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**TÜV Rheinland Group**

**Automation, Software and Information Technology**

**Report on the type approval of the safety function  
“Safe standstill” within the Frequency AC  
Drive PowerFlex 700L**

**Report-No.: 968/EZ 230.00/06  
Date: 2006-06-27**

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**Pages:** 7

**Test object:** Adjustable Frequency AC Drive PowerFlex 700L  
Frames 3A and 3B - 400 V, 480 V, 600 V, 690 V

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

**Manufacturer:** Rockwell Automation  
6400 West Enterprise Drive  
USA-Mequon, WI 53092  
United States of America

**Order-No./Date:** PO#TUV30103 dated 2005-12-01

**Test Institute:** TÜV Rheinland Industrie Service GmbH  
Automation, Software and Information Technology  
Competence Center Safeguards and Safety Components  
Am Grauen Stein  
D-51105 Köln

**TÜV-Offer-No./Date:** 968/43/05 dated 2005-02-23

**TÜV-Order-No./Date:** 9412250 dated 2005-12-14

**Inspector:** Dipl.-Ing. Thomas Steffens

**Test Locations:** See Test Institute

**Test period:** December 2005 until April 2006

The test results are exclusively related to the test samples.

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## 1. **Scope**

In this document the type approval of the safety function “Safe standstill” within the adjustable frequency AC Drive Powerflex 700L is documented and the results of the approval are revealed.

It shall be established that the safety function “Safe standstill” within the adjustable frequency AC Drive Powerflex 700L meets the functional and safety related requirements of the Safety category 3 according to EN 954-1.

## 2. **Standards as basis for the requirements and tests**

- [1] EN 954-1:1996  
Safety of machinery - Safety-related parts of control systems  
Part 1: General principles for design
- [2] EN ISO 13849-2:2003  
Safety of machinery - Safety-related parts of control systems -  
Part 2: Validation
- [3] EN 60204-1:1997  
Safety of machinery - Electrical equipment of machines  
Part 1: General requirements
- [4] EN 50178:1997  
Electronic equipment for the use in power installations
- [5] EN 61800-3:2004  
Adjustable speed electrical power drive systems -  
Part 3: EMC product standard including specific test methods

## 3. **Identification of the device under test**

### 3.1 **Technical data**

All technical data of the devices under test can be found in the belonging instruction sheets and the documents listed below.

### 3.2 **Documents**

- User Manual “Safe Off Option for PowerFlex 700S Phase II AC Drives and PowerFlex 700L Liquid-Cooled”, June 2006, 28 pages, Rockwell
- Declaration from Rockwell, 2006-06-01, 1 page
- Schematic “PHASE II ENCODER OPTION BOARD SCHEMATIC DIAGRAM PF 700S SERIES B”, 319830-2, Revision 03, 2004-04-16, 2 pages, Rockwell
- Schematic “SCH,PF700S,MAIN CNTRL BD”, 96419654, Revision A01, 07/2004, 46 pages, Rockwell
- SRS for PF700S Safe Off Control, 1122305, 2004-07-06, 5 pages, Rockwell
- Summary Report of TÜV Rheinland of North America (TRNA) No.: P30561162.001, dated 2006-05-01, 10 pages
- Summary of TRNA Report No.: 30571246.001 dated 2006-06-05, 43 pages

### 3.3 Test sample, test set-up

The realized safety function of the PF700L is technically identical to the already type approved safety function of the PF700S. Due to this fact a repetition of the practical fault insertion test has been judged as not required. The judgement of the realized safety function "Safe standstill" has been carried out based on the provided documents.

All other mentioned tests, carried out by Rockwell or by TRNA, were performed on representative models.

The test sample will be kept by Rockwell Automation.

## 4. Test 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 tolerance 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 Description and judgement of the safety structure

The frequency AC Drive PowerFlex 700L provides the safety function "Safe standstill". The safety function "Safe standstill" has to fulfil the requirements for safety category 3 according to EN 954-1, that means no single fault results in a lost of the safety function. For this safety function the power supply to the motor or driven machine must be safely interrupted. A monitoring of the standstill position is not required.

The safety function "Safe standstill" of the PF700L provides only a coast-to-stop capability. In application where coasting to a standstill may result in a hazard, additional protective measures, as the use of mechanical brackes, are required.

