Ref. Certif. No.
CN27429

IEC SYSTEM FOR MUTUAL RECOGNITION OF TEST CERTIFICATES FOR ELECTRICAL EQUIPMENT (IECEE) CB SCHEME

SYSTEME CEI D'ACEPTATION MUTUELLE DE CERTIFICATS D'ESSAIS DES EQUIPEMENTS ELECTRIQUES (IECEE) METHODE OC

CB TEST CERTIFICATE

Product Produit	Low-voltage Switchgear Assemblies
Name and address of the applicant Nom et adresse du demandeur	BEIJING FIRST SWITCHGEAR CO.,LTD. Exonomic technique in Beijing development area east wreath inside road A No.1
Name and address of the manufacturer Nom et adresse du fabricant	BEIJING FIRST SWITCHGEAR CO.,LTD. Exonomic technique in Beijing development area east wreath inside road A No.1
Name and address of the factory Nome et adresse de l'usine Note: *When more than one factory, please report on page 2* Note: *Lorsqueily plus d'une usinem, veuillez utilliser la 2ème page*	BEIJING FIRST SWITCHGEAR CO.,LTD. Exonomic technique in Beijing development area east wreath inside road A No.1
Ratings and principal characteristics Valeurs nominales et caractéristiques principales	Ue:AC415V;Ui:AC1000V;In(Main Busbar):3150A;Icw (Main Busbar):65kA/1s;Ipk(Main Busbar):143kA;In (Vertical Busbar):1000A;Icw(Vertical Busbar):30kA/1s;Ipk (Vertical Busbar):63kA;IP30;50Hz
Trademark (if any) Marque de fabrique (si elle existe)	
Model / Type Ref. Ref. De type	BLOKSET
Additional information (if necessary may also be reported on page 2) Les informations complémentaires (si nécessaire, peuvent être indiqués sur la 2ème page)	
	PUBLICATION **EDITION**
A sample of the product was tested and found to be in conformity with Un échantillon de ce produit a été essayé et a été considéré conforme à la	IEC60439-1(ed.4);am1
As shown in the Test Report Ref. No. which forms part of this Certificate Comme indiqué dans le Rapport d'essais numéro de référence qui constitre partie de ce Certificat	C-034-AY021614-2013-S

This CB Test Certificate is issued by the National Certification Body
Ce Certificat d'essai OC est établi par l'Organisme **National de Certification**

CHINA QUALITY CERTIFICATION CENTRE

Date: 2013-07-10

Signature: Wang Kejiao

Issued 2003-05
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CB 0020189

Test Report issued under the responsibility of

TEST REPORT
IEC 60439-1
Low-voltage switchgear and controlgear assemblies
Part 1: Type-tested and partially type-tested assemblies

Report Reference No. ..... :	C-034-AY021614-2013-S	
Tested by (name+signature) ..... :	Zhou Yuan	Zhou Yuan
Witnessed by (name+signature) ..... :	Cong Lin	Cong Lin
Supervised by (name+signature) ..... :	Zhu Jinhua	Zhu Jinhua
Approved by (name+signature) ..... :	Su Shiqing	Su Shiqing
Date of issue ..... :	May. 15, 2013	

CB Testing Laboratory ..... :	Shandong Product Quality Supervision & Inspection Research Institute
Address ..... :	No.31000 Jingshidong Road, Jinan, Shandong, P.R.China
Testing location/ procedure ..... :	CBTL ■ RMT ☐ SMT ☐ TMP ☐
Testing location/ address ..... :	No.31000 Jingshidong Road, Jinan, Shandong, P.R.China
Applicant's name ..... :	Beijing First Switchgear Co. (Ltd.
Address ..... :	Economic technique in Beijing development area east wreath inside road A No. 1

Test specification:

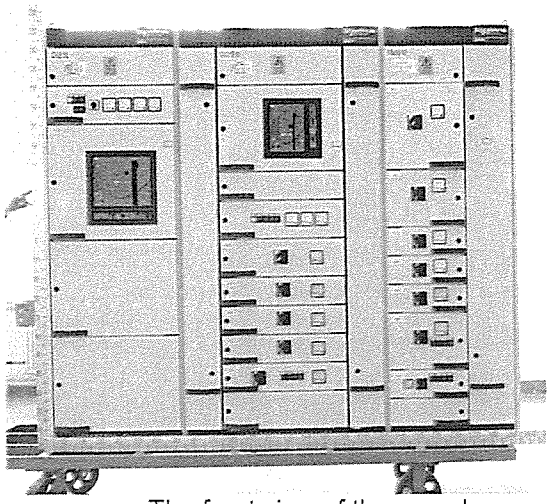
Standard ..... :	IEC 60439-1:1999 (4th Edition) + A1:2004
Test procedure ..... :	CB Scheme
Non-standard test method ..... :	N/A

Test Report Form No. ..... :	IECEN60439_1B
Test Report Form(s) Originator ..... :	IMQ
Master TRF ..... :	Dated 2005-08

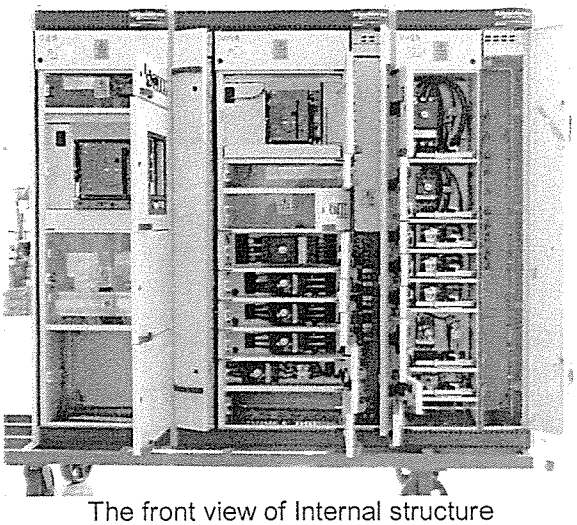
This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

Test item description	:	
Trade Mark	:	/
Manufacturer	:	Beijing First Switchgear Co., Ltd..
Model/Type reference	:	BLOKSET
Rating(s)	:	*Ue*=415 V a.c.; *Ui*=1000 V a.c.; 50Hz; IP30 Main busbar *In* = 3150A, *Icw* = 65kA; Distribution busbar *In* = 1000A, *Icw* = 30kA;

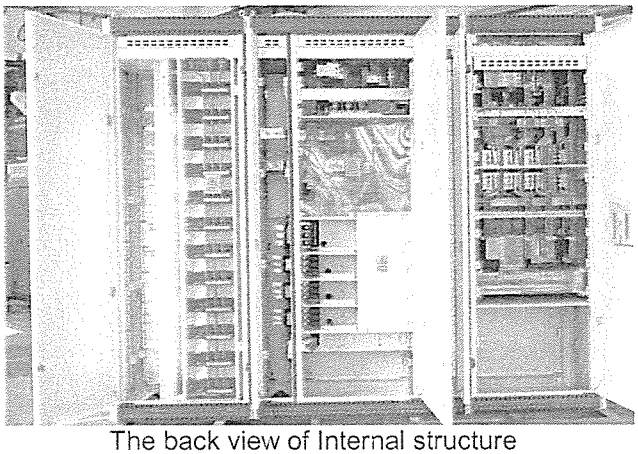
Copy of marking plate



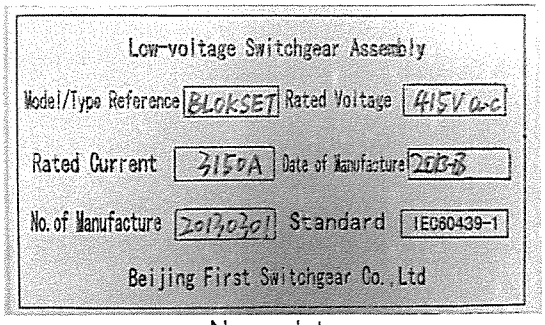
The front view of the sample



The front view of Internal structure



The back view of Internal structure



Nameplate

Summary of testing:

All tests were performed in Shandong Supervision and Inspection Institute for Product Quality.

All tests were passed.

Test item particulars ..... :	
External design ..... :	multicubicle
Place of installation ..... :	indoor
Service conditions ..... :	normal
Mobility ..... :	stationary
IP Code ..... :	IP30
Protection against electric shock ... :	protective earthing
Possible test case verdicts:	
- test case does not apply to the test object ..... :	N/A
- test object does meet the requirement ..... :	Pass (P)
- test object does not meet the requirement .... :	Fail (F)
Testing ..... :	
Date of receipt of test item ..... :	Apr. 24, 2013
Date (s) of performance of tests ..... :	May. 10, 2013
Product verification per IECEE 02, Clause 6.2.5:	N/A
Steps taken by the NCB to ensure that the products from all the factories stated in the CB Test Certificate are equal ..... :	N/A

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a comma (point) is used as the decimal separator.

General product information:

MNS Low-voltage Switchgear Assembly is composed of air circuit-breakers, moulded case circuit-breakers, copper busbar, supporting insulating parts, current transformers and enclosures, etc.

IEC/EN 60439-1			
Clause	Requirement - Test	Result - Remark	Verdict
1	GENERAL		P
1.1	Scope and object: TTA / PTTA	TTA	P
	Max. 1000 V a.c. 1000 Hz / 1500 V d.c.	415 V a.c. 50Hz	P
	Additional specific requirements		P
1.2	Normative references (see the standard)		P
2	DEFINITIONS		P
	(see the standard)		P
3	CLASSIFICATION		P
	External design:		P
	- open type		N/A
	- dead front		N/A
	- enclosed: cubicle / multi-cubicle / box / multi-box / desk	multi-cubicle	P
	- busbar trunking system: tap-off / trolley		N/A
	Place of installation: indoor / outdoor	indoor	P
	Mobility: stationary / movable	stationary	P
	Degree of protection (IP Code)	IP30	P
	Type of enclosure; material: steel / aluminium / plastic / other	steel	P
	Method of mounting: parts removable / parts fixed / parts withdrawable	removable / parts fixed / parts withdrawable	P
	Measures for protection of persons		P
	Protection against direct contact		P
	- safety extra-low voltage		N/A
	- insulation of live parts		N/A
	- barriers/enclosures		P
	- obstacles		N/A
	Protection against indirect contact		P
	- protective earthing		P
	- electrical separation		N/A
	- total insulation		N/A
	Form of internal separation	Form 3a	P
	Types of electrical connections (main incoming-main outgoing-auxiliary; code letters FDW)	FDW	P
4	ELECTRICAL CHARACTERISTICS		P
4.1	Rated voltages		P
4.1.1	- operational (U_e) assembly / circuit	415 V a.c	P

IEC/EN 60439-1			
Clause	Requirement - Test	Result - Remark	Verdict
4.1.2	- insulation (U_{ii}) assembly / circuit ($U_i \geq U_e$)	1000 V a.c (main circuit), 500 V a.c (auxiliary circuit)	P
4.1.3	- impulse withstand (U_{imp}) assembly / circuit ($U_{imp} \geq U_{transient}$)		N/A
4.2	Rated current (I_n) (stated by the manufacturer)	3150A	P
4.3	Rated short-time withstand current (I_{cw}) (current and time, A/s)	65kA	P
4.4	Rated peak withstand current (I_{pk})	143kA	P
4.5	Rated conditional short-circuit current (I_{CC})		N/A
4.6	Rated fused short-circuit current (I_{cf})		N/A
4.7	Rated diversity factor: from table 1 or as stated by the manufacturer	feed cabinet 1 and control cabinet 0,9	P
4.8	Rated frequency (f)	50Hz	P
5	INFORMATION TO BE GIVEN		
5.1	Nameplates		P
	a) the manufacturers name / trade mark	Beijing First Switchgear Co.,Ltd.	P
	b) type designation / identification mark	BLOKSET	P
	c) number of the standard (IEC/EN 60439-1)	IEC60439-1	P
	d) type of current (and a.c. frequency)		N/A
	e) rated operational voltage(s)	415V a.c	P
	f) rated insulation voltage(s)		N/A
	- rated impulse withstand voltage		N/A
	g) rated voltages of auxiliary circuits		N/A
	h) limits of operation		N/A
	j) rated current (of each main circuit)		N/A
	k) short-circuit withstand strength		N/A
	l) degree of protection (IP-code)		N/A
	m) measures against electric shock		N/A
	n) service conditions for indoor use / for outdoor use / for special use if not usual as in 6.1 - pollution degree declared by the manufacturer		N/A
	o) types of system earthing		N/A
	p) dimensions (height x width x depth)		N/A
	q) weight		N/A
	r) form of internal separation		N/A
	s) types of the connections of functional units		N/A
	t) EMC environment (A and/or B)		N/A

IEC/EN 60439-1			
Clause	Requirement - Test	Result - Remark	Verdict
5.2	Markings		P
	- identification of individual circuits and their protective devices;		P
	- identity of designations with IEC 61346-1 and with the wiring diagrams;		P
	- designations in accordance with IEC 61082;		N/A
5.3	Instructions		P
	- the conditions for installation/operation/ maintenance;		P
	- measures of particular importance;		P
	- recommended extent and frequency of maintenance, if necessary;		N/A
	- information (wiring diagrams / tables) of circuitry, if needed;		P
	- measures to be taken with regard to EMC associated with the installation, operation and maintenance of the assembly		N/A
	- warning for assembly specifically intended for environment A to be used in environment B		N/A
6	SERVICE CONDITIONS		
6.1	Normal		P
6.2	Special		N/A
6.3	Conditions during transport, storage and erection: normal (see 6.3.1) or as agreed between the user and the manufacturer		N/A
7	DESIGN AND CONSTRUCTION		
7.1	Mechanical design		P
7.1.1	General		P
	Material is required to be capable of withstand: - mechanical stresses; - electrical stresses; - thermal stresses; - effects of humidity; - resistance to abnormal heat and fire		P
	Protection against corrosion have to be ensured;		P
	Mechanical strength of enclosures and partitions have to be sufficient;		P
	The degree of safety have to be ensured while facilitated of operation and maintenance of apparatus / circuits;		P
7.1.2	Clearances, creepage distances and isolating distances		P
7.1.2.1	Clearances and creepage distances		P

IEC/EN 60439-1			
Clause	Requirement - Test	Result - Remark	Verdict
	- the requirements of relevant standards apply to distances in apparatus forming part of the assembly;		P
	- specified creepage distances and clearances or rated impulse withstand voltage (U_{imp}) have to be complied with;	creepage distances: ≥16mm clearances: ≥10mm (Utest,see 7.1.2.3)	P
	- specified creepage distances and clearances or U_{imp} of bare live conductors and terminations are required to comply at least with those specified for the associated apparatus;	creepage distances: ≥16mm clearances: ≥10mm (Utest,see 7.1.2.3)	P
	- abnormal conditions shall not permanently reduce the clearances / dielectric strength;		N/A
7.1.2.2	Isolation of withdrawable parts		P
	Compliance of isolation: with the requirements in the relevant specification for disconnectors;	≥20mm	P
7.1.2.3	Dielectric properties		P
	U_{imp} declared by manufacturer (... kV), the requirements of 7.1.2.3.1...7.1.2.3.6 apply;		N/A
	- dielectric tests and verifications specified in 8.2.2.6 and 8.2.2.7 are applied to circuits;		N/A
	- in other case: dielectric tests specified in 8.2.2.2... 8.2.2.5 are applied for circuits;		P
7.1.2.3.1	General: $U_{overvolt.\ category}$ (=... kV), U_{imp} (=... kV)	U_{test} = .. kV/.. s	N/A
7.1.2.3.2	U_{imp} of main circuit		N/A
	a) From live parts to parts to be earthed;	U_{test} = .. kV/.. s	N/A
	- between poles;	U_{test} = .. kV/.. s	N/A
	b) Across open contacts for withdrawable parts in the isolation position, the appropriate test voltage is given in table 15;	U_{test} = .. kV/.. s	N/A
	c) U_{imp} of solid insulation associated with clearances a) and/or b); the impulse voltage is specified in a) and/or b);	U_{test} = .. kV/.. s	N/A
7.1.2.3.3	U_{imp} of auxiliary and control circuits		N/A
	a) Circuits operated directly from the main circuit at the rated operational voltage (U_e): required to comply with 7.1.2.3.2 a) and c) ;		N/A
	- from live parts to parts to be earthed;	U_{test} = .. kV/.. s	N/A
	- between poles;	U_{test} = .. kV/.. s	N/A
	- solid insulation associated with clearances;	U_{test} = .. kV/.. s	N/A
	b) Circuits which do not operate directly from the main circuit: $U_{overvolt.\ category}$ (=...kV), U_{imp} (=...kV)		N/A
	- from live parts to parts to be earthed;	U_{test} = .. kV/.. s	N/A
	- between poles;	U_{test} = .. kV/.. s	N/A
	- solid insulation associated with clearances;	U_{test} = .. kV/.. s	N/A

IEC/EN 60439-1			
Clause	Requirement - Test	Result - Remark	Verdict
7.1.2.3.4	Clearances are required to:		P
	- be sufficient (see 7.1.2.3.2-3)	10 mm	P
	- be ≥ .. mm (table 14 / case B)		N/A
	U_{imp} need not be tested, if they are higher than given in table 14/case A;	Minimum clearance 16,86 mm(Overvoltage category Ⅳ)	P
7.1.2.3.5	Creepage distances		P
	a) Dimensioning		P
	- for pollution degrees 1 and 2 distances are not allowed to be less than associated clearances according to 7.1.2.3.4;		N/A
	- for pollution degrees 3 and 4 distances ≥ the case A clearances;		P
	Creepage distances are required to correspond to the pollution degree (see 6.1.2.3) and to the material group (I / II / IIIa / IIIb);	Material group: IIIa Pollution degree: 3 Required creepage: 16 mm Measured creepage: Min. 24,24 mm	P
	b) Use of ribs		N/A
	- ribs height ≥ 2 mm, if creepage distances reduced to 0,8 mm of the value from table 16;		N/A
	c) Special applications		N/A
	- circuits for applications where severe results of insulation fault have to take into account: one or more influencing factors of table 15 is applied;		N/A
7.1.2.3.6	Spacing between separate circuits		N/A
	The highest voltage ratings have to be used for dimensioning clearances, creepage distances and solid insulation (U_e= ... V, U_{imp} = ... kV);	U_{test} = .. kV/.. s	N/A
7.1.3	Terminals for external conductors		N/A
7.1.3.1	Manufacturer indicates whether terminals are for aluminium or copper conductors or both;		N/A
	- a reliable connection for Cu conductors and/or for Al conductors is required;		N/A
7.1.3.2	Dimensioning of terminals per circuit: terminals are required to be suitable for:		N/A

circuit	I_n / A	S (Al / Cu) required (mm²)	S (Al / Cu) observed (mm²)

	- agreement between manufacturer and user;	N/A
	- terminals for external conductors with low currents (I_n <1 A; U_e < 50 V a.c. or <120 V d.c.)	N/A

IEC/EN 60439-1			
Clause	Requirement - Test	Result - Remark	Verdict
7.1.3.3	The available wiring space is required to permit proper connection of the external conductors;		N/A
7.1.3.4	Terminals for neutral conductors is required to allow the connection of Cu-conductor:		N/A
	- S_{neutr} . ≥ ½ x S_{phase}, if S_{phase} >10 mm^2;		N/A
	- S_{neutr} = S_{phase}, if S_{phase} ≤10 mm^2;		N/A
7.1.3.5	Terminals for incoming / outgoing N-, PE- and PEN-conductors have to be in the vicinity of the associated phase conductor terminals;		N/A
7.1.3.6	Openings are required to be such that the stated degree of protection against contact are obtained after cables are properly installed;		N/A
	Openings: amount and type (cable glands/ membranes/pre-pressed etc.):		N/A
	Manufacturer's instructions for sealing/tightening		N/A
7.1.3.7	Identification of terminals; compliance with IEC 60445;		N/A
7.1.4	Resistance to abnormal heat and fire		N/A
	Parts of insulating material are not adversely affected by abnormal heat and fire (glow-wire test of 8.2.9)		N/A
	Requirement not applied to parts or components which have been previously tested according to this standard or according to their own product standard		N/A
	Different test (for example, the needle flame test of IEC 60695-2-2) selected for small parts (14x14 mm)		N/A
7.2	Enclosure and degree of protection		P
7.2.1	Degree of protection is required to:		P
7.2.1.1	- be indicated by IP Code (IEC 60529);		P
	- preferred IP for indoor (IP00, -2X, -3X, -4X, -5X)		N/A
7.2.1.2	- be at least IP2X for enclosed assembly;	IP30	P
7.2.1.3	- be at least IPX3 for outdoor assembly;		N/A
7.2.1.4	- apply to the complete assembly, unless otherwise specified;		N/A
	- manufacturer's instructions, if needed;		N/A
7.2.1.5	Possible different IP-degrees of parts of the assembly;		N/A
7.2.1.6	IP code is not allowed for PTTA without the verifications;		N/A

IEC/EN 60439-1			
Clause	Requirement - Test	Result - Remark	Verdict
7.2.2	Measures to take account of atmospheric humidity		
	- harmful condensation must be prevented: ventilation, heating, drain holes (dimensions, effectness);	() no humidity treatment () humidity treatment according to IEC 60068-2	N/A
7.3	Temperature rise		P
	Limits given in table 2 are not allowed to be exceeded, when verified in as required in 8.2.1;		P
	Test arrangements and test results in details;	See Annex I	P
	Ambient temperature during the tests;	24 °C	P
	Temperature-rise limits given in table 2		P
	- terminals for external insulated conductors 70 K	65 K max.	P
	- manual operating means: • of metal 15 K • of insulating material 25 K	insulating material: 8 K max.	P
	- accessible external enclosures: • of metal 30/40 K; • of insulating material 40/50 K;	metal material: 12 K max.	P
	- temperature-rise in busbars, conductors, plug-in contacts of parts is limited by: - mechanical strength of conducting material; - possible effect on adjacent equipment;		P
	- built-in components in accordance with the relevant product standard requirements or in accordance with the component manufacture's instructions, taking into consideration the temperature in the assembly:	Built-in components including Air circuit-breaker, Moulded case circuit-breaker and terminals have been type tested.	P
	Component (name) Standard Allowed Δt	Measured: ... K max. ... K max. ... K max. ... K max	N/A
	- discrete arrangements of plug and socket-type connection, Δt limited to the values allowed for components of related equipment of which they form part, allowed Δt ... K according to ...		N/A
7.4	Protection against electric shock (generally according to IEC 60364-4-41)		P
7.4.1	Protection against direct and indirect contact		P
7.4.1.1	Protection by safety extra-low voltage (SELV)		N/A
	- according to clause 411.1 of IEC 60364-4-41;		N/A
7.4.2	Protection against direct contact		P

IEC/EN 60439-1			
Clause	Requirement - Test	Result - Remark	Verdict
	- protection can be obtained: - by constructional measures of the assembly, or – by additional measures to be taken during installation;		N/A
7.4.2.1	Protection by insulation of live parts		N/A
	- live parts are required to be completely covered with stationary insulation;		N/A
	- insulation shall be made of materials which durably withstand the mechanical, electrical and thermal stresses which may occur in normal use;		N/A
	- paint, varnishes, lacquers and similar are not considered to provide an adequate insulation;		N/A
7.4.2.2	Protection by barriers or enclosures		P
7.4.2.2.1	External surfaces are required to conform at least IP2X or IPXXB against direct contact;	IP30	P
	- distance between mechanical protection means of metal and live parts they protect ≥ values specified in sub-clause 7.1.2;		N/A
7.4.2.2.2	Barriers and enclosures are required to be:		P
	- firmly secured in place;		P
	- sufficient stability and durability to resist the strains and stresses which may occur in normal service without reducing the clearances according to 7.4.2.2.1;		P
7.4.2.2.3	Where is necessity for removal of barriers or parts of enclosures or opening of enclosures, one of the following requirements apply:		N/A
	a) The use of a key or tool is required for removal, opening or withdrawal ;		P
	b) Touchable live parts have to be disconnected before the door can be opened;		N/A
	- if a device is provided to obtain access to live parts while the equipment is live, interlock is required to restore automatically;		N/A
	c) Assembly have include an internal obstacle or shutter shielding live parts from unintentional touching when the door is open;		N/A
	- the requirements of 7.4.2.2.1 and 7.4.2.2.2 apply to the obstacle or shutter;		N/A
	- obstacle or shutter is required to be reliable and not to be removed without key/tool;		N/A
	d) Where any parts behind a barrier or inside an enclosure need occasional handling, removal, opening or withdrawal without the use of a key or tool and without switching off is allowed only if the following conditions are fulfilled;		N/A

