

<input type="checkbox"/>	NO EXCEPTIONS NOTED
<input checked="" type="checkbox"/>	EXCEPTIONS NOTED REVISE & RESUBMIT
<input checked="" type="checkbox"/>	RETURN FOR CORRECTIONS
<input type="checkbox"/>	FOR INFORMATION ONLY
REVIEW DOES NOT RELIEVE CONTRACTOR FROM RESPONSIBILITY FOR ERRORS OR DEVIATIONS FROM CONTRACT REQUIREMENTS	
SIGNATURE	DATE
PT. PLN (Persero) UTP JBB	

PLN Comment:

- Periksa kesesuaian TPG dengan TPG kontrak
- Periksa kesesuaian TPG dengan Outline Drawing
- Beri definisi pada Outline untuk spesifikasi yang muncul dalam TPG
- Agar ditambahkan cap dan tanda tangan dari PT Twink dan pabrikan pada setiap halaman TPG
- Agar ditambahkan tanda tangan pada cover

A	YASRIN	EKO	SUJATMOKO	FOR APPROVAL
	30-09-2024	30-09-2024	30-09-2024	FA
REV	DESIGNED DATE	CHECKED DATE	APPROVED DATE	DESCRIPTION
				STATUS

CLIENT : **PT PLN (PERSERO)**

UNIT INDUK PEMBANGUNAN
JAWA BAGIAN BARAT

CONTRACTOR: **CONSORTIUM**

	
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PT TWINK INDONESIA **PT MULTIFABRINDO GEMILANG**

SUBCONTRACTOR : **SIEMENS energy** **PT SIEMENS ENERGY INDONESIA**

PROJECT : PEMBANGUNAN GITET 500kV CIKANDE BESERTA OUTLET TERKAIT				CONTRACT NO : 0173.PJ/DAN.01.03/F01020000/2024	
				DRAWING TITLE : 500KV CIKANDE	
DESIGNED	30-09-2024	YASRIN		500kV Circuit Breaker Technical Specification	
CHECKED	30-09-2024	EKO			
APPROVED	30-09-2024	SUJATMOKO			
EM	<input checked="" type="checkbox"/>	SCALE	SIZE	DRAWING NO : 0173-GI500-CKD-E-018-A	SHEET No. 1
CIVIL	<input type="checkbox"/>	NTS	A4		LAST SHEET 9
SURVEY	<input type="checkbox"/>				REV. A

TECHNICAL PARTICULAR AND GUARANTEE

TPG.2.1.AIS.500KV : CIRCUIT BREAKER AIS 500 KV (LINE BAY AND DIAMETER BAY WITH CLOSING RESISTOR)

NO	DESCRIPTION	UNIT	REQUIRED	PROPOSED AND GUARANTEE
1	Manufacturer Type Designation Standard	-	To be mentioned To be mentioned SPLN T3.011-1:2021; IEC 62271-100 dan IEC 62271-1	Siemens Energy 3AP3FI-550KV SPLN T3.011-1:2021; IEC 62271-100 dan IEC 62271-1
2	Service condition	-	Outdoor, Tropical area	Outdoor, Tropical area
3	Type of circuit breaker	-	Live Tank	Live Tank
4	Type of arc quenching medium	-	SF6	SF6
5	Number of phases	phase	3	3
6	Rated voltage (U_r)	kV _{rms}	550	550
7	Rated frequency (F_r)	Hz	50	50
8	Rated normal current (I_r)	A _{rms}	≥ 4000	4000
a.	For line bay	A _{rms}	NA	NA
b.	For transformer bay	A _{rms}	≥ 4000	4000
c.	For diameter bay	A _{rms}	50	50
9	Rated short-time withstand current (I_k)	KA _{rms}	50	50
10	Rated peak withstand current (I_p)	KA _{peak}	$\geq 2.5 \times I_k$	$\geq 2.5 \times I_k (50) = 125$
11	Rated duration of short circuit	s	3	3
12	Rated insulation level : Power frequency withstand voltage, dry for 1 minute - Phase to earth, between the phases Impulse withstand voltage (at 1.2/50 microsecond) - Phase to earth, between the phases Switching withstand voltage (at 250/2500 microsecond) - Phase to earth and across the open breaker gap - Between the phases	kV _{rms} kV _{peak} kV _{peak} kV _{peak}	620 1550 1175 1760	620 1550 1175 1760



TECHNICAL PARTICULAR AND GUARANTEE

TPG.2.1.AIS.500KV : CIRCUIT BREAKER AIS 500 KV (LINE BAY AND DIAMETER BAY WITH CLOSING RESISTOR)

NO	DESCRIPTION	UNIT	REQUIRED	PROPOSED AND GUARANTEE
13	Minimum creepage distance (<i>select as appropriate</i>)	mm/kV	31	31
14	Operating sequence and operating duty - Nominal sequence (rapid auto-reclosing/dead time) - Out of phase	-	O - 0.3s - CO - 180s - CO O - CO	O - 0.3s - CO - 180s - CO O - CO
15	Rated making and breaking current to Normal/Reclose - Making current - Breaking current (symmetrical) - DC component	kA _{peak} kA _{rms} %	≥ 2.5 x I _{th} 50 > 20	2.5 x I _{th} (50) = 12.5 50 > 20
16	Breaking current under out of phase condition	kA _{rms}	≥ 0.25 x I _{th}	2.5 x I _{th} (50) = 12.5
17	Rated capacitive switching currents	A _{rms}	Refer to IEC 62271-100 table 9	Refer to IEC 62271-100 table 9
18	Radio influence voltage (RIV) level, measured at 1.1 U _r /√3 at 1 Mhz	μV	≤ 2500	≤ 2500
19	Classes - Electrical endurance - Transient recovery voltage - First pole-to-clear factor - Mechanical endurance - Restrike performance	- - - - -	E1 Refer to IEC 62271-100 table 26 1.3 (2.0 in out-of-phase condition) M2 C2	E1 Refer to IEC 62271-100 table 26 1.3 (2.0 in out-of-phase condition) M2 C2
20	Temperature rise at : - Contacts in SF6 - Connection, bolted or equivalent in SF6 - Terminal	°K	≤ 65 ≤ 75 ≤ 65	≤ 65 ≤ 75 ≤ 65



TECHNICAL PARTICULAR AND GUARANTEE

TPG.2.1.AIS.500KV : CIRCUIT BREAKER AIS 500 KV (LINE BAY AND DIAMETER BAY WITH CLOSING RESISTOR)

NO	DESCRIPTION	UNIT	REQUIRED	PROPOSED AND GUARANTEE
	MECHANISM			
21	Number of interrupters in series per phase	pcs	2	2
22	Number of tripping coils per phase	pcs	2	2
23	Number of closing coils per phase	pcs	1	1
24	Operating mechanism :			
	- Type	-	Motor - Spring	Motor - Spring
	- Number of stored energy operation	-	3 (One per phase)	3 (One per phase)
25	Protection level of control cubicle	-	IP54	IP54
26	Supply voltage :			
	- Control voltage	VDC	110	110
	- Tripping and closing coils	VDC	110	110
	- Motor voltage	VAC	230/400	230
	- Heater	VAC	230	230
27	Tolerance range for auxiliary supply voltage			
	- Tripping coil	%	70 to 110	70 to 110
	- Closing coil	%	85 to 110	85 to 110
	- Motor	%	85 to 110	85 to 110
28	Mechanical performance			
	1. Total break time (trip initiation to final arc extinction)	ms	≤ 40	≤ 40
	2. Opening time (trip initiation to contact separation) without current	ms	≤ 30	≤ 30
	3. Time interval between opening of interrupters of first and last phase	ms	≤ 4	≤ 4
	4. Time interval between opening of interrupters of one phase	ms	≤ 2.5	≤ 2.5
	5. Closing time without current	ms	≤ 110	≤ 110
	6. Time interval between closure of interrupters of the first and last pole	ms	≤ 10	≤ 10
	7. Time interval between closure of interrupters of one phase	ms	≤ 3	≤ 3
	8. Time from extinction of main arc to contact make during auto-reclose duty	ms	≤ 300	≤ 300
29	Number of spare for auxiliary contacts (NO/NC) per pole	pcs	> 10	> 10



TECHNICAL PARTICULAR AND GUARANTEE

TPG.2.1.AIS.500KV : CIRCUIT BREAKER AIS 500 KV / LINE BAY AND DIAMETER PAY WITH CLOSING RESISTOR)

NO	REN EM UIP JBB: Agar dapat disamakan dengan narasi dalam dokumen kontrak tertulis: OTHERS Discrepancy device Antipumping device Method of controlling Method of closing control Value of closing resistor Pre-insertion time of closing resistor Number of SF6 Pressure Indicator Number of counter for recording number of operations Seismic condition (<i>according to seismic map</i>) Leakage rate of SF6 gas per annum Contact resistance across main contacts per phase Number of switch operations between two inspections for changing the main-contacts : - With rated continuous current - With rated breaking current Material of insulator Minimum clearance in air : - Between phase - Phase to earth - Live conductor to ground level - Live insulator to ground level Test certificates Catalogue, drawings, manual and other references	UP perhitungan	ED Belum ada lampiran perhitungan	PROPOSED AND GUARANTEE
31	-	-	Yes	Yes
32	-	-	Yes	Yes
33	-	-	Capacitor	Capacitor
34	-	-	Closing resistor	Closing resistor
35	Ohm	≥ 400	≥ 400	800
36	ms	10	10	10 ± 2
37	pcs	3 (One for one phase)	3 (One for one phase)	3 (One for one phase)
38	pcs	3 (One for one phase)	3 (One for one phase)	3 (One for one phase)
39	g	$\geq 0,3$	$\geq 0,3$	$\geq 0,3$
40	%	$\leq 0,5$	$\leq 0,5$	$\leq 0,5$
41	μOhm	< 80	< 80	< 80
42	-	-	-	6000
43	-	-	-	10
44	-	-	-	Porcelain
45	-	-	Refer to outline drawing	≥ 5700
46	-	-	-	8264
		-	-	8068
		-	-	7721
		-	Attached	Attached
		-	-	Tidak terdefinisiakan di dalam Outline
		-	-	Tidak terdefinisiakan di dalam Outline



TECHNICAL PARTICULAR AND GUARANTEE

TPG.2.2.AIS.500KV : CIRCUIT BREAKER AIS 500 KV (LINE BAY, TRAFO BAY AND DIAMETER BAY WITHOUT CLOSING RESISTOR)

NO	DESCRIPTION	UNIT	REQUIRED	PROPOSED AND GUARANTEE
	Manufacturer Type Designation	-	To be mentioned To be mentioned	Siemens Energy 3AP2FI-550KV
1	Standard		SPLN T3.011-1:2021; IEC 62271-100 dan IEC 62271-1	SPLN T3.011-1:2021; IEC 62271-100 dan IEC 62271-1
2	Service condition		Outdoor, Tropical area	Outdoor, Tropical area
3	Type of circuit breaker		Live Tank	Live Tank
4	Type of arc quenching medium		SF6	SF6
5	Number of phases	phase	3	3
6	Rated voltage (U_r)	kV _{rms}	550	550
7	Rated frequency (F_r)	Hz	50	50
8	Rated normal current (I_r)			
a.	For line bay		NA	NA
b.	For transformer bay		≥ 2500	2500
c.	For diameter bay		NA	NA
9	Rated short-time withstand current (I_k)	kA _{rms}	50	50
10	Rated peak withstand current (I_p)	kA _{peak}	$\geq 2.5 \times I_k$	$\geq 2.5 \times I_k (50) = 125$
11	Rated duration of short circuit	s	3	3
12	Rated insulation level : Power frequency withstand voltage, dry for 1 minute - Phase to earth, between the phases Impulse withstand voltage (at 1.2/50 microsecond) - Phase to earth, between the phases Switching withstand voltage (at 250/2500 microsecond) - Phase to earth and across the open breaker gap - Between the phases	kV _{rms} kV _{peak} kV _{peak} kV _{peak}	620 1550 1175 1760	620 1550 1175 1760



TECHNICAL PARTICULAR AND GUARANTEE

TPG.2.2.AIS.500KV : CIRCUIT BREAKER AIS 500 KV (LINE BAY, TRAFO BAY AND DIAMETER BAY WITHOUT CLOSING RESISTOR)

NO	DESCRIPTION	UNIT	REQUIRED	PROPOSED AND GUARANTEE
13	Minimum creepage distance (<i>select as appropriate</i>)	mm/kV	31	31
14	Operating sequence and operating duty - Nominal sequence (rapid auto-reclosing/dead time) - Out of phase	-	O - 0.3s - CO - 180s - CO O - CO	O - 0.3s - CO - 180s - CO O - CO
15	Rated making and breaking current to Normal/Reclose - Making current - Breaking current (symmetrical) - DC component	kA _{peak} kA _{rms} %	≥ 2.5 x I _{th} 50 > 20	≥ 2.5 x I _{th} (50) = 125 50 > 20
16	Breaking current under out of phase condition	kA _{rms}	≥ 0.25 x I _{th}	0.25 x I _{th} (50) = 12.5
17	Rated capacitive switching currents	A _{rms}	Refer to IEC 62271-100 table 9	Refer to IEC 62271-100 table 9
18	Radio influence voltage (RIV) level, measured at 1.1 U _r /√3 at 1 Mhz	μV	≤ 2500	≤ 2500
19	Classes - Electrical endurance - Transient recovery voltage - First pole-to-clear factor - Mechanical endurance - Restrike performance	- - - - -	E1 Refer to IEC 62271-100 table 26 1.3 (2.0 in out-of-phase condition) M2 C2	E1 Refer to IEC 62271-100 table 26 1.3 (2.0 in out-of-phase condition) M2 C2
20	Temperature rise at : - Contacts in SF6 - Connection, bolted or equivalent in SF6 - Terminal	°K	≤ 65 ≤ 75 ≤ 65	≤ 65 ≤ 75 ≤ 65



TECHNICAL PARTICULAR AND GUARANTEE

TPG.2.2.AIS.500KV : CIRCUIT BREAKER AIS 500 KV (LINE BAY, TRAFO BAY AND DIAMETER BAY WITHOUT CLOSING RESISTOR)

NO	DESCRIPTION	UNIT	REQUIRED	PROPOSED AND GUARANTEE
	MECHANISM			
21	Number of interrupters in series per phase	pcs	2	2
22	Number of tripping coils per phase	pcs	2	2
23	Number of closing coils per phase	pcs	1	1
24	Operating mechanism :			
	- Type	-	Motor - Spring	Motor - Spring
	- Number of stored energy operation	-	3 (One per phase)	3 (One per phase)
25	Protection level of control cubicle	-	IP54	IP54
26	Supply voltage :			
	- Control voltage	VDC	110	110
	- Tripping and closing coils	VDC	110	110
	- Motor voltage	VAC	230/400	230
	- Heater	VAC	230	230
27	Tolerance range for auxiliary supply voltage			
	- Tripping coil	%	70 to 110	70 to 110
	- Closing coil	%	85 to 110	85 to 110
	- Motor	%	85 to 110	85 to 110
28	Mechanical performance			
	1. Total break time (trip initiation to final arc extinction)	ms	≤ 40	≤ 40
	2. Opening time (trip initiation to contact separation) without current	ms	≤ 30	≤ 30
	3. Time interval between opening of interrupters of first and last phase	ms	≤ 4	≤ 4
	4. Time interval between opening of interrupters of one phase	ms	≤ 2.5	≤ 2.5
	5. Closing time without current	ms	≤ 110	≤ 110
	6. Time interval between closure of interrupters of the first and last pole	ms	≤ 10	≤ 10
	7. Time interval between closure of interrupters of one phase	ms	≤ 3	≤ 3
	8. Time from extinction of main arc to contact make during auto-reclose duty	ms	≤ 300	≤ 300
29	Number of spare for auxiliary contacts (NO/NC) per pole	pcs	> 10	> 10



TECHNICAL PARTICULAR AND GUARANTEE

TPG.2.2.AIS.500KV : CIRCUIT BREAKER AIS 500 KV (LINE BAY, TRAFO BAY AND DIAMETER BAY WITHOUT CLOSING RESISTOR)

NO	DESCRIPTION	UNIT	REQUIRED	PROPOSED AND GUARANTEE
	OTHERS			
31	Discrepancy device	-	Yes	Yes
32	Antipumping device	-	Yes	Yes
33	Method of controlling voltage distribution between break unit	-	Capacitor	Capacitor
34	Method of closing control	-	N.A	N.A
35	Value of closing resistor	Ohm	N.A	N.A
36	Pre-insertion time of closing resistor	ms	N.A	N.A
37	Number of SF6 Pressure Indicator	pcs	3 (One for one phase)	3 (One for one phase)
38	Number of counter for recording number of operations	pcs	3 (One for one phase)	3 (One for one phase)
39	Seismic condition (<i>according to seismic map</i>)	g	≥ 0.3	≥ 0.3
40	Leakage rate of SF6 gas per annum	%	≤ 0.5	≤ 0.5
41	Contact resistance across main contacts per phase	μOhm	< 80	< 80
42	Number of switch operations between two inspections for changing the main-contacts :			
	- With rated continuous current	-		6000
	- With rated breaking current	-		10
43	Material of insulator	-		Porcelain
44	Minimum clearance in air :			Refer to outline drawing
	- Between phase	-	≥ 5700	≥ 5700
	- Phase to earth	-	≥ 8264	≥ 8264
	- Live conductor to ground level	-	8068	8068
	- Live insulator to ground level	-	7721	7721
45	Test certificates	-		Attached
46	Catalogue, drawings, manual and other references	-		Attached

"Phase to Earth"
 Angka dalam TPG dan
 Outline tidak konsisten

perhitungan jarak "Phase to Phase" harus konsisten
 dengan "Phase to Earth"

mentioned (refer to IEC 61936-1)
 mentioned (refer to IEC 61936-1)
 mentioned (refer to IEC 61936-1)
 mentioned (refer to IEC 61936-1)

Tidak terdefinisiakan
 di dalam Outline

Tidak terdefinisiakan
 di dalam Outline



BROCHURE & TYPE TEST



From 72.5 kV up to 800 kV

High-Voltage Circuit Breakers



Customized products with the shortest delivery times
from our global circuit breaker production network

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3AP1 FG 145 kV



3AP4 FI 800 kV pole



Live tank circuit breakers



Compact circuit breakers



3AP1 DTC 145 kV



3AP1 DTC 245 kV

Circuit breakers from Siemens

The availability of electric energy is vital for economic development and for quality of life. One of the necessary conditions for a reliable electric power supply is a well functioning transmission system. We are the only company worldwide that supports customers along the entire chain of energy conversion, with an efficient range of products, solutions and know-how for the transmission and distribution of electrical energy from one source. Circuit breakers are the central part of air-insulated (AIS) and gas-insulated (GIS) switchgear. High-voltage circuit breakers are mechanical switching devices which connect and break current circuits (operating currents and fault currents) and carry the nominal current in closed position.

As a world market leader, Siemens takes the responsibility to provide circuit breakers which meet the environmental, technological and economic conditions in the various countries worldwide. More than 90,000 circuit breakers delivered to more than 140 countries prove this.

In this brochure, we are pleased to inform you about our well established product portfolio in the high-voltage range starting from 72.5 kV up to 800 kV and a brand-new prototype for 1200 kV. It comprises live tank and dead tank circuit breakers as well as hybrid solutions combining different functions in a compact design, such as our Dead Tank Compact (DTC) and our Disconnecting Circuit Breaker (DCB).

All our products are manufactured based on our proven modular design encompassing identical interrupter units, operating mechanisms and control elements for all circuit breaker types, whether for GIS or for AIS applications. They are available with porcelain or composite insulators.

Furthermore, you will find out about our quality management over the product lifecycle from development through to operation at our customers' locations. This quality management covers, among other things, service and customer training.

As an outlook for our future ambitions we are also glad to present you a prototype of the next generation in high-voltage switchgear technology. This new generation of circuit breakers performs completely without SF₆ but with a vacuum interrupter based on 40 years of experience in medium power networks up to 52 kV.

In line with our vision as worldwide trendsetter, Siemens engineers have now advanced this vacuum technology for applications above 52 kV to keep pace with our customers' economical as well as ecological requirements. Siemens has introduced the world's first SF₆-free circuit breaker with vacuum technology for 72.5 kV. Our daily work is to continue this new trend.

We are looking forward to your feedback, questions and remarks. Please do not hesitate to contact us at circuit-breaker@siemens.com or at one of our 1,640 Siemens locations worldwide.



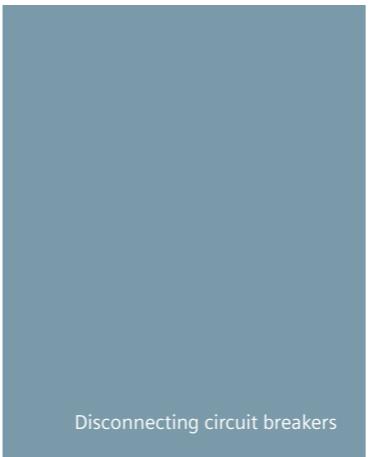
3AP1 DT 145 kV



3AP2 DT 550 kV pole



Dead tank circuit breakers



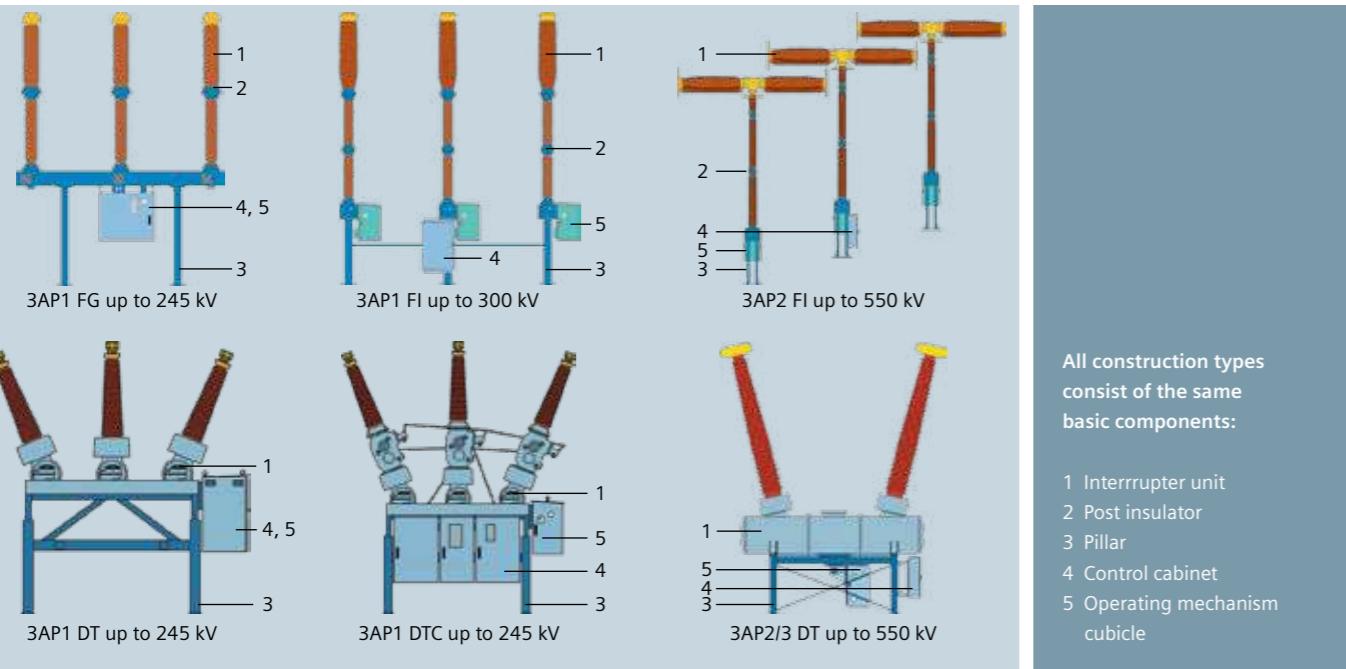
Disconnecting circuit breakers



3AP1 DCB 145 kV

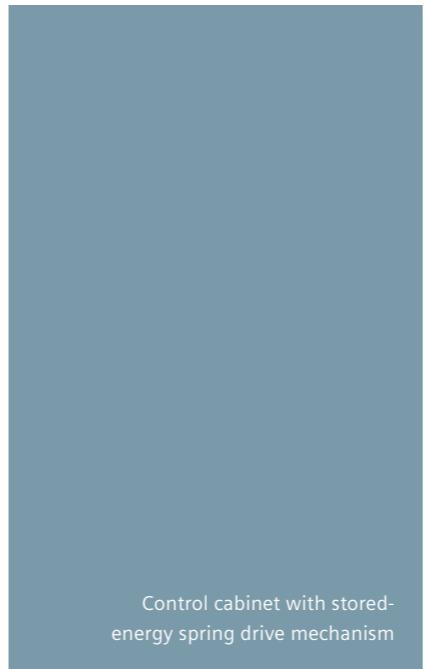


3AP2 DCB 420 kV pole



All construction types consist of the same basic components:

- 1 Interrupter unit
- 2 Post insulator
- 3 Pillar
- 4 Control cabinet
- 5 Operating mechanism cubicle



Control cabinet with stored-energy spring drive mechanism



Modular design

Few basic components leading to a high diversity of types

Siemens high-voltage circuit breakers, regardless of type or voltage range, are designed in a well proven modular platform concept. This leads to a high diversity of circuit breaker types and to high flexibility with regard to various applications according to our customers' requirements.

- The main components, such as
 - operating mechanism
 - control system
 - base frame
 - kinematic chain and
 - insulator designs

are identical and based on decades of manufacturing and operating experience. Our GIS switchgear range also includes the same interrupter units, operating mechanisms and control elements. By applying this proven modular design not only at our lead factory in Germany, but also within our global manufacturing network, we are able to fulfill the highest expectations regarding availability and reliability at eminently competitive prices.

This modular principle can also be found in the type definition of our high voltage circuit breakers.

3AP1 FG	Three-pole outdoor circuit breaker
3AP1 FG	Name of circuit breaker series (P, Q, T, V)
3AP1 FG	Interrupter units per pole
3AP1 FG	Spring (F) / hydraulic (E) operated mechanism
3AP1 FG	G: 1 mechanism + 1 common base E: 3 mechanisms + 1 common base I: 3 mechanisms + 3 separate bases
3AP1 DT	DT: Dead Tank DTC: Dead Tank Compact DCB: Disconnecting Circuit Breaker

Control

The control system includes the secondary technical components required for operating the circuit breaker, which are mainly arranged in the control cabinet. The current transformer connections are also located in the control cabinet. The control, tripping, motor and heating power supplies can be selected by the customer. Two standard control variants are available depending on your requirements.

Basic variant

The basic variant includes all control and monitoring elements that are needed for operation of the circuit-breaker, including the following:

- 19 auxiliary switch contacts (9 normally open, 9 normally closed, 1 wiper contact)
- Switching operation counter
- Local actuator

Compact variant

In addition to the basic variant, this compact variant includes:

- Spring monitoring by motor run time monitoring
- Heating monitoring (current measuring relay)
- Light and socket attachment with a common circuit breaker to facilitate servicing and maintenance work

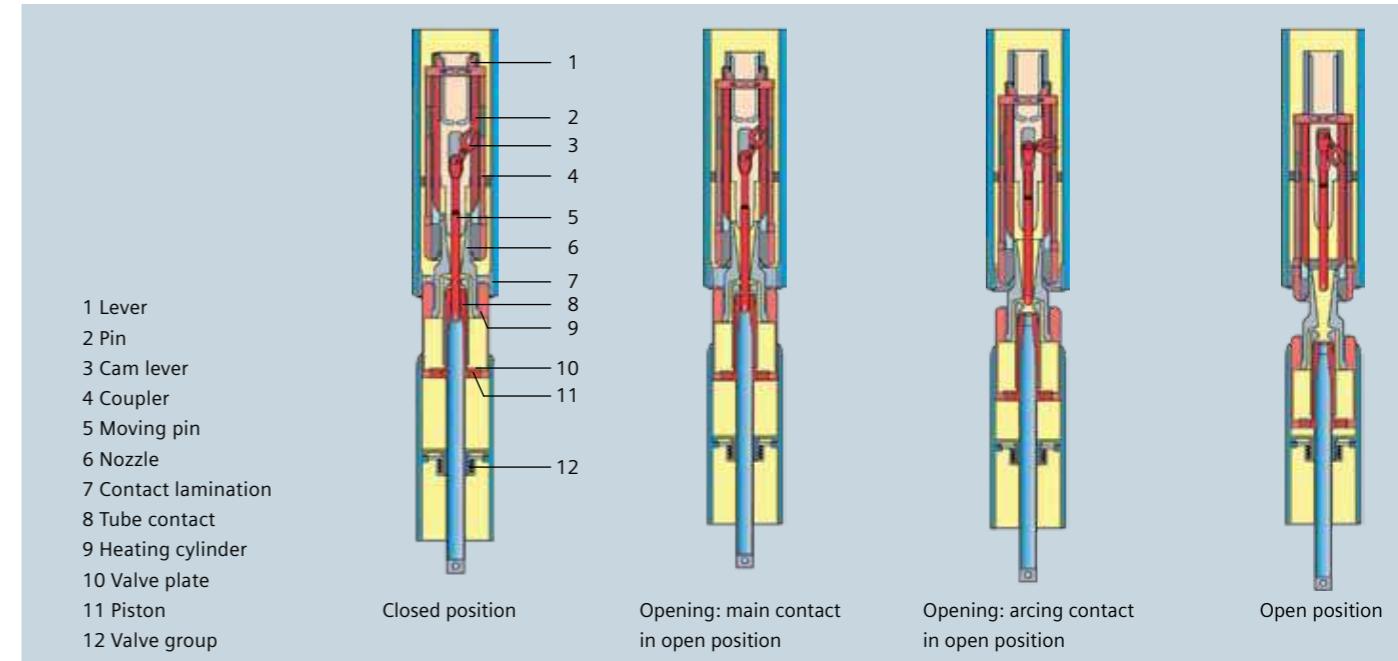
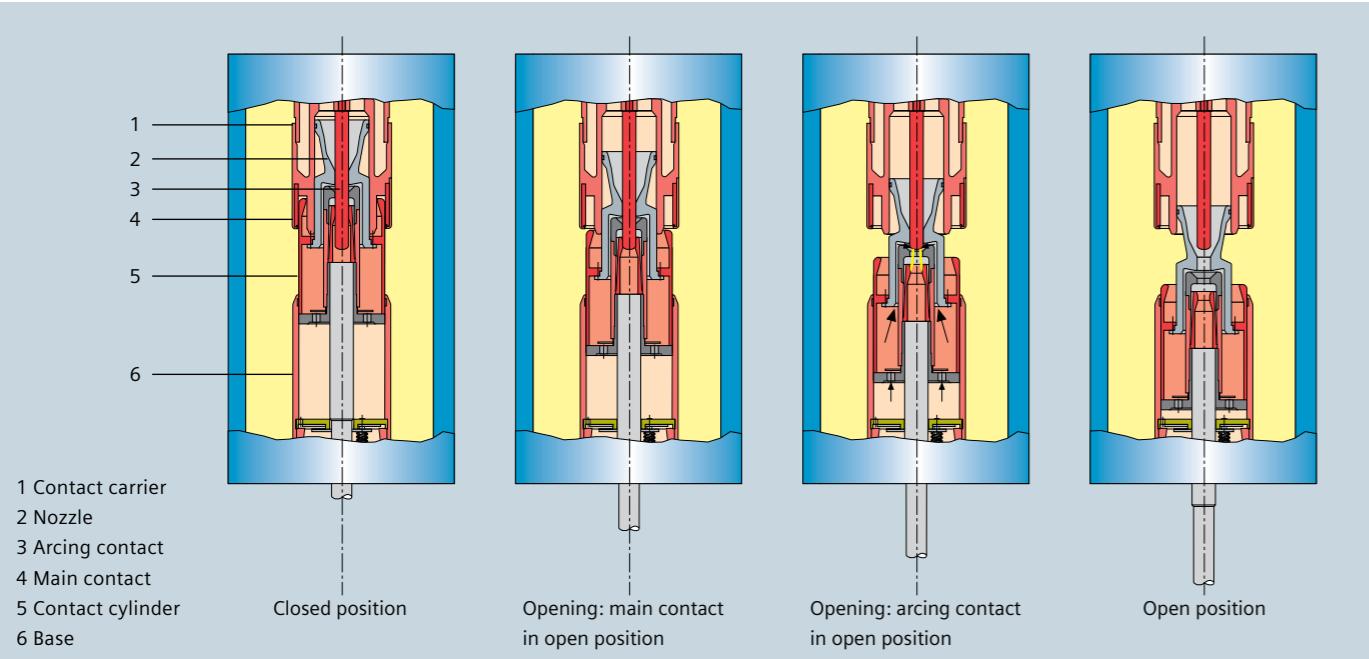
- Overvoltage attenuation
- Motor circuit breaker
- Heating circuit breaker

Special features

Above and beyond these two standard variants, a large number of further components and options are at our customers' disposal. Every control configuration of a circuit breaker can therefore be designed individually. All control components have been type-tested for use on our circuit breakers. They are completely located in a weatherproof cubicle (IP 55 degree of protection), they are resistant to switching vibrations, and they meet the requirements for electromagnetic compatibility (EMC). The circuit breaker's documentation contains the wiring diagram of the control configuration. This diagram consists of the following documents:

- Circuit diagram
- Extended equipment diagram along with technical data and equipment parts list
- Connection diagram

Whether our customers prefer the basic variant or the compact variant, we are able to mount them on any circuit breaker of our portfolio. And if a customized control cabinet is needed, we are able to modify the control cabinet according to the customers' wishes.



Quenching principles

Our complete 3AP family up to 800 kV and above relies on our arc-quenching principles, either the self-compression or the dynamic self-compression principle using the thermal energy of the arc. Siemens patented this method for arc quenching in 1973 and has continued to develop the technology of the self-compression interrupter unit. In short-circuit breaking operations the actuating energy required is reduced to the energy needed for mechanical contact movement.

Self-compression principle

For applications up to 245 kV, our 3AP circuit breakers with self-compression principle ensure optimum switching performance under every operating condition.

Mode of operation

The current conducting path of the interrupter unit consists of the contact carrier (1), the base (6) and the movable contact cylinder (5). In the closed position, the current flows via the main contact (4) and the contact cylinder (5).

During the opening operation, the main contact (4) opens first, and the current commutes to the still closed arcing contact. During the further course of opening, the arcing contact (3) opens up and an arc is drawn between the contacts.

At the same time, the contact cylinder (5) moves into the base (6) and compresses the SF₆ gas located there. This gas compression creates a gas flow through the contact cylinder (5) and the nozzle (2) to the arcing contact, extinguishing the arc.

When it comes to interrupting a high short-circuit breaking current, the SF₆ gas is heated up considerably at the arcing contact due to the energy of the arc. This leads to a pressure increase in the contact cylinder. During the further course of opening, this increased pressure initiates a gas flow through the nozzle (2), extinguishing the arc. In this case, the arc energy is used to interrupt the fault circuit breaking current. This energy does not have to be provided by the operating mechanism.

Dynamic self-compression principle

From 245 kV onwards, the dynamic self-compression principle with two-way moving contacts is utilized in our 3AP type circuit breakers.

Mode of operation

In an opening operation, the main contact located between the contact lamination (7) and the heating cylinder (9) is opened. The arcing contact, consisting of the moving pin (5) and the tube contact (8) remains closed, with the result that the current commutes onto the arcing contact.

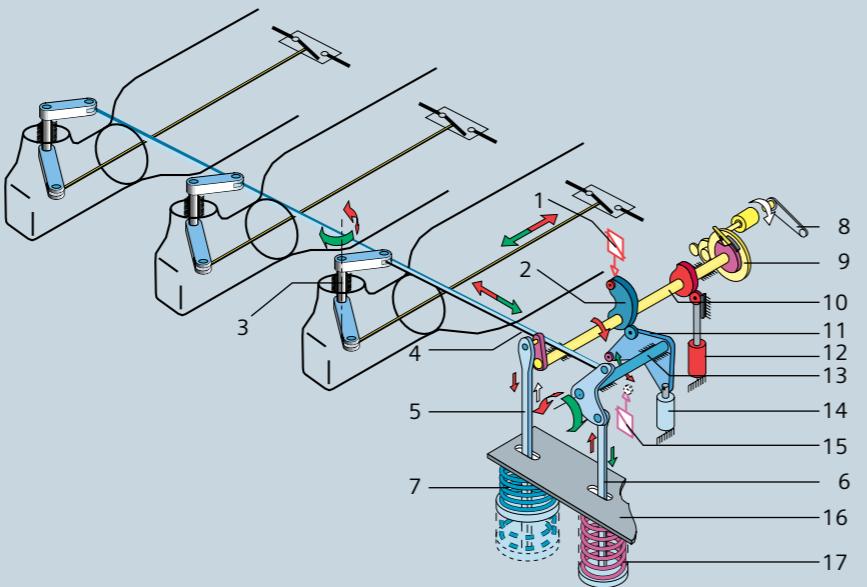
The moving pin (5) is moved against the direction of movement of the tube contact (8) by the connected components of heating cylinder (9), nozzle (6), connecting rod (4), pin (2), control lever (3) (circuit breaker opening movement).

The moved electrode is also pushed in the direction of the heating cylinder (9). During the continued course of the opening operation, the arcing contact opens, creating an arc. At the same time, the heating cylinder (9) moves to the left and compresses the quenching gas between piston (11) and valve group (12).

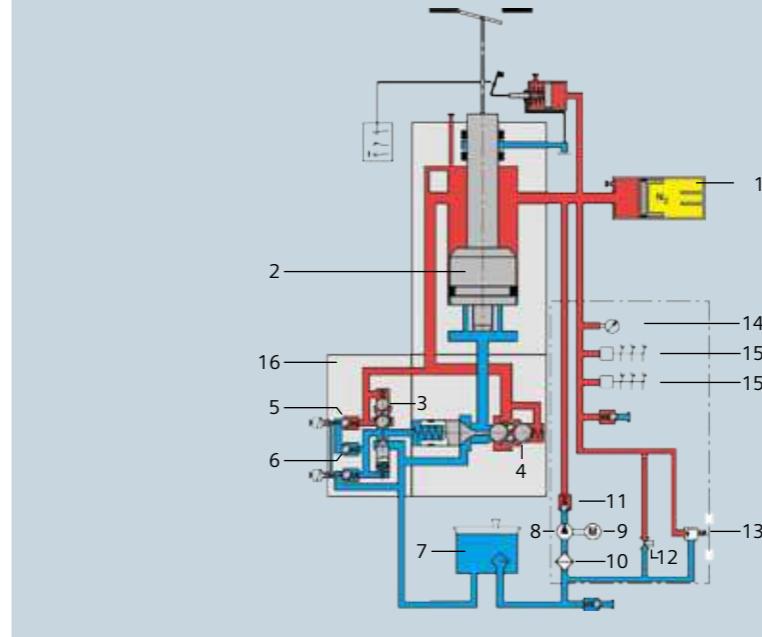
This causes the quenching gas to be forced in the direction opposite to the movement of the moving contact components through the non-return valve, consisting of piston (11) and valve plate (10), into the heating cylinder and through the gap between the tube contact (8) and the arc quenching nozzle, thus quenching the arc.

With large short-circuit currents, the quenching gas surrounding moving pin (5) in the arcing chamber is heated by the arc's energy and driven into the heating cylinder (9) at high pressure. When the current passes through zero, the gas flows back from the heating cylinder into the nozzle and quenches the arc. When this happens, the valve plate (10) in the heating cylinder (9) prevents the high pressure from entering the compression chamber between piston (11) and the valve group (12).

- 1 Trip coil CLOSE
 2 Cam plate
 3 Corner gear
 4 Connecting rod
 5 Connecting rod for closing spring
 6 Connecting rod for opening spring
 7 Closing spring
 8 Emergency hand crank
 9 Charging gear
 10 Charging shaft
 11 Roller lever
 12 Damper (for closing)
 13 Operating shaft
 14 Damper (for opening)
 15 Trip coil OPEN
 16 Drive mechanism housing
 17 Opening spring



- 1 Hydraulic storage cylinder
 2 Operating piston
 3 Pilot valve
 4 Main valve
 5 Closing solenoid
 6 Opening solenoid
 7 Oil tank
 8 Oil pump
 9 Motor
 10 Filter
 11 Non-return valve
 12 Pressure compensating valve
 13 Safety valve
 14 Pressure gauge
 15 Pressure monitor
 16 Compact hydraulic operating mechanism



Drive systems

Stored-energy spring mechanism

The operating mechanism is a central part of high-voltage circuit breakers. The drive concept of the 3AP circuit breaker family is based on the patented stored-energy spring principle and is identical on all types. The use of such an operating mechanism for voltage ranges of up to 800 kV became appropriate as a result of the development of a self-compression interrupter unit that requires minimal actuating energy. The compact design of this operating mechanism makes it possible to place the stored-energy spring mechanism within the control cubicle in a compact housing.

The mechanism types differ in terms of the number, size and arrangement of the opening and closing springs. Both the closing and opening springs are located inside the operating mechanism, thereby achieving a simple and sturdy device. This design minimizes the number of required moving parts. The use of roller bearings and of the maintenance-free charging mechanism is a prerequisite for reliable operation over decades. Proven design principles such as vibration-isolated latches and load-free isolation of the charging mechanism were retained.

Advantages of the stored-energy spring mechanism:

- Same principle for rated voltages from 72.5 kV up to 800 kV
- High reliability thanks to low operating energy (10,000 operating cycles guaranteed)
- Fail-safe, economical and persistent due to uncomplicated and robust construction with few moving parts
- Controllable switching state at all times
- Easy access to springs as they are not integrated in SF₆ compartments
- Maintenance-free for 25 years or 6,000 operation cycles
- Low environmental impact compared to former drive systems

Electrohydraulic operating mechanism

The electrohydraulic operating mechanism has been used in 3AT and 3AQ circuit breakers for more than 20 years. Even the highest switching voltages are safely brought under control in the shortest possible time and also the most difficult switching tasks can be mastered.

Closing

The main valve (4) is opened electromagnetically. This causes the pressure from the hydraulic storage cylinder (1) to be applied equally to both surfaces of the differential operating piston (2). The force on the side with the larger piston surface is greater and closes the breaker via the connecting rod and operating rod. The operating mechanism is designed such that, in the event of a drop in pressure, the contact position will be maintained.

Opening

The main valve (4) is closed electromagnetically. This releases the pressure on the larger of the two piston surfaces and the operating piston (2) moves into the open position due to the pressure differential on the respective piston sides. The circuit breaker is always ready for opening. Two electrically isolated tripping circuits are available, as an option, for reversing the movement of the main valve (4) towards the open position.

Advantages of the electrohydraulic operating mechanism:

- High operating energy for the highest switching performance in the shortest possible time
- Contact positions are reliably maintained even if the auxiliary power supply fails
- Multiple reclosure possible without the need for recharging
- Constant self-monitoring
- Checking of energy reserves at any time
- Low-maintenance, economical and long service life
- Meets stringent environmental safety requirements



Quality right from the start

Development

The foundation of quality for Siemens high-voltage circuit breakers begins right in the development of a new product. Switching performance, high voltage stability and performance under normal mechanical loads (wind and short circuits) as well as seismic conditions are simulated and optimized in the outline design phase using computer-aided calculations. The use of parts and assembly units in a large number of breaker types such as live tank, dead tank, as well as GIS leads to a high volume standardization of the main components. Steady and regular amounts of produced units form a continuous production process and ensure the highest standards. Statistical quality control is based on large numbers produced, and hence, a higher validity is achieved.

All 3AP circuit breakers are earthquake-proof up to 0.5 g.

All our circuit breakers are completely type-tested in accordance with latest IEC and ANSI standards before their market launch. In our Berlin factory, we have one of the most modern testing laboratories available which are accredited to EN 45001 and part of the European network of the independent testing organization, PEHLA.

All required facilities are available:

- Physics laboratory
- High voltage testing laboratory
- High-power testing laboratory
- Mechanical testing laboratory
- Temperature rise testing laboratory

Other testing laboratories that we work together with are KEMA, CESI, IPH and FGH, which are also part of the European network of independent testing organizations.

Routine testing

Important components are subjected to complete pre-acceptance testing before assembly. The routine test is performed on the assembled circuit breaker. The specification requirements are automatically imported into the computer-aided routine test plan during order processing. This makes sure that fulfillment of every customer requirement is checked before delivery.

Routine testing is performed in accordance with IEC or ANSI and encompasses the following points at least:

- 100 mechanical operations
- Closing and opening times
- Release and motor currents
- Gas monitoring
- Testing of control circuits in accordance with the circuit diagram
- Voltage drop of the main conducting path
- High voltage testing
- 2 kV testing of auxiliary circuits

IEC specifies an annual maximum SF₆ leakage rate of 0.5 % or 1 %. Experience from several high and low temperature tests and decades of operational experience show that the leakage rate of Siemens circuit breakers is below even 0.1 % per year.



Easy installation and commissioning

Our circuit breakers for voltage ratings from 72.5 kV to 300 kV can be transported fully pre-assembled and routine-tested. All higher ratings are dismantled into compact, clear and space saving subassemblies for transportation purposes. Transportation costs are minimized by packing several circuit breakers together in one shipment. The subassemblies can quickly be installed into a complete circuit breaker at the switching station. A single supervisor can install one circuit breaker within one and a half days.

Due to the fact that the circuit breaker is already routine-tested in the factory, commissioning can be reduced to a minimum and there is no need for special tools or equipment.

Lifelong Service for the circuit breaker

We provide installation, commissioning and maintenance on request. And once installed, Siemens high-voltage circuit breakers will operate safely and reliably for years. But in the unlikely event of a fault, you can rely on our worldwide customer support.

We offer service attendance throughout the entire operating life of the circuit breaker. Inspection, maintenance, repair and a round-the-clock fault service give you the necessary backup.

The first inspection of the circuit breaker is necessary after 12 years or 3,000 operation cycles, and the first maintenance is recommended after 25 years or 6,000 operation cycles.

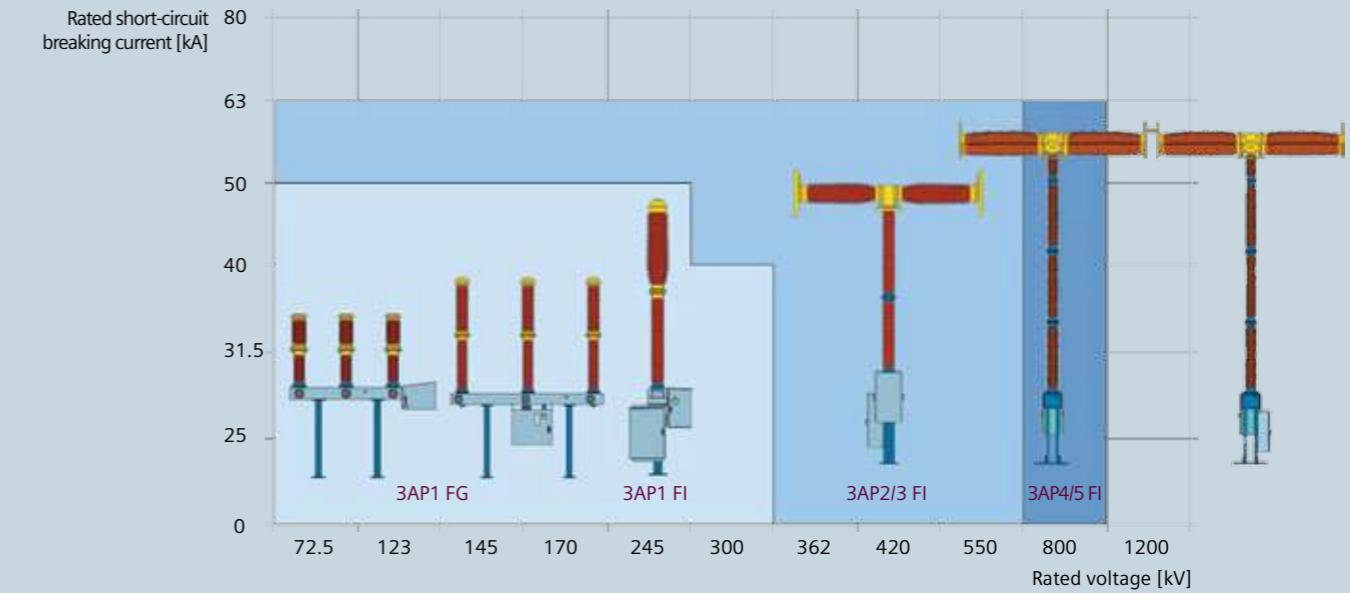
Spare parts and maintenance kits are available for a minimum of 25 years after delivery.



Depending on customer requests, we can offer installation, commissioning and maintenance training in our training center or on site during the regular installation services.



Technical Data



3AP live tank circuit breaker - the bestseller

For applications from 72.5 kV up to 800 kV

In contrast to dead tank circuit breakers, the interrupter unit in live tank breakers is not grounded during operation; it is exposed to high-voltage potential and therefore these circuit breakers are called live tanks.

The 3AP circuit breaker family is available for rated voltages from 72.5 kV up to 800 kV. 3AP1 circuit breakers up to 300 kV are equipped with one interrupter unit per pole and 3AP2 circuit breakers up to 550 kV include two interrupter units. For applications from 362 kV to 550 kV, the circuit breakers can be equipped with optional closing resistors (3AP3). The 3AP4 includes 4 interrupter units per pole and can also be delivered with closing resistors on request (3AP5).

Moreover, our high-voltage live tank circuit breakers are available for three-pole operation with a common base (FG), for single pole operation also with a common base (FE) or for one pole operation with separate bases (FI).

In accordance with our modular design, all Siemens 3AP live tank breakers are provided with our stored-energy spring drive mechanism and our self-compression interrupter units.

Safety and availability at any time

The 3AP high-voltage circuit breakers operate safely and are capable of withstanding high mechanical loads. Particularly strong porcelain insulators and a circuit breaker design optimized by using the latest mathematical techniques give it very high seismic stability whilst in operation, enabling it to perform to its full potential during its entire service life.

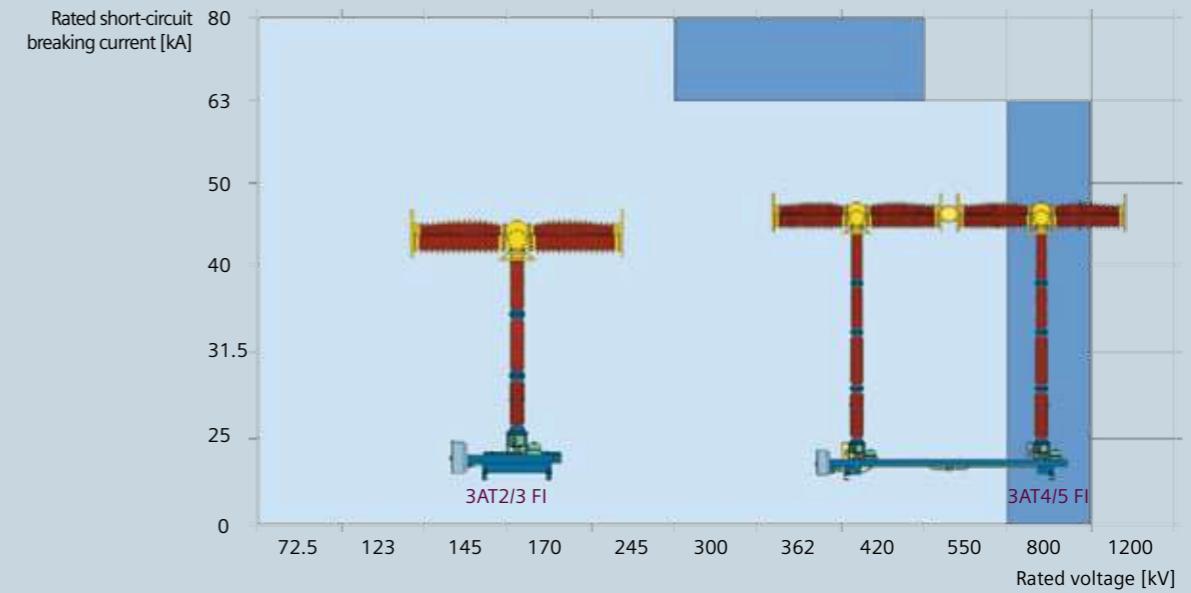
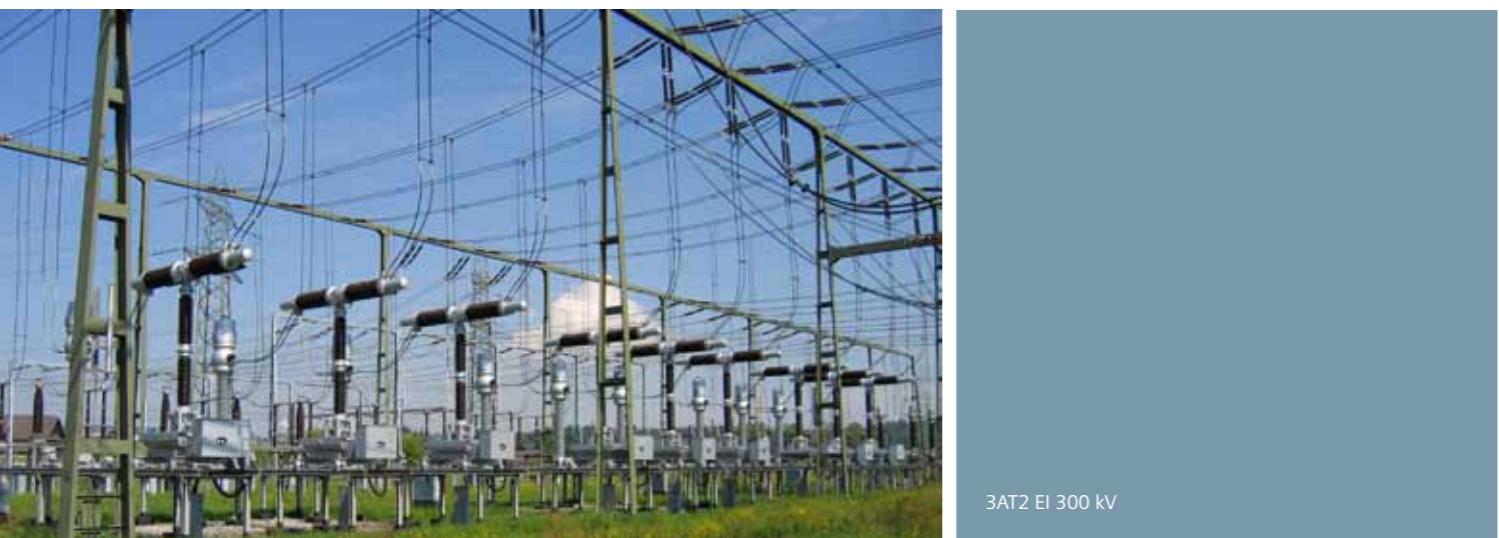


Almost 100 years of our experience in high-voltage switching technology go into the design and production of 3AP circuit breakers which define an international trend for attractive products at competitive prices. With the high standard of quality that Siemens is known for, we comply with our customers' demands for reliability, safety and cost-effectiveness and serve them throughout the world. No matter what your application is, 3AP circuit breakers provide the best solution for your requirements at any time.

Type	3AP1								3AP2/3		3AP4/5				
Rated voltage	kV	72.5	123	145	170	245	300	420	550	800					
Number of interrupter units per pole		1								2		4			
Rated power-frequency withstand voltage/min	kV	140	230	275	325	460	460	610	800	830					
Rated lightning impulse withstand voltage/min	kV	325	550	650	750	1050	1050	1425	1550	2100					
Rated switching impulse withstand voltage	kV	-								850	1050	1175	1425		
Rated normal current, up to	A	2500	4000	4000	4000	4000	4000	5000	5000	5000					
Rated short-time withstand current (1s-3s), up to	kA _(rms)	31.5	40	40	40	50	40	63	63	63					
Rated short-circuit breaking current, up to	kA	31.5	40	40	40	50	40	63	63	63					
Temperature range	°C	-55 up to +55													
Rated operating sequence		0-0.3 s-CO-3 min-CO or CO-15 s-CO													
Rated break time		3 cycles								2 cycles					
Rated frequency	Hz	50 or 60													
Maintenance after		25 years													

All values in accordance with IEC; other values on request

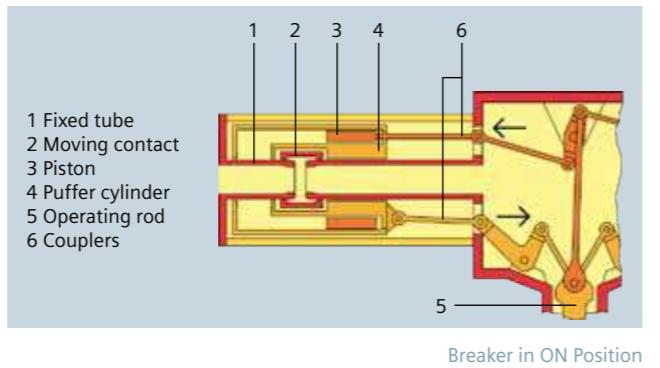
Technical Data



3AT live tank circuit breaker - the power pack

Electrohydraulically operating circuit breaker for applications from 245 kV up to 800 kV

In contrast to our 3AP series, 3AT circuit breakers are equipped with a hydraulic operating mechanism. Just like all of our circuit breaker types, it provides a high operating energy which safely controls even the highest switching voltages. It can master the most difficult switching duties such as breaking short-circuit currents in the shortest possible time. Its switching performance and the design of its interrupter unit make it eminently suited for generator applications.



