

Test report for the determination of B_{10d} values for emergency stop button
Of LA42JZ-11 of Shanghai Tayee Electric Co.,Ltd.

Report-No.: 1140017841 001

Date: 2015-03-12

**Test report for the determination of B_{10d} values for emergency stop button
Of LA42JZ-11 of Shanghai Tayee Electric Co.,Ltd.**

Report-No.: 1140017841 001
Date: 2015-03-12

Customer/Manufacturer: Shanghai Tayee Electric Co., Ltd
No.181 Beimin Rd, Chidun Town, Songjiang District,
Shanghai

Customer/Order Ref/Order No.:

Test Institute: TÜV Rheinland (China) Ltd
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Beijing 100022,
P.R. China

TÜV Order No./Date: 1142004910 dated 2015-02-12

TÜV Certificate No./Date: 1140017841 dated 2015-02-13

Inspector: Yonglin Liu

Test Institute: 100 Test Institute

Test Duration: Jan 28th 2015 to Mar 12th 2015

The test results are only directly related to the test samples.

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Test Institute.

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Test object: Test report for the determination of B_{10d} values for emergency stop button of LA42JZ-11 of Shanghai Tayee Electric Co.,Ltd.

Customer/Manufacture: Shanghai Tayee Electric Co., Ltd
No.101 Beimin Rd,Chedun Town, Songjiang District,
Shanghai

Customer-Order-No./Date: -

Test Institute: TÜV Rheinland (China) Ltd.
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Ring Road, Chaoyang District
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TÜV-Offer-No./Date: 1142004610 dated 2015-02-12

TÜV-Order-No./Date: 1140017841 dated 2015-02-13

Inspector: Yonglin Liu

Test location: see Test Institute

Test duration: Jan.28th 2015 to Mar.12th 2015

The test results are exclusively related to the test samples.

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3. Identification of the test object

3.1. Description of the device under test

The device under test is an emergency stop button LA4232-C1 with twist-to-release action. The details are in detail described in the following table.

3.2. Documents

The following documents have been provided to the Test Institute:

| No. | Document-Title | Document-No. | Date |
|-----|---|---|------------|
| 001 | Product Description | User Manual for LA4232 emergency stop button with status indication.pdf | 2015-01-23 |
| 002 | Test plan for B _{10d} testing | Test plan for LA4232 emergency Stop button with status indication.doc | |
| 003 | Test report of LA4232-11 B _{10d} testing | LA4232-11 test report.pdf | |
| 004 | Reference of IEC 60947-5-5 | CarBlock for LA4232 emergency stop button with status indication.jpg | 2014-12-09 |

3.3. Test samples

No test samples were required for the inspection. The inspection was executed based on the technical drawing and documents provided by the manufacturer.

1. Scope

For the new emergency stop button LA42JZ-11 which includes one NC switch and one NO switch, Tayee Electric has performed tests in order to determine B_{10d} values for this product. This report only considers the NC switch. It shall be inspected whether the testing has been defined, performed and evaluated in accordance with the standards listed below as far as applicable.

2. Standards forming the basis for the requirements

[1] IEC 60947-5-5:1997+A1:2005

Low-voltage switchgear and controlgear
Part 5-5: Control circuit devices and switching elements
Electrical emergency stop device with mechanical latching function

[2] IEC 60947-4-1:2009, Annex K

Low-voltage switchgear and controlgear
Part 4-1: Contactors and motor-starters
Electromechanical contactors and motor-starters
Procedure to determine data for electromechanical contactors used in functional safety applications

[3] IEC 61649:2008

Weibull analysis

3. Identification of the test object

3.1. Description of the device under test

Emergency stop button LA42JZ-11 with twist-to-release action. The product is in detail described in [D1].

3.2. Documents

The following documents have been provided to the Test Institute.

| Documents Manufacturer | | | |
|------------------------|--|---|------------|
| No. | Documents | Document-No. | Date |
| [D1] | Product Description | User Manual for LA42JZ emergency stop button with status indication.pdf | 2015-01-23 |
| [D2] | Test Plan of B_{10d} Testing | Test plan for LA42JZ emergency Stop button with status indication.doc | - |
| [D3] | Test Report of LA42JZ-11 B_{10d} Testing | LA42JZ-11 test report.pdf | - |
| [D4] | Certificate of IEC 60947-5-5 | Certificate for LA42JZ emergency stop button with status indication.jpg | 2014-12-09 |

3.3. Test samples

No test samples were required for the inspection. The inspection was executed based on the information and documents provided by the manufacturer.

4. Tests and test results

4.1. General

The measuring and test equipment, which has been used by the TÜV Rheinland Group in the tests described in the following, is subject to regular inspection and calibration. Only devices with valid calibration have been used. The devices used in the various tests are recorded in the inspector's documentation.

