भारतीय मानक **IS/ISO 7240-2 : 2017**

Indian Standard

अग्नि संसूचन एवं संचेतक तंत्र

भाग 2 अग्नि संसूचक नियंत्रण एवं सूचक उपकरण

(पहला पुनरीक्षण)

Fire Detection and Alarm Systems

Part 2 Fire Detection Control and Indicating Equipment

(First Revision)

ICS 13.220.20

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NATIONAL FOREWORD

This Indian Standard (Part 2) (First Revision) which is identical to ISO 7240-2 : 2017 'Fire detection and alarm systems — Part 2: Fire detection control and indicating equipment' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Fire Fighting Sectional Committee and approval of the Civil Engineering Division Council.

This standard was first published in 2018 as IS/ISO 7240-2 : 2003. This revision has been undertaken to align it with the latest version of ISO 7240-2 to make pace with the latest international practices.

This standard is published in various parts. The other parts in this series are:

Part 3	Audible alarm devices
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	Point-type fire detectors using a carbon monoxide sensor in combination with a heat sensor
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 15	Point-type fire detectors using smoke heat sensors
Part 16	Sound system control and indicating equipment
Part 17	Transmission path isolators
Part 18	Input/output devices
Part 20	Aspirating smoke detectors
Part 21	Routing equipment
Part 22	Smoke-detection equipment for ducts
Part 23	Visual alarm devices
Part 24	Fire alarm loudspeakers
Part 25	Components using radio transmission paths
Part 27	Point-type fire detectors using a smoke sensor in combination with carbon monoxide sensor and, optionally, one or more heat sensors
Part 29	Video fire detectors
Part 31	Resettable line-type heat detectors

This standard is published on the basis of mandatory functions, which are to be provided on all control and indicating equipment, and optional functions (with requirements) which may be provided.

It is intended that the options be used for specific applications, as recommended in application guidelines. Each optional function is included as a separate entity, with its own set of associated requirements, in order to permit control and indicating equipment with many different combinations of functions to comply with this standard.

Other functions associated with fire detection and alarm may also be provided, even if not specified in this standard.

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions and terminologies are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'; and

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 7240-4 Fire detection and alarm systems — Part 4: Power supply equipment	IS/ISO 7240-4 : 2017 Fire detection and alarm systems: Part 4 Power supply equipment (*first revision*)	Identical
ISO 7240-14 Fire detection and alarm systems — Part 14: Design, installation, commissioning and service of fire detection and fire alarm systems in and around buildings	IS 2189 : 2008 Selection, installation and maintenance of automatic fire detection and alarm system — Code of practice (*fourth revision*)	Technically Equivalent
ISO 8201 Acoustics — Audible emergency evacuation signal	IS 13735 : 2023/ISO 8201 : 2017 Audible emergency evacuation signal — Requirements (*first revision*)	Identical
IEC 60068-1 Environmental testing — Part 1: General and guidance	IS/IEC 60068-1 : 2013 Environmental testing: Part 1 General and guidance	Identical
IEC 60068-2-1 Environmental testing — Part 2-1: Tests — Tests A: Cold	IS/IEC 60068-2-1 : 2007 Environmental testing: Part 2 Tests, Section 1 Test A: Cold	Identical
IEC 60068-2-6 Environmental testing — Part 2: Tests — Test Fc: Vibration (sinusoidal)	IS/IEC 60068-2-6 : 2007 Environmental testing: Part 2 Tests, Section 6 Test Fc: Vibration (sinusoidal)	Identical

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60068-2-47 Environmental testing — Part 2: Test methods — Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests	IS/IEC 60068-2-47 : 2005 Environmental testing: Part 2 Tests, Section 47 Mounting of specimens for vibration, impact and similar dynamic tests	Identical
IEC 60068-2-75 Environmental testing — Part 2-75: Tests — Test Eh: Hammer tests	IS 9000 (Part 7/Sec 7) : 2020/ IEC 60068-2-75 : 2014 Environmental testing: Part 7 Tests, Section 7 Test Eh: Hammer tests (*first revision*)	Identical
IEC 60068-2-78 Environmental testing — Part 2-78: Tests — Test cab: Damp heat, steady state	IS 9000 (Part 4) : 2020/ IEC 60068- 2-78 : 2012 Environmental testing: Part 4 Tests — Test cab: Damp heat, steady state (*second revision*)	Identical
IEC 60529 Degrees of protection provided by enclosures (IP code)	IS/IEC 60529 : 2001 Degrees of protection provided by enclosures (IP code)	Identical
IEC 60721-3-3 Classification of environmental conditions — Part 3-3: Classification of groups of environmental parameters and their severities — Stationary use at weather protected locations	IS/IEC 60721-3-3 : 2019 Classification of environmental conditions: Part 3 Classification of groups of environmental parameters and their severities, Section 3 Stationary use at weather protected locations	Identical

The Committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard:

International Standard	*Title*
ISO 7240-1: 2014	Fire detection and alarm systems — Part 1: General and definitions
IEC 62599-2	Alarm systems — Part 2: Electromagnetic compatibility — Immunity requirements for components of fire and security alarm systems

This standard also makes a reference to the BIS certification marking of the product, details of which are given in National Annex K.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Introduction

The fire detection control and indication function (ISO 7240-1:2014, Figure 1, item B), within a fire detection and alarm system (FDAS) installed in and around buildings, is provided by the fire detection control and indicating equipment (FDCIE).

FDCIE receives signals from the fire detection function (ISO 7240-1:2014, Figure 1, item A) and the manual initiating function (ISO 7240-1:2014, Figure 1, item D). FDCIE processes received signals and may indicate information at the FDCIE and/or send signals to other functions within the fire detection and alarm system. The signals are used to provide notification to building occupants and other parties responsible for building safety in accordance with the design objectives for the fire detection and alarm system (see also ISO 7240-14 or equivalent national design standard).

This document is drafted on the basis of mandatory functions, which are provided on all fire detection control and indicating equipment, and optional functions (with requirements) which may be provided. It is intended that the options be used for specific applications, and to meet the fire detection and alarm system design objectives. Each optional function is included as a separate entity, with its own set of associated requirements, in order to permit fire detection control and indicating equipment with many different combinations of functions to comply with this document.

Other functions associated with fire detection and fire alarm may also be provided, even if not specified in this document.

Indian Standard

FIRE DETECTION AND ALARM SYSTEMS

PART 2 FIRE DETECTION CONTROL AND INDICATING EQUPMENT

(First Revision)

1 Scope

This document specifies requirements, test methods and performance criteria for fire detection control and indicating equipment (FDCIE) for use in fire detection and fire alarm systems installed in buildings.

For the testing of other types of FDCIE, this document is intended to be used only for guidance. FDCIE with special characteristics, developed for specific risks, are not covered in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 7240-1:2014, *Fire detection and alarm systems — Part 1: General and definitions*

ISO 7240-4, *Fire detection and alarm systems — Part 4: Power supply equipment*

ISO 7240-14, *Fire detection and alarm systems — Part 14: Design, installation, commissioning and service of fire detection and fire alarm systems in and around buildings*

ISO 8201, *Acoustics — Audible emergency evacuation signal*

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

IEC 60068-2-1, *Environmental testing — Part 2: Tests. Tests A: cold*

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

IEC 60068-2-47, *Environmental testing — Part 2: Test methods — Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests*

IEC 60068-2-75, *Environmental testing — Part 2: Tests — Test Eh: Hammer tests*

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

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60721-3-3, *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities — Section 3: Stationary use and weather protected locations*

IEC 62599-2, *Alarm systems — Part 2: Electromagnetic compatibility — Immunity requirements for components of fire and security alarm systems*

3 Terms, definitions and abbreviated terms

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Terms and definitions

3.1.1
functional condition
condition characterized by its indication

Note 1 to entry: The functional conditions recognized in this document are the following:

— fire alarm condition, when a fire alarm is indicated;

— supervisory signal condition, when a supervisory signal is indicated;

— fault warning condition, when a fault is indicated;

— disabled condition, when the disablement of functions is indicated;

— test condition, when the testing of functions is indicated;

— quiescent condition, when FDCIE is powered by a power supply in accordance with ISO 7240-4 and no other functional condition is indicated.

3.2 Abbreviated terms

EMC electro-magnetic compatibility

IP ingress protection

PSE power supply equipment

4 Requirements

4.1 General

4.1.1 FDCIE shall have provision for grouping the signals from points to provide zonal indications.

4.1.2 The processing of signals shall give the highest priority to the indication of fire alarms.

4.1.3 FDCIE shall be capable of unambiguously indicating the following functional conditions, in accordance with 4.3 to 4.8:

— quiescent condition;

— fire alarm condition;

— fault warning condition;

— disablement condition, where the condition is provided;

— test condition, where the condition is provided;

— supervisory signal condition, where the condition is provided.

4.1.4 FDCIE shall be capable of being simultaneously in any combination of the following functional conditions:

— fire alarm condition;

— fault warning condition;

— disablement condition, where the condition is provided;

— test condition, where the condition is provided;

— supervisory signal condition, where the condition is provided.

4.2 Compliance

4.2.1 In order to comply with this document, FDCIE shall meet the following requirements.

a) Clause 4, which shall be verified by visual inspection or engineering assessment, shall be tested in accordance with Clause 5 and shall meet the requirements of the tests.

b) Clause 7 and 8, which shall be verified by visual inspection.

4.2.2 If an optional function with requirements is included in FDCIE, then all the corresponding requirements shall be met (see Annex A for a list of optional functions).