Constant availability assured

Further significant advantages are the reliability and the extremely rugged design of 3AT high-voltage circuit breakers. Solid porcelain for the insulators and breaker bases optimized by means of the most up-to-date computing techniques provide this circuit breaker with an excellent seismic loading capacity.

With additional earthquake damping equipment from Siemens, it is unshakable in almost any location.

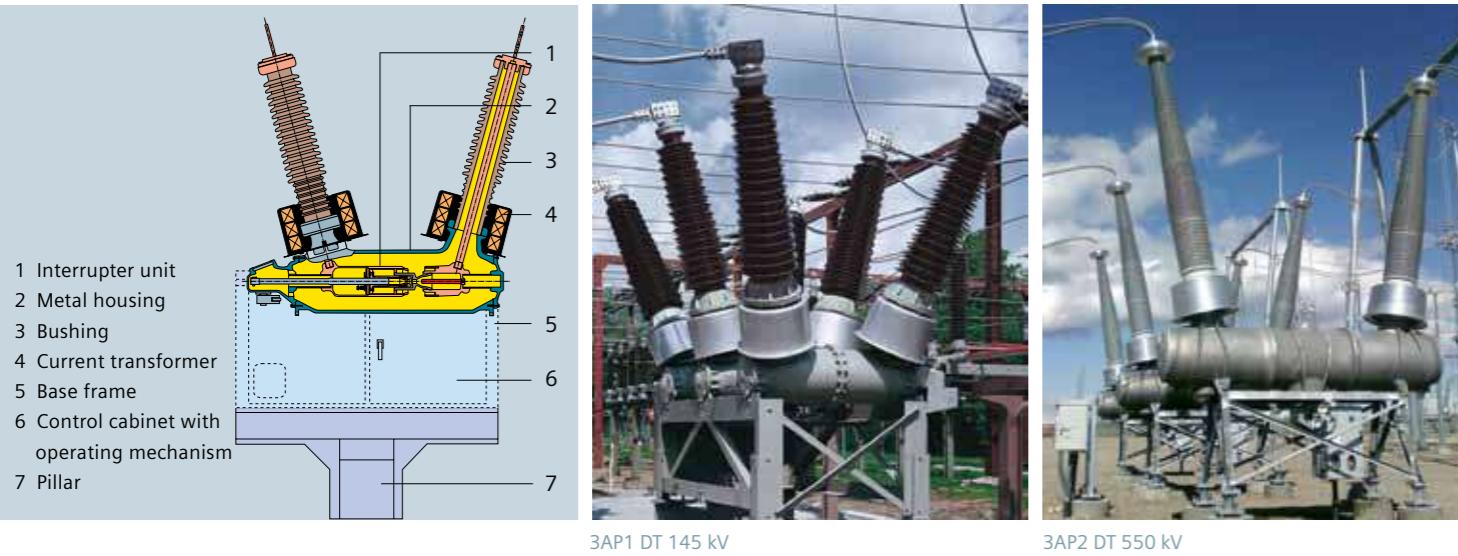
The switching mechanism in the interrupter unit is operated via the hydraulic operating mechanism. Also, the current interruption differs from 3AP circuit breakers. The 3AT interrupter unit uses the tried-and-tested double-nozzle quenching system. A contact system with graphite double nozzles ensures a constant quenching response and likewise constant electric strength. The high-performance double nozzles are resistant to erosion and have a long service life.

Further advantages of this quenching technique include the minimal pressure rise during the quenching process and the minimal conductivity of the arc plasma. The double-nozzle system is even suitable for special applications such as restrike-free interruption of low inductive and capacitive currents as well as interruption of all types of short-circuits.

Type	3AT2/3					3AT4/5													
Rated voltage	kV	245	300	362	420	550	362	420	550	800									
Number of interrupter units per pole	2					4													
Rated power-frequency withstand voltage/min	kV	460	460	520	610	800	450	520	620	830									
Rated lightning impulse withstand voltage/min	kV	1050	1050	1175	1425	1550	1175	1425	1550	2100									
Rated switching impulse withstand voltage	kV	-	850	950	1050	1175	950	1050	1175	1425									
Rated normal current, up to	A	4000																	
Rated short-time withstand current (1s-3s), up to	kA _(rms)	80	63	63	63	63	80	80	63	63									
Rated short-circuit breaking current, up to	KA	80	63	63	63	63	80	80	63	63									
Temperature range	°C	-25 up to +50																	
Rated operating sequence	0-0.3 s-CO-3 min-CO or CO-15 s-CO																		
Rated break time	2 cycles																		
Rated frequency	Hz	50 or 60																	
Maintenance after	25 years																		

All values in accordance with IEC; other values on request

Technical Data



3AP dead tank circuit breaker - the well grounded

For applications from 72.5 kV up to 550 kV

In contrast to live tank circuit breakers, dead tanks have a metal-enclosed interrupter unit, and the housing is always grounded. Therefore they are called dead tank circuit breakers. For certain substation designs, dead tank circuit breakers might be required instead of the standard live tank breakers. The dead tank breaker offers particular advantages if the protection design requires the use of several current transformers per pole assembly.

Most important characteristics of a dead tank breaker:

- Toroidal-core current transformers on bushings (compact construction)
- High short-circuit breaking currents possible (up to 63 kA with one interrupter unit)
- No creepage path across interrupter unit
- Low impulse load of the bases
- Low center of gravity of the bases (higher seismic withstand capability)
- Heating system available for low temperature applications
- Gas-insulated components ensure highest availability at minimum maintenance effort
- Metal-enclosed interrupter unit (grounded housing)

Current Transformers

The dead tank circuit breakers can be equipped with bushing current transformers for measurement or protection purposes, fulfilling the requirements according to international standards such as IEC, ANSI, etc.

The current transformers are mounted in weatherproof housings on both sides of each breaker pole and are located at the base of the bushings. The current transformer leads terminate in the control cubicle at short-circuiting type terminal blocks. Our standard housing provides space for up to three current transformers per bushing.

Another of its strengths

The 3AP DT high-voltage circuit breaker operates safely and is capable of bearing high loads. Extra-strong porcelain bushings and an optimized circuit breaker design give it a very high seismic stability while in operation. The circuit breaker covers the whole temperature range from -55 °C up to 50 °C with pure SF₆, which makes it applicable for all climate zones. Like the other circuit breakers, our dead tanks are based on our proven modular design using a patented self-compression arc-quenching system and the stored-energy spring drive mechanism. They assure consistent quenching performance with rated and short-circuit currents – even after many switching operations.

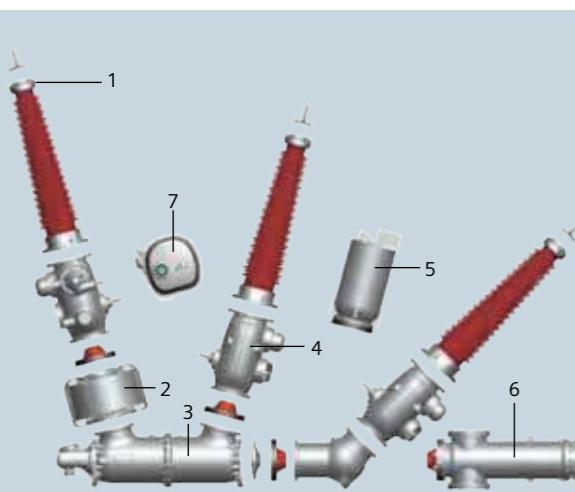
Coming soon

The upcoming new member of our dead tank breaker family will be usable in ultra high-voltage applications up to 1200 kV. End of 2011, a prototype of this brand-new 3AP5 DT has been delivered to India in the course of expanding the nationwide grids.

Type		3AP1			3AP2/3		
Rated voltage	kV	72.5	123	145	245	362	550
Number of interrupter units per pole		1			2		
Rated power-frequency withstand voltage/min	kV	140	230	275	460	520	800
Rated lightning impulse withstand voltage/min	kV	325	550	650	1050	1380	1865
Rated switching impulse withstand voltage	kV	-			1095		1350
Rated normal current, up to	A	3150	3150	3150	3150	4000	4000
Rated short-time withstand current (1s-3s), up to	kA _(rms)	40	40	63	63	63	63
Rated short-circuit breaking current, up to	kA	40	40	63	63	63	63
Temperature range	°C	-55 up to +55					
Rated operating sequence		0-0.3 s-CO-3 min-CO or CO-15 s-CO					
Rated break time		3 cycles			2 cycles		
Rated frequency	Hz	50 or 60					
Maintenance after		25 years					

All values in accordance with IEC; other values on request

Technical Data

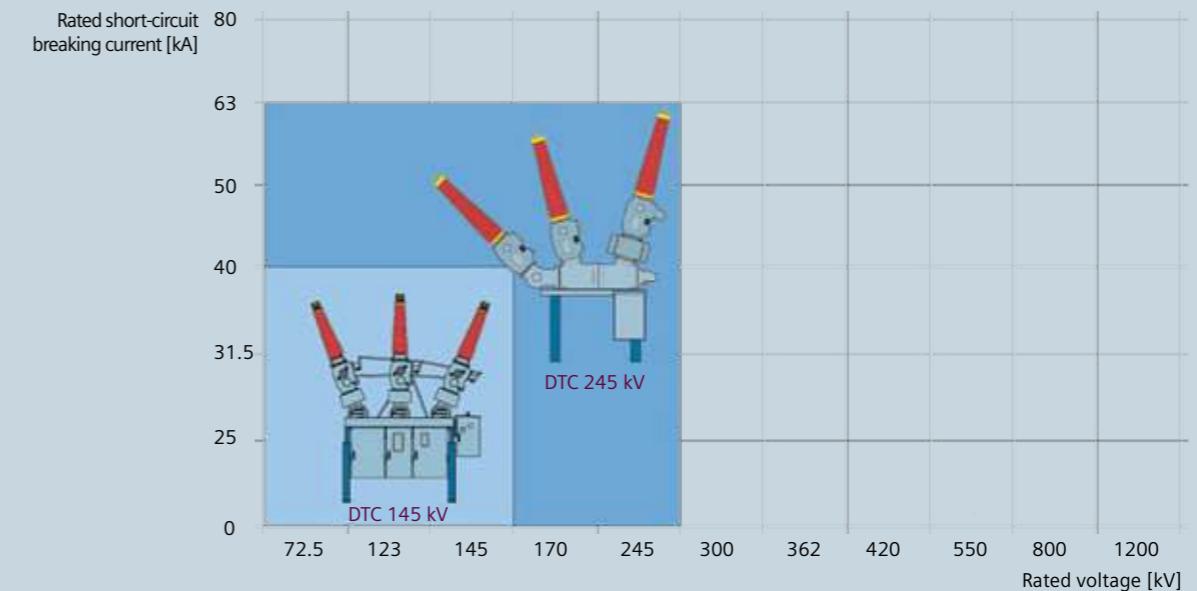


Possible components for the 3AP1 DTC compact switchgear

1. Bushing
2. Current transformer
3. Circuit breaker with self-compression principle
4. Three-position disconnector / earthing switch
5. Voltage transformer
6. Cable connection assembly
7. High speed earthing switch

Flexible solutions according to your substation configurations

- Circuit breaker with one or three-pole operating mechanism
- Disconnector, earthing switch, high-speed earthing switch
- Current transformer, voltage transformer and voltage detection system
- Cable connections possible at various positions
- Bushings available as porcelain or composite insulators
- Additional separations of gas compartment, with SF₆ density monitor on request
- Double breaker modules for ultra compact substation designs
- Possibility of stand-alone components, e.g. disconnector module with voltage transformer



3AP Dead Tank Compact - the versatile

For 145 kV and 245 kV applications

The hybrid concept on which the 3AP1 Dead Tank Compact (DTC) is based combines SF₆-encapsulated components and air-insulated devices. The application of gas insulated components increases availability of the switchgear. According to CIGRE analyses, gas-insulated components are four times more reliable than air insulated components. Furthermore, safety can be enhanced by separating gas compartments, e.g. between the circuit breaker and disconnector.

The DTC circuit breaker is a compact arrangement of several functions needed in a substation. The elements of this Siemens compact switchgear is a dead tank circuit breaker, fitted with one or two current transformers, one or more disconnectors, earthing switches and bushings as applicable for connection to the bus bar system. And of course, based on our modular design, the core components are adopted from our high-voltage circuit breakers, disconnectors and GIS product family. Due to the compact design and the flexible use of predefined modules, different layouts can be realized with a minimum of engineering effort.

The level of encapsulation and the design of the DTC module can be defined in accordance with the requirements of the individual substation layout and the system operator's project budget. This leads to optimized investments and greater success for our customers' businesses.



3AP1 DTC 245 kV

The 3AP1 DTC offers you:

- Proven SF₆- and air-insulated components that can be combined in new and different ways
- Optimized investments according to the requirements of your individual substation layout
- Gas insulated components ensure the highest availability at minimum maintenance effort
- Flexibility in confined spaces and extreme environmental conditions, e.g. low temperature applications

Benefit from the hybrid idea!

Type	3AP1 DTC	
Rated voltage	kV	145 245
Number of interrupter units per pole		1
Rated power-frequency withstand voltage/min	kV	275 460
Rated lightning impulse withstand voltage/min	kV	650 1050
Rated switching impulse withstand voltage	kV	—
Rated normal current, up to	A	3150 4000
Rated short-time withstand current (1s-3s), up to	kA _(rms)	40 63
Rated short-circuit breaking current, up to	kA	40 63
Temperature range	°C	-55 up to +55
Rated operating sequence		O-0.3 s-CO-3 min-CO or CO-15 s-CO
Rated break time		3 cycles
Rated frequency	Hz	50 or 60
Maintenance after		25 years

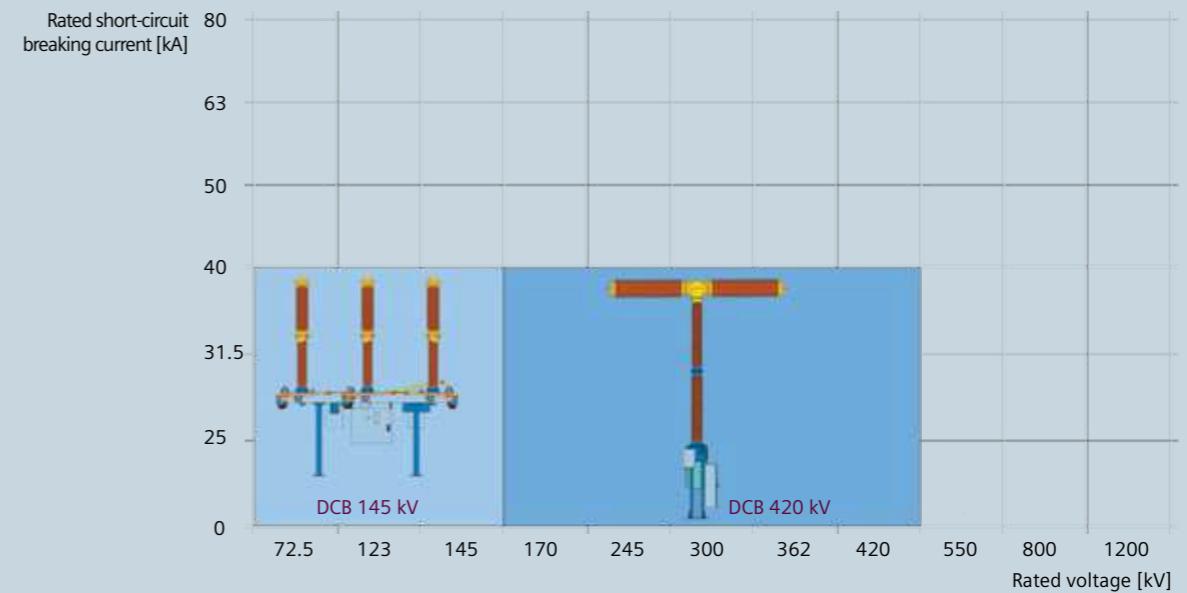
All values in accordance with IEC; other values on request

Technical Data



Your advantages:

- Highest reliability by applying well-proven and established components from Siemens circuit breakers and Ruhrtal earthing switches
- Highest availability due to reduced maintenance interruptions
- Costs and space saving solution by combining the circuit breaker and disconnector in one device
- Minimized costs for transportation, maintenance, installation and commissioning as well as civil engineering (foundation, steel, cable ducts etc.)
- Compact and intelligent interlocking and position indicating device
- Optionally available with earthing switch (145 kV)
- From one source (documentation and technical support, assembly and installation, customer training, 24-hour-service)



3AP DCB Disconnecting Circuit Breaker – the combined

For 145 kV and 420 kV applications

In switchgear, isolating distances in air combined with circuit breakers are used to protect the circuit state in the grid.

Siemens has developed a device in which the isolating distance has been integrated in the SF₆ gas compartment in order to reduce external environmental influences. The DCB (Disconnecting Circuit Breaker) is used as a circuit breaker and additionally as a disconnector – two functions combined in one device.

The DCB was developed on the basis of a higher-rated standard 3AP circuit breaker to provide the higher dielectric properties required. Due to the SF₆-insulated disconnector function there is no visible opening distance anymore. The proper function of the kinematic chain has been most thoroughly verified. The closest attention was paid to developing a mechanical interlock which guarantees that the circuit breaker remains in the open position when used as a disconnector.

When this mechanical interlock is activated, it is impossible to close the breaker. The current status of the DCB can also be monitored electrically and is shown by clearly visible position indicators.

Up to voltages of 145 kV, an additional air-insulated earthing switch could be mounted onto the supporting structure. Its earthing function has been implemented by a



3AP2 DCB interlock indicator

well-established earthing switch with a Ruhrtal designed maintenance-free contact system.

The disconnecting circuit breakers are type-tested according to class M2 and C2 of IEC 62271-108, a specific standard for combined switching devices.

By combining the strengths of our well proven product portfolio, we can provide a new type of device which fulfills customers' needs for the highest reliability and safety, while saving space and costs at the same time.

ONE device – TWO functions

Type	3AP1 DCB	3AP2 DCB
Rated voltage	kV 145	420
Number of interrupter units per pole	1	2
Rated power-frequency withstand voltage/min	kV 275 or 315	520 or 610
Rated lightning impulse withstand voltage/min	kV 650 or 750	1425 or 1665
Rated switching impulse withstand voltage	kV —	1050 or 1245
Rated normal current, up to	A 3150	4000
Rated short-time withstand current (1s-3s), up to	kA _(rms) 31.5	40
Rated short-circuit breaking current, up to	kA 31.5	40
Temperature range	°C -40 up to +40	
Rated operating sequence		O-0.3 s-CO-3 min-CO or CO-15 s-CO
Rated break time		3 cycles
Rated frequency	Hz 50	
Maintenance after		25 years
Insulating medium		SF ₆

All values in accordance with IEC; other values on request

Technical Data



3AV1FG 72.5 kV prototype

Reliable

- More than 40 years of experience in vacuum switching technology
- Suitable for low temperature applications

Efficient

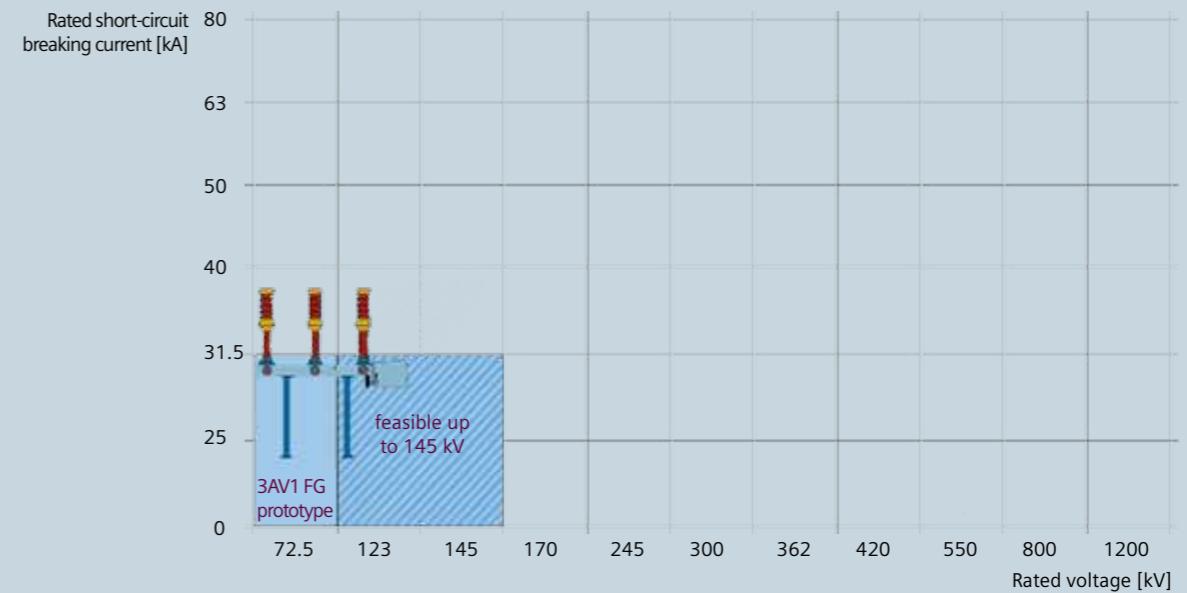
- Maintenance and service-free even with frequent breaking operations

Performance

- 2-cycle current interruption
- Feasible up to 145 kV
- High number of short-circuit interruptions

Ecological

- Vacuum interrupting medium
- Nitrogen insulating medium



3AV vacuum circuit breaker – the trendsetter

3AV1FG 72.5 kV prototype

The next generation of high-voltage circuit breakers

The outstanding technical performance and low lifecycle costs of vacuum circuit breakers make this solution the preferred technology in power networks up to 52 kV. Based on 40 years of experience producing medium-voltage vacuum interrupters and with more than 3 million units delivered, Siemens is now introducing this proven technology to high-voltage power networks above 52 kV.

The upcoming new member of our circuit breaker family meets the same high quality standards as our SF₆ portfolio and is also designed according to our well proven modular platform concept.

The new 3AV1 vacuum circuit breaker has concrete technical advantages: It features reliable switching capacity, requires no maintenance even when subjected to frequent breaking operations, and is also environmentally friendly – thanks to switching operations performed in a vacuum, with nitrogen as the insulating medium.

These circuit breakers will be the right choice for future projects and a wide range of applications.

Field experience

Prototypes of the new Siemens high-voltage vacuum circuit breakers have already been installed in European power networks. A number of Energy customers are operating the 3AV1 prototypes in their systems and are sharing operating and field experience with us.

In fact, several thousand switching operations have already been performed successfully in the field, and documented.

Market launch will follow the completion of studies. Siemens ensures the highest quality standards and offers customers the highest degree of security for their energy supplies. A complete set of type tests in accordance with the latest edition of IEC 62271-100 has proven the suitability of the 72.5 kV live tank vacuum circuit breaker prototype.



Vacuum interrupters for 72.5 kV and 145 kV

High-voltage goes vacuum

Type	3AV1	
Rated voltage	kV	72.5
Number of interrupter units per pole		1
Rated power-frequency withstand voltage/min	kV	140
Rated lightning impulse withstand voltage/min	kV	325
Rated switching impulse withstand voltage	kV	—
Rated normal current, up to	A	2500
Rated short-time withstand current (1s-3s), up to	kA _(rms)	31.5
Rated short-circuit breaking current, up to	kA	31.5
Temperature range	°C	-55 up to +40
Rated operating sequence	O-0.3 s-CO-3 min-CO or CO-15 s-CO	
Rated break time		2 cycles
Rated frequency	Hz	50
Maintenance after		25 years
Insulating medium		N ₂

All values in accordance with IEC; other values on request

Full control with circuit breaker accessories

Controlled switching with PSD02/03



Energizing and re-energizing during an autoreclosing operation of shunt compensated transmission lines cause switching overvoltages on the transmission lines. These overvoltages can be minimized by the introduction of controlled switching, which can be provided by the standard PSD02 control unit from Siemens or the specialized PSD03 version. Conventional methods to reduce overvoltages and protect the electrical equipment involve circuit breakers equipped with closing resistors or the installation of surge arresters. Using PSD can replace these additional devices and helps to save costs. The design is based on more than 10 years of experiences with controlled switching. This includes applications such as capacitor bank and reactor switching, energizing of transformers and uncompensated transmission lines up to 800 kV.

At a glance:

- Switching of transmission lines without closing resistors
- Single and three phase auto-reclosing
- One device for all switching tasks
- Unrestricted parameter-definable software
- Standard CLOSE- and OPEN-trigger circuits
- Two switching procedures can be specified at the same time
- Linear and vectorial compensation
- Secure current measurement with "ring-type transducers"
- Software operation protected by user hierarchy
- Evaluation using graphic user interface
- Switching history can be transferred
- Cyclic history, alarms, measurement values



Controlled contacts with SiCEA01



The SiCEA01 contact erosion analyzer is used to determine the extent of wear to the circuit breaker contacts. The breaking currents of the circuit breaker are used to determine the contact wear. Switching operations with currents below the rated normal current are evaluated with the rated normal current. The contact burn off is calculated using the integral of the circuit breaker breaking currents. The result is compared with the configured reference values. If the result of this comparison exceeds the warning or alarm value, the corresponding signal contact is activated, and the signal light on the contact wear analysis device shows the status. With this warning or alarm, SiCEA01 shows whether the circuit breaker contact system has already been worn down to a specific level, which allows servicing work to be scheduled in good time.

At a glance:

- Device for determination of contact-wear
- 2 limits (warning and alarm), adjustable in % of the maximum permissible contact-wear
- Digital relays and LEDs for warning and alarm
- Calculation of the integrated current during open operation for three poles
- Ambient temperature from -40 up to +85°C
- Input:
 - 3 x analog signal of protection current-transformer input ± 100 mA signal conditioning with external AC-transformer 100A/100 mA; 3 x reference contact; auxiliary contacts
- Output:
 - 3 relay output (warning, alarm, system OK); 3 LEDs
- Communication via Ethernet



Controlled monitoring with SOLM01



The Siemens SOLM01 on-line monitoring system supervises the status of the circuit breaker by means of sensor technology. SOLM01 records events, measures momentary values as well as other external parameters and compares them with given reference values. It is able to inform the servicing team automatically about divergences or signs of wear, and calculates trends for the further operational behavior. It optimizes servicing work with regard to corrective and preventive maintenance measures. The measured data is continuously obtained by the data collector and stored in a database on the Oracle server. The data can be accessed via a web browser on the Intranet/Internet by an unlimited number of authorized users with different rights. Alarm messages can also be sent directly to the SCADA system via relay outputs.

At a glance:

- Complex monitoring for determining its condition
- Measurement of momentary values
- Determination of external parameters
- Cumulative or integral monitoring of the operating stress of the breaker
- Estimation of tendencies of the operating behaviour
- Assessing the further reliability
- SOLM01 does not influence circuit-breaker control
- Data acquisition with distributed front-end pre-processing
- Premature detection of possible malfunctions
- Supports the future field bus communication protocol IEC 61850



Published by and copyright © 2012:

Siemens AG
Energy Sector
Freyeslebenstrasse 1
91058 Erlangen, Germany

Siemens AG
Energy Sector
Power Transmission Division
High Voltage Products
Nonnendammallee 104
13629 Berlin, Germany

For more information, please contact
our Customer Support Center.

Phone: +49 180/ 524 70 00

Fax: +49 180/ 524 24 71

(Charges depending on provider)

E-mail: support.energy@siemens.com
or: circuit-breaker@siemens.com

Power Transmission Division
Order no. E50001-G630-A211-X-4A00
Printed in Germany
Dispo 30002

Printed on paper bleached without the use of elemental chlorine.

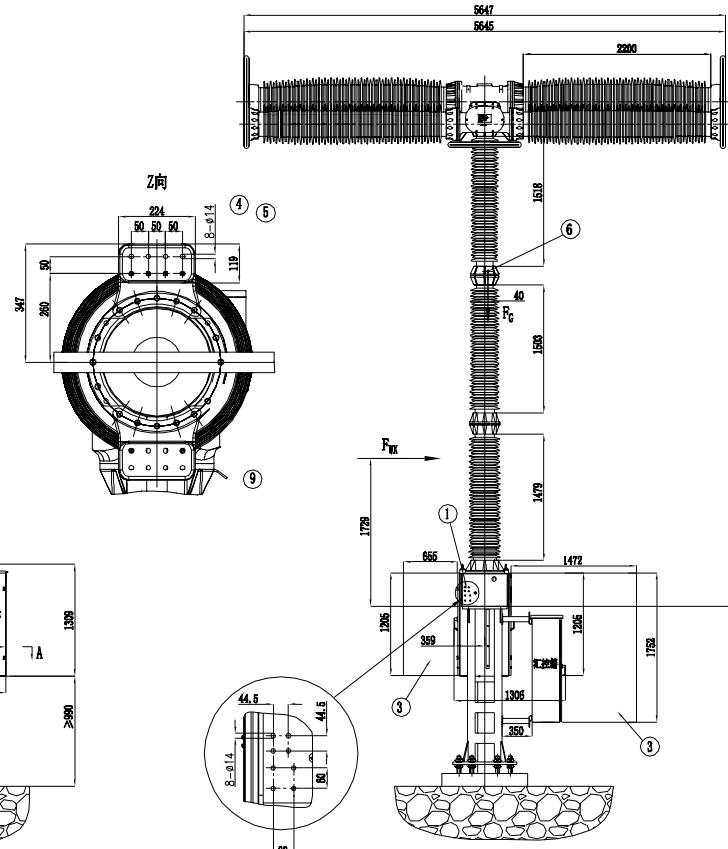
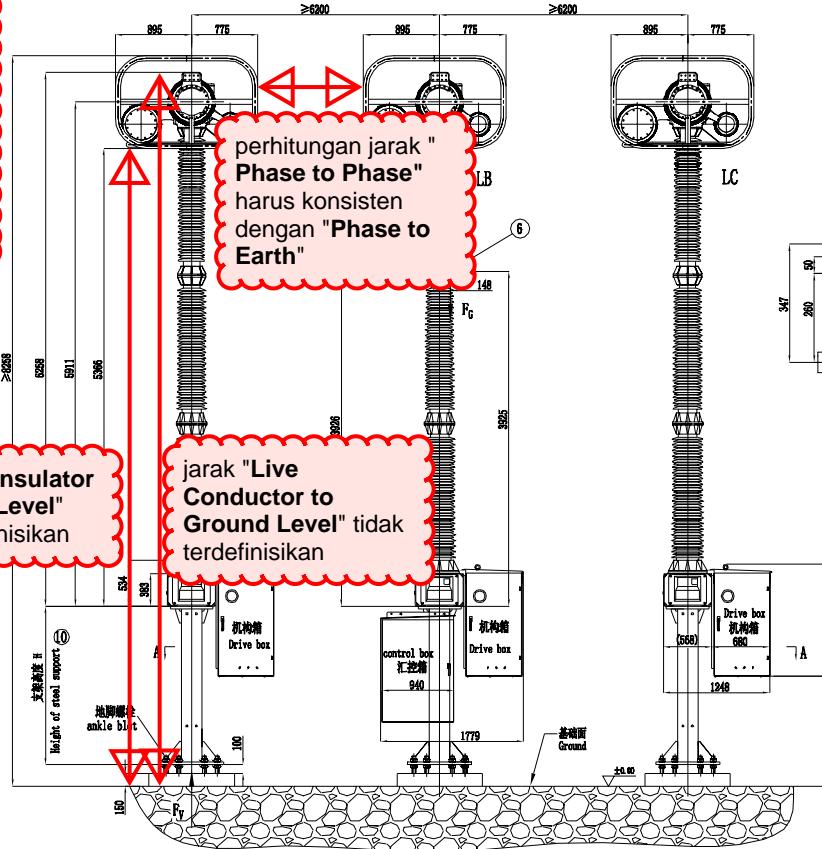
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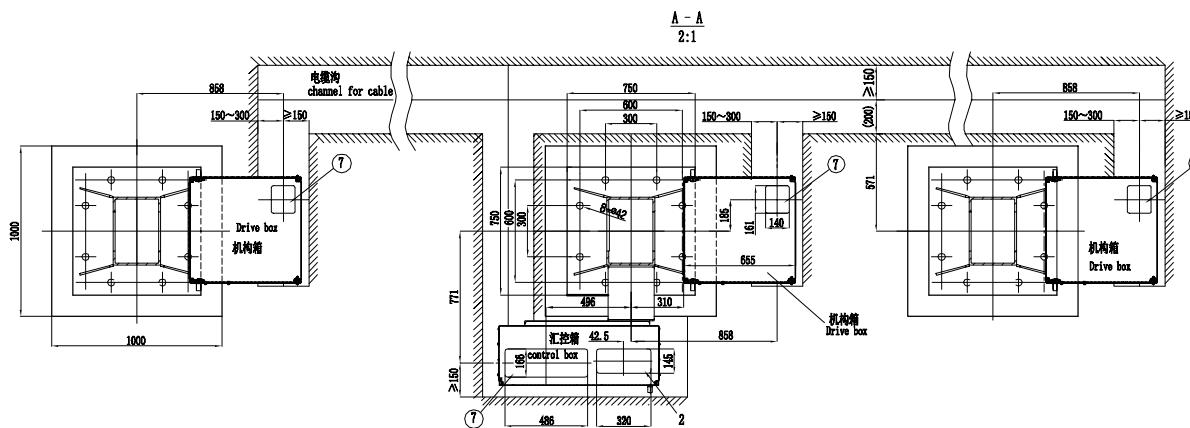
Subject to change without prior notice.

The information on this document contains general descriptions of the technical options available, which may not apply in all cases. The required technical options should therefore be specified in the contract.

"Phase to Earth"
Angka dalam
TPG dan
Outline
tidak
konsisten



- Remark:**
说明:
- ① Earth-Terminal M12, DIN 46011 and NEMA
用M12螺栓连接的接地点根据DIN46011标准
 - ② Flange for outgoing wires, drilled according to order
电缆出线法兰
 - ③ Clearance required for checking and dismantling
检查和拆卸所需的空间
 - ④ Aluminum terminal plates with holes, DIN 46206 part 3
按DIN46206 T3标准, 带连接孔的铝制接线板
 - ⑤ Terminal plates position: mounting as required
接线端子板安装位置, 需在订货时提出
 - ⑥ Center of gravity
重心
 - ⑦ Flange for outgoing wires, drilled according to order
相同电缆出线法兰
 - ⑧ There are total 6 (or 9) interphase cables and 2 (or 3)
相间电缆共6根(或9根), 即每相2根(或3根), 由机构箱连接
cables per pole, which connect machine chest to control
chest. The cable outlet position is in A-A view. The cable
spec: #35mm², with aviation socket (125X43X90mm)
电缆规格: 直径#35mm, 带航
空插座(125X43X90mm)
 - ⑩ The height of steel support must be in accordance with order
支架高度必须安装合同执行
 - ⑪ Minor deviations from the dimension and data stated are
permissible
给定的尺寸和参数允许有较小的偏差
 - ⑫ operating loads per pillar
操作动载荷 每相
vertical F_y:
垂直 F_y:
+ 29 kN (up) 向上拉力
- 39 kN (down) 向下压力
horizontal F_x: ± 9.5 kN
水平 F_x: ± 9.5 kN



F _g	F _{yx}	F _{yy}	F _{stat.}	F _{stat+dyn}
weight loads 重量荷载	wind loads, at a wind speed of 33m/s 风载荷, 风速为33m/s	3.5 kN	2 kN	5 kN

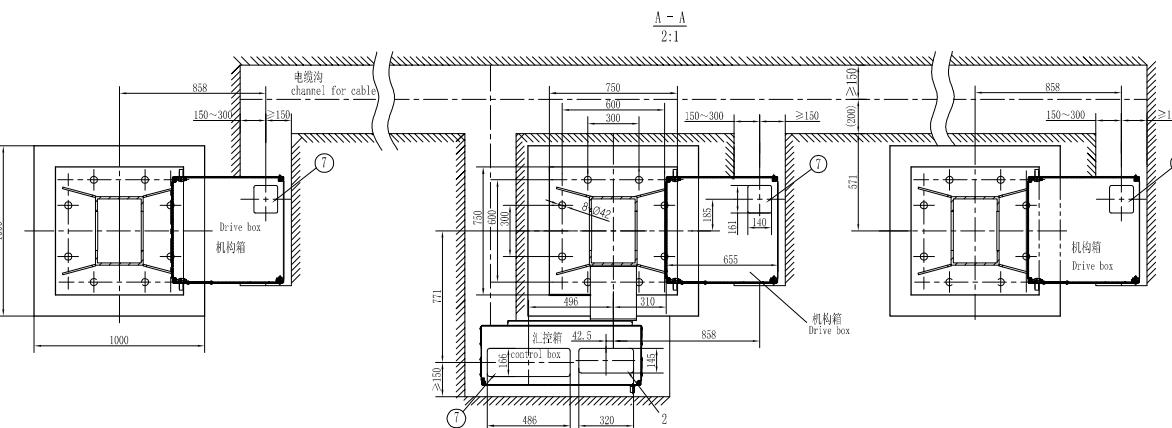
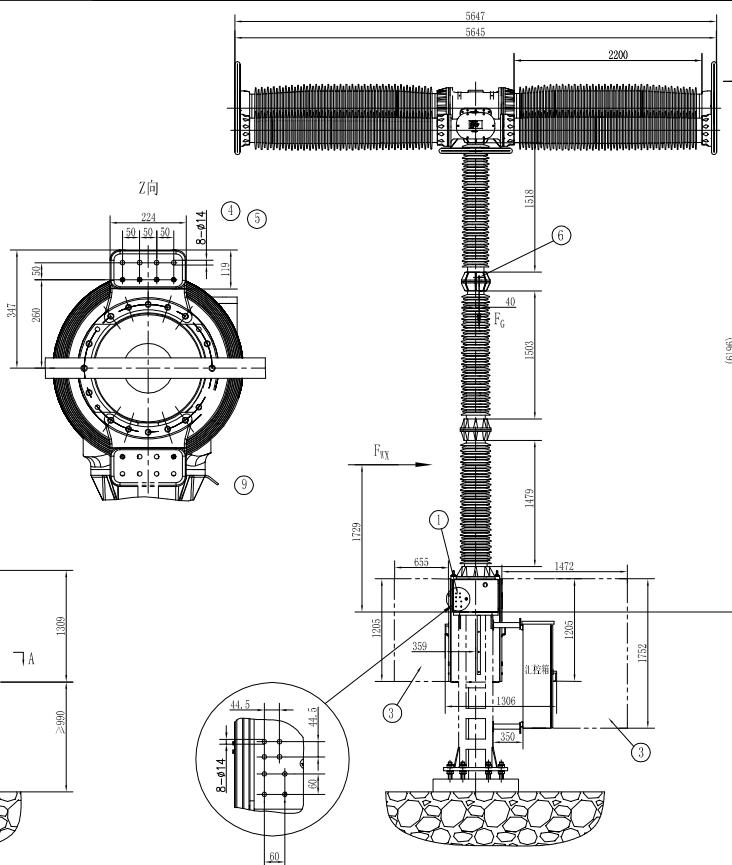
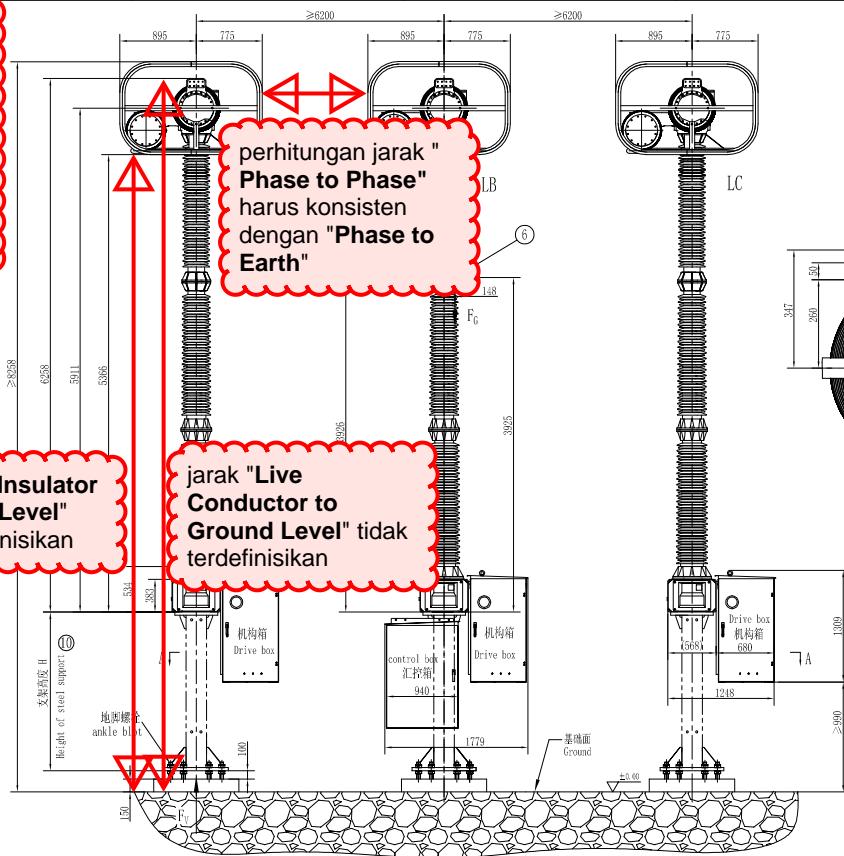
Triple-Pole Circuit Breaker 三相断路器		Type	3AP3 FI 550kV
designed	Xie Fang	2015-06-26	图号 Drw No. 3Z-27-30002-001_01
checked			1/1
approved			SIEMENS 西门子(杭州)高压开关有限公司 Siemens High Voltage Circuit Breaker Co.,Ltd., HZ

"Phase to Earth"
Angka dalam
TPG dan
Outline
tidak
konsisten

perhitungan jarak "
Phase to Phase"
harus konsisten
dengan "Phase to
Earth"

jarak "Live Insulator
to Ground Level"
tidak terdefinisi

jarak "Live
Conductor to
Ground Level" tidak
terdefinisi



Remark:

说明:

- ① Earth-terminal M12, DIN 46011 and NEMA 用M12螺栓连接的接地点根据DIN46011标准
- ② Flange for outgoing wires, drilled according to order 电缆出线法兰
- ③ Clearance required for checking and dismantling 检查和拆卸所需的空间
- ④ Aluminum terminal plates with holes, DIN 46206 part 3 按DIN46206 T3标准, 带连接孔的铝制接线板
- ⑤ ⑨ Terminal plates position: mounting as required 接线端子板安装位置, 须在订货时提出
- ⑥ Center of gravity 重心
- ⑦ Flange for outgoing wires, drilled according to order 相间电缆出线法兰
- ⑧ There are total 6 (or 9) interphase cables and 2 (or 3) cables per pole, which connect machine chest to control chest. The cables outlet position is in A-A view. The cable spec: Ø35mm, with aviation socket (125X43X90mm) 相间电缆共6根(或9根), 即每相2根(或3根), 由机构箱连接到汇控箱, 出线孔位置见A-A视图。电缆规格: 直径Ø35mm, 带航空插头(125X43X90mm)
- ⑩ The height of steel support must be in accordance with order 支架高度必须安装合同执行
- ⑪ Minor deviations from the dimension and data stated are permissible 给定的尺寸和参数允许有较小的偏差
- ⑫ operating loads per pillar 操作动载荷 每相
- vertical F_v : 垂直 F_v:
+ 29 KN (up) 向上拉力
- 39 KN (down) 向下压力
- horizontal F_h : ± 9.5 kN 水平 F_h: ± 9.5 kN

loads per pol (LB)
每相受力载荷

F_G	F_WX	F_WY	Fs stat.	Fs stat+dyn
weight loads 重量载荷	wind loads, at a wind speed of 33m/s 风载荷, 风速为33m/s	tensile load 拉伸载荷	静态	动态
26.5 kN	2.5 kN	3.5 kN	2 kN	5 kN

Triple-Pole Circuit Breaker		型号 Type	3AP3 FI-550kV_W/O GC
designed	Xie Fang	2013-12-10	图号 Drw No. 3Z-27-XXXX-001_0-
checked			1/1
approved			SIEMENS 西门子(杭州)高压开关有限公司 High Voltage Circuit Breaker Co. Ltd., HZ



C E R T I F I C A T E

Management system as per

DIN EN ISO 9001 : 2015

DIN EN ISO 14001 : 2015

DIN ISO 45001 : 2018

The Certification Body TÜV NORD CERT GmbH hereby confirms as a result of the audit, assessment and certification decision according to ISO/IEC 17021-1:2015, that the organization

Siemens Energy Global GmbH & Co. KG

Division Transmission

Freyeslebenstraße 1

91058 Erlangen

Germany

with the locations according to the annex

operates a management system in accordance with the requirements of ISO 9001 : 2015, ISO 14001 : 2015 and ISO 45001 : 2018 and will be assessed for conformity within the 3 year term of validity of the certificate.

Scope

Marketing, Sales, Engineering, Project Management, Supply Chain Management, Product Lifecycle Management, Research and Development, Consulting Services, Inspection, Testing (local Complete Unit Test), Installation, Commissioning, Training , Diagnostic Services, Refurbishment, Repair, Maintenance, Overhaul, Operation and Maintenance, Parts Management, Field Service, Modernization and Upgrades, Long Term Programs, Technical Support, Emergency Services, Digital Services, Extensions of Transmission Products, Transmission Systems, Transmission Solutions

Certificate Registration No. 44 100 210961

Valid from 2021-07-29

Valid until 2024-07-28

Certificate Registration No. 44 104 210961

Valid from 2021-07-29

Valid until 2024-07-28

Certificate Registration No. 44 126 210961

Valid from 2021-07-29

Valid until 2024-07-28

Audit Report No. 3530 9074

Initial certification 2010

Audit Report No. 3530 9080

Initial certification 2010

Audit Report No. 3530 9085

Initial certification 2019

Certification Body
at TÜV NORD CERT GmbH

Essen, 2022-02-16

Validity can be verified at <https://www.tuev-nord.de/de/unternehmen/zertifizierung/zertifikatsdatenbank>.



ANNEX

to Certificate Registration No. 44 100 210961

to Certificate Registration No. 44 104 210961

to Certificate Registration No. 44 126 210961

DIN EN ISO 9001 : 2015

DIN EN ISO 14001 : 2015

DIN ISO 45001 : 2018

Siemens Energy Global GmbH & Co. KG

Division Transmission

Freyeslebenstraße 1

91058 Erlangen

Germany

Certificate Reg.-No.	Location	Scope
44 100 210961-001	Siemens Energy Global GmbH & Co. KG	Marketing, Sales, Engineering, Project Management, Supply Chain Management, Product Lifecycle
44 104 210961-001	Division Transmission	Management, Research and Development, Consulting Services, Inspection, Testing (local Complete Unit Test), Installation, Commissioning, Training , Diagnostic Services, Refurbishment, Repair, Maintenance, Overhaul, Operation and Maintenance, Parts Management, Field Service, Modernization and Upgrades, Long Term Programs, Technical Support, Emergency Services, Digital Services, Extensions of Transmission Products, Transmission Systems, Transmission Solutions
44 126 210961-001	Freyeslebenstraße 1 91058 Erlangen Germany	
44 100 210961-002	Siemens Energy Global GmbH & Co. KG	Engineering, Project Management, Supply Chain Management, Manufacturing, Product Lifecycle
44 104 210961-002	Division Transmission	Management, Research and Development, Consulting Services, Inspection, Installation, Commissioning, Training , Diagnostic Services, Refurbishment, Repair, Maintenance , Overhaul, Parts Management, Field Service, Modernization and Upgrades, Long Term Programs, Technical Support, Emergency Services, Digital Services, Extensions of Transmission & Distribution Products, Transmission & Distribution Systems, Transmission & Distribution Solutions
44 126 210961-002	Humboldtstraße 64 90459 Nürnberg Germany	

ANNEX

to Certificate Registration No. 44 100 210961

to Certificate Registration No. 44 104 210961

to Certificate Registration No. 44 126 210961

DIN EN ISO 9001 : 2015

DIN EN ISO 14001 : 2015

DIN ISO 45001 : 2018

Certificate Reg.-No.	Location	Scope
44 100 210961-003	Siemens Energy Global GmbH & Co. KG Division Transmission	Marketing, Sales, Engineering, Project Management, Supply Chain Management, Consulting Services, Inspection, Installation, Commissioning, Training, Diagnostic Services, Refurbishment, Repair, Maintenance, Overhaul, Operation and Maintenance, Parts Management, Field Service, Modernization and Upgrades, Long Term Programs, Technical Support, Emergency Services, Digital Services, Extensions of Transmission Products, Transmission Systems, Transmission Solutions
44 104 210961-003	Lindenplatz 2 20099 Hamburg Germany	
44 126 210961-003		
44 100 210961-004	Siemens Energy Global GmbH & Co. KG Division Transmission	Marketing, Sales, Engineering, Assembly, Inspection, Testing (local Complete Unit Test), Installation, Commissioning, Repair, Maintenance, Field Service of Transmission & Distribution Products, Transmission & Distribution Systems, Transmission & Distribution Solutions
44 104 210961-004	Paulsternstraße 26 13629 Berlin Germany	
44 126 210961-004		
44 100 210961-005	Siemens Energy Global GmbH & Co. KG Division Transmission	Sales, Project Management, Installation of Transmission Products
44 104 210961-005	Löwenstraße 11 a 44135 Dortmund Germany	
44 126 210961-005		
44 100 210961-006	Siemens Energy Global GmbH & Co. KG Division Transmission	Marketing, Sales, Engineering, Project Management of Transmission Solutions
44 104 210961-006	c/o Siemens Energy AB Tunbytorpsgatan 31 721 37 Västerås Sweden	
44 126 210961-006		

ANNEX

to Certificate Registration No. 44 100 210961

to Certificate Registration No. 44 104 210961

to Certificate Registration No. 44 126 210961

DIN EN ISO 9001 : 2015

DIN EN ISO 14001 : 2015

DIN ISO 45001 : 2018

Certificate Reg.-No.	Location	Scope
44 100 210961-007	Siemens Energy Global GmbH & Co. KG Division Transmission	Marketing, Sales, Engineering, Project Management of Transmision Solutions
44 104 210961-007	c/o Siemens Energy AB Evenemangsgatan 21 169 79 Solna Sweden	
44 126 210961-007		
44 100 210961-008	Siemens Energy Global GmbH & Co. KG Division Transmission 4601 Six Forks Road Raleigh, NC 27609 USA	Marketing, Sales, Engineering, Project Management of Transmision Systems, Transmision Solutions
44 100 210961-012	Siemens Energy Global GmbH & Co. KG Division Transmission	Project Management, Supply Chain Management, Consulting Services, Inspection, Installation, Commissioning, Training , Diagnostic Services, Refurbishment, Repair, Maintenance , Overhaul, Parts Management, Field Service, Modernization and Upgrades, Long Term Programs, Technical Support, Emergency Services, Digital Services, Extensions of Transmission & Distribution Products, Transmission & Distribution Systems, Transmission & Distribution Solutions
44 104 210961-012		
44 126 210961-012	Mellinghofer Straße 55 45473 Mülheim an der Ruhr Germany	

ANNEX

to Certificate Registration No. 44 100 210961

to Certificate Registration No. 44 104 210961

to Certificate Registration No. 44 126 210961

DIN EN ISO 9001 : 2015

DIN EN ISO 14001 : 2015

DIN ISO 45001 : 2018

Certificate Reg.-No.	Location	Scope
44 100 210961-013	Siemens Energy Global GmbH & Co. KG	Marketing, Sales, Engineering, Project Management, Supply Chain Management, Manufacturing, Research and Development, Consulting Services, Inspection, Testing (local Complete Unit Test), Installation, Commissioning, Training , Diagnostic Services, Refurbishment, Repair, Maintenance , Overhaul, Parts Management, Field Service, Modernization and Upgrades, Long Term Programs, Technical Support, Emergency Services, Digital Services, Extensions of Transmission & Distribution Products, Transmission & Distribution Systems, Transmission & Distribution Solutions
44 104 210961-013	Division Transmission	
44 126 210961-013	Katzwanger Straße 150 90461 Nürnberg Germany	
44 100 210961-015	Siemens Energy Global GmbH & Co. KG	Sales, Engineering, Project Management, Supply Chain Management, Product Lifecycle Management, Consulting Services, Inspection, Installation, Commissioning, Training , Diagnostic Services, Refurbishment, Repair, Maintenance , Overhaul, Parts Management, Field Service, Modernization and Upgrades, Long Term Programs, Technical Support, Emergency Services, Digital Services, Extensions of Transmission & Distribution Products, Transmission & Distribution Systems, Transmission & Distribution Solutions
44 104 210961-015	Division Transmission	
44 126 210961-015	Nonnendammallee 101 13629 Berlin Germany	
44 100 210961-016	Siemens Energy Global GmbH & Co. KG	Marketing, Sales, Engineering, Project Management, Supply Chain Management, Manufacturing, Research and Development, Testing (local Complete Unit Test), Installation, Commissioning of Transmission Products
44 104 210961-016	Division Transmission	
44 126 210961-016	c/o Siemens Energy Austria GmbH Transformers and Global Core Cutting Center Weiz Elingasse 3 8160 Weiz Austria	

ANNEX

to Certificate Registration No. 44 100 210961

to Certificate Registration No. 44 104 210961

to Certificate Registration No. 44 126 210961

DIN EN ISO 9001 : 2015

DIN EN ISO 14001 : 2015

DIN ISO 45001 : 2018

Certificate Reg.-No.	Location	Scope
44 100 210961-017	Siemens Energy Global GmbH & Co. KG	Marketing, Sales, Engineering, Project Management, Supply Chain Management, Manufacturing, Research and Development, Testing (local Complete Unit Test), Installation, Commissioning of Transmission Products
44 104 210961-017	Division Transmission	
44 126 210961-017	c/o Siemens Energy Austria GmbH - Transformers Linz Kraußstraße 7 4020 Linz Austria	
44 100 210961-019	Siemens Energy Global GmbH & Co. KG	Marketing, Sales, Engineering, Project Management, Supply Chain Management, Manufacturing, Research and Development, Testing (local Complete Unit Test), Repair, Maintenance, Parts Management, Technical Support of Transmission Products
44 104 210961-019	Division Transmission	
44 126 210961-019	Hegelstraße 20 73230 Kirchheim unter Teck Germany	
44 100 210961-032	Siemens Energy Global GmbH & Co. KG	Marketing, Sales, Engineering, Project Management, Supply Chain Management, Manufacturing, Research and Development, Testing (local Complete Unit Test), Installation, Commissioning of Transmission Products
44 104 210961-032	Division Transmission	
44 126 210961-032	Overbeckstraße 44 01139 Dresden Germany	
44 100 210961-033	Siemens Energy Global GmbH & Co. KG	Marketing, Sales, Engineering, Project Management, Supply Chain Management, Manufacturing, Research and Development, Testing (local Complete Unit Test), Installation, Commissioning of Transmission Products
44 104 210961-033	Division Transmission	
44 126 210961-033	c/o Siemens Energy Transformers S.r.l. Via di Spini, 9 38121 Trento (TN) Italy	
44 100 210961-034	Siemens Energy Global GmbH & Co. KG	Marketing, Sales, Engineering, Project Management, Supply Chain Management, Manufacturing, Research and Development, Testing (local Complete Unit Test), Repair of Transmission Products
44 104 210961-034	Division Transmission	
44 126 210961-034	c/o Trench Italia S.r.l. Strada Curagnata 37, 17014 Cairo Montenotte (SV) Italy	

ANNEX

to Certificate Registration No. 44 100 210961

to Certificate Registration No. 44 104 210961

to Certificate Registration No. 44 126 210961

DIN EN ISO 9001 : 2015

DIN EN ISO 14001 : 2015

DIN ISO 45001 : 2018

Certificate Reg.-No.	Location	Scope
44 100 210961-035	Siemens Energy Global GmbH & Co. KG Division Transmission	Marketing, Sales, Engineering, Project Management, Supply Chain Management, Manufacturing, Research and Development, Testing (local Complete Unit Test), Repair, Maintenance, Parts Management, Technical Support of Transmission Products
44 104 210961-035	c/o Siemens Energy Kft. II. Rákoczi Ferenc út 189 1214 Budapest Hungary	
44 126 210961-035		
44 100 210961-036	Siemens Energy Global GmbH & Co. KG Division Transmission	Sales, Engineering, Project Management of Transmission & Distribution Products, Transmission & Distribution Systems
44 104 210961-036	c/o Siemens Energy AS Bratsbergvegen 5, 7031 Trondheim, Norway	
44 126 210961-036		
44 100 210961-037	Siemens Energy Global GmbH & Co. KG Division Transmission	Marketing, Sales, Engineering, Project Management, Supply Chain Management, Manufacturing, Product Lifecycle Management, Research and Development, Testing (local Complete Unit Test), Training, Parts Management of Transmission Products
44 104 210961-037	Muggenhoferstraße 135 90429 Nuernberg	
44 126 210961-037	Germany	

- End of the List -


 Certification Body
 at TÜV NORD CERT GmbH

Essen, 2022-02-16

TÜV NORD CERT GmbH

Am TÜV 1

45307 Essen

www.tuev-nord-cert.com





三星九千认证
Beijing Sanxing 9000 Certification Body Co., Ltd.



