

Translation

Supplementary requirements for the testing and certification of proximity switches used for safety functions

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These principles will be revised and amended periodically in consideration of knowledge gained in the area of occupational safety and the state of technological progress. The most recent edition shall always be binding for the tests conducted by the testing and certification body of the committee for electrical engineering in DGUV TEST.

These Principles of testing serve as verification that the requirements of the German Product Safety Act (ProdSG) and, as such, the 1st and 9th provisions of the ProdSG in particular, have been complied with in conjunction with DIN EN 60947 5 3.

This is the English translation of the German test principle. The German original version is obligatory.

Changes with respect to Edition 2015-05:

- Section 4.1: Adaptation of the requirements related to legibility of inscriptions
- Section 4.1: Adaptation of the requirement related to legibility of inscriptions
- Section 4.4: Adaptation of the requirement related to mounting elements
- Section 4.7: Update to the German PAH test specifications, from AfPS GS 2014:01: PAK to AfPS GS 2019:01: PAK

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1 General

1.1 Scope

Proximity Devices with a Defined Behaviour under fault conditions (PDDB) must comply with the requirements and be subjected to the testing according to DIN EN 60947-5-3.

These Principles of testing supplement select requirements from DIN EN 60947-5-3.

1.2 Technical rules

The basis for these Principles of testing comprises:

With regard to undated references, the last edition of the referenced document applies (including all changes).

DIN EN ISO 14119:2014-03	Safety of machinery - Interlocking devices associated with separating protective devices Principles for design and selection
DIN EN 60947-1 VDE 0660 Part 100:2015-09	Low-voltage switchgear - Part 1: General rules
DIN EN 60947-5-1 VDE 0660 Part 200:2018-03	Low-voltage switchgear - Part 5-1: Control units and switching elements, Electromechanical control circuit devices
DIN EN 60947-5-2 VDE 0660 Part 208:2015-09	Low-voltage switchgear - Part 5-2: Control units and switching elements, Proximity switch
DIN EN 60947-5-3 VDE 0660 Part 214:2014-12	Low-voltage switchgear - Part 5-3: Control units and switching elements, Requirements for proximity devices with defined behavior under fault conditions (PDDB)
AfPS-GS-2019:01 PAK	Testing and assessment of Polycyclic Aromatic Hydro-carbons (PAH)

2 Terms

DIN EN 60947-5-3, Section 2 shall apply with the following amendments:

Bypassing

An operation, through which an interlocking device is rendered inoperative or is by-passed in such a manner that a machine can no longer be used as intended by its design, or only without its required safety features.

Bypassing by simple and predictable means

The bypassing of an interlocking device either manually or through the use of a readily available object.

Note 1 regarding the term:

This definition includes the removal of switches or actuators using tools required for the proper operation of a machine, or which are readily available (e.g. screwdriver, wrench, hexagonal spanner and pliers).

Note 2 regarding the term:

Objects readily available for alternative actuation include screws, needles and Sheet metal blanks, as well as everyday items, such as keys, coins, adhesive tape, packing twine and wire, spare keys for interlocking devices with key transfer systems and spare actuators.

3 Test documentation to be submitted

3.1 Technical documents

The information for the connecting and commissioning the proximity switch must be provided in the form of drawings, circuit diagrams, tables and user information. The following documents must be submitted for technical testing:

- All user information supplied with the device (Operating instructions, installation instructions, etc.)
- Sales literature (if available)
- Overview of the actuators deemed suitable for the proximity switch
- Block circuit diagram (if applicable)
- Electric circuit diagram
- Technical drawings

- Parts list(s)
- Printed circuit board layouts (if applicable)
- Description of the functional process (if necessary)
- Single fault analysis (e.g. FMEA)
- Fault combination analysis (e.g. FTA)
- Software documentation according to the applicable standard (if applicable)
- Maintenance procedures and setting instructions (if necessary)
- Description of fault characteristics (if necessary)
- Data sheets, test certificates, certificates for the proximity switch and/or the parts it comprises (if available)

The testing facility can request further documentation if deemed necessary.

3.2 Prototype

DIN EN 60947-5-8:-3, Section 8.3.1 applies.

The number of prototypes to be submitted will be determined by the testing facility.

In compliance with the testing sequence prescribed in DIN EN 60947-5-3, at least 5 prototypes must be made available.

If pre-assembled printed circuit boards are used, a set of bare circuit boards must also be made available.

4. Supplemental test requirements

4.1 Labels and markings

DIN EN 60947-5-3, Section 5.3 shall apply with the following amendments:

Each position switch must be labelled with the following discernible, clearly legible (e.g. minimum font height = 2 mm with good contrast) and durably marked inscriptions:

- Inscriptions required as a minimum on the enclosure:
- Manufacturer's/authorised representative's company name and complete address
- Designation of the safety component
- Design series or type designation
- CE-marking
- Year of manufacture.

The designation of the safety component must agree with the designation in the Operating instructions. If an abbreviation is not used as a designator, then „English“ should be used as the preferred language.

If sufficient space is not available for the markings, a tag can be attached to a component on the proximity switch with the manufacturer's complete address and the product designation.

The markings must be readable without removal of the product enclosure.

Test: Visual inspection, comparison with the technical documentation; check for completeness, correctness and consistency of information, measurement of font height, rubbing test (gently rub using two cotton cloths, one soaked in water and the other in a test fluid* for 15 s each).

