

KEMA TYPE TEST CERTIFICATE OF SHORT-CIRCUIT PERFORMANCE

Object A three-pole dead-tank SF₆ circuit-breaker incorporating one interrupter per pole in single-pole enclosures with a common operating mechanism **2153-16**

Type TCB 145-40-31 **Serial No.** 16000702, 16000703

Rated voltage	145 kV	Rated normal current	3150 A
Rated short-circuit current	40 kA	Rated frequency	50/60 Hz

Manufacturer Qingdao TGOOD Electric Co., Ltd., Qingdao, China ^{*)}

Client Qingdao TGOOD Electric Co., Ltd., Qingdao, China

Tested by KEMA Nederland B.V., Arnhem, The Netherlands

Date of tests 30 and 31 May, 2, 7, 10, 15, 17, 20, 28 and 29 June 2016

The object, constructed in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to the series of proving tests in accordance with

IEC 62271-100 (2012) subclauses 6.6 (STC), 6.102 to 6.106 (T10, T30, T60, T100), 6.109 (SLF), 6.108 (DEF) and 6.110 (Out-of-phase).

This Certificate has been issued by DNV GL following exclusively the STL Guides.

The results are shown in the record of proving tests and the oscillograms attached hereto. The values obtained and the general performance are considered to comply with the above standard and to justify the ratings assigned by the manufacturer as listed on page 10.

This Certificate 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.

^{*)} as declared by the manufacturer

This Certificate consists of 655 pages in total.

KEMA Nederland B.V.



J.P. Fonteijne
Executive Vice President
KEMA Laboratories



Laboratories

Arnhem, 12 August 2016

INFORMATION SHEET

1 KEMA Type Test Certificate

A KEMA Type Test Certificate contains a record of a series of (type) tests carried out in accordance with a recognized standard. The object tested has fulfilled the requirements of this standard and the relevant ratings assigned by the manufacturer are endorsed by DNV GL. In addition, the object's technical drawings have been verified and the condition of the object after the tests is assessed and recorded. The Certificate contains the essential drawings and a description of the object tested. A KEMA Type Test Certificate signifies that the object meets all the requirements of the named subclauses of the standard. It can be identified by gold-embossed lettering on the cover and a gold seal on its front sheet.

The Certificate is applicable to the object tested only. DNV GL is responsible for the validity and the contents of the Certificate. The responsibility for conformity of any object having the same type references as the one tested rests with the manufacturer.

Detailed rules on types of certification are given in DNV GL's Certification procedure applicable to KEMA Laboratories.

2 KEMA Report of Performance

A KEMA Report of Performance is issued when an object has successfully completed and passed a subset (but not all) of test programmes in accordance with a recognized standard. In addition, the object's technical drawings have been verified and the condition of the object after the tests is assessed and recorded. The report is applicable to the object tested only. A KEMA Report of Performance signifies that the object meets the requirements of the named subclauses of the standard. It can be identified by silver-embossed lettering on the cover and a silver seal on its front sheet.

The sentence on the front sheet of a KEMA Report of Performance will state that the tests have been carried out in accordance with The object has complied with the relevant requirements.

3 KEMA Test Report

A KEMA Test Report is issued in all other cases. Reasons for issuing a KEMA Test Report could be:

- Tests were performed according to the client's instructions.
- Tests were performed only partially according to the standard.
- No technical drawings were submitted for verification and/or no assessment of the condition of the object after the tests was performed.
- The object failed one or more of the performed tests.

The KEMA Test Report can be identified by the grey-embossed lettering on the cover and grey seal on its front sheet.

In case 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, the following sentence will appear on the front sheet. The tests have been carried out in accordance with the client's instructions. Test procedure and test parameters were based on If the object 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 client's request.

When the tests, test procedure and/or test parameters are not in accordance with a recognized standard, the front sheet will state the tests have been carried out in accordance with client's instructions.

4 Official and uncontrolled test documents

The official test documents of DNV GL are issued in bound form. Uncontrolled copies may be provided as a digital file for convenience of reproduction by the client. The copyright has to be respected at all times.

5 Accreditation of KEMA Laboratories

The KEMA Laboratories of DNV GL are accredited in accordance with ISO/IEC 17025 by the respective national accreditation bodies. KEMA Laboratories Arnhem, the Netherlands, is accredited by RvA under nos. L020, L218, K006 and K009. KEMA Laboratories Chalfont, United States, is accredited by A2LA under no. 0553.01. KEMA Laboratories Prague, the Czech Republic, is accredited by CAI as testing laboratory no. 1035.