质量管理体系认证证书

注册号: 03121Q20269R7M

兹证明: 西门子(杭州)高压开关有限公司

统一社会信用代码: 91330100609135896C

地址: 浙江省杭州市经济技术开发区 18 号大街 (东) 128 号

质量管理体系符合

GB/T 19001-2016/ISO 9001:2015 标准

该质量管理体系适用于:

高压断路器、隔离开关、气体绝缘开关和高压断路器零部件的生产

颁证日期: 2021 年 07 月 14 日

有效期至: 2024 年 07 月 19 日

初次颁证: 2000 年 09 月 24 日

签发人

北京三星九千认证中心有限公司

注: 在一个认证周期内获证组织定期接受监督审核且合格后此证书保持有效, 可扫描二维码获取当前状态
本证书信息可在本机构网站 (www.sanxing9000.com) 及国家认证认可监督管理委员会官方网站 (www.cnca.gov.cn) 上查询



中国认可
国际互认
管理体系
MANAGEMENT SYSTEM
CNAS C031-M

CERTIFICATE OF CONFORMITY OF QUALITY MANAGEMENT SYSTEM CERTIFICATION

Certificate 03121Q20269R7M

This is to certify the quality management system of
**SIEMENS HIGH VOLTAGE CIRCUIT BREAKER
CO., LTD. HANGZHOU**

Unified social credit code: 91330100609135896C

Add: No.128,18th Avenue(East)of Technological Economy Development Zone,
Hangzhou,Zhejiang Province,China

is in conformity with

GB/T 19001-2016/ISO 9001:2015 standard

This certificate is valid to the following product(s)/service

Production of high voltage circuit breaker, disconnecting switch,
gas insulated switchgear and high voltage circuit breaker parts

Date of Issue: Jul 14th,2021

Date of Expiry: Jul 19th,2024

Date of Initial Issue: Sep 24th,2000

Signer

Beijing Sanxing 9000 Certification Body Co., Ltd.

Notice: The organization must be audited regularly within one certification cycle. Upon qualified, the certificate would be valid and QR code can be scanned to obtain its current status. The certificate information can be queried on the Beijing Sanxing 9000 Certification Body Co., Ltd's website by www.sanxing9000.com or certification and accreditation administration of the P.R.C. website by www.cnca.gov.cn.



中国认可
国际互认
管理体系
MANAGEMENT SYSTEM
CNAS C031-M



三星九千认证
Beijing Sanxing 9000 Certification Body



环境管理体系认证证书

注册号: 03120E20172R3M

兹证明: 西门子(杭州)高压开关有限公司

统一社会信用代码: 91330100609135896C

地址: 浙江省杭州市经济技术开发区 18 号大街 (东) 128 号

环境管理体系符合

GB/T 24001-2016/ISO 14001:2015 标准

该环境管理体系适用于:

高压断路器、隔离开关、气体绝缘开关和高压断路器零部件的生产

颁证日期: 2020 年 09 月 08 日

有效期至: 2023 年 09 月 22 日

初次颁证: 2011 年 12 月 27 日

注: 在一个认证周期内获证组织定期接受监督审核且合格后此证书保持有效, 可扫描二维码获取当前状态
本证书信息可在本机构网站 (www.sanxing9000.com) 及国家认监委官方网站 (www.cnca.gov.cn) 上查询

总经理

北京三星九千认证中心



中国认可
国际互认
管理体系
MANAGEMENT SYSTEM
CNAS C031-M

CERTIFICATE OF CONFORMITY OF ENVIRONMENT MANAGEMENT SYSTEM CERTIFICATION

Certificate 03120E20172R3M

This is to certify the environment management system of
**SIEMENS HIGH VOLTAGE CIRCUIT BREAKER
CO., LTD. HANGZHOU**

Unified social credit code: 91330100609135896C

Add: No.128,18th Avenue(East)of Technological Economy Development Zone,
Hangzhou,Zhejiang Province,China

is in conformity with

GB/T 24001-2016/ISO 14001:2015 standard

This certificate is valid to the following product(s)/service

**Production of high voltage circuit breaker, disconnecting switch,
gas insulated switchgear and high voltage circuit breaker parts**

Date of Issue: Sep 8th,2020

Date of Expiry: Sep 22nd,2023

Date of Initial Issue: Dec 27th,2011

General Manager

Beijing Sanxing 9000 Certification Body

Notice: The organization must be audited regularly within one certification cycle. Upon qualified, the certificate would be valid and QR code can be scanned to obtain its current status. The certificate information can be queried on the beijing sanxing 9000 certification body's website by www.sanxing9000.com or certification and accreditation administration of the P.R.C. website by www.cnca.gov.cn.



中国认可
国际互认
管理体系
MANAGEMENT SYSTEM
CNAS C031-M



A U T H O R I Z A T I O N

This is to confirm that

P.T. Siemens Indonesia
Arkadia Office Park Tower F., 18th Floor
Jl. TB Simatupang Kav. 88
Jakarta 12520

Indonesia

is granted the **exclusive** sales rights for Contractual Products of Siemens Energy Global GmbH & Co. KG, Munich, Federal Republic of Germany ("Siemens Energy") in the Contractual Territory.

The Contractual Territory is **Indonesia**.

Contractual Products are the products, systems and services of the following Siemens Energy portfolio:

Siemens Energy:	
➤ Large Gas Turbines	(SE) (SE G LRE)
➤ Aero Derivative Gas Turbines	(SE O&G PR)
➤ Medium Gas Turbines	(SE G IGT)
➤ Small Gas Turbines	(SE O&G PR)
➤ Large Steam Turbines	(SE G LRE)
➤ Industrial Steam Packages	(SE G INP)
➤ Small Steam Packages	(SE G INP)
➤ Oil & Gas Products	(SE O&G PR)
➤ Oil & Gas Solutions ¹⁾	(SE O&G SO)
➤ Distributed Control Systems	(SE G I&C)
➤ Transmission Products	(SE T SE/SP)
➤ Transmission Solutions	(SE T SO)
➤ Service Power Generation	(SE G SV)
➤ Service Distributed Generation and Oil & Gas	(SE O&G SV)
➤ Service Controls and Digitalization	(SE SV CD)
➤ Service Power Transmission	(SE G SV)

¹⁾ Sales and representation rights to the Contractual Products of Siemens Energy, Oil & Gas Solutions, Water Solutions (SE O&G SO WS) are excluded.

In this capacity, **P.T. Siemens Indonesia** is authorized to market, mediate and sell Contractual Products in the Contractual Territory.

Siemens Energy Global GmbH & Co. KG

Registered office: Munich, Germany; Commercial registry: Munich, HRA 111200;
 Personally liable partner: Siemens Energy Management GmbH;
 Chairman of the Supervisory Board: Joe Kaeser;
 Executive Board: Christian Bruch, President and Chief Executive Officer; Jochen Eickholt, Maria Ferraro, Tim Oliver Holt;
 Registered office: Munich, Germany; Commercial registry: Munich, HRB 241345

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 20211104_AUT_PT Siemens Indonesia.doc

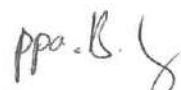
P.T. Siemens Indonesia is also authorized to receive tenders and inquiries from public authorities and private customers in the Contractual Territory within the scope of its authorization and to deliver corresponding offers made by Siemens Energy.

The conclusion of any contract or agreement on behalf of Siemens Energy or any action imposing any financial or other obligation on Siemens Energy requires the prior written consent of Siemens Energy.

This Authorization is valid until **December 31, 2022**.

Munich, November 4, 2021

Siemens Energy Global GmbH & Co. KG



Björn Ley



Birgit Heininger

I, Dr. Eva Maria Klatt, Notary Public of the City of Duisburg, Federal Republic of Germany, do hereby certify and attest, that

1. Mr. Björn Ley, born on 16.03.1978,
with his business seat Wolfgang-Reuter-Platz 4, 47053 Duisburg,
-personally known to me-

2. Mrs. Birgit Heininger, born on 28.05.1967,
with her business seat Wolfgang-Reuter-Platz 4, 47053 Duisburg,
-personally known to me-
acting as authorized signatory on the basis of the attached notarized copy of the power
of attorney from the Siemens Energy Global GmbH & Co. KG,

have signed their signatures on the foregoing document in my presence.

No. 267 of the record book 2021 (DrEK)

Duisburg, 10th November 2021


Dr. Eva Maria Klatt
Notary Public

Siemens Energy Global GmbH & Co. KG, Wolfgang-Reuter-Platz 4; 47053
Duisburg; Deutschland

Birgit Heininger
Drosselweg 12
42579 Heiligenhaus

Name	Abteilung
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Mobil	+49 (
Mail	frank

Ihr Zeichen	1468
Orgeinheit	SE R
FK	Linde

Datum	21.11
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- Handlungsvollmacht

Sehr geehrter Frau Heininger,

die Siemens Energy Global GmbH & Co. KG erteilt Ihnen hiermit für Ihre

Im Rahmen der Handlungsvollmacht sind Sie befugt, die Siemens En
hinsichtlich der Geschäfte, die innerhalb Ihres Aufgabenbereichs gewö
einem Prokuristen, einem anderen Handlungsbevollmächtigten oder ein
der Siemens Energy Global GmbH & Co. KG zu vertreten. Sofern das Ge
Ihrem Aufgabenbereich gewöhnlich anfallenden Geschäfte hinausgeht, (c
Global GmbH & Co. KG nur gemeinsam mit Ihrem Vorgesetzten, soweit d
einem Prokuristen vertreten.

Im Rahmen der Handlungsvollmacht sind Sie grundsätzlich nicht befugt
von Grundstücken, zur Eingehung von Wechselverbindlichkeiten, zur
Abgabe von Patronatsklärungen, Garantien oder anderen H
Prozessführung. Die Handlungsvollmacht umfasst jedoch
Gerichtsstandsvereinbarungen sowie von Rechtswahl- und Schiedskau
Absatz genannten Geschäfte.

Ferner schließt diese Handlungsvollmacht die Befugnis zur Einstellung u
nicht ein.

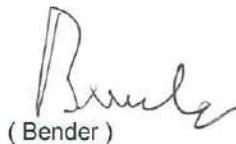
9101 E 1 - 40013

Die Echtheit vorstehender – umseitiger - Unterschrift
der Notarin

Dr. Eva Maria Klatt in Duisburg

und die Echtheit des beigedrückten Dienstsiegels /
Dienststempels werden hiermit bescheinigt.
Zugleich wird bescheinigt, dass die Vorgenannte zur
Vornahme der Amtshandlung befugt ist.

Duisburg, 23. November 2021
Der Präsident des Landgerichts


(Bender)



**KEDUTAAN BESAR REPUBLIK INDONESIA
EMBASSY OF THE REPUBLIC OF INDONESIA**

No. 932-SL/PK/XII-2021

Melihat dan mengesahkan stempel dari Kantor Pengadilan Tinggi
wilayah DUISBURG dan tanda tangan

BENDER,

Pejabat Kantor Pengadilan Tinggi di DUISBURG.
Pengesahan tidak mencakup isi dokumen.

Berlin, 21 Desember 2021

o.n. Kepala Perwakilan R.I.

Bea/Fee
€ 125,00



Satriyo Pringgodihary
 Counsellor Protokol-Konsuler
 NIP. 19780924 199803 1 001

Siemens Energy Global GmbH & Co. KG, SE GP T SP PRO R&D,
Paulsternstr. 26, 13629 Berlin, Germany

To whom it may concern

Name
Department

Oliver Dohnke
SE GP T SP PRO R&D

Telephone
E-mail

+49 (175) 1821533
oliver.dohnke@siemens-energy.com

Date

May 12, 2022

Confirmation

Report-No.: SP K180

Content: 2 Sheet

Object: Global Manufacturing & Supply Experience

Product(s): High Voltage Circuit Breakers 3AP Series

Manufacturer: Siemens High Voltage Circuit Breaker Co., Ltd., Hangzhou

GLOBAL MANUFACTURING & SUPPLY EXPERIENCE FOR 3AP SERIES HIGH VOLTAGE CIRCUIT BREAKERS

We write referring to Siemens High Voltage Circuit Breaker Manufacturing facility in China, we take this opportunity to draw your kind attention on below referred facts.

1. Siemens High Voltage Circuit Breaker Co., Ltd., Hangzhou (hereafter, Hangzhou factory) is manufacturing and supplying High Voltage Circuit Breakers up to 1100kV under license of Siemens Energy Global, Germany, manufacturing.
2. The Hangzhou factory is one of the global manufacturing bases of Siemens Energy worldwide.
3. Hangzhou factory is fully supported by our principals 'Siemens Energy, Germany', with the design specifications, manufacturing processes and quality standards from its global operations. This collaboration lets Hangzhou factory avail the vast knowledge and experience from Siemens Energy to ensure the quality in order to meet customer expectations.

Siemens Energy Global GmbH & Co. KG

Paulsternstr. 26
13629 Berlin
Germany

Tel.: +49 (30) 5859 0

Registered office: Munich, Germany; Commercial registry: Munich, HRA 111200;
Personally liable partner: Siemens Energy Management GmbH;
Chairman of the Supervisory Board: Joe Kaeser;
Executive Board: Christian Bruch, President and Chief Executive Officer; Karim Amin, Maria Ferraro, Tim Oliver Holt;
Registered office: Munich, Germany; Commercial registry: Munich, HRB 241345
SCF V12

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4. The manufacturing processes are in line with worldwide valid instructions defined by Siemens Energy in Berlin / Germany as lead factory. The technical support and knowledge transfer is ensured on continuous basis.
5. Hangzhou factory manufactures the High Voltage Circuit Breakers type 3AP, following design & technology of Siemens Energy Berlin / Germany.
6. Hangzhou factory also sources some of the major important and critical components of High Voltage Circuit Breakers from Siemens Energy, Germany and their direct qualified suppliers.
7. Due to aligned processes, design and supply chains, applicable type test documents prove the technical capability independent from the production site.

We, at Siemens Energy continuously work and invest for future proof technologies so as to serve our valued customers with up-to-date solutions built up in our state-of-the-art facilities.

With above submission, we would also take the opportunity to invite you at the works in Hangzhou factory, to witness the world class facilities and experience global collaborations. We trust during your visit to the Hangzhou factory, we will be able to explain and demonstrate the proven processes and quality standards as well as practices in an enhanced manner.

Considering the mentioned above processes, technical and quality standards Hangzhou factory is strictly following in line with Siemens Energy Berlin factory standards, Siemens Energy confirms that manufacturing, supply and successful commissioning experience of 3AP series High Voltage Circuit Breakers gained by Siemens Energy globally is also available for High Voltage Circuit breakers produced in Siemens High Voltage Circuit Breaker Co., Ltd., Hangzhou.

Dohnke
Oliver

Digital signiert von Dohnke
Oliver
DN: cn=Dohnke Oliver, c=DE,
o=Siemens,
email=oliver.dohnke@siemens-
energy.com
Datum: 2022.05.12 14:10:39
+02'00'

Oliver Dohnke
SE GP T SP PRO R&D
Principal Key Expert Air-Insulated Switchgears
May 12th, 2022

To whom it may concern

Energy

Name	Oliver Dohnke
Department	E T HP CB B GTS
Location,	BLN N 101, GERMANY
Country	
Company	Siemens AG
name	
Telephone	+49 (30) 386-57502
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Mobile	+49 (175) 1821533
E-mail	oliver.dohnke@siemens.com
Date	April 15, 2013

Report-No.: ET HP CB GTS K024

Confirmation

Object: Siemens Circuit Breaker production in Hangzhou

Applied Standard: IEC 62271-1, IEC 62271-100 and related product standards

Manufacturer: Siemens AG, E T HP CB

Siemens confirms that the circuit breaker types produced at the Siemens Hangzhou factory, SHVC, are manufactured according to drawing and design of Siemens Berlin factory and are a product of Siemens Company.

The Siemens circuit breaker factory in Hangzhou is subjected to the same high quality system and manufacturing processes as the Siemens circuit breaker factory in Berlin.

Furthermore it is confirmed that due to the mentioned topics above the present type test documents are still valid.

The manufacturing process is according to the Siemens quality and control system and the requirements of the international standards IEC 62271-1, IEC 62271-100 and related product standards are fulfilled.

The responsibility regarding the quality of the circuit breaker types is in the hand of Siemens.



Oliver Dohnke

Siemens AG
Energy Sector; Management: Michael Suess
Power Transmission Division; Management: Karlheinz Springer
High Voltage Products; Management: Dieter Schade

Nonnendammallee 104
13629 Berlin
Germany

Tel.: +49 (30) 386 0

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme;
Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer, Roland Busch, Brigitte Ederer, Klaus Helmrich,
Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmsen, Michael Suess
Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684
WEEE-Reg.-No. DE 23691322

CB reference list

SHVC						Up to Dec 31th 2021
Years	Country	Type	Type_code	Voltage	Sum of Qty	
2007	China	LT	3AP3 FI 550	550	9	
					9	
					9	
					9	
2008	China	LT	3AP3 FI 550	550	15	
					15	
					15	
					15	
2009	China	LT	3AP3 FI 550	550	3	
					3	
					3	
					3	
2010	China	LT	3AP3 FI 550	550	2	
					2	
					2	
					2	
2011	China	LT	3AP3 FI 550	550	3	
					3	
					3	
					3	
2012	China	LT	3AP3 FI 550	550	3	
					3	
					3	
					3	
2014	China	LT	3AP3 FI 550	550	13	
					13	
					13	
					13	
2015	Kazakhstan	LT	3AP3 FI 550	550	2	
					2	
					2	
					2	
2016	China	LT	3AP3 FI 550	550	10	
					10	
					10	
					10	
2017	China	LT	3AP3 FI 550	550	27	
					8	
					8	
					8	

CB reference list

SHVC				Up to	Dec 31th 2021
2017	China	LT	3AP3 FI 550	550	8
	Pakistan	LT			19
			3AP3 FI 550		19
				550	19
2018	China				9
		LT			1
			3AP3 FI 550		1
				550	1
	Indonesia	LT			2
			3AP3 FI 550		2
				550	2
	Vietnam	LT			6
			3AP3 FI 550		6
				550	6
2019	Vietnam				31
		LT			28
			3AP3 FI 550		28
				550	28
	Kazakhstan	LT			3
			3AP3 FI 550		3
				550	3
2020	Vietnam				21
		LT			5
			3AP3 FI 550		5
				550	5
	Philippines	LT			16
			3AP3 FI 550		16
				550	16
2021	Vietnam				13
	China	LT			8
			3AP3 FI 550		8
				550	8
	Vietnam	LT			5
			3AP3 FI 550		5
				550	5
总计					161



11 Apr 2020

PST JATENG II PROYEK GITET 500kv MANDIRANCAN EKT

Pekerjaan: Pemasangan short grounding CT Dia 4 sisi AB untuk persiapan stability buspro-



High Voltage Circuit Breaker Co., Ltd., Hangzhou

Siemens High Voltage Circuit Breaker Co., Ltd., Hangzhou

550 kV Porcelain-pole AC Circuit Breaker

Type Test Report



High Voltage Circuit Breaker Co., Ltd., Hangzhou

Table of Contents

Product Model	Serial No.	Type Test Report No.	Date of Report Issued	Validity Period of Report	Inspection Institution	Report Type	Remarks
Porcelain-type 3AP2/3 -FI 550kV 5000A 63kA 分相操作	1	06048bs	2006.10	Long-term validity	PEHLA	Dielectric test	1)power frequency withstand voltage test(to earth/ across open contacts: 860/530+530); lightning impulse withstand voltage test(to earth/ across open contacts:1800/1550+450); switching impulse withstand voltage test(to earth/ across open contacts:1300/1175+450); radio interference test.
		06057bs	2006.10	Long-term validity	PEHLA	Dielectric test	lightning impulse withstand voltage test (to earth/ across open contacts:2000/1800+315);
		06084bs	2006.11	Long-term validity	PEHLA	Measurement of resistance of main circuit; temperature rise test	Temperature rise test current 5500A ($1.1 \times I_r$ according to SGCC standard)
	2	06043bs	2006.07	Long-term validity	PEHLA	short-circuit withstand current and peak withstand current test	Meet SGCC standard
	3	M0467C/E	2006.09	Long-term validity	Siemens	Mechanical operation test at normal temperature(M2 class)	Mechanical endurance 10000 times.
	4	06035-bs;06036-bs;06040-bs;S0623;S0624;S0625	2006.07 2006.09	Long-term validity	PEHLA; KEMA;	Short-circuit making and breaking current	63kA breaking test(according to IEC62271- 100 T10、T30、T60、T100s(a)、T100s(b)、T100a)
5	06039bs		2007.01	Long-term validity	PEHLA	Capacitive current switching test, Line charging and cable charging current making and	Test result meet C2 class

					breaking test.	
6	06041bs; 06042bs	2006.11	Long-term validity	PEHLA	Short line fault test	L75and L90
7	06046bs	2006.07	Long-term validity	PEHLA	Out-of-phase making and breaking test	Meet SGCC requirements
8	06074bs	2006.11	Long-term validity	PEHLA	Low and high temperature test	Passed the low and high temperature tests at -30°C~+55°C
9	0610Bm	2007.04	Long-term validity	PEHLA	Single phase shunt reactor current switching tests	Test-Duty 1-4
10	H321M-VB0811	2008.01	Long-term validity	Siemens	Seismic analysis-qualification report	0.5g
11	0145BS	2002.02	Long-term validity	PEHLA	EMC test	

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Confirmation

Report No.: 06048Bs-0

Copy No.: 0

Contents: 2 Sheets

Test object: One pole of a three-pole outdoor circuit-breaker

Designation: 3AP3FI-550kV-4000A-63kA-60Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 60 Hz

Serial No.: 06/35097235

Drawing No.: 1 HZ 427-06500-803

3HM 427-06710-001

Manufacturer: Siemens AG PTD H3

Client: Siemens AG PTD H322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: August 15-18, 2006

Applied test specifications:

IEC Publication 62271-100 Edition 1.1 (2003-05)

IEC Publication 60694 Edition 2.2 (2002-01)

ANSI C37.06 (2000)

Customer requirements

Tests performed:

Dielectric tests including

Rated power-frequency voltage tests

Rated lightning impulse withstand voltage tests

Chopped wave lightning impulse withstand voltage tests

Lightning impulse voltage against power-frequency voltage (combined voltage) tests

Rated switching impulse withstand voltage tests (dry and wet)

Switching impulse voltage against power-frequency voltage (combined voltage) tests (dry and wet)

Radio interference voltage tests

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.

Detailed results will be documented in a separate document.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Meier

Pesevski

Observers of the test
Representatives of Technical Committee

Berlin, August 18, 2006

The test results relate only to the items tested.

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50PE0402



DAT-P-017/92-52

Test Conditions and Results

Test conditions:

Condition of test object before tests:

All components were in a factory new condition and completely assembled as in service.

Connections of test object:

The connection to the high-voltage sources was performed by copper wire, except for the radio interference voltage test where the connection to the high-voltage source was performed by conductor tube.

The frame (designated with F) was earthed during all tests.

The test object was filled with SF₆-gas at minimum functional gas pressure for insulation: 0.60 MPa abs. at 20°C

Tested values:

Rated short-duration power-frequency withstand voltage (phase to earth)	860	kV
Rated short-duration power-frequency withstand voltage across open circuit breaker (phase opposition)	530+530	kV *)
Rated lightning impulse withstand voltage (phase to earth) and across open circuit breaker	1800	kV
Chopped wave lightning withstand voltage across open circuit breaker	2320	kV
Rated lightning impulse withstand voltage across open circuit breaker (combined voltage test)	1550+450	kV *)
Rated switching impulse withstand voltage (phase to earth) in dry and wet conditions	1300	kV *)
Rated switching impulse withstand voltage across open circuit breaker in dry and wet conditions	1300	kV
Rated switching impulse withstand voltage across open circuit breaker (combined voltage test) in dry and wet conditions	1175+450	kV *)
Radio interference voltage test	349	kV

Remarks:

*) With respect to standard rated values increased test levels specified by the client

Evaluation:

The test object passed all tests without any objection.

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Confirmation

Report No.: 06057Bs-0

Copy No.: 0

Contents: 2 Sheets

Test object: One pole of a three-pole outdoor circuit-breaker

Designation: 3AP3FI-550kV-4000A-63kA-60Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 60 Hz

Serial No.: 06/35097235

Drawing No.: 1 HZ 427-06500-803

3HM 427-06710-001

Manufacturer: Siemens AG PTD H3

Client: Siemens AG PTD H322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: August 15-18, 2006

Applied test specifications:

IEC Publication 62271-100 Edition 1.1 (2003-05)

IEC Publication 60694 Edition 2.2 (2002-01)

ANSI C37.06 (2000)

Customer requirements

Rated lightning impulse withstand voltage tests: 2000 kV,

Lightning impulse voltage against power-frequency voltage (combined voltage) tests: (1800+315) kV

Tests performed:

Dielectric tests including

Rated lightning impulse withstand voltage tests

Lightning impulse voltage against power-frequency voltage (combined voltage) tests

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.

Detailed results will be documented in a separate document.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Meier

Peshevski

Observers of the test
Representatives of Technical Committee

Berlin, August 18, 2006

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50PE0402



Test Confirmation

Report No.: 06084 Bs-0

Copy No.: 1

Contents: 2 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP3 FI – 550 kV – 5500 A – 63kA – 50/60 Hz

Rated voltage: 550kV Rated normal current: 5500 A

Rated frequency: 60 Hz

Serial No.: 06 / 35097606

Drawing No.: 1HZ 427 – 06500 – 802

Manufacturer: Siemens AG, PTD H3, Berlin

Client: Siemens AG, PTD H322-2, Berlin

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: November 20 to 21, 2006

Applied test specifications:

IEC 62271-100 Ed. 1.0 (2003) ; according customer requirements rated normal current :5500 A

IEC 60694 Ed. 2.2 (2002)

Tests performed:

Temperature-rise test for a rated normal current of 5500 A, 60 Hz

Measurement of the resistance of the main circuit

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performance proved of the test object comply with the requirements of the specifications mentioned above.

Detailed results will be documented in a separate document.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Wachholz

Dr. Wachholz

Observers of the test
Representatives of Technical Committee

Heinrich

Dr. Heinrich

Berlin, November 24, 2006

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PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Confirmation

Report No.: 06043 Bs -0

Copy No.: 1

Contents: 2 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Serial No.: 35097604

Drawing No.: 1HZ 427 06300 804

Manufacturer: Siemens AG, PTD H3, Berlin

Client: Siemens AG, PTD H322, Berlin

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: 16.07.2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

Tests performed:

Short-time withstand current and peak withstand current tests for a peak factor of 2.7 p.u. and a duration of short-circuit of 3 s.

Test results:

The test object has passed the test(s) stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.

Detailed results will be documented in a separate document.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Eugenio D'Adda
D'Adda

Werning
Werning

Berlin, 19.07.2006

Observers of the test
Representatives of Technical Committee

The test results relate only to the items tested.

This document is issued immediate after the tests and is valid only until publishing the entire test document.

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50SE0407

Test Report

Report-No.: M 0467 C/E

Copy-No.: 0

Contents: 13 Sheets

Test Object: Single-pole operated outdoor circuit-breaker
3AP3 FI – 550 kV – 4000 A – 63 kA – 50/60 Hz

Manufacturer: Siemens AG, PTD H3, Berlin

Client: Siemens AG, PTD H3, Berlin

Date of Test: August 10 to August 30, 2006

Testing Station: Siemens AG, Mechanical Test Laboratory

Applied Test Specifications:

IEC 62271-100 Ed. 1.1 (2003)
IEC 60694 Ed. 2.2 (2002)

Test Performed:

Mechanical operation test at ambient air temperature with 10 000 operating cycles.

Test Result:

The test object has passed the test stated above without any objection.
The results obtained and the performance proved of the test object comply with the requirements of the specifications mentioned above.

**Power Transmission and Distribution
Circuit-Breakers
Mechanical Laboratories PTD H 321**

i.V.N. Trapp
Dr. Trapp
Head Test Laboratories
High Voltage Division



n.v. Kraft
Kraft
Head Mechanical Test Laboratory
High Voltage Division

Berlin, September 07, 2006

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Confirmation

Report No.: 06035 Bs -0

Copy No.: 1

Contents: 2 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Serial No.: 35097232

Drawing No.: 1HZ 427 06300 804

Manufacturer: Siemens AG, PTD H3, Berlin

Client: Siemens AG, PTD H322, Berlin

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: 05.07.2006 und 12.07.2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

Tests performed:

Basic short-circuit making and breaking tests, test duty T10

Test results:

The test object has passed the test(s) stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.

Detailed results will be documented in a separate document.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Haitz

Gierl

Berlin, 13.07.2006

Observers of the test
Representatives of Technical Committee

The test results relate only to the items tested.

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50SE0407

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Confirmation

Report No.: 06036 Bs -0

Copy No.: 1

Contents: 2 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Serial No.: 35097232

Drawing No.: 1HZ 427 06300 804

Manufacturer: Siemens AG, PTD H3, Berlin

Client: Siemens AG, PTD H322, Berlin

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: 05.07.2006 und 12.07.2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

Tests performed:

Basic short-circuit making and breaking tests, test duty T30

Test results:

The test object has passed the test(s) stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.

Detailed results will be documented in a separate document.



Berlin, 13.07.2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Haitz

Giere

Observers of the test
Representatives of Technical Committee

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Confirmation

Report No.: 06040 Bs -0

Copy No.: 0

Contents: 2 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Serial No.: 35097604

Drawing No.: 1HZ 427 06300 804

Manufacturer: Siemens AG, PTD H3, Berlin

Client: Siemens AG, PTD H322, Berlin

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: 06.07.2006 und 11.07.2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

Tests performed:

Basic short-circuit making and breaking tests, test duty T60

Test results:

The test object has passed the test(s) stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.

Detailed results will be documented in a separate document.



Berlin, 13.07.2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Haitz

Trempler

Observers of the test
Representatives of Technical Committee

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50SE0407



DAT-P-017/92-52

SUMMARY OF TESTS PERFORMED

Client : Siemens AG,
Berlin, Germany

Manufacturer : Siemens AG,
Berlin, Germany

Apparatus tested : One pole of a single-pole-operated three-pole outdoor SF₆ circuit-breaker,
incorporating two interrupter units per pole.
Grading capacitor per interrupter unit 1000 pF.

Designation 3AP2 FI-550 kV-4000 A-63 kA-50 Hz

Rated voltage	550 kV
Rated current	4000 A
Rated frequency	50 Hz
First pole to clear factor	1,5
Rated short-time current:	
Peak value	170 kA
Rms value	63 kA for 3 s
Rated pressure for interruption	0,7 MPa
Minimum pressure for interruption	0,6 MPa

Test dates : September 2006

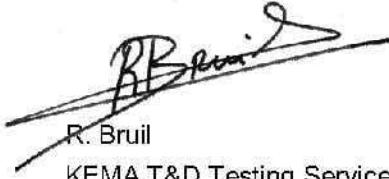
Test location : KEMA High-Power Laboratory

Test requirement : IEC 62271-100

Tests performed : T100s(a) (full pole) and T100s(b) (half pole and FF 1,3/1,5) at 0,6 MPa

Summary and conclusion : During the tests the circuit-breaker operated satisfactorily.

KEMA Nederland B.V.


R. BruilKEMA T&D Testing Services
Certification and reports

SUMMARY OF TESTS PERFORMED

Client : Siemens AG,
Berlin, Germany

Manufacturer : Siemens AG,
Berlin, Germany

Apparatus tested : One pole of a single-pole-operated three-pole outdoor SF₆ circuit-breaker,
incorporating two interrupter units per pole.
Grading capacitor per interrupter unit 1000 pF.

Designation 3AP2 FI-550 kV-4000 A-63 kA-50 Hz

Rated voltage	550 kV
Rated current	4000 A
Rated frequency	50 Hz
First pole to clear factor	1,5
Rated short-time current:	
Peak value	170 kA
Rms value	63 kA for 3 s
Rated pressure for interruption	0,7 MPa
Minimum pressure for interruption	0,6 MPa

Test dates : September 2006

Test location : KEMA High-Power Laboratory

Test requirement : IEC 62271-100

Tests performed : T100a (full pole and FF 1,3) at 0,6 MPa

Summary and conclusion : During the tests the circuit-breaker operated satisfactorily.

KEMA Nederland B.V.


R. BruilKEMA T&D Testing Services
Certification and reports

SUMMARY OF TESTS PERFORMED

Client : Siemens AG,
Berlin, Germany

Manufacturer : Siemens AG,
Berlin, Germany

Apparatus tested : One pole of a single-pole-operated three-pole outdoor SF₆ circuit-breaker,
incorporating two interrupter units per pole.
Grading capacitor per interrupter unit 1000 pF.

Designation 3AP2 FI-550 kV-4000 A-63 kA-50 Hz

Rated voltage	550 kV
Rated current	4000 A
Rated frequency	50 Hz
First pole to clear factor	1,5
Rated short-time current:	
Peak value	170 kA
Rms value	63 kA for 3 s
Rated pressure for interruption	0,7 MPa
Minimum pressure for interruption	0,6 MPa

Test dates : September 2006

Test location : KEMA High-Power Laboratory

Test requirement : IEC 62271-100

Tests performed : T100a (half pole and FF 1,5) at 0,6 MPa

Summary and conclusion : During the tests the circuit-breaker operated satisfactorily.

KEMA Nederland B.V.

R. Bruij
KEMA T&D Testing Services
Certification and reports

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06039 Bs

Copy No.: 0

Contents: 193 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A

Rated short-circuit breaking current: 63 kA

Rated frequency: 50 Hz

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 31 - August 03, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Capacitive current switching tests for verification of the making and breaking performance of line-charging and cable-charging currents for a capacitive voltage factor of $K_c=1.4$ p.u. and a frequency of 50 Hz according class C2.

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, January 22, 2007

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

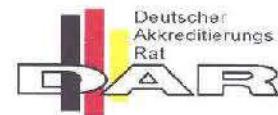
Management Committee

Technical Committee

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02SE0607



DAT-P-017/92-52

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06041 Bs Copy No.: 0 Contents: 44 Sheets
Test object: Single-pole operated outdoor circuit-breaker
Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz
Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA
Manufacturer: Siemens AG, PTD H 3
Client: Siemens AG, PTD H 322-2
Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt
Date of test: August 02, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)
IEC Publication 60694 (2002)
IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Short-line fault test, test duty L90 including voltage test as a condition check.

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

v. Haiz Walz
Technical Committee

Mannheim, November 24, 2006

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02SE0607



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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06042 Bs

Copy No.: 0

Contents: 41 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 KV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 KV Rated normal current: 4000 A

Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 18, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Short-line fault test, test duty L75

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

Mannheim, October 30, 2006

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02SE0607



PEHLA

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Confirmation

Report No.: 06046 Bs -0

Copy No.: 1

Contents: 2 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Serial No.: 35097604

Drawing No.: 1HZ 427 06300 804

Manufacturer: Siemens AG, PTD H3, Berlin

Client: Siemens AG, PTD H322, Berlin

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: 20.-21.07.2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

Tests performed:

Out-of-phase making and breaking tests, test duty OP2; first-pole-to-clear factor 2.5 p.u. and arcing times satisfying the conditions for a first-pole-to-clear factor of 2.0 p.u.

Test results:

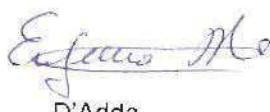
The test object has passed the test(s) stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.

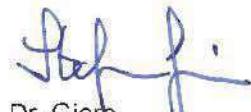
Detailed results will be documented in a separate document.



Berlin, 26.07.2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN


D'Adda


Dr. Giere

Observers of the test
Representatives of Technical Committee

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50SE0407



DAT-P-017/92-52

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06074 Bs

Copy No.: 0

Contents: 21 Sheets

Test object: Single-pole operated three-pole outdoor circuit-breaker

Designation: 3AP3FI – 550 kV – 4000 A – 63 kA – 50/60 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50/60 Hz
Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H3, Germany

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: September 29 to October 16, 2006

Applied test specifications:

IEC 62271-100 Ed. 1.1 (2003)

IEC 60694 Ed. 2.2 (2002)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned standards and the STL Guides wherever applicable.

Tests performed:

Low and high temperature tests at -30°C and +55°C

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Pamela *A. Bach* *U. L.*
Technical Committee

Mannheim, November 16, 2006

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DAT-P-017/92-52

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Report

Report No.: 0610Bm

Copy No.: 1

Contents: 146 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A

Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Serial No.: 35097232

Drawing No.: 1HZ 427 06300 804

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin Marzahn

Date of test: July 26-27, 2006

Applied test specifications:

IEC Publication 62271-110 (2005)

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

Tests performed:

Single-phase shunt reactor current switching tests

The unit test was performed with a voltage distribution factor of 0.53.

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

Mannheim, April 25, 2007

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03PE0402



DAT-P-019/92-62

Seismic Analysis-Qualification Report

No.: H321M-VB0811

Copy-No.: 0

Content: 8 Sheet(s)

Circuit-breaker 3AP2 FI 550 kV

The above-named high voltage circuit-breaker with support structure, mounted on firm ground, is qualified by finite element analysis in accordance with IEC 62271-300 for a seismic qualification level of 0.5g ZPA (zero period acceleration). The required response spectrum (RRS) and additional loads are chosen as demanded in IEC 62271-300 (2006).

**Power Transmission and Distribution
Switching Devices
Mechanical Test Laboratory – PTD H 321 M**


Bernd-Heiko Krafft
Head Mechanical Test Laboratory



Berlin, 2008 January 28

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Address:
Siemens AG
PTD H 321
13623 Berlin

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the Short-Circuit-Testing Liaison (STL)

Test Report

Report No.: 0145 BS

Copy No.: 0

Contents: 11 Sheets
Annex: Test Report
EMCC WE/nr-910112L/LB

Equipment under test: Control cubicle of high voltage outdoor circuit-breaker
3AP1 FI

Drawing No. of test objects: 3HS 455 00025 229 2
3HS 455 00025 900 8

Manufacturer: Siemens AG, PTD H 3, Berlin

Client: Siemens AG, PTD H 372, Berlin

Testing station: EMCC Dr. Rašek by order of PEHLA-Prüffeld Berlin-Siemensstadt

Date of test: December 03 – December 12, 2001; January 16, 2002

Applied test specifications:
IEC Publication 60694 (1996) + Amd. 1 (2000) + Amd. 2 (2001)

Enhanced clients specifications:

Unipede Automation and Control Apparatus for Generating Stations and Substations Electromagnetic Compatibility Immunity Requirements (1995)

Tests performed:

Electromagnetic compatibility (EMC) tests on secondary systems

Continued on sheet 2

Test results:

At the control cubicle (drawing no. 3HS 455 00025 229 2) EMC tests as listed on sheet 2 were performed. During the tests no deviation from specified operation occurred. After the tests the control cubicle was still fully operational. The tests were passed without any objections.

After the installation of additional varistors the control cubicle (drawing no. 3HS 455 00025 900 8) passed the test according to IEC 61000-4-4 and IEC 61000-4-5 without any objections. During the test no deviation from specified operation occurred. After the test the control cubicle was still fully operational.

With these tests the EMC requirements according to IEC 60694 and Unipede „Automation Control Apparatus for Generating Stations and Substations Electronic Compatibility Immunity Requirements“ were fulfilled.

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN



Pauer
Technical Committee

H. Jahn

H. Felder

Mannheim, February 28, 2002

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REPORT OF PERFORMANCE

524-06

APPARATUS	Single-pole operated outdoor circuit-breaker. Grading capacitor per interrupter unit 1000 pF.
TYPE	3AP2 FI – 550 kV – 4000 A – 63 kA – 50 Hz
SERIAL No.	35097232
CLIENT	Siemens AG, PTD H322-2 Berlin, Germany
MANUFACTURER	Siemens AG, PTD H3 Berlin, Germany
TESTED BY	KEMA HIGH-POWER LABORATORY Utrechtseweg 310 - 6812 AR Arnhem - The Netherlands
DATE(S) OF TESTS	31 August and 1 September 2006
TEST SPECIFICATION	The tests have been carried out strictly in accordance with IEC 62271-100, subclause 6.102 to 6.105 and 6.106.4 (T100s with k_{pp} 1,3/1,5 and at 50 Hz).
REMARKS	The apparatus has complied with the relevant requirements.

This report consists of 71 sheets in total.

This report falls under the scope of the accreditation certificates L 020 of the Dutch Council for Accreditation.
See information sheet (page 2).

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The sealed and bound version of the report is the only valid version.

KEMA Nederland B.V.



P.G.A. Bus
KEMA T&D Testing Services
Managing Director

Arnhem, 13 February 2008

1 Certificate

A Certificate contains a record of a series of type tests carried out strictly in accordance with a recognized standard. The equipment tested has fulfilled the requirements of this standard and the relevant ratings assigned by the manufacturer are endorsed by KEMA. The Certificate is applicable only to the equipment tested. KEMA is responsible for the validity and the contents of the Certificate.

The responsibility for conformity of any apparatus having the same designation as the one tested rests with the manufacturer. The Certificate contains the essential drawings and a description of the equipment tested.

Detailed rules are given in KEMA's Certification procedure.

2 Report of Performance

A Report of Performance contains a record of one or more tests which have been carried out according to the client's instructions. These tests are not necessarily in accordance with a recognized standard. The test results do not verify ratings of the test object.

KEMA issues three types of Reports of Performance:

2.1 *The tests have been carried out strictly in accordance with The apparatus has complied with the relevant requirements.*

This sentence will appear on the front page of a Report of Performance if the tests have been performed in accordance with a recognized standard, but the series of tests does not completely fulfil the requirements for a Certificate of Compliance (for example, if the number of test duties is not a complete series of type tests). The Report contains verified drawings and a description of the equipment tested. Detailed rules are given in KEMA's Certification procedure. The condition of the test object after the tests is assessed and recorded in the Report.

2.2 *The tests have been carried out in accordance with the client's instructions. Test procedure and test parameters were based on*

This sentence will appear on the front page of a Report of Performance if the number of tests, the test procedure and the test parameters are based on a recognized standard and related to the ratings assigned by the manufacturer. If the apparatus does not pass the tests such behaviour will be mentioned on the front sheet. Verification of the drawings (if submitted) and assessment of the condition after the tests is only done on the client's request.

2.3 *The tests have been carried out according to the client's instructions.*

This sentence will appear on the front page of a Report of Performance if the tests, test procedure and/or test parameters are not in accordance with a recognized standard.

3 Standards

When reference is made to a standard, and the date of issue is not stated, this applies to the latest issue, including amendments which have been officially published prior to the date of the tests.

4 Official and uncontrolled test documents

The official test documents of KEMA High-Power Laboratory are issued in bound form. Uncontrolled copies may be provided as loose sheets or as a digital file for convenience of reproduction by the client. The copyright has to be respected at all times.

5 Accuracy of measurement

In the table of test results the measured quantities are given in three digits. This method of presentation does not indicate an accuracy. The guaranteed uncertainty in the figures mentioned, taking into account the total measuring system, is less than 5%, unless mentioned otherwise.

6 Qualified by RvA (Dutch Council for Accreditation)

KEMA High-Power Laboratory and High-Voltage Laboratory have been entered in the RvA-register for laboratories under resp. Nrs. L 020 and L 218 for the testing services as defined in the Field of Accreditation.

The accreditation is carried out in accordance with ISO/IEC 17025.



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RATINGS ASSIGNED BY THE MANUFACTURER

Voltage	550 kV
Normal current	4000 A
Number of poles	3
Frequency	50 Hz
Operating sequence	O-0,3 s-CO-3 min-CO
Short-time withstand current	63 kA
Peak withstand current	170 kA
Duration of short-circuit	3 s
Short-circuit making current	170 kA
Short-circuit breaking current	63 kA
DC time constant of rated short-circuit current	45 ms
DC component	55 %
First-pole-to-clear factor	1,3/1,5
Pressure for interruption SF ₆ at 20 °C	0,7 MPa
Supply voltage of closing and opening devices	110 Vd.c.
Class	M2, C2
Voltage distribution factor	52 %

DESCRIPTION OF APPARATUS TESTED

Single-pole operated outdoor circuit-breaker.
Grading capacitor per interrupter unit 1000 pF.

Minimum pressure for interruption at 20 °C	0,6 MPa
Rated pressure for interruption at 20 °C	0,7 MPa

Mechanism:

Stored energy closing (springs, charged by motor).
Stored energy opening (springs, charged at closing).

Supply voltage closing coil	110 Vd.c.
Supply voltage opening coil	110 Vd.c.
Supply voltage motor	110 Vd.c.

All pressure values in this document are absolute values.

TRAVEL RECORDER

Travel recorder attached to main contact shaft. Non-linear with contact travel.

LIST OF DRAWINGS

The manufacturer has guaranteed that the equipment submitted for tests has been manufactured in accordance with the following drawings.

KEMA has verified that these drawings adequately represent the equipment tested.

The following drawing has been included in this Report.

3HM 427-06716-001 Rev. B01

The following drawings have been stamped by KEMA and returned to the manufacturer.

KEMA has also verified these drawings.

3HM 427 06716 001 Rev. B01

1HZ 427 06300 805 Rev. B01 - d

1HG 427 06350 003Rev. B01 - c

1HG 427 06360 001 Rev. B01 - a

1HG 427 06365 002 Rev. B01 - a

4FR 950 23862 000 Rev. B01

1HG 427 06355 001 Rev. B01 - a

1HG 451 02120 003Rev. B01 - c

2HT 451 02423 001 Rev. B01

1HT 451 01234 001 Rev. B01 - e

2HT 451 12419 001 Rev. B01 - a

2HT 451 01551 001 Rev. B01 - c

3HT 451 01246 002 Rev. B01 - c

3HT 451 01247 002 Rev. B01 - c

2HT 451 01238 001 Rev. B01 - e

3HG 451 01723 001Rev. B01 - b

1HG 451 02125 001 Rev. B01 - c

2HG 451 02130 001 Rev. B01 - a

1HT 451 02163 001 Rev. B01 - d

2HT 451 02166 001 Rev. B01 - c

3HG 451 01994 001Rev. B01 - d

3HT 451 01272 001 Rev. B01 - f

2HT 451 01993 001 Rev. B01 - d

4HT 428 00288 001 Rev. B01 - f

3HG 451 01517 001Rev. B01 - b

3HG 451 01505 001 Rev. B01 - e

1HT 427 06387 001 Rev. B01 - c

1HG 427 06450 001 Rev. B01 - c

1HG 412 11940 001 Rev. B01 - a

1HG 412 13810 001 Rev. B01 - a

4HT 412 13812 002 Rev. B02 - c

4HT 412 13811 002 Rev. B02 - b

0HG 427 06550 001 Rev. B01 - c

1HF 521 15000 611 Rev. B01

2HF 522 15004 611 Rev. B01

2HF 522 15006 611 Rev. B01

4HF 523 11071 801 Rev. B01

2HD 427 06630 001Rev. B01

THE TESTS WERE WITNESSED BY

Name	Company
Chyla, T. Wallner, C.	Siemens AG, Berlin, Germany

THE TESTS WERE OBSERVED BY

Name	Company
te Paske, L.H.	KEMA, Arnhem, The Netherlands

NOTE

The mechanical behaviour corresponds to the established reference mechanical travel characteristics (drawingno. 2HD 427 06630 001 Rev. B01). The travel measurement during the no-load operations before and after tests did not show any significant changes.

PHASE INDICATIONS

If more than one phase is recorded on oscillogram, the phases are indicated by the digits 1, 2 and 3. These phases 1, 2 and 3 correspond to the phase values in the columns of the accompanying table, respectively from left to right.

EXPLANATION OF THE LETTER SYMBOLS AND ABBREVIATIONS ON THE OSCILLOGRAMS

pu	Per unit (the reference length of one unit is represented by the black bar on the oscillogram)
CS1	Timing signal contact separation
CS2	Timing signal contact separation
IABcl	Current closing coil auxiliary breaker
IABop	Current opening coil auxiliary breaker
ITO	Current through test object
ITO/A	Current through test object, amplified
ITOcl	Current closing coil test object
ITOop	Current opening coil test object
Ics	Current of current circuit, synthetic tests
Ireig	Current reignition circuit, synthetic tests
Isyn	Current synthetic circuit
TR	Travel recorder
UTO	Voltage across test object
UTO/A	Voltage across test object, amplified
Ucs	Voltage current circuit
IABop I	Current opening coil auxiliary breaker

Test no.		060831 5008	060831 5009	060831 5010	060831 5011	060831 5012	060831 5013
Time interval since previous test	min	-	-	-	-	-	-
Time interval between operations	s	-	0,292	-	0,294	-	-
Operation		O	CO	O	CO	CO	O
		1	1	1	1	1	1
Interrupter		-	-	-	-	-	-
		2	2	2	2	2	2
Current closing coil	A	-	2,45	-	2,22	2,22	-
	ms	-	60,8	-	62,3	62,0	-
Closing time	ms	-	-	-	-	-	-
	ms	-	60,9	-	62,5	62,3	-
Current opening coil	A	-13,5	-13,2	-12,0	-11,9	-11,8	-12,0
	ms	18,3	18,2	18,5	18,6	18,4	18,5
Opening time	ms	-	-	-	-	-	-
	ms	18,3	18,2	18,5	18,6	18,4	18,5
Voltage closing coil	Vd.c.	-	121	-	110	110	-
Voltage opening coil	Vd.c.	121	121	110	110	110	110
Gas pressure at 20 °C	MPa	0,6	0,6	0,6	0,6	0,6	0,6
Operating pressure	MPa	-	-	-	-	-	-

REMARKS

060831-5008	-
060831-5009	-
060831-5010	-
060831-5011	-
060831-5012	-
060831-5013	-

SUMMARY (continued)

Test no.		060831 5014	060831 5015	060831 5016	060831 5017		
Time interval since previous test	min	-	-	-	-		
Time interval between operations	s	-	0,297	-	-		
Operation		O	CO	CO	O		
		1	1	1	1		
Interrupter		-	-	-	-		
		2	2	2	2		
Current closing coil	A	-	1,88	1,88	-		
	ms	-	65,7	65,5	-		
Closing time	ms	-	-	-	-		
	ms	-	65,7	65,7	-		
Current opening coil	A	-8,45	-8,35	-8,34	-8,36		
	ms	18,9	18,9	18,9	18,9		
Opening time	ms	-	-	-	-		
	ms	18,9	18,9	19,0	19,0		
Voltage closing coil	Vd.c.	-	93,5	93,5	-		
Voltage opening coil	Vd.c.	77	77	77	77		
Gas pressure at 20 °C	MPa	0,6	0,6	0,6	0,6		
Operating pressure	MPa	-	-	-	-		

REMARKS

060831-5014	-
060831-5015	-
060831-5016	-
060831-5017	-

Test no.		060831 5032					
Time interval since previous test	min	-					
Operation		C					
Applied voltage current circuit, phase value	kV	36,4					
Charging voltage capacitor bank, DC value	kV dc	585					
Applied voltage test object, phase value	kV	320					
Making current, peak	kA	-108					
Symmetrical current, end	kA	66,7					
Make time	ms	62,3					
Transfer time	μs	60,0					
Pre-arcng time	ms	2,23					
Current duration	ms	240					
Voltage closing coil	Vd.c.	93,5					
Voltage opening coil	Vd.c.	-					
Gas pressure at 20 °C	MPa	0,6					
Operating pressure	MPa	-					

REMARKS

060831-5032 Breaker closed.
 Making occurred within 15° related to the peak value of the applied voltage.

Test no.		060901 5007	060901 5008	060901 5009	060901 5012	060901 5013	060901 5015
Time interval since previous test	min	-	-	-	-	-	30
Time interval between operations	s	-	-	-	-	0,293	-
Operation		O _S	O _S	O _S	O _D	C _D O _S	C _D O _S
Applied voltage, current source, phase value	kV	33,0	32,6	32,7	-	35,1	35,0
Charging voltage capacitor bank, DC value	kV dc	-402	-402	-402	-	-403	-403
Making current, peak	kA	-	-	-	-	180	123
Breaking current, symmetrical, phase value	kA	63,5	63,5	63,5	64,5	63,9	64,6
Breaking current, DC-component	%	1	2	4	4	8	2
di/dt at last current zero	A/μs	-	-	-	-	-	-
TRV, peak	kV	-492	-492	-	-	-490	-492
Recovery voltage, phase value	kV	-264	-261	-	33,6	-244	-251
Make time	ms	-	-	-	-	64,8	65,4
Arc duration	ms	11,7	9,4	-	9,4	19,0	13,1
Opening time	ms	19,0	19,1	19,3	19,4	19,3	19,0
Break time	ms	30,7	28,5	-	28,8	38,3	32,1
t _h	μs	25,0	25,0	25,0	-	25,0	25,0
Current last loop, peak	kA	80,2	81,4	88,1	-	87,2	85,6
Voltage closing coil	Vd.c.	-	-	-	-	93,5	93,5
Voltage opening coil	Vd.c.	77	77	77	77	77	77
Gas pressure at 20 °C	MPa	0,6	0,6	0,6	0,6	0,6	0,6
Operating pressure	MPa	-	-	-	-	-	-

REMARKS

060901-5007	Breaker cleared. O _S = Operation in a synthetic circuit.
060901-5008	Breaker cleared. O _S = Operation in a synthetic circuit.
060901-5009	Test to verify the correct reignition behaviour of the breaker (Sub-clause 6.102.10 of 62271-101). Arcing time set for 8,3 ms.
060901-5012	O _D = Operation with current source only.
060901-5013	Breaker closed and cleared. C _D = Operation with current source only. O _S = Operation in a synthetic circuit.
060901-5015	Breaker closed and cleared. Time interval since previous test > 10 min, due to test laboratory and not caused by faulty operation of the test breaker. This is the only occurrence during the series of test-duties of this Certificate and does not disqualify these tests (sub-clause 6.105.1 of IEC 62271-100). C _D = Operation with current source only. O _S = Operation in a synthetic circuit.

Test no.		060901 5016	060901 5017	060901 5018	060901 5019	060901 5020	060901 5021
Time interval since previous test	min	-	-	-	-	-	-
Time interval between operations	s	-	0,294	-	0,296	-	-
Operation		O	CO	O	CO	CO	O
		1	1	1	1	1	1
Interrupter		-	-	-	-	-	-
		2	2	2	2	2	2
Current closing coil	A	-	2,44	-	2,20	2,20	-
	ms	-	62,2	-	64,1	63,3	-
Closing time	ms	-	-	-	-	-	-
	ms	-	62,2	-	64,1	63,4	-
Current opening coil	A	-13,1	-12,9	-11,8	-11,6	-11,7	-11,8
	ms	18,3	18,1	18,3	18,7	18,1	18,4
Opening time	ms	-	-	-	-	-	-
	ms	18,3	18,1	18,3	18,6	18,1	18,4
Voltage closing coil	Vd.c.	-	121	-	110	110	-
Voltage opening coil	Vd.c.	121	121	110	110	110	110
Gas pressure at 20 °C	MPa	0,6	0,6	0,6	0,6	0,6	0,6
Operating pressure	MPa	-	-	-	-	-	-

REMARKS

060901-5016	-
060901-5017	-
060901-5018	-
060901-5019	-
060901-5020	-
060901-5021	-

SUMMARY (continued)

Test no.		060901 5022	060901 5023	060901 5024	060901 5025		
Time interval since previous test	min	-	-	-	-		
Time interval between operations	s	-	0,299	-	-		
Operation		O	CO	CO	O		
		1	1	1	1		
Interrupter		-	-	-	-		
		2	2	2	2		
Current closing coil	A	-	1,87	1,87	-		
	ms	-	67,6	66,5	-		
Closing time	ms	-	-	-	-		
	ms	-	67,6	67,0	-		
Current opening coil	A	-8,17	-7,96	-8,07	-8,19		
	ms	18,9	18,8	18,8	19,0		
Opening time	ms	-	-	-	-		
	ms	18,8	18,7	18,6	18,9		
Voltage closing coil	Vd.c.	-	93,5	93,5	-		
Voltage opening coil	Vd.c.	77	77	77	77		
Gas pressure at 20 °C	MPa	0,6	0,6	0,6	0,6		
Operating pressure	MPa	-	-	-	-		

REMARKS

060901-5022	-
060901-5023	-
060901-5024	-
060901-5025	-



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DUTY: No-load test

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TEST NUMBERS

060831-5008

060831-5009

060831-5010

060831-5011

060831-5012

060831-5013

060831-5014

060831-5015

060831-5016

060831-5017

CONDITION BEFORE TESTS

Breaker new.

