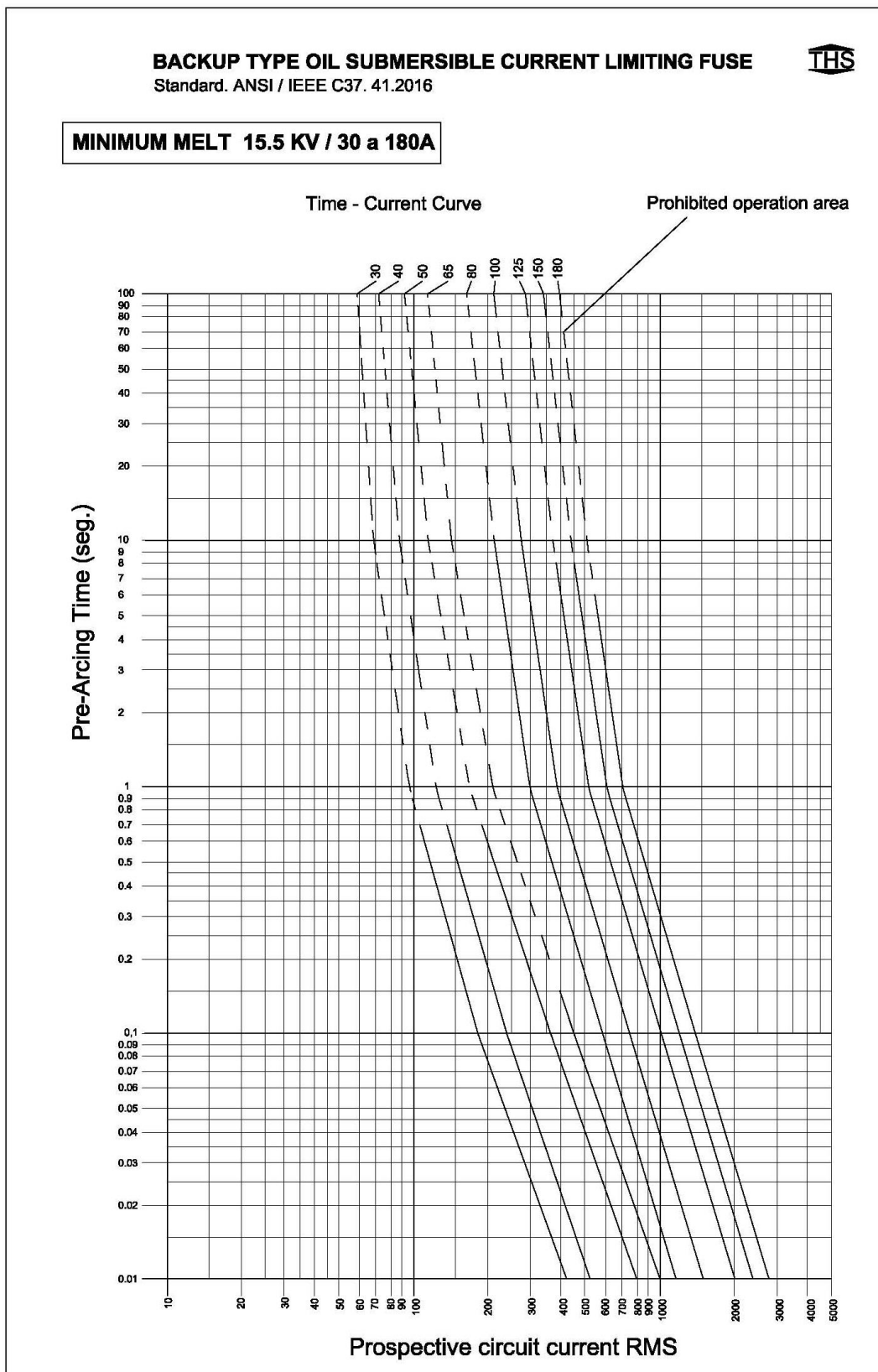


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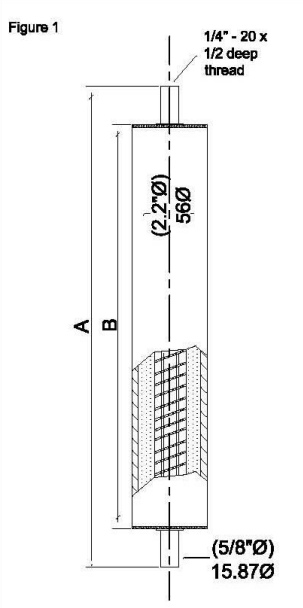
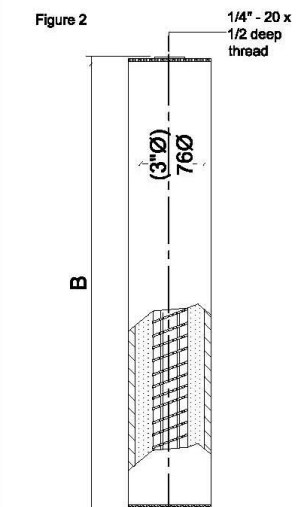
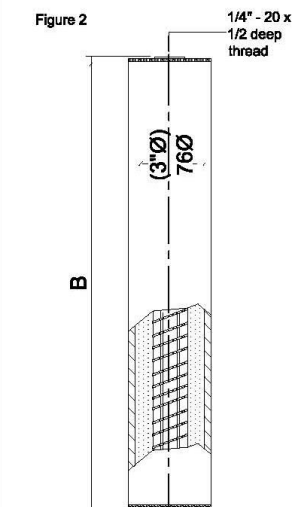
Test No: 1201349

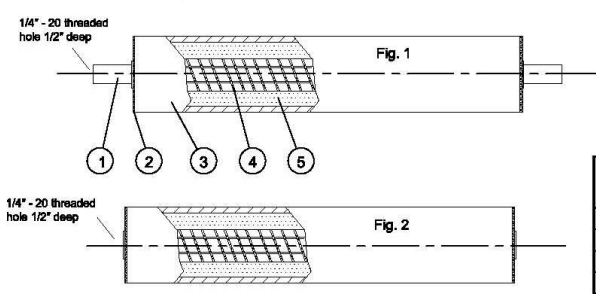


7. Drawings




Dimensional for Oil - Submersible - Transformer Backup Fuse. Standard ANSI / IEEE C37.41-2016.

Main Dimension - Transformer Back-up Fuse	Fuse Code	Current Rating (A)	Dimension		Min Melt I ² t (A ² s)	Max Clear I ² t (A ² s)	Figure	Fuse Voltage (KV)	Peak arc Voltage (KV)	Max. Interrupting Capacity (KA)					
			A	B											
	8/30	30	7.2 (184)	6.0 (153)			1	8.3	24	50					
	8/40	40	7.2 (184)	6.0 (153)											
	8/50	50	7.2 (184)	6.0 (153)											
	8/65	65	7.2 (184)	6.0 (153)											
	8/80	80	9.6 (245)	8.5 (215)											
	8/100	100	9.6 (245)	8.5 (215)											
	8/125	125	9.6 (245)	8.5 (215)											
	8/150	150	—	11.4 (290)											
	8/165	165	—	11.4 (290)											
	8/180	180	—	11.4 (290)											
	8/200	200	—	11.4 (290)											
	8/250	250	—	11.4 (290)											
		9/30	30	9.6 (245)	8.5 (215)							1	9.9	49	40
		9/40	40	9.6 (245)	8.5 (215)										
		9/50	50	9.6 (245)	8.5 (215)										
9/65		65	9.6 (245)	8.5 (215)											