4.2.3 If functions other than those specified in this document are provided, they shall not jeopardize compliance with any requirement of this document.

4.3 Quiescent condition

Any kind of system information may be displayed during the quiescent condition. However, no indications shall be given which could be confused with indications used in the

— fire alarm condition,

— fault warning condition,

— disabled condition,

— test condition, or

— supervisory signal condition.

4.4 Fire alarm condition

4.4.1 Reception and processing of fire signals

4.4.1.1 FDCIE shall enter the fire alarm condition when signals are received which, after any necessary processing (see Annex B), are interpreted as a fire alarm.

4.4.1.2 FDCIE shall be capable of receiving, processing and indicating signals from fire detection zones. A signal from one fire detection zone shall not falsify the processing storing and/or indication of signals from other fire detection zones.

4.4.1.3 Except where 4.4.11 or 4.4.12 applies, the time taken by scanning, interrogation, or other processing of signals from fire detectors, in addition to that required to take the fire alarm decision, shall not delay the indication of the fire alarm condition, or of a new fire detection zone in alarm by more than 10 s.

4.4.1.4 FDCIE shall enter the fire alarm condition within 10 s of the activation of any manual call point.

4.4.1.5 The mandatory indications and/or outputs shall not be falsified by multiple fire signals received from the same or different detection circuits as a result of the simultaneous operation of two points, the operation of further points or both.

4.4.2 Indication of fire alarm condition

The fire alarm condition shall be indicated without prior manual intervention. The indication is established when all of the following are present:

a) a visible indication, by means of a separate red light-emitting indicator (the general fire alarm indicator);

b) a visible indication, as specified in 4.4.3, of the fire detection zones in alarm, which may be omitted for FDCIE capable of receiving signals from only one fire detection zone;

c) an audible indication, as specified in 4.4.4.

4.4.3 Indication of fire detection zones in alarm

4.4.3.1 The fire detection zones in alarm shall be visibly indicated by means of a separate red light-emitting indicator for each fire detection zone or an alphanumeric display or both (see also Annex C).

4.4.3.2 If the zonal indications are on an alphanumeric display, which because of its limited capacity cannot simultaneously indicate all the fire detection zones in alarm, at least the following shall be displayed:

a) the first fire detection zone in alarm, in a field at the top of the display;

b) additional fire detection zones in alarm, in another field;

c) the total number of fire detection zones in alarm;

d) fire detection zones in alarm not currently indicated, at access level 1 or 2. A single manual action shall be required to display each zonal information. Fields or the alarm window, may be temporarily suppressed to permit the display of additional fire detection zones in alarm; however, if there is no further manual intervention, the display shall meet the requirements of 4.4.3.2 a), 4.4.3.2 b) and 4.4.3.2 c) within 30 s of the suppression.

4.4.4 Audible indication

4.4.4.1 The audible indication shall be capable of being silenced at access level 1 or 2 by means of a separate manual control. This control shall only be used for silencing the audible indication, and may be the same as that used for silencing in the fault warning condition. Access level for the silence control may be configurable, see A.2. Which level is appropriate is be determined by the site requirements for management of the FDAS.

4.4.4.2 The audible indication shall not be silenced automatically.

4.4.4.3 Silencing the audible indication may be accompanied by changes in the visual indications of fire alarm (e.g. the indication of light emitting indicators may change from flashing to steady or the information given on the alphanumeric display may be updated), provided that the conditions are still indicated as required in this document.

4.4.4.4 The audible indication shall re-sound for each new fire detection zone in alarm. If the option in 4.4.8.1 d) 3) is provided, then a new alarm in the same detection zone shall also re-sound the audible indication.

4.4.5 Other indications during the fire alarm condition

4.4.5.1 If faults, disablements or tests are indicated by means of separate light-emitting indicators, and such indications are suppressed in the fire alarm condition, it shall be possible to reveal these by means of a manual operation at access level 1 or 2.

4.4.5.2 If the fire alarm indications are on an alphanumeric display, the following shall apply to the display of other information on the alphanumeric display.

a) Information not related to the fire alarm condition shall be suppressed unless the display has more than one window, one of which is exclusively reserved for fire alarm indications.

b) Suppressed indications of faults, disablements and optionally, test or supervisory modes, shall each be capable of being displayed at any time by manual operations at access level 1 or 2. These operations shall be different from, or additional to, that specified in 4.4.3.2 d) for displaying fire detection zones in alarm and shall display the suppressed indications independently of each other.

c) Fields or the alarm window, may be temporarily suppressed to permit the display of faults, disablements and optionally, test or supervisory modes, however, the display shall meet the requirements of 4.4.3.2 a), 4.4.3.2 b) and 4.4.3.2 c) within 30 s of the suppression.

4.4.6 Reset from fire alarm condition

4.4.6.1 FDCIE shall be reset from the fire alarm condition at access level 2, by means of a separate manual control, or as specified in 4.6.1.5 or 4.9 (if provided). This control shall be used only for reset and may be the same as that used for reset from the fault warning condition.

4.4.6.2 Following a reset operation, the correct functional conditions, corresponding to any received signals, shall either remain, or be re-established within 60 s. Reset shall either be completed within 20 s following the manual operation, or where a reset cannot be completed in 20 s, it shall be indicated within 20 s that the reset process is running.

4.4.7 Output of fire alarm condition

4.4.7.1 At least one output that signals the fire alarm condition shall be provided, which may be an output in accordance with 4.4.8, 4.4.9 or 4.4.10.

4.4.7.2 Except where 4.4.11 or 4.4.12 or both apply, FDCIE shall activate all mandatory outputs within 3 s of the indication of a fire alarm condition.

4.4.7.3 Except where 4.4.11 applies, FDCIE shall activate all mandatory outputs within 10 s of the activation of any manual call point.

4.4.8 Output to fire alarm signalling function — Optional function

4.4.8.1 FDCIE shall have provision for the automatic transmission of fire alarm signals to the fire alarm signalling function (see ISO 7240-1:2014, Figure 1, item C). In this case, the following shall apply.

a) It shall be possible to disable fire alarm signalling devices at access level 2.

b) Following disablement, it shall be possible to re-enable fire alarm signalling devices at access level 2.

c) It shall not be possible to automatically disable fire alarm signalling devices.

d) It shall be possible to configure automatic re-activation of fire alarm signalling devices to at least the following modes:

   1) no automatic re-activation;

   2) automatically re-activate on an alarm from another zone;

   3) automatically re-activate on an alarm from the same zone.

e) Activation of the output to C shall be indicated by means of a separate light emitting indicator, an alphanumeric display, or both. The indication shall be at least common for all such controls, and shall not be suppressed during the fire alarm condition.

4.4.8.2 Where the fire alarm signalling function is not controlled directly from FDCIE, signals may be transferred to the fire alarm control and indication function (see ISO 7240-1:2014, Figure 1, item M).

4.4.9 Control of fire alarm routing function — Optional function

4.4.9.1 Output to fire alarm routing function

FDCIE may have provision for the automatic transmission of fire alarm signals to the fire alarm routing function (see ISO 7240-1:2014, Figure 1, item E). The transmission of the signal may be indicated by means of a separate red light-emitting indicator or a field on the alphanumeric display or both. In this case, the indication shall remain until the fire alarm condition is reset.

4.4.9.2 Input from fire alarm routing function

Where the output specified in 4.4.9.1 is provided, FDCIE may have an input which is capable of receiving signals from the fire alarm routing function (see ISO 7240-1:2014). In this case, the reception of the signals shall be indicated by means of a separate red light-emitting indicator or a field on the alphanumeric display, or both. The light-emitting indicator may be used instead of the indicator specified in 4.4.9.1. The indication shall remain until the fire alarm condition is reset.

4.4.10 Output to fire protection control function — Optional function

4.4.10.1 Output type A

FDCIE may have provision for the transmission of fire alarm signals to the fire protection control function (see ISO 7240-1:2014, Figure 1, item G).

4.4.10.2 Output type B

FDCIE may have provision for the transmission of fire alarm signals to the fire protection control function (see ISO 7240-1:2014, Figure 1, item G). In this case, the transmission of the signal shall be indicated by means of a separate red light-emitting indicator or a field on the alphanumeric display or both. The indication shall be at least common to all such function, and shall not be suppressed during the fire alarm condition.

4.4.10.3 Output type C

4.4.10.3.1 FDCIE may have provision for the transmission of fire alarm signals to the fire protection control function (see ISO 7240-1:2014, Figure 1, item G). In this case, the reception of a confirmatory signal from such function shall be indicated by means of a separate red light-emitting indicator or a field on the alphanumeric display or both. The indication shall be at least common to all such functions, and shall not be suppressed during the fire alarm condition.

4.4.10.3.2 The indicator for type C may be the same indicator used for type B, provided that the indication status is clearly discernible (e.g. the use of a flashing indication for type B and a steady-state indication for type C).

4.4.11 Delays to outputs — Optional function

4.4.11.1 Configuration of delays

FDCIE may have provision to delay the activation of outputs to the fire alarm signalling function (see ISO 7240-1:2014, Figure 1, item C) or to fire alarm routing function (see ISO 7240-1:2014, Figure 1, item E) or to the fire protection control function (see ISO 7240-1:2014, Figure 1, item G), or all these (see Annex D). In these cases, at least the following shall apply.

a) The operation of delays to outputs to the fire alarm signalling function or outputs to the fire protection control function shall be selectable at access level 3 to apply to

   — fire detectors, and/or

   — manual call points, and/or

   — signals from individual fire detection zones.

b) The operation of delays to signals to fire alarm routing function shall be selectable at access level 3, to apply to

   — fire detectors, and/or

   — signals from individual fire detection zones.

c) The delay times shall be configurable at access level 3, in increments not exceeding 1 min, up to a maximum of 10 min.

d) It shall be possible to override the delays and immediately activate delayed outputs by means of a manual operation at access level 1 or by means of a signal from a manual call point.

e) The delay to one output signal shall not affect the activation of other outputs.

f) The activation of the delay shall be indicated by a separate yellow light-emitting indicator or a field on the alphanumeric display, or both.