Interrupter 1 and 2 under test (full pole test).

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Photograph before test

Page 15

5001 – 5007 calibration tests

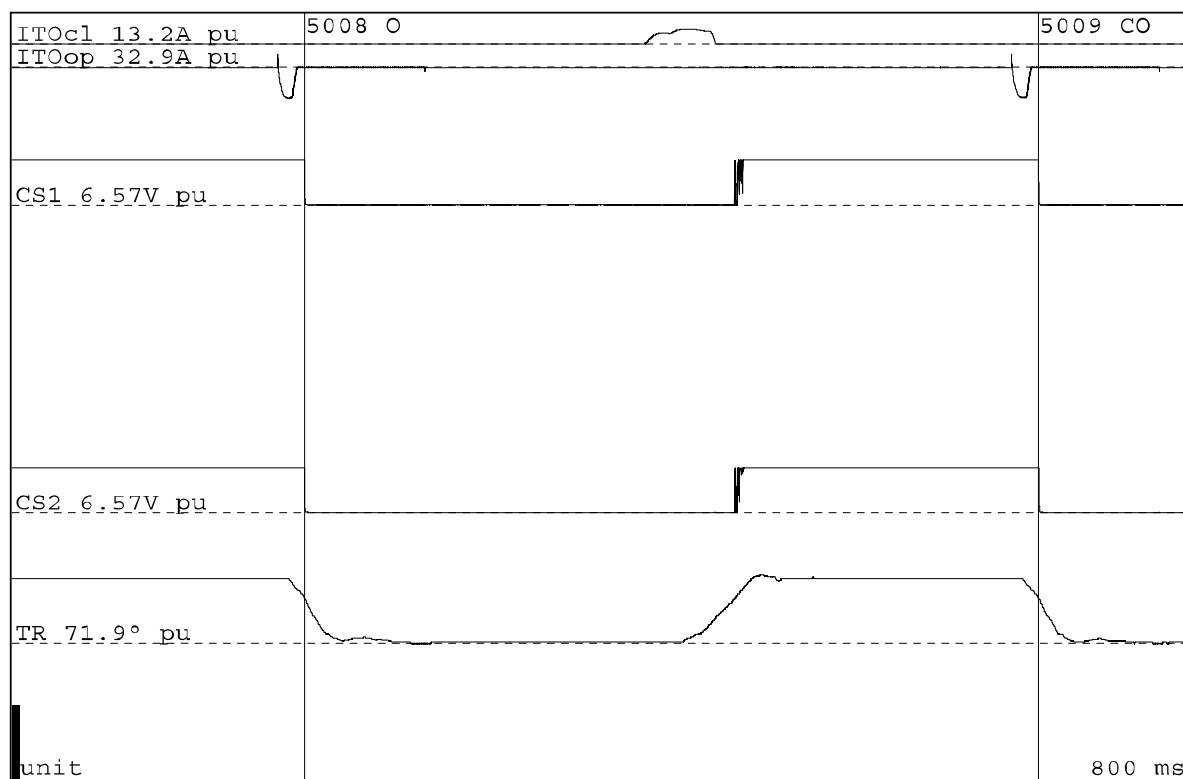
524-06

Photograph before test

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5001 – 5007 calibration tests

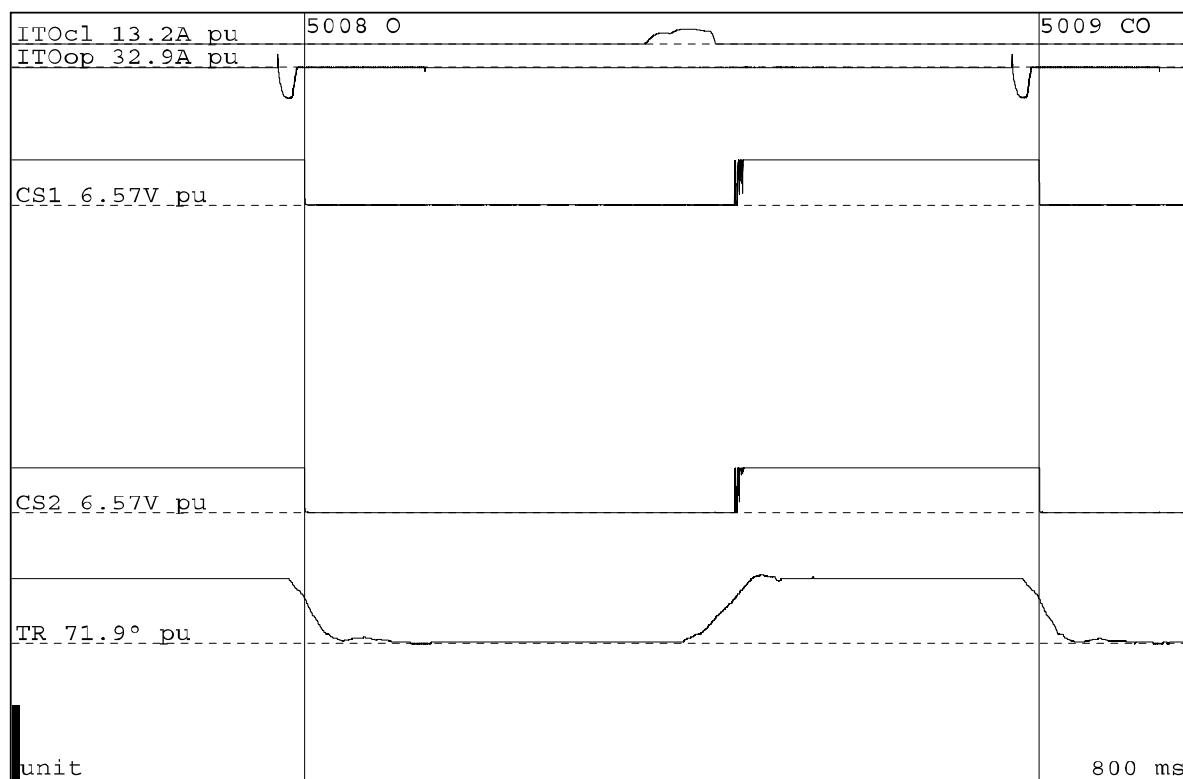



TEST NUMBER: 060831-5008

Operation		O		
Interrupter		1	-	2
Current opening coil	A	-13,5		
Opening time	ms	18,3	-	18,3

Voltage opening coil	121 Vd.c.	Gas pressure at 20 °C	0,6 MPa
		Operating pressure	- MPa

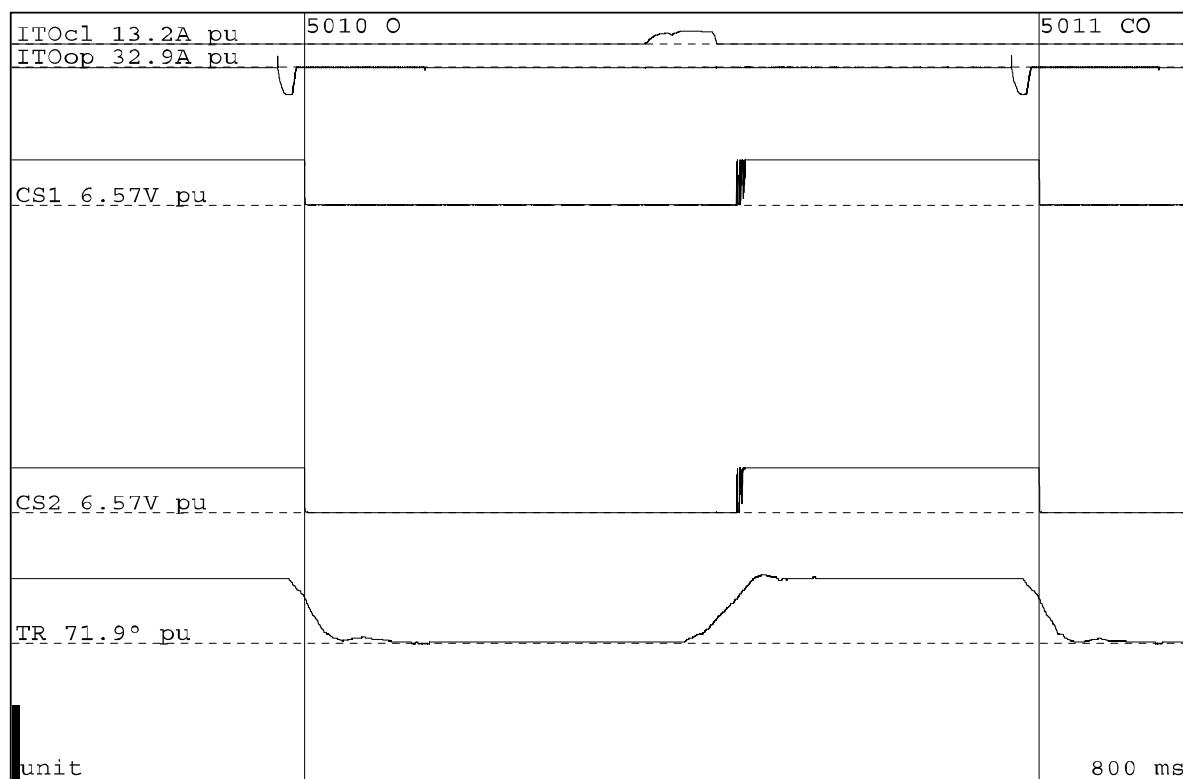
Remarks:	-
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TEST NUMBER: 060831-5009

Time interval since previous test	min	-		
Time interval between operations	s	0,292		
Operation	CO			
Interrupter		1	-	2
Current closing coil	A	2,45		
Closing time	ms	60,8	-	60,9
Current opening coil	A	-13,2		
Opening time	ms	18,2	-	18,2

Voltage closing coil	121 Vd.c.	Gas pressure at 20 °C	0,6 MPa
Voltage opening coil	121 Vd.c.	Operating pressure	- MPa

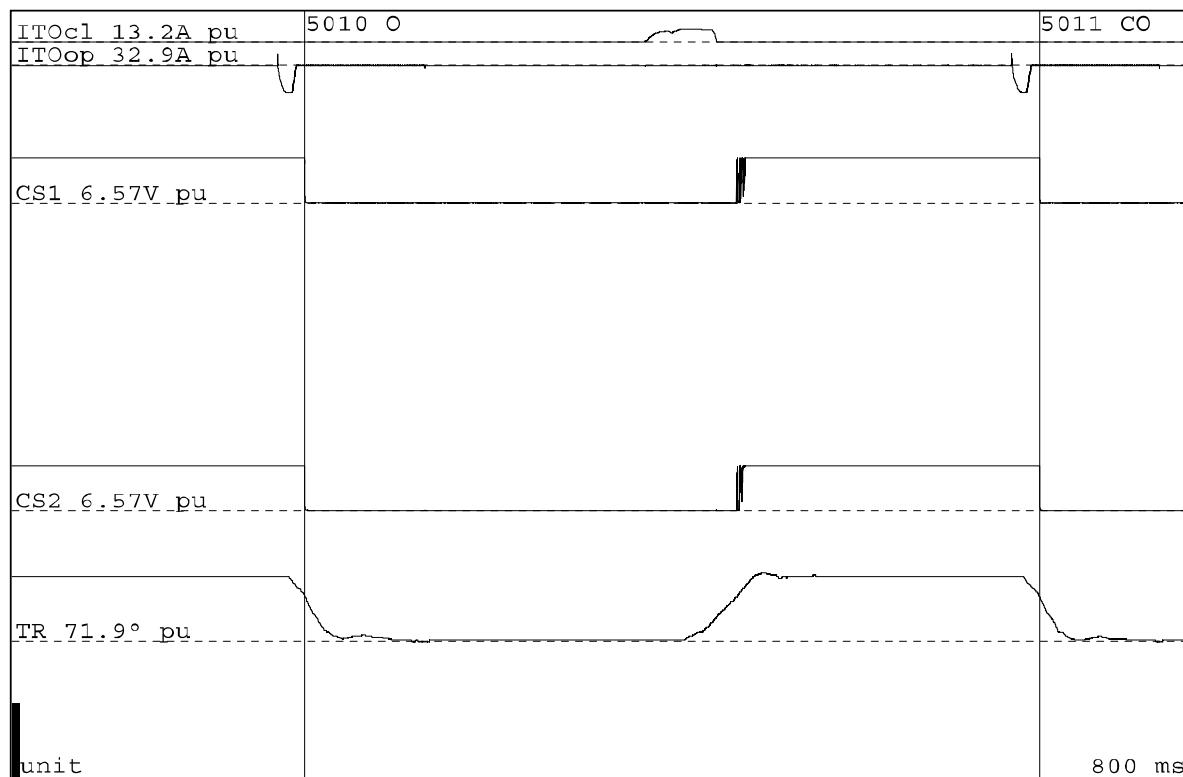
Remarks:	-
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TEST NUMBER: 060831-5010

Operation		O		
Interrupter		1	-	2
Current opening coil		A	-12,0	
Opening time	ms	18,5	-	18,5

Voltage opening coil	110 Vd.c.	Gas pressure at 20 °C	0,6 MPa
		Operating pressure	- MPa

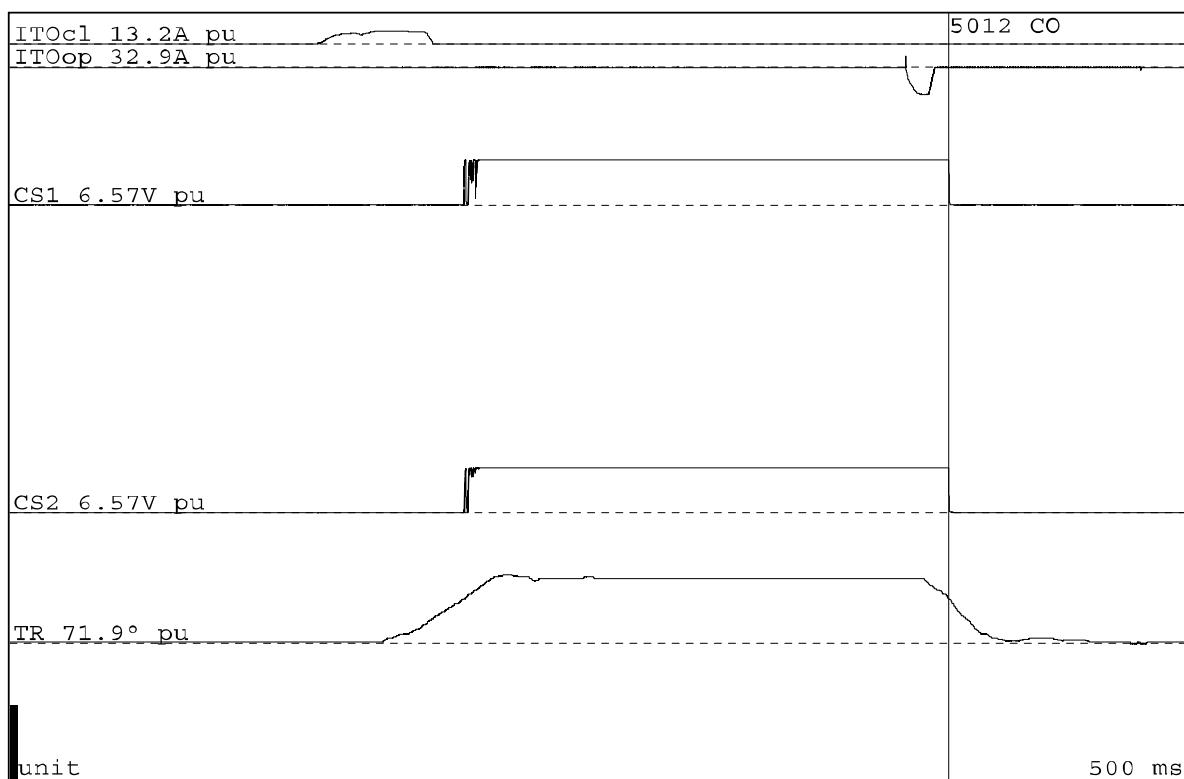
Remarks:	-
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TEST NUMBER: 060831-5011

Time interval since previous test	min	-		
Time interval between operations	s	0,294		
Operation		CO		
Interrupter		1	-	2
Current closing coil	A	2,22		
Closing time	ms	62,3	-	62,5
Current opening coil	A	-11,9		
Opening time	ms	18,6	-	18,6

Voltage closing coil	110 Vd.c.	Gas pressure at 20 °C	0,6 MPa
Voltage opening coil	110 Vd.c.	Operating pressure	- MPa

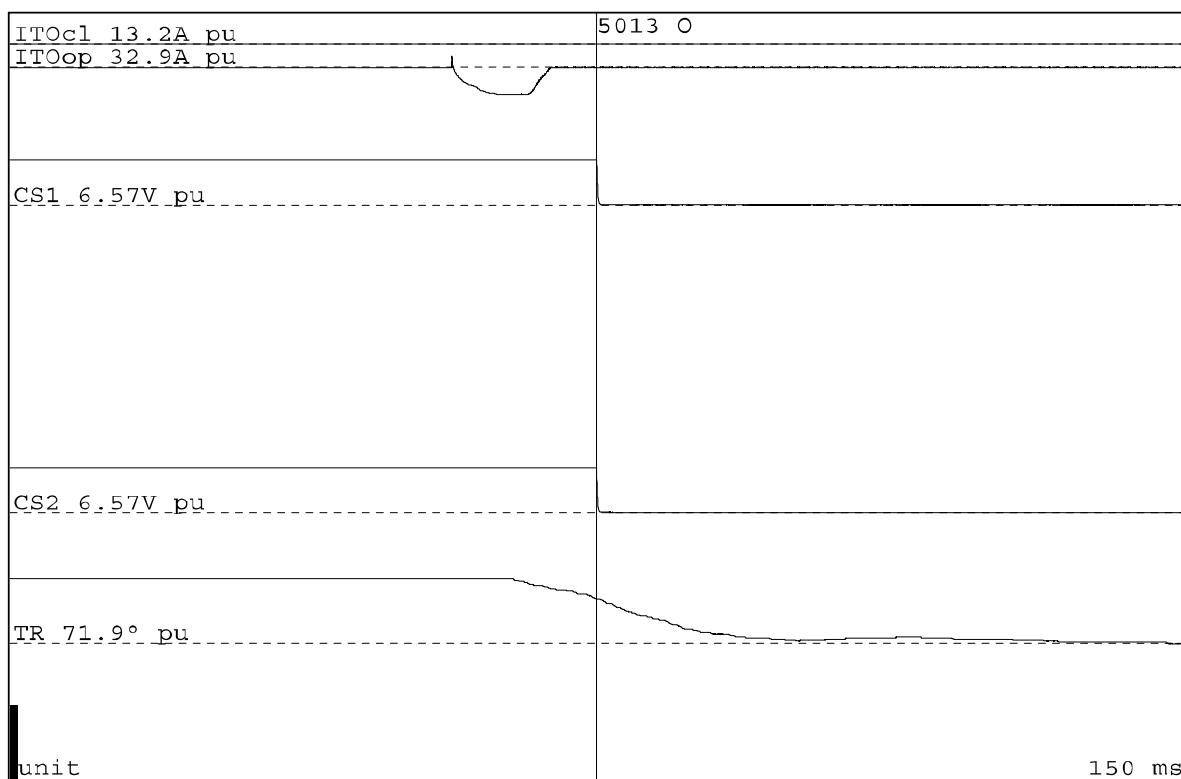
Remarks:	-
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TEST NUMBER: 060831-5012

Operation		CO		
Interrupter		1	-	2
Current closing coil	A		2,22	
Closing time	ms	62,0	-	62,3
Current opening coil	A		-11,8	
Opening time	ms	18,4	-	18,4

Voltage closing coil	110 Vd.c.	Gas pressure at 20 °C	0,6 MPa
Voltage opening coil	110 Vd.c.	Operating pressure	- MPa

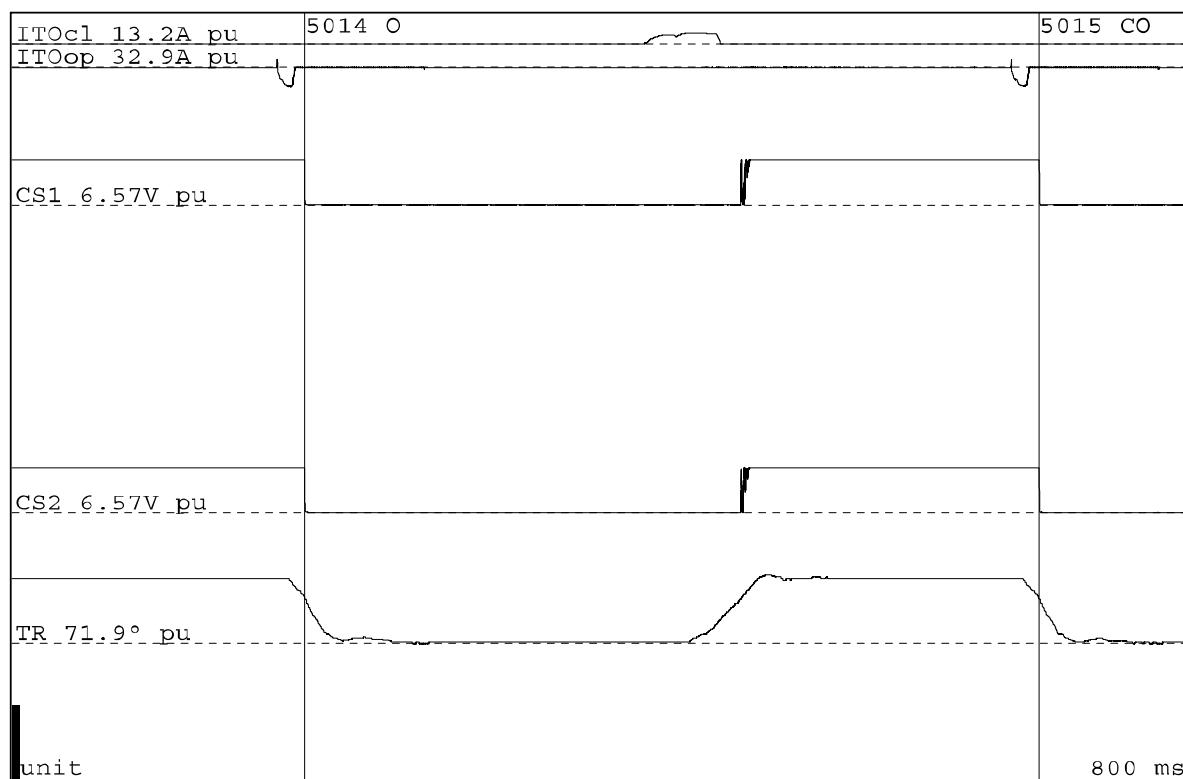
Remarks:	-
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TEST NUMBER: 060831-5013

Operation		O		
Interrupter		1	-	2
Current opening coil		A		-12,0
Opening time	ms	18,5	-	18,5

Voltage opening coil	110 Vd.c.	Gas pressure at 20 °C	0,6 MPa
		Operating pressure	- MPa

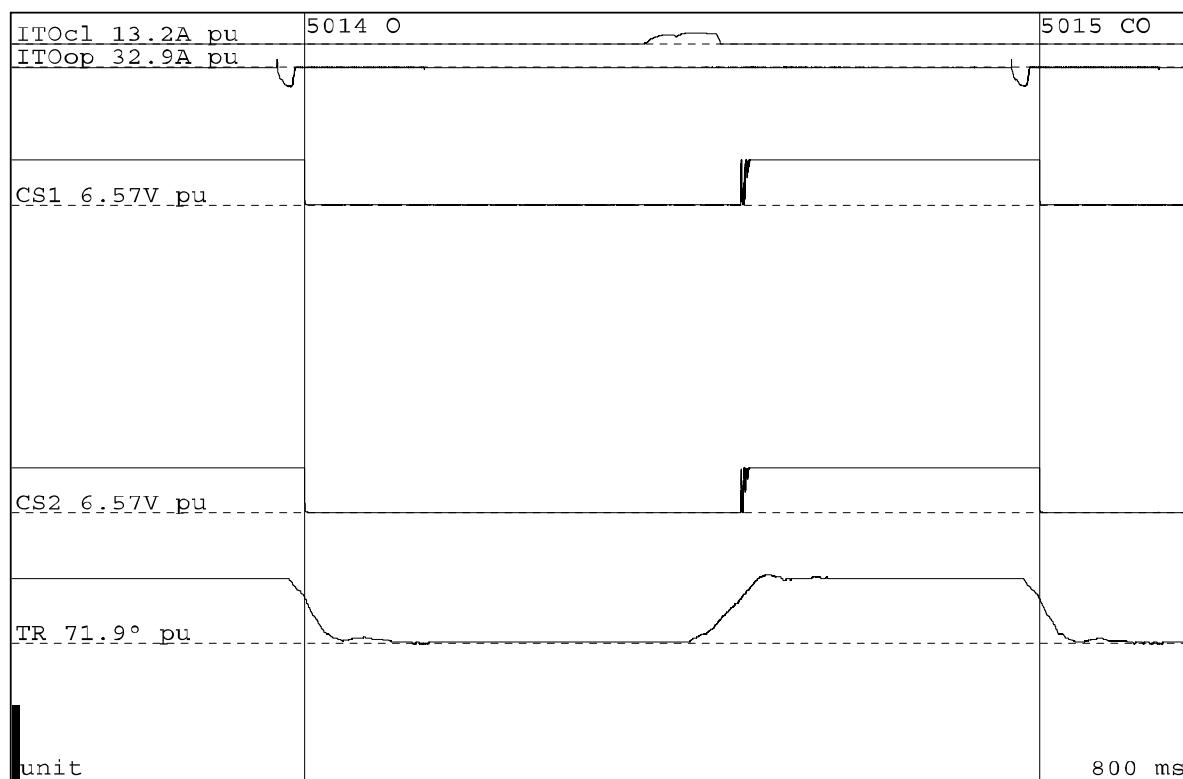
Remarks: -


TEST NUMBER: 060831-5014

Operation		O		
Interrupter		1	-	2
Current opening coil		A		-8,45
Opening time	ms	18,9	-	18,9

Voltage opening coil	77 Vd.c.	Gas pressure at 20 °C	0,6 MPa
		Operating pressure	- MPa

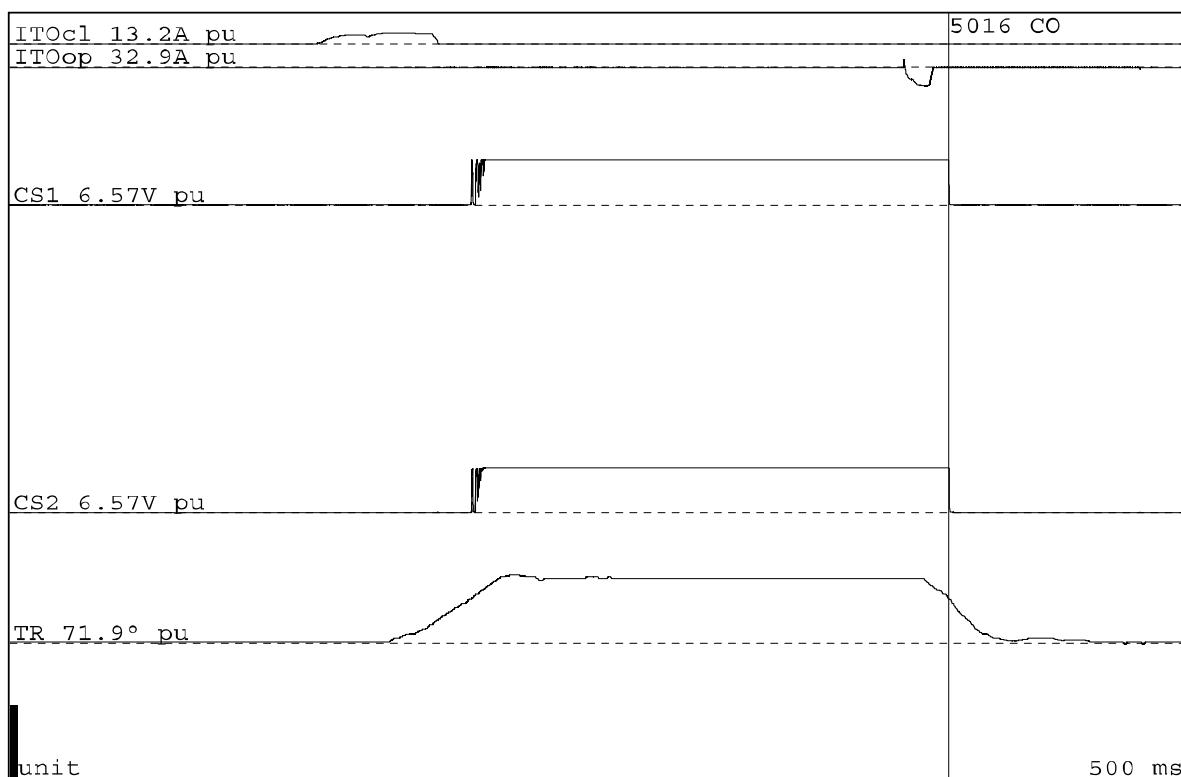
Remarks:	-
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TEST NUMBER: 060831-5015

Time interval since previous test	min	-		
Time interval between operations	s	0,297		
Operation	CO			
Interrupter		1	-	2
Current closing coil	A	1,88		
Closing time	ms	65,7	-	65,7
Current opening coil	A	-8,35		
Opening time	ms	18,9	-	18,9

Voltage closing coil	93,5 Vd.c.	Gas pressure at 20 °C	0,6 MPa
Voltage opening coil	77 Vd.c.	Operating pressure	- MPa

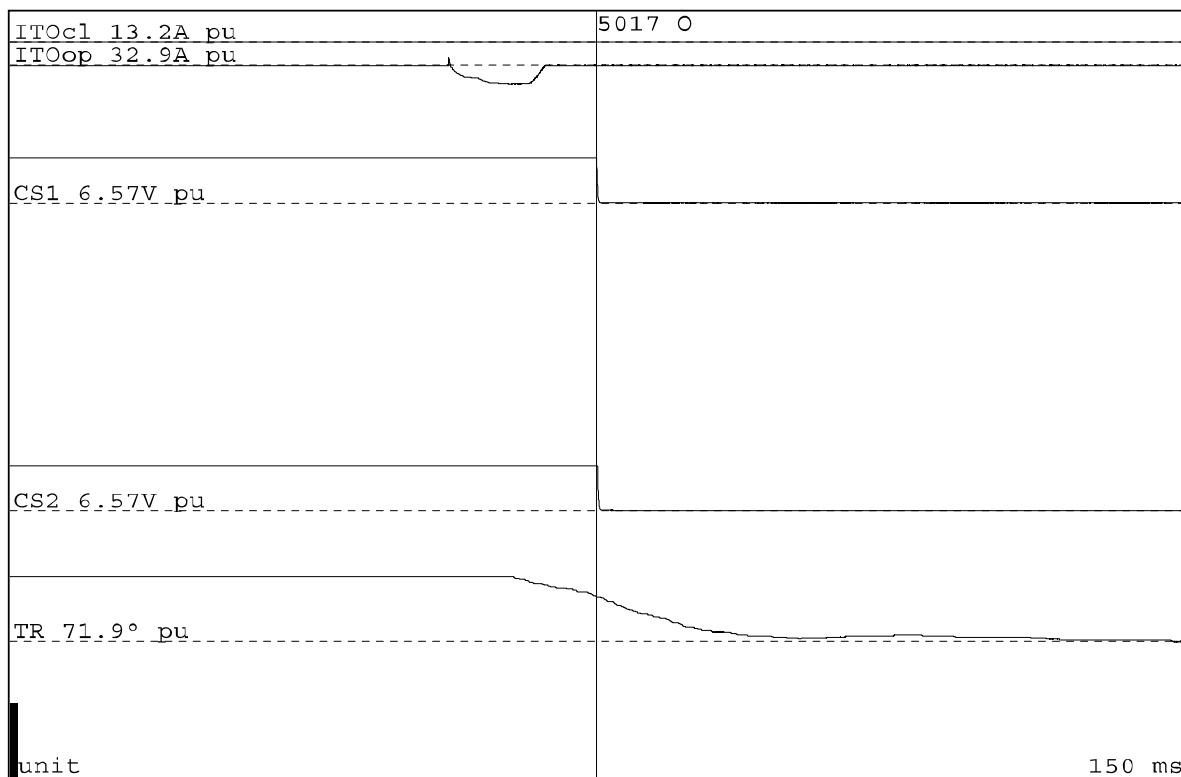
Remarks:	-
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TEST NUMBER: 060831-5016

Operation		CO		
Interrupter		1	-	2
Current closing coil		A	1,88	
Closing time	ms	65,5	-	65,7
Current opening coil		A	-8,34	
Opening time	ms	18,9	-	19,0

Voltage closing coil	93,5 Vd.c.	Gas pressure at 20 °C	0,6 MPa
Voltage opening coil	77 Vd.c.	Operating pressure	- MPa

Remarks:	-
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TEST NUMBER: 060831-5017

Operation		O		
Interrupter		1	-	2
Current opening coil		A -8,36		
Opening time	ms	18,9	-	19,0

Voltage opening coil	77 Vd.c.	Gas pressure at 20 °C	0,6 MPa
		Operating pressure	- MPa

Remarks:	-
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DUTY: T100s(a)

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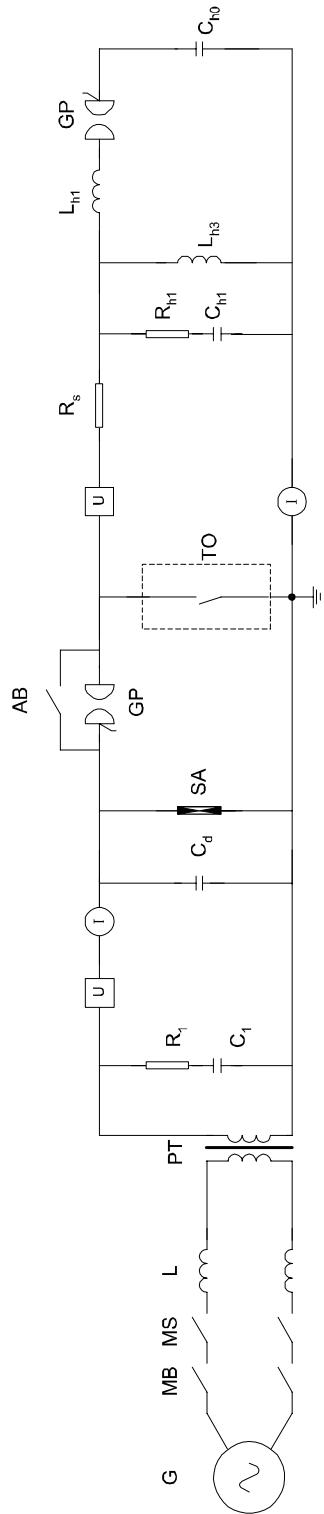
TEST NUMBERS

060831-5032

CONDITION BEFORE TESTS

Breaker in same condition.

Interrupter 1 and 2 under test (full pole test).

TEST-CIRCUIT S02 (diagram)


G = Generator	L = Reactor	U = Voltage Measurement to earth	SA = Surge Arrester
MB = Master Breaker	TO = Test Object	I = Current Measurement	AB = Auxiliary Breaker
MS = Make Switch	R = Resistor	AL = Artificial line	GP = Gap
PT = Power Transformer	C = Capacitor	ML = Multi-loop device	VS = Voltage Source

TEST-CIRCUIT S02 (values)

Current circuit		
Power	MVA	2268
Frequency	Hz	50
Phase(s)		1
Voltage	kV	36
Current	kA	63
Impedance	Ω	0,571
Power factor		< 0,1
Neutral		not earthed

TRV elements added in current circuit		
C ₁	μ F	0,2
R ₁ (in parallel)	Ω	-
R ₁ (in series)	Ω	108
L ₁	mH	-
C _d	nF	15
Neutral		earthed

Load	
Short-circuit point	earthed

Voltage circuit		
C _{h0}	μ F	3,67
U _{h0}	kVd.c.	585
U _{applied}	kV	318
L _{h1}	mH	30
f _h	Hz	-
R _{h1}	Ω	1000
C _{h1}	μ F	0,5
C _{hd}	nF	-
R _{hc}	Ω	-
C _{hc}	nF	-
R _{h2}	Ω	-
C _{h2}	μ F	-
L _{h2}	mH	-
R _s	k Ω	90
L _{h3}	mH	2400
f _{RV}	Hz	50

DESCRIPTION OF THE SINGLE-PHASE SYNTHETIC CIRCUIT FOR SYNTHETIC MAKE

The circuit is composed of:

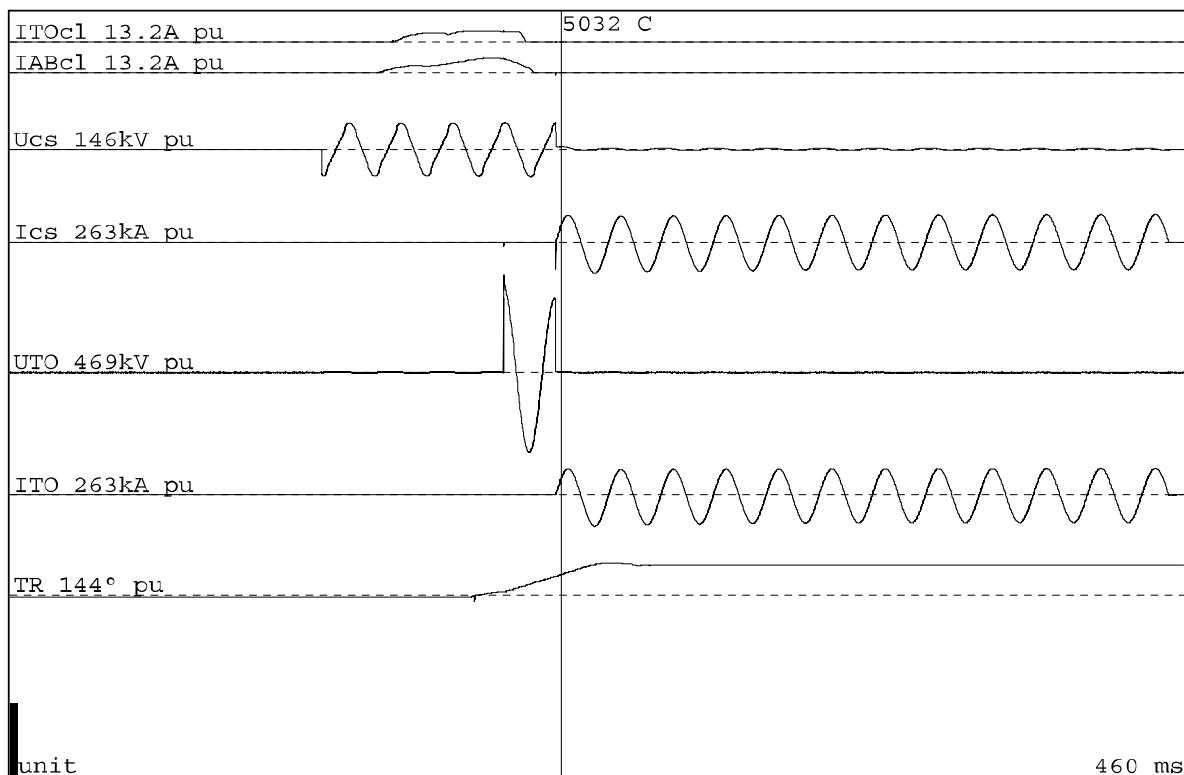
a) **A single-phase current circuit**

b) **A single-phase voltage circuit**

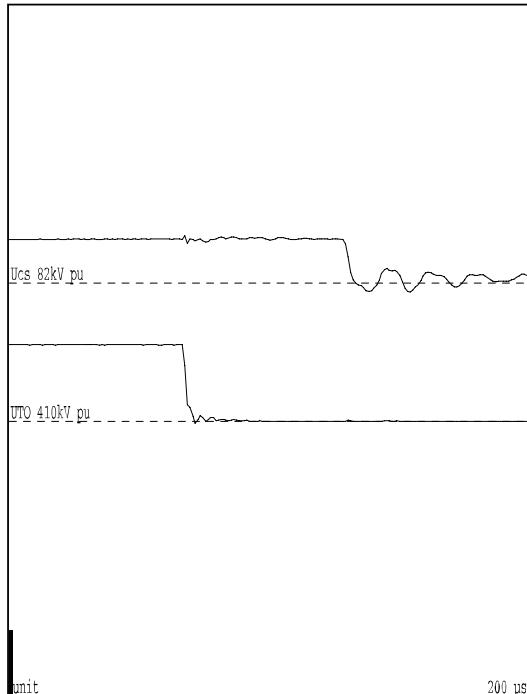
This voltage is used to ascertain that the duration of pre-arching of the making device is correct.
The evolving fault current is regulated by the dependent triggered gap GP.

The delay between the commencement of the pre-arching and the evolving fault current is the transfer time.

Remarks: -


TEST NUMBER: 060831-5032

Time interval since previous test	min	-
Operation		C
Phase		-
Applied voltage current circuit, phase value	kV	36,4
Charging voltage capacitor bank, DC value	kV dc	585
Applied voltage test object, phase value	kV	320
Making current, peak	kA	-108
Symmetrical current, end	kA	66,7
Make time	ms	62,3
Transfer time	μs	60,0
Pre-arching time	ms	2,23
Current duration	ms	240
Voltage closing coil	93,5 Vd.c.	Gas pressure at 20 °C 0,6 MPa
Voltage opening coil	- Vd.c.	Operating pressure - MPa



Remarks: Breaker closed.
Making occurred within 15° related to the peak value of the applied voltage.

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DUTY: T100s(b)

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TEST NUMBERS

060901-5007
060901-5008
060901-5009
060901-5012
060901-5013
060901-5015

CONDITION BEFORE TESTS

Breaker in same condition.

Half pole test.

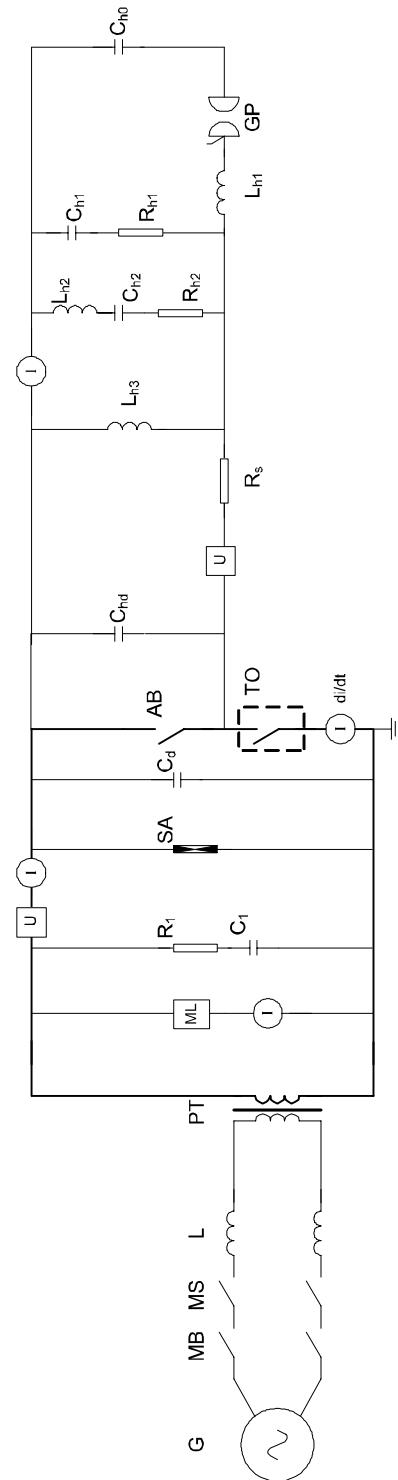
Interrupter 1: test-breaker.

Interrupter 2: auxiliary breaker.

Supply to intermediate point of circuit-breaker. (gear unit housing)

TEST-CIRCUIT S05 (diagram)

Voltage injection



G = Generator	L = Reactor	U = Voltage Measurement to earth	SA = Surge Arrester
MB = Master Breaker	TO = Test Object	I = Current Measurement	AB = Auxiliary Breaker
MS = Make Switch	R = Resistor	AL = Artificial line	GP = Gap
PT = Power Transformer	C = Capacitor	ML = Multi-loop device	VS = Voltage Source

TEST-CIRCUIT S05 (values)

Supply		
Power	MVA	2268
Frequency	Hz	50
Phase(s)		1
Voltage	kV	36
Current	kA	63
Impedance	Ω	0,571
Power factor		< 0,1
Neutral		not earthed

Voltage source		
C_{h0}	μF	6,5
U_{h0}	kVd.c.	415
L_{h1}	mH	96
R_{h1}	Ω	250
C_{h1}	μF	0,5
C_{hd}	nF	30
R_{h2}	Ω	125
C_{h2}	μF	0,85
L_{h2}	mH	72
L_{h3}	mH	1200
R_s	Ω	90

Prospective TRV current source		
Voltage U_0	kV.a.c.	36
Depression factor		0,775
$u_{0,\sqrt{2},\text{depr.}}$	kV	40
t_d	μs	2
RRRV	kV/ μs	1,1

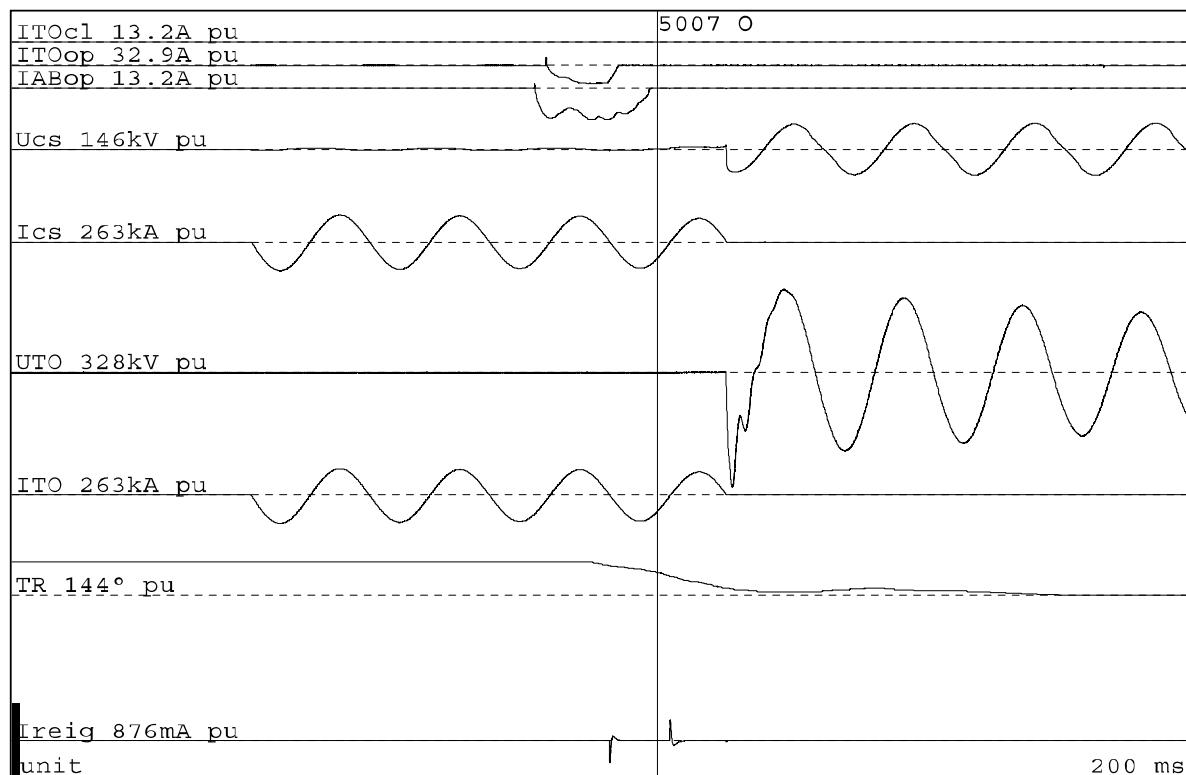
Load	
Short-circuit point	earthed

Prospective TRV voltage source		
U_{recovery}	kVd.c.	248
U_{1a}	kV	223
U_{ca}	kV	450
t_{1a}	μs	223
t_{2a}	μs	981
RRRV	kV/ μs	1,0

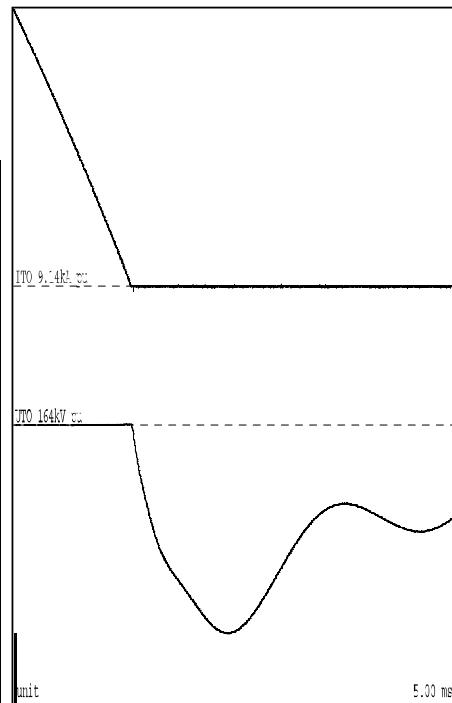
TRV control elements added (supply)		
C_1	μF	0,9
R_1 (in parallel)	Ω	-
R_1 (in series)	Ω	50
L_1	mH	-
C_d	nF	15
Neutral		earthed

Total prospective TRV		
U_1	kV	263
U_c	kV	490
t_1	μs	253
t_2	μs	1011
t_d	μs	2
RRRV	kV/ μs	1,04
Based on a moment of injection after current zero: t_i	μs	25

Remarks: -

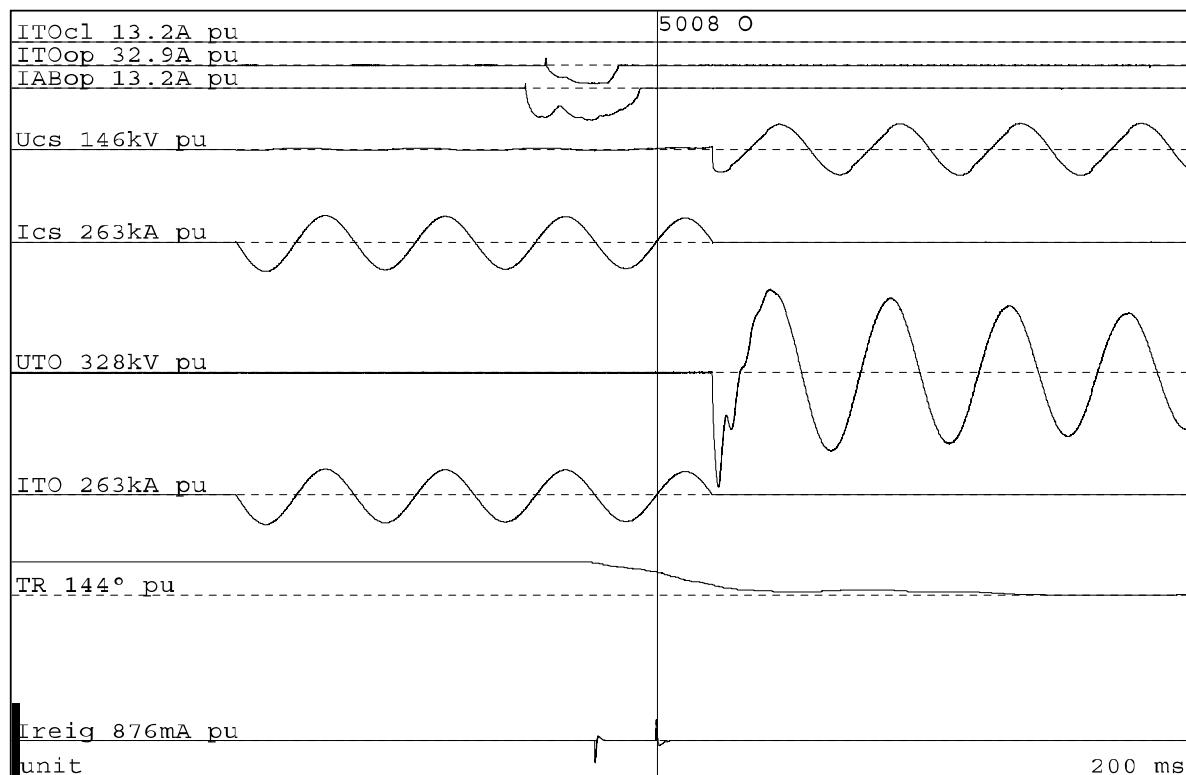

TEST NUMBER: 060901-5007

Time interval since previous test	min	-	
Operation		O _s	
Phase		-	
Applied voltage, current source, phase value	kV	33,0	
Charging voltage capacitor bank, DC value	kV dc	-402	
Breaking current, symmetrical, phase value	kA	63,5	
Breaking current, DC-component	%	1	
di/dt at last current zero	A/μs	-	
TRV, peak	kV	-492	
Recovery voltage, phase value	kV	-264	
Arc duration	ms	11,7	
Opening time	ms	19,0	
Break time	ms	30,7	
t ₁	μs	25,0	
Current last loop, peak	kA	80,2	
Voltage opening coil	77 Vd.c.	Gas pressure at 20 °C Operating pressure	0,6 MPa - MPa

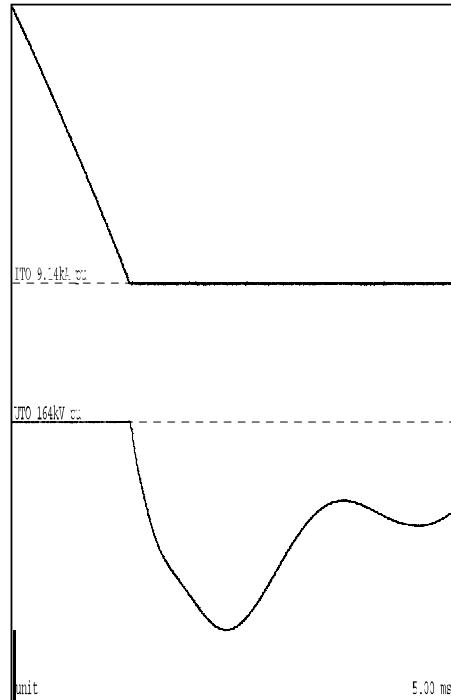


Remarks: Breaker cleared.

O_s = Operation in a synthetic circuit.