IEC/EN 60439-1			
Clause	Requirement - Test	Result - Remark	Verdict
	- an obstacle giving partial protection for live parts not protected by another protective measure is required;		N/A
	- it is not allowed to remove the obstacle except through the use of a key or tool;		N/A
7.4.2.3	Protection by obstacles		N/A
	This measure applies to open-type assemblies;		N/A
7.4.3	Protection against indirect contact		P
	The protective measure of the installation for which the assembly is intended (IEC 60364-4-41)		P
7.4.3.1	Protection by using protective circuits		P
	Protective circuit is required to provide protection against the consequences:		P
	- of faults within the assembly;		P
	- of faults in external circuits;		P
	Requirements to be complied with, see sub-clauses 7.4.3.1.1...7.4.3.1.11 below;		P
7.4.3.1.1	It is required to ensure the continuity between the exposed parts and between these parts and the protective circuits of installation;		P
	- for PTTA, a separate PE-conductor is used, if PTTA is not type-tested or its short-circuit strength is not necessary to be verified;		N/A
7.4.3.1.2	Conductive parts which do not constitute danger, need not be connected to the protective circuits: - because they cannot be touched/grasped; - because they are of small size (≤ 50x50 mm);		P
7.4.3.1.3	Manual operating means are required to be: - reliably electrically connected with parts connected to the protective circuits, or - provided with adequate additional insulation;		P
7.4.3.1.4	Metal parts covered with a layer of varnish or enamel are not considered to be adequately insulated;		P
7.4.3.1.5	Continuity of protective circuits is required to be ensured by effective interconnections:		P
	a) Protective circuits are not allowed to interrupt when a part of the assembly is removed;		P
	b) Metal supporting surfaces of removable/ withdrawable parts may be sufficient;		P
	- continuity of protective circuits is required to remain effective from the connected to the disconnected position;		P
	c) Metal screwed connections/hinges are sufficient for lids / doors / cover plates, if no electrical equipment is attached to them;		P

IEC/EN 60439-1			
Clause	Requirement - Test	Result - Remark	Verdict
	- continuity of the protective circuits is ensured if electrical equipment using other than ELV are attached in lids / doors / cover plates;		P
	d) Parts of protective circuit are required to withstand the highest thermal/dynamic stresses;		P
	e) Requirements of 7.4.3.1.7 applies to cross-sectional area of the enclosure used as a part of protective circuit;		P
	f) Protective circuit in connectors and plug-and-socket devices is allowed to interrupt only after live connections and connected before live connections;		P
	g) It is not allowed to include any disconnecting devices in the protective circuit; exceptions: 1: see f) above; 2: links accessible only to authorized personnel and removable only with a tool are allowed;		P
7.4.3.1.6	Terminals for external PE-conductors have to:		P
	- be bare, where required;		P
	- be suitable for Cu-conductors;		P
	- separate terminal of adequate size are required for all outgoing protective conductors;		P
	- in the case of aluminium the danger of electrolytic corrosion have to be avoided;		N/A
	- means is required to be provided to ensure continuity between exposed conductive parts of the assembly and metal sheathing of connecting cables and metal conduits;		P
	- it is not allowed that the connecting means to ensure the continuity of the exposed conductive parts with protective conductors have other function;		P
7.4.3.1.7	The cross-sections of protective conductors (PE, PEN) in an assembly are determined in one of the following ways:		P
	a) The cross-section of PE/PEN is not allowed to be less than the appropriate value in table 3;	500 mm²	P
	The following additional requirements apply: - cross-sectional area of PEN is at least 10 mm² Cu or 16 mm² Al; - PEN need not be insulated within an assembly; - structural parts are not allowed to use as PEN; - table 3 assumes that the neutral conductor currents do not exceed 30% of the phase currents; - PEN having conductivity ≥ phase conductors may be necessary for certain applications;		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	b) the cross-section can be calculated with the aid of formula indicated in annex B, $S_p = \frac{\sqrt{I^2 t}}{k}$	I = .. A, k =..., t = ... s S_p = ... mm^2	N/A
	- or the cross-section can be tested according to 8.2.4.2;		N/A
7.4.3.1.8	A protective conductor need not be insulated from structural parts, enclosures etc. Made of conducting material;		P
7.4.3.1.9	Conductors for certain protective devices, for instance voltage-operated fault current detectors, is required to be carefully insulated;		N/A
7.4.3.1.10	Exposed conductive parts of a device not connected to the protective circuit by the fixing means are required to be connected to the protective circuit for protective bonding by Cu-conductor whose cross-sectional area is given in table 3A		P
7.4.3.2	Protection by measures other than using protective circuits can be provided by : - electrical separation of circuits; - total insulation.		N/A
7.4.3.2.1	Electrical separation of circuits: the requirements given in IEC 60364-4-41 are applied;		N/A
7.4.3.2.2	Protection by total insulation		N/A
	The following requirements are required to meet:		N/A
	a) Apparatus are required to be completely enclosed in insulating material;		N/A
	- the enclosure is required to carry the symbol of class II equipment;		N/A
	- the symbol is required to be visible from outside;		N/A
	b) The enclosure is required to manufacture of an insulating material which is: - capable of withstanding mechanical, electrical and thermal stresses which may occur under the service conditions; - resistant to ageing; - flame-resistant;		N/A
	c) Enclosure is not allowed to be pierced by conducting parts in such a manner that a fault voltage can be brought out of the enclosure;		N/A
	- metal parts being brought through the enclosure are required to be insulated on the inside or the outside of the enclosure from the live parts;		N/A
	- actuators made of metal are required to be provided with insulation rated for the max. U_i;		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	- metal parts of actuators of insulation material are required to be insulated from live parts for max. U_{li};		N/A
	d) The enclosure, when ready for operation, have to enclose live parts, exposed conductive parts and parts belonging to a protective circuit such a manner that they cannot be touched;		N/A
	- the enclosure is required to give at least the protection of IP 2XC;		N/A
	- terminals for protective conductors passing through an assembly are required to be provided and identified by suitable marking;		N/A
	- inside the enclosure, the protective conductor and its terminals are requited to be insulated as live parts;		N/A
	e) Within the assembly exposed conductive parts are not allowed to be connected to the protective circuit;		N/A
	f) If doors and covers can be opened without the use of a key/tool, an obstacle of insulating material is required for protection against unintentional contact with live parts and exposed conductive parts which are accessible after the door being opened; this obstacle is not allowed to be removable without the use of a tool;		N/A
7.4.4	Discharging of electrical charges		N/A
	A warning plate is required for items of equipment which may retain dangerous electrical charges after switched off;	() not any such equipment; () small capacitors only; () warning plate exists;	N/A
7.4.5	Operating and maintenance gangways within an assembly		N/A
	Gangways within an assembly have to comply with IEC 60364-4-481;	() not any gangway	N/A
7.4.6	Requirements related to accessibility in service by authorized personnel		N/A
	For accessibility in service by authorized person, one or more of the following requirements are required to be fulfilled subject to agreement between manufacturer and user;	() no agreement is informed; () requirements of National Wiring Rules are followed; () the agreement, see annex	N/A
7.4.6.1	Requirements related to accessibility for inspection and similar operations		N/A
	The assembly is required to construct so that certain operations, as agreed upon between manufacturer and user, can be performed when the assembly is in service and under voltage;	() no agreement is informed; () requirements of National Wiring Rules are followed; () the agreement , see annex	N/A
7.4.6.2	Requirements related to accessibility for maintenance		N/A
	Necessary measures shall have taken to enable maintenance on a disconnected functional units / groups with adjacent units still under voltage as agreed upon between manufacturer and user;	() no agreement is informed; () requirements of National Wiring Rules are followed; () the agreement , see annex	N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	Necessary measures include the selection of a form of separation and may also be: • sufficient space between the actual functional unit/group and adjacent functional units/groups; • use of barriers; • use of compartments for each functional unit; • insertion of additional protective means provided or specified by the manufacturer;		N/A
7.4.6.3	Requirements related to accessibility for extension under voltage		N/A
	Where future extension of assembly is enabled with the rest of assembly still under voltage, the requirements in 7.4.6.2 apply subject to agreement between manufacturer and user;		N/A
7.5	Short-circuit protection and short-circuit withstand strength		P
7.5.1	General		P
	Assemblies are required to withstand the thermal and dynamic stresses resulting from short-circuit currents up to the rated values;		P
	- assemblies are required to be protected against short-circuit currents by means of suitable protective device (circuit-breakers, fuses etc.);	Air circuit-breaker and Moulded case circuit-breaker	P
	- the user specifies the short-circuit conditions at the point of installation;		N/A
	- for PTTA, type-tested arrangements should be used or the strength is verified by extrapolation;		N/A
7.5.2	Information concerning the short-circuit withstand strength		P
7.5.2.1	The manufacturer states the short-circuit strength as specified in 7.5.2.1.1...7.5.2.3 below;		P
7.5.2.1.1	SCPD incorporated in the incoming unit: the manufacturer indicates the maximum allowable value of prospective short-circuit current at the terminals of the incoming unit;	65kA (Incoming cabinet) 50kA (Feed cabinet) 30kA (Control cabinet)	P
7.5.2.1.2	SCPD not incorporated in the incoming unit: the manufacturer indicates the short-circuit withstand strength in one or more of the following ways;		N/A
	a) rated short-time withstand current (with the associated if different from 1 s) and rated peak withstand current		N/A
	b) rated conditional short-circuit current		N/A
7.5.2.2	For an assembly having several incoming units which are unlikely to be in use simultaneously: short-circuit strength can be indicated for each of the incoming units according 7.5.2.1;		P

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Clause	Requirement - Test	Result - Remark	Verdict
7.5.2.3	For an assembly having several incoming units which are in use simultaneously and assemblies having one incoming unit and one or more outgoing units for high-power rotating machines: a special agreement is necessary;		N/A
7.5.3	Relationship between peak current and short-circuit current		P
	The value of peak current is obtained by multiplying the short-circuit current by the factor n; standard values of n are given in table 4;	n: 2,2 (Incoming cabinet) n: 2,1 (Feed cabinet) n: 2,1 (Control cabinet)	P
7.5.4	Co-ordination of protective devices		P
7.5.4.1	The co-ordination: an agreement between the manufacturer and user is necessary;		P
7.5.4.2	If the operating conditions require maximum continuity of supply, the settings or selection of the protective devices within the assembly should be graded according to 7.5.4.2;		P
7.5.5	Circuits within an assembly		P
7.5.5.1	Main circuits		P
7.5.5.1.1	The busbars are required to be arranged so that an internal short circuit is not to be expected under normal operating conditions;		P
7.5.5.1.1	The conductors within a section, rated between the main busbars and the supply side of functional units on the reduced short-circuit stresses, have to be arranged / insulated so that under normal operating conditions, an internal short-circuit in only a remote possibility;	See 7.5.5.3	N/A
7.5.5.2	Auxiliary circuits		P
	The supply earthing system is taken into account in the design of the auxiliary circuits;		P
	- an earth-fault or fault between live part and exposed conductive part is not allowed to cause unintentional dangerous operation;		P
	- auxiliary circuits are required to be protected against the efforts of short-circuits;		P
7.5.5.3	Selection and installation of non-protected active conductors to reduce the possibility of short-circuits		N/A
	Selection and installation are required to be done so that the possibility of an integral short-circuit between phases and between phase and earth is only a remote possibility;		N/A
7.6	Switching devices and components installed in assemblies		P
7.6.1	Selection of devices and components		P
	Components have to comply with the relevant IEC standards;	component list, see Annex J	P

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Clause	Requirement - Test	Result - Remark	Verdict
	- components must be suitable for the particular application with respect to the external design of the assembly, their ratings, service life etc.;		P
	- it is required that components having a short-circuit strength and /or breaking capacity insufficient to withstand stresses likely to occur at the installation place, are protected by the protective devices;		P
	- requirements for co-ordination of switching devices and other components are given in the relevant IEC standards;		P
	- switching devices and other components in a circuit for which a rated U_{imp} is declared by the manufacture are not allowed to generate switching overvoltages higher than U_{imp} of the circuit and are not allowed to subject switching overvoltages higher than the U_{imp} of the circuit;		N/A
7.6.2	Installation		P
	Components are required to be installed in accordance with the instructions of their manufacturer;		P
7.6.2.1	Accessibility		P
	Apparatus, functional units and terminals for external conductors must be arranged so that they are accessible for wiring, mounting, maintenance and replacement;		P
	- terminals for incoming/outgoing cables are placed so that it is easy to connected the cables to them; height of at least 0,2 m above base of a floor-mounted assembly is recommended;		P
	- adjusting and resetting devices operated inside assembly are necessary to be easily accessible;		P
	- for floor-mounted assemblies, indicating instruments needed to be read by the operator should not be located higher than 2 m;		P
	- operating devices should be located at such a height that they can easily be operated; their centreline should not be higher than 2 m;		P
7.6.2.2	Interaction		P
	Components are required to be installed so that their proper functioning is not impaired;		P
	- when an enclosure is fitted with fuses, thermal effects have to be considered; the manufacturer states the type and rating of the fuse-links;		N/A
7.6.2.3	Barriers		N/A
	Barriers are designed so that the switching arcs do not present a danger to the operator; interphase barriers may be necessary;		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
7.6.2.4	Conditions existing at site of installation		P
	If necessary, suitable precautions have to be taken to ensure that the service conditions essential for proper functioning are maintained;		P
7.6.2.5	Cooling		N/A
	Both natural and forced cooling allowed;		N/A
	- the manufacturer supplies the necessary information to ensure proper cooling;		N/A
7.6.3	Fixed parts		P
	The connections of main circuits can only be established/broken when the assembly is dead;		P
	- the use of a tool is required, in general, for removal and installation of fixed parts;		P
	- the switching device may be provided with means to secure it one or more of its positions;		P
7.6.4	Removable and withdrawable parts		P
7.6.4.1	Design		P
	Removable and withdrawable parts have to be so designed that their equipment can safely isolated from and connect to the live main circuit; an insertion interlock may be provided;		P
	- minimum clearances and creepage distances are required to comply with in different positions and during transfer from one position to another;		P
	The following positions are specified: - removable parts: a connected position and a removed position; - withdrawable parts: a connected position, a isolated position and a removed position; a test position is optional;		P
	- the parts are required to be located in the clearly discernible positions;		P
	- the electrical conditions of different positions of withdrawable parts are given in table 6;		P
7.6.4.2	Interlocking and padlocking of withdrawable parts		P
	A device which ensures that the apparatus can only be withdrawn and/or re-inserted after its main circuit has been interrupted is required in withdrawable parts;		P
	- withdrawable parts may be provided with means for a padlock or lock to secure them in one or more positions;		P
7.6.4.3	Degree of protection		P

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Clause	Requirement - Test	Result - Remark	Verdict
	The IP code of an assembly normally applies to the connected position of the withdrawable and removable parts; the manufacturer indicates IP code obtained in other positions and during the transfer between them;		P
	- if the original IP code is not maintained after the removal of the removable / withdrawable parts, an agreement is necessary how the adequate protection can be ensured;		N/A
7.6.4.4	Mode of connection of auxiliary circuits		P
	- auxiliary circuits can be opened with or without the use of a tool; in the case of withdrawable parts is recommended that the opening is possible without the use of a tool;		P
7.6.5	Identification		P
7.6.5.1	Identification of the conductors of main and auxiliary circuits		P
	- identification is the liability of the manufacturer, with the except ion mentioned in 7.6.5.2;		P
	- identification is necessary to be in harmony with the indications on the wiring diagrams and drawings;		P
	- IEC 60445 and IEC 60446 are applied, where appropriate;		N/A
7.6.5.2	Identification of the protective conductor and of the neutral conductor of the main circuits		P
	The protective conductor must be readily distinguishable by shape, location, marking or colour; colour must be yellow / green;		P
	- colouring is required to be used in case of an insulated single-core cable;		N/A
	- neutral conductor of main circuit should be readily distinguishable by shape, location, marking or colour; light blue is recommended;		P
	- the terminals for external protective conductors have to be marked according to IEC 60445; graphical symbol, see No. 5019 of IEC 60417;		P
7.6.5.3	Direction of operation and indication of switching positions		P
	Operational positions of components and devices are clearly identified		P
	Direction of operation not in accordance with IEC 60447: this direction is clearly identified		N/A
7.6.5.4	Indicator lights and push-buttons		P
	Colours of indicator lights and push-buttons given in IEC 60073 are followed;	indicator lights: yellow, red and green push-buttons: red (start), green (stop)	P
7.7	Internal separation of assemblies by barriers or partitions		P

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Clause	Requirement - Test	Result - Remark	Verdict
	One or more separation forms can be attained;	separation form is 3a	P
	- protection to the adjacent functional units is required to be at least IP XXB;		N/A
	- protection from one unit to an adjacent unit is required to be at least IP2X;		N/A
7.8	Electrical connections inside an assembly		P
7.8.1	General		P
	The connections of current-carrying parts are not allowed to suffer undue alteration as a result of normal temperature rise, ageing of insulation materials and vibrations occurring in normal operation		P
	-contact pressure in connections between current-carrying parts shall be sufficient and durable;		P
7.8.2	Dimensions and rating of busbars and insulated conductors		P
	The manufacturer makes the choice of cross-sections of conductors; current which must be carried, the mechanical stresses to which they are subjected, the way they are laid, the type of insulation and the kind of elements connected are taken into account;		P
7.8.3	Wiring		P
7.8.3.1	Insulated conductors are requited to be rated for at least the rated U_i of the circuit;		P
7.8.3.2	It is not allowed to have intermediate splices or soldered joints in cables between two connecting devices;		P
	- connections have to be made at fixed terminals as far as possible;		P
7.8.3.3	Insulated conductors are required to be adequately supported and not rest against bare live parts or sharp edges;		P
7.8.3.4	Supply leads to apparatus in doors and covers shall be so installed that no mechanical damages can occur as a result of movement of a door/cover;		P
7.8.3.5	Soldered connections to apparatus are permitted only where provision is made for this type of connection;		N/A
7.8.3.6	Mechanical securing is necessary where heavy vibration exist, soldering is not acceptable and attention is drawn to support the conductors;		N/A
7.8.3.7	Generally only one conductor should be connected to one terminal, two or more only if the terminals are designed for this purpose;		N/A
7.9	Requirements for electronic equipment supply circuits		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
7.9.1	Input voltage variations		N/A
	1) The supply voltage range for battery sources is equal to the rated supply voltage ±15 %;		N/A
	2) The range of the input direct voltages is that rectified from a.c. voltage (see item 3 below);		N/A
	3) The supply voltage range for a.c. sources is equal to rated input voltage ±10 %;		N/A
	4) Wider tolerances are subjected to agreement between manufacturer and user;		N/A
7.9.2	Overvoltages		N/A
	Supply overvoltages are as specified in fig. 1;		N/A
	- the assembly is required to be designed so that its service ability in the case of overvoltages below the values represented by curve 1 is ensured;		N/A
7.9.3	Waveform		N/A
	Harmonics of the input a.c. voltage supplying the assembly incorporating electronic equipment are restricted in the following limits:		N/A
	1) The relative harmonic content : ≤ 10%;		N/A
	2) Harmonic components shall not exceed the values given in fig. 2;		N/A
	3) The highest periodic momentary value of the a.c. supply voltage is not allowed to be > 20% above of the peak value of the fundamental;		N/A
7.9.4	Temporary variations in voltage and frequency		N/A
	The equipment is required to operate without damage in the following temporary variations:		N/A
	a) Voltage drops not exceeding 15 % of U_e for no longer than 0,5;		N/A
	b) Supply frequency deviation of up to ± 1 % of rated frequency;		N/A
	c) The manufacturer indicates the maximum admissible duration of an interruption of the supply voltage for equipment;		N/A
7.10	Electromagnetic compatibility (EMC)		N/A
7.10.1	EMC environment		N/A
	Two sets of environmental conditions are considered: a) environment A related to LV non-public or industrial networks / locations / installations including highly disturbing sources; b) environment B related to LV public networks such as domestic, commercial and light industrial locations / installations;	The assembly is for: () the environment A () the environment B () both environments A and B	N/A

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Clause	Requirement - Test	Result - Remark	Verdict
7.10.2	Requirement for testing		N/A
	No EMC immunity or emission tests are required on the assembly if:		N/A
	a) incorporated devices / components are designed for the specified environment in line with the relevant EMC standards;		N/A
	b) the internal installation and wiring are carried out in accordance with the instructions of the device and component manufacturers;		N/A
7.10.3	Immunity		N/A
7.10.3.1	No immunity testing is required for assemblies not incorporating electronic circuits:		N/A
7.10.3.2	Assemblies incorporating electronic equipment: electronic equipment complies with the immunity requirements of the relevant EMC standards and is suitable for the EMC environment stated by the assembly manufacturer;		N/A
	In all other cases, the EMC requirements are verified by tests as mentioned in H.8.2.8.		N/A
7.10.4	Emission		N/A
7.10.4.1	Assemblies not incorporating electronic circuits:		N/A
	Requirements for the emissions are satisfied and no verification is necessary;		N/A
7.10.4.2	Assemblies incorporating electronic circuits:		N/A
	Individual devices and components containing electronic equipment comply with the emission requirements of the relevant EMC standards and are suitable for the EMC environment stated by the assembly manufacturer;		N/A
7.10.4.2.1	Frequencies of 9 kHz or higher:		N/A
	Emissions do not exceed the limits specified in the relevant product standard, or		N/A
	Emissions do not exceed the limits based on table H.1 for Environment A and/or table H.2 for Environment B;	The assembly is for: () the environment A () the environment B () both environments A and B	N/A
7.10.4.2.2	Frequencies lower than 9 kHz:		N/A
	Assemblies incorporating electronic circuits which generate low-frequency harmonics on the main supply comply with the requirements of IEC 61000-3-2 where applicable;		N/A
7.11	Description of the types of electrical connections of functional units		N/A
	The types of electrical connections can be denoted by a 3-letter code (letters F, D, W) , see 2.2.12;	() denoted code: () the code not described	N/A