The safety structure of the safety function is technically identical to the already type approved safety function of the PF700S and is described in detail in the reports 968/EZ 189.00/05 and 968/EL 328.00/05.

With this described safety structure, the safety function "safe standstill" fulfils the requirements for safety category 3 according to EN 954-1.

### 4.2 Results of the functional and safety analyses

Due to the fact that the safety function "Safe standstill" of the PF700L is technically identical to the already type approved safety function of the PF700S the conditions for a safe use which have to be considered for the PF700S are also valid for the PF700L.

Therefore following conditions have to be considered:

- Both safety inputs have to be used independently to each other.
- Due to the fact that a short circuit between the external wiring of the safety inputs will not be revealed by the system. The wiring has to be performed in such a way, that a fault exclusion acc. to ISO 13849-2 for the failures “short-circuits” is allowed. This is possible for example, when the cable is protected against external damage by cable ducting or armouring.
- The correct function of the safety function has to be tested in a periodic maintenance interval. The time period of this interval depends on the safety analysis of the system where the PF700S is installed.
- The possibility of small movement of the motor resulting from simultaneous IGBT failures shall be taken into account during the hazard analysis of the application.
- Additional measures to keep the motor in the standstill position must be foreseen, if external forces may have an impact on the motor position.

The requirements for the safety function “Safe standstill” are fulfilled according to EN 954-1, category 3.

All required information for a safe use is content of the user manual.

#### **4.3 Electrical safety**

The TÜV Rheinland of North America (TRNA) has performed the electrical safety certification according to EU Low Voltage Directive (LVD) and to EN 50178. The results are documented in the summary report-no.: 30571246.001 dated 2006-06-05. They confirm, that the PF700L fulfils requirements according to the EU Low Voltage Directive (LVD) and to EN 50178.

The results are accepted by the Test Institute.

#### **4.4 Environmental tests**

The environmental tests according to EN 50178 have been carried out. The results of these tests are documented in the same summary report-no.: 30571246.001 dated 2006-06-05. They confirm, that the requirements according to EN 50178 are fulfilled.

The results are accepted by the Test Institute.

#### **4.5 EMC/EMI contemplation**

The EMC testing was performed on the PF700L at two test locations: Rockwell Automation, 6400 West Enterprise Drive, USA-Mequon WI, 53092 and LS Compliance Inc., W66 N220 Commerce Ct., Cedarburg WI 53012.

The EMC testing was performed for the following types of the PF700L drives:

Allen-Bradley Power Flex 700L 400v, 480v, 600v, 690v on Frames 3A & 3B

All EMC tests were witnessed by an inspector of TÜV Rheinland of North America.

The results of the EMC tests are documented in the summary report-no.: P30561162.001 dated 2006-05-01. They confirm, that the requirements for EMC according to EN 61800-3 are fulfilled.

The results are accepted by the Test Institute.

## 5. Summary

The type approval of the Frequency AC Drive Powerflex 700S, manufactured by Rockwell Automation, Inc., came to the result, that the requirements of the applicable standards, which are listed in clause 2, are met.

Furthermore the inspection of the safety function "Safe standstill" of the frequency AC Drive Powerflex 700L came to result, that the safety function fulfils the requirements for safety category 3 according to EN 954-1 under the following prerequisites:

- Both safety inputs have to be used independently to each other.
- Due to the fact that a short circuit between the external wiring of the safety inputs will not be revealed by the system. The wiring has to be performed in such a way, that a fault exclusion acc. to ISO 13849-2 for the failures "short-circuits" is allowed. This is possible for example, when the cable is protected against external damage by cable ducting or armouring.
- The correct function of the safety function has to be tested in a periodic maintenance interval. The time period of this interval depends on the safety analysis of the system where the PF700S is installed.
- The possibility of small movement of the motor resulting from simultaneous IGBT failures shall be taken into account during the hazard analysis of the application.
- Additional measures to keep the motor in the standstill position must be foreseen, if external forces may have an impact on the motor position.

The above listed conditions and the user manuals must be considered.

Cologne, 2006-06-27  
TIS/ASI/Kst 968 stf-la

The expert

A handwritten signature in blue ink that reads 'Steffens'.

Dipl.-Ing. Thomas Steffens