

# KEMA INSPECTION REPORT

3110-17

**Object** A three-phase SF<sub>6</sub> gas insulated switchgear assembly, incorporating single-phase enclosed circuit breaker (CB), disconnector-earthing switch (DES), fast earthing switch (FES) and busbar

**Type** ZFW34A-252(L)/T4000-50 **Serial No.** 252GIS-001, 002

252 kV - 4000 A - 50 kA – 50/60 Hz

**Client** CHINT Electric Co., Ltd.,  
Shanghai, China

**Manufacturer** CHINT Electric Co., Ltd.,  
Shanghai, China

**Inspected by** DNV GL Netherlands B.V.,  
Arnhem, the Netherlands

**Test location** CHINT Electric Co., Ltd.,  
Shanghai, China

Laboratory of Alstom Grid Technology Center Co., Ltd.,  
Shanghai, China

**Date of tests** 23 March to 28 July 2017

**Test specification** The tests have been carried out in accordance with IEC 62271-203:2011 and IEC 62271-102:2013.

**Regarding** Type tests

**Summary and conclusion** The object has complied with the relevant requirements of the standard.

This report applies only to the object tested. The responsibility for conformity of any object having the same type references as that tested rests with the Manufacturer.

This report consists of 54 pages in total.

DNV GL Netherlands B.V.



J.P. Fonteijne  
Executive Vice President  
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## 1 IDENTIFICATION OF THE OBJECT TESTED

### 1.1 Ratings/characteristics of the object tested

Rated voltage	252	kV
Rated current	4000	A
Rated frequency	50/60	Hz
Rated power frequency withstand voltage		
Common value	460	kV
Across the isolating distance	460 (+146)	kV
Rated lightning impulse withstand voltage		
Common value	1050	kV
Across the isolating distance	1050 (+206)	kV
Rated short-time withstand current	50	kA
Rated peak withstand current	130	kA
Rated duration of short circuit	3	s
Class of mechanical endurance	M1	
Rated SF <sub>6</sub> filling pressure of circuit breaker (relative, 20 °C)	0,62	MPa
Minimum SF <sub>6</sub> filling pressure of circuit breaker (relative, 20 °C)	0,55	MPa
Rated SF <sub>6</sub> filling pressure of other compartments (relative, 20 °C)	0,58	MPa
Minimum SF <sub>6</sub> filling pressure of other compartments (relative, 20 °C)	0,50	MPa

### 1.2 Description of the object tested

#### Circuit breaker (CB)

Manufacturer	CHINT Electric Co., Ltd., Shanghai, China
Type designation	NGCB2-IV
Rated control voltage	DC 220 V
Operating mechanism	Motor-spring operated
Motor manufacturer	Jiangnan Yifan Motor Co., Ltd.
Motor model No.	HDZ-210050B
Motor rating	AC / DC 220 V, 1000 W

#### Disconnecter and earthing switch (DES)

Manufacturer	CHINT Electric Co., Ltd., Shanghai, China
Type designation	252kV GIS DES
Operating mechanism	Motor-operated, Model CJ 30
Manufacturer	Yuyao Huayu Electric Co., Ltd.
Serial No.	16300667
Rated operating time	≤ 2 s
Rated output torque	120 Nm
Control voltage	DC 220 V
Motor type	HDZ-28003C
Motor manufacturer	Jiangnan Yifan Motor Co., Ltd.
Motor rating	AC / DC 220 V, 7,5 A, 800 W

**Fast earthing switch (FES)**

Manufacturer	CHINT Electric Co., Ltd., Shanghai, China
Type designation	HYT5
Operating mechanism	Motor-spring operated
Manufacturer	Yuyao Huayu Electric Co., Ltd.
Control voltage	DC 220V
Rated output torque	128/200 Nm
Serial No.	160514115
Rated operating time	≤ 6 s
Motor type	HDZ-23603C
Motor rating	AC/DC 220 V, 3,3 A, 360 W
Closing speed	1,8~2,7 m/s