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Clause	Requirement - Test	Result - Remark	Verdict
8	TEST SPECIFICATIONS		
8.1	Classification of tests (type tests, routine tests)		P
8.1.1	Type tests		P
	Type tests can be carried out on the whole assembly or on the parts of the assembly;	carried out on the assembly	P
	Type tests include the following:		P
	a) verification of temperature-rise limits;	See 8.2.1 below	P
	b) verification of the dielectric properties;	See 8.2.2 below	P
	c) verification of short-circuit withstand strength;	See 8.2.3 below	P
	d) verification of the effectiveness of the protective circuit;	See 8.2.4 below	P
	e) verification of clearances and creepage distances;	See 8.2.5 below	P
	f) verification of mechanical operation;	See 8.2.6 below	P
	g) verification of the degree of protection;	See 8.2.7 below	P
	h) verification EMC	See 7.10 and, if applicable, annex H	N/A
8.1.2	Routine tests (not applicable)		N/A
8.1.3	Testing of devices and self-contained components incorporated in the assembly		N/A
	Type tests or routine tests are not required to be carried out, if devices/self-contained components have been selected in accordance with 7.6.1 and installed in accordance with the instructions of their manufacturer;		N/A
8.2	Type tests		P
8.2.1	Verification of temperature-rise limits		P
8.2.1.1	General		P
	General test arrangements: - the test is normally carried out at In; - the test may be carried out with the aid of heating resistors of an equivalent power loss; - the test on the individual circuits is made with the type of current for which they are intended and at the design frequency;	3150A	P
	Temperature-rise test on the main circuit rated above 800 A carried out at 50Hz are valid if the rated current at 60 Hz is reduced to 95%		N/A
	For rated currents up to 800 A, test carried out at 50 Hz are normally applicable for 60 Hz		N/A
	Verification of temperature rise limits for PTTA is made by test in accordance with 8.2.1, or by extrapolation;		N/A
8.2.1.2	Arrangement of the assembly		P
	The assembly is arranged as in normal use;		P

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Clause	Requirement - Test	Result - Remark	Verdict
	- when testing individual parts or constructional units, the adjoining parts/units producing the same temperature conditions as in normal use is used;		P
8.2.1.3	Temperature-rise test using current on all apparatus		P
	The test is made on representative combinations of circuits for which the assembly is designed;		P
	- incoming circuit have to be loaded to its rated current /n;		P
	- each outgoing circuit have to be loaded with its /n multiplied by the diversity factor;		P
	- fuses are required to be fitted for the test with fuse-links specified by the manufacturer;	no fuses in the assembly	N/A
	-the power losses of the fuse-links used for the test have to be stated in the test report;		N/A
	- the size and disposition of external test conductors have to be stated in the test report;		P
8.2.1.3.1	For values of test current ≤ 400 A: - test current .. A , S_{test} = .. mm^2 (from table 8)	S_{test} , see Annex I	P
8.2.1.3.2	For values of test current > 400 A ≤ 800 A: - test current .. A , S_{test} = .. mm^2		N/A
8.2.1.3.3	For values of test current > 800 A ≤ 3150 A: - test current .. A , S_{test} = .. mm^2 from table 9 or as specified by the manufacturer;	S_{test} , see Annex I	P
8.2.1.3.4	For values of test current > 3150 A: as agreed between the manufacturer and user;	S_{test} , see Annex I	P
8.2.1.4	Temperature-rise test using heating resistors with equivalent power loss		N/A
	For assemblies with circuits having low-rated currents the power loss may be simulated by means of heating resistors producing the same amount of heat;		N/A
8.2.1.5	Measurement of temperatures		P
	- thermocouples or thermometers are used for temperature measurement;	thermocouples used	P
	- for windings, method of measuring by resistance variation is generally used;		N/A
8.2.1.6	Ambient air temperature		P
	Thermocouples or thermometers are used; special agreement between the manufacturer and user is needed if the temperature is not in the given limits (+10 ...+40 °C);	thermocouples used temperature = 24 °C	P
8.2.1.7	Results to be obtained		P
	The temperature rise is not allowed to exceed the values given in table 2;	detailed values, see Annex I	P

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Clause	Requirement - Test	Result - Remark	Verdict
	- the apparatus is required to operate satisfactorily within the voltage limits specified for them at the temperature inside the assembly;		P
8.2.2	Verification of dielectric properties		P
8.2.2.1	General		P
	Tests are made in accordance with: - 8.2.2.6.1...8.2.2.6.4 if U_{imp} has declared; - 8.2.2.2...8.2.2. 5 in the other cases;	testing in accordance with 8.2.2.2...8.2.2.5	P
8.2.2.2	Testing of enclosures made of insulating material		N/A
	An additional dielectric test is carried out for the enclosure, applied test voltage is equal to 1,5 x the values indicated in table 10;	the test voltage = .. V	N/A
8.2.2.3	External operating handles of insulating material		P
	An additional dielectric test is carried out for handles made of or covered by insulating material, applied test voltage is equal to 1,5 x the values indicated in table 10;	the test voltage = 5250 V	P
8.2.2.4	Application and value of the test voltage		P
	The test voltage is applied: 1) between all live parts and the interconnected exposed conductive parts of the assembly; 2) between each pole and all the other poles connected to the interconnected exposed conductive parts of the assembly;		P
	- the test voltage (sinusoidal waveform and a frequency 45 Hz...62 Hz) is maintained for 5 s;		P
8.2.2.4.1	- the test voltage for the main and directly supplied auxiliary circuits is given in table 10;	U_{test} (for main) = 3500 V U_{test} (for auxiliary) = ... V	P
8.2.2.4.2	- the test voltage for the auxiliary circuit not directly supplied is indicated in table 11;	U_{test} = 2000 V	P
8.2.2.5	Results obtained		P
	No puncture or flash-over is allowed;	Tested and passed	P
8.2.2.6	Impulse voltage withstand test		N/A
8.2.2.6.1	General conditions as specified in 8.2.2.6.1;		N/A
8.2.2.6.2	Test voltages		N/A
	- are as specified in 7.1.2.3.2 and 7.1.2.3.3;		N/A
	- the test may be done using power frequency or d.c. voltage as given in table 13;		N/A
	- equipment with overvoltage suppressing means is preferred to test with impulse voltage;		N/A
	a) the impulse voltage 1,2/50 μs is applied three times for each polarity at intervals 1 s;		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	b) - power frequency is applied during three cycles in case of a.c., - d.c. voltage is applied 10 ms for each polarity;		N/A
	- clearances ≥ the values of case A of table 14 may be verified by measurement, according to the method described in annex F;		N/A
8.2.2.6.3	Application of test voltages		N/A
	a) between each live part and the interconnected exposed conductive parts;		N/A
	b) between each pole of the main circuit and the other poles;		N/A
	c) between each control and auxiliary circuits not normally connected to the main circuit and - the main circuit, - the other circuits, - the exposed conductive parts, - the enclosure or mounting plate;		N/A
	d) for withdrawable parts in the disconnected position across the isolating gaps, between the supply side and the withdrawable part and between the supply terminal and load terminal;		N/A
8.2.2.6.4	Results to be obtained		N/A
	No unintentional disruptive discharge is allowed during the tests;	() no disruptive discharges () detailed results, see ...	N/A
8.2.2.7	Verification of creepage distances		N/A
	Shortest creepage distance is measured:		N/A
	- between phases;		N/A
	- between conductors at different voltages;		N/A
	- between live and exposed conductive parts;		N/A
	The requirements of 7.1.2.3.5 apply the measured creepage distance with respect to material group and pollution degree;		N/A
8.2.3	Verification of short-circuit withstand strength		P
8.2.3.1	Circuits being exempted from the verification of short-circuit withstand strength		N/A
	The verification of short-circuit withstand strength is not required in the following cases:		N/A
8.2.3.1.1	- for assemblies having I_{cw} or I_{cc} ≤ 10 kA;		N/A
8.2.3.1.2	- for assemblies protected by current-limiting devices having a cut-off current ≤ 17 kA at max. prospective short-circuit current at the incoming terminals of the assembly;		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
8.2.3.1.3	- for auxiliary circuits of the assembly connected to transformer whose short-circuit impedance is ≥ 4 % and whose rated power is: ≤ 10 kVA for $U_{n\ second}$ ≥ 100 V; or ≤ 1,6 kVA for $U_{n\ second}$ < 110 V ;		N/A
8.2.3.1.4	- for all parts of the assembly which have already been subjected to type tests valid for conditions in the assembly;		N/A
8.2.3.2	Circuits of assemblies of which short-circuit withstand strength is verified		P
	Applies to all circuits not mentioned in 8.2.3.1;		P
8.2.3.2.1	Test arrangements		P
	The assembly is set up as in normal use;	see Annex I	P
8.2.3.2.2	Performance of test – General		P
	- if fuses are incorporated in test circuit, fuse-links of the maximum current rating are used;		P
	-the test circuit is connected to the input terminals of the assembly;		P
	- the 3-phase assembly is connected on a 3-phase basis;		P
	- all the short-circuit withstand ratings is determined from calibration oscillogram at a supply voltage equal to 1,05 x U_e;		P
	- for a.c. tests, frequency of the test circuit during the short-circuit tests is f_r ± 25%;		P
	All parts to be connected to the protective conductor in service, are connected:		P
	1) for assemblies for use on 3-phase 4-wire (TN-/TT-) systems with earthed star point: - to the neutral point of supply or to the specified artificial neutral;		N/A
	2) for assemblies for use on 3-phase 3-wire as well as on 3-phase 4-wire (TN-/TT-/IT) systems: -to the phase conductor least likely to arc to earth		P
	- reliable device for detection of the fault current in the test circuit, except 7.4.3.2.2;		P
	- prospective fault current in the fusible element circuit is 1500 A ±10 % except the case of small equipment or supply with artificial neutral;		P
8.2.3.2.3	Testing of the main circuits		P
	For assemblies with busbars, the tests according to items a), b) and d) below apply;		P
	For assemblies without busbars, the tests according to item a) applies;		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	For assemblies where requirements of 7.5.5.1.2 are not fulfilled, item c) applies in addition;		N/A
	a) Where an outgoing circuit includes a component which has not previously been subjected to appropriate test, the test and test method specified in the sub-clause a) applies;		P
	- for testing an outgoing circuit, the associate outgoing terminals are short-circuited;		P
	- for circuit-breakers having $I_n \leq 630$ A,a cable of 0,75 m and S corresponding to the $I_{th\ conventional}$ are included in the test circuit;		N/A
	- the switching device have to be closed and held closed as normally in service;		P
	- the test voltage is then applied once for time long enough to enable the short-circuit device in outgoing unit to operate to clear the fault and for not less than 10 cycles;		P
	b) Assemblies containing main busbars are subjected to one additional test in accordance with the sub-clause b);		P
	- the short-circuit is produced in the point 2 m ± 0,40 m distant from the nearest point of supply; for the verification of Icw and Ipk this distance may be increased on the described presumptions		P
	- if the length of the busbars is less than 1,6 m and assembly is not intended to be extended, then the complete busbars are tested;		N/A
	c) A short circuit is obtained on the conductors connecting the busbars to a single outgoing unit;		P
	- the value of the short-circuit current is same as that for the main busbars;		P
	d) If the neutral bar exists, it is subjected to one test to prove its strength in relation to the nearest phase busbar including any joints;		P
	- for the connection of the N-bar to the phase-bar the requirements of item b) of 8.2.3.2.3 apply;		P
	- the value of test current in the neutral bar is 60 % of the phase current during the 3-phase test;		P
8.2.3.2.4	Value and duration of the short-circuit current		P
	a) For assemblies protected by short-circuit protective device the test voltage is applied for time that the short-circuit device in outgoing unit operates and for not less than 10 cycles;		P

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Clause	Requirement - Test	Result - Remark	Verdict
	b) Assemblies not incorporating a short-circuit protective device in the incoming unit: for all short-circuit withstand ratings, the dynamic and thermal stresses are verified with a prospective current, at the supply side of the protective device, if any, equal to the value of I_{cw}, I_{pk}, I_{cc} or I_{cf} assigned by the manufacturer;		N/A
	- for I_{cw} and I_{pk} withstand tests any overcurrent release likely to operate during the test rendered inoperative;		N/A
	- all tests are made at the f_r ± 25 % and at the power factor appropriate to the short-circuit current in accordance with table 4;		N/A
	- the current is required to be within the tolerance + 5 %/ 0 % and the power factor within the tolerance between 0,0 and –0,05 in each phase;		N/A
	- the current is applied for the specified time during which the r.m.s. value of its a.c. component shall remain constant;		N/A
	- for the conditional and fused short-circuit test, the test is conducted at 1,05 times U_e with prospective currents, at the supply side of the specified protective device, equal to the value of I_{cc} or I_{cf}; tests at lower voltages are not permitted		N/A
8.2.3.2.5	Results to be obtained		P
	After the tests: - not any undue deformation in the conductors or busbars; - not any significant signs of deterioration in the insulation of the conductors and the supporting insulating parts; - the detection device does not indicate a fault current; - no loosening of parts used for the connection of conductors;		P
	After the tests: - the conductors are not separated from the outgoing terminals; - any distortion of the busbar circuit or the frame of the assembly which impairs normal insertion of withdrawable or removable units are deemed failure;		P

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Clause	Requirement - Test	Result - Remark	Verdict
	- additionally after the test of 8.2.3.2.3 a) and tests incorporating protective devices, the tested equipment is required to withstand the dielectric test of 8.2.2 at a voltage for the after test condition prescribed in the relevant standard for the appropriate short-circuit test, as follows: a) between all live parts and the frame of the assembly, and b) between each pole and all other poles connected to the frame of the assembly; - these tests are carried out with any fuses replaced and with any switching device closed;		P
8.2.3.2.6	For PTTA, the verification of short-circuit withstand strength is made either by test in 8.2.3.2.1 to 8.2.3.2.5 , or by extrapolation from similar type-tested arrangements;		N/A
8.2.4	Verification of the effectiveness of the protective circuit		P
8.2.4.1	Verification of the effective connection between the exposed conductive parts of the assembly and the protective circuit		P
	The different exposed conductive parts of the assembly have to be effectively connected to the protective circuit;		P
	The resistance between the incoming protective conductor and the relevant exposed conductive parts is not allowed to exceed 0,1 Ω ;		P
	- verification is made using a resistance measuring instrument/arrangement which is capable of driving a current of at least 10 A a.c. or d.c. into an impedance of 0,1 Ω between the points of the measurement;	current used for measurement: 10 A; measured resistance value(s): 0,0452 Ω	P
8.2.4.2	Verification of the short-circuit strength of the protective circuit by test		P
	(does not apply for circuits mentioned in 8.2.3.1)		N/A
	A single-phase test supply is connected to the incoming terminal of one phase and to the terminal for the incoming protective conductor ;		P
	- a separate test is made for each representative outgoing unit, with a bolted short-circuit connection between the corresponding outgoing phase terminal of the unit and the terminal for the relevant outgoing protective conductor;		P
	- each outgoing unit on test is provided with that protective device among those intended for the unit which lets through the maximum value of peak current and I^2t;		P
	- the frame of the assembly is insulated from earth for this test;		P
	- the test voltage is equal to the single-phase value of the U_e;		P

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Clause	Requirement - Test	Result - Remark	Verdict
	- the value of prospective short-circuit current used is 60 % of the value of that of the 3-phase short-circuit test of the assembly;		P
	- all other conditions are as in 8.2.3.2;		P
8.2.4.3	Results to be obtained		P
	Not any significant impairs in the continuity and the short-circuit withstand strength of the protective circuit;		P
8.2.5	Verification of clearances and creepage distances		P
	Clearances and creepage distances have to comply with the values in 7.1.2;		P
8.2.6	Verification of mechanical operations		P
	The test is not made on such devices which have already been type tested according to their relevant specifications provided that mechanical operation is not impaired by their mounting;		N/A
	- for parts which need a type test, mechanical operation is verified after installation; number of operating cycles is 50.		P
	-the operation of the mechanical interlocks associated with these movements are checked at the same time;		P
	-the test is passed if the operating conditions of the apparatus, interlocks etc. have not been impaired and if the effort required for operation is practically the same as before the test;		P
8.2.7	Verification of degree of protection		P
	The degree of protection (IP Code) is verified in accordance with IEC 60529;		P
	- after the test for water ingress, the dielectric properties is verified by test in accordance with 8.2.2, if necessary;		N/A
	- the test device for IP 3X and IP 4X and the type of support for enclosure during the IP 4X test have to be stated in the test report;		N/A
	- assemblies having a degree of protection of IP5X are tested according to category 2;		N/A
	- assemblies having a degree of protection of IP6X are tested according to category 1;		N/A
8.2.8	EMC tests		N/A
	For EMC tests see H 8.2.8		N/A
8.2.9	Verification of the resistance of insulating materials to abnormal heat and fire		N/A
	Glow-wire test carried out according to IEC 60695-2-10 and IEC 60695-2-11		N/A
	Glow-wire test (960 °C) for parts necessary to retain current-carrying parts in position		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	No visible flames and no sustained glowing, or if flame and glowing, extinguish within 30 s.....:		N/A
	Glow-wire test (650 °C) for parts not necessary to retain current-carrying parts in position including parts necessary to retain the protective conductor		N/A
	No visible flames and no sustained glowing, or if flame and glowing, extinguish within 30 s.....:		N/A
8.3	Routine tests (in responsibility of the manufacturer, not applicable in type testing)		N/A

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Clause	Requirement - Test	Result - Remark	Verdict

	Annex H		N/A
H 8.2.8	EMC tests		N/A
	Assemblies or parts of them which do not fulfil the requirements of 7.10.2 a) and b) are subjected to the following tests as applicable;		N/A
	Emission and immunity tests are carried out in according with the relevant EMC standard (see tables H.1, H.2, H.3 and H.4)		N/A
	The manufacturer has specified any additional measures necessary to verify the criteria of performance for the assemblies if necessary		N/A

H 8.2.8.1	Immunity tests		N/A
H 8.2.8.1.1	Assemblies not incorporating electronic circuits		N/A
	No tests are necessary		N/A
H 8.2.8.1.2	Assemblies incorporating electronic circuits		N/A
	Tests for EMC immunity for Environment A (Table H.3)		N/A
	Electrostatic discharge immunity test (IEC 61000-4-2)		N/A
	Test level required:		N/A
	- air discharge: ± 8 kV		N/A
	- contact discharge: ± 4 kV		N/A
	Performance criterion: B		N/A
	Radiated radio-frequency electromagnetic field immunity test (IEC 61000-4-3) at 80 MHz to 1 GHz and 1,4 GHz to 2 GHz		N/A
	Test level required: 10 V/m		N/A
	Performance criterion: A		N/A
	Electrical fast transient/burst immunity test (IEC 61000-4-4)		N/A
	Test level required:		N/A
	- supply ports: ± 2 kV		N/A
	- signal ports including auxiliary circuits: ± 1 kV		N/A
	Performance criterion: B		N/A
	1,2/50 µs and 8/20 µs surge immunity test (IEC 61000-4-5), not required for equipment and/or input/output ports with a rated d.c. voltage of 24 V or less		N/A
	Test level required:		N/A
	- ± 2 kV (line to earth)		N/A
	- ± 1 kV (line to line)		N/A
	Performance criterion: B		N/A
	Conducted radio-frequency immunity test (IEC 61000-4-6) at 150 kHz to 80 MHz		N/A
	Test level required: 10 V		N/A
	Performance criterion: A		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	Immunity to power-frequency magnetic fields (IEC 61000-4-8)		N/A
	Test level required: 30 A/m, applicable only to apparatus containing devices susceptible to magnetic fields		N/A
	Performance criterion: A		N/A
	Immunity to voltage dips and interruptions (IEC 61000-4-11)		N/A
	Test level required:		N/A
	1) 30 % reduction for 0,5 cycles		N/A
	2) 60 % reduction for 5 and 50 cycles		N/A
	3) 95 % reduction for 250 cycles		N/A
	Performance criterion:		N/A
	1) B		N/A
	2) C		N/A
	3) C		N/A
	Immunity to harmonics in the supply (IEC 61000-4-13)		N/A
	No requirements		—
	Tests for EMC immunity for Environment B (Table H.4)		N/A
	Electrostatic discharge immunity test (IEC 61000-4-2)		N/A
	Test level required:		N/A
	- air discharge: ± 8 kV		N/A
	- contact discharge: ± 4 kV		N/A
	Performance criterion: B		N/A
	Radiated radio-frequency electromagnetic field immunity test (IEC 61000-4-3) at 80 MHz to 1 GHz and 1,4 GHz to 2 GHz		N/A
	Test level required: 3 V/m		N/A
	Performance criterion: A		N/A
	Electrical fast transient/burst immunity test (IEC 61000-4-4)		N/A
	Test level required:		N/A
	- supply ports: ± 1 kV		N/A
	- signal ports including auxiliary circuits: ± 0,5 kV		N/A
	Performance criterion: B		N/A
	1,2/50 µs and 8/20 µs surge immunity test (IEC 61000-4-5), not required for equipment and/or input/output ports with a rated d.c. voltage of 24 V or less		N/A
	Test level required:		N/A
	- ± 0,5 kV (line to earth)		N/A
	- ± 1 kV (line to earth), for mains supply input port		N/A
	- ± 0,5 kV (line to line)		N/A
	Performance criterion: B		N/A
	Conducted radio-frequency immunity test (IEC 61000-4-6) at 150 kHz to 80 MHz		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	Test level required: 3 V		N/A
	Performance criterion: A		N/A
	Immunity to power-frequency magnetic fields (IEC 61000-4-8)		N/A
	Test level required: 3 A/m, applicable only to apparatus containing devices susceptible to magnetic fields		N/A
	Performance criterion: A		N/A
	Immunity to voltage dips and interruptions (IEC 61000-4-11)		N/A
	Test level required:		N/A
	1) 30 % reduction for 0,5 cycles		N/A
	2) 60 % reduction for 5 cycles		N/A
	3) 95 % reduction for 250 cycles		N/A
	Performance criterion:		N/A
	1) B		N/A
	2) C		N/A
	3) C		N/A
	Immunity to harmonics in the supply (IEC 61000-4-13)		N/A
	No requirements		—
H 8.2.8.2	Emission tests		N/A
H 8.2.8.2.1	Assemblies not incorporating electronic circuits		N/A
	No tests are necessary		N/A
H 8.2.8.2.2	Assemblies incorporating electronic circuits (see 7.10.4.2)		N/A
	Emission limits for Environment A (Table H.1)		N/A
	Radiated emissions (IEC 61000-6-4 or CISPR 11, Class A, Group 1)		N/A
	Frequency range: 30-230 MHz		N/A
	Limits: 30 dB (µV/m) quasi peak at 30 m		N/A
	Frequency range: 230-1000 MHz		N/A
	Limits: 37 dB (µV/m) quasi peak at 30 m		N/A
	Conducted emissions (IEC 61000-6-4 or CISPR 11, Class A, Group 1)		N/A
	Frequency range: 0,15-0,5 MHz		N/A
	Limits: 79 dB (µV) quasi peak		N/A
	Limits: 66 dB (µV) average		N/A
	Frequency range: 0,5-5 MHz		N/A
	Limits: 73 dB (µV) quasi peak		N/A
	Limits: 60 dB (µV) average		N/A
	Frequency range: 5-30 MHz		N/A
	Limits: 73 dB (µV) quasi peak		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	Limits: 60 dB (µV) average		N/A
	Emission limits for Environment B (Table H.2)		N/A
	Radiated emissions (IEC 61000-6-3 or CISPR 11, Class B, Group 1)		N/A
	Frequency range: 30-230 MHz		N/A
	Limits: 30 dB (µV/m) quasi peak at 10 m		N/A
	Frequency range: 230-1000 MHz		N/A
	Limits: 37 dB (µV/m) quasi peak at 10 m		N/A
	Conducted emissions (IEC 61000-6-3 or CISPR 11, Class A, Group 1)		N/A
	Frequency range: 0,15-0,5 MHz		N/A
	Limits: 66 dB (µV) – 56 dB (µV) quasi peak		N/A
	Limits: 56 dB (µV) – 46 dB (µV) average		N/A
	Frequency range: 0,5-5 MHz		N/A
	Limits: 56 dB (µV) quasi peak		N/A
	Limits: 46 dB (µV) average		N/A
	Frequency range: 5-30 MHz		N/A
	Limits: 60 dB (µV) quasi peak		N/A
	Limits: 50 dB (µV) average		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	Annex I		P
8.2.1	Verification of temperature-rise limits		P
	Ambient air temperature (℃) .....: +10～+40	24	P
	Testing current (A).....: main circuit 3150	3150	P
	Connecting conductor (mm^2× m) .....: 3 bar (10×100)×3	3 bar (10×100)×3,5	P
	Testing current(A).....: outgoing 1 400	400	P
	Connecting conductor(mm^2× m): 240×2	240×4	P
	Testing current(A).....: outgoing 2 250	250	P
	Connecting conductor(mm^2× m): 120×2	120×4	P
	Testing current(A).....: outgoing 3 160	160	P
	Connecting conductor(mm^2× m): 70×2	70×4	P
	Testing current(A).....: outgoing 4 100	100	P
	Connecting conductor(mm^2× m): 35×1	35×4	P
	Testing current(A).....: outgoing 5 40	40	P
	Connecting conductor(mm^2× m): 10×1	10×4	P
	Testing current(A).....:branch 2 800	835	P
	Connecting conductor(mm^2× m):2 bar 240×2	2 bar 240×4	P
	Testing current(A).....: outgoing 6 360	360	P
	Connecting conductor(mm^2× m).....: 240×2	240×4	P
	Testing current(A).....: outgoing 7 225	225	P
	Connecting conductor(mm^2× m).....: 95×2	95×4	P
	Testing current(A).....: outgoing 8 144	144	P
	Connecting conductor(mm^2× m).....: 50×2	50×4	P
	Testing current(A) : outgoing 9 130,6	130,5	P
	Connecting conductor(mm^2× m).....: 50×2	50×4	P
	Testing current(A) : outgoing 10 90	90	P
	Connecting conductor(mm^2× m).....: 35×1	35×4	P
	Testing current(A) : outgoing 11 36	36	P
	Connecting conductor(mm^2× m).....: 10×1	10×4	P
	Testing current(A) : outgoing 12 14,4	14,5	P
	Connecting conductor(mm^2× m).....: 2,5×1	2,5×4	P
	Testing current(A).....: load 1 50	50	P
	Connecting conductor(mm^2× m).....: 10×1	10×4	P
	Testing current(A).....:load 2 350	315	P