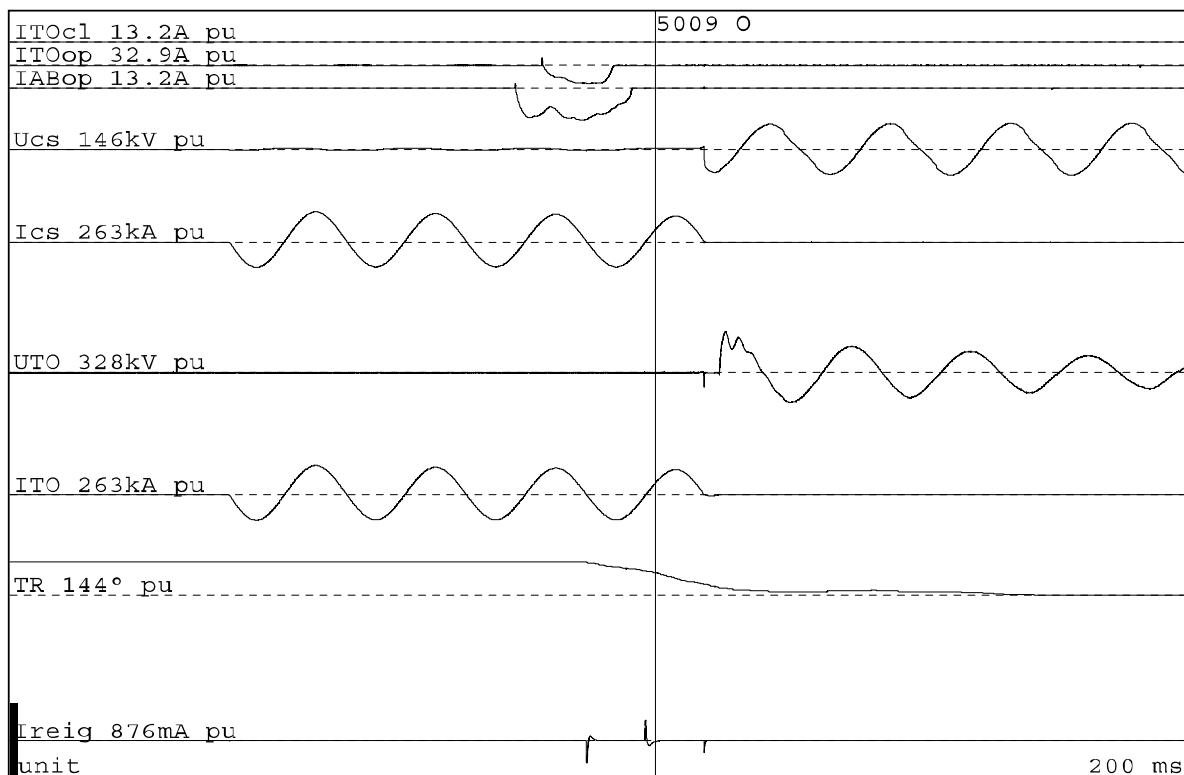

TEST NUMBER: 060901-5008

Time interval since previous test	min	-
Operation		O _s
Phase		-
Applied voltage, current source, phase value	kV	32,6
Charging voltage capacitor bank, DC value	kV dc	-402
Breaking current, symmetrical, phase value	kA	63,5
Breaking current, DC-component	%	2
di/dt at last current zero	A/μs	-
TRV, peak	kV	-492
Recovery voltage, phase value	kV	-261
Arc duration	ms	9,4
Opening time	ms	19,1
Break time	ms	28,5
t ₁	μs	25,0
Current last loop, peak	kA	81,4
Voltage opening coil	77 Vd.c.	Gas pressure at 20 °C 0,6 MPa
		Operating pressure - MPa

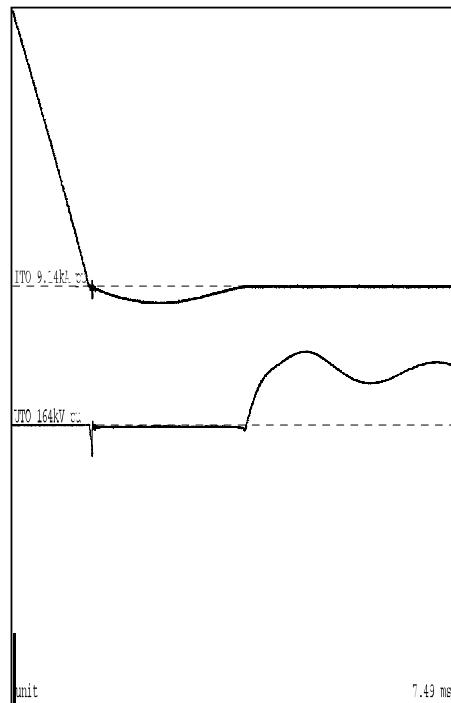


Remarks: Breaker cleared.

O_s = Operation in a synthetic circuit.

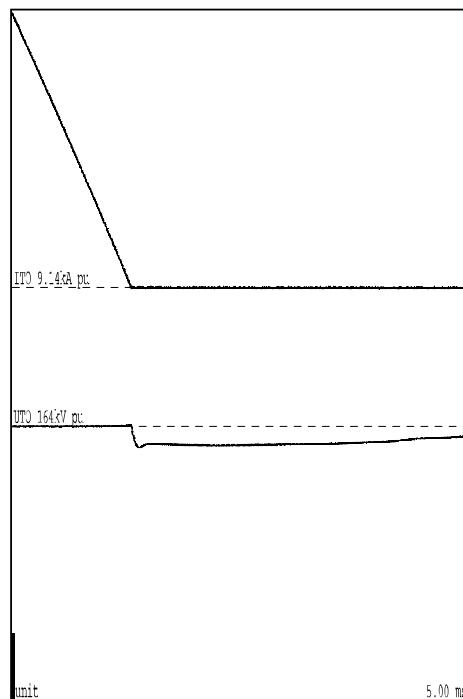
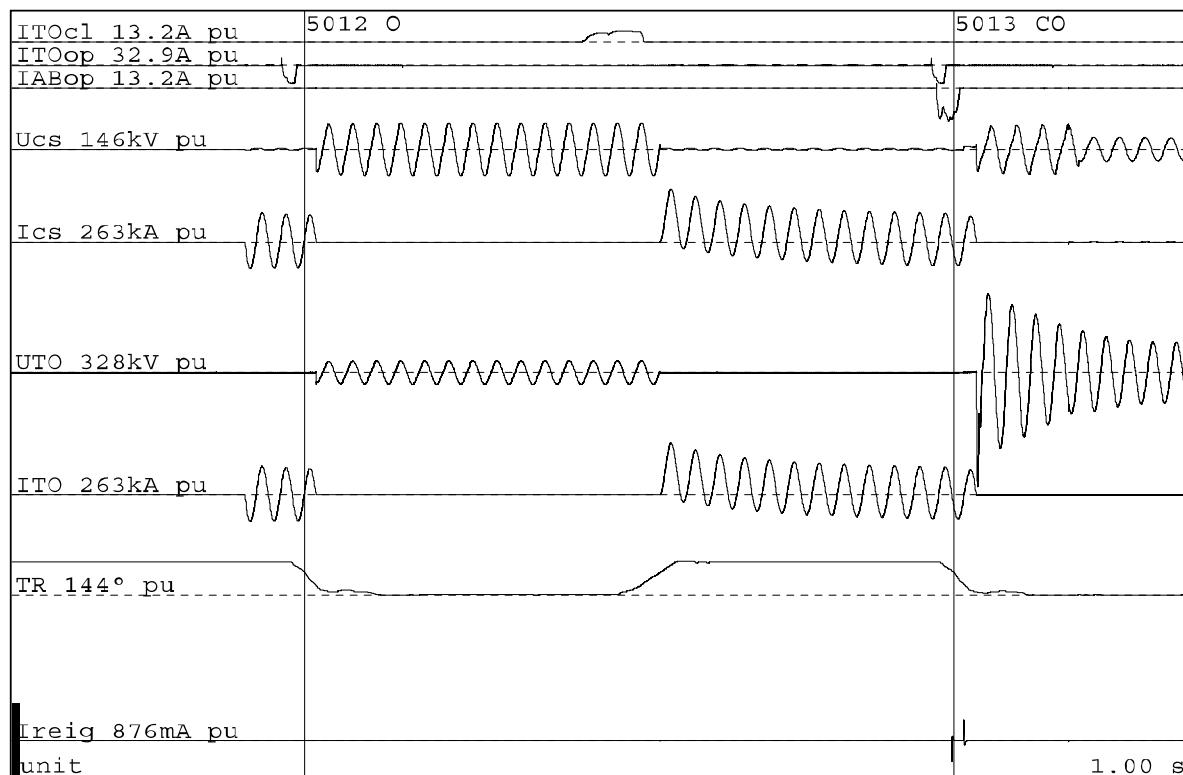

TEST NUMBER: 060901-5009

Time interval since previous test	min	-
Operation		O _s
Phase		-
Applied voltage, current source, phase value	kV	32,7
Charging voltage capacitor bank, DC value	kV dc	-402
Breaking current, symmetrical, phase value	kA	63,5
Breaking current, DC-component	%	4
di/dt at last current zero	A/μs	-
TRV, peak	kV	-
Recovery voltage, phase value	kV	-
Arc duration	ms	-
Opening time	ms	19,3
Break time	ms	-
t _i	μs	25,0
Current last loop, peak	kA	88,1
Voltage opening coil	77 Vd.c.	Gas pressure at 20 °C 0,6 MPa
		Operating pressure - MPa



Remarks: Test to verify the correct reignition behaviour of the breaker (Sub-clause 6.102.10 of 62271-101).
Arcing time set for 8,3 ms.

O_s = Operation in a synthetic circuit.

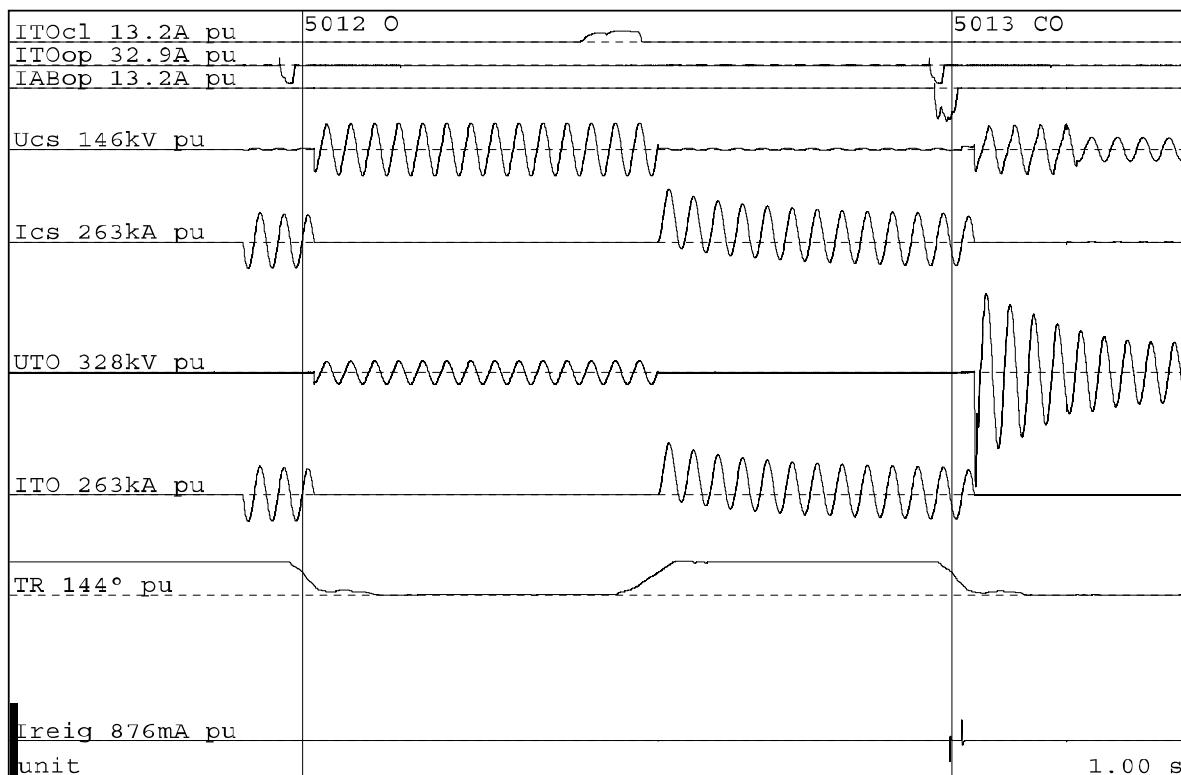

TEST NUMBER: 060901-5012

Time interval since previous test	min	-
Operation		O _D
Phase		-
Breaking current, symmetrical, phase value	kA	64,5
Breaking current, DC-component	%	4
Recovery voltage, phase value	kV	33,6
Arc duration	ms	9,4
Opening time	ms	19,4
Break time	ms	28,8
Voltage opening coil	77 Vd.c.	Gas pressure at 20 °C Operating pressure

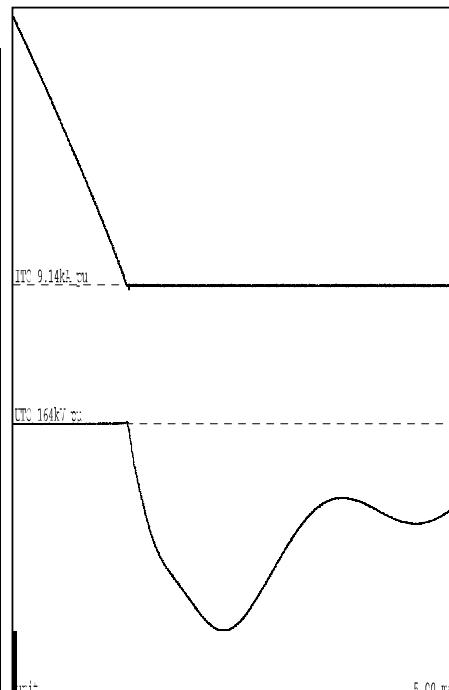
0,6 MPa
- MPa

Remarks: Breaker cleared.

O_D = Operation with current source only.

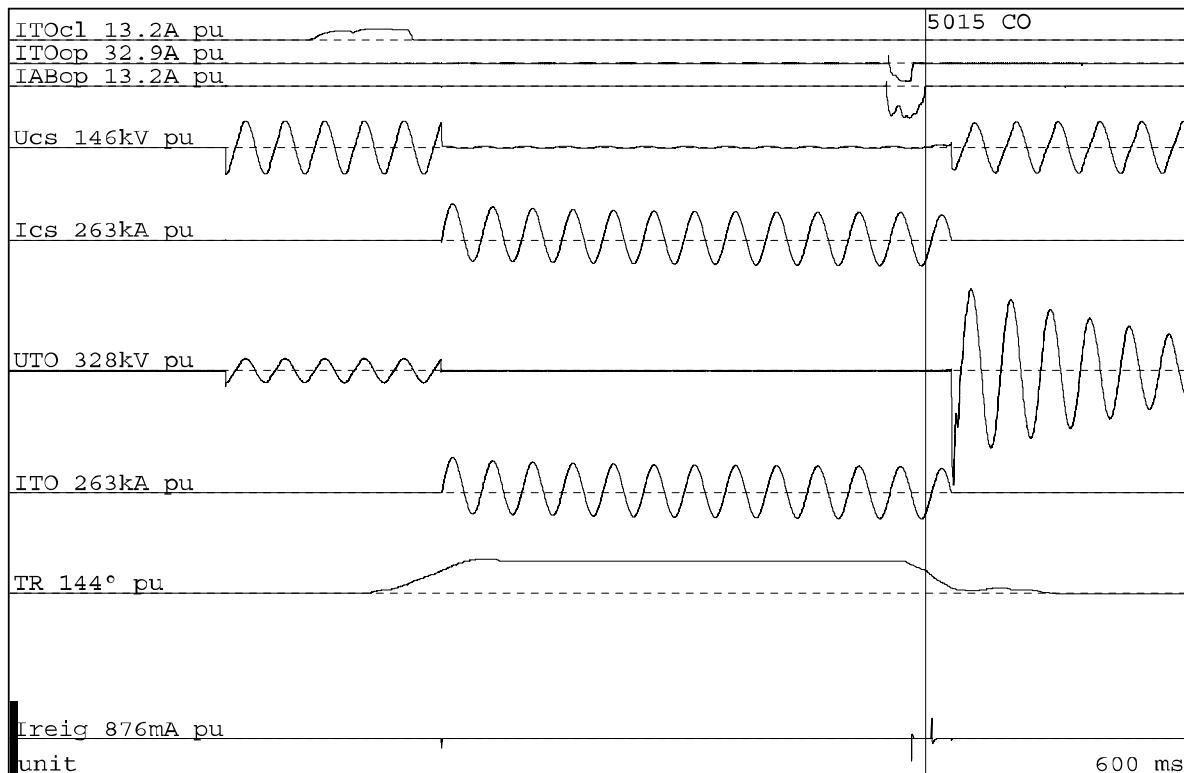

TEST NUMBER: 060901-5013

Time interval since previous test	min	-	
Time interval between operations	s	0,293	
Operation	C _D O _S		
Phase		-	
Applied voltage, current source, phase value	kV	35,1	
Charging voltage capacitor bank, DC value	kV dc	-403	
Making current, peak	kA	180	
Breaking current, symmetrical, phase value	kA	63,9	
Breaking current, DC-component	%	8	
di/dt at last current zero	A/μs	-	
TRV, peak	kV	-490	
Recovery voltage, phase value	kV	-244	
Make time	ms	64,8	
Arc duration	ms	19,0	
Opening time	ms	19,3	
Break time	ms	38,3	
t ₁	μs	25,0	
Current last loop, peak	kA	87,2	
Voltage closing coil	93,5 Vd.c.	Gas pressure at 20 °C	0,6 MPa
Voltage opening coil	77 Vd.c.	Operating pressure	- MPa

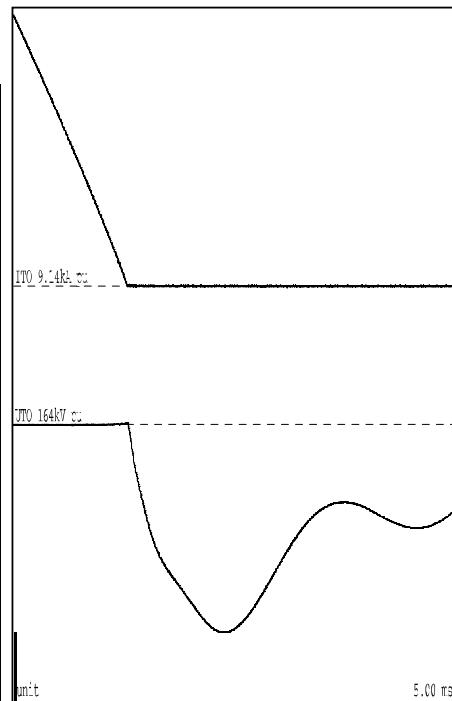


Remarks: Breaker closed and cleared.

C_D = Operation with current source only.
 O_S = Operation in a synthetic circuit.


TEST NUMBER: 060901-5015

Time interval since previous test	min	30
Operation		C _D O _S
Phase		-
Applied voltage, current source, phase value	kV	35,0
Charging voltage capacitor bank, DC value	kV dc	-403
Making current, peak	kA	123
Breaking current, symmetrical, phase value	kA	64,6
Breaking current, DC-component	%	2
di/dt at last current zero	A/μs	-
TRV, peak	kV	-492
Recovery voltage, phase value	kV	-251
Make time	ms	65,4
Arc duration	ms	13,1
Opening time	ms	19,0
Break time	ms	32,1
t _i	μs	25,0
Current last loop, peak	kA	85,6
Voltage closing coil	93,5 Vd.c.	Gas pressure at 20 °C 0,6 MPa
Voltage opening coil	77 Vd.c.	Operating pressure - MPa



Remarks: Breaker closed and cleared.

Time interval since previous test > 10 min, due to test laboratory and not caused by faulty operation of the test breaker. This is the only occurrence during the series of test-duties of this Certificate and does not disqualify these tests (sub-clause 6.105.1 of IEC 62271-100).

C_D = Operation with current source only.

O_S = Operation in a synthetic circuit.



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DUTY: No-load test

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TEST NUMBERS

060901-5016

060901-5017

060901-5018

060901-5019

060901-5020

060901-5021

060901-5022

060901-5023

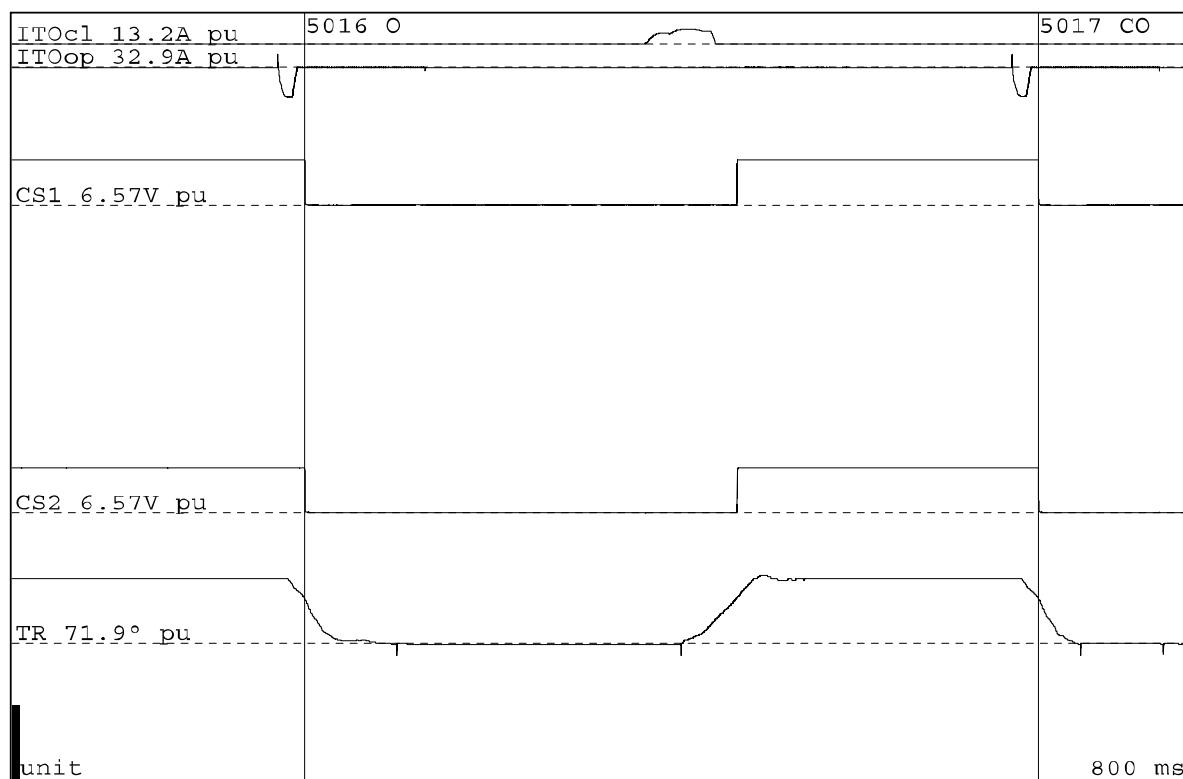
060901-5024

060901-5025

CONDITION BEFORE TESTS

Breaker in same condition.

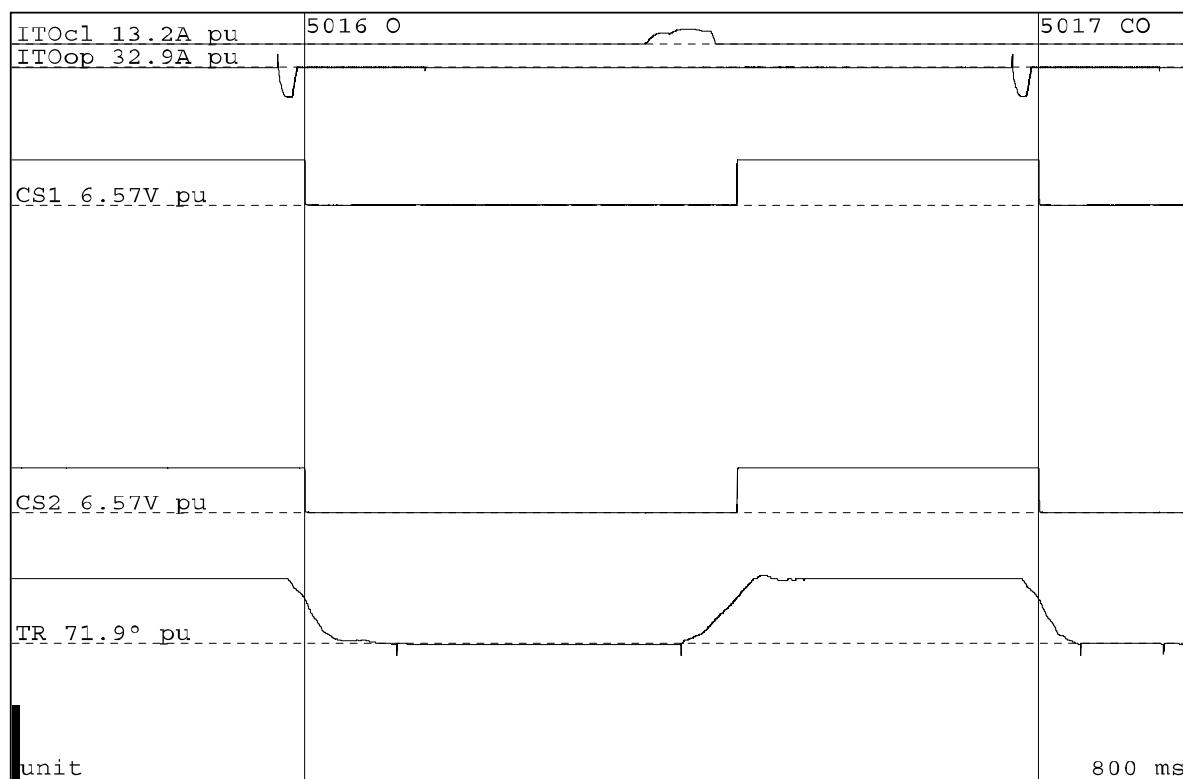
Interrupter 1 and 2 under test (full pole test).


TEST NUMBER: 060901-5016

Operation		O		
Interrupter		1	-	2
Current opening coil	A	-13,1		
Opening time	ms	18,3	-	18,3

Voltage opening coil	121 Vd.c.	Gas pressure at 20 °C	0,6 MPa
		Operating pressure	- MPa

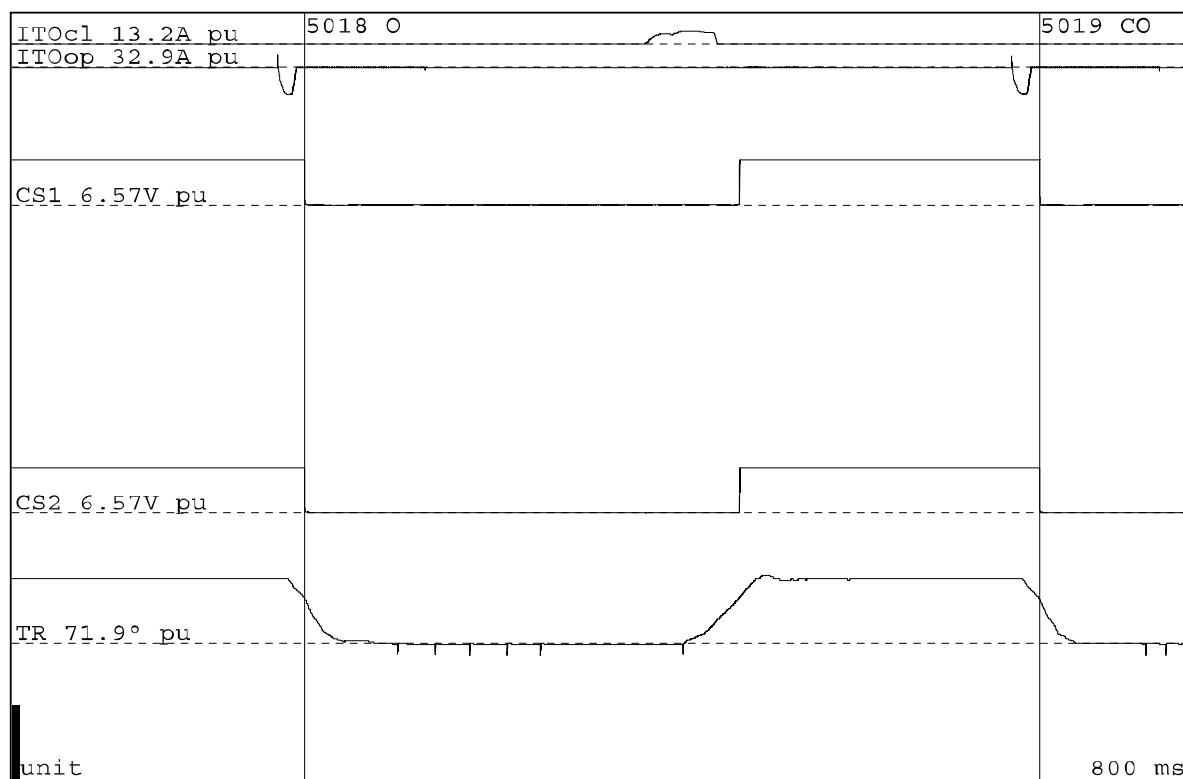
Remarks:	-
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TEST NUMBER: 060901-5017

Time interval since previous test	min	-		
Time interval between operations	s	0,294		
Operation		CO		
Interrupter		1	-	2
Current closing coil	A	2,44		
Closing time	ms	62,2	-	62,2
Current opening coil	A	-12,9		
Opening time	ms	18,1	-	18,1

Voltage closing coil	121 Vd.c.	Gas pressure at 20 °C	0,6 MPa
Voltage opening coil	121 Vd.c.	Operating pressure	- MPa

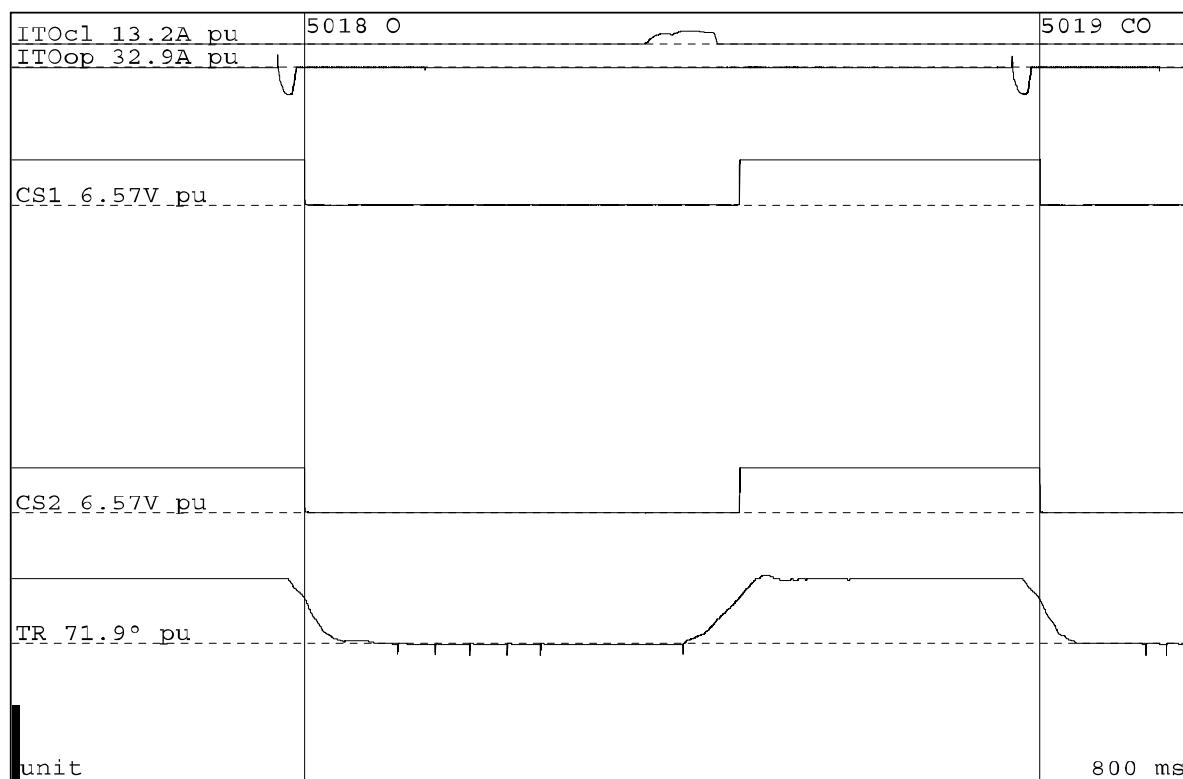
Remarks:	-
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TEST NUMBER: 060901-5018

Operation		O		
Interrupter		1	-	2
Current opening coil	A	-11,8		
Opening time	ms	18,3	-	18,3

Voltage opening coil	110 Vd.c.	Gas pressure at 20 °C	0,6 MPa
		Operating pressure	- MPa

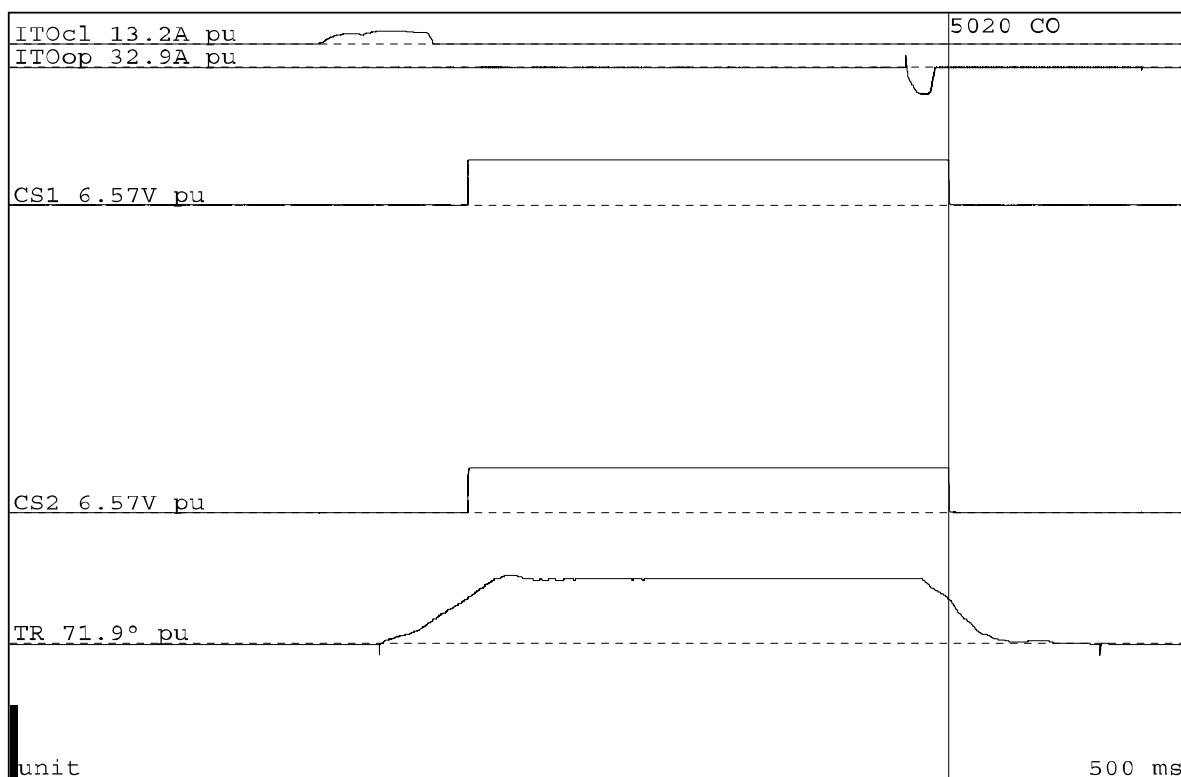
Remarks:	-
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TEST NUMBER: 060901-5019

Time interval since previous test	min	-		
Time interval between operations	s	0,296		
Operation		CO		
Interrupter		1	-	2
Current closing coil	A	2,20		
Closing time	ms	64,1	-	64,1
Current opening coil	A	-11,6		
Opening time	ms	18,7	-	18,6

Voltage closing coil	110 Vd.c.	Gas pressure at 20 °C	0,6 MPa
Voltage opening coil	110 Vd.c.	Operating pressure	- MPa

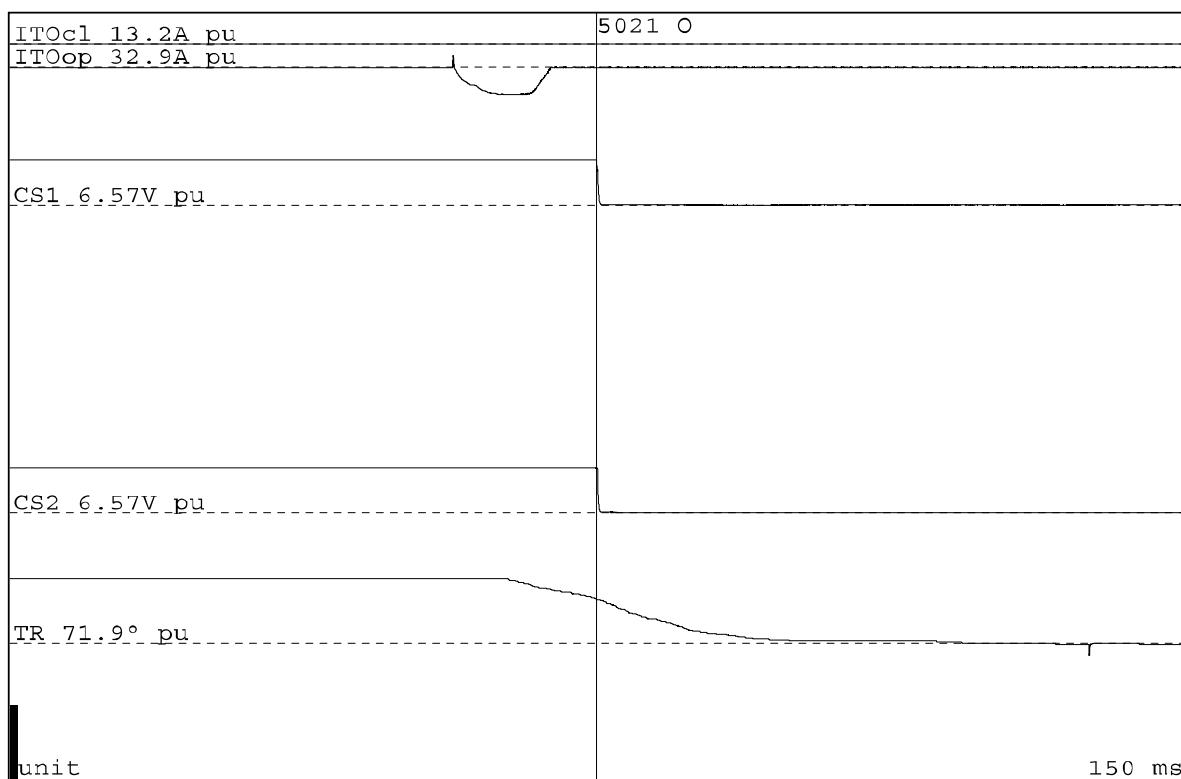
Remarks:	-
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TEST NUMBER: 060901-5020

Operation		CO		
Interrupter		1	-	2
Current closing coil		A	2,20	
Closing time	ms	63,3	-	63,4
Current opening coil		A	-11,7	
Opening time	ms	18,1	-	18,1

Voltage closing coil	110 Vd.c.	Gas pressure at 20 °C	0,6 MPa
Voltage opening coil	110 Vd.c.	Operating pressure	- MPa

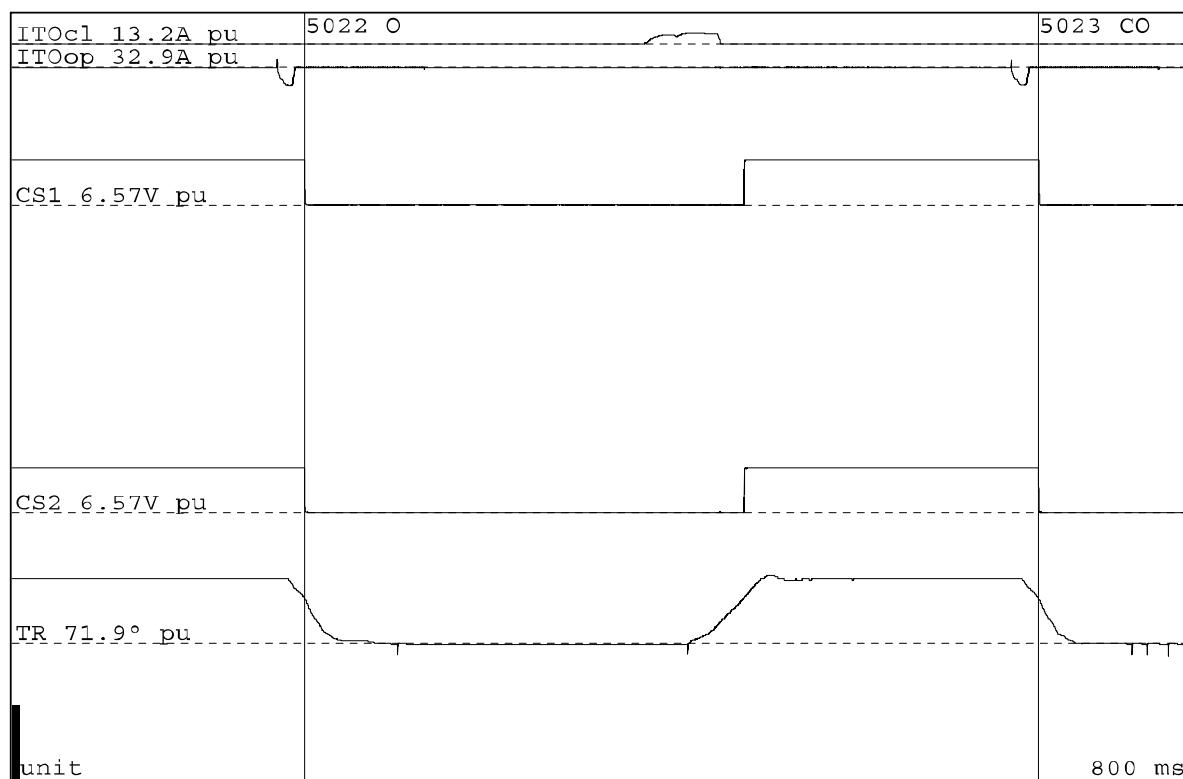
Remarks:	-
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TEST NUMBER: 060901-5021

Operation		O		
Interrupter		1	-	2
Current opening coil	A	-11,8		
Opening time	ms	18,4	-	18,4

Voltage opening coil	110 Vd.c.	Gas pressure at 20 °C	0,6 MPa
		Operating pressure	- MPa

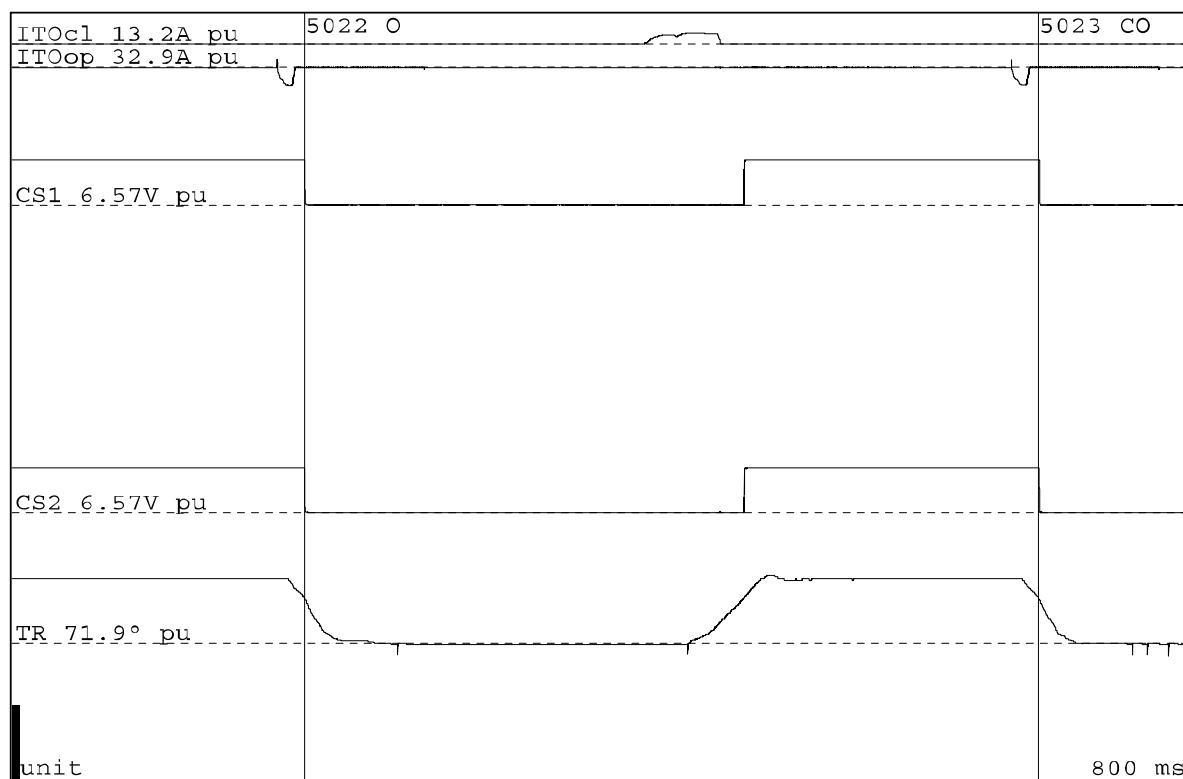
Remarks: -


TEST NUMBER: 060901-5022

Operation		O		
Interrupter		1	-	2
Current opening coil		A		-8,17
Opening time	ms	18,9	-	18,8

Voltage opening coil	77 Vd.c.	Gas pressure at 20 °C	0,6 MPa
		Operating pressure	- MPa

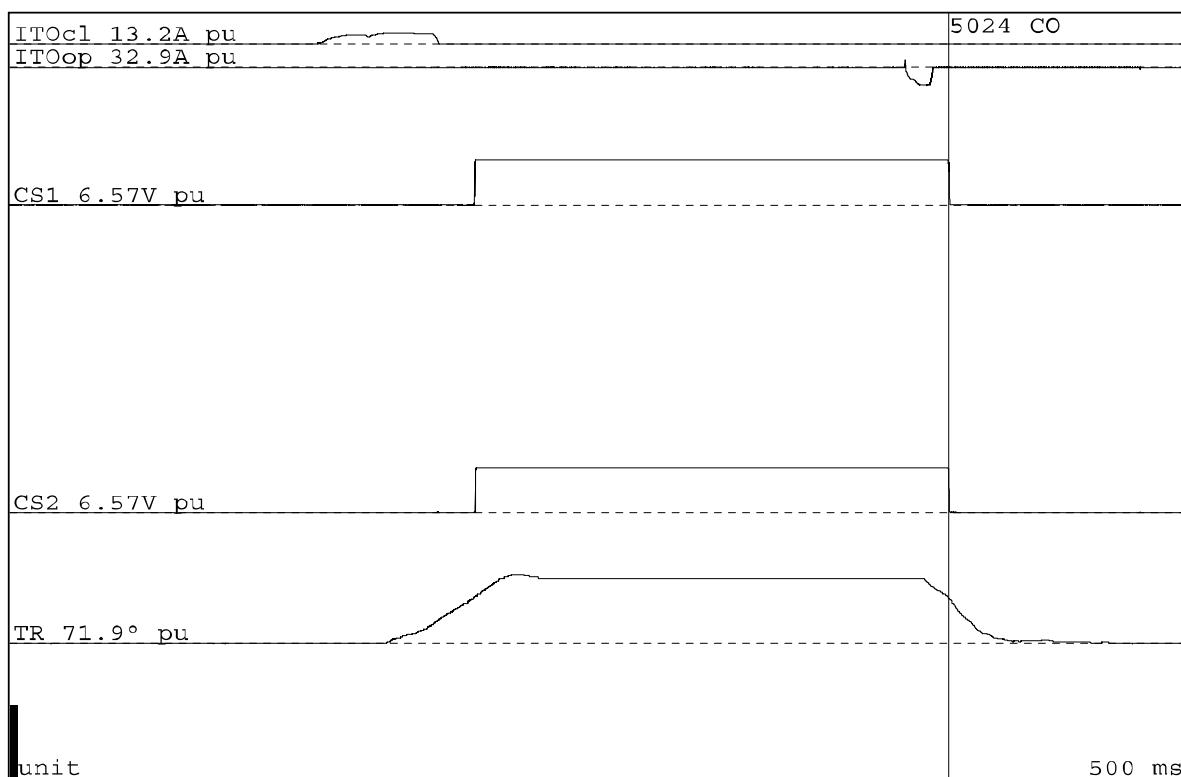
Remarks:	-
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TEST NUMBER: 060901-5023

Time interval since previous test	min	-		
Time interval between operations	s	0,299		
Operation		CO		
Interrupter		1	-	2
Current closing coil	A	1,87		
Closing time	ms	67,6	-	67,6
Current opening coil	A	-7,96		
Opening time	ms	18,8	-	18,7

Voltage closing coil	93,5 Vd.c.	Gas pressure at 20 °C	0,6 MPa
Voltage opening coil	77 Vd.c.	Operating pressure	- MPa

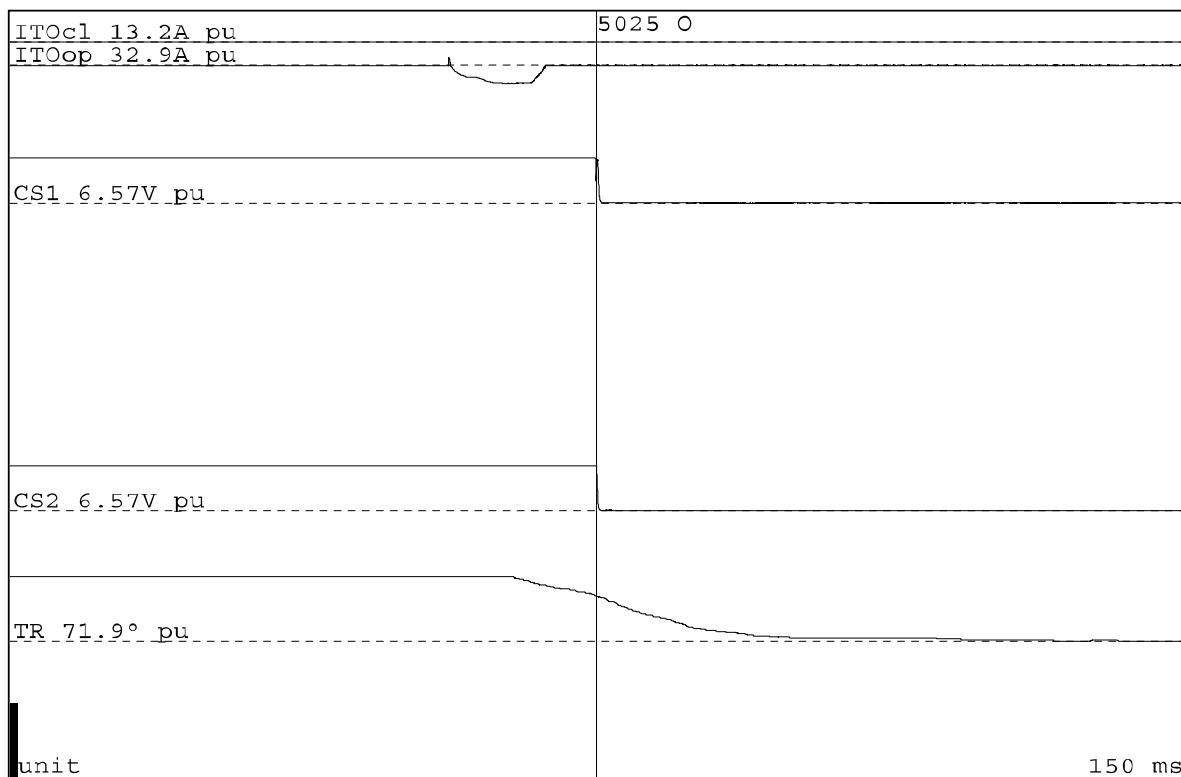
Remarks:	-
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TEST NUMBER: 060901-5024

Operation		CO		
Interrupter		1	-	2
Current closing coil		A	1,87	
Closing time	ms	66,5	-	67,0
Current opening coil		A	-8,07	
Opening time	ms	18,8	-	18,6

Voltage closing coil	93,5 Vd.c.	Gas pressure at 20 °C	0,6 MPa
Voltage opening coil	77 Vd.c.	Operating pressure	- MPa

Remarks:	-
----------	---



TEST NUMBER: 060901-5025

Operation		O		
Interrupter		1	-	2
Current opening coil	A	-8,19		
Opening time	ms	19,0	-	18,9

Voltage opening coil	77 Vd.c.	Gas pressure at 20 °C	0,6 MPa
		Operating pressure	- MPa

Remarks:	-
----------	---

CONDITION / INSPECTION AFTER TEST

Externally no visible change.

Inspection of contacts:

Both interrupters:

Fixed main contact finger tips slightly burnt, contacts are "silver faced".

Moving main contact rim slightly burnt contacts are "silver faced".

Fixed arcing contact slightly burnt.

Moving arcing contact slightly to moderately burnt.

Nozzle slightly eroded.

Auxiliary nozzle moderately eroded.

Inspection of interrupter 1 after test T100s(a) and used as test breaker during T100s(b).

Inspection of interrupter 2 after test T100s(a) and used as auxiliary breaker during T100s(b).

NOTES

During all tests no emission of gas, oil or flames did occur.

According to IEC 62271-100, subclause 6.102.9.2, the circuit-breaker was considered to be able to make, carry and break its rated normal current at the rated voltage.