15/30		30	9.6 (245)	8.5 (215)											
15/40		40	9.6 (245)	8.5 (215)											
15/50		50	9.6 (245)	8.5 (215)											
15/60		65	9.6 (245)	8.5 (215)											
15/80		80	14.2 (360)	12.9 (329)											
15/100		100	14.2 (360)	12.9 (329)											
15/125		125	16.9 (430)	15.6 (397)											
15/150		150	—	16.0 (406)											
15/165		165	—	16.0 (406)											
15/180		180	—	16.0 (406)											
		17/30	30	14.2 (360)	12.9 (329)			1	17.2	49	40				
	17/40	40	14.2 (360)	12.9 (329)											
	17/50	50	14.2 (360)	12.9 (329)											
	17/65	65	14.2 (360)	12.9 (329)											
	23/30	30	15.6 (396)	14.4 (365)											
	23/40	40	15.6 (396)	14.4 (365)											
	23/50	50	15.6 (396)	14.4 (365)											
	23/65	65	15.6 (396)	14.4 (365)											
	23/80	80	16.9 (430)	15.6 (397)											
	23/100	100	16.9 (430)	15.6 (397)											
	23/125	125	—	19.0 (482)											
	23/150	150	—	19.0 (482)											
	23/165	165	—	19.0 (482)											



5	Silica Sand Filler	H-31 / 40-mesh	—
4	Element	—	—
3	Fiberglass / Epoxy Tube	—	1
2	Epoxy Adhesive	—	—
1	Contact	—	2
Ref.	Title / Material / Dimension	Draw. Nr.	Qty.

THS CURRENT LIMITING -BACKUP - FUSE			
Data	28.01.20	CURRENT	30 - 200
Des.	HS	VOLTAGE	8.3/15.5/ 23KV
Ver.	HS		
Esc.	1:1		
		Proj. Nr.	Draw Nr. 5803