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Clause	Requirement - Test	Result - Remark			Verdict
	Connecting conductor(mm^2× m)……: 185×2	185×4			P
	Temperature rise test point	A	B	C	P
	a1:Input terminals of power source ≤70K……:	55	58	56	P
	a2:Input terminals of main circuit-breaker ≤70K...:	59	63	60	P
	a3:Output terminals of main circuit-breaker ≤70K:	59	65	62	P
	a4:Bus fixed junction between feed cabinet branch 1 busbars and Main busbar≤70K……:	48	53	49	P
	a5:Input terminals of circuit-breaker branch 2 ≤70K……:	49	50	47	P
	a6:Output terminals of circuit-breaker branch 2 ≤70K……:	45	47	44	P
	a7:Input terminals of circuit-breaker outgoing 1 ≤ 70K ……:	41	45	42	P
	a8:Output terminals of circuit-breaker outgoing 1 ≤ 70K……:	38	42	39	P
	a9:Input terminals of circuit-breaker outgoing 2 ≤ 70K ……:	40	43	41	P
	a10:Output terminals of circuit-breaker outgoing 2 ≤ 70K……:	38	40	38	P
	a11:Input terminals of circuit-breaker outgoing 3 ≤ 70K ……:	38	41	37	P
	a12:Output terminals of circuit-breaker outgoing 3 ≤ 70K……:	36	39	35	P
	a13:Input terminals of circuit-breaker outgoing 4 ≤ 70K ……:	34	36	35	P
	a14:Output terminals of circuit-breaker outgoing 4 ≤ 70K……:	31	35	32	P
	a15: Input terminals of circuit-breaker outgoing 5 ≤ 70K ……:	28	30	28	P
	a16: Output terminals of circuit-breaker outgoing 5 ≤ 70K……:	26	28	26	P
	a17: Input terminals of AC Contactor outgoing 5 ≤ 65K ……:	24	27	25	P
	a18: Output terminals of AC Contactor outgoing 5 ≤ 65K……:	22	25	23	P
	a19: Bus fixed junction between control cabinet busbars and Main busbar≤70K……:	47	49	45	P
	a20: Input terminals of connector outgoing 6 ≤ 55K……:	38	41	37	P
	a21: Input terminals of circuit-breaker outgoing 6 ≤ 70K……:	42	44	40	P
	a22: Output terminals of circuit-breaker outgoing 6≤ 70K……:	40	42	38	P
	a23: Output terminals of connector outgoing 6 ≤ 55K……:	37	39	36	P
	a24: Input terminals of connector outgoing 7 ≤ 55K……:	36	38	35	P

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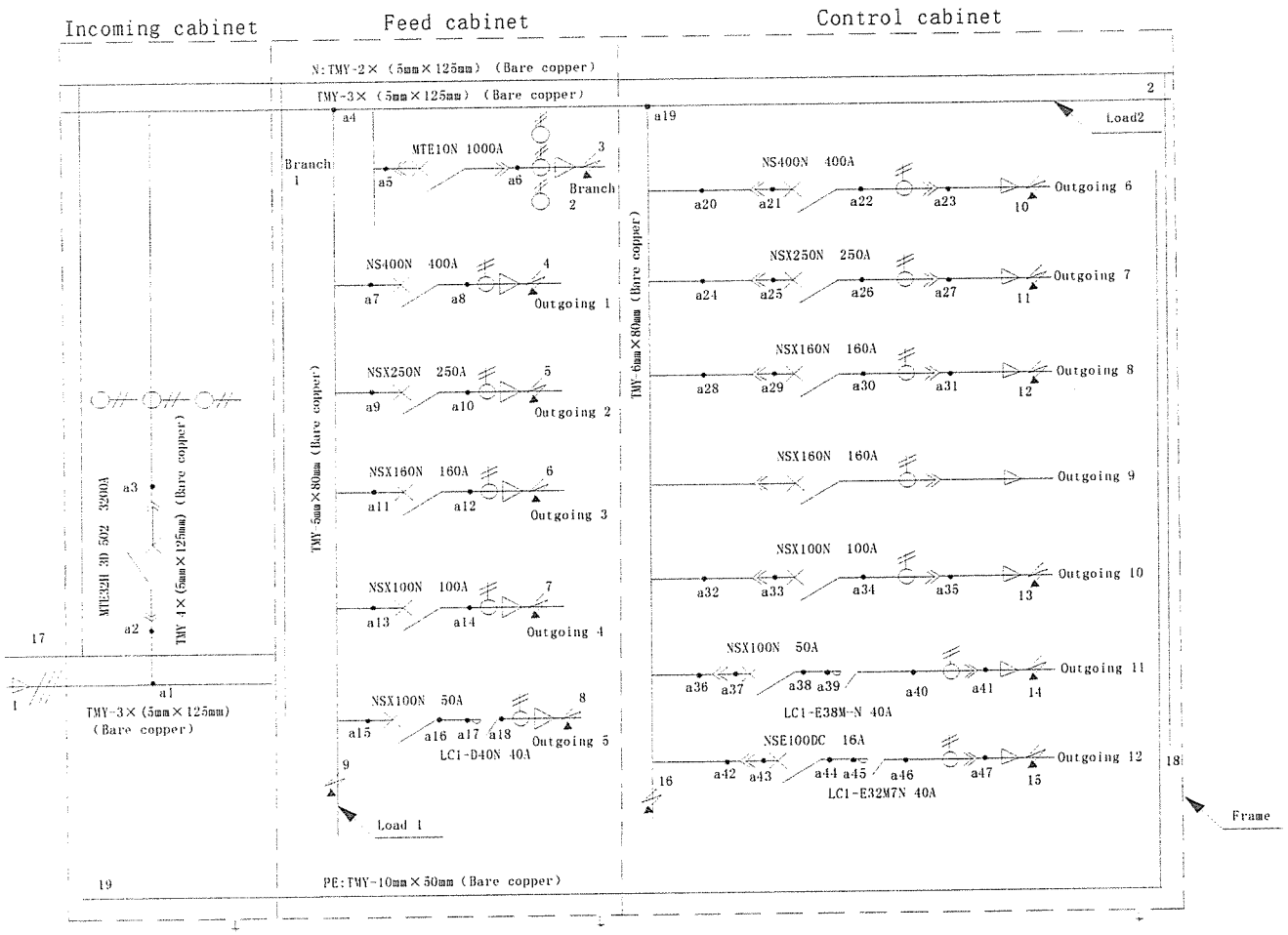
Clause	Requirement - Test	Result - Remark	Verdict

	Temperature rise test point	A	B	C	P
	a25: Input terminals of circuit-breaker outgoing 7 ≤ 70K.....:	39	42	38	P
	a26: Output terminals of circuit-breaker outgoing 7 ≤ 70K.....:	36	39	37	P
	a27: Output terminals of connector outgoing 7 ≤ 55K.....:	35	37	34	P
	a28: Input terminals of connector outgoing 8 ≤ 55K.....:	33	35	34	P
	a29: Input terminals of circuit-breaker outgoing 8 ≤ 70K.....:	35	38	34	P
	a30: Output terminals of circuit-breaker outgoing 8 ≤ 70K.....:	33	36	32	P
	a31: Output terminals of connector outgoing 8 ≤ 55K.....:	30	33	31	P
	a32: Input terminals of connector outgoing 10 ≤ 55K.....:	31	33	29	P
	a33: Input terminals of circuit-breaker outgoing 10 ≤ 70K.....:	33	34	31	P
	a34: Output terminals of circuit-breaker outgoing 10 ≤ 70K.....:	32	33	30	P
	a35: Output terminals of connector outgoing 10 ≤ 55K.....:	28	31	27	P
	a36: Input terminals of connector outgoing 11 ≤ 55K.....:	23	26	22	P
	a37: Input terminals of circuit-breaker outgoing 11 ≤ 70K.....:	26	28	24	P
	a38: Output terminals of circuit-breaker outgoing 11 ≤ 70K.....:	24	26	23	P
	a39: Input terminals of AC Contactor outgoing 11 ≤ 65K .....:	23	24	21	P
	a40: Output terminals of AC Contactor outgoing 11 ≤ 65K.....:	21	23	20	P
	a41: Output terminals of connector outgoing 11 ≤ 55K.....:	21	23	19	P
	a42: Input terminals of connector outgoing 12 ≤ 55K.....:	17	19	16	P
	a43: Input terminals of circuit-breaker outgoing 12 ≤ 70K.....:	19	22	18	P
	a44: Output terminals of circuit-breaker outgoing 12 ≤ 70K.....:	18	20	17	P
	a45: Input terminals of AC Contactor outgoing 12 ≤ 65K .....:	17	20	16	P
	a46: Output terminals of AC Contactor outgoing 12 ≤ 65K.....:	16	17	15	P
	a47: Output terminals of connector outgoing 12 ≤ 55K.....:	15	17	14	P
	a48: Metal enclosures and covers of Incoming cabinet ≤ 30K.....:	12			P
	a49: Insulation handle of Incoming cabinet's circuit-breaker ≤ 25K.....:	8			P

Fig.1 Temperature rise and the short-circuit point diagram



Temperature rise parameters diagram

Circuit	Incoming cabinet		Feed cabinet （Rated diversity factor 1）								
			Branch 1							Bra-nch 2	Load 2
	Main circuit	Mian-busb-ar	Distribu-tion busbar	Outg-oing 1	Outg-oing 2	Outg-oing 3	Outg-oing 4	Outg-oing 5	Load 1		
Rated circuit current (A)	3150	3150	1000	400	250	160	100	40	/	800	/
Test current (A)	3150	3150	1000	400	250	160	100	40	50	835	315
The deviation between test current and require current (%)	0	0	0	0	0	0	0	0	/	4,4	/
Connect-ing conductor (mm2)	3 bar（10× 100）		/	240	120	70	35	10	10	2 bar 240	185

Circuit	Control cabinet（Rated diversity factor 0,9）							
	Distribution busbar	Outgoing 6	Outgoing 7	Outgoing 8	Outgoing 9	Outgoing 10	Outgoing 11	Outgoing 12
Rated circuit current (A)	1000	400	250	160	160	100	40	16
Test current (A)	1000	360	225	144	130,5	90	36	14,5
The deviation between test current and require current (%)	0	0	0	0	/	0	0	0,7
Connecting conductor (mm^2)	/	240	95	50	50	35	10	2,5

Short circuit test line and the short-circuit point diagram

Testing items of short-circuit withstand strength	Terminals connected to the power supply	Terminals short circuit
Verification of short-circuit breaking of incoming cabinet MTE32H 3D 502 3200A	1	2
Verification of short-circuit withstand strength of the main busbars	1	2
Verification of short-circuit breaking of feed cabinet outgoing 1 NS400N 400A	1	4
Verification of short-circuit breaking of feed cabinet outgoing 2 NSX250N 250A	1	5
Verification of short-circuit breaking of feed cabinet outgoing3 NSX160N 160A	1	6
Verification of short-circuit breaking of feed cabinet outgoing 4 NSX100N 100A	1	7
Verification of short-circuit breaking of feed cabinet outgoing 5 NSX100N 50A	1	8
Verification of short-circuit breaking of feed cabinet branch 2 MTE10N 1000A	1	3
Verification of short-circuit withstand strength of feed cabinet branch 1 busbars	1	9
Verification of short-circuit breaking of control cabinet outgoing 6 NS400N 400A	1	10
Verification of short-circuit breaking of control cabinet outgoing 7 NSX250N 250A	1	11
Verification of short-circuit breaking of control cabinet outgoing 8 NSX160N 160A	1	12
Verification of short-circuit breaking of control cabinet outgoing 10 NSX100N 100A	1	13
Verification of short-circuit breaking of control cabinet outgoing 11 NSX100N 50A	1	14
Verification of short-circuit breaking of control cabinet outgoing 12 NSE100DC 16A	1	15
Verification of short-circuit withstand strength of control cabinet distribution busbars	1	16
Verification of short-circuit strength of the protection circuit of incoming cabinet MTE32H 3D 502 3200A	1(C Phase) and 19	2(C Phase) and the frame
Verification of short-circuit strength of the protection circuit of feed cabinet outgoing 5 NSX100N 50A	1(C Phase) and 19	8(C Phase) and the frame
Verification of short-circuit strength of the protection circuit of control cabinet outgoing 12 NSE100DC 16A	1(C Phase) and 19	15(C Phase) and the frame
Verification of short-circuit withstand strength of the N busbars	1(C Phase) and 17	2(C Phase) and 18

Annex J

Component List

1. Switch electrical appliances and components

No.	Parts name	Type-specification	Quantity	Manufacturer (Factory) / CCC Certificte No.
1	Air circuit-breaker	MTE32H 3D 502 3200A Ics=85kA,Icu=85kA	1	Schneider Shanghai Power Distribution Elec.App.Co.,Ltd. 2007010307236278
		MTE10N 1000A Ics=50kA,Icu=50kA	1	Schneider Shanghai Power Distribution Elec.App.Co.,Ltd. 2007010307236013
2	Moulded case circuit-breaker	NS400N 400A Ics=50kA,Icu=50kA	2	Schneider (Beijing) Medium & Low Voltage Co., Ltd. 2002010307001566
		NSX250N 250A Ics=50kA,Icu=50kA	2	Schneider (Beijing) Medium & Low Voltage Co., Ltd. 2008010307280177
		NSX160N 160A Ics=50kA,Icu=50kA	3	
		NSX100N 100A Ics=50kA,Icu=50kA	2	
		NSX100N 50A Ics=50kA,Icu=50kA	2	
		NSE100DC 16A Icu/Ics:85kA/85kA	1	Schneider (Beijing) Medium & Low Voltage Co., Ltd. 2007010307224606
3	AC Contactor	LC1-D40N 40A	1	Schneider Shanghai Industrial Control Co.,Ltd. 2006010304179530
		LC1-E38M-N 40A	1	Schneider Shanghai Industrial Control Co.,Ltd. 2010010304405643
		LC1-E32M7N 40A	1	
4	Current Transformer	SDH-6III 4000/5A	3	Suzhou Hengxiang Electrical Co., Ltd.
		SDH-3III 1000/5A	3	
		SDH-01 400/5A	2	
		SDH-02 250/5A	2	
		SDH-02 200/5A	3	
		SDH-02 100/5A	2	
		SDH-02 50/5A	2	
		SDH-02 25/5A	1	
5	Enclosures	BLOKSET Enclosures (Front door plate thickness: 2,0mm; Curb, sealing plate and rear door plate thickness: 1,5mm)	3	Beijing First Switchgear Co., Ltd.

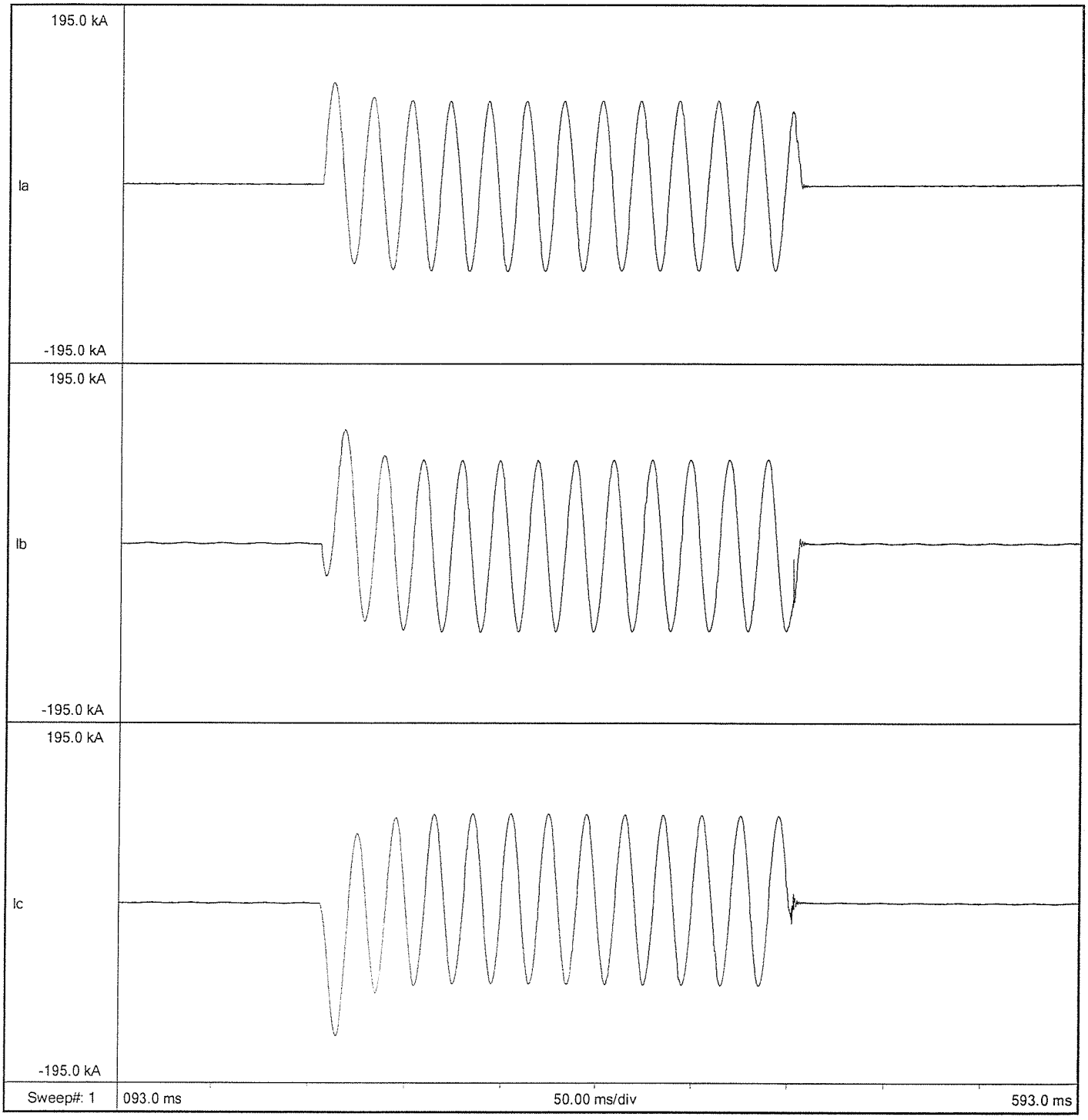
2. Busbar and Insulated conductor

No.	Parts name	Material name	Type-specification	Manufacturer (Factory) / CCC Certificte No.
1	Main switch input - output busbar	Copper busbar (Bare copper)	TMY-4×(5mm×125mm)	Tianjin Ruilin special-shaped copper Electric Co. Ltd.
	Busbar (horizontal busbar)		TMY-3×(5mm×125mm)	
	Feed cabinet branch 1 busbars		TMY-5mm×80mm	
	Control cabinet distribution busbar		TMY-6mm×80mm	
	Busbar (N)		TMY-2×(5mm×125mm)	
	Busbar (PE)		TMY-10mm×50mm	
2	Insulated conductor	PVC insulated conductor	BV-70mm^2、50mm^2、35mm^2、2,5mm^2、BVR-2,5mm^2	Shanghai Nanyang Cable Co., Ltd.(Shanghai Jinfeng Cable Co.,Ltd.) 2005010105140232

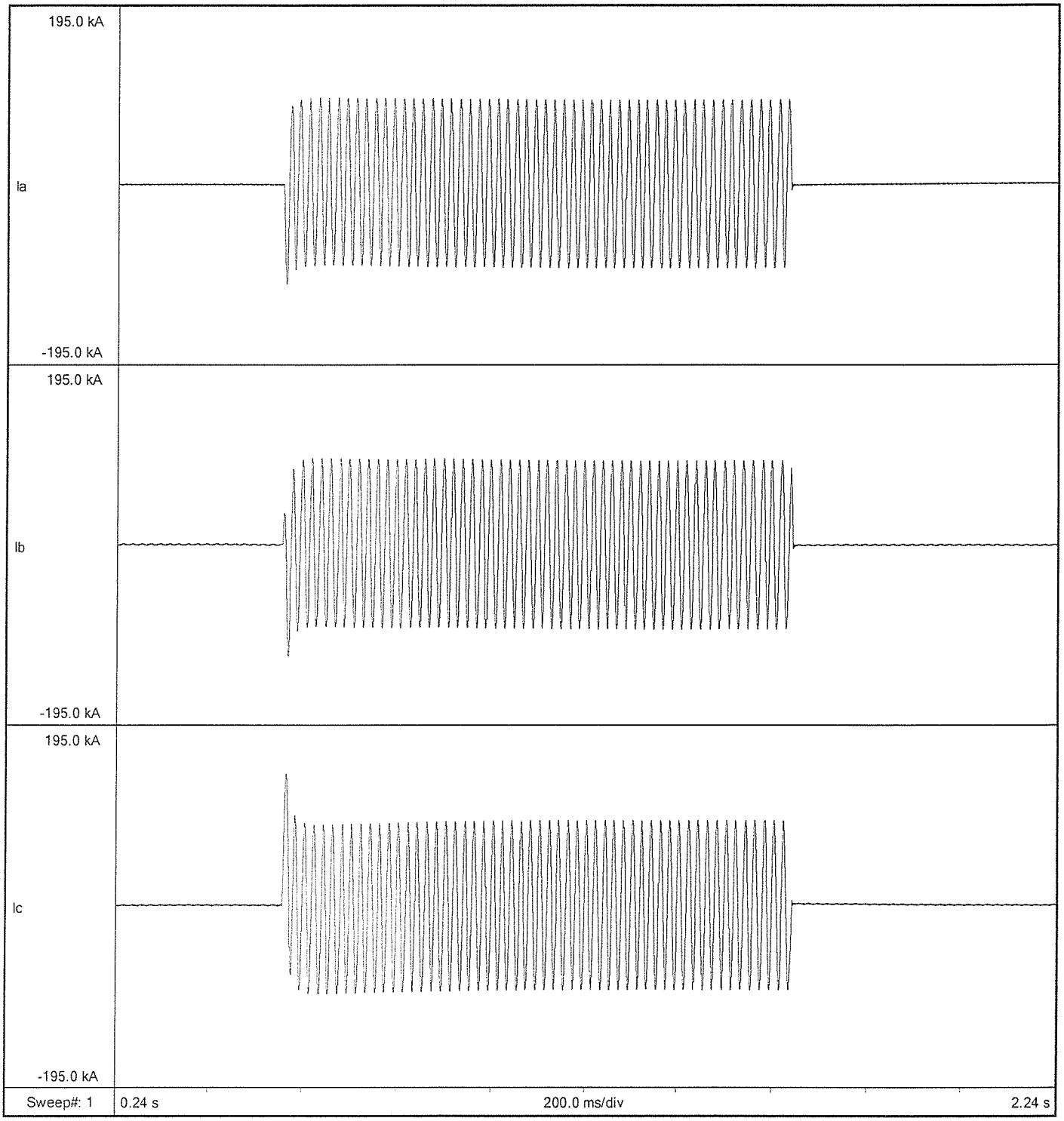
3. Supporting insulating parts and Connectors