4.4.11.2 Control of delay

If the configuration is according to 4.4.11.1, FDCIE may have provision to switch on and switch off the delayed operation of outputs. In this case, the following is applicable.

a) Provision may be made to switch on and switch off delays, by means of a manual operation at access level 2.

b) Provision may be made to automatically switch on and/or switch off delays by means of a programmable timer, which shall be configurable at access level 3.

c) A separate light-emitting indicator or a field on the alphanumeric display or both shall be visible when the delayed operation of outputs is switched on. The indication shall not be suppressed during the fire alarm condition.

4.4.12 Dependency on more than one alarm signal — Optional function

4.4.12.1 Type A dependency

Following the receipt of an initial alarm signal from a fire detector, the entry to the fire alarm condition may be inhibited until the receipt of a subsequent alarm signal from the same fire detector, or from a fire detector in the same fire detection zone. In this case, the following shall apply.

a) The mode of operation shall be configurable at access level 3 for individual fire detection zones or individual detectors.

b) The initial alarm state need not be indicated.

c) It shall be possible to receive a subsequent alarm signal within 60 s of the receipt of the initial alarm signal.

d) The initial alarm state shall be automatically cancelled within 30 min of the receipt of the initial alarm signal.

e) Information on the values of the configured delay times shall be accessible at access level 2 or 3.

4.4.12.2 Type B dependency

Following the receipt of an initial alarm signal from a fire detector, the entry to the fire alarm condition may be inhibited until the receipt of a subsequent alarm signal from another fire detector, which may be in the same or a different fire detection zone. In this case, the following shall apply.

a) The mode of operation shall be configurable at access level 3 for individual fire detection zones or individual detectors.

b) The initial alarm state shall be indicated by means of

   — an audible indication, which may be the same as that in the fire alarm condition or fault warning condition, or

   — a visible indication of the affected fire detection zone, which may be the same as that for indication of the fire detection zone in alarm according to 4.4.3; the general fire alarm indicator shall not be illuminated.

c) It shall be possible to manually cancel the initial alarm state. This may be done with the same control used for reset from the fire alarm condition or fault warning condition.

d) FDCIE may have provision to automatically cancel the initial alarm state after a time interval, which shall not be less than 5 min.

e) If configured to accept a subsequent alarm signal from the same fire detector, the signal shall not be inhibited for more than 4 min following the receipt of the initial alarm signal.

4.4.12.3 Type C dependency

4.4.12.3.1 Following the receipt of an initial alarm signal from a fire detector or a manual call point, and until a subsequent signal is received from another fire detector or manual call point in the same or another fire detection zone, FDCIE shall enter the fire alarm condition but may have provision to inhibit the operation of outputs. In this case, it shall be possible to configure the mode of operation at access level 3 to apply individually to each of the following (where provided):

— output to the fire alarm signalling function (see ISO 7240-1:2014, Figure 1, item C), according to 4.4.8;

— output to the fire alarm routing function (see ISO 7240-1:2014, Figure 1, item E), according to 4.4.9;

— output to the fire protection control function (ISO 7240-1:2014, Figure 1, item G), according to 4.4.10.

4.4.12.3.2 The inhibition of one output signal shall not affect the activation of other outputs.

4.4.13 Alarm counter — Optional function

FDCIE may have provision to record and display the number of instances that FDCIE enters the fire alarm condition. In this case, at least the following shall apply.

a) Re-initialization of the counter shall be possible only at access level 4.

b) The information shall be available at access level 1 or 2.

c) The counter shall be capable of recording at least 999 instances.

d) In the event of a loss of the main and the stand-by power sources, the data shall be retained for at least 14 days.

4.4.14 Output of standard emergency evacuation signal — Optional function

FDCIE shall have provision for the output of a standard emergency evacuation signal in accordance with ISO 8201. The requirements of 4.4.8 shall apply.

4.5 Fault warning condition

4.5.1 Reception and processing of fault signals

4.5.1.1 FDCIE shall enter the fault warning condition when signals are received which, after any necessary processing, are interpreted as a fault (see also Annex E).

4.5.1.2 FDCIE shall be capable of simultaneously recognizing all of the faults specified in 4.5.2 and if provided, in 4.5.3, unless this is prevented by

— the presence of fire alarm signals from the same fire detection zone, and/or

— the disablement of the corresponding fire detection zone or function, and/or

— the testing of a corresponding fire detection zone or function,

— the activation of the output to a transmission path which is exclusively used to transmit signals to

  1) fire alarm signalling function (see ISO 7240-1:2014, Figure 1, item C), or

  2) fire alarm routing function (see ISO 7240-1:2014, Figure 1, item E), or

  3) fire protection control function (see ISO 7240-1:2014, Figure 1, item G), or

  4) fault warning routing function (see ISO 7240-1:2014, Figure 1, item J).

4.5.1.3 FDCIE shall enter the fault warning condition within 100 s of the occurrence of the fault or the reception of a fault signal, or as specified in 4.18.4.

4.5.2 Indication of faults

4.5.2.1 The presence of faults specified in 4.5.2.4, 4.5.2.5, 4.5.2.6 and 4.5.3 (if provided) shall be indicated without prior manual intervention. The fault warning condition is established when the following are present:

a) a visible indication by means of a separate yellow light-emitting indicator (the general fault warning indicator);

b) a visible indication for each recognized fault;

c) an audible indication, as specified in 4.5.6.

4.5.2.2 If the indication is by means of separate yellow light-emitting indicators, these may be the same as those used to indicate disablement and/or testing of the corresponding fire detection zones or functions.

4.5.2.3 If the indication is on an alphanumeric display, which cannot simultaneously indicate all of the faults, the following shall apply:

a) the presence of fault indications which have been suppressed shall be indicated;

b) suppressed fault indications shall be capable of being displayed by means of a manual operation at access level 1 or 2.

4.5.2.4 The following faults shall be indicated by means of separate yellow light-emitting indicators or an alphanumeric display or both. The indications may be suppressed during the fire alarm condition:

a) an indication for each fire detection zone in which the transmission of signals from a point to FDCIE is affected by

   — a short circuit in a detection circuit, unless the short circuit is reported as a fire alarm,

   — an interruption in a detection circuit,

   — the removal of a point;

b) an indication at least common to any power supply fault resulting from

   — a short circuit or an interruption in a transmission path to the power supply function (see ISO 7240-1:2014, Figure 1, item L), where the PSE is contained in a different cabinet from that of FDCIE,

   — power supply faults as specified in ISO 7240-4;

c) an indication at least common to any single earth fault which affects a mandatory function, and which is not otherwise indicated as a fault of a supervised function;

d) an indication as a fault of the supervised function of the rupture of any fuse, or the operation of any protective device which is capable of affecting a mandatory function in the fire alarm condition;

e) an indication of any short circuit or interruption, at least common to all transmission paths between parts of FDCIE contained in more than one cabinet, which is capable of affecting a mandatory function, and which is not otherwise indicated as a fault of a supervised function;

f) an indication of any short circuit or interruption, at least common to all transmission paths, which affects the transmission of a signal to, or reception of signals from, controls for fire protection control function (see ISO 7240-1:2014, Figure 1, item G);

g) an indication of any short circuit or interruption, at least common to all transmission paths, which affects the transmission of signals to fault warning routing function (see ISO 7240-1:2014, Figure 1, item J).

4.5.2.5 The following faults shall be indicated by means of separate yellow light-emitting indicators or an alphanumeric display or both. The indications shall not be suppressed during the fire alarm condition:

a) an indication of any short circuit or interruption, at least common to all transmission paths, which affects the transmission of signals to the fire alarm signalling function (see ISO 7240-1:2014, Figure 1, item C);

b) an indication of any short circuit or interruption, at least common to all transmission paths, which affects the transmission of signals to the fire alarm routing function (see ISO 7240-1:2014, Figure 1, item E).

4.5.2.6 The following faults shall be indicated at least by means of the general fault warning indicator:

a) any short circuit or interruption in a transmission path between parts of FDCIE contained in more than one mechanical cabinet, where the fault does not affect a mandatory function;

b) any short circuit or interruption in a detection circuit, where the fault does not prevent the transmission of signals to FDCIE.

4.5.3 Fault monitoring of fire protection control function — Optional function

FDCIE may have provision to receive fault warning signals from the fire protection control function (see ISO 7240-1:2014, Figure 1, item G). The signal shall be indicated by means of a separate yellow light-emitting indicator or a field on the alphanumeric display or both. The indication shall be at least common to all such function, and shall not be suppressed during the fire alarm condition. The indicator may be the same as that of 4.5.2.4 f).

4.5.4 Fault signals from points — Optional function

FDCIE may have provision for the reception, processing and indication of fault signals from points. In this case, faults shall be indicated at least as fire detection zone faults, as specified in 4.5.2.4 a).

4.5.5 Total loss of the power supply — Optional function

In the event of the loss of the main power source (in accordance with ISO 7240-4), FDCIE may recognize and indicate the depletion of the standby power source to a level where it may no longer be possible to fulfil mandatory functions of this document. In this case, an audible indication shall be given for at least 1 h.