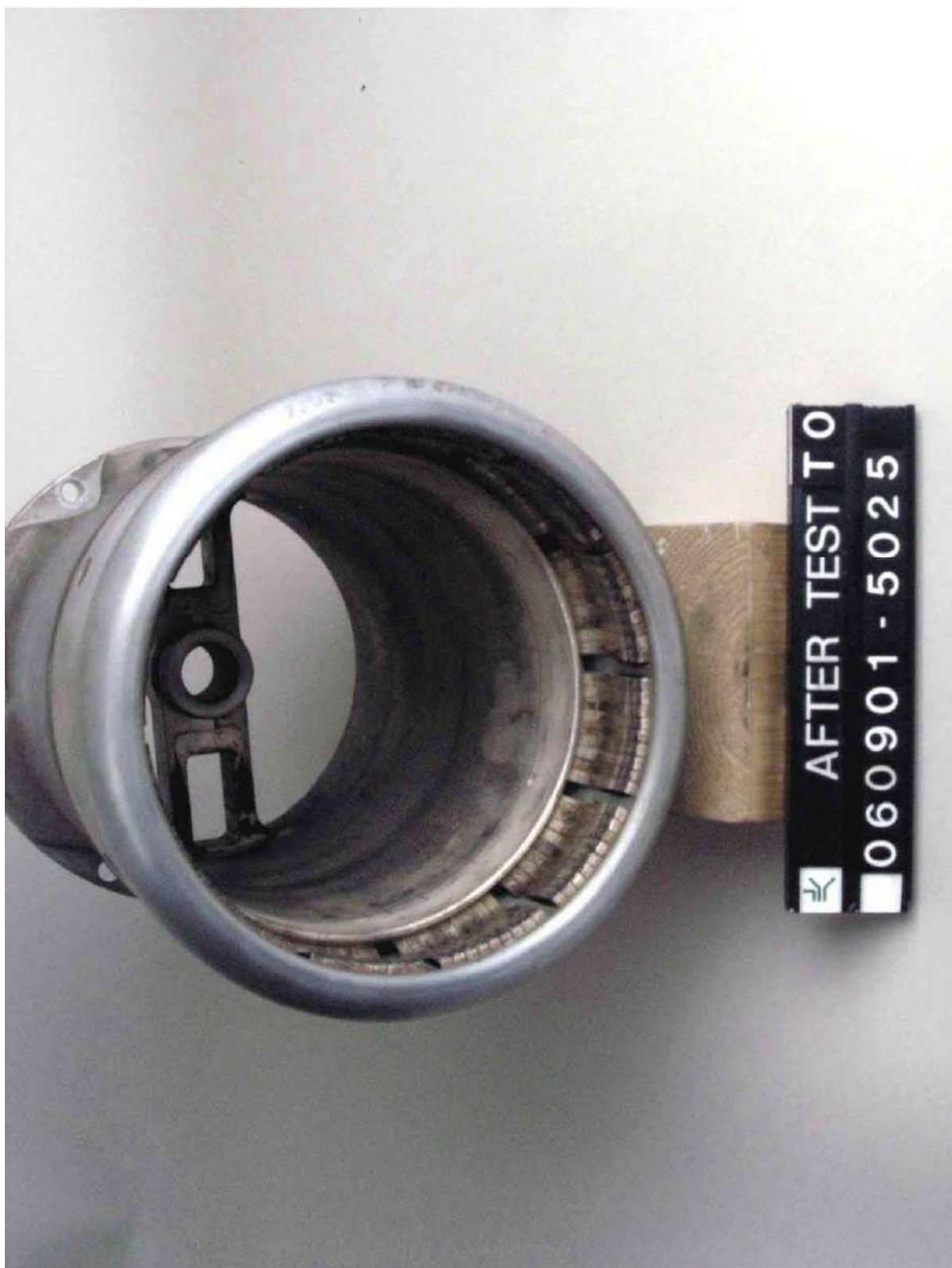


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Photograph after test

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Interrupter 1



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Photograph after test

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Interrupter 1



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Photograph after test

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Interrupter 1



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Photograph after test

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Interrupter 1

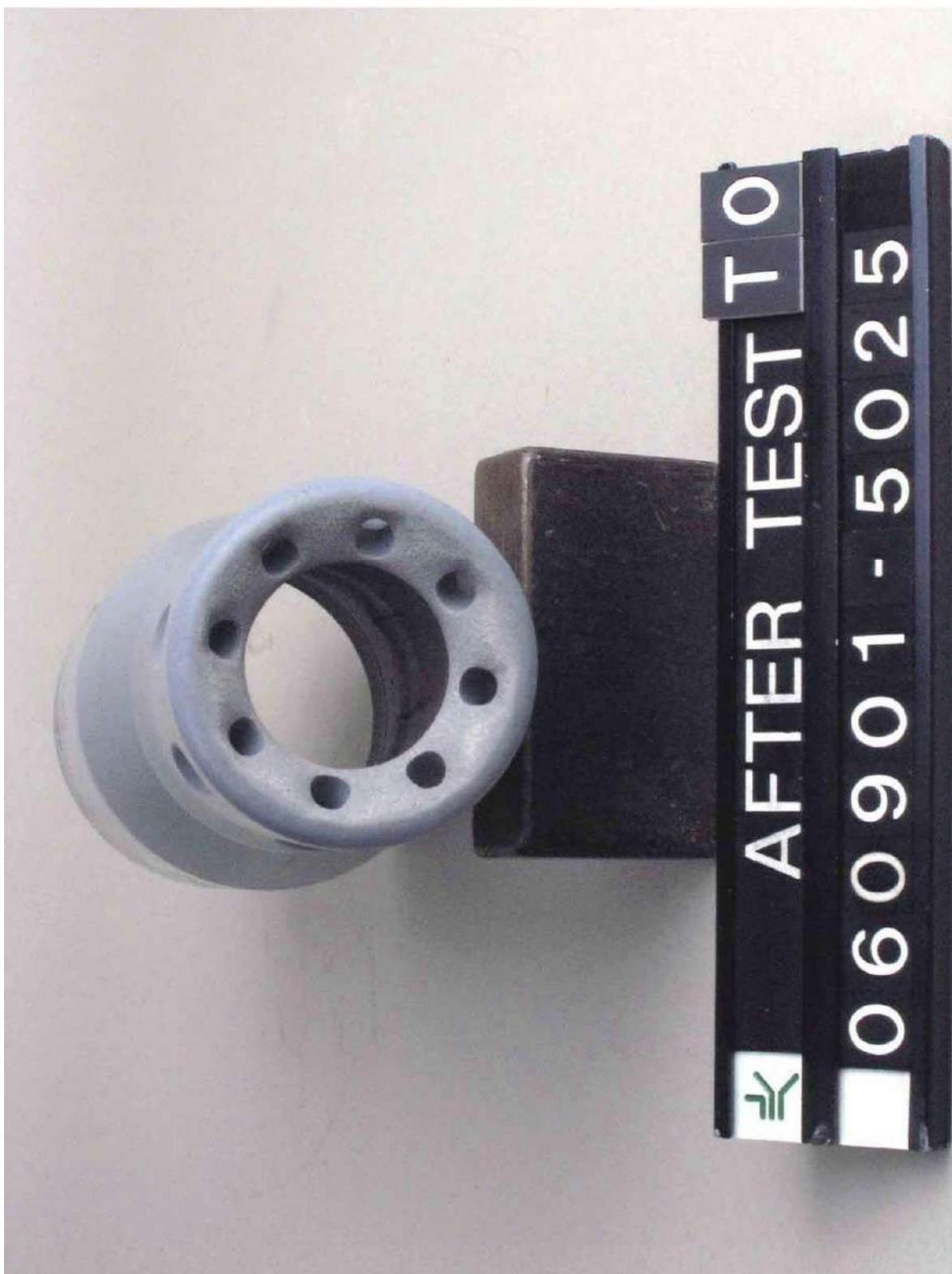


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Photograph after test

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Interrupter 1



Interrupter 1



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Photograph after test

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Interrupter 2



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Photograph after test

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Interrupter 2



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Photograph after test

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Interrupter 2



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Photograph after test

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Interrupter 2



Interrupter 2



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Photograph after test

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Interrupter 2





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Photograph new parts

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Photograph new part

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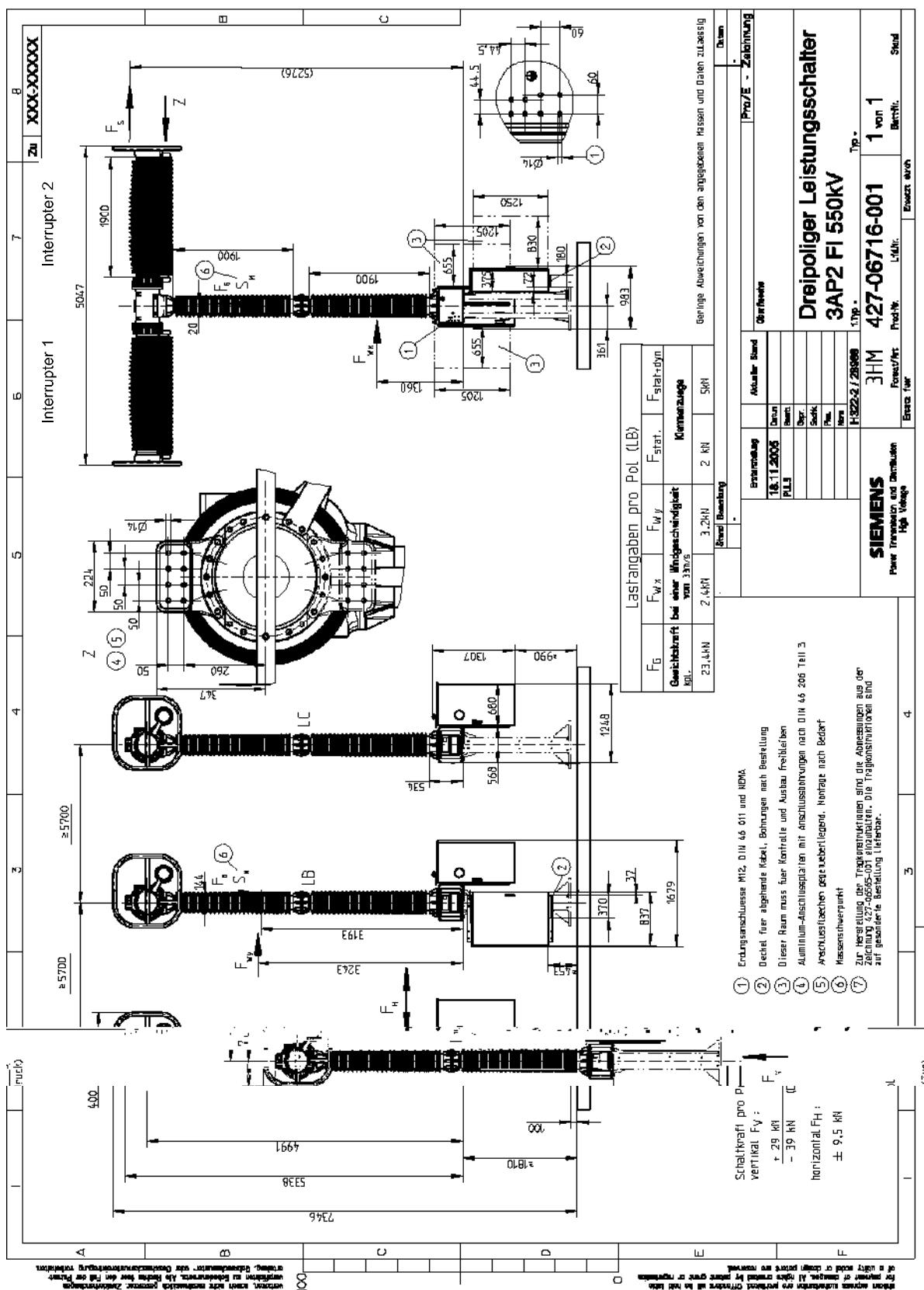


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Photograph new parts

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SIEMENS

High Voltage Circuit Breaker Co. Ltd., Hangzhou

**Siemens High Voltage Circuit Breaker
Co., Ltd., Hangzhou**

**550 kV SF₆ Live Tank Circuit Breaker
3AP3 FI-550kV**

Type Test Report

List of test performed

Serial No.	Type Test Report No.	Issued Date	Inspection Institution	Tests performed
1	06048Bs	2006-10-31	PEHLA	Dielectric test; Radio interference voltage test
2	06057Bs	2006-10-31	PEHLA	Dielectric test
3	06084Bs	2007-1-9	PEHLA	Temperature-rise test; Measurement of the resistance of the main circuit
4	06043Bs	2006-7-19	PEHLA	Short-time withstand current and peak withstand current tests
5	M 0467 C/E	2006-9-7	Siemens AG	Mechanical operation test, 10000 operating cycles
6	06035Bs	2006-8-31	PEHLA	Basic short-circuit current making and breaking tests, test duty T10
7	06036Bs	2006-7-13	PEHLA	Basic short-circuit current making and breaking tests, test duty T30
8	06040Bs	2006-8-31	PEHLA	Basic short-circuit current making and breaking tests, test duty T60
9	524_06	2008-2-13	KEMA	Basic short-circuit current making and breaking tests, test duty T100s
10	525_06	2008-2-13	KEMA	Basic short-circuit current making and breaking tests, test duty T100a (kpp 1.5 at 50 Hz)
11	526_06	2008-2-13	KEMA	Basic short-circuit current making and breaking tests, test duty T100a (kpp 1.3 at 50 Hz)
12	06039Bs	2007-1-22	PEHLA	Capacitive current switching tests, C2
13	06041Bs	2006-11-24	PEHLA	Short-line fault test, test duty L90
14	06042Bs	2006-10-30	PEHLA	Short-line fault test, test duty L75
15	06046Bs	2006-11-24	PEHLA	Out-of-phase making and breaking tests, test duty OP2
16	06074Bs	2006-11-16	PEHLA	Low and high temperature tests at -30°C and +55°C



High Voltage Circuit Breaker Co. Ltd., Hangzhou

17	0610Bm	2007-4-25	PEHLA	Single-phase shunt reactor current switching tests
18	H321M-VB0710	2007-4-23	Siemens AG	Seismic Analysis
19	S 3562 BE	2011-5-16	Siemens AG	Single-phase capacitive current switching tests for class C2 circuit breaker
20	S 3581 BE	2014-2-14	Siemens AG	Single-phase capacitive current switching tests for class C2 circuit breaker
21	06056Bs	2006-10-17	PEHLA	Dielectric tests on auxiliary and control circuits
22	0145 Bs; 10044-42-1	2002-2-28	PEHLA Siemens AG	EMC tests
23	M 0485 AE	2007-8-28	Siemens AG	Sound pressure level test
24	H321M-VB0688	2007-3-2	Siemens AG	Verification of the static terminal load
25	M 0488 A/E; 07075BS; 07076BS	2007-7-9	Siemens AG PEHLA	Verification of the Degree of Protection

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06048Bs

Copy No.: 0

Contents: 28 Sheets

Test object: One pole of a three-pole outdoor circuit-breaker

Designation: 3AP3FI – 550 kV – 4000 A – 63 kA – 60 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 60 Hz

Manufacturer: Siemens AG PTD H 3

Client: Siemens AG PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: August 15-18, 2006

Applied test specifications:

IEC Publication 62271-100 Edition 1.1 (2003)

IEC Publication 60694 Edition 2.2 (2002)

ANSI C37.06 (2000)

Customer requirements

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned standards and the STL Guides wherever applicable.

Tests performed:

Dielectric tests including:

Power-frequency voltage test

Power-frequency voltage test (phase opposition)

Rated lightning impulse withstand voltage test

Chopped wave lightning impulse withstand voltage test

Lightning impulse voltage against power-frequency voltage (combined voltage) test

Rated switching impulse withstand voltage test (dry and wet)

Switching impulse voltage against power-frequency voltage (combined voltage) test (dry and wet)

Radio interference voltage test

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, October 31, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

The test results relate only to the items tested.

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02PE0607



DAT-P-017/92-52

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Report

Report No.: 06057Bs

Copy No.: 0

Contents: 14 Sheets

Test object: One pole of a three-pole outdoor circuit-breaker

Designation: 3AP3F1 – 550 kV – 4000 A – 63 kA - 60Hz

Rated voltage: 550 kV Rated normal current: 4000 A

Rated frequency: 60 Hz

Manufacturer: Siemens AG PTD H 3

Client: Siemens AG PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: August 15-18, 2006

Applied test specifications:

IEC Publication 62271-100 Edition 1.1 (2003)

IEC Publication 60694 Edition 2.2 (2002)

ANSI C37.06 (2000)

Customer requirements

Tests performed:

Dielectric tests including

Lightning impulse withstand voltage test

Lightning impulse voltage against power-frequency voltage (combined voltage) test

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, October 31, 2006

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HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

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GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06084 Bs

Copy No.: 0

Contents: 11 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP3 FI - 550 kV - 5500 A - 63 kA - 60 Hz

Rated voltage: 550 kV Rated normal current: 5500 A Rated frequency: 60 Hz

Manufacturer: Siemens AG, PTD H 3, Berlin

Client: Siemens AG, PTD H 322-2, Berlin

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: November 20 to November 21, 2006

Applied test specifications:

IEC 62271-100 Ed. 1.2 (2006)

IEC 60694 Ed. 2.2 (2002)

according customer requirements rated normal current: 5500 A

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned standards and the STL Guides wherever applicable.

Tests performed:

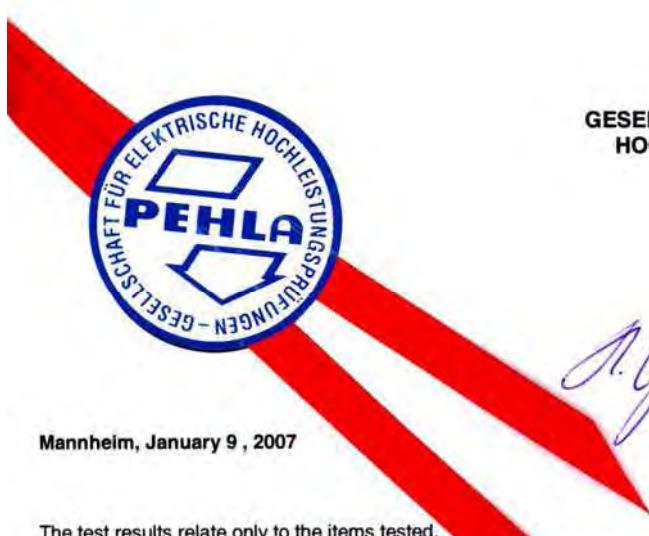
Temperature-rise test for a rated normal current of 5500 A, 60 Hz

Measurement of the resistance of the main circuit

Test is also valid for rated frequency of 50 Hz

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performance proved of the test object comply with the requirements of the specifications mentioned above.



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Management Committee

A. Glan W.
Technical Committee

Mannheim, January 9, 2007

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06043 Bs

Copy No.: 0

Contents: 32 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 17, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

According to STL Objectives and Operating Principles PEHLA issues a Type Test Certificate following exclusively the above mentioned IEC-guidelines and the STL Guides wherever applicable.

Tests performed:

Short-time withstand current and peak withstand current tests for a peak factor of 2.7 p.u. and a duration of short-circuit of 3 s.

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, October 10, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

A. Glan
Management Committee

H.-J. W.
Technical Committee

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DAT-P-017/92-52

Test Report

Report-No.: M 0467 C/E

Copy-No.: 0

Contents: 13 Sheets

Test Object: Single-pole operated outdoor circuit-breaker
3AP3 FI – 550 kV – 4000 A – 63 kA – 50/60 Hz

Manufacturer: Siemens AG, PTD H3, Berlin

Client: Siemens AG, PTD H3, Berlin

Date of Test: August 10 to August 30, 2006

Testing Station: Siemens AG, Mechanical Test Laboratory

Applied Test Specifications:

IEC 62271-100 Ed. 1.1 (2003)
IEC 60694 Ed. 2.2 (2002)

Test Performed:

Mechanical operation test at ambient air temperature with 10 000 operating cycles.

Test Result:

The test object has passed the test stated above without any objection.
The results obtained and the performance proved of the test object comply with the requirements of the specifications mentioned above.

Power Transmission and Distribution
Circuit-Breakers
Mechanical Laboratories PTD H 321

i.V. N. Trapp

Dr. Trapp
Head Test Laboratories
High Voltage Division



n.v. Kraft

Kraft
Head Mechanical Test Laboratory
High Voltage Division

Berlin, September 07, 2006

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06035 Bs

Copy No.: 0

Contents: 42 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 04 - 05, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Basic short-circuit making and breaking tests, test duty T10

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, August 31, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

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i.v. *Hank* *U.C.*

Technical Committee

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Test Document

Report No.: 06036 Bs

Copy No.: 0

Contents: 36 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A

Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 06, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Basic short-circuit making and breaking tests, test duty T30

Test results:

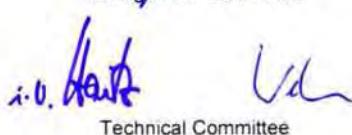
The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, August 31, 2006

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HOCHLEISTUNGSPRÜFUNGEN


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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06040 Bs

Copy No.: 0

Contents: 37 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 06, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publikation 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Basic short-circuit making and breaking tests, test duty T60

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, August 31, 2006

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HOCHLEISTUNGSPRÜFUNGEN

Management Committee

U. Haft W. L.

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DAT-P-017/92-52



REPORT OF PERFORMANCE

524-06

APPARATUS	Single-pole operated outdoor circuit-breaker. Grading capacitor per interrupter unit 1000 pF.
TYPE	3AP2 FI – 550 kV – 4000 A – 63 kA – 50 Hz
SERIAL No.	35097232
CLIENT	Siemens AG, PTD H322-2 Berlin, Germany
MANUFACTURER	Siemens AG, PTD H3 Berlin, Germany
TESTED BY	KEMA HIGH-POWER LABORATORY Utrechtseweg 310 - 6812 AR Arnhem - The Netherlands
DATE(S) OF TESTS	31 August and 1 September 2006
TEST SPECIFICATION	The tests have been carried out strictly in accordance with IEC 62271-100, subclause 6.102 to 6.105 and 6.106.4 (T100s with k_{pp} 1,3/1,5 and at 50 Hz).
REMARKS	The apparatus has complied with the relevant requirements.

This report consists of 71 sheets in total.

This report falls under the scope of the accreditation certificates L 020 of the Dutch Council for Accreditation.
See information sheet (page 2).

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KEMA Nederland B.V.



P.G.A. Bus
KEMA T&D Testing Services
Managing Director

Arnhem, 13 February 2008



REPORT OF PERFORMANCE

525-06

APPARATUS Single-pole operated outdoor circuit-breaker.
Grading capacitor per interrupter unit 1000 pF.

TYPE 3AP2 FI – 550 kV – 4000 A – 63 kA – **SERIAL No.** -
50 Hz

CLIENT Siemens AG, PTD H322-2
Berlin, Germany

MANUFACTURER Siemens AG, PTD H3
Berlin, Germany

TESTED BY KEMA HIGH-POWER LABORATORY
Utrechtseweg 310 - 6812 AR Arnhem - The Netherlands

DATE(S) OF TESTS 4 September 2006

TEST SPECIFICATION The tests have been carried out strictly in accordance with IEC 62271-100,
subclause 6.102 to 6.105 and 6.106.5 (T100a with k_{pp} 1,5 and at 50 Hz).

REMARKS The apparatus has complied with the relevant requirements.

This report consists of 71 sheets in total.

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KEMA Nederland B.V.



P.G.A. Bus
KEMA T&D Testing Services
Managing Director

Arnhem, 13 February 2008



REPORT OF PERFORMANCE

526-06

APPARATUS

Single-pole operated outdoor circuit-breaker.
Grading capacitor per interrupter unit 1000 pF.

TYPE 3AP2 FI – 550 kV – 4000 A – 63 kA – **SERIAL No.** 35097604
50 Hz

CLIENT

Siemens AG, PTD H322-2
Berlin, Germany

MANUFACTURER

Siemens AG, PTD H3
Berlin, Germany

TESTED BY

KEMA HIGH-POWER LABORATORY
Utrechtseweg 310 - 6812 AR Arnhem - The Netherlands

DATE(S) OF TESTS

4, 5 and 6 September 2006

TEST SPECIFICATION

The tests have been carried out strictly in accordance with IEC 62271-100,
subclause 6.102 to 6.105 and 6.106.5 (T100a with k_{pp} 1,3 and at 50 Hz).

REMARKS

The apparatus has complied with the relevant requirements.

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KEMA T&D Testing Services
Managing Director

Arnhem, 13 February 2008

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06039 Bs

Copy No.: 0

Contents: 193 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 31 - August 03, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Capacitive current switching tests for verification of the making and breaking performance of line-charging and cable-charging currents for a capacitive voltage factor of $k_c=1.4$ p.u. and a frequency of 50 Hz according class C2.

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

Mannheim, January 22, 2007

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06041 Bs Copy No.: 0 Contents: 44 Sheets
Test object: Single-pole operated outdoor circuit-breaker
Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz
Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA
Manufacturer: Siemens AG, PTD H 3
Client: Siemens AG, PTD H 322-2
Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt
Date of test: August 02, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)
IEC Publication 60694 (2002)
IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Short-line fault test, test duty L90 including voltage test as a condition check.

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

Mannheim, November 24, 2006

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06042 Bs

Copy No.: 0

Contents: 41 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 18, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Short-line fault test, test duty L75

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, October 30, 2006

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HOCHLEISTUNGSPRÜFUNGEN



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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06046 Bs Copy No.: 0 Contents: 43 Sheets
Test object: Single-pole operated outdoor circuit-breaker
Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz
Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA
Manufacturer: Siemens AG, PTD H 3
Client: Siemens AG, PTD H 322-2
Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt
Date of test: July 20 - 21, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)
IEC Publication 60694 (2002)
IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Out-of-phase making and breaking tests, test duty OP2

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, November 24, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

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Management Committee

W. Volz
Technical Committee

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06074 Bs

Copy No.: 0

Contents: 21 Sheets

Test object: Single-pole operated three-pole outdoor circuit-breaker

Designation: 3AP3FI – 550 kV – 4000 A – 63 kA – 50/60 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50/60 Hz
Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H3, Germany

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: September 29 to October 16, 2006

Applied test specifications:

IEC 62271-100 Ed. 1.1 (2003)

IEC 60694 Ed. 2.2 (2002)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned standards and the STL Guides wherever applicable.

Tests performed:

Low and high temperature tests at -30°C and +55°C

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN


Management Committee


Technical Committee

Mannheim, November 16, 2006

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Report

Report No.: 0610Bm

Copy No.: 1

Contents: 146 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2FI – 550 kV – 4000 A – 63 kA – 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A

Rated frequency: 50 Hz

Rated short –circuit breaking current: 63 kA

Serial No.: 35097232

Drawing No.: 1HZ 427 06300 804

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin Marzahn

Date of test: July 26-27, 2006

Applied test specifications:

IEC Publication 62271-110 (2005)

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

Tests performed:

Single-phase shunt reactor current switching tests

The unit test was performed with a voltage distribution factor of 0.53.

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Paul N
Management Committee

i.V. Paul N. Glau
Technical Committee

Mannheim, April 25, 2007

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03PE0402

Seismic Analysis-Qualification Report

No.: H321M-VB0710

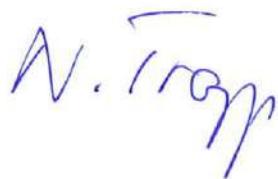
Copy-No.: 0

Content: 8 Sheet(s)

Circuit-breaker 3AP3FI 550 kV

The above-named high voltage circuit-breaker with support structure, mounted on firm ground, is qualified by finite element analysis in accordance with IEC 62271-300 for a seismic qualification level of 0.3g ZPA (zero period acceleration). The required response spectrum (RRS) and additional loads are chosen as demanded in IEC 62271-300 (2006).

Power Transmission and Distribution
Switching Devices
Test Laboratories – PTD H 321



Dr. Norbert Trapp
Head Test Laboratories



Berlin, 2007 April 23

Report No.: H321M-VB0710

Qualified to seismic qualification level 0.3g ZPA of the RRS of IEC 62271-300 (2006)

Equipment designation: 3AP3 FI 550 kV Siemens circuit breaker

Dimensional drawing: 427-06710-002
(calculation with pedestal 433-01810-037)

Report prepared by: Dr. U. Heinrich

Date signed: 2007 April 23

This is to certify that the above-named equipment and support, mounted on firm ground, meets or exceeds all of the requirements according to IEC 62271-300. The used response spectrum is specified for 0.3g ZPA according to IEC 62271-300.

Signed:



Table Contents

1. General
2. Equipment data
3. Method of analysis
4. Results

Appendices

- Appendix A: plot of FE model
Appendix B: Mises stress plots
Appendix C: dimensional drawing

1. General

Loads considered by FEA calculation are:

- deadweight
- inner pressure of 10 bar
- line pull force of 1400 N on the terminal in y-direction
- force from wind speed 10 m/s in x- and y-direction
- seismic force (100% -horizontal and 50% vertical)

As damping ratio 4% in x-direction and 6% in y-Direction was used. Because measurement has shown as this damping ratio.

The pedestal, pole column and the steel frame are modelled with shell elements. The anchor bolts are modelled with beam elements. Since it is conservative, only the outer pole column without inner components was modelled with overall mass. That means that the inner components have no stiffness. The Young's Modulus for the steel is $E=210000$ MPa and for porcelain $E=98000$ MPa.

2. Equipment data

mass of the circuit breaker:	3440 kg
first frequencies of the circuit breaker:	0.7 Hz in x-and 0.8 Hz in y-direction
damping ratio:	4% in x- and 6% in y-direction
center of gravity of the hole equipment:	6140 mm (height)

3. Method of Analysis

First the static analysis was done, in order to calculate the displacements and stresses resulting from line pull, wind pressure and inner pressure. Then the modal analysis followed by the response spectrum analysis was used in order to determine the modal stresses. The modal stresses are combined using the square root of the sum of the squares (SRSS).

In the last step the results from the seismic calculation in each horizontal (x- and y-direction) respectively and the vertical direction and the results from static analysis were superimposed. The most critical case (x-z-direction and static load or y-z-direction and static load) is mentioned and graphically depicted in this report.

The finite element analysis program ANSYS (Version 10.0) was used, in order to calculate the resonance frequencies and to carry out the response spectrum analysis. The response spectrum is given for the program by some corner points. Between those points the program interpolates linearly in order to calculate the spectrum value at a certain frequency point.

Table 1: Response spectrum for 4 % and 6% damping ratio according high required response spectrum of IEC 62271-300 – 0.3g ZPA

Frequency Hz	acceleration m/s ² (4%)	acceleration m/s ² (6%)
0.5	2070	1720
0.8	3130	2500
1.0	3830	3830
2.4	6230	4840
9.0	6230	4920
20	4230	4040
25	3000	3000
35	3000	3000

4. Results

The maximum displacement at the terminal is about 109 mm in x-direction and 110 mm in y-direction.

calculated frequencies:

MODE FREQUENCY (HERTZ)

FREQUENCY RANGE REQUESTED=	0.00000	35.0000
1	0.7775896200277	
2	0.7967833961573	
3	1.632381336403	
4	3.182562454116	
5	8.038457294528	
6	11.11948110188	
7	14.99942417810	
8	15.46117886280	
9	16.38164649358	
10	18.34788592351	
11	19.86920240757	
12	30.95666343261	
13	34.36658074795	

Table 2: Summary of maximum stresses for the highest loaded components

component	calculated mises stress in MPa	rupture or yield stress in MPa	safety factor calculated
post insulator 1 (above)	24	60 ¹	2.5
post insulator 2	34	60 ¹	1.7
post insulator 3 (below)	37	60 ¹	1.6
porcelain jacket (breaking chamber)	15	35 ²	2.3
steel frame	281	355 ³	1.2
pedestal	252	355 ³	1.4
anchor bolts	124	355 ³	2.8

1 rupture strength

2 rupture strength

3 yield strength 0.2% - 355 MPa (steel)

Appendix A



Figure 1: Plot of the FE-model

Appendix B

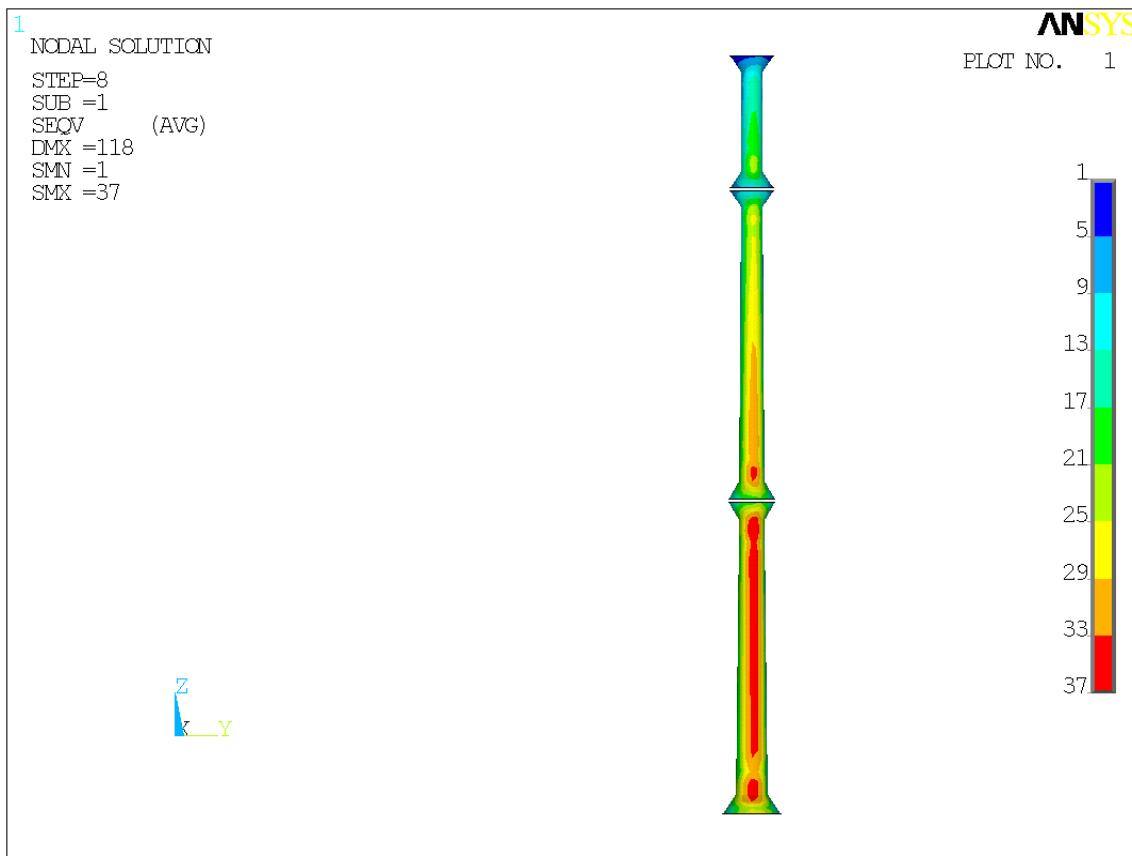


Figure 2: Mises stress plot; post insulator

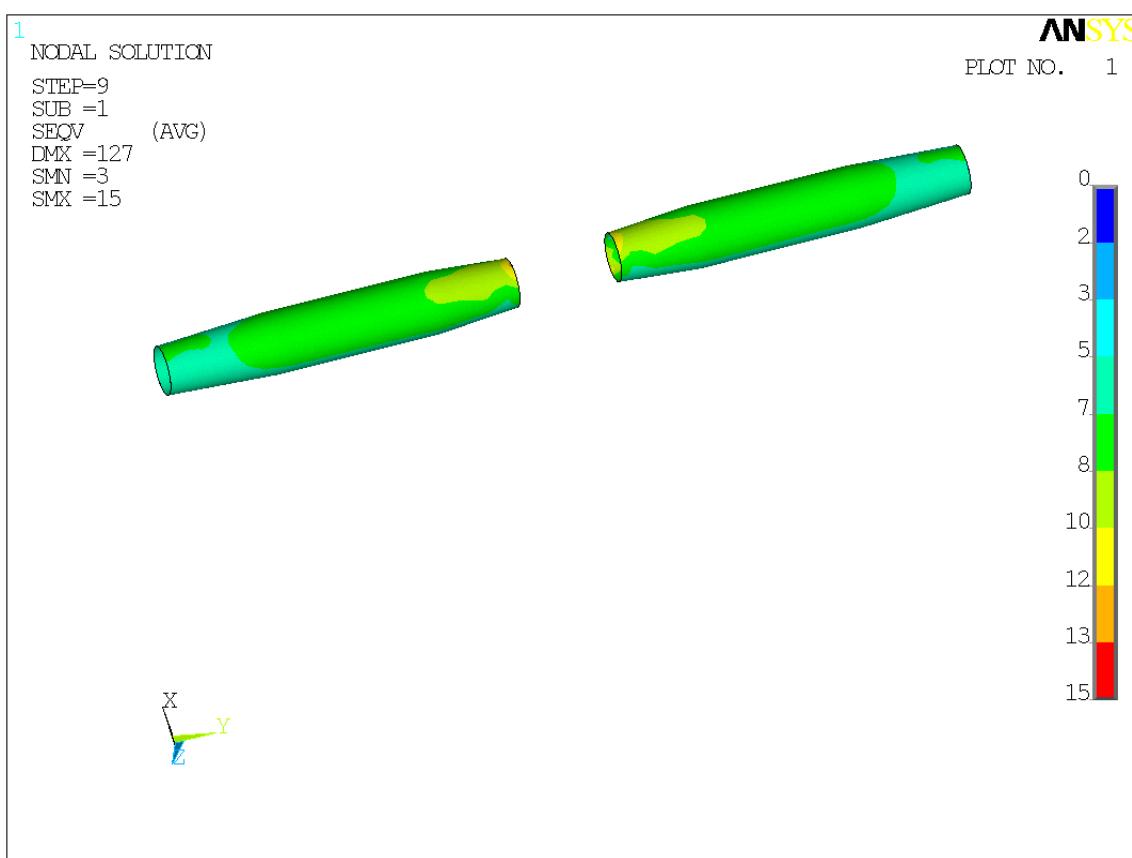


Figure 3: Mises stress plot; breaking chamber

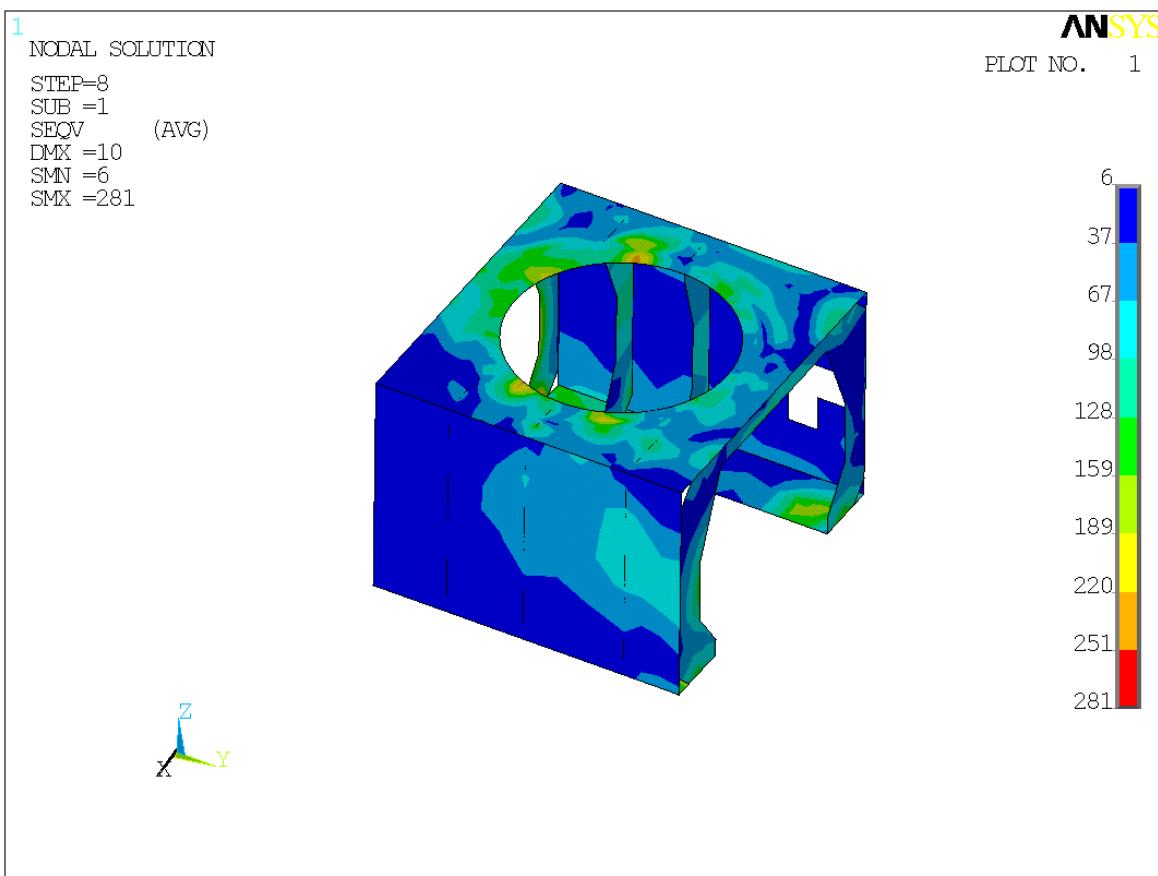


Figure 4: Mises stress in MPa; steel frame

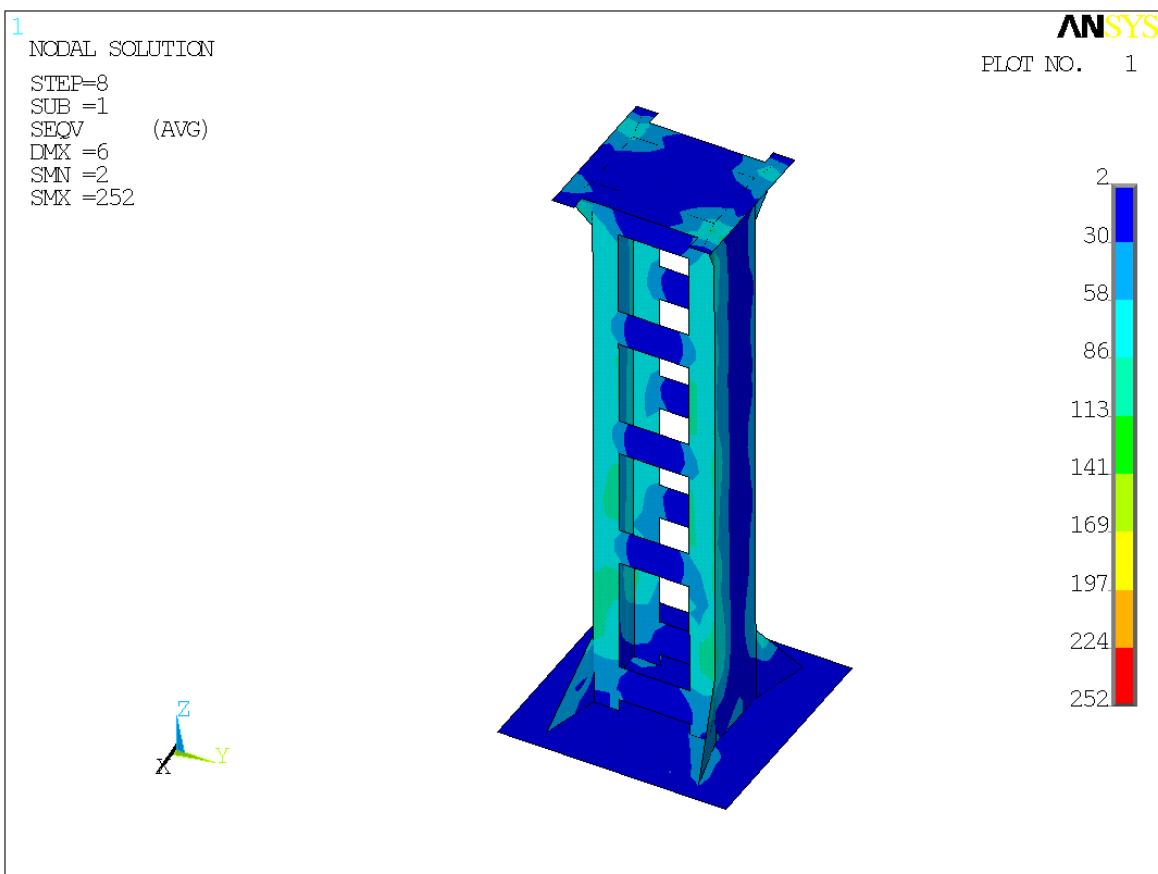
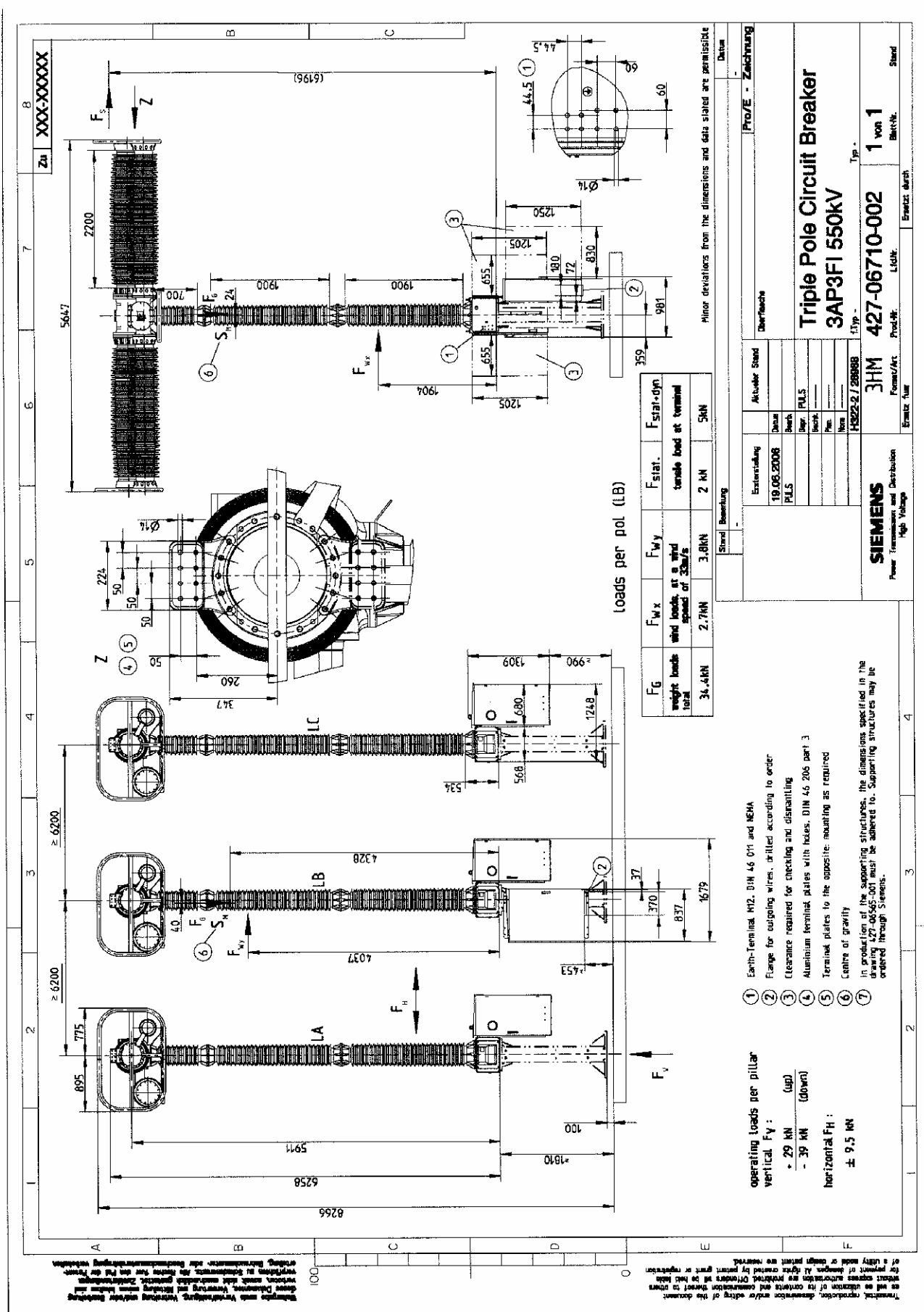


Figure 5: Mises stress in MPa; pedestal

Appendix C



SIEMENS

Test Report

Report-No.: S 3562 B/E

Copy-No.: 1

Contents: 41 Sheets

Test Object: Single-pole operated outdoor circuit-breaker
3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz
Manufacturer: Siemens AG, E T HP CB MF B
Client: Siemens AG, E T HP CB PLM R&D B EP
Date of Test: April 28 - 29, 2011
Testing Station: Siemens AG, High-Power Testing Laboratory

Applied Test Specifications:

Client's requirements based on:
IEC Publication 62271-1, Edition 1.0 (2007)
IEC Publication 62271-100, Edition 2.0 (2008)
IEC Publication 62271-101, First Edition (2006) + Amendment 1 (2010)

Test Performed:

Single-phase capacitive current switching tests for class C2 circuit-breaker

- Preconditioning test T60 without TRV
- Single-capacitor bank current switching tests:
making operations with a capacitive voltage factor of $k_C = 1.4$ p.u.
breaking operations with a capacitive voltage factor of $k_C = 1.7$ p.u.

Test Result:

The test object passed the tests performed in accordance with the applied test specifications.

Siemens Aktiengesellschaft
Energy Sector

i. v. Eiselt

Mr. Eiselt
Head of Testing Laboratories



i. v. M. Gerlach

Mr. Gerlach
Head of High-Power Testing Laboratory

Berlin, May 16, 2011

Test Report

Report-No.: S 3581 B/E

Copy-No.: 0

Contents: 40 Sheets

Appendix: 143 Sheets

Test Object: Single pole operated outdoor circuit-breaker
3AP2FI - 550 kV - 5000 A - 63 kA - 50 Hz

Manufacturer: Siemens AG, E T HP CB

Client: Siemens AG, E T HP CB R&D

Date of Test: November 15 - 19, 2013

Testing Station: Siemens AG, High-Power Testing Laboratory

Applied Test Specifications:

Client's instruction based on:

IEC Publication 62271-1, Edition 1.1 (2011)

IEC Publication 62271-100, Edition 2.1 (2012)

IEC Publication 62271-101, Edition 2.0 (2012)

Customer specification

Test Performed:

Single-phase capacitive current switching test for class C2 circuit-breakers:

- Preconditioning test T60 without TRV
- Single-capacitor bank current switching tests:
 - making operations
 - breaking operations to verify the voltage peak of 1470 kV and a breaking current of 1.5 kA

Test Result:

The test object passed the tests performed in accordance with the applied test specifications.

**Siemens Aktiengesellschaft
Energy Sector**

i. v. H. Kuschel

Dr. Kuschel
Head of Testing Laboratories



i. v. H. Gerlach

Mr. Gerlach
Head of High-Power Testing Laboratory

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06056Bs

Copy No.: 0

Contents: 17 Sheets

Test object: Auxiliary and control cubicles of outdoor circuit-breaker

Designation: 3AP2FI- / 3AP3FI- 550 kV - 4000 A - 63 kA - 60 Hz

Manufacturer: Siemens AG PTD H 3

Client: Siemens AG PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: August 03 - 04, 2006

Applied test specifications:

IEC Publication 62271-100 Edition 1.1 (2003-05)

IEC Publication 60694 Edition 2.2 (2002-01)

Customer requirements

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Dielectric tests on auxiliary and control circuits

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, October 17, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

P. Müller

Technical Committee

N. Jahn U. Uh

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02PE0607

Confirmation

No.: 10044-42-1

Copy-No.: 1

Content: 1 Sheet(s)

Electromagnetic compatibility (EMC) of the Control Cubicle of the Outdoor Circuit-Breaker Type 3AP2 FI – 550 kV

The control cubicle of the outdoor circuit-breaker type 3AP1 FI – 170 kV manufactured in accordance with the drawing numbers 1HG 412 11080 and 3HS 455 00025 229 2 fulfils the requirements of the EMC tests according to IEC 62271-100 and IEC 60694 (new IEC 62271-1) as shown in the PEHLA test document 0145Bs.

The control cubicle of the outdoor circuit-breaker type 3AP2 FI – 550 kV with the drawing numbers 1HG 412 11080 and 3HS 458 00042 072 is in design and construction comparable to the control cubicle of the outdoor circuit-breaker type 3AP1 FI – 170 kV. The relevant parts and the used electronic components of the circuit-breaker type 3AP2 FI – 550 kV are identical to the electronic components of the outdoor circuit-breaker type 3AP1 FI – 170 kV.

Therefore the PEHLA test document 0145Bs is applicable to the control cubicle of the outdoor circuit-breaker type 3AP2 FI – 550 kV. The relevant requirements of IEC 62271-100 and IEC 60694 (new IEC 62271-1) regarding the EMC tests are fulfilled for the outdoor circuit-breaker type 3AP2 FI – 550 kV.

**Energy Sector – Power Transmission Division
High Voltage Products
E T HP CB PLM R&D B EH**



Edelhard Kynast
Engineering High-Voltage

Berlin, June 16, 2010



PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the Short-Circuit-Testing Liaison (STL)

Test Report

Report No.: 0145 BS

Copy No.: 0

Contents: 11 Sheets
Annex: Test Report
EMCC WE/nr-910112L/LB

Equipment under test: Control cubicle of high voltage outdoor circuit-breaker
3AP1 FI

Drawing No. of test objects: 3HS 455 00025 229 2
3HS 455 00025 900 8

Manufacturer: Siemens AG, PTD H 3, Berlin

Client: Siemens AG, PTD H 372, Berlin

Testing station: EMCC Dr. Rašek by order of PEHLA-Prüffeld Berlin-Siemensstadt

Date of test: December 03 – December 12, 2001; January 16, 2002

Applied test specifications:
IEC Publication 60694 (1996) + Amd. 1 (2000) + Amd. 2 (2001)

Enhanced clients specifications:

Unipede Automation and Control Apparatus for Generating Stations and Substations Electromagnetic Compatibility Immunity Requirements (1995)

Tests performed:

Electromagnetic compatibility (EMC) tests on secondary systems

Continued on sheet 2

Test results:

At the control cubicle (drawing no. 3HS 455 00025 229 2) EMC tests as listed on sheet 2 were performed. During the tests no deviation from specified operation occurred. After the tests the control cubicle was still fully operational. The tests were passed without any objections.

After the installation of additional varistors the control cubicle (drawing no. 3HS 455 00025 900 8) passed the test according to IEC 61000-4-4 and IEC 61000-4-5 without any objections. During the test no deviation from specified operation occurred. After the test the control cubicle was still fully operational.

With these tests the EMC requirements according to IEC 60694 and Unipede „Automation Control Apparatus for Generating Stations and Substations Electronic Compatibility Immunity Requirements“ were fulfilled.

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN



Technical Committee

H. Jähn

H. Felder

Mannheim, February 28, 2002

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01PEB002



Report No.: H321M-VB0688

Static Terminal Load Analysis

Verification of the static terminal load (calculated)

Equipment designation: 3AP3FI 550 kV Siemens circuit breaker

Dimensional drawing: 427-06710-002

Report prepared by: Dr. U. Heinrich

Date signed: 2007 March 2

This is to certify that the above-named equipment and support, mounted on firm ground, withstand the static terminal load of 2000 N without damages. The load combination was chosen according to IEC 62155.

Signed:



Table Contents

1. General
2. Equipment data
3. Method of analysis
4. Results

Appendices

Appendix A: plot of FE model
Appendix B: Mises stress plots
Appendix C: dimensional drawing

1. General

Loads considered by FEA calculation are:

- deadweight
- inner pressure of 10 bar
- 30% of force from wind load (47m/s)
- line pull force of 2000 N on the terminal in y-direction

The pedestal, pole column and the steel frame are modelled with shell elements. The anchor bolts are modelled with beam elements. Since it is conservative, only the outer pole column without inner components was modelled with overall mass. That means that the inner components have no stiffness. The Young's Modulus for the steel is $E=210000$ MPa, for aluminium 70000 MPa and for porcelain $E=98000$ MPa.

2. Equipment data

mass of the circuit breaker:	3450 kg
first frequencies of the circuit breaker:	0.7 Hz in x-and 0.8 Hz in y-direction
damping ratio:	4% in x- and 6% in y-direction
center of gravity of the hole equipment:	about 6140 mm (height)
post insulator 1 (above):	522-15005
post insulator 2 :	522-15004
post insulator 3 (below):	522-15006
breaking chamber:	521-15003
pedestal:	433-01810-037
steel frame:	427-06780-001

3. Method of Analysis

A static analysis was done, in order to calculate the displacements and stresses resulting from line pull , wind forces and inner pressure. The results from static analysis were superimposed. The finite element analysis program ANSYS (Version 10.0) was used for calculation.

4. Results

The maximum displacement at the terminal is about 31 mm.