No.	Parts name	Material name	Type-specification	Manufacturer (Factory)
1	Supporting insulating part	Busbar clamp (DMC Material)	PMJ-3×(5mm×125mm)	Yueqing Haitan Huayuan assemblies equipment fittings factory
			PMJ-2×(5mm×125mm)	
			AMJ-5mm×80mm	
			AMJ-6mm×80mm	
		Insulator (DMC Material)	M10	

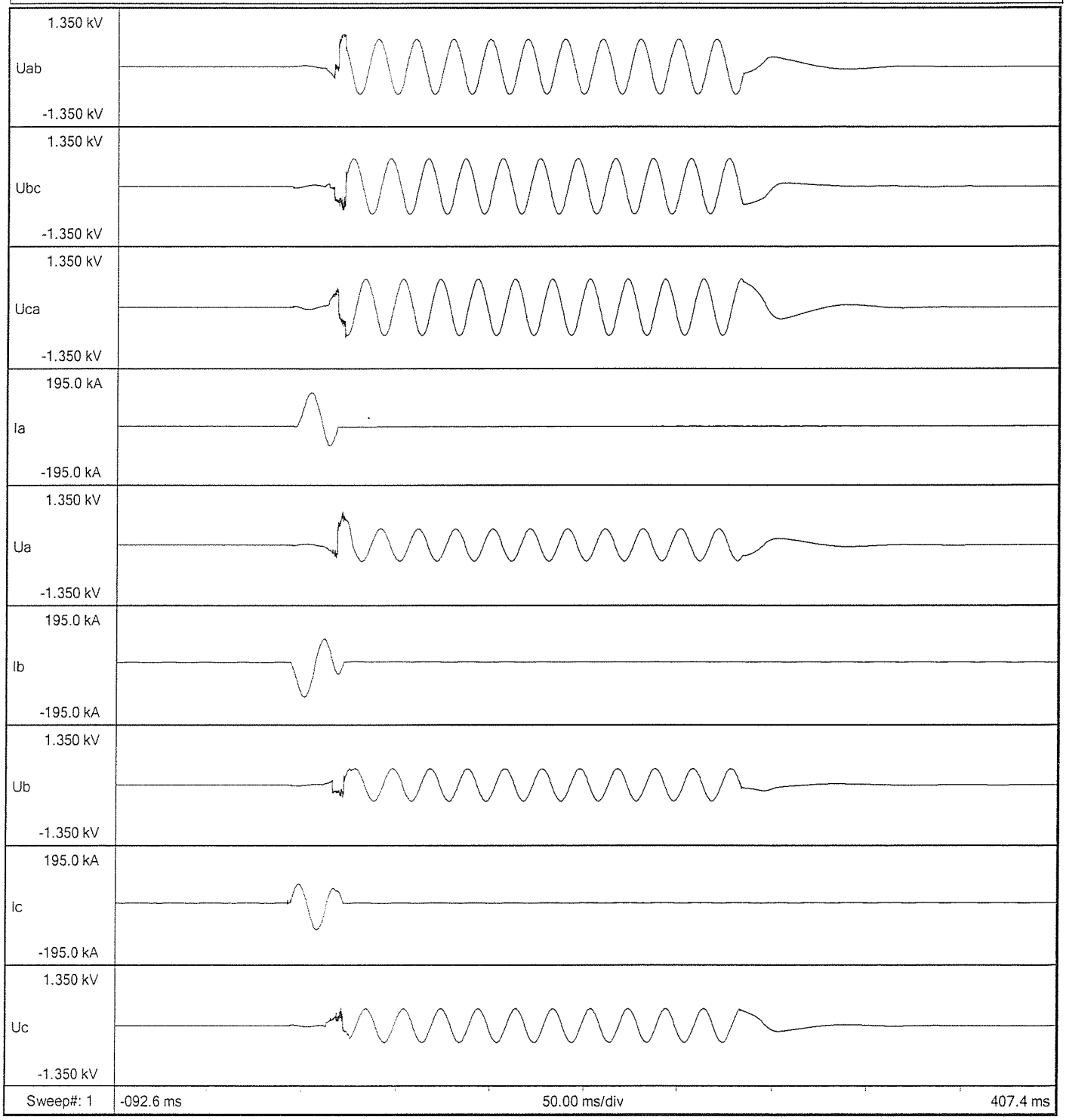
65kA three poles prospective current oscillogram	The oscillogram No.:S13161401
U=446,6V I=65,8kA/Ip=145,0kA	COSφ=0,18



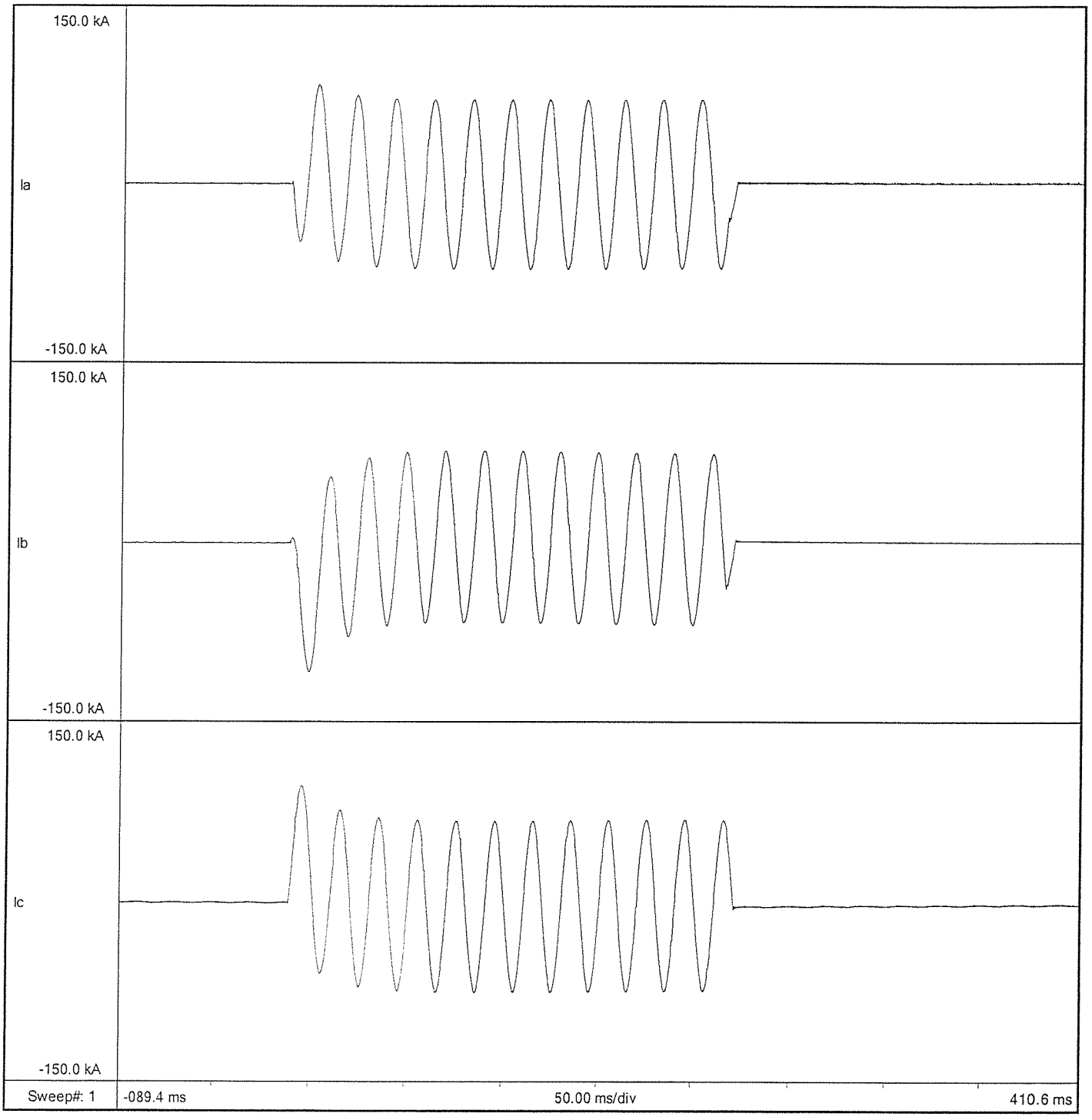
65kA verification of three poles short-circuit withstand strength The oscillogram No.:S13161402
The parameters of the prospective current: U=446,6V I=65,8kA/Ip=145,0kA COSφ=0,18
Ip=143,4kA I^2t=4601,0×10^6A^2s T=1,082s



65kA verification of short-circuit breaking	The oscillogram No.:S13161403
The parameters of the prospective current: U=446,6V I=65,8kA/Ip=145,0kA	COSφ=0,18
Ip=116,1kA	$I^2t=112,4\times10^6A^2s$



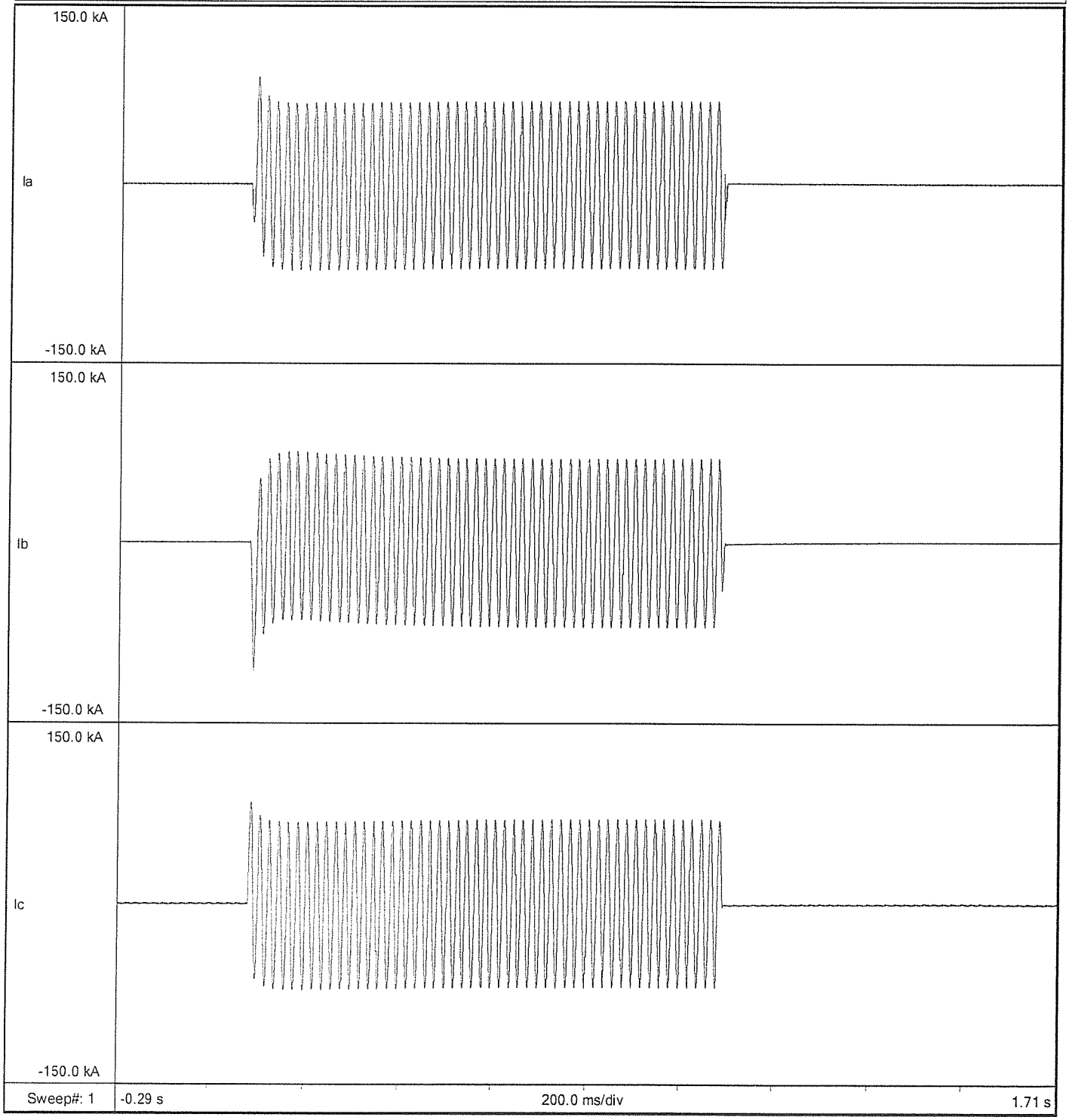
50kA three poles prospective current oscillogram	The oscillogram No.:S13161404
U=447,2V I=50,9kA/Ip=108,6kA	COSφ=0,23



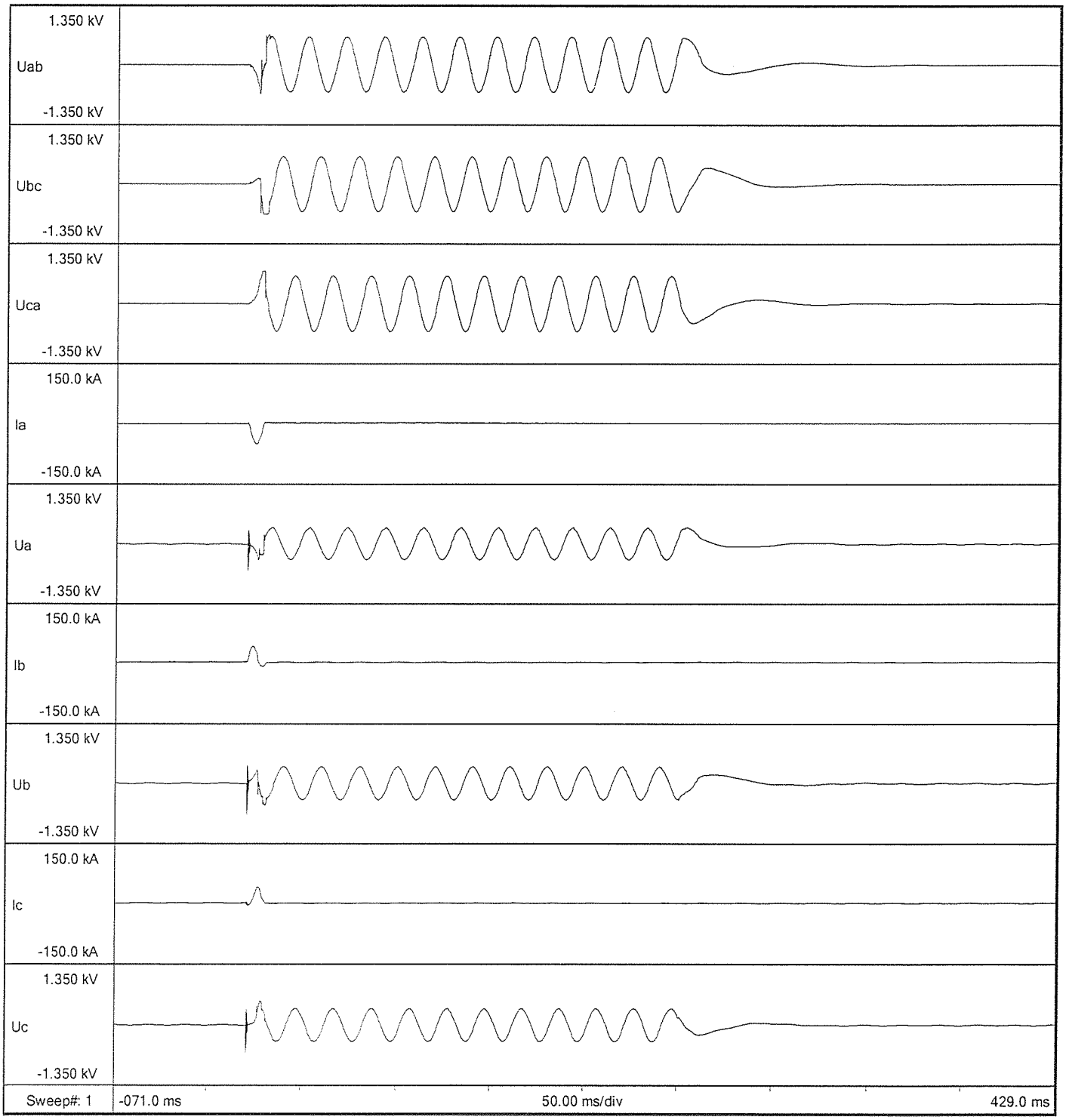
50kA verification of three poles short-circuit withstand strength The oscillogram No.:S13161405

The parameters of the prospective current: U=447,2V I=50,9kA/Ip=108,6kA COSφ=0,23

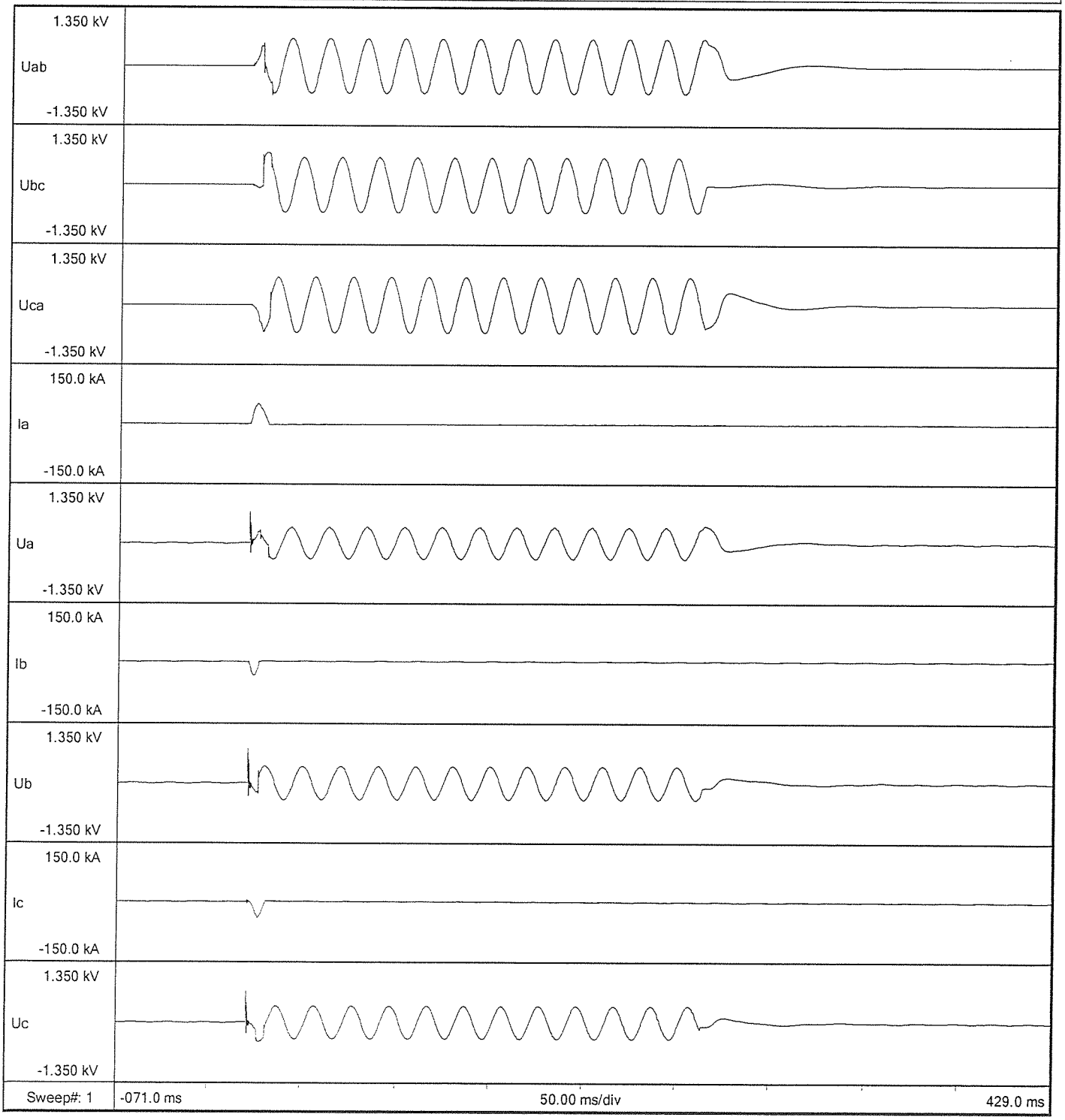
Ip=108,2kA $I^2t=2567,2\times10^6A^2s$ T=1,015s



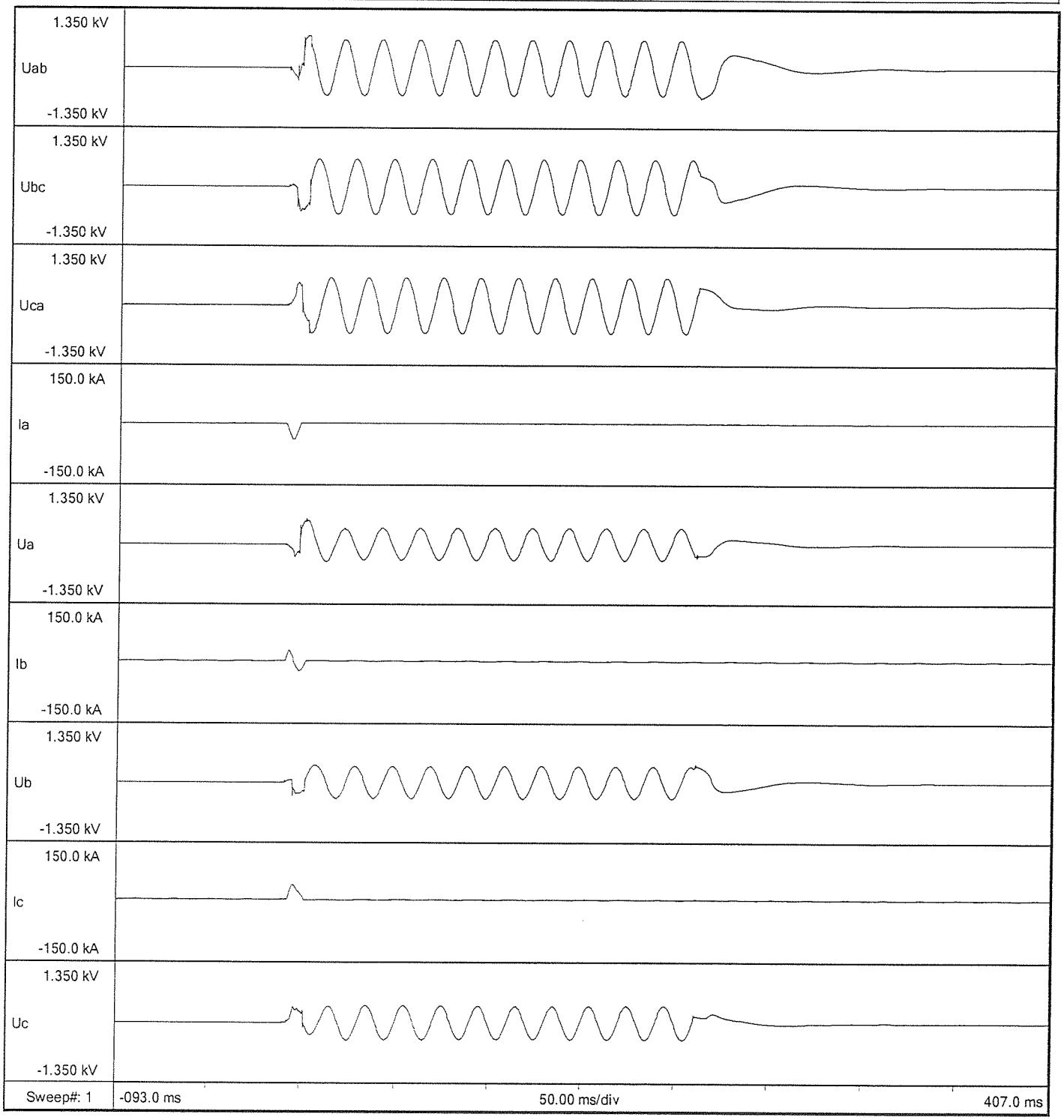
50kA verification of short-circuit breaking	The oscillogram No.:S13161406	
The parameters of the prospective current:	U=447,2V	I=50,9kA/Ip=108,6kA COSφ=0,23
Ip=53,2kA	$I^2t=11,0\times10^6A^2s$	



