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Fire detection and fire alarm systems —

Part 17: Short-circuit isolators

Systèmes de détection d'incendie et d'alarme —

Partie 17: Isolateurs de court-circuit

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7240-17 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 3, *Fire detection and alarm systems*.

ISO 7240 consists of the following parts, under the general title *Fire detection and fire alarm systems*:

— *Part 1: General and definitions*

— *Part 2: Control and indicating equipment*

— *Part 4: Power supply equipment*

— *Part 5: Point-type heat detectors*

— *Part 6: Carbon monoxide fire detectors using electro-chemical cells*

— *Part 7: Point-type smoke detectors using scattered light, transmitted light or ionization*

— *Part 8: Carbon monoxide fire detectors using an electro-chemical cell in combination with a heat sensor*

— *Part 9: Test fires for fire detectors* [Technical Specification]

— *Part 10: Point-type flame detectors*

— *Part 11: Manual call points*

— *Part 12: Line type smoke detectors using a transmitted optical beam*

— *Part 13: Compatibility assessment of system components*

— *Part 14: Guidelines for drafting codes of practice for design, installation and use of fire detection and fire alarm systems in and around buildings* [Technical Report]

— *Part 15: Point type fire detectors using scattered light, transmitted light or ionization sensors in combination with a heat sensor*

— *Part 16: Sound system control and indicating equipment*

— *Part 17: Short-circuit isolators*

— *Part 18: Input/output devices*

— *Part 19: Design, installation, commissioning and service of sound systems for emergency purposes*

— *Part 20: Aspirating smoke detectors*

— *Part 21: Routing equipment*

— *Part 22: Smoke-detection equipment for ducts*

— *Part 24: Sound-system loudspeakers*

— *Part 25: Components using radio transmission paths*

— *Part 27: Point-type fire detectors using a scattered-light, transmitted-light or ionization smoke sensor, an electrochemical-cell carbon-monoxide sensor and a heat sensor*

— *Part 28: Fire protection control equipment*

A Part 3, dealing with audible alarm devices and a Part 23, dealing with visual alarm devices, are in preparation.

Introduction

This part of ISO 7240 is based on a European standard EN 54-17, prepared by the European Committee for Standardization CEN/TC 72 *"Fire detection and fire alarm systems"*.

The purpose of short-circuit isolators is to limit the consequences of low-parallel-resistance faults between the lines of a transmission path of a fire detection and alarm system. This is normally achieved by connecting the transmission path in a loop configuration, separating sections of the loop with short-circuit isolators and introducing a means of detecting the presence of a fault, if its consequences (e.g. reduction in the line voltage) jeopardizes the correct operation of components on the transmission path. The faulty section of the loop can then be switched out, between a pair of short-circuit isolators, allowing the rest of the loop to continue to function correctly.

It is recognized that it is not possible for this part of ISO 7240 to specify all of the requirements for the function of a short-circuit isolator in a system. The requirements for the functioning of a short-circuit isolator are dependent on the system operation, the other components associated with the transmission path (e.g. the control and indicating equipment and detectors) and the transmission path parameters (e.g. line impedance and line loads) and it is necessary that they be verified in a system test.

However, this part of ISO 7240 includes the following:

— a requirement for the manufacturer to provide all of the specifications for the short-circuit isolator required by system designers to use the device correctly, in accordance with the system requirements;

NOTE It is the responsibility of the system designer to ensure that only those short-circuit isolators having the necessary performance are chosen to meet the system design requirements.

— tests to verify that the short-circuit isolator functions in accordance with the manufacturer's specifications; and

— tests to verify the performance of the short-circuit isolator in environmental and electromagnetic compatibility (EMC) conditions.

Due to the many different concepts that can be used for the operation of short-circuit isolators, it is not possible to define a precise functional test procedure applicable to all types. Instead, this part of ISO 7240 requires that a functional test procedure be developed to verify the manufacturer's specification and lists the most important points that it is necessary to verify. To assist in developing such test procedures, some example procedures are given in Annex A.

With respect to the foregoing, it is important that, in addition to meeting the requirements of this part of ISO 7240, short-circuit isolators are shown to operate correctly within the types of systems with which they are intended for use.

Fire detection and fire alarm systems —

Part 17: Short-circuit isolators

1 Scope

This part of ISO 7240 specifies requirements, test methods and performance criteria for short-circuit isolators, for use in fire detection and alarm systems for buildings; see ISO 7240-1.

Means of isolation or protection incorporated within control and indicating equipment in ISO 7240-1:2005, Figure 1, item B, are not covered by this part of ISO 7240.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 209, *Aluminium and aluminium alloys — Chemical composition*

ISO 7240-1:2005, *Fire detection and alarm systems — Part 1: General and definitions*

IEC 60068-1, *Environmental testing — Part 1: General and guidance*

IEC 60068-2-1, *Environmental testing — Part 2-1: Tests — Test A: Cold*

IEC 60068-2-2, *Environmental testing — Part 2-2: Tests — Test B: Dry heat*

IEC 60068-2-6, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

IEC 60068-2-30, *Environmental testing — Part 2-30: Tests — Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-42, *Environmental testing — Part 2-42: Tests — Test Kc: Sulphur dioxide test for contacts and connections*

IEC 60068-2-78, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state*

EN 50130-4:1995, *Alarm systems — Part 4: Electromagnetic compatibility — Product family standard: Immunity requirements for components of fire, intruder and social alarm systems*

3 Terms and definitions

For the purposes of this document, the terms, definitions and symbols given in ISO 7240-1 and the following apply.

