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Test Report No. EU-BD 1025/1

Applicant:	Zhejiang Xizi Forvorda Electrical Machinery Co., Ltd. No.55 Nanhuan Road, Lin'an Economy Development Area, Zhejiang, China
Manufacturer of the Test sample:	Zhejiang Xizi Forvorda Electrical Machinery Co., Ltd. No.55 Nanhuan Road, Lin'an Economy Development Area, Zhejiang, China
Date of Application:	2019-05-06
Our order No.:	2482015480(7482238045)
Notified Body:	TÜV SÜD Industrie Service GmbH Westendstr. 199 80686 München – Germany
Test number:	EU-BD 1025/1
Test object:	Braking device acting on the traction sheave, as part of the protection device against overspeed for the car moving in upwards direction and braking element against unintended car movement Type DZD1-500, DBB510-A
Order / Purpose of the examination:	Extension of an EU-type examination for a safety component according to Annex III, of Directive 2014/33/EU
Basis of examination:	- Directive 2014/33/EU, Annex I - EN 81-20:2014 - EN 81-50:2014
Extent of tests:	Verification of the requested modification according to the submitted documents as well as the documents of the existing EU-Type Examination Certificate EU-BD 1025 dated 2016-12-16 and performing tests

Date: 2019-07-15

Our reference:
RI-LCC/SZY

Document:
PB_EU-BD_1025-1_190715_en.docx

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The test results refer exclusively to the units under test.

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1 Description of the change

The existing EU-Type examination certificate EU-BD 1025 was issued on 2016-12-16. Based on the application from the manufacturer dated on 2019-05-06, the application scope will be extended from the original maximum tripping rotary speed 223 rpm corresponding to the nominal brake torque 2 × 922 Nm = 1844 Nm as the current maximum tripping rotary speed 251 rpm. Except for this change, there is no any other design changes.

New tests are carried out for verifying the above extension. The test samples used for verification are listed in the table below.

Test sample	S.N.	Nominal Brake torque	Maximum tripping rotary speed	Without Over-excitation	With Over-excitation		Brake control (In parallel/ series)	Nominal air gap (min. – max.)	With/without a bleeder circuit connected in parallel with the power supply circuit of brake coils
				Rated voltage/ current/ power	Over-excitation voltage/ current/ power	Holding voltage / current/power			
Sample1 (single braking device)	FW923507	922 Nm	251 rpm	110 VDC / 1.15 A / 127 W	Not applicable	Not applicable	Parallel	0.25 – 0.35 mm	With
Sample2 (single braking device)	FW923508	922 Nm	251 rpm	110 VDC / 1.15 A / 127 W	Not applicable	Not applicable		0.25 – 0.35 mm	With

And the test location will be changed as the company, thyssenkrupp Elevators (Shanghai) Co., Ltd./ No.2 Xunye Road, Sheshan Subarea Songjiang Industrial Area, Shanghai 201602, P.R. China from the original test lab Shenzhen Institute of Special Equipment Inspection and Test (SISE). And the test bench of thyssenkrupp are different from that of SISE.

Based on the application from the company Zhejiang Xizi Forvorda Electrical Machinery Co., Ltd., because of region market demand, one new type "DBB510-A" will be added. This new type "DBB510-A" have the exactly same design construction and have the same application scope in the certificate as that of the original type "DZD1-500", and the only difference is the name of type.

2 The report is based on following documents and Test samples

|U01| PP_Annex1_Pictures_EU-BD 1025-1_190715.pdf

|U02| Test record graphic and data DZD1-500.docx from thyssenkrupp

|U03| Application for EU-Type examination dated 2019-05-06 from Zhejiang Xizi Forvorda Electrical Machinery Co., Ltd.

|U04| EU-type examination certificate EU-BD 1025 with complete documentation dated 2016-12-16

|U05| Calibration certificates of test equipment, see the Point 4.4 of this report.

|M01| Test samples, see the Point 1 of this report

3 Test procedure

3.1 Requirements of the test procedure

The test procedure is described in clause 5.6.6.11, 5.6.7.13 of EN 81-20:2014 and clause 5.7, 5.8 of EN 81-50: 2014, and was detailed in the test report no. EU-BD 1025 dated 2016-12-16.