Table 2: Summary of maximum stresses for the highest loaded components

component	calculated mises stress in MPa	rupture or yield stress in MPa	safety factor calculated
post insulator 1	10.7	60 ¹	5.6
post insulator 2	11.3	60 ¹	5.3
post insulator 3	12.4	60 ¹	4.8
porcelain jacket (breaking chamber)	11	35 ²	3.2
steel frame	99	355 ³	3.6
pedestal	64	235 ⁴	3.7
anchor bolts	48	355 ³	7.4

1 rupture strength

2 rupture strength

3 yield strength 0.2% - 355 MPa

4 yield strength 0.2% - 235 MPa

Appendix A



Figure 1: Plot of the FE-model

Appendix B

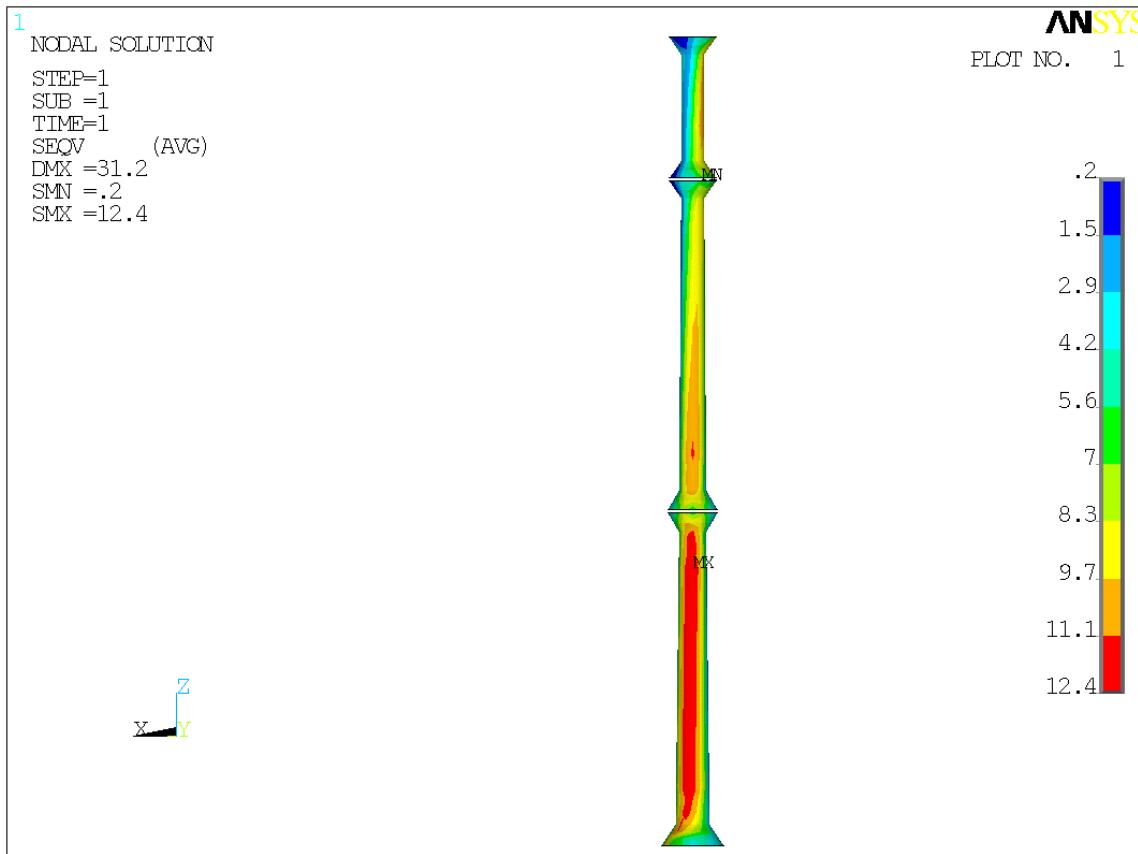


Figure 2: Mises stress plot; pole column

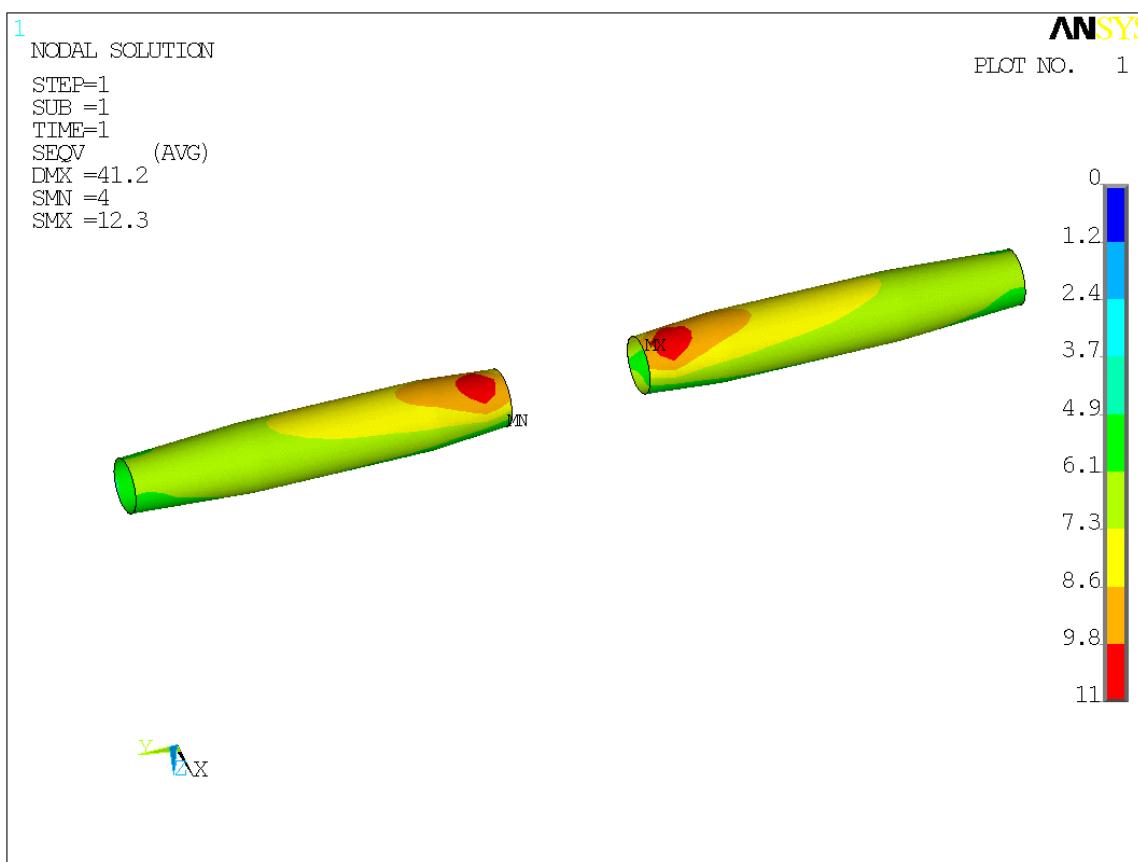


Figure 3: Mises stress plot; breaking chamber

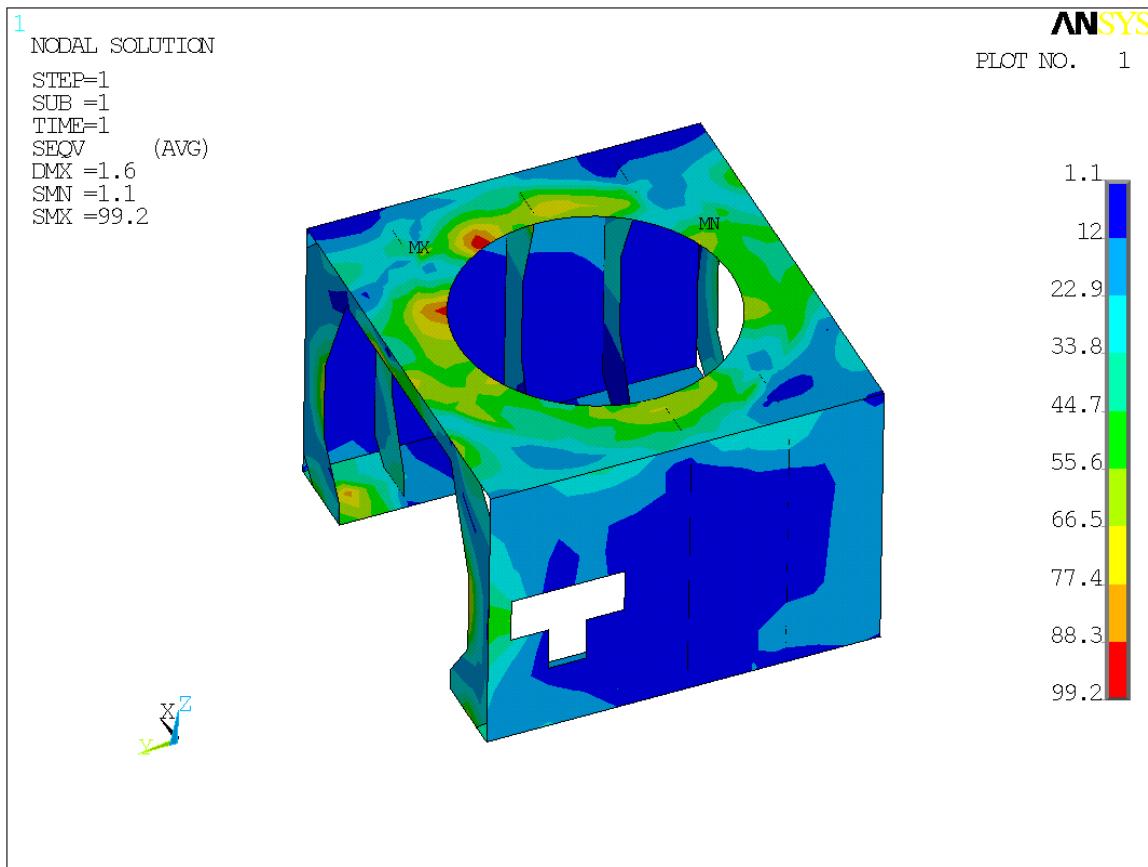


Figure 4: Mises stress plot; steel frame

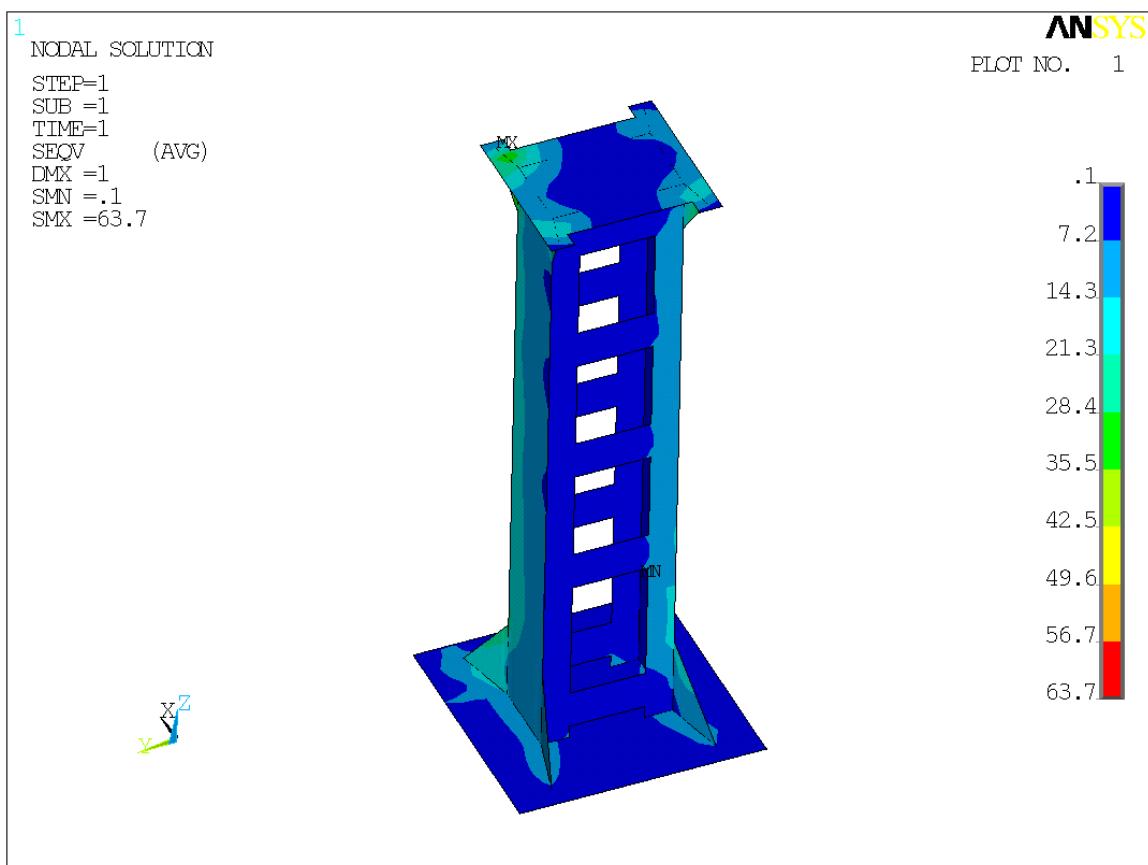
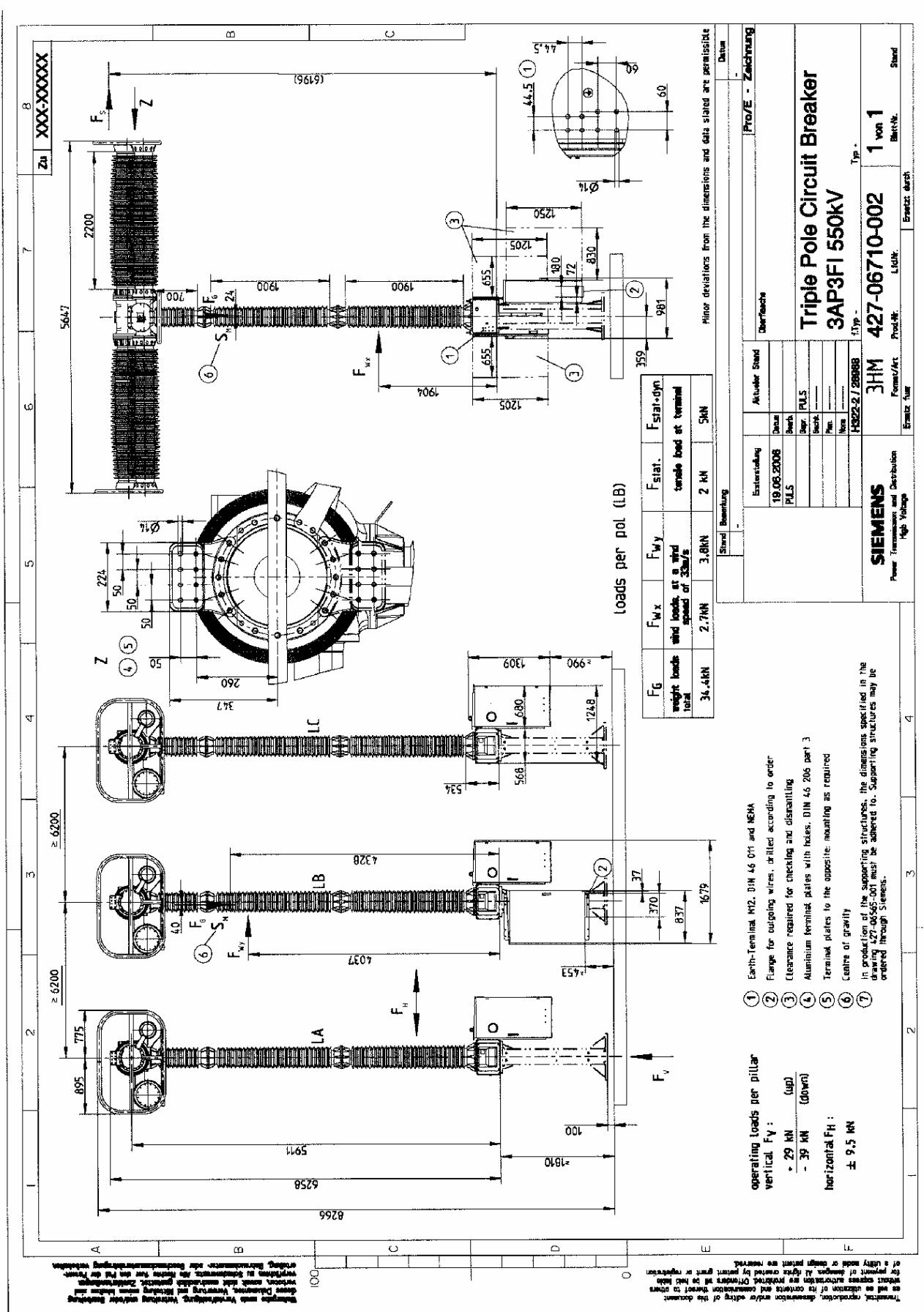


Figure 5: Mises stress in MPa; pedestal

Appendix C



Confirmation

No.: M 0488 A/E

Copy-No.: 1

Content: 1 Sheet(s)

Degree of Protection provided by Enclosures (IP Code) of the Control and the Operating Mechanism Cubicle of Outdoor Circuit-Breaker Type 3AP2 FI – 550 kV

The control and the operating mechanism cubicle of the indoor GIS and outdoor HIS circuit-breaker type 8DQ1 P2 550 kV manufactured in accordance with the drawing numbers 1HG 412-11080 (GIS/HIS) and 1HG 412-11768 (GIS), 1HG 412 11766 (HIS) has passed the examinations of protection category IP5X and IPX5 successfully as described in the PEHLA test documents 07075 Bs and 07076 Bs.

The control and the operating mechanism cubicle of the outdoor circuit-breaker type 3AP2 FI-550 kV is in design and construction of the relevant parts identical to the control and the operating mechanism cubicle of the indoor GIS and outdoor HIS circuit breaker type 8DQ1 P2 550 kV.

Therefore the PEHLA test documents 07075 Bs and 07076 Bs are applicable to the control and the operating mechanism cubicle of the outdoor circuit-breaker type 3AP2 FI-550 kV.

**Power Transmission and Distribution
Circuit – Breakers
Mechanical Test Laboratory – PTD H 321 M**



Bernd-Heiko Krafft
Head of Mechanical Test Laboratory

Berlin, September 19, 2007



PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 07075 Bs

Copy No.: 0

Contents: 12 Sheets

Annex: Test Report Rittal No. 469a/07

3 Sheets

Test object: Control cubicle of circuit-breaker of gas-insulated metal-enclosed switchgear

Designation: 8DQ1 – 550 kV – 5000 A – 63 kA – 50/60 Hz

Rated voltage: 550 kV Rated normal current: 5000 A Rated frequency: 50/60 Hz

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322

Testing station: Qualitätssicherungs-Labor Rittal Werk Rudolf Loh GmbH & Co. KG Herborn
by order of PEHLA Testing Laboratory Berlin-Siemensstadt

Date of test: June 25 to 26, 2007

Applied test specifications:

IEC Publication 60694 (2002)

IEC Publication 60529 (2001) + Corr. 1 (2003)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned standards and the STL Guides wherever applicable.

Tests performed:

Degree of Protection against access to hazardous parts and against solid foreign objects (IP 5X).

Degree of Protection against water jets (IP X5).

Test results:

The test object has passed the tests stated above without any objection. It fulfilled the protection against access to hazardous parts and solid foreign objects indicated by the first characteristic numeral 5 of IP Code: IP 5X and water jets indicated by the second characteristic numeral 5 of IP Code: IP X5.

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee



Technical Committee



Mannheim, July 09, 2007

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02PE0607



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Test Document

Report No.: 07076 Bs

Copy No.: 0

Contents: 12 Sheets

Annex: Test Report Rittal No. 469b/07

3 Sheets

Test object: Operating mechanism of circuit-breaker of gas-insulated metal-enclosed switchgear

Designation: 8DQ1 – 550 kV – 5000 A – 63 kA – 50/60 Hz

Rated voltage: 550 kV Rated normal current: 5000 A

Rated frequency: 50/60 Hz

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322

Testing station: Qualitätssicherungs-Labor Rittal Werk Rudolf Loh GmbH & Co. KG Herborn
by order of PEHLA Testing Laboratory Berlin-Siemensstadt

Date of test: June 25 to 26, 2007

Applied test specifications:

IEC Publication 60694 (2002)

IEC Publication 60529 (2001) + Corr. 1 (2003)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned standards and the STL Guides wherever applicable.

Tests performed:

Degree of Protection against access to hazardous parts and against solid foreign objects (IP 5X).

Degree of Protection against water jets (IP X5).

Test results:

The test object has passed the tests stated above without any objection. It fulfilled the protection against access to hazardous parts and solid foreign objects indicated by the first characteristic numeral 5 of IP Code: IP 5X and water jets indicated by the second characteristic numeral 5 of IP Code: IP X5.



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Management Committee

Technical Committee

Mannheim, July 09, 2007

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02PE0607



DAT-P-017/92-52

Test Document

Report-No.: M 0485 A/E

Copy-No.: 0

Contents: 7 Sheets

Test Object: Single-pole operated outdoor circuit-breaker
3AP3 FI – 550 kV – 4000 A – 63 kA – 50/60 Hz
Manufacturer: Siemens AG, PTD H3, Berlin
Client: Siemens AG, PTD H322-2, Berlin
Date of Test: June 02, 2007
Testing Station: Siemens AG, Mechanical Test Laboratory

Applied Test Specifications:

DIN 45 635, Sheet 1 (1984): Measurement of airborne noise, envelope method
DIN 45 635, Sheet 12 (1978): Measurement of airborne noise, envelope method,
electrical switchgear and controlgear
ISO 3744, second edition (1994): Acoustics - Determination of sound power levels of noise sources
using pressure - Engineering method in an essentially free field over a
reflecting plane

Test Performed:

Measurement of the A-weighted impulse sound pressure level of no-load operations at rated service-
conditions in several microphone positions. Measurement of the sound pressure spectrum in one
microphone position.

Test Result:

The A-weighted impulse sound pressure level of the three-pole circuit-breaker 3AP3 FI 550 kV is 98.6 /
96.4 dB_{A1} for closing / opening operations at 8 m measurement distance. The impulse sound power level is
130.6 / 128.4 dB_{A1} for closing / opening operations.

Siemens Aktiengesellschaft
Schaltwerk Hochspannung, Berlin

i.V. N. Trapp

Dr. Trapp
Manager of Testing Department
High Voltage Division



i.V. Kraft

Kraft
Manager of Mechanical Test Laboratory
High Voltage Division

Berlin, August 28, 2007

SIEMENS

High Voltage Circuit Breaker Co. Ltd., Hangzhou

**Siemens High Voltage Circuit Breaker
Co., Ltd., Hangzhou**

**550 kV SF₆ Live Tank Circuit Breaker
3AP3 FI-550kV**

Type Test Report

List of test performed

Serial No.	Type Test Report No.	Issued Date	Inspection Institution	Tests performed
1	15058Bs	2015-5-18	PEHLA	Dielectric test; Radio interference voltage test
2	15057 Bs; 15056 Bs; 15070 Bs	2015-5-20 2015-5-4 2015-6-10	PEHLA	Basic short-circuit current making and breaking test
3	15064 Bs	2015-6-4	PEHLA	Line and Cable Charging Switching Test, LC/CC
4	15078 Bs	2015-6-5	PEHLA	Short line fault test
5	06048Bs	2006-10-31	PEHLA	Dielectric test; Radio interference voltage test
6	06057Bs	2006-10-31	PEHLA	Dielectric test
7	06084Bs	2007-1-9	PEHLA	Temperature-rise test; Measurement of the resistance of the main circuit
8	06043Bs	2006-7-19	PEHLA	Short-time withstand current and peak withstand current tests
9	M 0467 C/E	2006-9-7	Siemens AG	Mechanical operation test, 10000 operating cycles
10	06035Bs	2006-8-31	PEHLA	Basic short-circuit current making and breaking tests, test duty T10
11	06036Bs	2006-7-13	PEHLA	Basic short-circuit current making and breaking tests, test duty T30
12	06040Bs	2006-8-31	PEHLA	Basic short-circuit current making and breaking tests, test duty T60
13	524-06	2008-2-13	KEMA	Basic short-circuit current making and breaking tests, test duty T100s
14	525-06	2008-2-13	KEMA	Basic short-circuit current making and breaking tests, test duty T100a (kpp 1.5 at 50 Hz)
15	526-06	2008-2-13	KEMA	Basic short-circuit current making and breaking tests, test duty T100a (kpp 1.3 at 50 Hz)



High Voltage Circuit Breaker Co. Ltd., Hangzhou

16	06039Bs	2007-1-22	PEHLA	Capacitive current switching tests, C2
17	06041Bs	2006-11-24	PEHLA	Short-line fault test, test duty L90
18	06042Bs	2006-10-30	PEHLA	Short-line fault test, test duty L75
19	06046Bs	2006-11-24	PEHLA	Out-of -phase making and breaking tests, test duty OP2
20	06074Bs	2006-11-16	PEHLA	Low and high temperature tests at -30°C and +55°C
21	0610Bm	2007-4-25	PEHLA	Single-phase shunt reactor current switching tests
22	H321M-VB0710	2007-4-23	Siemens AG	Seismic Analysis
23	S 3562 BE	2011-5-16	Siemens AG	Single-phase capacitive current switching tests for class C2 circuit breaker
24	S 3581 BE	2014-2-14	Siemens AG	Single-phase capacitive current switching tests for class C2 circuit breaker
25	06056Bs	2006-10-17	PEHLA	Dielectric tests on auxiliary and control circuits
26	0145 Bs; 10044-42-1	2002-2-28	PEHLA Siemens AG	EMC tests
27	M 0485 AE	2007-8-28	Siemens AG	Sound pressure level test
28	H321M-VB0688	2007-3-2	Siemens AG	Verification of the static terminal load
29	M 0488 A/E; 07075BS; 07076BS	2007-7-9	Siemens AG PEHLA	Verification of the Degree of Protection

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 15058 Bs

Copy No.: 0

Contents: 29 Sheets

Test object: Single-pole operated, triple-pole circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A

Rated frequency: 50 Hz

Manufacturer: Siemens AG, EM HP CB, Berlin

Tested for: Siemens AG, EM HP CB R&D EN

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: April 13 - 15, 2015

Applied test specifications:

IEC Publication 62271-1, Edition 1.1 (2011) IEC Publication 62271-100, Edition 2.1 (2012)

Instructions of Siemens AG, EM HP CB R&D EN based on DL/T 593 (2006) or higher values

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Dielectric type tests with increased test voltages including:

- Power-frequency withstand voltage test
- Power-frequency withstand voltage test, phase opposition
- Lightning impulse withstand voltage test
- Lightning impulse withstand voltage against power-frequency withstand voltage (combined voltage) test
- Switching impulse withstand voltage test
- Switching impulse withstand voltage against power-frequency withstand voltage (combined voltage) test
- Switching impulse withstand voltage test, wet
- Switching impulse withstand voltage against power-frequency withstand voltage, wet (combined voltage) test

Radio interference voltage test

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, May 18, 2015

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Dr. S. Göttlich

Management Committee

Dr. T. Ebke

Technical Committee

M. Bahr

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GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Confirmation

Report No.: 15057 Bs - 0

Copy No.: 0

Contents: 2 Sheets

Test object: Single-pole operated three-pole outdoor circuit-breaker

Designation: 3AP2FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Serial No.: 35140565

Drawing No.: 3HM 427-06741-003

1HZ 427-06300-828

Manufacturer: Siemens AG, EM HP CB

Tested for: Siemens AG, EM HP CB R&D EN

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: May 19, 2015

Applied test specifications:

IEC Publication 62271-1, Edition 1.1 (2011)

IEC Publication 62271-100, Edition 2.1 (2012)

IEC Publication 62271-101, Edition 2.0 (2012)

Tests performed:

Basic short-circuit making and breaking tests, test duty T30 for effectively (first-pole-to-clear factor $k_{pp} = 1.3$ p.u.) earthed neutral systems, performed for the rated frequency of 50 Hz.

This test is also valid for a rated frequency of 60 Hz.

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.

Detailed results will be documented in a separate document.



Berlin, May 20, 2015

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Glabsch

Wagner

Observers of the test
Representatives of Technical Committee

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This document is issued immediate after the tests and is valid only until publishing the entire test document.

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04PE1408

Deutsche
Akkreditierungsstelle
D-PL-12072-04-01

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 15056 Bs

Copy No.: 0

Contents: 60 Sheets

Test object: Single-pole operated three-pole outdoor circuit-breaker

Designation: 3AP2FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, EM HP CB

Tested for: Siemens AG, EM HP CB R&D EN

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: March 30 and April 01, 2015

Applied test specifications:

IEC Publication 62271-1, Edition 1.1 (2011)

IEC Publication 62271-100, Edition 2.1 (2012)

IEC Publication 62271-101, Edition 2.0 (2012)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Basic short-circuit breaking tests, test duty T100a for effectively (first-pole-to-clear factor $k_{pp}=1.3$ p.u.) earthed neutral systems with a system time constant of 45 ms and a minimum clearing time of 35.1 ms, performed for the rated frequency of 50 Hz.

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, May 04, 2015

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

W. Moritz
Management Committee

M. Thom
Technical Committee

M. Wurster

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02PE1409



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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 15070 Bs

Copy No.: 0

Contents: 58 Sheets

Test object: Single-pole operated three-pole outdoor circuit-breaker

Designation: 3AP2FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, EM HP CB

Tested for: Siemens AG, EM HP CB R&D EN

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: April 27, 2015

Applied test specifications:

IEC Publication 62271-1, Edition 1.1 (2011)

IEC Publication 62271-100, Edition 2.1 (2012)

IEC Publication 62271-101, Edition 2.0 (2012)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Basic short-circuit making and breaking tests, test duty T100s for effectively earthed neutral systems (first-pole-to-clear factor $k_{pp} = 1.3$ p.u.), performed for the rated frequency of 50 Hz.

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, June 10, 2015

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

R. Schiller

Management Committee

M. Thom

Technical Committee

M. Wurster

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 15064 Bs

Copy No.: 0

Contents: 46 Sheets

Appendix: 144 Sheets

Test object: Single-pole operated three-pole outdoor circuit-breaker

Designation: 3AP2FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A
Rated short-circuit breaking current: 63 kA

Rated frequency: 50 Hz

Manufacturer: Siemens AG, EM HP CB

Tested for: Siemens AG, EM HP CB R&D EN

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: April 14 - 16, 2015

Applied test specifications:

IEC Publication 62271-1, Edition 1.1 (2011)

IEC Publication 62271-100, Edition 2.1 (2012)

IEC Publication 62271-101, Edition 2.0 (2012)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Single-phase capacitive current switching tests for class C2 circuit-breaker with a capacitive voltage factor of 1.2 p.u., performed for the rated frequency of 50 Hz:

- Preconditioning test, test duty T60 without TRV
- Line-charging and cable-charging current switching tests
- Recovery voltage application test

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Dr. S. Göttlich

Management Committee

Dr. T. Ebke

Technical Committee

M. Wurster



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GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 15078 Bs

Copy No.: 0

Contents: 56 Sheets

Test object: Single-pole operated three-pole outdoor circuit-breaker

Designation: 3AP2FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, EM HP CB

Tested for: Siemens AG, EM HP CB R&D EN

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: May 11, 2015

Applied test specifications:

IEC Publication 62271-1, Edition 1.1 (2011)

IEC Publication 62271-100, Edition 2.1 (2012)

IEC Publication 62271-101, Edition 2.0 (2012)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Short-line fault test, test duty L90, performed at a frequency of 50 Hz including voltage test as a condition check.

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, June 05, 2015

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

W. Moritz

Management Committee

M. Thom

M. Wurster

Technical Committee

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06048Bs

Copy No.: 0

Contents: 28 Sheets

Test object: One pole of a three-pole outdoor circuit-breaker

Designation: 3AP3FI – 550 kV – 4000 A – 63 kA – 60 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 60 Hz

Manufacturer: Siemens AG PTD H 3

Client: Siemens AG PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: August 15-18, 2006

Applied test specifications:

IEC Publication 62271-100 Edition 1.1 (2003)

IEC Publication 60694 Edition 2.2 (2002)

ANSI C37.06 (2000)

Customer requirements

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned standards and the STL Guides wherever applicable.

Tests performed:

Dielectric tests including:

Power-frequency voltage test

Power-frequency voltage test (phase opposition)

Rated lightning impulse withstand voltage test

Chopped wave lightning impulse withstand voltage test

Lightning impulse voltage against power-frequency voltage (combined voltage) test

Rated switching impulse withstand voltage test (dry and wet)

Switching impulse voltage against power-frequency voltage (combined voltage) test (dry and wet)

Radio interference voltage test

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, October 31, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Report

Report No.: 06057Bs

Copy No.: 0

Contents: 14 Sheets

Test object: One pole of a three-pole outdoor circuit-breaker

Designation: 3AP3F1 – 550 kV – 4000 A – 63 kA - 60Hz

Rated voltage: 550 kV Rated normal current: 4000 A

Rated frequency: 60 Hz

Manufacturer: Siemens AG PTD H 3

Client: Siemens AG PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: August 15-18, 2006

Applied test specifications:

IEC Publication 62271-100 Edition 1.1 (2003)

IEC Publication 60694 Edition 2.2 (2002)

ANSI C37.06 (2000)

Customer requirements

Tests performed:

Dielectric tests including

Lightning impulse withstand voltage test

Lightning impulse voltage against power-frequency voltage (combined voltage) test

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, October 31, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee



DAT-P-017/92-52

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06084 Bs

Copy No.: 0

Contents: 11 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP3 FI - 550 kV - 5500 A - 63 kA - 60 Hz

Rated voltage: 550 kV Rated normal current: 5500 A Rated frequency: 60 Hz

Manufacturer: Siemens AG, PTD H 3, Berlin

Client: Siemens AG, PTD H 322-2, Berlin

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: November 20 to November 21, 2006

Applied test specifications:

IEC 62271-100 Ed. 1.2 (2006)

IEC 60694 Ed. 2.2 (2002)

according customer requirements rated normal current: 5500 A

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned standards and the STL Guides wherever applicable.

Tests performed:

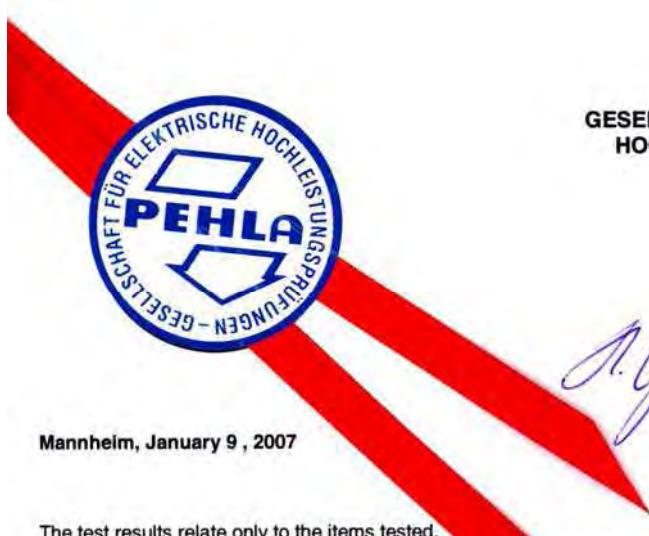
Temperature-rise test for a rated normal current of 5500 A, 60 Hz

Measurement of the resistance of the main circuit

Test is also valid for rated frequency of 50 Hz

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performance proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

A. Glan W.
Technical Committee

Mannheim, January 9, 2007

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06043 Bs

Copy No.: 0

Contents: 32 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 17, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

According to STL Objectives and Operating Principles PEHLA issues a Type Test Certificate following exclusively the above mentioned IEC-guidelines and the STL Guides wherever applicable.

Tests performed:

Short-time withstand current and peak withstand current tests for a peak factor of 2.7 p.u. and a duration of short-circuit of 3 s.

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, October 10, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

A. Glan
Management Committee

H.-J. W.
Technical Committee

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02SE0607



DAT-P-017/92-52

Test Report

Report-No.: M 0467 C/E

Copy-No.: 0

Contents: 13 Sheets

Test Object: Single-pole operated outdoor circuit-breaker
3AP3 FI – 550 kV – 4000 A – 63 kA – 50/60 Hz

Manufacturer: Siemens AG, PTD H3, Berlin

Client: Siemens AG, PTD H3, Berlin

Date of Test: August 10 to August 30, 2006

Testing Station: Siemens AG, Mechanical Test Laboratory

Applied Test Specifications:

IEC 62271-100 Ed. 1.1 (2003)
IEC 60694 Ed. 2.2 (2002)

Test Performed:

Mechanical operation test at ambient air temperature with 10 000 operating cycles.

Test Result:

The test object has passed the test stated above without any objection.
The results obtained and the performance proved of the test object comply with the requirements of the specifications mentioned above.

Power Transmission and Distribution
Circuit-Breakers
Mechanical Laboratories PTD H 321

i.V. N. Trapp

Dr. Trapp
Head Test Laboratories
High Voltage Division



n.v. Kraft

Kraft
Head Mechanical Test Laboratory
High Voltage Division

Berlin, September 07, 2006

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06035 Bs

Copy No.: 0

Contents: 42 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 04 - 05, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Basic short-circuit making and breaking tests, test duty T10

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, August 31, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

i.v. *Hank* *U.C.*

Technical Committee

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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06036 Bs

Copy No.: 0

Contents: 36 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A

Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 06, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Basic short-circuit making and breaking tests, test duty T30

Test results:

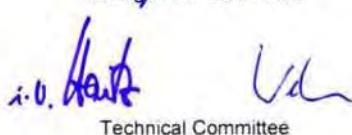
The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, August 31, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN


Management Committee


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Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06040 Bs

Copy No.: 0

Contents: 37 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 06, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publikation 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Basic short-circuit making and breaking tests, test duty T60

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

Mannheim, August 31, 2006

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02SE0607



REPORT OF PERFORMANCE

524-06

APPARATUS	Single-pole operated outdoor circuit-breaker. Grading capacitor per interrupter unit 1000 pF.
TYPE	3AP2 FI – 550 kV – 4000 A – 63 kA – 50 Hz
SERIAL No.	35097232
CLIENT	Siemens AG, PTD H322-2 Berlin, Germany
MANUFACTURER	Siemens AG, PTD H3 Berlin, Germany
TESTED BY	KEMA HIGH-POWER LABORATORY Utrechtseweg 310 - 6812 AR Arnhem - The Netherlands
DATE(S) OF TESTS	31 August and 1 September 2006
TEST SPECIFICATION	The tests have been carried out strictly in accordance with IEC 62271-100, subclause 6.102 to 6.105 and 6.106.4 (T100s with k_{pp} 1,3/1,5 and at 50 Hz).
REMARKS	The apparatus has complied with the relevant requirements.

This report consists of 71 sheets in total.

This report falls under the scope of the accreditation certificates L 020 of the Dutch Council for Accreditation.
See information sheet (page 2).

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KEMA Nederland B.V.



P.G.A. Bus
KEMA T&D Testing Services
Managing Director

Arnhem, 13 February 2008



REPORT OF PERFORMANCE

525-06

APPARATUS Single-pole operated outdoor circuit-breaker.
Grading capacitor per interrupter unit 1000 pF.

TYPE 3AP2 FI – 550 kV – 4000 A – 63 kA – **SERIAL No.** -
50 Hz

CLIENT Siemens AG, PTD H322-2
Berlin, Germany

MANUFACTURER Siemens AG, PTD H3
Berlin, Germany

TESTED BY KEMA HIGH-POWER LABORATORY
Utrechtseweg 310 - 6812 AR Arnhem - The Netherlands

DATE(S) OF TESTS 4 September 2006

TEST SPECIFICATION The tests have been carried out strictly in accordance with IEC 62271-100,
subclause 6.102 to 6.105 and 6.106.5 (T100a with k_{pp} 1,5 and at 50 Hz).

REMARKS The apparatus has complied with the relevant requirements.

This report consists of 71 sheets in total.

This report falls under the scope of the accreditation certificates L 020 of the Dutch Council for Accreditation.
See information sheet (page 2).

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KEMA Nederland B.V.

P.G.A. Bus
KEMA T&D Testing Services
Managing Director

Arnhem, 13 February 2008



REPORT OF PERFORMANCE

526-06

APPARATUS

Single-pole operated outdoor circuit-breaker.
Grading capacitor per interrupter unit 1000 pF.

TYPE 3AP2 FI – 550 kV – 4000 A – 63 kA – **SERIAL No.** 35097604
50 Hz

CLIENT

Siemens AG, PTD H322-2
Berlin, Germany

MANUFACTURER

Siemens AG, PTD H3
Berlin, Germany

TESTED BY

KEMA HIGH-POWER LABORATORY
Utrechtseweg 310 - 6812 AR Arnhem - The Netherlands

DATE(S) OF TESTS

4, 5 and 6 September 2006

TEST SPECIFICATION

The tests have been carried out strictly in accordance with IEC 62271-100,
subclause 6.102 to 6.105 and 6.106.5 (T100a with k_{pp} 1,3 and at 50 Hz).

REMARKS

The apparatus has complied with the relevant requirements.

This report consists of 71 sheets in total.

This report falls under the scope of the accreditation certificates L 020 of the Dutch Council for Accreditation.
See information sheet (page 2).

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KEMA Nederland B.V.


P.G.A. Bus
KEMA T&D Testing Services
Managing Director

Arnhem, 13 February 2008

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06039 Bs

Copy No.: 0

Contents: 193 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 31 - August 03, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Capacitive current switching tests for verification of the making and breaking performance of line-charging and cable-charging currents for a capacitive voltage factor of $k_c=1.4$ p.u. and a frequency of 50 Hz according class C2.

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

Mannheim, January 22, 2007

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02SE0607



DAT-P-017/92-52

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06041 Bs Copy No.: 0 Contents: 44 Sheets
Test object: Single-pole operated outdoor circuit-breaker
Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz
Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA
Manufacturer: Siemens AG, PTD H 3
Client: Siemens AG, PTD H 322-2
Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt
Date of test: August 02, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)
IEC Publication 60694 (2002)
IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Short-line fault test, test duty L90 including voltage test as a condition check.

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

Mannheim, November 24, 2006

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GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06042 Bs

Copy No.: 0

Contents: 41 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz

Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: July 18, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Short-line fault test, test duty L75

Test results:

The test object has passed the test stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, October 30, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

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DAT-P-017/92-52

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06046 Bs Copy No.: 0 Contents: 43 Sheets
Test object: Single-pole operated outdoor circuit-breaker
Designation: 3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz
Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50 Hz
Rated short-circuit breaking current: 63 kA
Manufacturer: Siemens AG, PTD H 3
Client: Siemens AG, PTD H 322-2
Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt
Date of test: July 20 - 21, 2006

Applied test specifications:

IEC Publication 62271-100 (2003)
IEC Publication 60694 (2002)
IEC Publication 62271-101 (2006)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Out-of-phase making and breaking tests, test duty OP2

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, November 24, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

H. Giese
Management Committee

W. Volz
Technical Committee

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DAT-P-017/92-52

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06074 Bs

Copy No.: 0

Contents: 21 Sheets

Test object: Single-pole operated three-pole outdoor circuit-breaker

Designation: 3AP3FI – 550 kV – 4000 A – 63 kA – 50/60 Hz

Rated voltage: 550 kV Rated normal current: 4000 A Rated frequency: 50/60 Hz
Rated short-circuit breaking current: 63 kA

Manufacturer: Siemens AG, PTD H3, Germany

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: September 29 to October 16, 2006

Applied test specifications:

IEC 62271-100 Ed. 1.1 (2003)

IEC 60694 Ed. 2.2 (2002)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned standards and the STL Guides wherever applicable.

Tests performed:

Low and high temperature tests at -30°C and +55°C

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN


Management Committee


Technical Committee

Mannheim, November 16, 2006

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GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Report

Report No.: 0610Bm

Copy No.: 1

Contents: 146 Sheets

Test object: Single-pole operated outdoor circuit-breaker

Designation: 3AP2FI – 550 kV – 4000 A – 63 kA – 50 Hz

Rated voltage: 550 kV Rated normal current: 4000 A

Rated frequency: 50 Hz

Rated short –circuit breaking current: 63 kA

Serial No.: 35097232

Drawing No.: 1HZ 427 06300 804

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin Marzahn

Date of test: July 26-27, 2006

Applied test specifications:

IEC Publication 62271-110 (2005)

IEC Publication 62271-100 (2003)

IEC Publication 60694 (2002)

Tests performed:

Single-phase shunt reactor current switching tests

The unit test was performed with a voltage distribution factor of 0.53.

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Paul N
Management Committee

i.V. Paul N. Glau
Technical Committee

Mannheim, April 25, 2007

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03PE0402

Seismic Analysis-Qualification Report

No.: H321M-VB0710

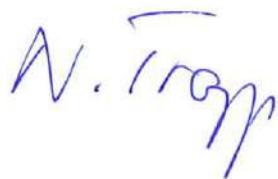
Copy-No.: 0

Content: 8 Sheet(s)

Circuit-breaker 3AP3FI 550 kV

The above-named high voltage circuit-breaker with support structure, mounted on firm ground, is qualified by finite element analysis in accordance with IEC 62271-300 for a seismic qualification level of 0.3g ZPA (zero period acceleration). The required response spectrum (RRS) and additional loads are chosen as demanded in IEC 62271-300 (2006).

**Power Transmission and Distribution
Switching Devices
Test Laboratories – PTD H 321**



Dr. Norbert Trapp
Head Test Laboratories



Berlin, 2007 April 23

Report No.: H321M-VB0710

Qualified to seismic qualification level 0.3g ZPA of the RRS of IEC 62271-300 (2006)

Equipment designation: 3AP3 FI 550 kV Siemens circuit breaker

Dimensional drawing: 427-06710-002
(calculation with pedestal 433-01810-037)

Report prepared by: Dr. U. Heinrich

Date signed: 2007 April 23

This is to certify that the above-named equipment and support, mounted on firm ground, meets or exceeds all of the requirements according to IEC 62271-300. The used response spectrum is specified for 0.3g ZPA according to IEC 62271-300.

Signed:



Table Contents

1. General
2. Equipment data
3. Method of analysis
4. Results

Appendices

- Appendix A: plot of FE model
Appendix B: Mises stress plots
Appendix C: dimensional drawing

1. General

Loads considered by FEA calculation are:

- deadweight
- inner pressure of 10 bar
- line pull force of 1400 N on the terminal in y-direction
- force from wind speed 10 m/s in x- and y-direction
- seismic force (100% -horizontal and 50% vertical)

As damping ratio 4% in x-direction and 6% in y-Direction was used. Because measurement has shown as this damping ratio.

The pedestal, pole column and the steel frame are modelled with shell elements. The anchor bolts are modelled with beam elements. Since it is conservative, only the outer pole column without inner components was modelled with overall mass. That means that the inner components have no stiffness. The Young's Modulus for the steel is $E=210000$ MPa and for porcelain $E=98000$ MPa.

2. Equipment data

mass of the circuit breaker:	3440 kg
first frequencies of the circuit breaker:	0.7 Hz in x-and 0.8 Hz in y-direction
damping ratio:	4% in x- and 6% in y-direction
center of gravity of the hole equipment:	6140 mm (height)

3. Method of Analysis

First the static analysis was done, in order to calculate the displacements and stresses resulting from line pull, wind pressure and inner pressure. Then the modal analysis followed by the response spectrum analysis was used in order to determine the modal stresses. The modal stresses are combined using the square root of the sum of the squares (SRSS).

In the last step the results from the seismic calculation in each horizontal (x- and y-direction) respectively and the vertical direction and the results from static analysis were superimposed. The most critical case (x-z-direction and static load or y-z-direction and static load) is mentioned and graphically depicted in this report.

The finite element analysis program ANSYS (Version 10.0) was used, in order to calculate the resonance frequencies and to carry out the response spectrum analysis. The response spectrum is given for the program by some corner points. Between those points the program interpolates linearly in order to calculate the spectrum value at a certain frequency point.

Table 1: Response spectrum for 4 % and 6% damping ratio according high required response spectrum of IEC 62271-300 – 0.3g ZPA

Frequency Hz	acceleration m/s ² (4%)	acceleration m/s ² (6%)
0.5	2070	1720
0.8	3130	2500
1.0	3830	3830
2.4	6230	4840
9.0	6230	4920
20	4230	4040
25	3000	3000
35	3000	3000

4. Results

The maximum displacement at the terminal is about 109 mm in x-direction and 110 mm in y-direction.

calculated frequencies:

MODE FREQUENCY (HERTZ)

FREQUENCY RANGE REQUESTED=	0.00000	35.0000
1	0.7775896200277	
2	0.7967833961573	
3	1.632381336403	
4	3.182562454116	
5	8.038457294528	
6	11.11948110188	
7	14.99942417810	
8	15.46117886280	
9	16.38164649358	
10	18.34788592351	
11	19.86920240757	
12	30.95666343261	
13	34.36658074795	

Table 2: Summary of maximum stresses for the highest loaded components

component	calculated mises stress in MPa	rupture or yield stress in MPa	safety factor calculated
post insulator 1 (above)	24	60 ¹	2.5
post insulator 2	34	60 ¹	1.7
post insulator 3 (below)	37	60 ¹	1.6
porcelain jacket (breaking chamber)	15	35 ²	2.3
steel frame	281	355 ³	1.2
pedestal	252	355 ³	1.4
anchor bolts	124	355 ³	2.8

1 rupture strength

2 rupture strength

3 yield strength 0.2% - 355 MPa (steel)

Appendix A



Figure 1: Plot of the FE-model

Appendix B

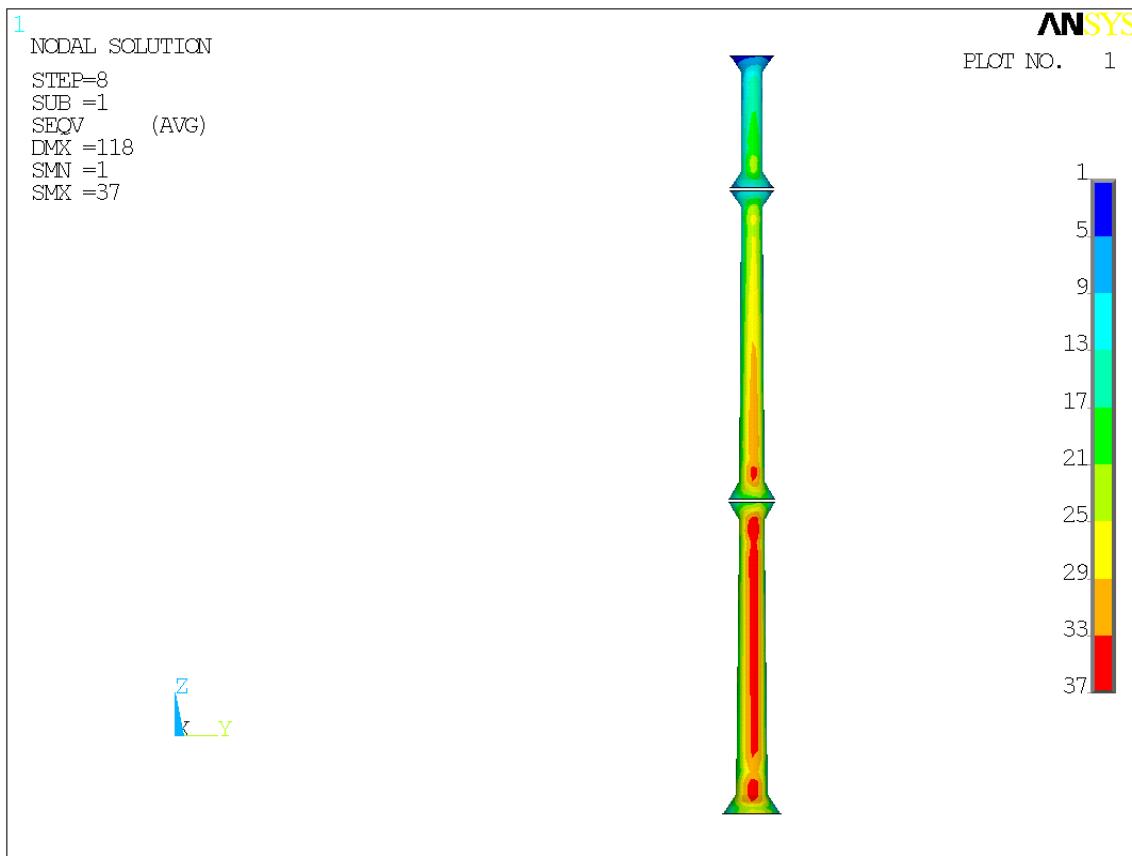


Figure 2: Mises stress plot; post insulator

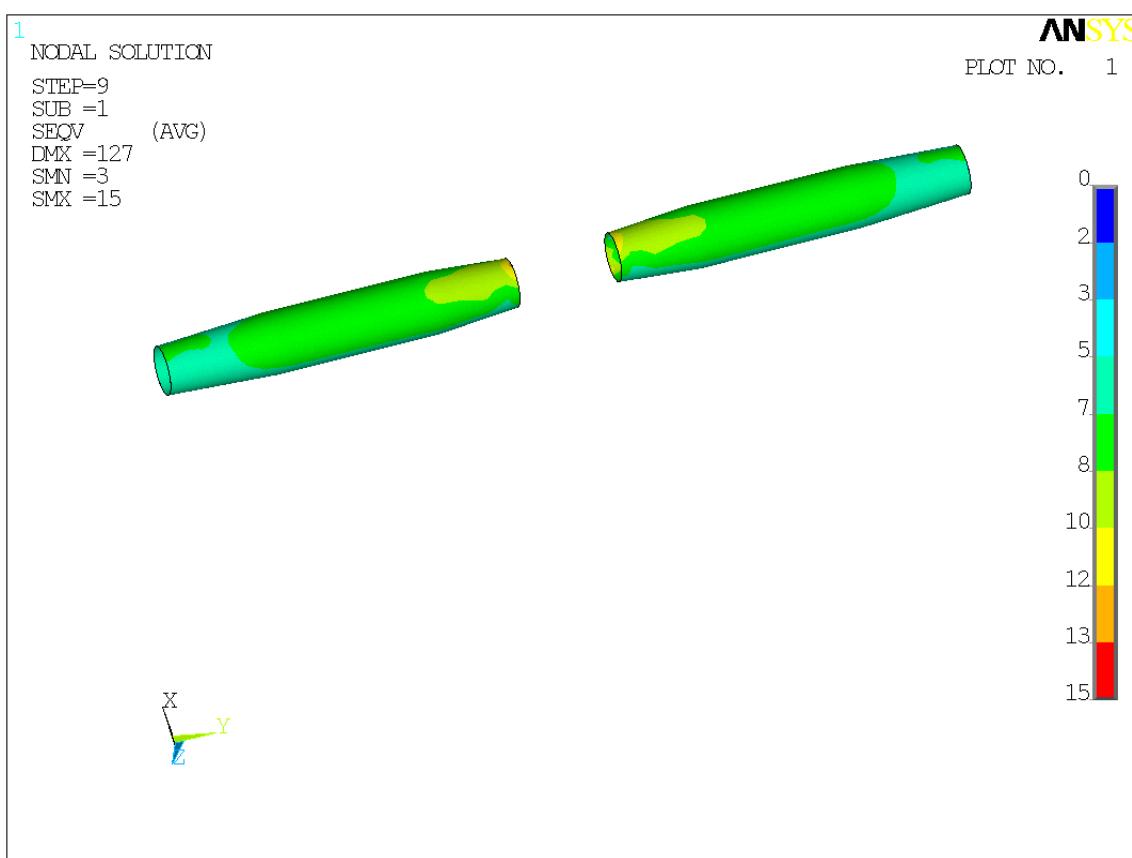


Figure 3: Mises stress plot; breaking chamber

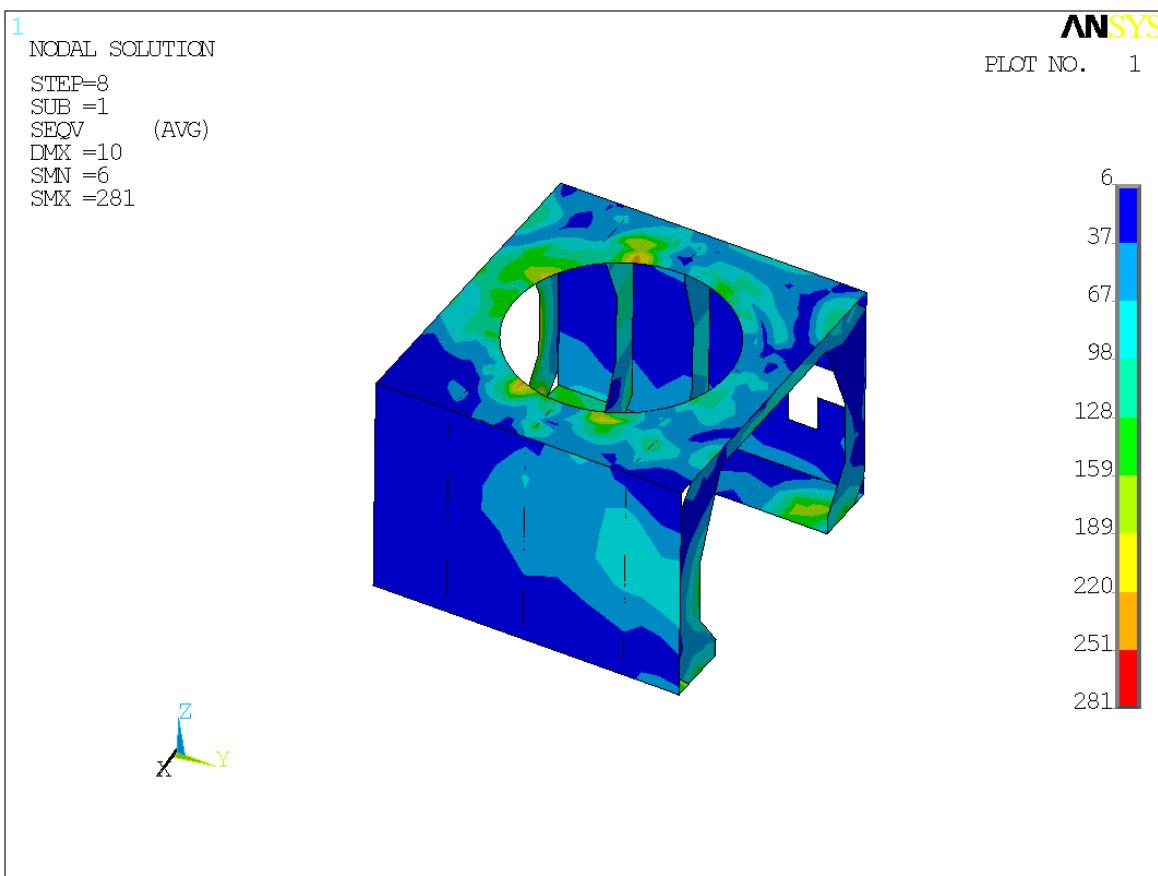


Figure 4: Mises stress in MPa; steel frame

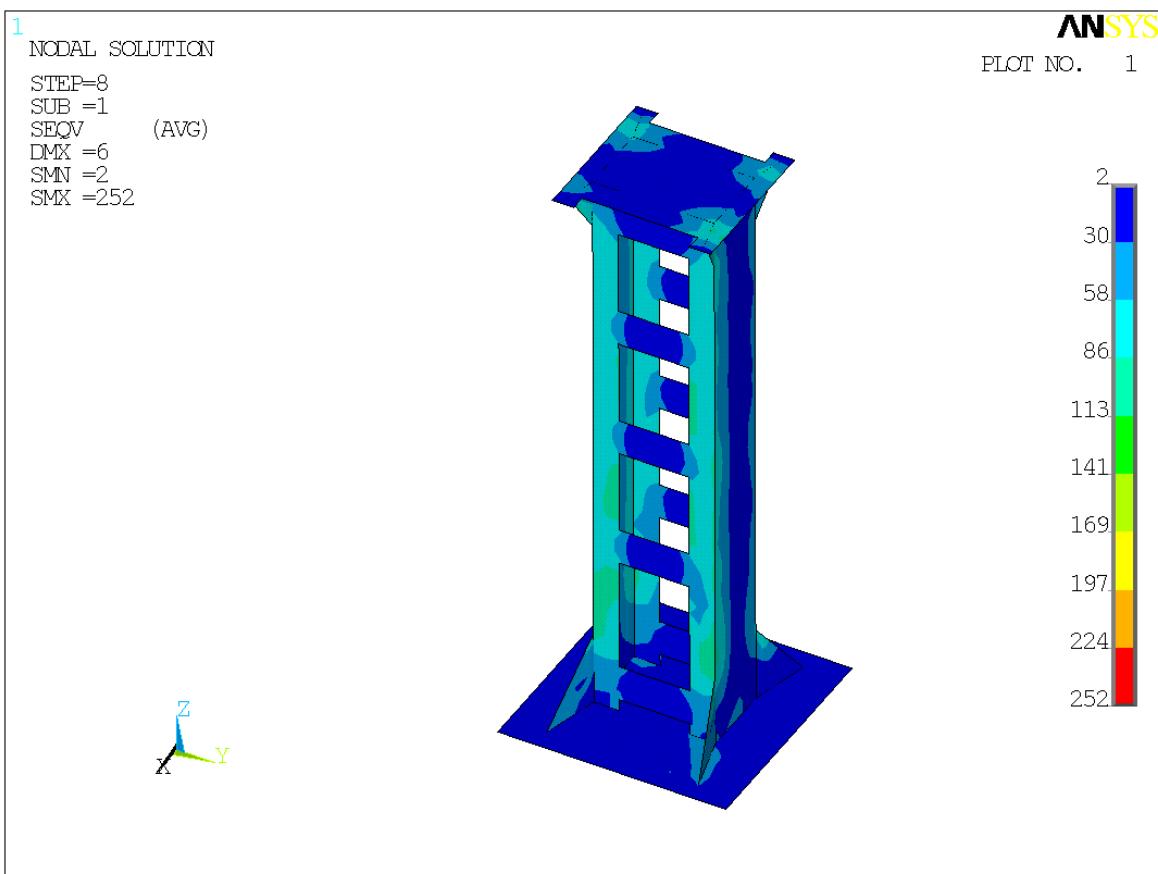
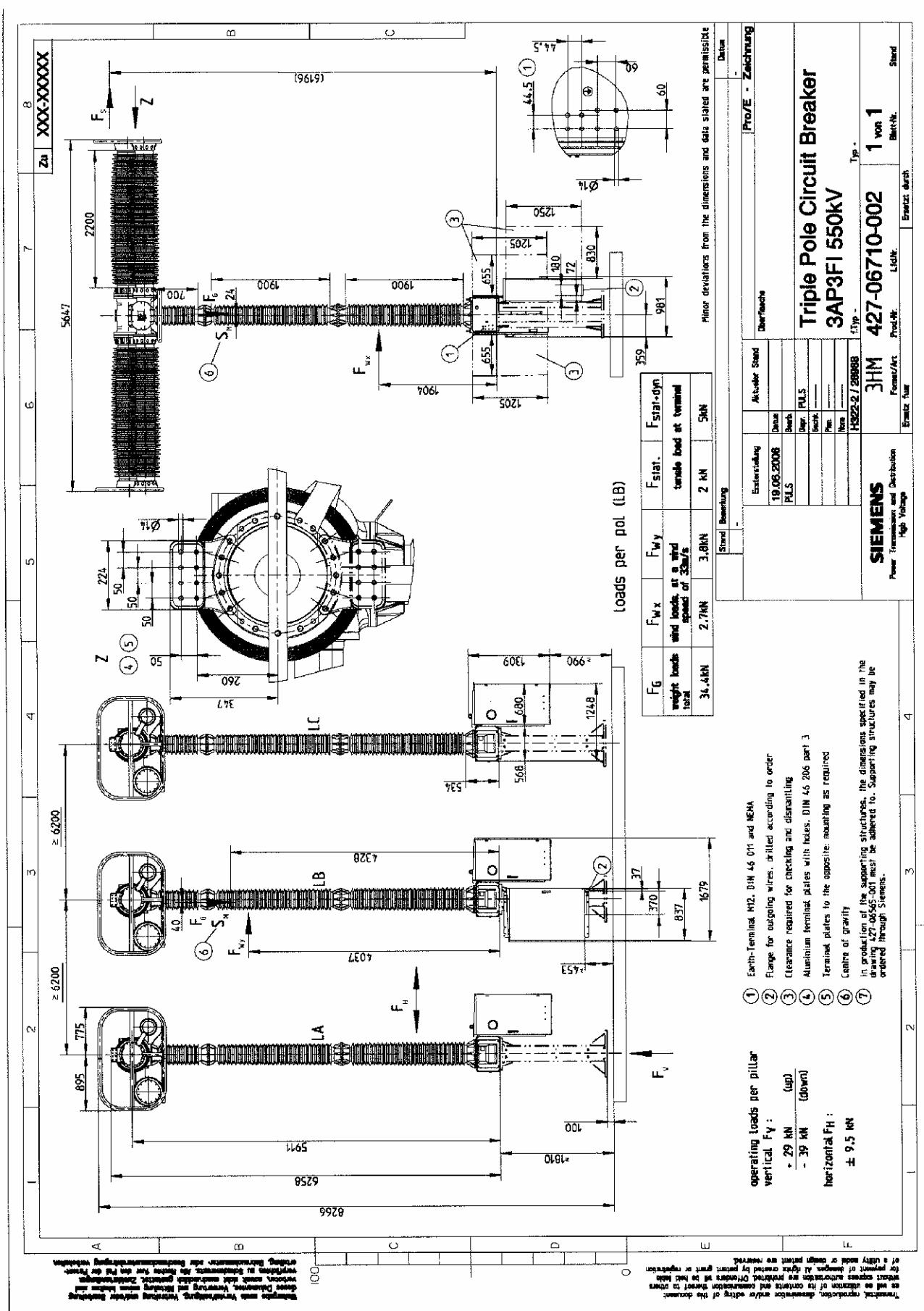


Figure 5: Mises stress in MPa; pedestal

Appendix C



SIEMENS

Test Report

Report-No.: S 3562 B/E

Copy-No.: 1

Contents: 41 Sheets

Test Object: Single-pole operated outdoor circuit-breaker
3AP2 FI - 550 kV - 4000 A - 63 kA - 50 Hz
Manufacturer: Siemens AG, E T HP CB MF B
Client: Siemens AG, E T HP CB PLM R&D B EP
Date of Test: April 28 - 29, 2011
Testing Station: Siemens AG, High-Power Testing Laboratory

Applied Test Specifications:

Client's requirements based on:
IEC Publication 62271-1, Edition 1.0 (2007)
IEC Publication 62271-100, Edition 2.0 (2008)
IEC Publication 62271-101, First Edition (2006) + Amendment 1 (2010)

Test Performed:

Single-phase capacitive current switching tests for class C2 circuit-breaker

- Preconditioning test T60 without TRV
- Single-capacitor bank current switching tests:
making operations with a capacitive voltage factor of $k_C = 1.4$ p.u.
breaking operations with a capacitive voltage factor of $k_C = 1.7$ p.u.