3.1
closed condition
condition of the short-circuit isolator that allows the normal signals and supply currents to pass through the short-circuit isolator, i.e. the correct condition for the short-circuit isolator when there is no short circuit

3.2
open condition
condition of the short-circuit isolator that prevents the passage of short-circuit currents through the short-circuit isolator, i.e. the correct condition for the short-circuit isolator when it is protecting part of a circuit from the effects of a short circuit

3.3
short-circuit isolator
device, which may be connected into a transmission path of a fire detection and fire alarm system, to limit the consequences of low-parallel-resistance faults between the lines of this transmission path

NOTE A short-circuit isolating device may be a physically separate device or it may be incorporated into another device apart from the control and indicating equipment, e.g. integrated into a smoke detector or detector base.

3.4
type A
device assessed for performance at (55 ± 2) °C

3.5
type B
device assessed for performance at (70 ± 2) °C

4 Requirements

4.1 Compliance

In order to comply with this part of ISO 7240, the short-circuit isolator shall meet the requirements of Clause 4, shall be verified by visual inspection or engineering assessment, shall be tested as described in Clause 5 and shall meet the requirements of the tests. However, for short-circuit isolating devices that are integrated into other devices already covered by an existing part of ISO 7240, the environmental conditioning shall be performed in accordance with that part of ISO 7240.

4.2 Integral status indication

If the short-circuit isolator incorporates an integral visual indication of its status, then this indication shall not be red.

4.3 Connection of ancillary devices

Where the short-circuit isolator provides for connections to ancillary devices (e.g. remote indicators), open- or short-circuit failures of these connections shall not prevent the correct operation of the short-circuit isolator.

4.4 Monitoring of detachable short-circuit isolators

If a short-circuit isolating device is detachable (i.e. it is attached to a mounting base), then a means shall be provided for a remote monitoring system (e.g. the control and indicating equipment) to detect the removal of the device from the base, in order to give a fault signal.

4.5 Manufacturer's adjustments

It shall not be possible to change the manufacturer's settings except by special means (e.g. the use of a special code or tool) or by breaking or removing a seal.

4.6 On-site adjustments

If there is provision for on-site adjustment of the short-circuit isolator, then for each setting the short-circuit isolator shall comply with the requirements of this part of ISO 7240. Access to the means of adjustment shall be possible only by the use of a code or special tool.

4.7 Marking

Each short-circuit isolator shall be clearly marked with the following information:

a) number of this part of ISO 7240 (i.e. ISO 7240-17);

b) name or trademark of the manufacturer or supplier;

c) model designation (type or number);

d) type A or type B as appropriate or the maximum operating temperature;

e) wiring terminal designations;

f) some mark(s) or code(s) (e.g. serial number or batch code), by which the manufacturer can identify, at least, the date or batch and place of manufacture and the version number(s) of any software contained within the short-circuit isolator.

For detachable short-circuit isolators, the detachable part shall be marked with a), b), c), d) and f), and the base shall be marked with, at least c) (i.e. its own model designation) and e).

Where any marking on the device uses symbols or abbreviations not in common use, these shall be explained in the data supplied with the device.

The marking shall be visible during installation of the short-circuit isolator and shall be accessible during maintenance.

The markings shall not be placed on screws or other easily removable parts.

4.8 Data

Short-circuit isolators shall either be supplied with sufficient technical, installation and maintenance data to enable their correct installation and operation or, if all of these data are not supplied with each isolator, reference to the appropriate data sheet shall be given on, or with, each short-circuit isolator.

To enable correct operation of the short-circuit isolators, these data should describe the requirements for the correct processing of the signals from the short-circuit isolator. This may be in the form of a full technical specification of these signals, a reference to the appropriate signalling protocol or a reference to suitable types of control and indicating equipment, etc.

At least the following data are required to conduct the tests specified in this part of ISO 7240:

a) maximum line voltage, V_{max};

b) minimum line voltage, V_{min}, i.e. without a short circuit or partial short circuit fault;

c) maximum rated continuous current with the switch closed, $I_{C\ max}$;

d) maximum rated switching current (e.g. under short circuit conditions), $I_{S\ max}$;

e) maximum leakage current, $I_{L\ max}$, with the switch open (isolated state);

f) maximum series impedance with the switch closed, $Z_{C\ max}$;

g) ranges of parameters for each stimulus that the manufacturer claims will cause the short-circuit isolator to change from the closed to the open condition;

h) ranges of parameters for each stimulus that the manufacturer claims will cause the short-circuit isolator to change from the open to the closed condition;

i) whether the device is type A or type B.

NOTE Additional information can be required, depending on the product design and function, to demonstrate conformity with the requirements of this part of ISO 7240.