The markings must still be clearly legible following the test. It must not be possible to easily remove the marking labels, nor should they be wrinkled or creased.

*The chemical product with the trade name “n-Hexan for analysis”, which fulfils the requirements for the test fluid defined in DIN EN 60335-1 and DIN EN 62368-1, should be used as test fluid.

4.2 Product information and user information

DIN EN 60947-5-3, Sections 5 and 7.4 shall apply with the following amendments:

4.2.1 The proximity must be accompanied by the information required for proper connection and commissioning.

Safety-related information must be provided in a language acceptable in the country, in which the proximity switch is to be installed. If the product information or the user information are not in the German language, a German translation must be provided. Testing will be conducted with reference to the German translation.

Furthermore, the product information and the user information must contain the following information, where applicable:

- a) Manufacturer's/authorised representative's company name and complete address
- b) Designation of the safety component (e.g. proximity switch)
- c) Rendering of the content found in the Declaration of Conformity (except for serial number and signature)
- d) Description of fault characteristics (if necessary)
- e) The code level (low, medium, high according to DIN EN ISO 14119) for coded interlocking devices

- f) Annotated reference, if applicable, to potential constraints on the scope of application, in particular with respect to the influences due to contamination (e.g. by swarf, dust, fluids).
- g) Annotated remark, clearly distinguished from other text passages, signifying that the installation and operation must particularly address the requirements of DIN EN 14119, Section 7 "Design for minimizing bypassing options for interlocking devices".
- h) Annotated remark that the Performance Level according to DIN EN 13849-1 can be reduced with series connected sensors due to decreased fault recognition.
- i) Provide notice to the user that the overall control concept, into which the proximity switch has been integrated, must be validated in accordance with DIN EN ISO 13849-2 or DIN EN 62061.
- j) Annotated remark, if applicable, that the proximity switch must not be used as a mechanical stop.
- k) If the proximity switch is suited for use as a mechanical stop according to manufacturer specifications: Specification of the resistance value against impact energy in J, or door mass and actuation speed, as well as specification of the maximum number of switching cycles (reduction of service life) as a function of impact energy (as a derating curve, if applicable).
- l) Scope of actuation system coverage
- m) Annotated remark that the availability of spare actuators makes it possible to easily bypass a safety device so, for this reason, the security of the spare actuators must be effectively monitored.

4.2.2 Proximity switches intended for safety functions must be designed in such a manner that the safety function cannot be defeated by simple and predictable means.

If a proximity switch is not coded, then safety instructions must be included in all product information related to selection and installation (e.g. Operating instructions, catalogues, installation instructions) in order to ensure that the switching state will not be influenced by intentional or unintentional external influences.

The "Safety instructions" section of the product information must include as a minimum:

- Notice that sensor installation must be done in such a manner that protection is warranted against
 - accidental actuation and
 - bypassing of the proximity switch by means of commonly available materials.
- Exemplary information for the appropriate installation of the sensor.

Test: Review of the technical documentation and comparison with the requirements; check for completeness, correctness and consistency of the information.

4.3 Sales literature

Sales literature, in which the proximity switch is described, must not contradict the Operating instructions with respect to safety aspects.

If performance characteristics are described in the sales literature, these must agree with the specifications in the Operating instructions

Test: Review of the documents submitted; check for correctness and consistency.

4.4 Mounting elements

It must not be possible to loosen proximity switch mounting elements by hand or with readily available objects.

This can be achieved, for example, through the use of one-way screws.

Test: Visual inspection of the mounting elements as delivered or review of the Operating instructions.

4.5 Testing in accordance with DIN EN 60947-5-3

DIN EN 60947-5-3, Section 8 shall apply with the following amendments:

Compliance with the requirements according to DIN EN ISO 13849-1 and/or DIN EN 62061 and/or DIN EN 61508 (depending on manufacturer specifications) is to be verified through testing and validation within the framework of prototype testing.

4.6 Impact energy

Note: This test must be performed only if the proximity switch is suitable for use as a mechanical stop according to manufacturer specifications.

The number of mechanical stops to be tested will be determined by manufacturer specifications.

Test: Testing must be performed on complete proximity switches in as-new condition with a mass and speed corresponding to the max. impact energy.

If the manufacturer specifies a max. mass and max. speed, then testing is to be performed using these values. The testing method is based up-on DIN EN 60947-5-1, Annexes C.1.2 and C.1.3.

Proper functioning of the proximity switch must still be warranted subsequent to loading.

4.7 External materials and properties

4.7.1 No materials containing substances harmful to health may be used on any part of the proximity switch that comes in regular contact with the operator's skin (e.g. door handles, knobs).

Test: Review of the safety data sheets for the materials used. Review of the information provided by the manufacturer regarding those component materials, which come in regular contact with the operator's skin and must not contain sub-stances harmful to health.

In order to check the amount of polycyclic aromatic hydrocarbon (PAH), use the procedure according to the German Product Safety Commission GS specification, AfPS GS 2019:01: PAK (or the valid version at the time of testing). The PAH value determined must not exceed the limit value as a function of contact duration.

4.7.2 Device components accessible by hand must not have any sharp corners, edges or abrasive surfaces that could cause injury. Corners and edges must be deburred, and surfaces must be smooth to the touch.

Test: Handling and visual inspection.