Test Result:

The test object passed the tests performed in accordance with the applied test specifications.

Siemens Aktiengesellschaft
Energy Sector

i. v. Eiselt

Mr. Eiselt
Head of Testing Laboratories



i. v. M. Gerlach

Mr. Gerlach
Head of High-Power Testing Laboratory

Berlin, May 16, 2011

Test Report

Report-No.: S 3581 B/E

Copy-No.: 0

Contents: 40 Sheets

Appendix: 143 Sheets

Test Object: Single pole operated outdoor circuit-breaker
3AP2FI - 550 kV - 5000 A - 63 kA - 50 Hz

Manufacturer: Siemens AG, E T HP CB

Client: Siemens AG, E T HP CB R&D

Date of Test: November 15 - 19, 2013

Testing Station: Siemens AG, High-Power Testing Laboratory

Applied Test Specifications:

Client's instruction based on:

IEC Publication 62271-1, Edition 1.1 (2011)

IEC Publication 62271-100, Edition 2.1 (2012)

IEC Publication 62271-101, Edition 2.0 (2012)

Customer specification

Test Performed:

Single-phase capacitive current switching test for class C2 circuit-breakers:

- Preconditioning test T60 without TRV
- Single-capacitor bank current switching tests:
 - making operations
 - breaking operations to verify the voltage peak of 1470 kV and a breaking current of 1.5 kA

Test Result:

The test object passed the tests performed in accordance with the applied test specifications.

**Siemens Aktiengesellschaft
Energy Sector**

i. v. H. Kuschel

Dr. Kuschel
Head of Testing Laboratories



i. v. H. Gerlach

Mr. Gerlach
Head of High-Power Testing Laboratory

PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 06056Bs

Copy No.: 0

Contents: 17 Sheets

Test object: Auxiliary and control cubicles of outdoor circuit-breaker

Designation: 3AP2FI- / 3AP3FI- 550 kV - 4000 A - 63 kA - 60 Hz

Manufacturer: Siemens AG PTD H 3

Client: Siemens AG PTD H 322-2

Testing station: PEHLA-Testing Laboratory Berlin-Siemensstadt

Date of test: August 03 - 04, 2006

Applied test specifications:

IEC Publication 62271-100 Edition 1.1 (2003-05)

IEC Publication 60694 Edition 2.2 (2002-01)

Customer requirements

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned test specifications and the STL Guides wherever applicable.

Tests performed:

Dielectric tests on auxiliary and control circuits

Test results:

The test object has passed the tests stated above without any objection. The results obtained and the performances proved of the test object comply with the requirements of the specifications mentioned above.



Mannheim, October 17, 2006

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

P. Müller

Management Committee

N. Jahn

Technical Committee

U. Wohlfahrt

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02PE0607

Confirmation

No.: 10044-42-1

Copy-No.: 1

Content: 1 Sheet(s)

Electromagnetic compatibility (EMC) of the Control Cubicle of the Outdoor Circuit-Breaker Type 3AP2 FI – 550 kV

The control cubicle of the outdoor circuit-breaker type 3AP1 FI – 170 kV manufactured in accordance with the drawing numbers 1HG 412 11080 and 3HS 455 00025 229 2 fulfils the requirements of the EMC tests according to IEC 62271-100 and IEC 60694 (new IEC 62271-1) as shown in the PEHLA test document 0145Bs.

The control cubicle of the outdoor circuit-breaker type 3AP2 FI – 550 kV with the drawing numbers 1HG 412 11080 and 3HS 458 00042 072 is in design and construction comparable to the control cubicle of the outdoor circuit-breaker type 3AP1 FI – 170 kV. The relevant parts and the used electronic components of the circuit-breaker type 3AP2 FI – 550 kV are identical to the electronic components of the outdoor circuit-breaker type 3AP1 FI – 170 kV.

Therefore the PEHLA test document 0145Bs is applicable to the control cubicle of the outdoor circuit-breaker type 3AP2 FI – 550 kV. The relevant requirements of IEC 62271-100 and IEC 60694 (new IEC 62271-1) regarding the EMC tests are fulfilled for the outdoor circuit-breaker type 3AP2 FI – 550 kV.

**Energy Sector – Power Transmission Division
High Voltage Products
E T HP CB PLM R&D B EH**



Edelhard Kynast
Engineering High-Voltage

Berlin, June 16, 2010



PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the Short-Circuit-Testing Liaison (STL)

Test Report

Report No.: 0145 BS

Copy No.: 0

Contents: 11 Sheets
Annex: Test Report
EMCC WE/nr-910112L/LB

Equipment under test: Control cubicle of high voltage outdoor circuit-breaker
3AP1 FI

Drawing No. of test objects: 3HS 455 00025 229 2
3HS 455 00025 900 8

Manufacturer: Siemens AG, PTD H 3, Berlin

Client: Siemens AG, PTD H 372, Berlin

Testing station: EMCC Dr. Rašek by order of PEHLA-Prüffeld Berlin-Siemensstadt

Date of test: December 03 – December 12, 2001; January 16, 2002

Applied test specifications:
IEC Publication 60694 (1996) + Amd. 1 (2000) + Amd. 2 (2001)

Enhanced clients specifications:

Unipede Automation and Control Apparatus for Generating Stations and Substations Electromagnetic Compatibility Immunity Requirements (1995)

Tests performed:

Electromagnetic compatibility (EMC) tests on secondary systems

Continued on sheet 2

Test results:

At the control cubicle (drawing no. 3HS 455 00025 229 2) EMC tests as listed on sheet 2 were performed. During the tests no deviation from specified operation occurred. After the tests the control cubicle was still fully operational. The tests were passed without any objections.

After the installation of additional varistors the control cubicle (drawing no. 3HS 455 00025 900 8) passed the test according to IEC 61000-4-4 and IEC 61000-4-5 without any objections. During the test no deviation from specified operation occurred. After the test the control cubicle was still fully operational.

With these tests the EMC requirements according to IEC 60694 and Unipede „Automation Control Apparatus for Generating Stations and Substations Electronic Compatibility Immunity Requirements“ were fulfilled.

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN



Technical Committee

H. Jähn

H. Felder

Mannheim, February 28, 2002

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01PEB002



Report No.: H321M-VB0688

Static Terminal Load Analysis

Verification of the static terminal load (calculated)

Equipment designation: 3AP3FI 550 kV Siemens circuit breaker

Dimensional drawing: 427-06710-002

Report prepared by: Dr. U. Heinrich

Date signed: 2007 March 2

This is to certify that the above-named equipment and support, mounted on firm ground, withstand the static terminal load of 2000 N without damages. The load combination was chosen according to IEC 62155.

Signed:



Table Contents

1. General
2. Equipment data
3. Method of analysis
4. Results

Appendices

Appendix A: plot of FE model
Appendix B: Mises stress plots
Appendix C: dimensional drawing

1. General

Loads considered by FEA calculation are:

- deadweight
- inner pressure of 10 bar
- 30% of force from wind load (47m/s)
- line pull force of 2000 N on the terminal in y-direction

The pedestal, pole column and the steel frame are modelled with shell elements. The anchor bolts are modelled with beam elements. Since it is conservative, only the outer pole column without inner components was modelled with overall mass. That means that the inner components have no stiffness. The Young's Modulus for the steel is $E=210000$ MPa, for aluminium 70000 MPa and for porcelain $E=98000$ MPa.

2. Equipment data

mass of the circuit breaker:	3450 kg
first frequencies of the circuit breaker:	0.7 Hz in x-and 0.8 Hz in y-direction
damping ratio:	4% in x- and 6% in y-direction
center of gravity of the hole equipment:	about 6140 mm (height)
post insulator 1 (above):	522-15005
post insulator 2 :	522-15004
post insulator 3 (below):	522-15006
breaking chamber:	521-15003
pedestal:	433-01810-037
steel frame:	427-06780-001

3. Method of Analysis

A static analysis was done, in order to calculate the displacements and stresses resulting from line pull , wind forces and inner pressure. The results from static analysis were superimposed. The finite element analysis program ANSYS (Version 10.0) was used for calculation.

4. Results

The maximum displacement at the terminal is about 31 mm.

Table 2: Summary of maximum stresses for the highest loaded components

component	calculated mises stress in MPa	rupture or yield stress in MPa	safety factor calculated
post insulator 1	10.7	60 ¹	5.6
post insulator 2	11.3	60 ¹	5.3
post insulator 3	12.4	60 ¹	4.8
porcelain jacket (breaking chamber)	11	35 ²	3.2
steel frame	99	355 ³	3.6
pedestal	64	235 ⁴	3.7
anchor bolts	48	355 ³	7.4

1 rupture strength

2 rupture strength

3 yield strength 0.2% - 355 MPa

4 yield strength 0.2% - 235 MPa

Appendix A



Figure 1: Plot of the FE-model

Appendix B

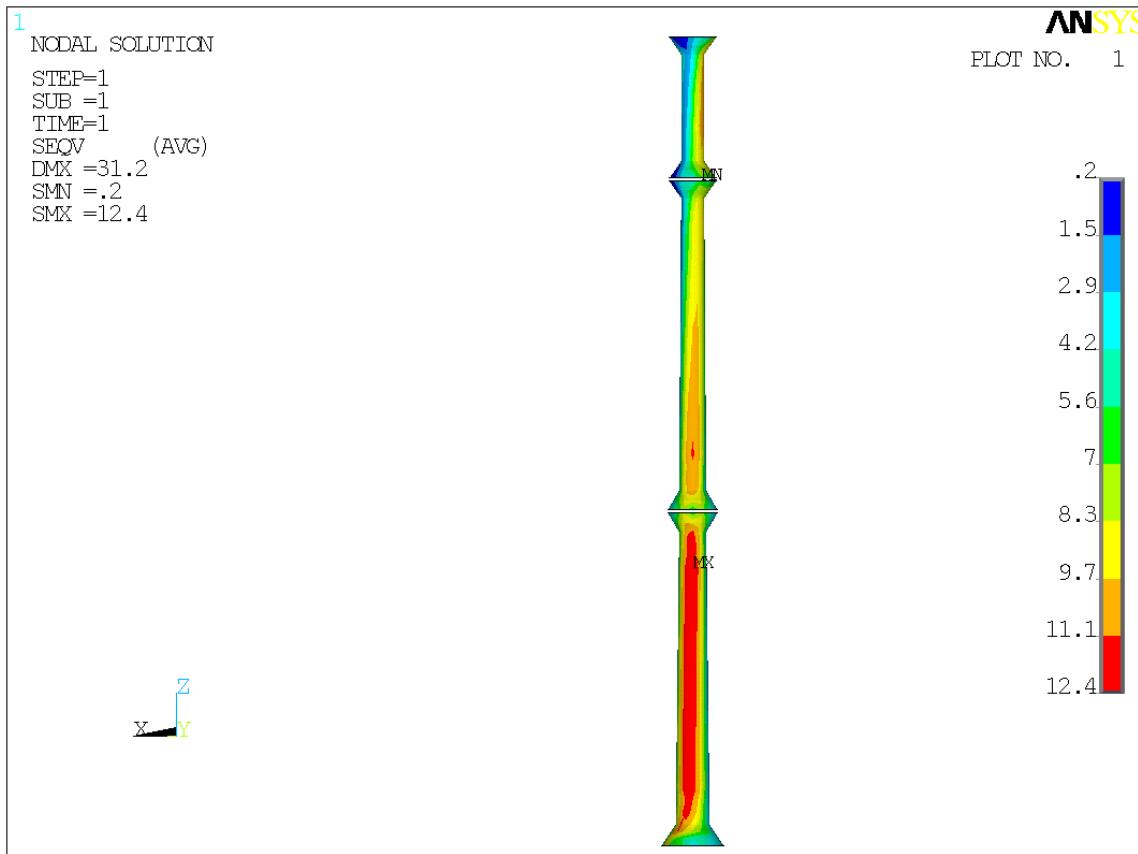


Figure 2: Mises stress plot; pole column

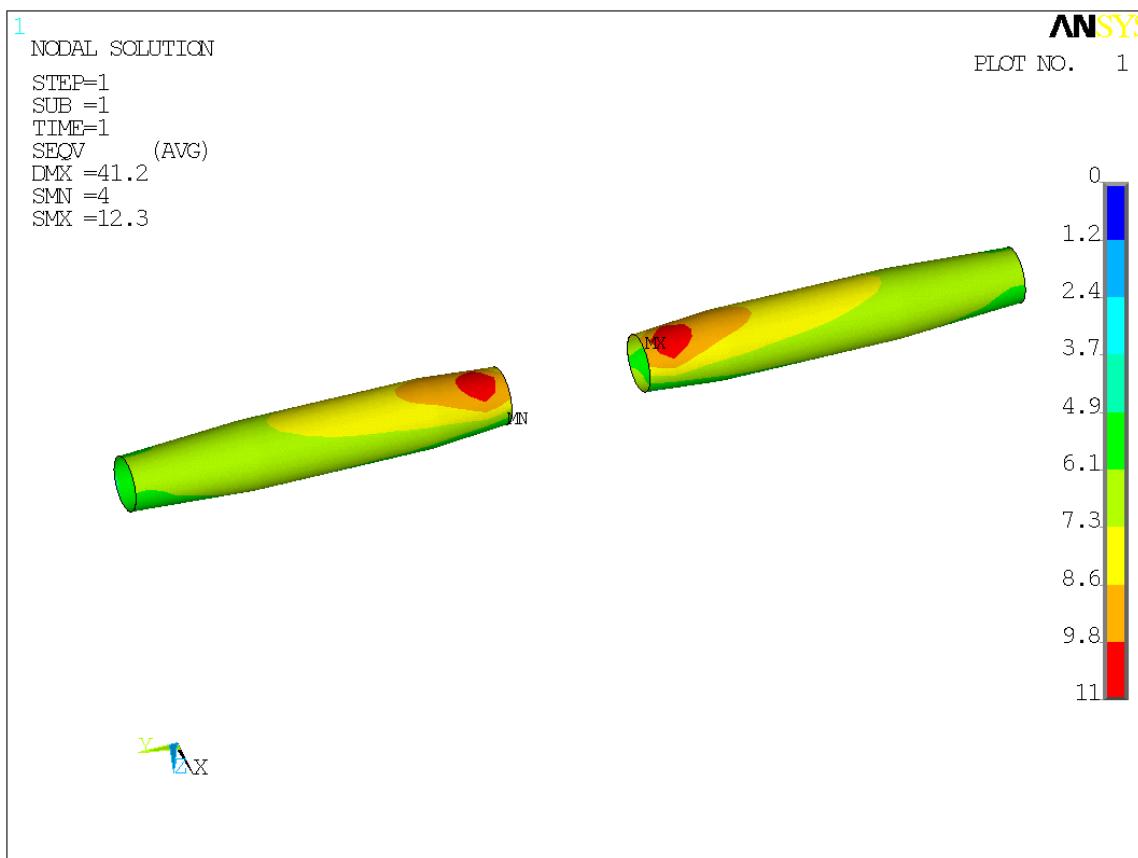


Figure 3: Mises stress plot; breaking chamber

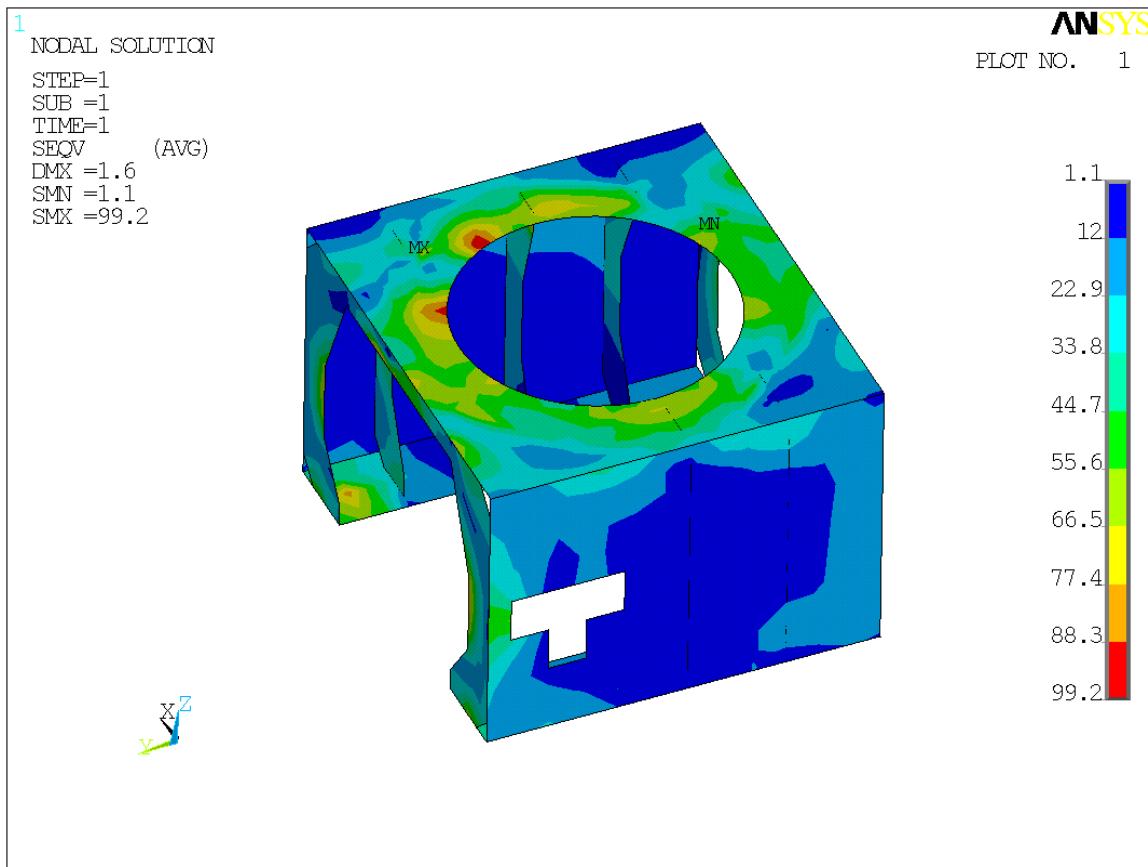


Figure 4: Mises stress plot; steel frame

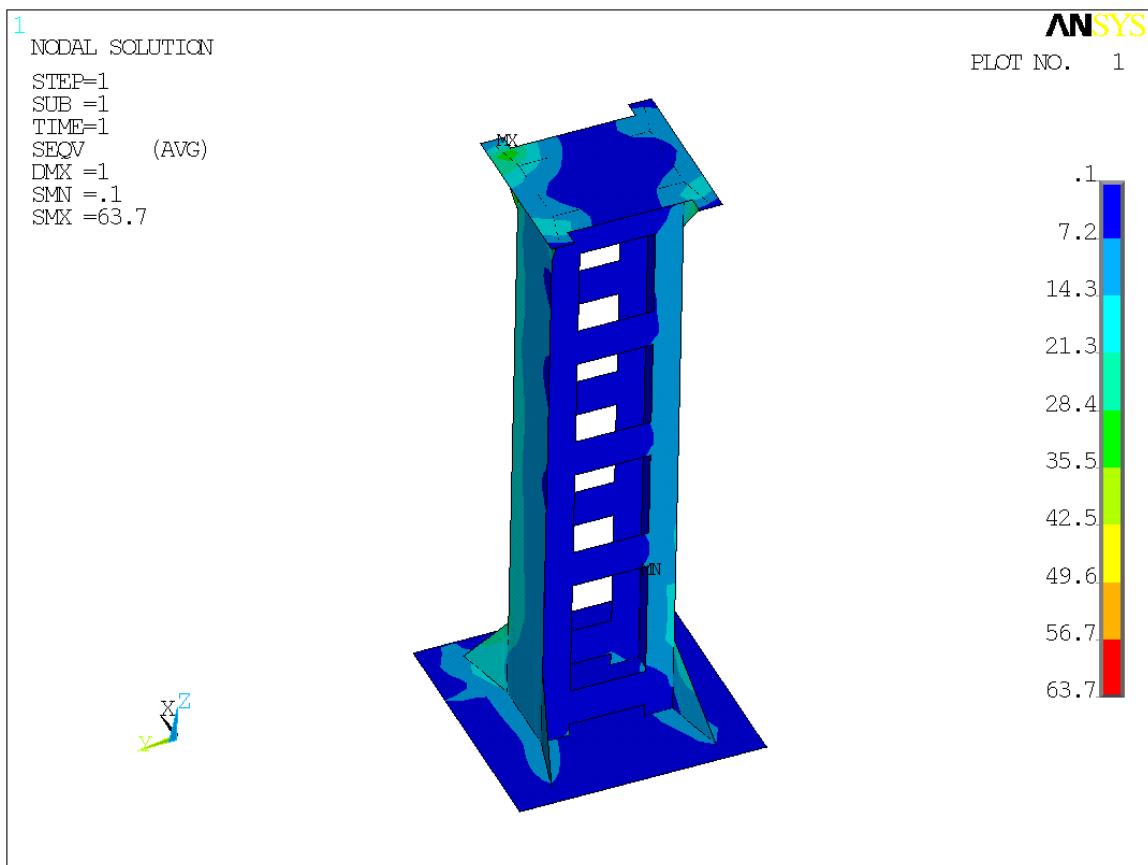
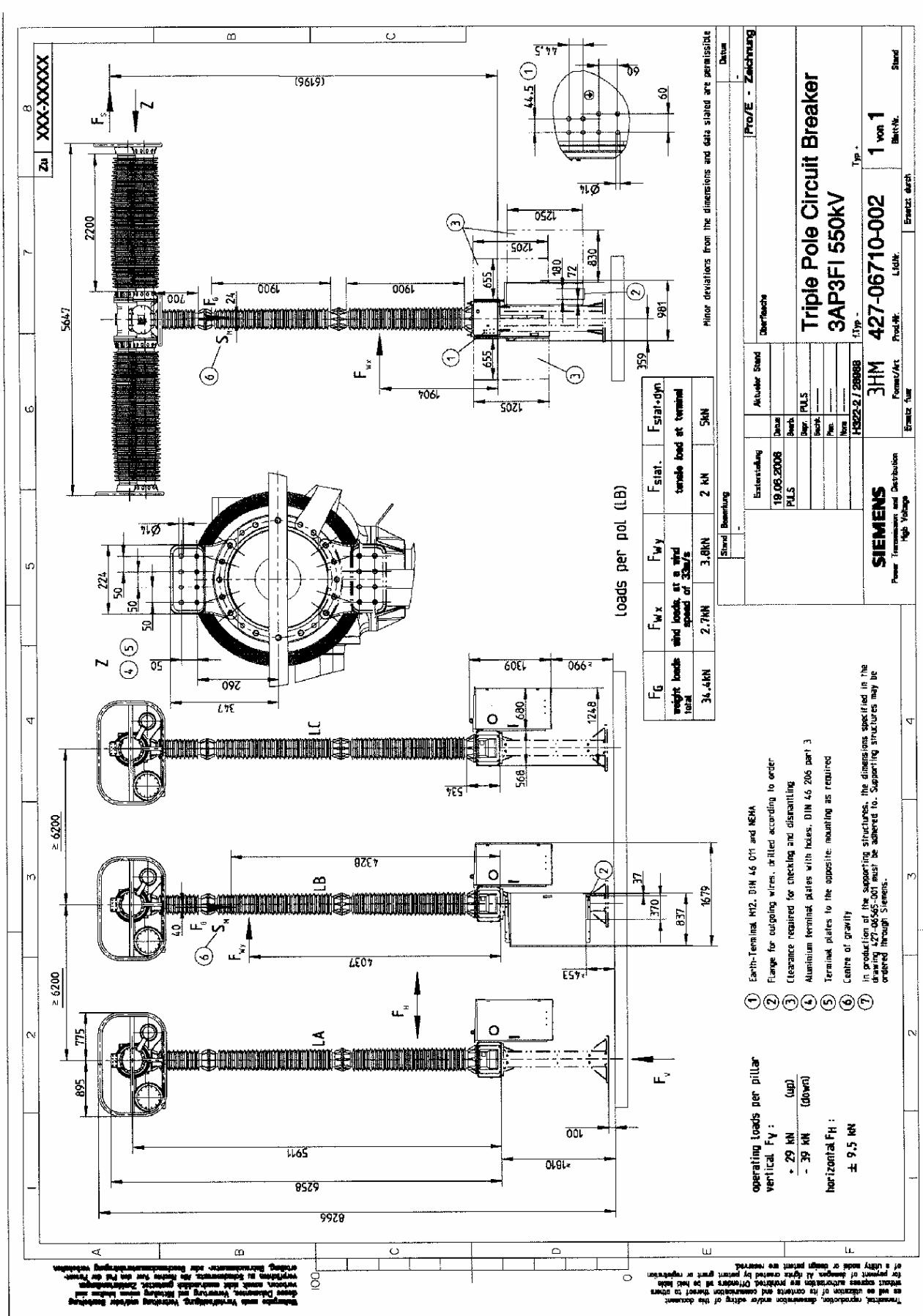


Figure 5: Mises stress in MPa; pedestal

Appendix C



Confirmation

No.: M 0488 A/E

Copy-No.: 1

Content: 1 Sheet(s)

Degree of Protection provided by Enclosures (IP Code) of the Control and the Operating Mechanism Cubicle of Outdoor Circuit-Breaker Type 3AP2 FI – 550 kV

The control and the operating mechanism cubicle of the indoor GIS and outdoor HIS circuit-breaker type 8DQ1 P2 550 kV manufactured in accordance with the drawing numbers 1HG 412-11080 (GIS/HIS) and 1HG 412-11768 (GIS), 1HG 412 11766 (HIS) has passed the examinations of protection category IP5X and IPX5 successfully as described in the PEHLA test documents 07075 Bs and 07076 Bs.

The control and the operating mechanism cubicle of the outdoor circuit-breaker type 3AP2 FI-550 kV is in design and construction of the relevant parts identical to the control and the operating mechanism cubicle of the indoor GIS and outdoor HIS circuit breaker type 8DQ1 P2 550 kV.

Therefore the PEHLA test documents 07075 Bs and 07076 Bs are applicable to the control and the operating mechanism cubicle of the outdoor circuit-breaker type 3AP2 FI-550 kV.

**Power Transmission and Distribution
Circuit – Breakers
Mechanical Test Laboratory – PTD H 321 M**



Bernd-Heiko Krafft
Head of Mechanical Test Laboratory

Berlin, September 19, 2007



PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 07075 Bs

Copy No.: 0

Contents: 12 Sheets

Annex: Test Report Rittal No. 469a/07

3 Sheets

Test object: Control cubicle of circuit-breaker of gas-insulated metal-enclosed switchgear

Designation: 8DQ1 – 550 kV – 5000 A – 63 kA – 50/60 Hz

Rated voltage: 550 kV Rated normal current: 5000 A Rated frequency: 50/60 Hz

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322

Testing station: Qualitätssicherungs-Labor Rittal Werk Rudolf Loh GmbH & Co. KG Herborn
by order of PEHLA Testing Laboratory Berlin-Siemensstadt

Date of test: June 25 to 26, 2007

Applied test specifications:

IEC Publication 60694 (2002)

IEC Publication 60529 (2001) + Corr. 1 (2003)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned standards and the STL Guides wherever applicable.

Tests performed:

Degree of Protection against access to hazardous parts and against solid foreign objects (IP 5X).

Degree of Protection against water jets (IP X5).

Test results:

The test object has passed the tests stated above without any objection. It fulfilled the protection against access to hazardous parts and solid foreign objects indicated by the first characteristic numeral 5 of IP Code: IP 5X and water jets indicated by the second characteristic numeral 5 of IP Code: IP X5.

GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee



Technical Committee



Mannheim, July 09, 2007

The test results relate only to the items ...
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02PE0607



PEHLA

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN
Member of the SHORT-CIRCUIT TESTING LIAISON (STL)

Test Document

Report No.: 07076 Bs

Copy No.: 0

Contents: 12 Sheets

Annex: Test Report Rittal No. 469b/07

3 Sheets

Test object: Operating mechanism of circuit-breaker of gas-insulated metal-enclosed switchgear

Designation: 8DQ1 – 550 kV – 5000 A – 63 kA – 50/60 Hz

Rated voltage: 550 kV Rated normal current: 5000 A

Rated frequency: 50/60 Hz

Manufacturer: Siemens AG, PTD H 3

Client: Siemens AG, PTD H 322

Testing station: Qualitätssicherungs-Labor Rittal Werk Rudolf Loh GmbH & Co. KG Herborn
by order of PEHLA Testing Laboratory Berlin-Siemensstadt

Date of test: June 25 to 26, 2007

Applied test specifications:

IEC Publication 60694 (2002)

IEC Publication 60529 (2001) + Corr. 1 (2003)

According to STL Objectives and Operating Principles PEHLA issues a Test Document following exclusively the above mentioned standards and the STL Guides wherever applicable.

Tests performed:

Degree of Protection against access to hazardous parts and against solid foreign objects (IP 5X).

Degree of Protection against water jets (IP X5).

Test results:

The test object has passed the tests stated above without any objection. It fulfilled the protection against access to hazardous parts and solid foreign objects indicated by the first characteristic numeral 5 of IP Code: IP 5X and water jets indicated by the second characteristic numeral 5 of IP Code: IP X5.



GESELLSCHAFT FÜR ELEKTRISCHE
HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

Mannheim, July 09, 2007

The test results relate only to the items tested.

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document. Copying the cover sheet accompanied by sheet 2 and the sheets mentioned here is
an exception.

02PE0607



DAT-P-017/92-52

Test Document

Report-No.: M 0485 A/E

Copy-No.: 0

Contents: 7 Sheets

Test Object: Single-pole operated outdoor circuit-breaker
3AP3 FI – 550 kV – 4000 A – 63 kA – 50/60 Hz
Manufacturer: Siemens AG, PTD H3, Berlin
Client: Siemens AG, PTD H322-2, Berlin
Date of Test: June 02, 2007
Testing Station: Siemens AG, Mechanical Test Laboratory

Applied Test Specifications:

DIN 45 635, Sheet 1 (1984): Measurement of airborne noise, envelope method
DIN 45 635, Sheet 12 (1978): Measurement of airborne noise, envelope method,
electrical switchgear and controlgear
ISO 3744, second edition (1994): Acoustics - Determination of sound power levels of noise sources
using pressure - Engineering method in an essentially free field over a
reflecting plane

Test Performed:

Measurement of the A-weighted impulse sound pressure level of no-load operations at rated service-
conditions in several microphone positions. Measurement of the sound pressure spectrum in one
microphone position.

Test Result:

The A-weighted impulse sound pressure level of the three-pole circuit-breaker 3AP3 FI 550 kV is 98.6 /
96.4 dB_{A1} for closing / opening operations at 8 m measurement distance. The impulse sound power level is
130.6 / 128.4 dB_{A1} for closing / opening operations.

Siemens Aktiengesellschaft
Schaltwerk Hochspannung, Berlin

i.V. N. Trapp

Dr. Trapp
Manager of Testing Department
High Voltage Division



i.v. Kraft

Kraft
Manager of Mechanical Test Laboratory
High Voltage Division

Berlin, August 28, 2007



PT PLN (PERSERO)
TRANSMISI JAWA BAGIAN TENGAH

Jl. Mohamad Toha Km. 4
Komplek PLN Cigereleg
BANDUNG - 40255
Telepon : (022) 5201723
Facsmile : (022) 5220214

Website :
Email :

Nomor : 0148/TRS.00.03/TRANS-JBT/2018
Surat Sdr.No. : 16/IV/2018/SKP
Lampiran : 1 (Satu) set
Sifat : Penting
Perihal : Surat Keterangan Beroperasi

18 Mei 2018

KEPADА :
PT. SIEMENS INDONESIA
Kirana 2 Tower, level 10 A
Jl. Jend.A.Yani Kav 67-68 Kel.Kayu Putih,
Kec.Pulogadung,Kota Jakarta Timur
Phone: (62-21) 24555-543

U.p. Yth. Manajer

Menindaklanjuti surat PT Siemens no : 16/IV/2018/SKP perihal "Permohonan Surat Kepuasan Pelanggan" tanggal 24 April 2018 bersama ini kami sampaikan bahwa MTU merek Siemens telah beroperasi di PT PLN (Persero) Transmisi Jawa Bagian Tengah dengan kondisi sebagai berikut:

No	Katagori	Merek	Kondisi	Keterangan
1	Circuit Breaker	Siemens	Baik	-
2	Current Transformers	Trench	Baik	-
3	Capacitive Voltage Transformer	Trench	Tidak Baik	Banyak kasus tegangan sekunder nol pada merk Trench (terlampir)
4	Lightning Arrester	Siemens	Baik	

Adapun surat keterangan beroperasi ini berlaku selama 1 (satu) tahun

Demikian disampaikan, atas perhatiannya diucapkan terima kasih.



Name: China Southern Power Grid, EHV Power Transmission Company

Guangzhou Branch

局名：南方电网超高压输电公司广州局

TO WHOM IT MAY CONCERN

敬启者

Herewith, we confirm that 9 sets of 3AP2 FI, 550kV, 63kA, have been in successful operation in Yunnan-guangdong ± 800kV Power Transmission Project, Suidong Convert substation since December, 2009.

西门子（杭州）高压开关有限公司生产的 9 台 3AP2 FI, 550kV, 63kA 型弹簧式断路器，自 2009 年 12 月在我司云广±800KV 直流输电工程穗东换流变电站投运至今，一切情况正常。

China Southern Power Grid, EHV Power Transmission Company
Guangzhou Branch

中国南方电网有限责任公司超高压输电公司广州局





PT PLN (PERSERO)
PENYALURAN DAN PUSAT PENGATUR BEBAN SUMATERA

Jl. S. Parman No. 221 Padang 25135
Telp. : (0751) 7054688 Hunting
PO. BOX : 331 Padang 25000

Facsimile : (0751) 7055067
E-mail : pln@p3b-sumatera.co.id

Website : www.p3b-sumatera.co.id

To:
PT SIEMENS INDONESIA
Jl. Jend. A. Yani
Kav. B 67 -68
Jakarta 13210

June 15, 2009

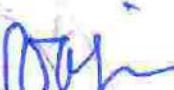
TO WHOM IT MAY CONCERN

This is to certify that **300 KV Circuit Breakers** type **3AP1 F1**, manufactured by **SIEMENS AG - Germany**, have been in operation in **Inalum Substation** since May 9, 2005.

Installations have been carried out by **SIEMENS** with good reliability and good performance in our network.

We thank **SIEMENS** for their contribution to our successful project in the past and we are looking forward in continuing a good business relationship in the future.

Best Regards,


Zainal Abidin Sihite
General Manager

CENTRAL VIETNAM POWER PROJECTS MANAGEMENT BOARD
Add.: 478 September 2nd Road, Danang City, Vietnam
Tel.: 84-0511-2220373 Fax: 84-0511-2220367

Date: August 25th, 2011

TO WHOM IT MAY CONCERN

SIEMENS PRODUCTS

This is to certify that we, Central Vietnam Power Projects Management Board (CPPMB), have successfully installed, commissioned and successful energized the following high voltage equipments in our Son La 500kV Substation:

Type	Manufacturer/ Country of Origin	Quantity	Year of Installation/Energization
<u>1. Circuit Breaker</u>			
3AP2/3 FI - 550	Siemens/Germany	11	2010
3AP1 FI - 245	Siemens/Germany	10	2010
3AF01 38.5	Siemens/India	2	2010
<u>2. Current Transformer</u>			
IOSK - 550	Trench (MWB)/China	48	2010
IOSK - 245	Trench (MWB)/China	30	2010
IOSK - 40.5	Trench (MWB)/China	12	2010
<u>3. Capacitive Voltage Transformer</u>			
TEMP - 500IUH	Trench (MWB)/China	35	2010
TEMP - 220SU	Trench (MWB)/China	27	2010
TEMP - 35SU	Trench (MWB)/China	6	2010
<u>4. Surge Arrester</u>			
3EP3 425	Siemens/Germany	33	2010
3EP4 192	Siemens/Germany	12	2010
3EP4 098	Siemens/Germany	4	2010

The operating experience concerning availability and reliability of the aforesaid Siemens products, as well as Siemens behavior has been fully satisfactory.

On behalf of

CENTRAL VIETNAM POWER PROJECTS MANAGEMENT BOARD

TRƯỞNG BAN

NGUYỄN ĐỨC TUYỀN





การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย
ELECTRICITY GENERATING AUTHORITY OF THAILAND

53 หมู่ 2 ถนนจันทร์สันติวงศ์ บางครัว แขวงบุรี 11130 ไทย 0 2433 6317, 0 2433 5523, 0 2434 4064 www.egat.co.th
53 Moo 2 Charansanitwong Rd. Bang Kruai Nonthaburi 11130 Thailand Fax (66) 2433 6317, 2433 5523, 2434 4064

No. EGAT 138 /2008

TO WHOM IT MAY CONCERN

This is to certify that the 115kV and 230kV power circuit breakers type 3AP1 produced by SIEMENS Limited have been operating with good reliability and good performance in our system since 1997 and 2001 consequently.

Issued on August 8 , 2008

ELECTRICITY GENERATING AUTHORITY OF THAILAND

(Mr. Weraphan Langkulchinda)

Director, Transmission System Maintenance Division

Acting on Behalf of Governor

POWER TRANSMISSION COMPANY NO.1

Add: 15 Cua Bac - Ba Dinh - Ha Noi - VietNam
Tel: +84. 4 2 2132183 Fax: +84. 4 3 7150152

Date: 22nd April 2015

TO WHOM IT MAY CONCERN

SIEMENS PRODUCTS

This is to certify that we, Power Transmission Company No.1, have successfully installed, commissioned and successful energized the following high voltage equipments in our 220kV Cao Bang Substation:

Type	Manufacturer/Country of Origin	Quantity	Year of Installation/ Energization
1. Circuit Breaker			
3AP1FG-245kV	Siemens/India	2	2011
3AP1FI-245kV	Siemens/India	3	2011
3AP1FG-145kV	Siemens/India	6	2011
3AF01-36kV	Siemens/India	1	2011
2. Current Transformer			
IOSK245	Trench (Siemens)/China	15	2011
IOSK123...IOSK145	Trench (Siemens)/China	18	2011
IOSK40.5	Trench (Siemens)/China	3	2011
3. Capacitive Voltage Transformer			
TEMP-220	Trench (Siemens)/China	15	2011
TEMP-110	Trench (Siemens)/China	19	2011
TEMP-35	Trench (Siemens)/China	3	2011
4. Surge Arrester			
3EL2 192	Siemens/China	12	2011
3EL2 098	Siemens/China	15	2011

The above mentioned Siemens products are commissioned and good in service from 2011 until now

On behalf of

POWER TRANSMISSION COMPANY NO.1



K/T. GIÁM ĐỐC
CÔNG TY TRUYỀN TẢI ĐIỆN 1
PHÓ GIÁM ĐỐC

Nguyễn Hữu Long

**THE NORTHERN VIETNAM POWER PROJECTS MANAGEMENT BOARD
(NPMB)**

Add.:4 Nguyen Khac Nhu street, Ba Dinh District, Hanoi city, Vietnam
Tel.: 84-4-22103093 Fax: 84-4-38940824

Date: May 4th, 2016

TO WHOM IT MAY CONCERN

SIEMENS PRODUCTS

This is to certify that we, The Northern Vietnam Power Projects Management Board (NPMB), have successfully installed, commissioned and energized the following high voltage equipments in our 500kV Pho Nai substation:

Type	Manufacturer/ Country of Origin	Quantity	Year of installation/Energization
1. Circuit Breaker			
3AP2 FI - 550	Siemens/China	11 sets	Apr. 2016
3AP1 FI - 245	Siemens/India	7 sets	Apr. 2016
3AP1 FG - 245	Siemens/India	2 sets	Apr. 2016
2. Current Transformer			
IOSK - 550	Trench/China	33 sets	Apr. 2016
IOSK - 245	Trench/China	27 sets	Apr. 2016
IOSK - 40.5	Trench/China	6 sets	Apr. 2016
3. Capacitor Voltage Transformer			
TEMP-550IU	Trench/China	24 sets	Apr. 2016
TEMP-220SL	Trench/China	28 sets	Apr. 2016
TEMP-35SU	Trench/China	3 sets	Apr. 2016

The aforesaid Siemens products have been operating well from the energization date.

On behalf of

THE NORTHERN VIETNAM POWER PROJECTS MANAGEMENT BOARD

w





广东省广州市天河南二路 2 号
#2 No.2 Tianhe Road South, Shaoguan, China

广东电网公司广州供电局

图传传真 FAX/SMILE TRANSMISSION

Name: Guangzhou Power Supply Bureau
局名: 广州供电局

Date: 2009-12-31
日期: 2009 年 12 月 31 日

TO WHOM IT MAY CONCERN
敬启者

Herewith, we confirm that 7 sets of 3AT2 EI have been in successful operation in 500kV Zengcheng substation.

西门子（杭州）高压开关有限公司生产的 7 台 550kV 液压断路器 3AT2 EI，在我局 500kV 增城站工程投运至今，运行状况良好。

Product range 产品名称	Description 型号说明	Number 数量	Operation Date 投运日期
3AT2 EI	550kV, 4000A	2	2005-05
		2	2006-12
		3	2007-07

1# Substation Department Guangzhou Power Supply Bureau



**THE NORTHERN VIETNAM POWER PROJECTS MANAGEMENT BOARD
(NPMB)**

Add.:4 Nguyen Khac Nhu street, Ba Dinh District, Hanoi city, Vietnam
Tel.: 84-4-22103093 Fax: 84-4-38940824

Date: May 4th, 2016

TO WHOM IT MAY CONCERN

SIEMENS PRODUCTS

This is to certify that we, The Northern Vietnam Power Projects Management Board (NPMB), have successfully installed, commissioned and energized the following high voltage equipments in our 500kV Pho Nai substation:

Type	Manufacturer/ Country of Origin	Quantity	Year of installation/Energization
1. Circuit Breaker			
3AP2 FI - 550	Siemens/China	11 sets	Apr. 2016
3AP1 FI - 245	Siemens/India	7 sets	Apr. 2016
3AP1 FG - 245	Siemens/India	2 sets	Apr. 2016
2. Current Transformer			
IOSK - 550	Trench/China	33 sets	Apr. 2016
IOSK - 245	Trench/China	27 sets	Apr. 2016
IOSK - 40.5	Trench/China	6 sets	Apr. 2016
3. Capacitor Voltage Transformer			
TEMP-550IU	Trench/China	24 sets	Apr. 2016
TEMP-220SL	Trench/China	28 sets	Apr. 2016
TEMP-35SU	Trench/China	3 sets	Apr. 2016

The aforesaid Siemens products have been operating well from the energization date.

On behalf of

THE NORTHERN VIETNAM POWER PROJECTS MANAGEMENT BOARD

w



**THE NORTHERN VIETNAM POWER PROJECTS MANAGEMENT BOARD
(NPMB)**

Add.:4 Nguyen Khac Nhu street, Ba Dinh District, Hanoi city, Vietnam
Tel.: 84-4-22103093 Fax: 84-4-38940824

Date: May 4th, 2016

TO WHOM IT MAY CONCERN

SIEMENS PRODUCTS

This is to certify that we, The Northern Vietnam Power Projects Management Board (NPMB), have successfully installed, commissioned and energized the following high voltage equipments in our 500kV Son La extension project at 500kV Son La substation:

Type	Manufacturer/ Country of Origin	Quantity	Year of Installation/Energization
1. Circuit Breaker			
3AP2 FI - 550	Siemens/China	02 sets	Nov. 2015
2. Current Transformer			
IOSK - 550	Trench/China	12 sets	Nov. 2015
3. Capacitor Voltage Transformer			
TCVT-550	Trench/China	8 sets	Nov. 2015

On behalf of

THE NORTHERN VIETNAM POWER PROJECTS MANAGEMENT BOARD



Certification of reference of products

Working situation

Project Name	BELES SUGAR FACTORIES POWER TRANSMISSION PROJECT
Manufacturer	Siemens High Voltage Circuit Breaker Co. Ltd., Hangzhou
Product Model	3AP2 FI 550
Number of Products	1 PCS

All products have been provided on time. The equipment have been shipped to site very carefully. Technologists and engineers have provide all technical service.

The products have advanced technologies and reliable qualities. The great virtues of the product include convenient operation, easy installation and free-maintenance. The equipment is in good conditions.

Hereby certify!



This letter will not release your warranty and liability under the contract between us.

Contact person: Zhang Xiaofeng

Tel: 0086-0512-63278718

Address: North of 318 National Highway 72k, Luxu Town, Wujiang City, Jiangsu Province, P. R.China

Name: State Grid Zhejiang Provincial Electrical Power Co.

局名：国网浙江省电力公司

Dated: 2015-03-16

日期：2015年3月16日

TO WHOM IT MAY CONCERN

Herewith, we confirm that 3 sets of 3AP2 FI 500kV, 63 kA (manufactured by Siemens High Voltage Circuit Breakers Co., Ltd. Hangzhou) have been in successful operation in 500kV Hanshan substation since May, 2011.

西门子(杭州)高压开关有限公司生产的3台550kV断路器3AP2 FI，自2011年5月在我局500kV含山变工程投运至今，一切情况正常。

State Grid Zhejiang Provincial Electrical Power Co.

国网浙江省电力公司

运维检修部

Office address:

Siemens High Voltage Circuit Breaker Co., Ltd., Hangzhou

128-18th Rd. of Xiaasha Industry Area, Hangzhou Economical & Technical Development Zone 310018, Zhejiang, P. R. China
Tel.: 0086 571 86912288 Fax: 0086 571 86910380

地址：

西门子(杭州)高压开关有限公司

中国浙江杭州经济技术开发区下沙工业园十八号路(东)128号
邮政编码：310018
Tel: 0086 571 86912288 Fax: 0086 571 86910380

**THE NORTHERN VIETNAM POWER PROJECTS MANAGEMENT BOARD
(NPMB)**

Add.:4 Nguyen Khac Nhu street, Ba Dinh District, Hanoi city, Vietnam
Tel.: 84-4-22103093 Fax: 84-4-38940824

Date: May 4th, 2016

TO WHOM IT MAY CONCERN

SIEMENS PRODUCTS

This is to certify that we, The Northern Vietnam Power Projects Management Board (NPMB), have successfully installed, commissioned and energized the following high voltage equipments in our 500kV Pho Nai substation:

Type	Manufacturer/ Country of Origin	Quantity	Year of installation/Energization
1. Circuit Breaker			
3AP2 FI - 550	Siemens/China	11 sets	Apr. 2016
3AP1 FI - 245	Siemens/India	7 sets	Apr. 2016
3AP1 FG - 245	Siemens/India	2 sets	Apr. 2016
2. Current Transformer			
IOSK - 550	Trench/China	33 sets	Apr. 2016
IOSK - 245	Trench/China	27 sets	Apr. 2016
IOSK - 40.5	Trench/China	6 sets	Apr. 2016
3. Capacitor Voltage Transformer			
TEMP-550IU	Trench/China	24 sets	Apr. 2016
TEMP-220SL	Trench/China	28 sets	Apr. 2016
TEMP-35SU	Trench/China	3 sets	Apr. 2016

The aforesaid Siemens products have been operating well from the energization date.

On behalf of

THE NORTHERN VIETNAM POWER PROJECTS MANAGEMENT BOARD

w



**THE NORTHERN VIETNAM POWER PROJECTS MANAGEMENT BOARD
(NPMB)**

Add.:4 Nguyen Khac Nhu street, Ba Dinh District, Hanoi city, Vietnam
Tel.: 84-4-22103093 Fax: 84-4-38940824

Date: May 4th, 2016

TO WHOM IT MAY CONCERN

SIEMENS PRODUCTS

This is to certify that we, The Northern Vietnam Power Projects Management Board (NPMB), have successfully installed, commissioned and energized the following high voltage equipments in our 500kV Son La extension project at 500kV Son La substation:

Type	Manufacturer/ Country of Origin	Quantity	Year of Installation/Energization
1. Circuit Breaker			
3AP2 FI - 550	Siemens/China	02 sets	Nov. 2015
2. Current Transformer			
IOSK - 550	Trench/China	12 sets	Nov. 2015
3. Capacitor Voltage Transformer			
TCVT-550	Trench/China	8 sets	Nov. 2015

On behalf of

THE NORTHERN VIETNAM POWER PROJECTS MANAGEMENT BOARD



Certification of reference of products

Working situation

Project Name	BELES SUGAR FACTORIES POWER TRANSMISSION PROJECT
Manufacturer	Siemens High Voltage Circuit Breaker Co. Ltd., Hangzhou
Product Model	3AP2 FI 550
Number of Products	1 PCS

All products have been provided on time. The equipment have been shipped to site very carefully. Technologists and engineers have provide all technical service.

The products have advanced technologies and reliable qualities. The great virtues of the product include convenient operation, easy installation and free-maintenance. The equipment is in good conditions.

Hereby certify!



This letter will not release your warranty and liability under the contract between us.

Contact person: Zhang Xiaofeng

Tel: 0086-0512-63278718

Address: North of 318 National Highway 72k, Luxu Town, Wujiang City, Jiangsu Province, P. R.China

Name: State Grid Zhejiang Provincial Electrical Power Co.

局名：国网浙江省电力公司

Dated: 2015-03-16

日期：2015年3月16日

TO WHOM IT MAY CONCERN

Herewith, we confirm that 3 sets of 3AP2 FI 500kV, 63 kA (manufactured by Siemens High Voltage Circuit Breakers Co., Ltd. Hangzhou) have been in successful operation in 500kV Hanshan substation since May, 2011.

西门子(杭州)高压开关有限公司生产的3台550kV断路器3AP2 FI，自2011年5月在我局500kV含山变工程投运至今，一切情况正常。

State Grid Zhejiang Provincial Electrical Power Co.

国网浙江省电力公司

运维检修部

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