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Report about the inspection of test reports for the determination of B_{10d} values for emergency stop switches of families 800F, 800H, 800T and D7 of Rockwell Automation

Report-No.:	968/EL 660.01/10
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Test object:	Test reports for the determination of B_{10d} values for emergency stop switches of families 800F, 800H, 800T and D7 of Rockwell Automation
Customer:	TÜV Rheinland (China) Ltd. Unit 707, AVIC Bldg., No.10B, Central Road East 3rd Ring Road, Chaoyang District Beijing 100022 P.R. China
Manufacturer:	Rockwell Automation Manufacturing (Shanghai) Ltd. Hongye Building, 1801 Hongmei Road Shanghai 200233 P.R. China
Order-No./Date:	1143001024 dated 2009-05-06
Test Institute:	TÜV Rheinland Industrie Service GmbH Automation, Software and Information Technology (ASI) Am Grauen Stein 51105 Köln Germany
Department:	Automation, Software and Information Technology (ASI)
TÜV-Offer-No./Date:	968/141/09 dated 2009-04-07
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Inspector:	Dr. Peter Kocybik
Test location:	see Test Institute
Test duration:	May 2009 to June 2010

The test results are exclusively related to the test samples.

1. Scope

For the existing families of emergency stop switches 800F, 800H, 800T and D7 Rockwell Automation has performed tests in order to determine B_{10d} values for these switch families. 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 60947-5-5:2005 Edition 1.1
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 devices under test

Emergency stop switch families 800F, 800H, 800T and D7 with push-to-release or twist-to-release action. The switches are 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	a116-ca911_-en-p.pdf	2009-03-02
[D2]	Test Plan B_{10d} Testing	Product Functional Safety test plan, version 1.8	2009-11-20
[D3]	Test Report 800F B_{10d} Testing	800F E-stop Mechanical Durability Test Report, version 1.9a	2009-11-25
[D4]	Test Report 800H B_{10d} Testing	800H E-stop Mechanical Durability Test Report, version 1.7	2009-11-20
[D5]	Test Report 800T B_{10d} Testing	800T E-stop Mechanical Durability Test Report, version 1.8	2009-11-20
[D6]	Test certificate IEC 60947-5-5 800H and 800T	DEMKO 99-04272	1999-12-16
[D7]	Test report IEC 60947-5-5 800F	PBS 2009-09-15-01	2009-09-17
[D8]	Test report IEC 60947-5-5 800FD	PBS 2009-09-15-02	2009-09-17
[D9]	Cross Reference List 800F – D7	B10d Conversion between 800F and D7	2010-05-31
[D10]	Test Report 800T B_{10d} Testing	800T E-stop 2nd Mechanical Durability Test Report, version 1.1	2010-06-02

The following document has been prepared by the Test Institute.

Documents Test Institute			
No.	**Documents**	**Document-No.**	**Date**
[T1]	Audit Report Test Laboratory Rockwell Shanghai	18000118001	2009-06-03
[T2]	Validation Test Results 800F, 800H and 800T	Validation_Results_800F_H_T_ 25_11_2009.xls	2009-11-25

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.

3.4. Previous test reports

[R1] Report about the inspection of test reports for the determination of B10d values for emergency switches of families 800F, 800H and 800T of Rockwell Automation

Report-No.: 968/EL 660.01/10 dated 2009-11-26

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 switches have been tested according to the applicable product standard IEC 60947-5-5 in the past. The switch families 800H and 800T have been tested with positive results by the Test Institute DEMKO, see [D6]. The variants of the switch family 800F have been tested with positive results by Rockwell Automation, see [D7] and [D8].

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

Rockwell Automation has defined a test method and a number of test set-ups for the B_{10d} testing of the different variants of the emergency stop switch families, see [D2]. The test method and test set-ups 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-ups are judged to be suitable for the B_{10d} testing.

Further Rockwell Automation 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 devices 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 Rockwell Shanghai Laboratory. The laboratory has been inspected by the Test Institute, see [T1]. It was found that the laboratory is organised according to the requirements defined in ISO/IEC 17025 and 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], [D4] and [D5]. The manufacturer performed a re-testing for the 800T family of switches with a higher number of test samples, see [D10]. The inspection of the test reports showed that the testing has been performed properly in accordance with the applicable requirements of the standards listed in chapter 2. The test reports are accepted by the Test Institute.

4.4. Cross reference for D7 family

The 800F family of switches is additionally sold under the brand name D7. Rockwell Automation has provided a cross reference list [D9] which shows the relation between the devices of the 800F and D7 families. As these devices are technically identical it is possible to transfer the results from the testing of the 800F family switches to the D7 family switches.

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

Based on the documented test results, see [D3], [D4], [D5] and [D10], the Test Institute has made calculations in order to determine the resulting B_{10d} values for the devices under test, see [T2]. The results from these calculations have been compared to the calculation results derived by Rockwell Automation as documented in the test reports. No significant deviations have been found.

The following table lists the resulting B_{10d} values for the different variants of the emergency stop switch families 800F, 800H, 800T and D7. The B_{10d} values have been determined with a confidence level of 90 %. During the B_{10d} testing an electrical load of 20 mA provided by a 24 VDC power source was used.

B_{10d} values for emergency stop families 800F, 800H, 800T and D7				
Family	**Type**	**B_{10d} value [operating cycles]**	**Load conditions**	**Confidence level**
800F	FD-MT44, twist to release	138,000	20 mA, 24 VDC	90 %
800F	FD-MT44, push to release	111,000	20 mA, 24 VDC	90 %
800F	FP-MT44, twist to release	736,000	20 mA, 24 VDC	90 %
800F	FP-LMT44, twist to release	206,000	20 mA, 24 VDC	90 %
800F	FP-MK44, twist to release	2,010,000	20 mA, 24 VDC	90 %
800F	FP-LMP44, push to release	243,000	20 mA, 24 VDC	90 %
800H	twist to release	1,829,000	20 mA, 24 VDC	90 %
800H	push to release	1,907,000	20 mA, 24 VDC	90 %

B_{10d} values for emergency stop families 800F, 800H, 800T and D7				
Family	**Type**	**B_{10d} value [operating cycles]**	**Load conditions**	**Confidence level**
800T	twist to release	2,500,000	20 mA, 24 VDC	90 %
800T	push to release	1,952,000	20 mA, 24 VDC	90 %
D7	D-MT44, twist to release	138,000	20 mA, 24 VDC	90 %
D7	D-MT44, push to release	111,000	20 mA, 24 VDC	90 %
D7	P-MT44, twist to release	736,000	20 mA, 24 VDC	90 %
D7	P-LMT44, twist to release	206,000	20 mA, 24 VDC	90 %
D7	P-MK44, twist to release	2,010,000	20 mA, 24 VDC	90 %
D7	P-LMP44, push to release	243,000	20 mA, 24 VDC	90 %

5. Summary

The inspection of the test reports for the determination of B_{10d} values of Rockwell Automation for the emergency stop families 800F, 800H, 800T and D7 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} values listed in chapter 4.5 can therefore be used as B_{10d} values for the emergency stop devices of families 800F, 800H, 800T and D7.

Cologne, 2010-06-08
TIS/ASI/Kst. 968 ko-ta

The inspector

Dr. Peter Kocybik

Report released after review:
Date: 2010-06-08

Dr. Thorsten Gantevoort