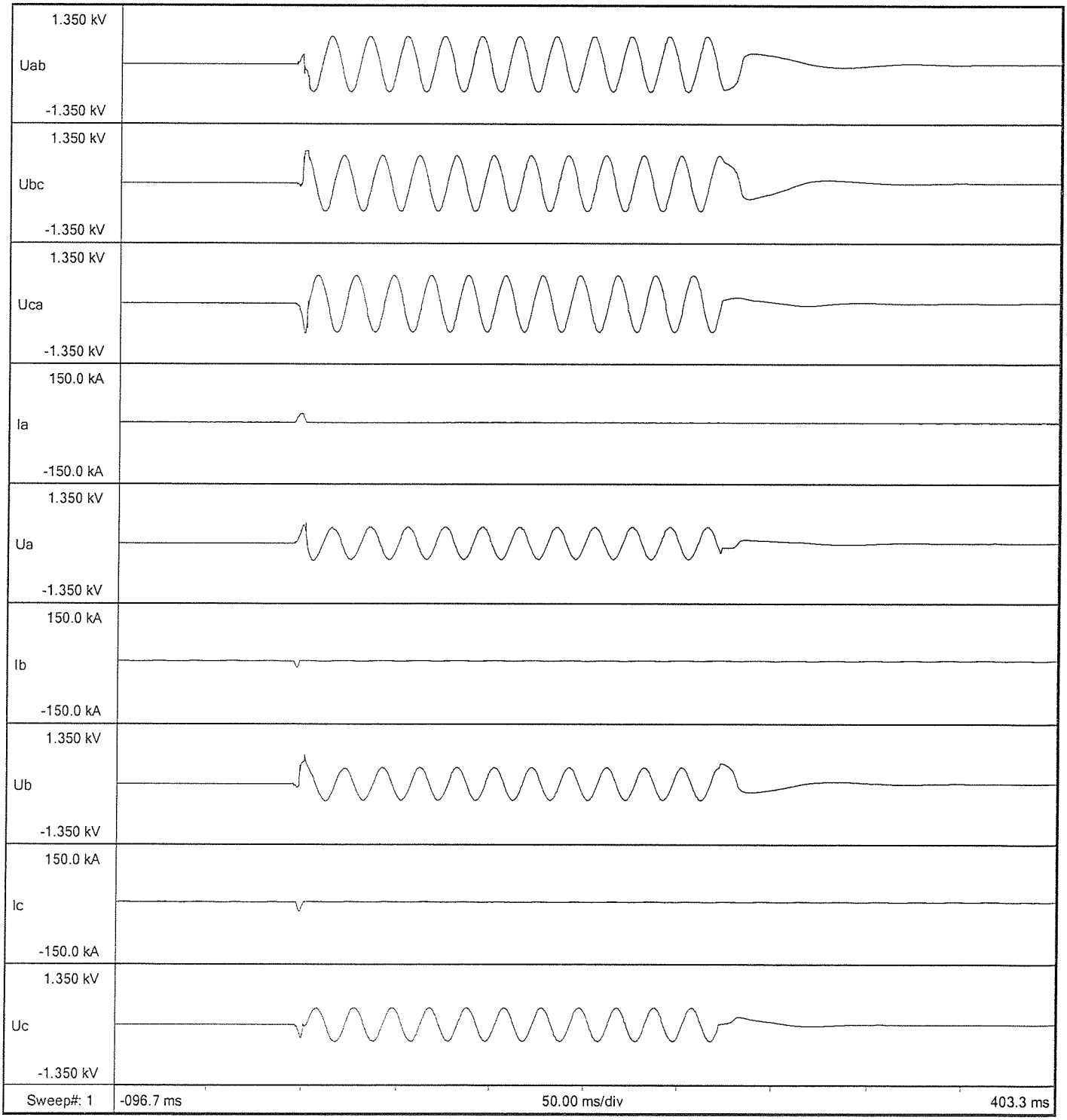
50kA verification of short-circuit breaking	The oscillogram No.:S13161407
The parameters of the prospective current:	U=447,2V I=50,9kA/Ip=108,6kA COSφ=0,23
Ip=52,2kA	$I^2t=11,6\times10^6A^2s$



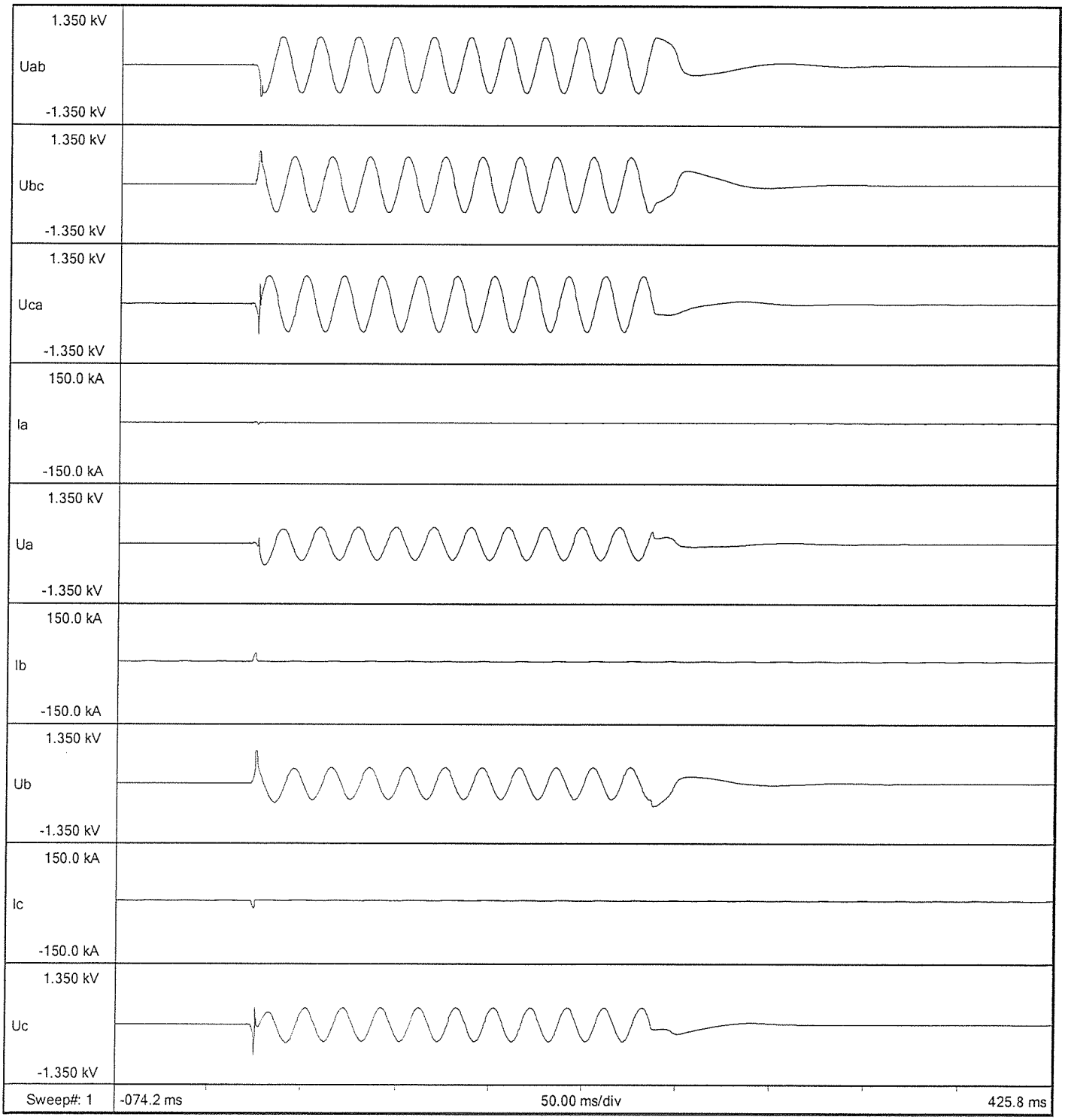
50kA verification of short-circuit breaking	The oscillogram No.:S13161408
The parameters of the prospective current:	U=447,2V I=50,9kA/Ip=108,6kA COSφ=0,23
Ip=42,5kA	$I^2t=5,5\times10^6A^2s$



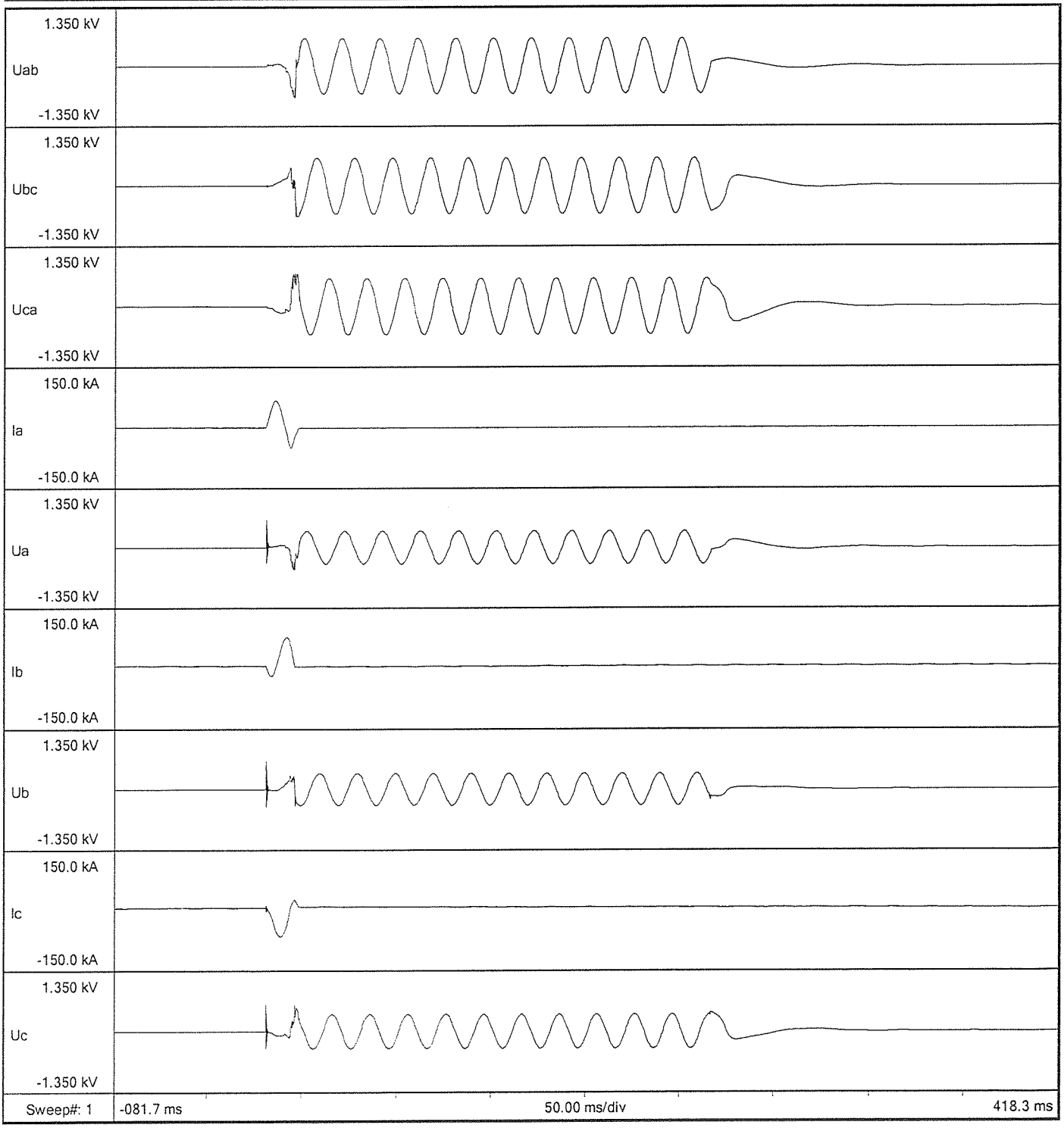
50kA verification of short-circuit breaking	The oscillogram No.:S13161409	
The parameters of the prospective current:	U=447,2V I=50,9kA/Ip=108,6kA	COSφ=0,23
Ip=26,4kA	$I^2t=1,6\times10^6A^2s$	



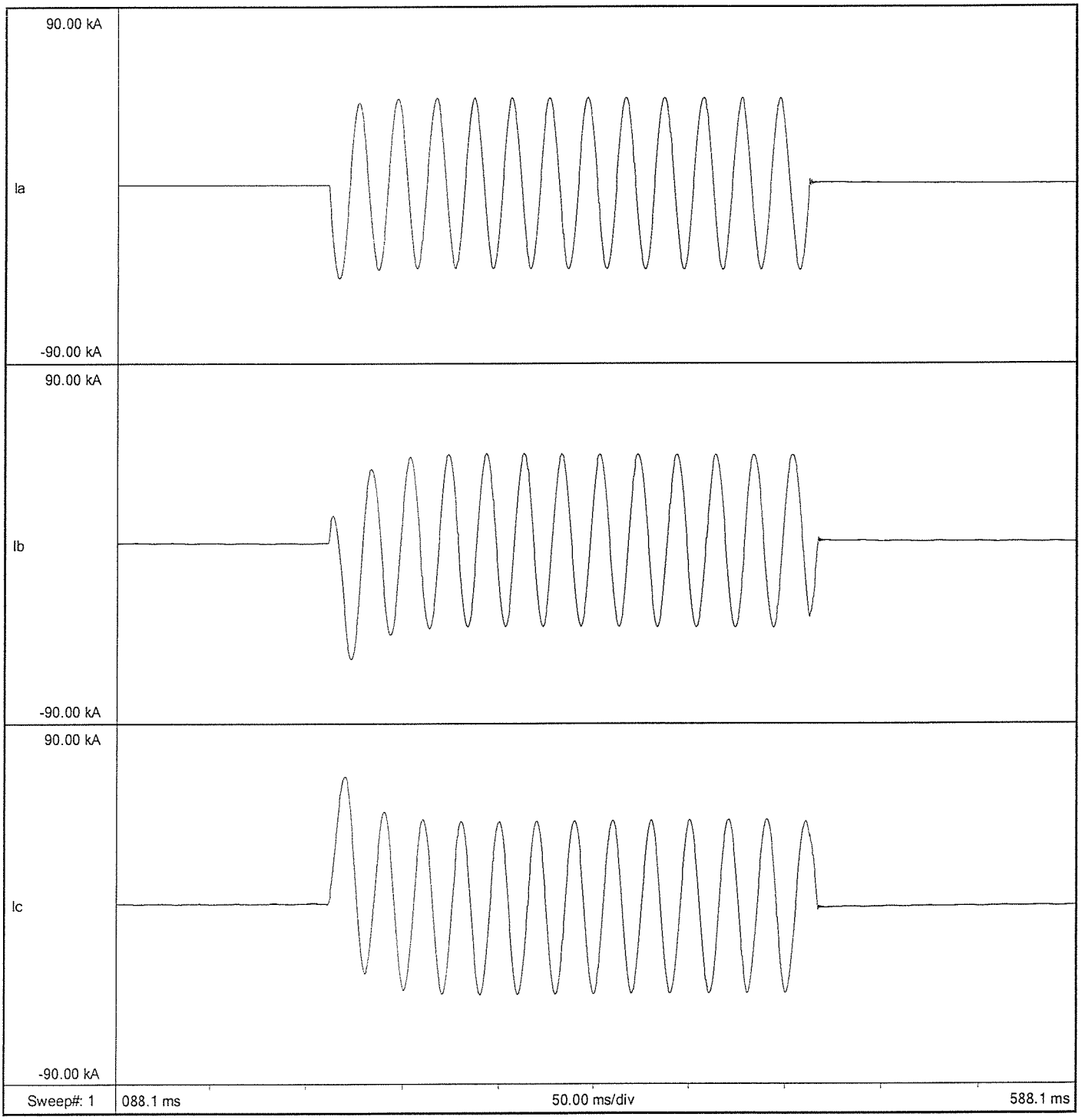
50kA verification of short-circuit breaking	The oscillogram No.:S13161410
The parameters of the prospective current: U=447,2V	I=50,9kA/Ip=108,6kA COSφ=0,23
Ip=21,6kA	$I^2t=0,5\times10^6A^2s$



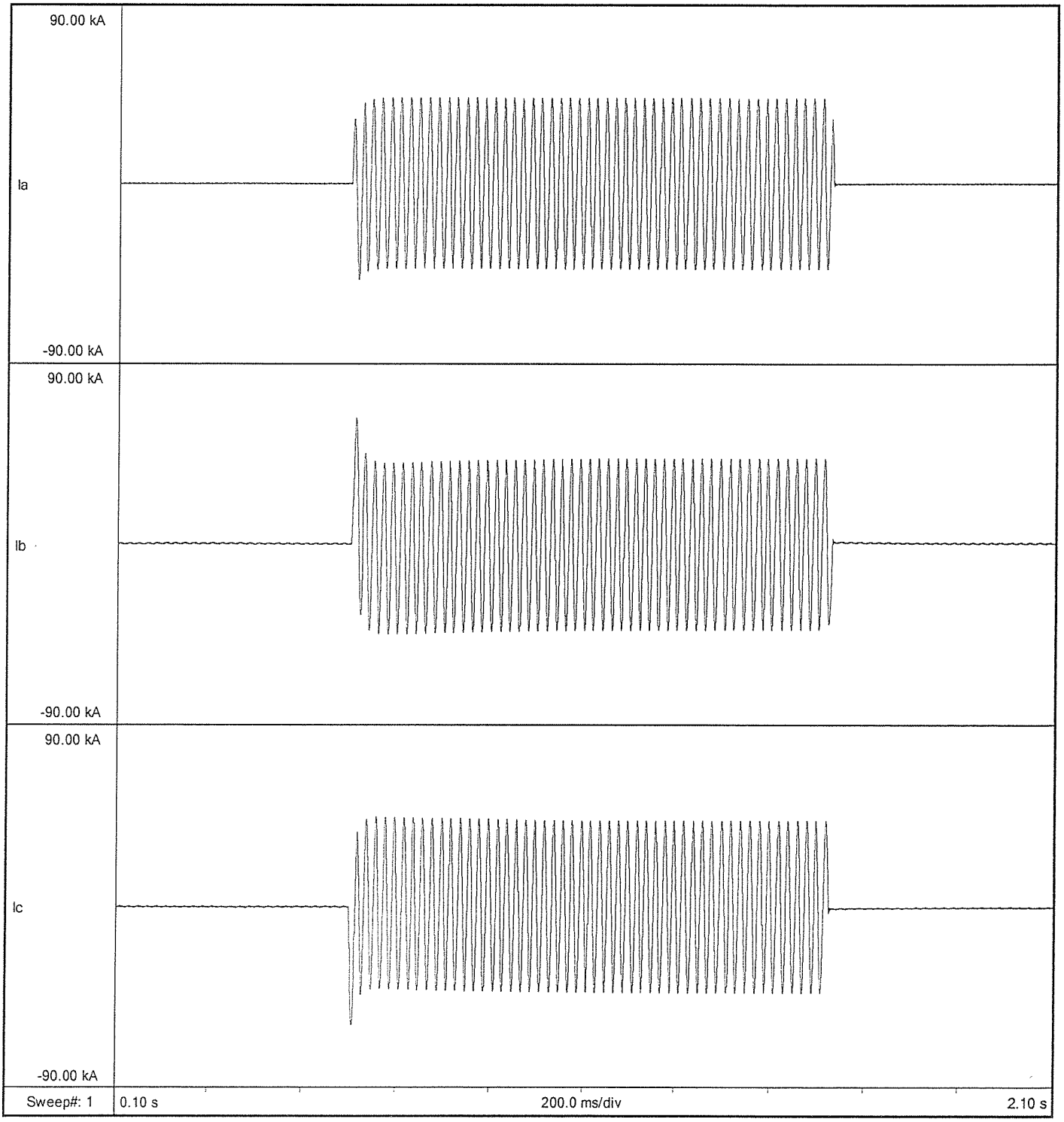
50kA verification of short-circuit breaking	The oscillogram No.:S13161411
The parameters of the prospective current:	U=447,2V I=50,9kA/Ip=108,6kA COSφ=0,23
Ip=74,6kA	$I^2t=29,7\times10^6A^2s$



30kA three poles prospective current oscillogram		The oscillogram No.:S13161412
U=447,1V	I=30,8kA/Ip=64,0kA	COSφ=0,23