4.5.6 System fault

A system fault is a fault as specified in 4.18.2 or 4.18.4 in the case of a software-controlled FDCIE. A system fault may prevent requirements of this document, other than those specified in this subclause and in 4.18.4, from being fulfilled. In the event of a system fault, at least the following shall apply.

a) A system fault shall be visibly indicated by means of the general fault warning indicator and a separate yellow light-emitting indicator. These indications shall not be suppressed by any other functional condition of FDCIE and shall remain until a manual reset and/or another manual operation at access level 2 or 3.

b) A system fault shall be audibly indicated. This indication may be capable of being silenced.

4.5.7 Audible indication

4.5.7.1 The audible indication of faults under 4.5.2 and 4.5.3 (if provided) shall be capable of being silenced manually at access level 1 or 2. The same manual operation may be used as that for silencing the fire alarm condition.

4.5.7.2 The audible indication shall be silenced automatically if FDCIE is automatically reset from the fault warning condition.

4.5.7.3 Silencing the audible indication may be accompanied by changes in the visual indications of fault signal, (e.g. the indication of light emitting indicators may change from flashing to steady or the

information given on the alphanumeric display may be updated) provided that the conditions are still indicated as required in this document.

4.5.7.4 If previously silenced, the audible indication shall re-sound for each newly recognized fault.

4.5.8 Reset of fault indications

4.5.8.1 Indications of faults specified in 4.5.2 and 4.5.3 (if provided) shall be capable of being reset

— automatically when faults are no longer recognized, and/or

— by a manual operation at access level 2, which may be the same as that used for resetting from the fire alarm condition.

4.5.8.2 Following a reset operation, the correct functional conditions, corresponding to any received signals, shall either remain or be re-established within 100 s. Reset shall either be completed within 20 s following the manual operation, or where a reset cannot be completed in 20 s, it shall be indicated within 20 s that the reset process is running.

4.5.9 Fault output

FDCIE shall have an output which signals the fault warning condition. This may be the output specified in 4.5.9. The output signal shall also be given if FDCIE is de-energized.

4.5.10 Output to fault warning routing function — Optional function

FDCIE may have provision for the transmission of fault signals to the fault warning routing function (see ISO 7240-1:2014, Figure 1, item J). This output shall signal all faults specified in 4.5. The output signal shall be given if FDCIE is de-energized. The signal shall be indicated by means of a separate yellow light-emitting indicator or a field on the alphanumeric display or both.

4.6 Disabled condition — Optional function

4.6.1 General

4.6.1.1 Disablements in accordance with 4.6.2 and 4.6.3 shall cause all corresponding mandatory indications or outputs or both to return to or remain in their quiescent condition, but shall not prevent other mandatory indications and/or outputs.

4.6.1.2 FDCIE shall have provision to independently disable and enable each of the functions specified in 4.6.2, by means of manual operations at access level 2.

4.6.1.3 FDCIE shall be in the disabled condition while a disablement in accordance with 4.6.2 or 4.6.3 or both exists.

4.6.1.4 Disablement and enablement shall not be affected by a reset from the fire alarm condition, or from the fault warning condition.

4.6.1.5 If a zone disablement operation is undertaken while the FDCIE is in fire alarm condition, the fire alarm condition in that zone shall be cancelled and the zone disabled. If that zone is the only zone in alarm, the fire alarm condition shall be automatically reset.

4.6.2 Disablements

4.6.2.1 The following shall be capable of being independently disabled and enabled, the indication of which may be suppressed during the fire alarm condition:

a) each fire detection zone;

b) output signals or transmission paths to controls for the fire protection control function (see ISO 7240-1:2014, Figure 1, item G), with manual controls and indication at least common for all equipment comprising the function;

c) output signals or transmission paths to fault warning routing function (see ISO 7240-1:2014, Figure 1, item J).

4.6.2.2 The following shall be capable of being independently disabled and enabled, the indication of which shall not be suppressed during the fire alarm condition:

a) output signals or transmission paths to the fire alarm signalling function (see ISO 7240-1:2014, Figure 1, item C), with the manual controls and indication at least common for all equipment comprising the function;

b) output signals or transmission paths to the fire alarm routing function (see ISO 7240-1:2014, Figure 1, item E).

4.6.3 Disablement and enablement of addressable points — Optional function

FDCIE shall have provision for disabling and enabling signals from addressable points by a manual operation at access level 2, either individually or in groups. In this case, at least the following shall apply:

a) it shall be possible to disable and enable each addressable point individually;

b) it shall be possible to identify all the disablements by manual interrogation at access level 1 or 2;

c) the disablement of addressable points shall not be indicated as fire detection zone disablements unless all the addressable points in the fire detection zones have been disabled;

d) if all addressable points in a fire detection zone are disabled, this shall be indicated as a fire detection zone disablement.

4.6.4 Indication of the disabled condition

4.6.4.1 Disablements shall either be indicated within 2 s of completion of the manual operation or where a disablement cannot be completed in 2 s, it shall be indicated within 2 s that the disablement process is running.

4.6.4.2 The disabled condition shall be indicated visibly, by means of the following:

a) a separate yellow light-emitting indicator (the general disablement indicator);

b) an indication for each disablement, in accordance with 4.6.2 and 4.6.3, which shall be indicated by means of separate yellow light-emitting indicators or an alphanumeric display or both.

4.6.4.3 The same yellow light-emitting indicator for each disablement may be used as that for the indication of the corresponding fault condition, although the indication shall be distinguishable.

4.6.4.4 The same yellow light-emitting indicator for each disablement may be used as that for the indication of a fire detection zone under test.

4.6.4.5 If the indication is on an alphanumeric display, which cannot simultaneously indicate all of the disablements because of its limited capacity, at least the following shall apply:

a) the presence of disablement indications which have been suppressed shall be indicated;

b) suppressed disablement indications shall be capable of being displayed, independently of other indications by means of a manual operation at access level 1 or 2.

4.7 Test condition — Optional function

4.7.1 General requirements

FDCIE may have provision for testing the processing and indication of fire alarm signals from fire detection zones. This may inhibit the requirements during the fire alarm condition which corresponds to that fire detection zone. In this case, at least the following shall apply:

a) FDCIE shall be in test condition while at least one fire detection zone is under test;

b) a test state shall only be entered and cancelled by a manual operation at access level 2 or 3;

c) it shall be possible to test the operation of each fire detection zone individually;

d) fire detection zones in the test state shall not prevent the mandatory indications and outputs from fire detection zones not in the test state;

e) signals from a fire detection zone under test shall not lead to the operation of the outputs to

- the fire alarm signalling function (see ISO 7240-1:2014, Figure 1, item C), except temporarily in order to test their functioning in relation to the corresponding fire detection zone;
- the fire alarm routing function (see ISO 7240-1:2014, Figure 1, item E);
- the fire protection control function (see ISO 7240-1:2014, Figure 1, item G);
- the fault warning routing function (see ISO 7240-1:2014, Figure 1, item J).

4.7.2 Indication of test condition

The test condition shall be indicated within 2 s of the completion of the manual operation, by means of the following:

a) a separate yellow light-emitting indicator (the general test indicator);

b) an indication for each fire detection zone, in accordance with 4.7.3.

4.7.3 Indication of fire detection zones in test state

Fire detection zones in the test condition shall be indicated by means of a separate yellow light-emitting indicator for each fire detection zone or an alphanumeric display or both. The same yellow light-emitting indicator and the same indication may be used to indicate a fire detection zone under test and a disabled fire detection zone. For indications on alphanumeric displays, at least the requirements of 4.6.4.5 shall apply.

4.8 Supervisory signal condition — Optional function

4.8.1 Reception and processing of supervisory signals

4.8.1.1 FDCIE shall enter the supervisory signal condition when signals are received which, after any necessary processing, are interpreted as an abnormal status (other than a fault) of equipment monitored

by FDCIE that could adversely affect the performance of other life, safety or property protection systems being monitored by FDCIE (see also Annex F).

4.8.1.2 FDCIE shall be capable of receiving, processing and indicating supervisory signals for which the manufacturer declares the equipment to be suitable, unless this is prevented by

— a fault in the same fire detection zone, and/or

— a disablement in the same fire detection zone, and/or

— a disablement of the transmission path from which signals originate, and/or

— a test of the same fire detection zone or function.

4.8.1.3 FDCIE shall enter the supervisory signal condition within 100 s of the occurrence of the supervisory signal.

4.8.2 Indication of the supervisory signal condition

The supervisory signal condition shall be indicated without prior manual intervention. The indication shall be established when the following are present:

— a visible indication by means of a separate yellow light-emitting indicator (the general supervisory signal indicator);

— a visible indication for each recognized signal, in accordance with 4.8.3;

— an audible indication in accordance with 4.8.4.

4.8.3 Indication of the supervisory signals from fire detection zones

4.8.3.1 The fire detection zones from which supervisory signals originate shall be visibly indicated by means of a separate yellow light-emitting indicator for each fire detection zone or an alphanumeric display or both.

4.8.3.2 If the indication is on an alphanumeric display which cannot simultaneously indicate all of the supervisory signals, the following shall apply.

a) If supervisory signal indications have been suppressed, this fact shall be indicated.

b) Suppressed supervisory signal indications shall be capable of being displayed by means of a manual operation at access level 1 or 2.

4.8.4 Audible indication

4.8.4.1 The audible indication shall be capable of being silenced by means of a separate manual control at access level 1 or 2. This control shall be used for silencing the audible indication and may be the same as that for silencing the fault warning condition.