**Basin insulator**

Manufacturer	CHINT Electric Co., Ltd., Shanghai, China
Drawing No.	5ZDK.720.375

## 3 TEMPERATURE-RISE TEST

### 3.1 Measurement of the resistance of circuits

#### Standard and date

Standard IEC 62271-203, subclause 6.4  
 Test date 11 to 12 April 2017

#### Environmental conditions (11 April 2017)

Ambient temperature 22 °C Ambient air pressure 1017 hPa  
 Relative humidity 53 %

#### Environmental conditions (12 April 2017)

Ambient temperature 24 °C Ambient air pressure 1020 hPa  
 Relative humidity 50 %

#### Procedure

The resistance of test object was measured before and after the temperature rise test. The current used for the measurement was equal or greater than 100 A DC to obtain sufficient accuracy of the measurement.

#### Test Data

Measurement between	Measuring DC-current A	Temperature of the test object °C		DC-resistance <sup>1)</sup> μΩ		Difference %
		before	after	before	after	
Central current path of test object	100	22	24	93	89	-4,3%

<sup>1)</sup> Presented results are an average of three individual measurements.

#### Requirements

The measured resistances after the test shall not be increased by more than 20%.

#### Result

The test object passed the tests.

## 3.2 Temperature-rise test on main circuit

### Standard and date

Standard	IEC 62271-203, subclause 6.5
Test dates	11 to 12 April 2017

### Environmental conditions

Ambient temperature	24 °C	Ambient air pressure	1015 hPa
		Relative humidity	50 %

### Procedure

The test object was filled with SF<sub>6</sub> gas at minimum functional pressure for insulation prior to the test. Per client's instruction, the test current was set to 110% rated current, 60Hz.

The test current was injected from the bushing terminal to the central current path. The current was then returned through the aluminum enclosure of the test object.

To ensure no heat was conducted away or conveyed to, the temperature of the terminal for external connection and the temperature at the temporary connections about 1 m from the terminal were measured. Their temperature difference was ensured not exceed 5 K.

The test was made over a period sufficient for the temperature rise to reach a stable value. This condition is deemed to be obtained when the increase of temperature rise does not exceed 1 K in 1 h.

The temperature of the test points was measured with thermocouples.

The ambient air temperature is the average temperature of the air surrounding the test object. Three thermocouples immersed in oil equally distributed around the test object at about the average height of its current-carrying parts and at about 1 m from the test object.

### Characteristic test data

Test current	4400 A
Frequency	60 Hz
Filling pressure of CB compartment (relative, 20 °C)	0,55 MPa
Filling pressure of other compartments (relative, 20 °C)	0,5 MPa

### Result

The test object passed the tests.

## 8 MECHANICAL ENDURANCE TEST (DES)

### 8.1 Measurement of the resistance of circuits

#### Standard and date

Standard IEC 62271-102, subclause 6.4

Test date 15 May and 19 June 2017

#### Environmental conditions (15 May 2017)

Ambient temperature 24,4 °C      Ambient air pressure 1013 hPa  
Relative humidity 47,5 %

#### Environmental conditions (19 June 2017)

Ambient temperature 25 °C

#### Procedure

The resistance was measured before and after the mechanical endurance tests. The current used for the measurement was 100 A DC to obtain sufficient accuracy of the measurement.

#### Test data

Measurement between	Measuring DC-current A	Temperature of the test object °C		DC-resistance <sup>1)</sup> μΩ		Difference <sup>4)</sup> %
		before <sup>2)</sup>	after <sup>3)</sup>	before <sup>2)</sup>	after <sup>3)</sup>	
A phase of 252kV DS	100	24,4	25	11	12	+9,1%
B phase of 252kV DS	100	24,4	25	12	14	+16,7%
C phase of 25 2kV DS	100	24,4	25	12	13	+8,3%
A phase of 252kV ES	100	24,4	25	14	15	+7,1%
B phase of 252kV ES	100	24,4	25	13	14	+7,7%
C phase of 252kV ES	100	24,4	25	15	15	0

<sup>1)</sup> Presented results are an average of three individual measurements.

<sup>2)</sup> Result before temperature-rise test.

<sup>3)</sup> Result after temperature-rise test.

<sup>4)</sup> Difference in DC-resistance between measurements before- and after temperature-rise test.