3.2 Examination in detail

3.2.1 Review of documents

3.2.2 Comparison of the test sample with the drawings

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3.2.3 Mechanical tests

4 Information regarding the Test procedure

4.1 Place of Inspection

thyssenkrupp Elevators (Shanghai) Co., Ltd./ No.2 Xunye Road, Sheshan Subarea Songjiang Industrial Area, Shanghai 201602, P.R. China

4.2 Date of Inspection

2019-06-13

4.3 Participants

Participant on behalf of the certificate holder/manufacturer:

- Ms. Tang Xiaowei

Participant on behalf of the testing company, thyssenkrupp Elevators (Shanghai) Co., Ltd:

- Mr. Chen Zhanqing, Ms. Wang Jing, Mr. Xu Lin'an

Participant on behalf of the notified body, TÜV SÜD Industrie Service GmbH:

- Ms. Shen Zhiying (TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch)

4.4 Test equipment

-	Name	Accuracy class/Uncertainty/Maximum permissible error	Manufacturer/Type/Serial no.	Calibration certificate/report no.	Metrology body (Accreditation no.)	Calibration date
P01	Torque sensor	Accuracy class: 0.05 (Fullscale:5000 Nm)	HBM T40B(T40S5) -	2019030401	Shanghai Testing & Inspection Institute for Electrical Equipment Co., Ltd. (CNAS L1145)	2019-03-19
P02	Power analyzer	Accuracy: DC: ± (% of reading + % of upper range value). Voltage: 0.02 + 0.08 Current: 0.02 + 0.1	ZIMMER; LMG670; LMG87002901612	900097139	SGS (CNAS L0599)	2019-03-13
P03	Digital caliper	Scale division = 0.01 mm 0 – 70 mm, MPE = ±0.02 mm; 70 – 200 mm, MPE = ±0.03 mm; U_{rel} = 0.01 mm, k = 2	SATA; 0-150 mm; S130800431	900093558-002	SGS (CNAS L0599)	2019-01-30
P04	Multimeter	Accuracy ± ([% of Reading] + [Counts]): DC Voltage: 0.5% + 2; DC Current: 1.0% + 3; Resistance: 0.9 % + 3	Fluke; 115C; CR-DI-LCC-006	J19126800347	Shanghai Institute of Quality Inspection and Technical Research (CNAS L0128)	2019-04-01

4.5 Description of test device

The conduct of the examination was performed on the torsion test stand.

As shown below (Pic.1 test system), the flywheel system of test bench is to be loaded for simulating the system inertia of elevator system.

Under the inverter control and the system software control, the synchronous machine is powered on and realizes the loading (reach the setting unbalance loading value), then the brake device is energized and the braking is released, the shaft, the traction sheave and the rotor starts to rotate, and accelerates to achieve the specified speed (the setting maximum tripping speed) while driving the flywheel system operation for completing the loading of the system inertia. At that time while reaching the maximum tripping speed, the brake device is powered off and holds the motor rotor. The shaft, the traction sheave and flywheel system will slow down and stop rotating with the action of the brake device.

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Torque sensors detect the brake torque in real time. By extracting voltage signal of brake coil contact and of the micro switch, and of the encoder (the rotary speed comes from the feedback speed (in inverter) of the encoder) and over the power analyzer (the system sampling rate 1000 Hz), the loss of power of the brake device, the micro-switch signal, and the building up brake torque, and the speed can be detected, recorded and analyzed. The test record graphs were submitted from the test company, thyssenkrupp.

Pic.1 Test system

5 Findings

5.1 Review of documents

The documents submitted correspond in scope and content the requirements of the test specifications.

5.2 Comparison of the test sample with the drawings

The execution of the test sample was consistent with certified construction documents.

5.3 Mechanical tests

Symbols:

V_{t_s}	is the max. tripping rotary speed of traction sheave (i.e. that of the shaft, brake disc/drum, or motor rotor) stated by the applicant [rpm];
V_{t_m}	is the tripping rotary speed of traction sheave (i.e. that of the shaft, brake disc/drum, or motor rotor) measured for each test [rpm];
M_{B_n}	is the permissible nominal brake torque stated by the applicant [Nm];
M_{B_mi}	is the average brake torque measured during the braking for each test [Nm];
M_{B_mc}	is the average brake torque calculated during the braking for a series of tests with 4 tests or 10 tests [Nm];
Dev_{B_mi}	is the deviation of the measured average brake torque M_{B_mi} of each test from the calculated value M_{B_mc} of a test series [%];
Dev_{B_mc}	is the deviation of the calculated average brake torque M_{B_mc} of a test series from the stated nominal brake torque M_{B_n} [%];
t_X	is the response time of the stopping element (brake device), here is the time difference between the drop of the braking power until establishing X% of the nominal brake torque, t_{50} optionally calculated $t_{50}= (t_{10}+ t_{90})/2$ or value taken from the examination recording [ms].