4.8.4.2 The audible indication shall not be silenced automatically.

4.8.4.3 Silencing the audible indication may be accompanied by changes in the visual indications of supervisory signal, (e.g. the indication of light emitting indicators may change from flashing to steady or the information given on the alphanumeric display may be updated) provided that the conditions are still indicated as required in this document.

4.8.4.4 If previously silenced, the audible indication shall re-sound for supervisory signals from each new fire detection zone.

4.8.5 Reset of supervisory signal

4.8.5.1 FDCIE shall be capable of being reset from the supervisory signal condition. This shall only be possible by means of a separate manual control at access level 2. This control shall be used only for reset, but may be the same as that used for reset from the fire alarm condition or from the fault warning condition.

4.8.5.2 Following a reset operation, the correct conditions, corresponding to any received signals, shall remain or be re-established within 100 s. Reset shall either be completed within 20 s following the manual operation, or where a reset cannot be completed in 20 s, it shall be indicated within 20 s that the reset process is running.

4.8.6 Supervisory signal condition output

FDCIE shall have an output capable of signalling at least a common supervisory signal to the fault warning routing function (see ISO 7240-1:2014, Figure 1, item J).

4.9 Standardized input/output interface — Optional function

FDCIE may have provision for a standardized input/output interface, suitable for the transmission and reception of signals to and from ancillary equipment (e.g. a fire brigade panel) (see Annex G). In this case, at least the following shall apply.

a) The interface shall be capable of transmitting at least the occurrence of

   — the fire alarm condition,

   — each fire detection zone in alarm,

   — the transmission of output signals to fire alarm routing function (see ISO 7240-1:2014, Figure 1, item E),

   — the transmission of output signals to fire protection control function (see ISO 7240-1:2014, Figure 1, item G),

   — the fault warning condition,

   — each zone in fault,

   — the disablement and enablement of each zone,

   — the disablement and enablement of the output to the fire alarm signalling function (see ISO 7240-1:2014, Figure 1, item C),

   — the disablement and enablement of the output to fire alarm routing function (see ISO 7240-1:2014, Figure 1, item E), and

   — the disablement and enablement of output signals to the fire protection control function (see ISO 7240-1:2014, Figure 1, item G).

b) The interface shall be capable of receiving at least the following information and of activating the corresponding functions of FDCIE:

   — silencing of the audible indication;

   — the reset of the fire alarm condition;

— silencing and re-sounding of the fire alarm signalling function (see ISO 7240-1:2014, Figure 1, item C);

— the disablement and enablement of zones;

— the disablement and enablement of output signals to fire alarm signalling function (see ISO 7240-1:2014, Figure 1, item C);

— the disablement and enablement of output signals to the fire alarm routing function (see ISO 7240-1:2014, Figure 1, item E).

— the disablement and enablement of output signals to the fire protection control function (see ISO 7240-1:2014), Figure 1, item G.

4.10 Accessibility of indications and controls

4.10.1 Four access levels shall be provided on FDCIE, from access level 1 (most accessible) to access level 4 (least accessible) (see also Annex H). Allocation to an access level shall prevent access to an access level with a higher number, but allow access to an access level of a lower number. Manual controls and other functions shall be grouped on the appropriate access level according to this document.

4.10.2 All mandatory indications shall be visible at access level 1 without prior manual intervention (e.g. the need to open a door).

4.10.3 Manual controls at access level 1 shall be accessible without special procedures.

4.10.4 Indications and manual controls which are mandatory at access level 1 shall also be accessible at access level 2.

4.10.5 The entry to access level 2 shall be restricted by a special procedure.

4.10.6 The entry to access level 3 shall be restricted by a special procedure, differing from that for access level 2.

4.10.7 The entry to access level 4 shall be restricted by special means which are not part of FDCIE.

4.11 Visual indications

4.11.1 General

All mandatory indications shall be clearly identifiable, except where otherwise specified in this document.

4.11.2 Indications by means of light-emitting indicators

4.11.2.1 Mandatory indications from light-emitting indicators shall be visible in an ambient light intensity up to 500 lx, at any angle up to 22,5° from a line through the indicator perpendicular to its mounting surface:

— at 3 m distance for the general indications of functional condition;

— at 3 m distance for the indication of the supply of power;

— at 0,8 m distance for other indications.

4.11.2.2 If flashing indications are used, both the "on" period and the "off" period shall be ≥0,25 s, and the frequencies of flash shall not be less than

— 1 Hz for fire alarm indications;

— 0,2 Hz for fault indications.

4.11.2.3 If the same light-emitting indicators are used for the indication of specific faults, disablements and tests, fault indications shall be flashing and disablement or test indications shall be steady.

4.11.3 Indications on alphanumeric displays

4.11.3.1 Alphanumeric displays used for mandatory indications shall have at least one clearly distinguishable window, consisting of at least two clearly identifiable fields.

4.11.3.2 Where an alphanumeric display is used to display indications relating to different functional conditions, these may be displayed at the same time. However, for each functional condition there shall be only one window, in which all of the fields relating to that functional condition shall be grouped.

4.11.3.3 If not included in the displayed information, the purpose of each field shall be clearly labelled.

4.11.3.4 Where Romanized characters are used, a field shall be capable of containing at least the following:

a) at least 16 characters where the display of a fire alarm uses a cross-reference to other information to identify the location;

b) at least 40 characters, where the display is intended to include the complete information on the location of a fire alarm.

4.11.3.5 Where other characters are used, a field shall be capable of containing the following:

a) at least four characters where the display of a fire alarm uses a cross-reference to other information to identify the location;

b) at least eight characters, where the display is intended to include the complete information on the location of a fire alarm.

4.11.3.6 Mandatory indications on an alphanumeric display shall be legible for the lesser of 1 h or the duration of the standby power source, following the display of a new indication of fire or fault, at 0,8 m distance, in ambient light intensities from 5 lx to 500 lx, at any angle from the normal to the plane of the display up to:

— 22,5° when viewed from each side;

— 15° when viewed from above and below.

4.11.3.7 Following the lesser of 1 h or the duration of the standby power source, the indications shall be legible at 100 lx to 500 lx, at the above distance and angles. It shall be possible to re-establish the legibility at 5 lx to 500 lx by means of a manual operation at access level 1.

4.11.3.8 If an alphanumeric display consists of elements or segments, the failure of one of these shall not affect the interpretation of the displayed information.

4.11.3.9 The use of different colour is not necessary for indications on alphanumeric displays. However, if different colours are used for different indications, the colours used shall be in accordance with the relevant functional condition.

4.11.3.10 Indications in addition to those required for functional conditions and visible at access level 1 or 2 shall be clearly labelled and may be any colour except red, unless required by another part of ISO 7240.

4.12 Audible indications

4.12.1 Audible indicators shall be part of FDCIE. The same device may be used for fire alarm and fault warning indications. If they are different, the fire alarm indication shall have priority.

4.12.2 The minimum sound level at a distance of 1 m with any access door on FDCIE closed shall be either

— 60 dB (A-weighted) for fire alarm indications, and

— 50 dB (A-weighted) for fault warning indications.

or

— 85 dB (A-weighted) for fire alarm indications; and

— 70 dB (A-weighted) for fault warning indications.

NOTE The allowance for two sets of audible indications contemplates some FDCIE being installed in normally occupied areas (such as a security room).

4.12.3 The sound level shall be measured in anechoic conditions.

4.13 Additional indications

Where indications are used in addition to mandatory indications, these shall not result in contradiction or confusion.

4.14 Testing of indicators

All mandatory visible and audible indicators shall be testable by a manual operation at access level 1 or 2.

4.15 Power supply

4.15.1 A visible indication shall be given by means of a separate green light-emitting indicator while FDCIE is supplied with power.

4.15.2 Transitions between the main and the standby power sources shall not change any indications and/or the state of any outputs, except those relating to the power supplies.

4.15.3 If FDCIE has provision for disconnecting or adjusting the main or the standby power source, this shall only be possible at access level 3 or 4.

4.16 Mechanical

4.16.1 The cabinet of FDCIE shall be of robust construction, consistent with the method of installation recommended in the documentation. At access level 1 and 2, it shall meet at least Classification IP30 of IEC 60529.

4.16.2 FDCIE may be housed in more than one cabinet. If the documentation shows that the cabinets may be installed in locations distributed within the protected premises, then all of the mandatory manual controls and indicators shall be on one cabinet, or on cabinets declared to be only ones suitable for mounting adjacent to each other.

4.16.3 All mandatory manual controls and light-emitting indicators shall be clearly labelled to indicate their purpose. The information shall be legible at 0,8 m distance in an ambient light intensity from 100 lx to 500 lx.

4.16.4 The terminations for transmission paths and the fuses shall be clearly labelled.

4.17 Integrity of transmission paths

4.17.1 A fault in any transmission path between FDCIE and other components of the fire detection and alarm system (as defined in ISO 7240-1) shall not affect the correct functioning of FDCIE or of any other required transmission path (see also Annex I).

4.17.2 If the manufacturer's documentation shows that points which are installed on a detection circuit may be grouped in more than one fire detection zone, or may perform more than one function (see Annex I), then means shall be specified and provided which ensures that a short circuit or an interruption in the detection circuit does not affect more than one function in more than one fire detection zone for longer than 300 s following the occurrence of the fault.

4.17.3 If the manufacturer's documentation shows that a FDCIE contained in more than one cabinet may be installed in locations distributed within the protected premises, then means shall be specified and provided which ensure that a short circuit or an interruption in any transmission path between the cabinets does not affect more than one function (see Annex I) in more than one zone, for longer than 20 s following the occurrence of the fault.

