

**Report on the update of the type approval of the safety function "Safe Torque Off"
within the Frequency AC Drive PowerFlex 700H**

Report-No.: 968/EZ 353.01/10

Date: 2010-05-10

Pages: 4

Test object: Safety Function "Safe Torque Off"
within the Frequency AC Drive PowerFlex 700H
Frame 9, 10, 11, 12, 13, 14
400 V, 480 V, 600 V, 690 V

Customer: Rockwell Automation
6400 West Enterprise Drive
Mequon, WI 53092
United States of America

Manufacturer: Vacon PLC
Runsorintie 7
P.O. Box 26
65381 Vaasa
Finland

Order-No./Date: email (approval form) dated 2009-01-19

Test Institute: TÜV Rheinland Industrie Service GmbH
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Department: Automation, Software and Information Technology (ASI)

TÜV-Offer-No./Date: 968/448/08 dated 2008-12-12

TÜV-Order-No./Date: 10138681-90 dated 2009-01-19

Inspector: Dipl.-Ing. Thomas Steffens

Test location: see Test Institute

Test duration: May 2010

The test results are exclusively related to the test samples.

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1. **Scope**

The already type approved safety function "Safe Torque Off" (STO according to EN 61800-5-2) within the Frequency AC Drive PowerFlex 700H shall be assessed according to the latest applicable standards.

In this context the safety parameters according to EN ISO 13849-1, EN 61800-5-2, IEC 61508 and EN 62061 shall be determined.

2. **Standards forming the basis for the requirements**

- [N1]** EN 61800-5-2:2007
Adjustable speed electrical power drive systems
Part 5-2: Safety requirements-Functional
- [N2]** EN 61800-5-1:2007
Adjustable speed electrical power drive systems
Part 5-1: Safety Requirements - Electrical, thermal and energy
- [N3]** EN 61800-3:2004
Adjustable speed electrical power drive systems -
Part 3: EMC product standard including specific test methods
- [N4]** EN ISO 13849-1:2008, AC:2009
Safety of machinery - Safety-related parts of control systems
Part 1: General principles for design
- [N5]** EN 62061:2005
Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
- [N6]** IEC 61508 Part 1-7:1998 and 2000
Functional safety of electrical/electronic/programmable electronic safety-related systems
- [N7]** EN 60204-1:2006, A1:2009 (in extracts)
Safety of machinery - Electrical equipment of machines
Part 1: General requirements

3. **Identification of the test object**

3.1 **Technical data**

The device under test is described in detail in documents which have been provided for the type approval (Report-No.: 968/EZ 353.00/09 dated 2009-03-05).

The types which are covered by this report are listed in the document "Cross reference list "700h_nxp_nxc_xref.xls"

3.2 **Documents**

- Excel file for the determination of safety parameters, Copy of PF700H_FMEA_for_stf 2010-04-22.xls
- Schematic "Schem 00328h_Confidential_stf.pdf", Revision H, 2004-04-16, 2 pages
- Schematic "Schem 00661c2 NXP CONFIDENTIAL_stf.pdf", Revision C2, 7 pages
- User manual "Kopie von PF700H User Man Markup.pdf"
- EMC test report "Kopie von Rockwell 31029 C-837-pf700safeoff REPORT.pdf"
- Process description for the life cycle phase modification "Common Change procedure cp1_17.pdf"

3.3 Test sample, test set-up

The assessment according to the latest revision of the applicable standards has been performed based on the provided documents.

3.4 Previous test report

Report-No.: 968/EZ 353.00/009 dated 2009-03-05

4. Tests and test results

4.1 General

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 Determination of the safety parameters

The determination and calculation of the safety parameters is documented in the Excel file "Copy of PF700H_FMEA_for_stf 2010-04-22.xl". The safety parameters for SIL 2 according to IEC 61508 and PL d/ category 3 according to EN ISO 13849-1 are met.

The Proof test interval (PTI) is determined to 20 years. Within this time interval the values for PFD_{av} and PFH are as follow:

$$PFD_{av} = 1.52 * 10^{-3}$$

$$PFH = 1,7 * 10^{-8} \text{ 1/h (calculated according to IEC 61508)}$$

$$MTTF_D = \text{High (2172 years)}$$

$$DC_{av} = \text{low (66 \%)}$$

Following diagnostic coverage values have been assumed

- Safety Enable Inputs 1 and 2: DC = 60 % provided by the drive controller.
- AND gates and switch off circuitry within the ASIC are not tested (DC = 0 %)
- Power supplies (2.6 V, 3.3 V, 5 V): DC = 90 %; monitored for under- and over-voltage

4.3 Measures for the avoidance of faults according to IEC 61508

The EN 61800-5-2 requires the realization and the verification of measures for the fault avoidance over the whole life cycle process of the safety system, beginning with the specification and finishing with the decommissioning of the safety system.

Since many years the Test Institute accompanied Rockwell in several type approvals for functional safety. As a main topic of these type approvals always the measures for fault avoidance for the different life cycle phases have been inspected. The result of these inspections was that the measures for the fault avoidance, which have been carried out by Rockwell in the past, were sufficient to fulfil the requirements for SIL 3 according to the IEC 61508.

The items of a functional safety management are partly considered in the ISO 9001 certified quality management system. Moreover the development team for functional safety products have a high degree of qualification in functional safety and are partly trained by the Test Institute in different workshops.

Vacon PLC is also certified according ISO 9001 by SGS-FIMKO. The drive is being sold since several years and modifications for the brand labelled Drives are also under control of the modification procedure of Rockwell "Common Change procedure cp1_17.pdf". This procedure is applicable to fulfil the requirements for the avoidance of faults for SIL 2.

4.4 EMC/EMI contemplation

According to the standards for functional safety increased EMC levels have to applied. The EMC tests with increased EMC levels according to EN 62061 have been performed in laboratories of LS Research.

The documented test results have been provided to the Test Institute.

The results are accepted by the Test Institute.

5. Summary

The safety function "Safe Torque Off" of the frequency AC Drive Powerflex 700H complies with the requirements of the relevant standards (Cat. 3 / PL d acc. to EN ISO 13849-1, SIL CL 2 acc. to EN 62061 / IEC 61508 / EN 61800-5-2) and can be used in applications up to Cat. 3 / PL d acc. to EN ISO 13849-1 and SIL 2 acc. to EN 62061 / IEC 61508 / EN 61800-5-2.

The instructions of the associated Installation and Operating Manual shall be considered.

Cologne 2010-05-10
TIS/ASI/Kst. 968 stf-nie

Report released after review:
Date: 2010-05-10

The inspector



Dipl.-Ing. Thomas Steffens



Dipl.-Ing. Stephan Häb