4.9 Additional requirements for software controlled short-circuit isolators

4.9.1 General

For short-circuit isolators that rely on software control in order to fulfil the requirements of this part of ISO 7240, the requirements of 4.9.2, 4.9.3 and 4.9.4 shall be met.

4.9.2 Software documentation

4.9.2.1 The manufacturer shall submit documentation that gives an overview of the software design. This documentation shall be in sufficient detail for inspection of the design for compliance with this part of ISO 7240 and shall include at least the following:

a) functional description of the main program flow, e.g. as a flow diagram or structogram, including

- a brief description of the modules and the functions that they perform,
- the way in which the modules interact,
- the overall hierarchy of the program,
- the way in which the software interacts with the hardware of the short-circuit isolator,
- the way in which the modules are called, including any interrupt processing;

b) description of those areas of memory used for the various purposes, e.g. the program, site-specific data and running data;

c) designation by which the software and its version can be uniquely identified.

4.9.2.2 The manufacturer shall prepare and maintain detailed design documentation. This shall be available for inspection in a manner that respects the manufacturer's rights for confidentiality. It shall comprise at least the following:

a) overview of the whole system configuration, including all software and hardware components;

b) description of each part of the program, containing at least

   — the name of the part,

   — a description of the tasks performed,

   — a description of the interfaces, including the type of data transfer, the valid data range and the checking for valid data;

c) full source code listings, as hard copy or in machine-readable form (e.g. ASCII-code), including all global and local variables, constants and labels used and sufficient comment to recognize the program flow;

d) details of any software tools used in the design and implementation phase (CASE-Tools, Compilers, etc.).

This detailed design documentation may be reviewed at the manufacturer's premises.

4.9.3 Software design

In order to ensure the reliability of the device, the following requirements for software design apply.

a) The design of the interfaces for manually and automatically generated data shall not permit invalid data to cause error in the program operation.

b) The software shall be designed to avoid the occurrence of deadlock of the program flow.

4.9.4 Storage of programs and data

The program necessary to comply with this part of ISO 7240 and any preset data, such as the manufacturer's settings, shall be held in non-volatile memory. Writing to areas of memory containing this program and data shall be possible only by the use of some special tool or code and shall not be possible during normal operation of the device.

Site-specific data shall be held in memory that retains data for at least two weeks without external power to the device, unless provision is made for the automatic renewal of such data, following loss of power, within 1 h of power being restored.

5 Tests

5.1 General

5.1.1 Atmospheric conditions for tests

Unless otherwise stated in a test procedure, carry out the testing after the test specimen has been allowed to stabilize in the standard atmospheric conditions for testing as specified in IEC 60068-1 as follows.

— temperature: (15 to 35) °C;

— relative humidity: (25 to 75) %;

— air pressure: (86 to 106) kPa.

The temperature and humidity shall be substantially constant for each environmental test where the standard atmospheric conditions are applied.

5.1.2 Operating conditions for tests

If a test method requires that a specimen be operational, then the specimen shall be connected to suitable supply and monitoring equipment with characteristics as required by the manufacturer's data. Unless otherwise specified in the test method, the supply parameters applied to the specimen shall be set within the manufacturer's specified range(s) and shall remain substantially constant throughout the tests. The value chosen for each parameter shall normally be the nominal value or the mean of the specified range. The short-circuit isolator shall be set to the closed condition and the supply and monitoring equipment shall be able to detect if the isolator changes to the open condition.

The details of the supply and monitoring equipment used shall be given in the test report; see Clause 6.

5.1.3 Mounting arrangements

The specimen shall be mounted by its normal means of attachment in accordance with the manufacturer's instructions. If these instructions describe more than one method of mounting then the method considered to be most unfavourable shall be chosen for each test.

5.1.4 Tolerances

Unless otherwise stated, the tolerances for the environmental test parameters shall be as given in the basic reference standards for the test, e.g. the relevant part of IEC 60068.

If a requirement or test procedure does not specify a tolerance or deviation limits, then deviation limits of ± 5 % shall be applied.

5.1.5 Functional test

5.1.5.1 Object

To confirm the correct operation of the short-circuit isolators, in accordance with the manufacturer's specification, and to verify their stability after and, where required, during the environmental and EMC tests.

5.1.5.2 Test procedure

Verify that the short-circuit isolator operates within the manufacturer's specification. Verify at least the following for both the input to and output from specimen:

a) each stimulus that the manufacturer claims will cause the short-circuit isolator to change from the closed to the open condition;

b) that the short-circuit isolator can switch the maximum specified switching current, $I_{S\ max}$;

c) the open-condition (isolation) leakage current, I_L, when there is a direct short circuit on one side of the isolator;

d) each stimulus that the manufacturer claims will cause the short-circuit isolator to change from the open to the closed condition;

e) the closed-condition resistance, Z_C, at the maximum rated continuous current, $I_{C\ max}$, or, if Z_C cannot be measured at $I_{C\ max}$ because the isolator changes to the open condition before a current of $I_{C\ max}$ is reached, then it shall be measured just before the isolator changes to the open condition;

f) the response to a direct short-circuit applied to one side of the isolator.

Examples of functional tests are given in Annex A.