4.17.4 Where FDCIE is designed to be used with a PSE contained in a separate cabinet remote from FDCIE, then an interface shall be provided for at least two transmission paths to the power supply, such that a short circuit or an interruption in one does not prevent the supply of power to FDCIE.

4.18 Software

4.18.1 General

FDCIE may contain elements which are controlled by software in order to fulfil requirements of this part of ISO 7240. In this case, FDCIE shall comply with the requirements of 4.18 where relevant to the technology used.

4.18.2 Program monitoring

4.18.2.1 The execution of the program shall be monitored to prevent the occurrence of a deadlock in the system (see also Annex J). The monitoring device shall signal a system fault if routines associated with the main functions of the program are not executed within a time limit of 100 s.

4.18.2.2 The functioning of the monitoring device and the signalling of a fault warning shall not be prevented by a failure in the execution of the program of the monitored system.

4.18.2.3 If an execution failure as in 4.18.2.1 is detected, FDCIE shall enter a safe state within 100 s. This safe state shall be defined by the manufacturer.

4.18.2.4 The monitoring device shall use the highest priority feature provided to enter the safe state of 4.18.2.3 (e.g. the highest priority non-maskable interrupt).

4.18.3 Storage of programs and data

4.18.3.1 All executable code and data necessary to comply with this document shall be held in memory which is capable of continuous, unmaintained, reliable operation for a period of at least 10 years (see also Annex J).

4.18.3.2 The program shall be held in non-volatile memory, which can only be written to at access level 4. Each memory device shall be identifiable such that its contents can be uniquely cross-referenced to the software documentation.

4.18.3.3 For site-specific data, the following requirements shall apply:

a) the alteration of site-specific data shall be possible only at access level 3 or 4;

b) the alteration of site-specific data shall not affect the structure of the program;

c) if stored in volatile memory, the site-specific data shall be protected against power loss by a back-up energy source which can only be separated from the memory at access level 4, and which is capable of maintaining the memory contents for at least 14 days;

d) if stored in read-write memory, there shall be a mechanism which prevents the memory being written-to during normal operation at access level 1 or 2, such that its contents are protected during a failure in program execution;

e) the site-specific data shall be given a version reference, which shall be updated when each set of alterations is carried out;

f) it shall be possible to identify the version reference of the site-specific data at access level 3.

4.18.4 Monitoring of memory contents

The contents of the memories containing the program and the site-specific data shall be automatically checked at intervals not exceeding 1 h. The checking device shall signal a system fault if a corruption of the memory contents is detected.

5 Tests

5.1 General

5.1.1 Standard atmospheric conditions for testing

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

Temperature: 15 °C to 35 °C

Relative humidity: 25 % to 75 %

Air pressure: 86 kPa to 106 kPa

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

5.1.2 Specimen configuration

5.1.2.1 The specimen configuration shall include at least one of each type of detection circuit, transmission path and internal circuits.

5.1.2.2 Unless designed only for one detection circuit, then it shall be provided with at least two detection circuits of each type.

5.1.2.3 The details of the FDCIE shall be given in the test report (see Clause 6).

5.1.3 Mounting and orientation

Unless otherwise stated in a test procedure, the specimen shall be mounted in its normal orientation by the normal means of mounting indicated by the manufacturer. The equipment shall be in the condition of access level 1, except where otherwise required for functional testing.

5.1.4 Electrical connection

5.1.4.1 If the test procedure requires the specimen to be in the operating condition, it shall be connected to PSE complying with ISO 7240-4.

5.1.4.2 Unless otherwise required, the power supply shall be in the nominal operating condition.

5.1.4.3 All detection circuits and transmission paths shall be connected to cables and equipment or to dummy loads. At least one of each type of detection circuit shall be maximum loaded, all within manufacturer's specification. Equipment other than FDCIE may be kept in the standard atmospheric condition during the tests.

5.1.5 Provision for tests

5.1.5.1 At least one FDCIE shall be provided for testing compliance with this document.

5.1.5.2 The specimen or specimens submitted shall be representative of the manufacturer's normal production and shall include the claimed options.

5.2 Functional test

5.2.1 Object of test

The object of the functional test is to demonstrate the operation of the equipment before, during and/or after the environmental conditioning.

5.2.2 Test schedule

5.2.2.1 A test schedule shall be prepared which ensures that during the functional test each type of input function and each type of output function is exercised.

5.2.2.2 This shall as a minimum include tests of the fire alarm condition, the fault warning condition and the disabled condition.

5.2.3 Fire alarm condition

5.2.3.1 Initiate and reset a fire alarm from at least two fire detection zones (unless only one fire detection zone is provided).

5.2.3.2 Check that the correct indications and the correct outputs to the fire alarm signalling devices, fire alarm routing equipment, and fire protection control equipment (if provided) are given.

5.2.4 Fault warning condition

5.2.4.1 Initiate and reset fault warnings corresponding at least to

— loss of one of the power sources,

— short circuit in a detection circuit,

— interruption in a detection circuit, and

— interruption in a transmission path to fire alarm device, fire alarm routing equipment, and fire protection control equipment, if provided.

5.2.4.2 Check that the correct indications and the output to fault warning routing equipment (if provided) are given.

5.2.5 Disabled condition

5.2.5.1 Disable and restore one fire detection zone.

5.2.5.2 Disable and restore one transmission path to a fire alarm device, fire alarm routing equipment, and fire protection control equipment, where provided.

5.2.5.3 Check that the operation of the disablement controls result in the correct indication on FDCIE, that only the relevant parts of the system are disabled and that on restoration of the disablements the function is restored.

5.2.6 Requirements

All mandatory functions and optional functions claimed by the manufacturer shall operate according to the requirements of this document.

5.3 Environmental tests

5.3.1 General

One, two or three specimens may be supplied for environmental testing. The tests to be applied are given in Table 1.

Table 1 — Environmental tests

Test	Operational or endurance	Subclause
Cold	Operational	5.4
Damp heat, steady-state	Operational	5.5
Impact	Operational	5.6
Vibration, sinusoidal	Operational	5.7

Table 1 *(continued)*

Test	Operational or endurance	Subclause
Electromagnetic compatibility (EMC) immunity test	Operational	5.8
Supply voltage variations	Operational	5.9
Damp heat, steady-state	Endurance	5.10
Vibration, sinusoidal	Endurance	5.11
Dry heat (Optional)	Operational	5.12

5.3.2 Tests for one specimen

If a single specimen is supplied for environmental testing, the specimen shall be subjected to all the operational tests, which may be carried out in any order. After the operational tests, the endurance tests shall be carried out on the same specimen in any order. Before and after each environmental test, a functional test shall be carried out.

NOTE The functional test after one environmental test can be taken as the functional test before the next environmental test.

5.3.3 Tests for two specimens

If two specimens are supplied for environmental testing, then the first test specimen shall be subjected to all the operational tests, which may be carried out in any order, followed by one of the endurance tests. The second specimen shall be subjected to the other endurance test. Before and after each environmental test, a functional test shall be carried out.

NOTE For the first specimen, the functional test after one environmental test can be taken as the functional test before the next environmental test.

5.3.4 Tests for three specimens

If three specimens are supplied for environmental testing, then one test specimen shall be subjected to all the operational tests, which may be carried out in any order. The second specimen shall be subjected to one of the endurance tests, and the third specimen shall be subjected to the other endurance test. Before and after each environmental test, a functional test shall be carried out.

NOTE For the first specimen, the functional test after one environmental test can be taken as the functional test before the next environmental test.

5.3.5 Requirements

5.3.5.1 During the tests given in 5.4 to 5.9, the specimen shall not change status in any of the functional conditions as specified in the corresponding clauses, except when such a change is required by the test procedure or when the change is a result of a functional test. However, in the tests of 5.8 and 5.9 visible and audible indications of purely transitory nature occurring during the application of the conditioning are allowed.

5.3.5.2 When subjected to the functional test, each specimen shall respond correctly (see 5.2).

5.4 Cold (operational)

5.4.1 Object of test

The object of the test is to demonstrate the ability of the equipment to function correctly at low ambient temperatures appropriate to the anticipated service environment.

5.4.2 Test procedure

5.4.2.1 General

Perform the test procedures with gradual changes in temperature according to IEC 60068-2-1. Use Test Ad for heat-dissipating specimens (in accordance with IEC 60068-2-1) and Test Ab for non-heat-dissipating specimens, and 5.4.2.2 to 5.4.2.6.

5.4.2.2 Initial examination

Before conditioning, subject the specimen to the functional test.

5.4.2.3 State of the specimen during conditioning

5.4.2.3.1 Mount the specimen in accordance with 5.1.3 and connect it to suitable power supply, monitoring and loading equipment (see 5.1.4).

5.4.2.3.2 Configure the specimen so it is in the quiescent condition.

5.4.2.4 Conditioning

Apply the following severity of conditioning.

Temperature: −5 °C ± 3 °C or other minimum rated temperature

Duration: 16 h

5.4.2.5 Measurements during conditioning

5.4.2.5.1 Monitor the specimen during the conditioning period to detect any change in status.

5.4.2.5.2 During the last hour of the conditioning period, subject the specimen to the functional test.

5.4.2.6 Final measurements

After the recovery period, subject the specimen to the functional test and inspect it visually for mechanical damage both externally and internally.

5.4.3 Requirements

5.4.3.1 All mandatory functions and optional functions claimed by the manufacturer shall operate according to the requirements of this document.