#### Requirements

For main circuit, the measured resistances after the test shall not be increased by more than 20%.

#### Result

The test object passed the tests.



## 8.4 Mechanical endurance test

### Standard and date

Standard IEC 62271-102, subclause 6.102.3  
Test date 6 to 17 June 2017

### Environmental conditions

Ambient temperature  $28 \pm 5$  °C

### Procedure

The operating cycles of the test object were achieved by its own operating mechanisms.

For every 1000 mechanical operation cycles, the test sequence was consisted of:

- 50 operating cycles of "CO" at maximum supply voltage;
- 900 operating cycles of "CO" at rated supply voltage;
- 50 operating cycles of "CO" at minimum supply voltage.

For extended mechanical endurance tests, the above test sequence was repeated.

Before, after and during the test program, the below operating characteristics were recorded or evaluated.

- operating time;
- maximum energy consumption.

### Characteristic test data

Rated supply voltage	220	Vdc
Minimum supply voltage	187	Vdc
Maximum supply voltage	242	Vdc
Number of operating cycles of DES	2000	

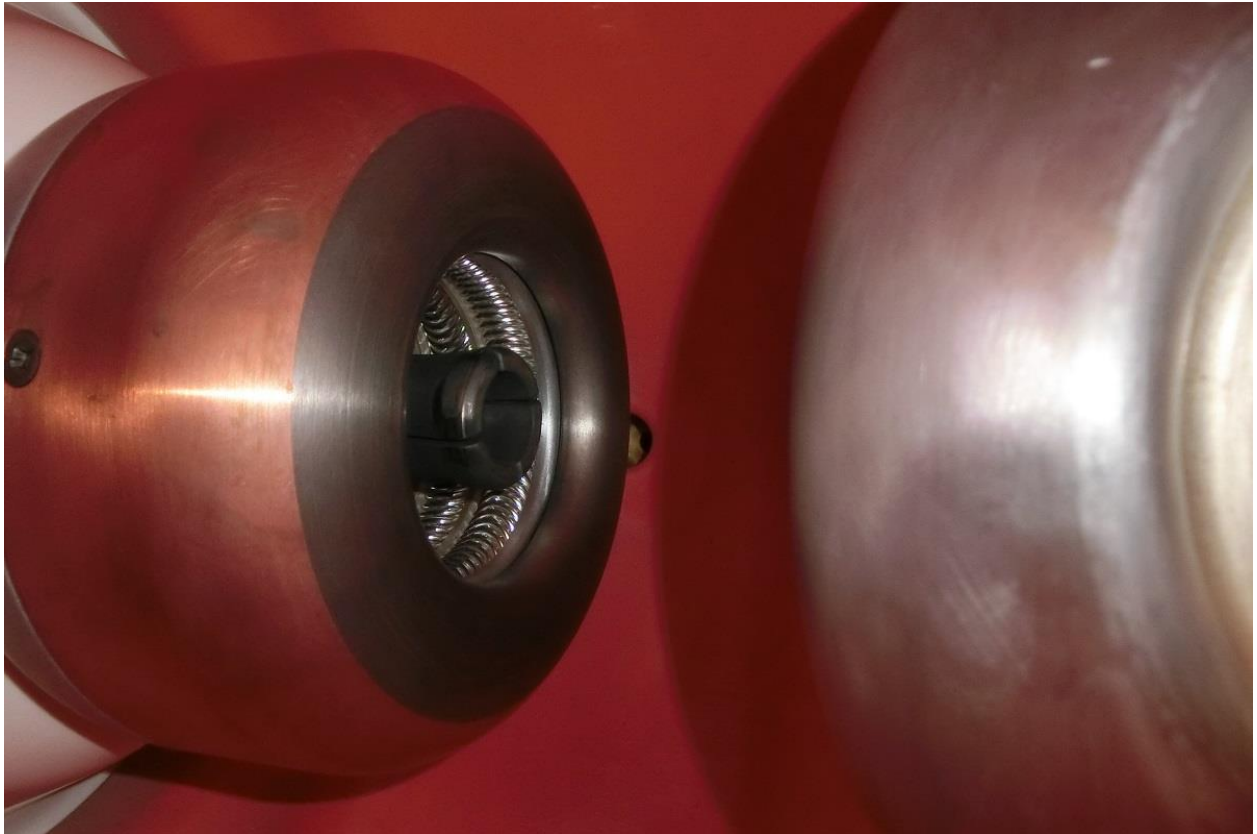
### Requirements

After the total test program, all parts, including contacts, shall be in good condition and shall not show undue wear in accordance with the relevant subclauses of IEC 62271-1.