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5.3.1 Tests for the braking device acting on the traction sheave, as part of the protection device against overspeed for the car movement in upwards direction

5.3.1.1 Braking tests with two brake devices

Test data under the condition of two brake devices' action at maximum tripping rotary speed 251 rpm corresponding to the nominal brake torque 2 × 922 Nm = 1844 Nm

Test no.	unit	1(CW)	2(CW)	3(CCW)	4(CCW)
V_{t_s}	rpm	251	251	251	251
V_{t_m}	rpm	266	265	265	265
M_{B_n}	Nm	1844	1844	1844	1844
M_{B_mi}	Nm	1986	1983	1988	1978
M_{B_mc}	Nm	1984			
Dev_{B_mi}	%	0.10	-0.05	0.20	-0.30
Dev_{B_mc}	%	7.59			

As shown in the above tests, the deviation (scatter) of the measured average braking torque during the tests were within the permissible range of ± 25% in relation to the value of the calculated average braking torque defined above. The calculated average braking torque during the test series deviates by less than 20% from the stated nominal brake torque. This set torque (nominal brake torque) is taken within the scope of the EU-type examination certificate.

5.3.1.2 Braking tests with a single brake device

4 tests (2 clockwise, 2 counterclockwise) are respectively carried out for verifying the corresponding brake torques under the condition of the action of a single brake device. The results show similar values of brake torque for each braking circuit.

Test data under the condition of a single brake's action (one single brake device) at maximum tripping rotary speed 251 rpm corresponding to the nominal brake torque 1 × 922 Nm = 922 Nm

-	Test no.	unit	1(CW)	2(CW)	3(CCW)	4(CCW)
Single brake device (on the right side)	V_{t_s}	rpm	251	251	251	251
	V_{t_m}	rpm	263	265	264	264
	M_{B_n}	Nm	922	922	922	922
	M_{B_mi}	Nm	976	979	948	945
	M_{B_mc}	Nm	962			
	Dev_{B_mi}	%	1.46	1.77	-1.46	-1.77
	Dev_{B_mc}	%	4.34			
-	Test no.	unit	1(CW)	2(CW)	3(CCW)	4(CCW)
Single brake device (on the left side)	V_{t_s}	rpm	251	251	251	251
	V_{t_m}	rpm	263	264	266	264
	M_{B_n}	Nm	922	922	922	922
	M_{B_mi}	Nm	1006	1006	973	978
	M_{B_mc}	Nm	991			

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	Dev_{B_mi}	%	1.51	1.51	-1.82	-1.31
	Dev_{B_mc}	%	7.48			

5.3.2 Tests for the braking element acting on the traction sheave, as a part of the protection device against unintended car movement

Test data under the condition of both two brake devices' action at maximum tripping rotary speed 251 rpm corresponding to the nominal brake torque 2 × 922 Nm = 1844 Nm

The power supply circuit of two single brake devices connected in parallel										
Test no.	unit	1(CW)	2(CW)	3(CW)	4(CW)	5(CW)	6(CCW)	7(CCW)	8(CCW)	9(CCW)	10(CCW)
V_{t_s}	rpm	251	251	251	251	251	251	251	251	251	251
V_{t_m}	rpm	265	266	265	266	266	265	265	265	264	263
t_{10}	ms	89	86	86	94	93	91	93	94	88	84
t_{50}	ms	109	107	106	116	115	109	112	112	105	103
t_{90}	ms	129	127	126	137	136	126	131	130	122	121
Max. t_x	ms	t_{10} = 94, t_{50} = 116, t_{90} = 137									
M_{B_n}	Nm	1844	1844	1844	1844	1844	1844	1844	1844	1844	1844
M_{B_mi}	Nm	1984	1986	1983	1989	1986	1994	1988	1978	1970	1979
M_{B_mc}	Nm	1984									
Dev_{B_mi}	%	0.00	0.10	-0.05	0.25	0.10	0.50	0.20	-0.30	-0.71	-0.25
Dev_{B_mc}	%	7.59									

As shown in the above test data, the deviation (scatter) of the measured average braking torque during the tests were within the permissible range of ± 20% in relation to the value of the calculated average braking torque defined above. And the calculated average braking torque during the test series deviates by less than 20% from the stated nominal brake torque. This set torque (nominal brake torque) is taken within the scope of the EU-type examination certificate.

5.3.3 Function test of the self-monitoring

The correct operation of the self-monitoring (limit-switch) was verified during the tests in the above point 5.3.1 and 5.3.2. The capability of the self-monitoring (micro-switch and control units) to detect loss of redundancy of the stopping element shall be verified on a complete unintended car movement protection system of a lift.

6 Test results

The EU type-examination proofed that the braking device acting on the traction sheave, as part of the protection device against overspeed for the car moving in upwards direction and braking element against unintend-ed car movement complies for its intend-ed use with the requirements of the basis of examination.