All considerations concerning uncertainty of the measurements, so far applicable, are stated in the inspector's documentation, too.

In cases where tests have been executed in an external test lab or in the test lab of the manufacturer and where the results of these tests have been used within the here documented approval, this has occurred after a positive assessment of the external test lab and the achieved test results in detail according to the Quality Management procedure QMA 3.310.05.

4.2. Testing according to IEC 60947-5-5

The manufacturer has provided proof that the emergency stop device has been successfully tested by the manufacturer according to the applicable product standard IEC 60947-5-5, see [D4].

4.3. Testing for the determination of B_{10d} values

Tayee electric has defined a test method and a test set-up for the B_{10d} testing of representative variants of the emergency stop device LA42JZ-11(NC switch), see [D2]. The test method and test set-up have been agreed with the Test Institute based on the applicable requirements of the standards listed in chapter 2. The test method and test set-up are judged to be suitable for the B_{10d} testing.

Further Tayee electric has defined failure criteria and methods for the evaluation of the test results from the B_{10d} testing, see [D2]. The failure criteria and methods for the evaluation have been agreed with the Test Institute. The defined failure criteria and methods for the evaluation of the B_{10d} test results are judged to be suitable for the determination of B_{10d} values for the device under test in accordance with the applicable requirements of the standards listed in chapter 2.

The testing for the determination of B_{10d} values has been performed at the Tayee electric Laboratory. The test installation and the product confirmation after test has been inspected by the Test Institute. It was found that the laboratory is capable of performing the testing for the determination of B_{10d} values.

The detailed test results from the testing for the determination of B_{10d} values are documented in [D3]. The inspection of the test report showed that the testing has been performed properly in accordance with the applicable requirements of the standards listed in chapter 2. The test report is accepted by the Test Institute.

4.4. Results of the determination of B_{10d} values

The testing of the emergency stop button of LA42JZ-11(NC switch) has been performed with 21 samples. No failures have been recorded during the testing. As described in the test plan and agreed with the Test Institute the number of cycles where the testing has been truncated can be used as the B₁₀ value for the device. Therefore a B₁₀ value of 100,000 cycles has been determined with an assigned confidence level of 90%.

The resulting B_{10d} has been calculated based on the assumption that 80% of all failures can be classified as safe failures and 20% of all failures can be classified as dangerous failures as per annex D of EN 62061:2005 for the NC switch.

The following table lists the resulting B_{10d} value for the emergency switch of LA42JZ-11(NC switch). The B_{10d} value has been determined with a confidence level of 90%. During the B_{10d} testing an electrical load of 7.14 mA provided by a 24 VDC power source was used.

| B _{10d} value for emergency stop LA42JZ-11(NC switch) | | | | |
|--|------|------------------------------------|-----------------|------------------|
| Product | Type | B _{10d} value [operating] | Load conditions | Confidence level |
| | | | | |

| | | cycles] | | |
|-----------|------------------|---------|-----------------|------|
| LA42JZ-11 | Twist to release | 500,000 | 7.14 mA, 24 VDC | 90 % |

Sample calculation of $MTTF_d$ and λ_d has been carried out based on Annex C of ISO 13849-1:2006.

Mean Time To Dangerous Failure: $MTTF_d = 13698$ y (Assume: $t_{cycle} = 1d$)

Dangerous failure rate: $\lambda_d = 7.3$ fit

Considering the worst case situation, the values of 365 for d_{op} and 24 for h_{op} are used.

For the values of $MTTF_d$ and λ_d , the end user shall re-calculate them based on the application using the following formula:

$$MTTF_d = B_{10d} / (0.1 * n_{op})$$

Where

$$n_{op} = d_{op} * h_{op} * 3600 / t_{cycle}$$

h_{op} is the mean operation, in hours per day;

d_{op} is the mean operation, in days per year;

t_{cycle} is the mean time between the beginning of two successive cycles of the component. (e.g. switching of a valve) in seconds per cycle.

5. Summary

The inspection of the test report for the determination of B_{10d} values of Tayee electric for the emergency stop button of LA42JZ-11(NC switch) came to the conclusion that the testing has been performed properly in accordance with the applicable requirements of the standards listed in chapter 2. Further the evaluation of the test results in order to determine B_{10d} values has also been performed in accordance with the standards listed in chapter 2.

The B_{10d} value of 500,000 cycles as listed in chapter 4.4 can therefore be used as the B_{10d} value for the emergency stop device of LA42JZ-11(NC switch).

Beijing, 2015-03-12

Report released after review:

Date: 2015-03-19

The inspector

Yonglin Liu

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