5.4.3.2 No mechanical damage shall be apparent on the specimen.

5.5 Damp heat, steady-state (operational)

5.5.1 Object of test

The object of the test is to demonstrate the ability of the equipment to function correctly at high relative humidity (without condensation) which may occur for short periods in the service environment.

5.5.2 Test procedure

5.5.2.1 General

Conduct the test procedure according to IEC 60068-2-78 and 5.5.2.2 to 5.5.2.6.

5.5.2.2 Initial examination

Before conditioning, subject the specimen to the functional test.

5.5.2.3 State of the specimen during conditioning

5.5.2.3.1 Mount the specimen in accordance with 5.1.3 and connect it to suitable power supply, monitoring and loading equipment (see 5.1.4).

5.5.2.3.2 Configure the specimen so it is in the quiescent condition.

5.5.2.4 Conditioning

5.5.2.4.1 Apply the following severity of conditioning.

Temperature: 40 °C ± 2 °C

Relative humidity: $93\,\%\ ^{+2}_{-3}\%$

Duration: 4 days

5.5.2.4.2 Precondition the specimen at the conditioning temperature (40 °C ± 2 °C) until temperature stability has been reached, in order to prevent the formation of water droplets on the specimen.

5.5.2.5 Measurements during conditioning

Monitor the specimen during the conditioning period to detect any change in status. During the last hour of the conditioning period, subject the specimen to the functional test.

5.5.2.6 Final measurements

After the recovery period, subject the specimen to the functional test and inspect it visually for mechanical damage both externally and internally.

5.5.3 Requirements

5.5.3.1 All mandatory functions and optional functions claimed by the manufacturer shall operate according to the requirements of this document.

5.5.3.2 No mechanical damage shall be apparent on the specimen.

5.6 Impact (operational) — Optional test

5.6.1 Object of test

The object of the test is to demonstrate the immunity of the equipment to mechanical impacts upon the surface, which it could sustain in the normal service environment and which it can reasonably be expected to withstand.

5.6.2 Test procedure

5.6.2.1 General

Use the test apparatus and perform the procedure in accordance with IEC 60068-2-75 and 5.6.2.2 to 5.6.2.6.

5.6.2.2 Initial examination

Before conditioning, subject the specimen to the functional test.

5.6.2.3 State of the specimen during conditioning

5.6.2.3.1 Mount the specimen in accordance with 5.1.3 and connect it to suitable power supply, monitoring and loading equipment (see 5.1.4).

5.6.2.3.2 Configure the specimen so it is in the quiescent condition.

5.6.2.4 Conditioning

5.6.2.4.1 Apply impacts to all surfaces of the specimen which are accessible at access level 1.

5.6.2.4.2 For all such surfaces, apply three blows to any point or points considered likely to cause damage to or impair the operation of the specimen.

5.6.2.4.3 Care should be taken to ensure that the results from a series of three blows do not influence subsequent series.

5.6.2.4.4 In case of doubt, disregard the defect and apply a further three blows to the same position on a new specimen.

5.6.2.4.5 Apply the following severity of conditioning.

Impact energy: 0,5 ± 0,04 J

Number of impacts per point: 3

5.6.2.5 Measurements during conditioning

Monitor the specimen during the conditioning periods to detect any changes in functional condition, and to ensure that the results of the three blows do not influence subsequent series.

5.6.2.6 Final measurements

After the conditioning, subject the specimen to the functional test and inspect it visually for mechanical damage both externally and internally.

5.6.3 Requirements

5.6.3.1 All mandatory functions and optional functions claimed by the manufacturer shall operate according to the requirements of this document.

5.6.3.2 No mechanical damage shall be apparent on the specimen.

5.7 Vibration, sinusoidal (operational) — Optional test

5.7.1 Object of test

The object of the test is to demonstrate the immunity of the equipment to vibrations at levels appropriate to the service environment.

5.7.2 Test procedure

5.7.2.1 General

5.7.2.1.1 Perform the test procedure according to IEC 60068-2-6 and 5.7.2.2 to 5.7.2.6.

5.7.2.1.2 The vibration operational test may be combined with the vibration endurance test, so that the specimen is subjected to the operational test conditioning followed by the endurance test conditioning in each axis.

5.7.2.2 Initial examination

Before conditioning, subject the specimen to the functional test.

5.7.2.3 State of specimen during conditioning

5.7.2.3.1 Mount the specimen in accordance with 5.1.3 and IEC 60068-2-47, and connect it to suitable power supply, monitoring and loading equipment (see 5.1.4).

5.7.2.3.2 Test the specimen in each of the following functional conditions:

a) quiescent condition;

b) fire alarm condition, initiated in a fire detection zone;

c) disabled condition, initiated by disablement of a zone and an output according to ISO 7240-1.

5.7.2.4 Conditioning

5.7.2.4.1 Subject the specimen to vibration in each of the three mutually perpendicular axes in turn, one of which is perpendicular to the plane of mounting of the specimen.

5.7.2.4.2 Apply the following severity of conditioning.

Frequency range: 10 Hz to 150 Hz

Acceleration amplitude: 0,981 m/s^2 (0,1 g_n)

Number of axes: 3

Number of sweep cycles per axis: one for each functional condition

5.7.2.5 Measurements during conditioning

Monitor the specimen during the conditioning periods to detect any changes in functional conditions.

5.7.2.6 Final measurements

After the conditioning, subject the specimen to the functional test and inspect it visually for mechanical damage, both externally and internally.

5.7.3 Requirements

5.7.3.1 All mandatory functions and optional functions claimed by the manufacturer shall operate according to the requirements of this document.

5.7.3.2 No mechanical damage shall be apparent on the specimen.

5.8 Electromagnetic compatibility (EMC) — Immunity tests (operational)

5.8.1 Test procedure

5.8.1.1 Conduct the following EMC immunity tests in accordance with IEC 62599-2.

a) Mains supply voltage variations: These tests are included as they should be applied to a PSE housed in FDCIE (see ISO 7240-4), or if FDCIE includes other mains inputs for which these tests are applicable.

b) Mains supply voltage dips and interruptions: These tests are included as they should be applied to a PSE housed in FDCIE (see ISO 7240-4), or if FDCIE includes other mains inputs for which these tests are applicable.

c) Electrostatic discharge.

d) Radiated electromagnetic fields.

e) Conducted disturbances induced by electromagnetic fields.

f) Fast transient bursts, with a repetition rate of 100 kHz.

g) Slow high energy voltage surges.

5.8.1.2 For the tests according to 5.8.1, the criteria for compliance specified in IEC 62599-2 and the following shall apply.

a) The functional test, called for in the initial and final measurements, shall be the functional test according to 5.2.

b) The required operating condition shall be in accordance with 5.1.4 and the equipment shall be tested in the quiescent condition.

c) The connections to the various inputs and outputs shall be made with unscreened cables, unless the manufacturer's installation data specifies that only screened cables shall be used.

d) In the electrostatic discharge test, the discharges shall be applied to parts of the equipment accessible at access level 2.

e) In the fast-transient burst test, the transients shall be applied to the AC mains lines by the direct injection method and to the other inputs, signal, data and control lines by the capacitive clamp method.

f) If the equipment has a number of identical types of inputs or outputs, then the tests of 5.8.1 e), f) and g), and, if applicable, a) and b), shall be applied to one of each type.

5.8.2 Requirements

5.8.2.1 All mandatory functions and optional functions claimed by the manufacturer shall operate according to the requirements of this part of ISO 7240.

5.8.2.2 No mechanical damage shall be apparent on the specimen.

5.9 Supply voltage variation (operational)

5.9.1 Object of test

The object of the test is to demonstrate the ability to function correctly over the anticipated range of supply voltage conditions.

5.9.2 Test procedure

5.9.2.1 General

Subject the specimen to conditioning specified in 5.9.2.4 until temperature stability is reached and the functional test has been conducted.

5.9.2.2 Initial examination

Before conditioning, subject the specimen to the functional test.

5.9.2.3 State of the specimen during conditioning

Mount the specimen in accordance with 5.1.3 and connect it to suitable power supply-, monitoring- and loading equipment (see 5.1.4).

Configure the specimen so it is in the quiescent condition.

5.9.2.4 Conditioning

Apply the following conditions:

a) supply of maximum input voltage as specified by the manufacturer;

b) supply of minimum input voltage as specified by the manufacturer.

NOTE Compatibility between FDCIE and any specific type of PSE will require that the range of input voltages specified for FDCIE include the range of output voltages recorded for the PSE in the tests of ISO 7240-4.

5.9.2.5 Measurements during conditioning

Monitor the specimen at the supply voltage conditions until temperature stability is reached and subject the specimen to the functional test at each voltage condition.

5.9.2.6 Final measurements

After the conditioning, subject the specimen to the functional test.

5.9.3 Requirements

5.9.3.1 All mandatory functions and optional functions claimed by the manufacturer shall operate according to the requirements of this document.

5.9.3.2 No mechanical damage shall be apparent on the specimen.

5.10 Damp heat, steady-state (endurance)

5.10.1 Object of test

The object of the test is to demonstrate the ability of the equipment to withstand the long-term effects of humidity in the service environment (changes in electrical properties due to absorption, chemical reactions involving moisture, galvanic corrosion, etc.).

5.10.2 Test procedure

5.10.2.1 General

Perform the test procedure according to IEC 60068-2-78 and 5.10.2.2 to 5.10.2.5.

5.10.2.2 Initial examination

Before conditioning, subject the specimen to the functional test.

5.10.2.3 State of the specimen during conditioning

Mount the specimen in accordance with 5.1.3 and connect it to suitable power supply-, monitoring- and loading equipment (see 5.1.4). Do not supply the specimen with power during the conditioning.