6.1 Use as braking device – part of the protection device against overspeed for the car moving in upwards direction – permissible brake torque and maximum tripping speed

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Permissible brake torque when the braking devices act on the traction sheave while the car is moving upward and the maximum tripping speed of the overspeed governor of the lift.

Brake assembly drawing no. XF25561	Permissible brake torque [Nm]	Maximum tripping rotary speed [rpm]
XF2556121001	2 × 668 = 1336	223
XF2556116001	2 × 922 = 1844	251
XF2556116005	2 × 1000 = 2000	274

The maximum tripping speed of the overspeed governor of the lift must be calculated on the basis of the maximum tripping rotary speed of the traction sheave as outlined below taking into account the diameter of the traction-sheave and car suspension.

$$v = \frac{D_{TS} \times \pi \times n}{60 \times i}$$

v = Tripping speed(m/s)
D_{TS} = Diameter of the traction sheave from rope's centre to rope's centre (m)
π = 3.14
n = Rotary speed(rpm)
i = Ratio of the car suspension

6.2 Use as braking element – part of the protection device against unintended car movement (acting in up and down direction)– permissible brake torque, response time, maximum tripping speed and features

6.2.1 Nominal brake torque and response time with relation to a brand-new brake element

Brake assembly drawing no. XF25561	Nominal Brake torque * [Nm]	Maximum tripping rotary speed [rpm]	Maximum response time ** [ms]		
			t_{10}	t_{50}	t_{90}
XF2556121001	2 × 668 = 1336	223	163	246	329
XF2556116001	2 × 922 = 1844	251	94	116	137
XF2556116005	2 × 1000 = 2000	274	67	107	146

Interim values can be interpolated

Explanations:

*** Nominal brake torque:** Brake torque assured for installation operation by the safety component manufacturer.

**** Response time:** t_X time difference between the drop of the braking power until establishing X% of the nominal brake torque, t_{50} optionally calculated $t_{50} = (t_{10} + t_{90})/2$ or value taken from the examination recording

6.2.2 Assigned execution features

Type of powering / deactivation		Continuous current / continuous current end					
Brake control		Parallel					
Nominal air gap		0.25 - 0.35 mm					
Damping elements		Yes					
Brake assembly drawing no. XF25561	-	Without over-excitation					
	XF2556121001	Rated voltage	110 VDC	Rated current	2 × 1.33 A	Rated power	2 × 146 W
	XF2556116001	Rated voltage	110 VDC	Rated current	2 × 1.15 A	Rated power	2 × 127 W
	XF2556116005	Rated voltage	110 VDC	Rated current	2 × 1.15 A	Rated power	2 × 127 W

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7 Conditions

7.1 Above mentioned safety component represents only a part of the protection device against overspeed for the car moving in upwards direction and unintended car movement (acting in up and down direction), only in combination with a detecting and triggering component in accordance with the standard (two separate components also possible), which must be subjected to an own type-examination, can the system be created for fulfilling the requirements for a protection device.

7.2 The installer of a lift must create an examination instruction to fulfil the overall concept, add it to lift documentation and provide any necessary tools or measuring devices, which allow a safe examination (e.g. with closed shaft doors).

7.3 The single brakes have to be arranged symmetrically around the circumference of the brake disc (rotor, drum). In order to comply with the redundancy required in clause 5.6.6.2 of EN 81-20:2014, at least two braking circuits (single brake actuator) must be used.

7.4 The setting of the brake torque/force has to be secured against unauthorized adjustment (e. g. sealing lacquer).

7.5 Brake drum(rotor) and traction sheave is a fix screwed unit.

8 Notes

8.1 This report was issued according to the following standards:

- EN 81-20:2014, Clause 5.6.6.11 and 5.6.7.13
- EN 81-50:2014, Clause 5.7 and 5.8

In case of changes resp. amendments of the above-named standards resp. advancements of the state of the art, a revision of this EU-Type Examination Certificate will be necessary.

8.2 The test results refer only to the test sample.

8.3 This test report is based on the state of the art which is documented by the relevant valid harmonized standards. In case of changes of the harmonized standards or an improvement of the state of the art, there may be performed a review (eventually with assessment of the adapted compensatory measures) by the Notified Body.

8.4 In the scope of this EU-type examination, it was found out, that the brake device also functions as a brake for normal operation, is designed as a redundant system and therefore meets the requirements to be used also as a part of the protection device against overspeed for the car moving in upwards direction and as braking element as a part of the protection device against unintended car movement.

8.5 Checking whether the requirements as per clause 5.9.2.2 of EN 81-20:2014 have been complied with is not part of this EU-type examination

8.6 Other requirements of the standard, such as reduction of brake moment respectively braking force due to wear or operational caused changes of traction are not part of this EU-type examination.

Technical Approval granted

Manfred Negru

the expert

Zhiying Shen