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1 IDENTIFICATION OF THE OBJECT TESTED

1.1 Ratings/characteristics of the object tested

Voltage	145 kV	
Normal current	3150 A	
Number of poles	3	
Frequency	50/60 Hz	X
Operating sequence	O-0,3 s-CO-3 min-CO	X
Short-time withstand current	40 kA	X
Peak withstand current	104 kA	X
Duration of short-circuit	3 s	X
Short-circuit making current	104 kA	X
Short-circuit breaking current	40 kA	X
DC time constant of rated short-circuit current	45 ms	X
DC component	53 %	X
First-pole-to-clear factor	1,5	X
Out-of-phase breaking current	10 kA	X
Line-charging breaking current	50 A	
Cable-charging breaking current	160 A	
Pressure for interruption and insulation SF ₆ at 20 °C	0,75 MPa	
Supply voltage of closing and opening devices	125 Vd.c.	
Class	E1	X
Class	C2	

Breaker is only intended for use in non-effectively earthed neutral systems.

X = This rating has been proved by the tests of this Certificate.

1.2 Description of the object tested

A three-pole dead-tank SF₆ circuit-breaker incorporating one interrupter per pole in single-pole enclosures with a common operating mechanism

Minimum pressure for interruption and insulation at 20 °C 0,70 MPa

Mechanism:

Stored energy closing (springs, charged by motor).

Stored energy opening (springs, charged at closing).

Supply voltage closing coil 125 Vd.c.

Supply voltage opening coil 125 Vd.c.

Supply voltage motor 125 Vd.c.

1.3 Travel recorder

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

1.4 List of drawings

The manufacturer has guaranteed that the object submitted for tests has been manufactured in accordance with the following drawings and/or documents. KEMA Laboratories has verified that these drawings and/or documents adequately represent the object tested. The manufacturer is responsible for the correctness of these drawings and/or documents and the technical data presented.

The following drawings and/or documents have been included in this Certificate:

Drawing no./document no.	Revision
2TG.029.001	1

The following drawings and/or documents are only listed for reference and are kept in KEMA Laboratories' files:

Drawing no./document no.	Revision	Drawing no./document no.	Revision
5TG.569.001	1	8TG.750.002	1
5TG.569.002	1	5TG.743.004	1
5TG.551.001	1	5TG.232.004	1
5TG.743.005	1	8TG.200.007	1
5TG.569.003	1	5TG.722.004	1
5TG.550.007	1	2TG.046.006	1
5TG.780.007	1	8TG.282.273	1
5TG.780.008	1	8TG.282.310	1
8TG.040.010	1	8TG.510.024	1
8TG.040.005	1	8TG.510.025	1
8TG.040.009	1	8TG.170.008	1
8TG.423.001	1	8TG.177.016	1
8TG.104.002	1	8TG.232.014	1
8TG.550.004	1	8TG.232.015	1
8TG.550.006	1	8TG.232.016	1
8TG.550.008	1	8TG.450.001	1
8TG.550.009	1	8TG.550.013	1
8TG.599.001	1	8TG.550.106	1
8TG.599.002	1	8TG.569.106	1
8TG.750.001	1		

2 GENERAL INFORMATION

2.1 The tests were witnessed by

Name	Company
Luo, X.	Qingdao TGOOD Electric Co., Ltd.,
Yang, L.	Qingdao, China
Dong, G.	
Xu, S.	

2.2 The tests were carried out by

Name	Company
Dekker, M. (15 June 2016)	KEMA Nederland B.V.,
Hofstee, A.B. (10, 29 June 2016)	Arnhem, The Netherlands
Minkhorst, D. (2, 20 June 2016)	
Nijman, R.M. (2, 20 June 2016)	
Wiggers, R. (30, 31 May, 2, 17, 28 June 2016)	
Aditya, J. (7, 10 June 2016)	

2.3 Accuracy of measurement

The guaranteed uncertainty for the measured voltages and currents taking into account the total measuring system, is less than 5%, unless mentioned otherwise.

3 LEGEND

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)
CS	Timing signal contact separation
CS1	Timing signal contact separation
CS2	Timing signal contact separation
CS3	Timing signal contact separation
I1cs	Current of current circuit, synthetic tests
I1TO	Current through test object
I2cs	Current of current circuit, synthetic tests
I2TO	Current through test object
I2TOa	Current through test object, amplified
I3cs	Current of current circuit, synthetic tests
I3TO	Current through test object
I3TOa	Current through test object, amplified
IABcl	Current closing coil auxiliary breaker
IABop	Current opening coil auxiliary breaker
Ics	Current of current circuit, synthetic tests
Ireig	Current reignition circuit, synthetic tests
Isyn	Current synthetic circuit
Isyn1	Current synthetic circuit
Isyn2	Current synthetic circuit
Itank	Tank current test object
ITO	Current through test object
ITO/A	Current through test object, amplified
ITOcl	Current closing coil test object
ITOop	Current opening coil test object
TR	Travel recorder
U1cs	Voltage current circuit
U1S	Supply voltage
U1TO	Voltage across test object
U2cs	Voltage current circuit
U2S	Supply voltage
U2TO	Voltage across test object
U3cs	Voltage current circuit
U3TO	Voltage across test object
Ucs	Voltage current circuit
UTO	Voltage across test object
UTO/A	Voltage across test object, amplified