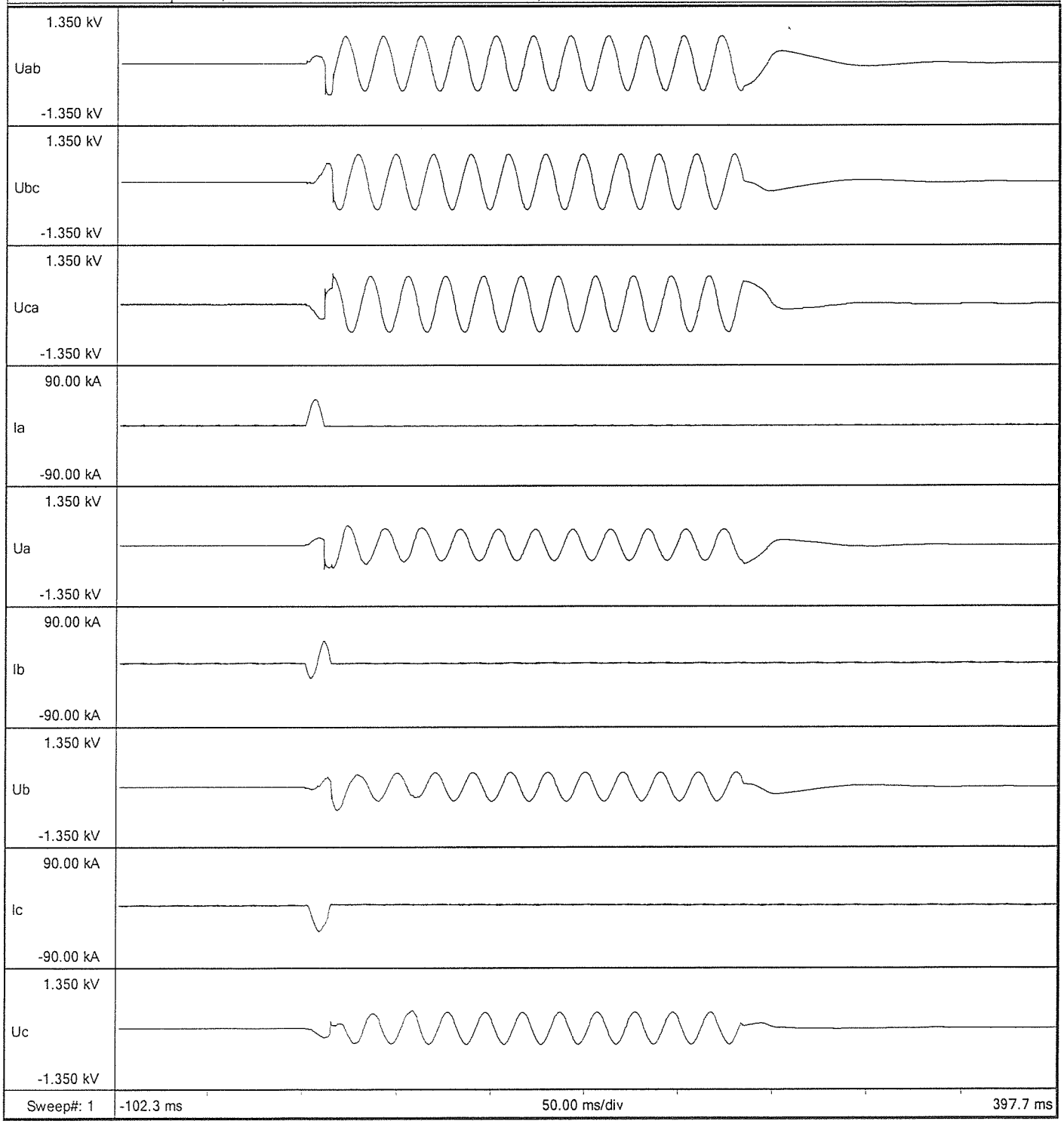
30kA verification of three poles short-circuit withstand strength The oscillogram No.:S13161413
The parameters of the prospective current: U=447,1V I=30,8kA/Ip=64,0kA COSφ=0,23
Ip=63,5kA $I^2t=951,3\times10^6A^2s$ T=1,028s



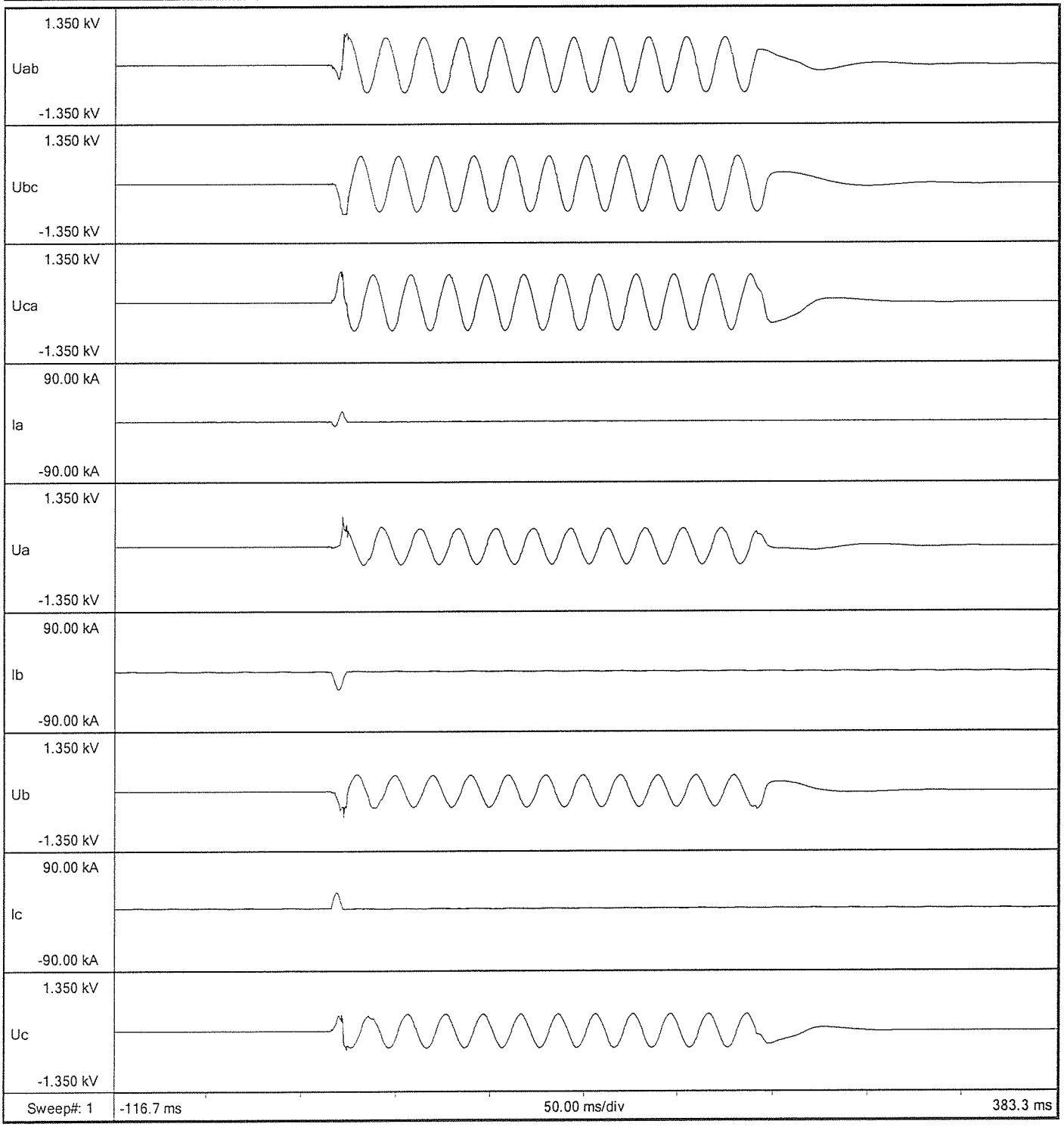
30kA verification of short-circuit breaking The oscillogram No.:S13161414

The parameters of the prospective current: U=447,1V I=30,8kA/Ip=64,0kA COSφ=0,23

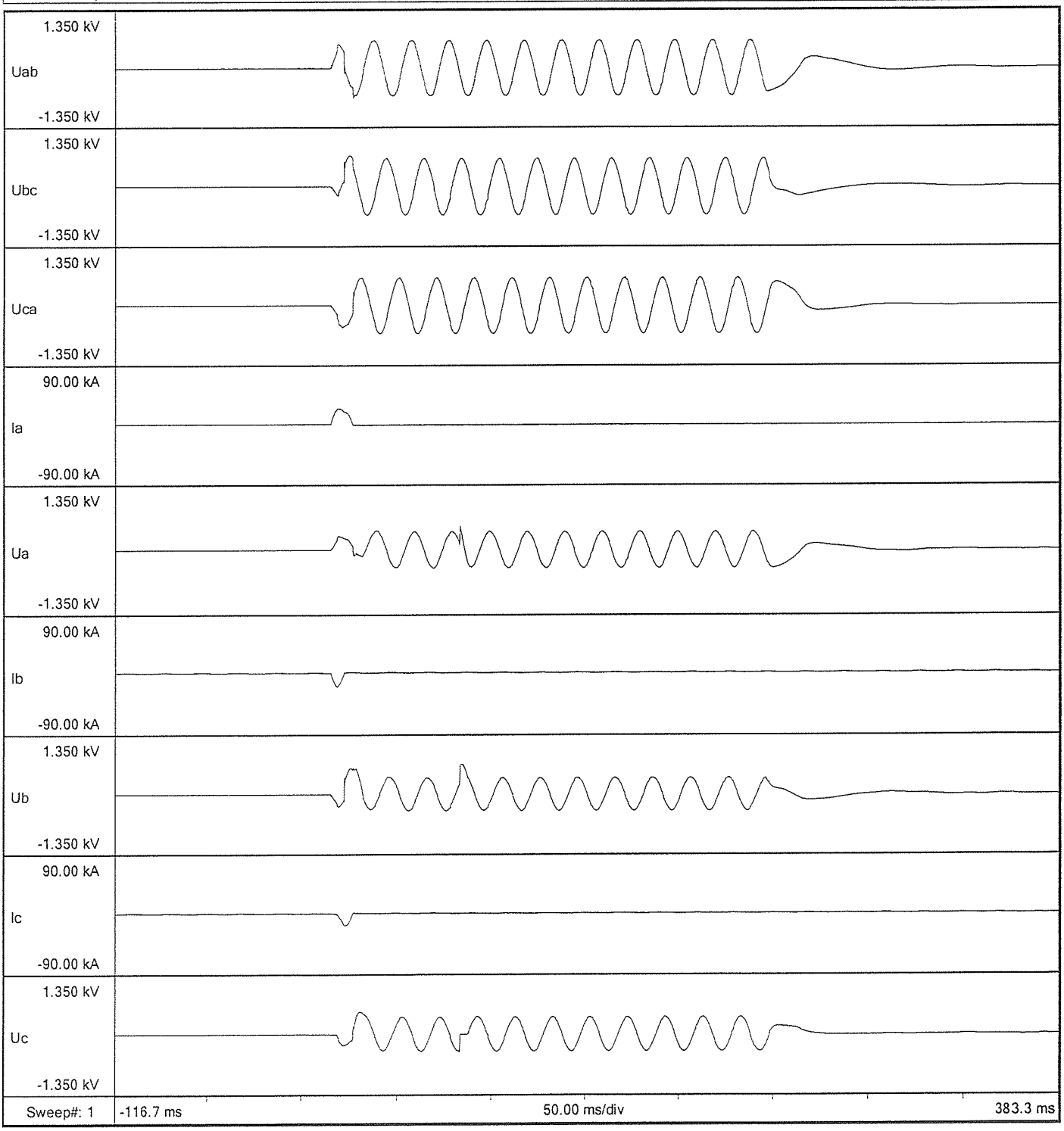
Ip=40,4kA $I^2t=9,0\times10^6A^2s$



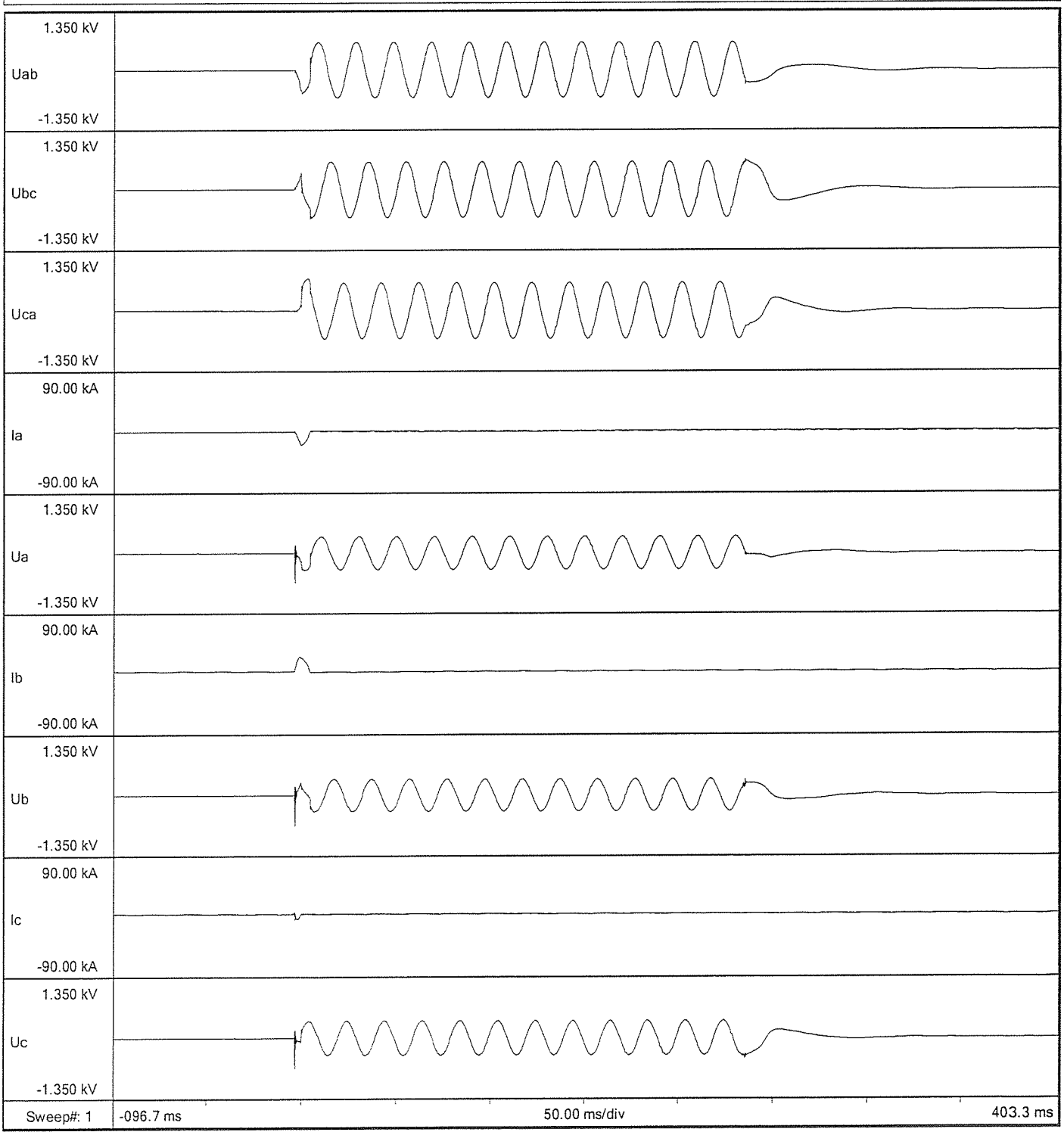
30kA verification of short-circuit breaking	The oscillogram No.:S13161415
The parameters of the prospective current: U=447,1V	I=30,8kA/Ip=64,0kA COSφ=0,23
Ip=28,3kA	$I^2t=2,6\times10^6A^2s$



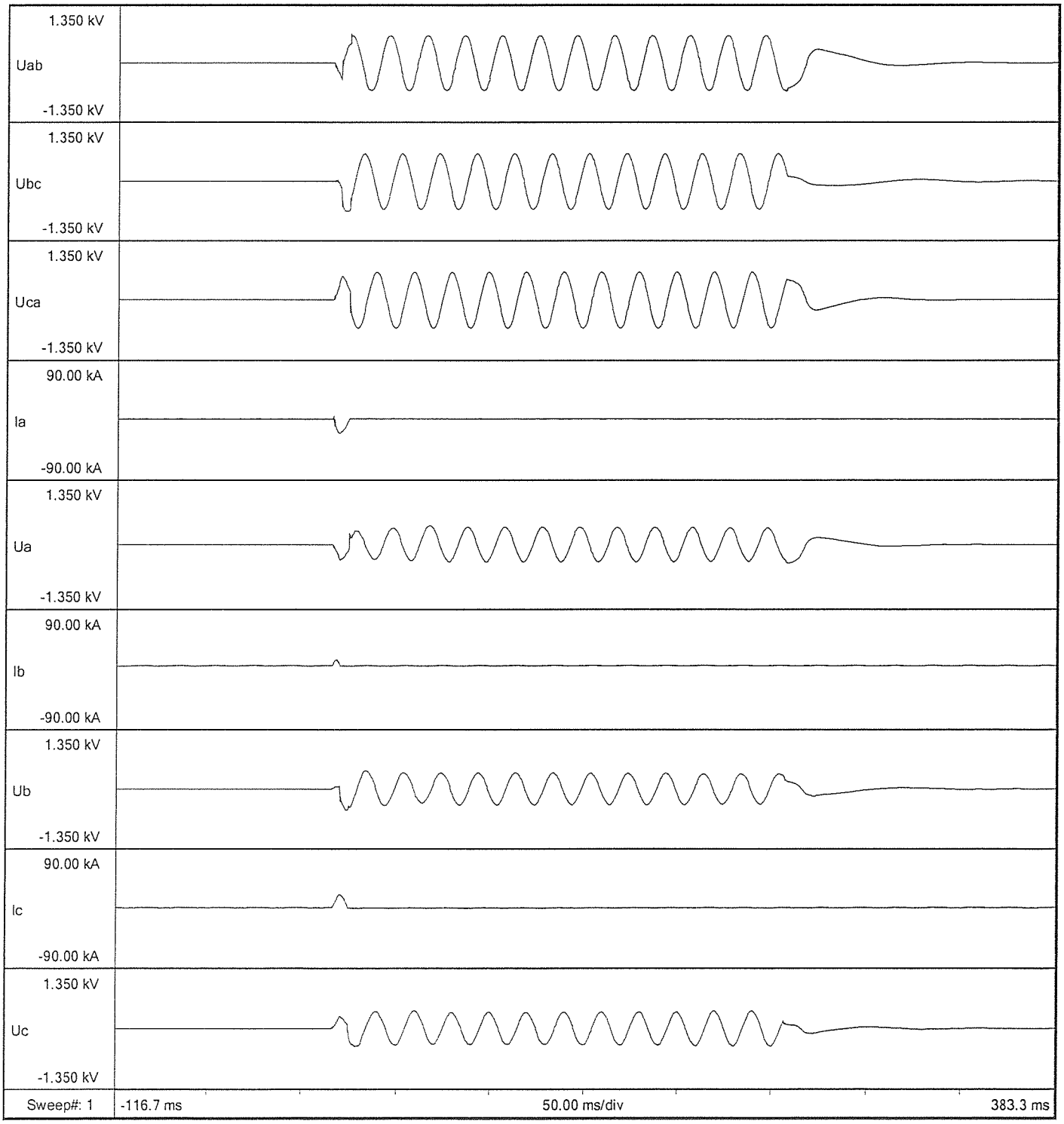
30kA verification of short-circuit breaking	The oscillogram No.:S13161416
The parameters of the prospective current: U=447,1V	I=30,8kA/Ip=64,0kA COSφ=0,23
Ip=25,6kA	$I^2t=2,7\times10^6A^2s$



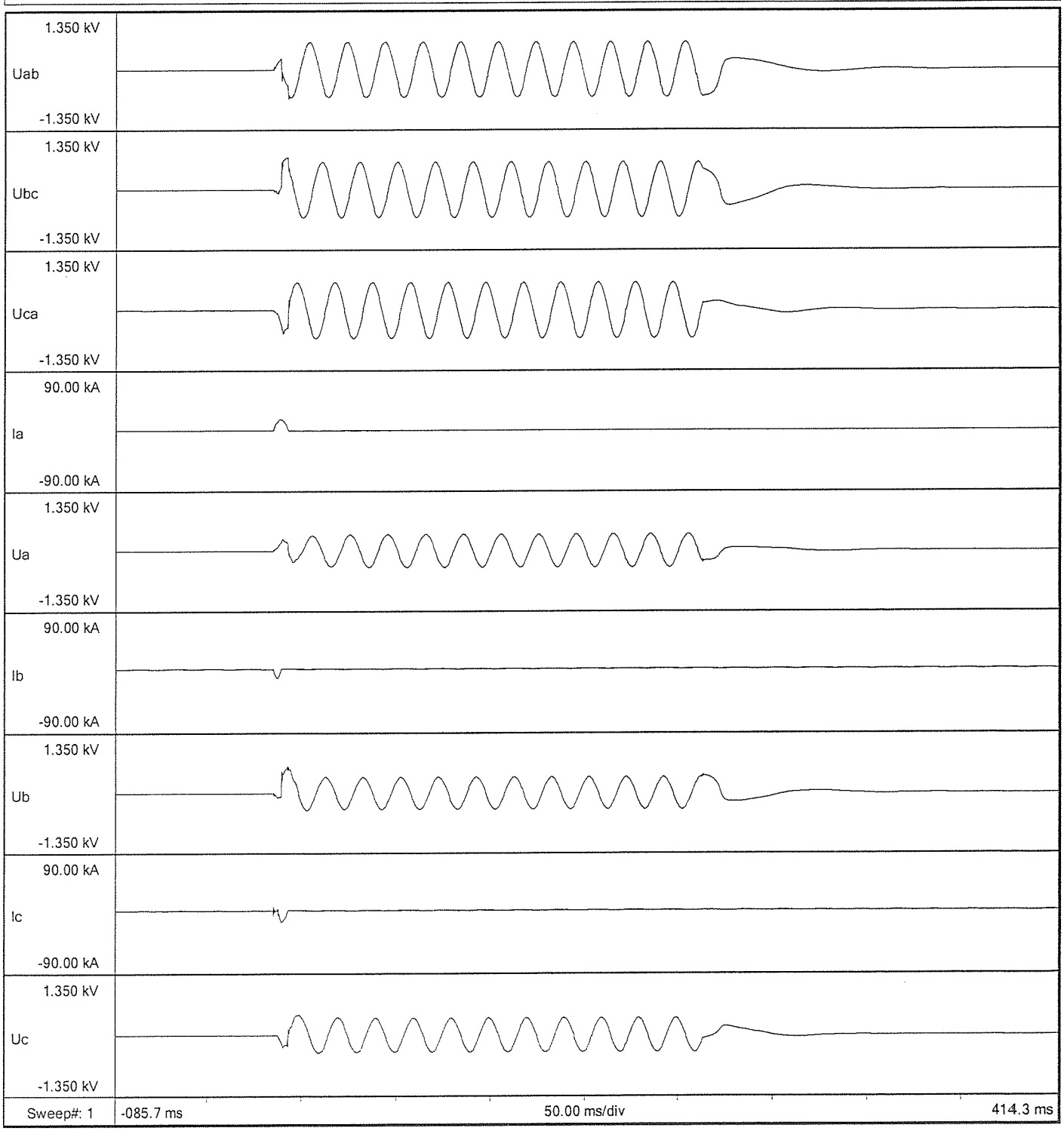
30kA verification of short-circuit breaking	The oscillogram No.:S13161417	
The parameters of the prospective current: U=447,1V	I=30,8A/Ip=64,0kA	COSφ=0,23
Ip=23,4kA	$I^2t=2,2\times10^6A^2s$	