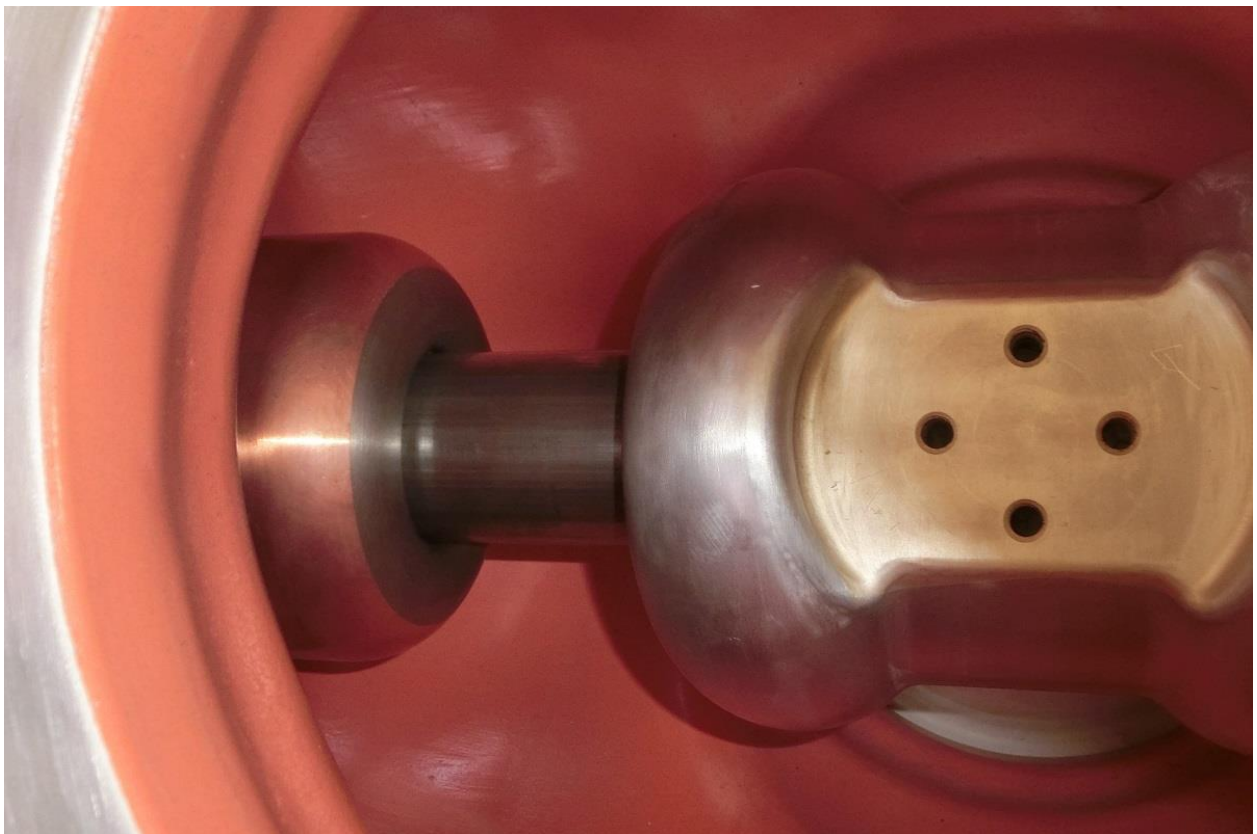
### Result

The test object passed the tests.

The operating characteristics before, during and after the tests can be found in Appendix B and C.



Fixed contact of 252 kV DES DS after 2000 cycles of mechanical endurance



Contact structure of 252 kV DES DS after 2000 cycles of mechanical endurance