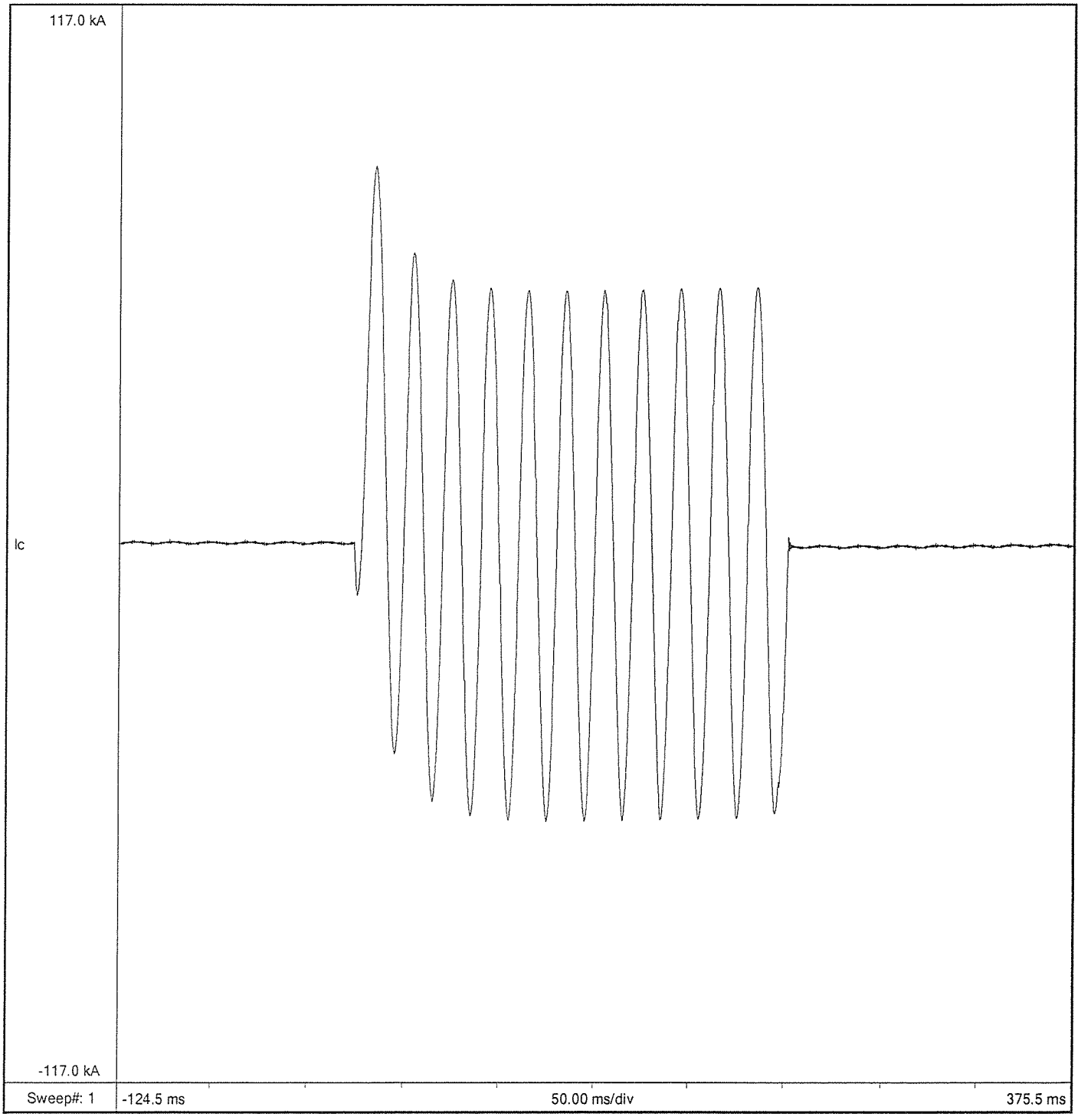
30kA verification of short-circuit breaking	The oscillogram No.:S13161418
The parameters of the prospective current: U=447,1V	I=30,8kA/Ip=64,0kA COSφ=0,23
Ip=23,0kA	$I^2t=2,1\times10^6A^2s$



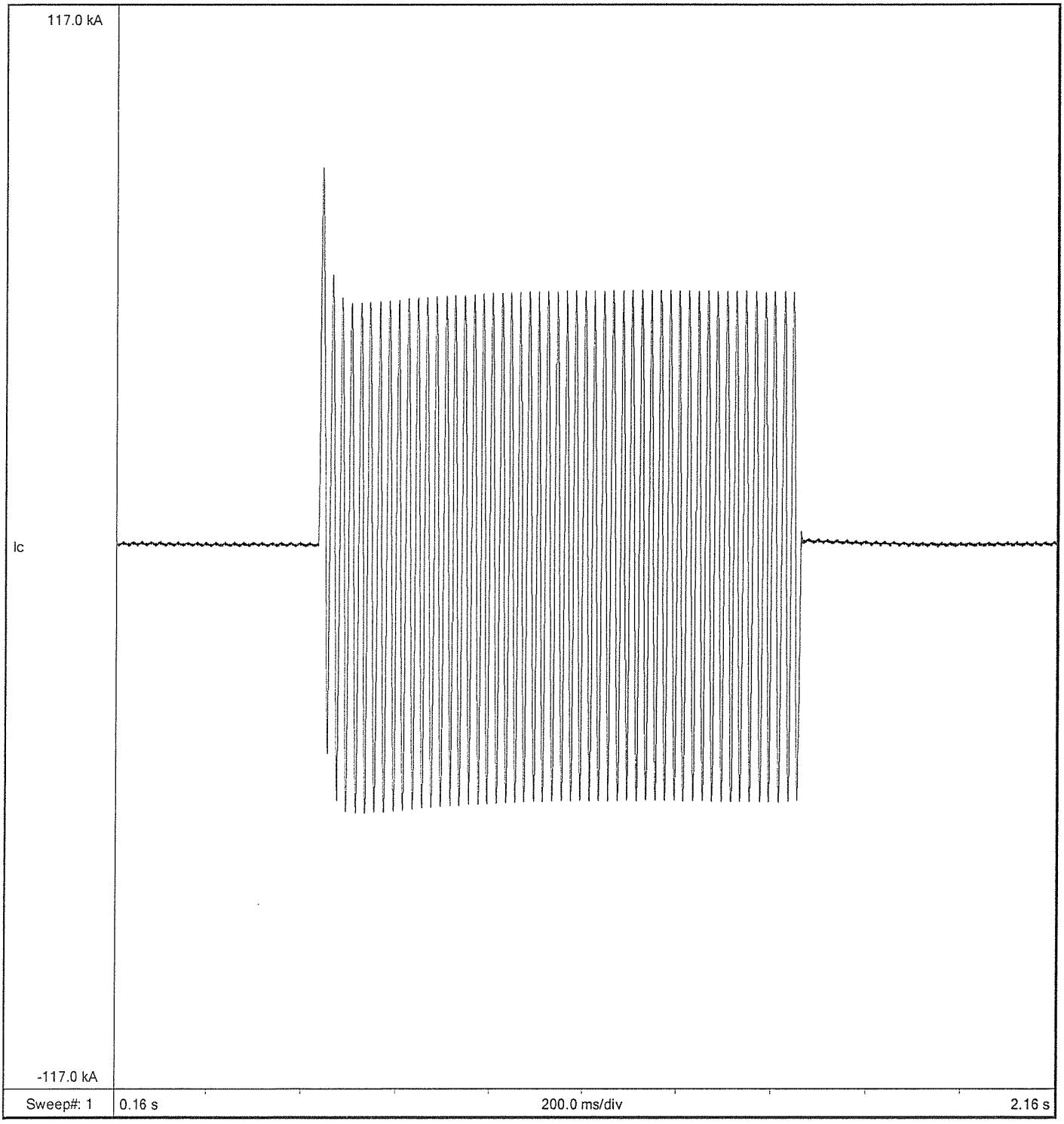
30kA verification of short-circuit breaking	The oscillogram No.:S13161419
The parameters of the prospective current:	U=447,1V I=30,8kA/Ip=64,0kA COSφ=0,23
Ip=17,4kA	$I^2t=1,2\times10^6A^2s$



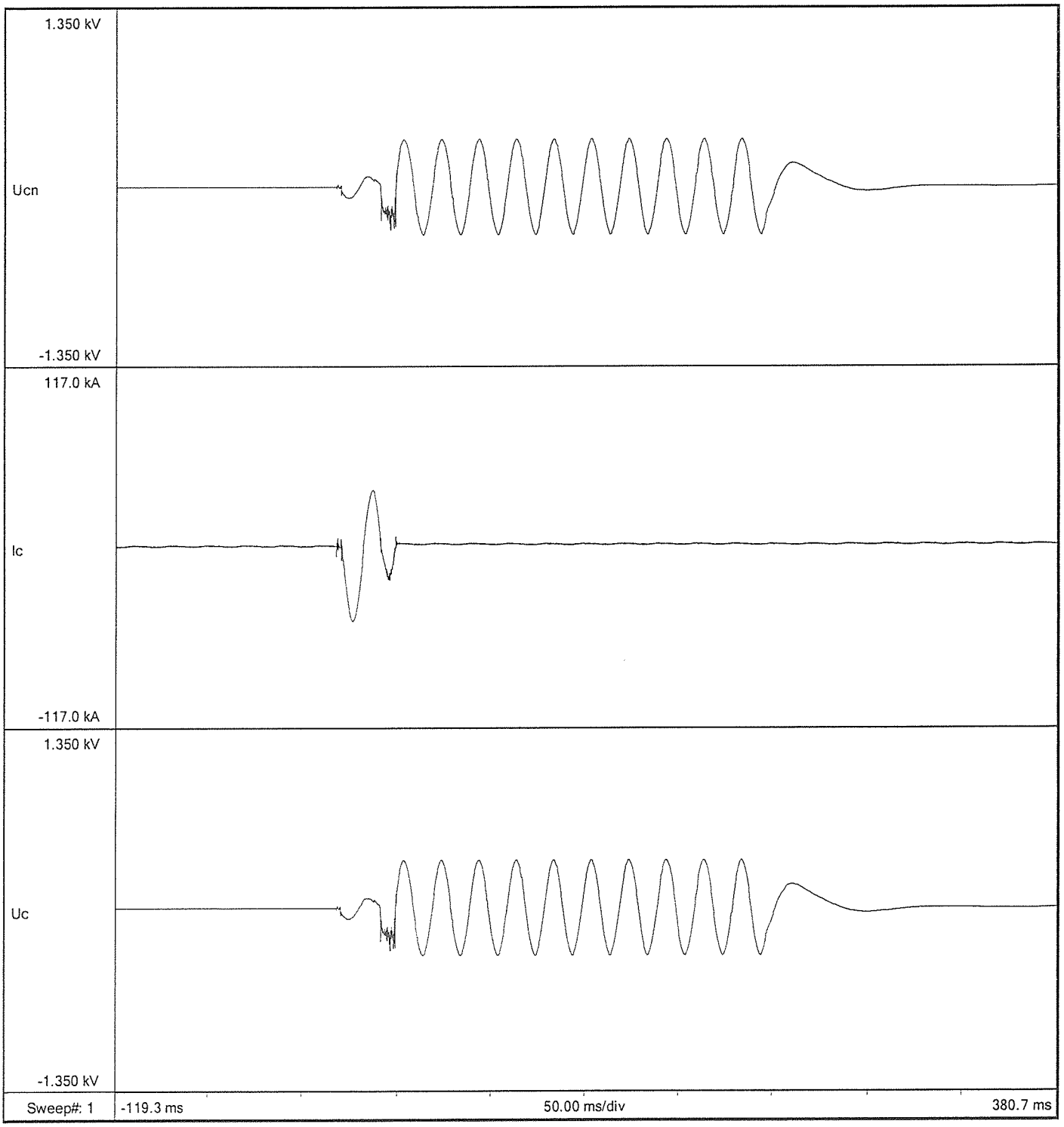
39kA single pole prospective current oscillogram	The oscillogram No.: S13161420
U=258,4V	I=40,8kA/Ip=82,3kA COSφ=0,23



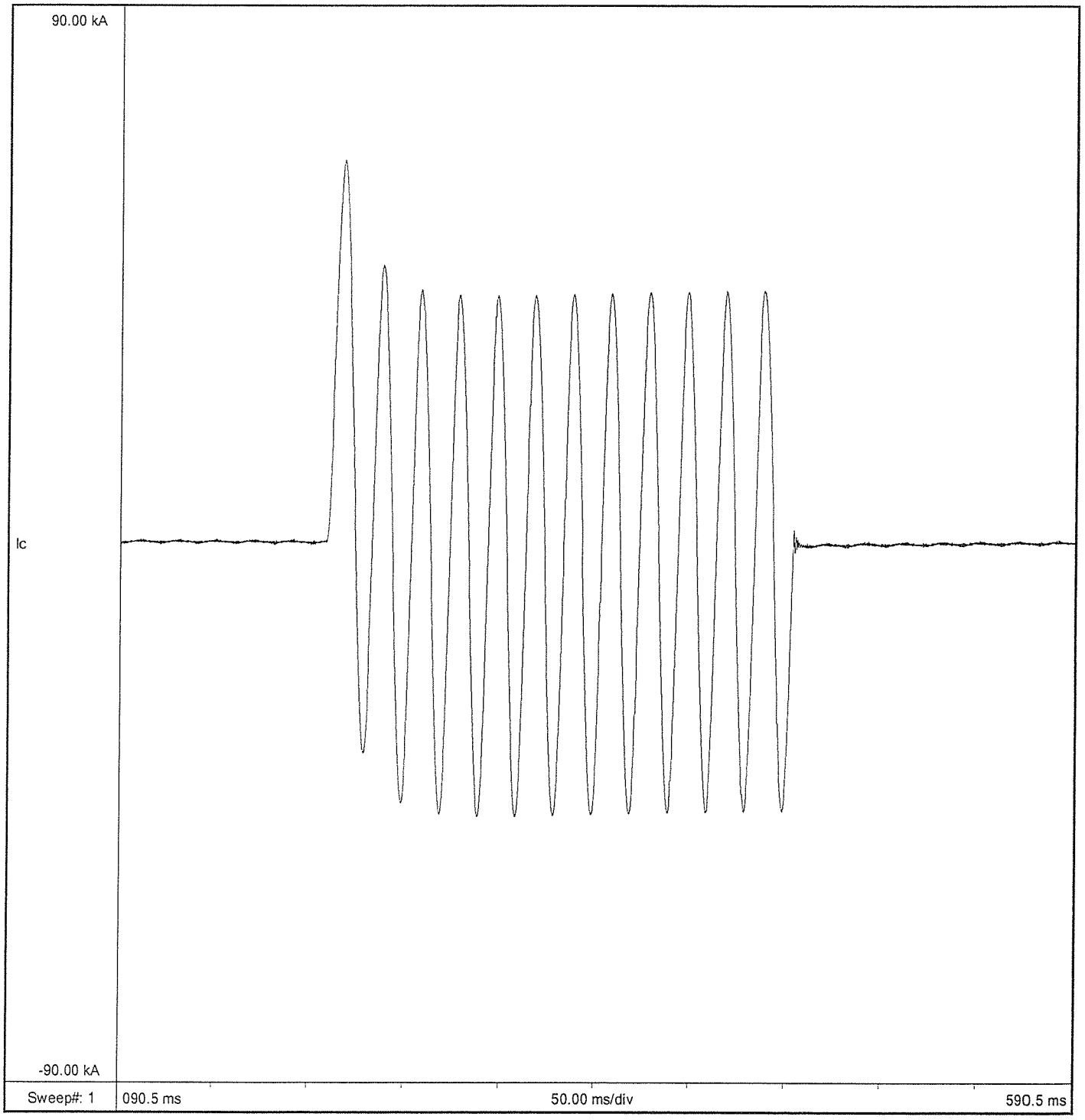
Verification of short-circuit withstand strength of the N busbars The oscillogram No.:S13161421
The parameters of the prospective current: U=258,4V I=40,8kA/Ip=82,3kA COSφ=0,23
Ip=82,0kA I^2t=1600,7×10^6A^2s T=1,026s



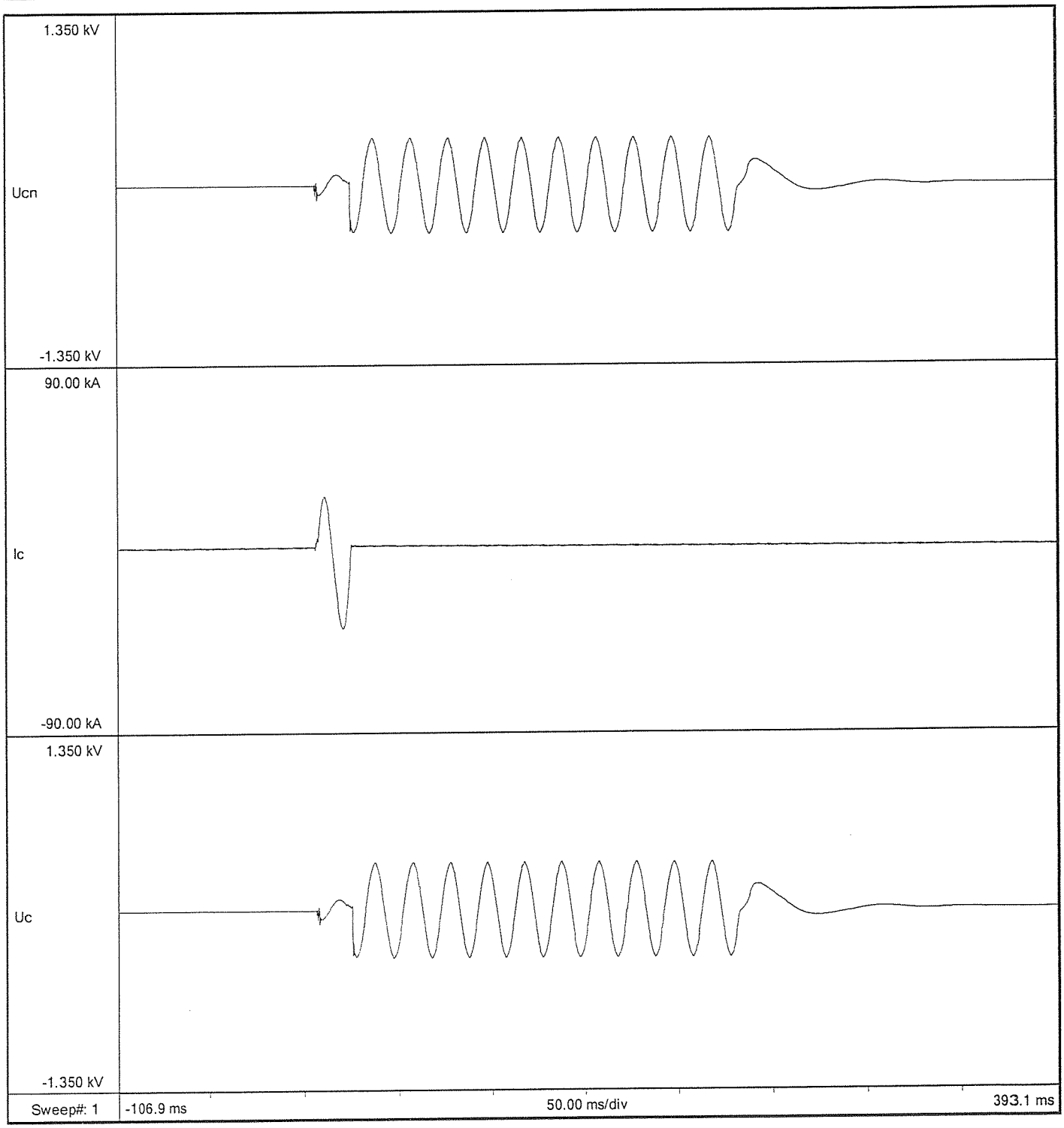
Verification of short-circuit strength of the protection circuit The oscillogram No.:S13161422
The parameters of the prospective current: U=258,4V I=40,8kA/Ip=82,3kA COSφ=0,23
Ip=48,2kA $I^2t=21,4\times10^6A^2s$



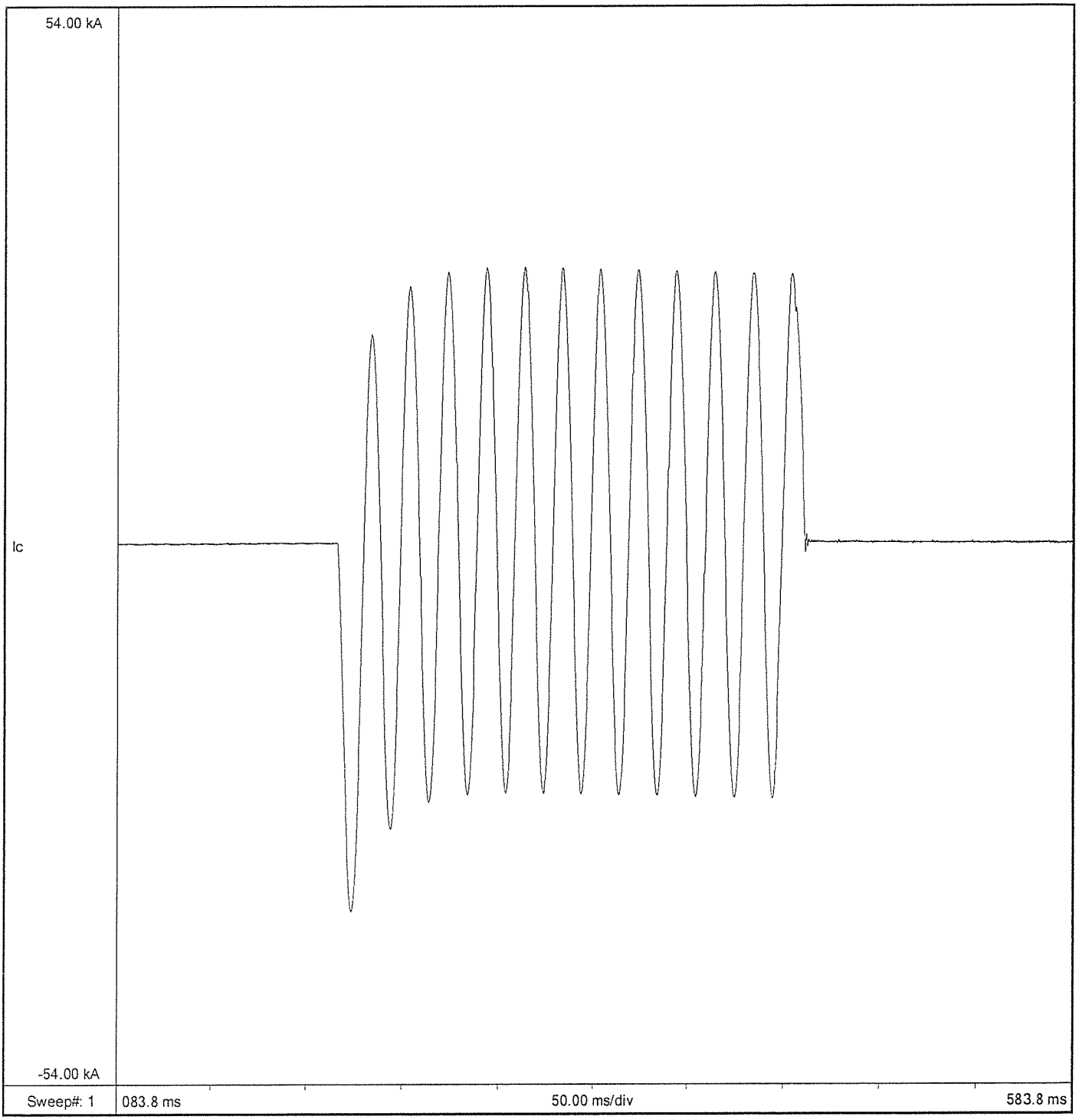
30kA single pole prospective current oscillogram	The oscillogram No.: S13161423
U=258,2V I=30,8kA/Ip=64,3kA	COSφ=0,23



Verification of short-circuit strength of the protection circuit	The oscillogram No.:S13161424
The parameters of the prospective current: U=258,2V I=30,8kA/Ip=64,3kA	COSφ=0,23
Ip=40,5kA	$I^2t=9,8\times10^6A^2s$



18kA single pole prospective current oscillogram	The oscillogram No.: S13161425
U=257,8V I=18,7kA/Ip=37,0kA	COSφ=0,28



Verification of short-circuit strength of the protection circuit	The oscillogram No.:S13161426
The parameters of the prospective current: U=257,8V	I=18,7kA/Ip=37,0kA COSφ=0,28
Ip=14,0kA	$I^2t=0,6\times10^6A^2s$