5.10.2.4 Conditioning

5.10.2.4.1 Apply the following severity of conditioning.

Temperature: 40 °C ± 2 °C

Relative humidity: 93^{+2}_{-3}%

Duration: 21 days

5.10.2.4.2 Pre-condition the specimen at the condition temperature (40 °C ± 2 °C) until temperature stability has been reached, in order to prevent the formation of water droplets on the specimen.

5.10.2.5 Final measurements

After the recovery period, subject the specimen to the functional test and inspect it visually for mechanical damage both externally and internally.

5.10.3 Requirements

5.10.3.1 All mandatory functions and optional functions claimed by the manufacturer shall operate according to the requirements of this document.

5.10.3.2 No mechanical damage shall be apparent on the specimen.

5.11 Vibration, sinusoidal (endurance)

5.11.1 Object of test

The object of the test is to demonstrate the ability of the equipment to withstand the long-term effects of vibration at levels appropriate to the environment.

5.11.2 Test procedure

5.11.2.1 General

5.11.2.1.1 Perform the test procedure according to IEC 60068-2-6 and 5.11.2.2 to 5.11.2.5.

5.11.2.1.2 The vibration endurance test may be combined with the vibration operational test, so that the specimen is subjected to the operational test conditioning followed by the endurance test conditioning in each axis in turn.

5.11.2.2 Initial examination

Before conditioning, subject the specimen to the functional test.

5.11.2.3 State of the specimen during conditioning

Mount the specimen in accordance with 5.1.3 and in accordance with IEC 60068-2-47, and connect it to suitable power supply, monitoring and loading equipment (see 5.1.4). Do not supply the specimen with power during the conditioning.

5.11.2.4 Conditioning

5.11.2.4.1 Subject the specimen to vibration in each of the three mutually perpendicular axes in turn, one of which shall be perpendicular to the plane of mounting of the specimen.

5.11.2.4.2 Apply the following severity of conditioning.

Frequency range: 10 Hz to 150 Hz

Acceleration amplitude: 4,905 m/s^2 (0,5 g_n)

Number of axes: 3

Number of sweep cycles: 20 per axis

5.11.2.5 Final measurements

After the conditioning, subject the specimen to the functional test and inspect it visually for mechanical damage, both externally and internally.

5.11.3 Requirements

5.11.3.1 All mandatory functions and optional functions claimed by the manufacturer shall operate according to the requirements of this document.

5.11.3.2 No mechanical damage shall be apparent on the specimen.

5.12 Dry heat (operational) — Optional

5.12.1 Object of test

The objective of the test is to demonstrate the ability of the equipment to function correctly at high temperature, which may occur for short periods in the service environment. This is an optional characteristic that may be applicable in some regions that experience excessive ambient temperature.

5.12.2 Test procedure

5.12.2.1 General

The test procedure described in AS 60068-2-2 should be used.

5.12.2.2 Initial examination

Before conditioning, subject the specimen to the functional test required by 5.2.

5.12.2.3 State of the specimen during conditioning

Mount the specimen in accordance with 5.1.2, connect it in accordance with 5.1.3 and ensure it is operating.

5.12.2.4 Conditioning

Apply the following severity of conditioning:

Temperature: nominated by the manufacturer ±2 °C

Duration: 16 h

Precondition the specimen at the nominated temperature (±2 °C) until temperature stability has been reached, to prevent the formation of water droplets on the specimen.

5.12.2.5 Measurements during conditioning

Monitor the specimen during the conditioning period to check that output voltages are within the specifications. During the last hour of the conditioning period, subject the specimen to the reduced functional test.

5.12.2.6 Final measurements

After the recovery period, subject the specimen to the functional test according to 5.2.4 and inspect it visually for mechanical damage both externally and internally.

5.12.3 Requirements

5.12.3.1 All mandatory functions and optional functions claimed by the manufacturer shall operate according to the requirements of this document.

5.12.3.2 No mechanical damage shall be apparent on the specimen.

6 Test report

The test report shall contain, as a minimum, the following information:

a) identification of the test specimen;

b) a reference to this document, i.e. ISO 7240-2:2014;

c) results of the tests: the individual response times and any other data, such as specimen orientation, as specified in the individual tests;

d) conditioning period and conditioning atmosphere;

e) temperature and relative humidity in the test room throughout the test;

f) details of the supply and monitoring equipment and the response criteria;

g) details of any deviation from this document or from the International Standards to which reference is made, and details of any operations regarded as optional.

7 Marking

7.1 FDCIE shall be marked with the following information, which shall be legible at access level 1:

a) the number of this document;

b) the name or trademark of the manufacturer or supplier;

c) the type number or other designation of FDCIE.

7.2 It shall be possible to identify a code or number which identifies the production period of FDCIE at access level 2.

8 Data

8.1 General

In order to assist the process of design inspection, the manufacturer shall declare, in writing, that

a) the design has been carried out in accordance with a quality management system, that incorporates a set of rules for the design of all elements of FDCIE, and

a) the components of FDCIE have been selected for the intended purpose, and are expected to operate within their specification when the environmental conditions outside the cabinet of FDCIE comply with Class 3k5 of IEC 60721-3-3.

8.2 Software documentation

8.2.1 The manufacturer shall prepare documentation which gives an overview of the software design. This documentation shall be in sufficient detail for the design to be inspected for compliance with this part of ISO 7240 and shall include at least the following:

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

   1) a brief description of the modules and the functions that they perform,

   2) the way in which the modules interact,

   3) the overall hierarchy of the program,

   4) the way in which the software interacts with the hardware,

5) the way in which the modules are called, including any interrupt processing;

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

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

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

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

b) a description of each module of the program, containing at least

1) the name of the module,

2) a description of the tasks performed,

3) 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 for the program flow to be recognized;

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

NOTE This detailed design documentation may be reviewed at the manufacturers' premises.

8.3 Hardware documentation

The manufacturer shall prepare design documentation, which shall include drawings, parts lists, block diagrams, circuit diagrams and a functional description to such an extent that compliance with this document can be checked and that a general assessment of the mechanical and electrical design is made possible.

8.4 Installation and user documentation

The manufacturer shall prepare installation and user documentation, which shall comprise at least the following:

a) a general description of the equipment, including a list of the

— optional functions with requirements of this document,

— functions relating to other parts of ISO 7240, and

— ancillary functions not required by this document;

b) technical specifications of the inputs and outputs of FDCIE sufficient to permit an assessment of the mechanical, electrical, and software compatibility with other components of the system (e.g. as described in ISO 7240-1), including, where relevant,

— the power requirements for recommended operation,

— the maximum number of fire detection zones, points and/or addressable points per detection circuit,

— the maximum number of zones, points, addressable points and/or fire alarm devices per FDCIE,

- the maximum and minimum electrical ratings for each input and output,
- information on the communication parameters employed on each transmission path,
- recommended cable parameters for each transmission path, and
- fuse ratings;

c) installation information, including

- the suitability for use in various environments,
- if FDCIE is contained in more than one cabinet, how the requirements of 4.16.2 and 4.17.2 may be met,
- if the FDCIE is designed to be used with a power supply contained in a separate cabinet, how the requirements of 4.16.2 and 4.17.2 may be met,
- mounting instructions, and
- instructions for connecting the inputs and outputs;

d) configuring and commissioning instructions;

e) operating instructions;

f) maintenance information.

Annex A
(informative)

Optional functions with requirements and alternatives

A.1 This document specifies mandatory functions and options with requirements. FDCIE complying with this document needs to fulfil the requirements of all of the mandatory functions, together with the requirements of those optional functions which are provided. The options described in this document are currently used in the ISO member countries and have been incorporated into this document in order to comply with necessary design requirements (see ISO 7240-14). They may also be called up in national codes of practice. Optional functions and their relevant clause numbers are listed in Table A.1.

Table A.1 — Optional functions

Option	Subclause
Output to fire alarm signalling function	4.4.8
Output to fire alarm routing function	4.4.9.1
Input from fire alarm routing function	4.4.9.2
Output to fire protection control function	4.4.10
Delays to outputs	4.4.11
Dependency on more than one alarm signal	4.4.12
Alarm counter	4.4.13
Output of standard emergency evacuation signal	4.4.14
Fault monitoring of fire protection control function	4.5.2.1
Fault signals from points	4.5.3
Total loss of power supply	4.5.4
Output to fault warning routing function	4.5.9
Disabled condition	4.6
Disablement of addressable points	4.6.3
Test condition	4.7
Supervisory signal condition	4.8
Standardized input/output interface	4.9

A.2 In addition, alternatives are offered in this document.

EXAMPLE

— automatic or manual reset of the fault warning condition

— indications by means of separate light-emitting indicators, or on an alphanumeric display

— Access level 1 or 2 for certain functions

— Access level 3 or 4 for certain functions

A.3 The choice of an alternative is entirely up to the manufacturer. They are equivalent solutions in this document and should not be specified in national regulations.

Annex B
(informative)

Processing of signals from fire detectors

B.1 Functions associated with other parts of ISO 7240 may be integrated within the design of a FDCIE. This integration may include the processing of signals from fire detectors to the point at which a fire alarm decision is taken. The design documentation needs to show where and how this decision is taken, so that these delays may be assessed. This would generally only be the case in a software-controlled FDCIE.

B.2 For the purposes of this document, the processing of the fire signals to this point is not considered to be a function of FDCIE, but of the appropriate detector standard (e.g. ISO 7240-7 in the case of smoke detectors). Functions which are part of FDCIE include

— the scanning and acquisition of signals by FDCIE from points,

— the control or scheduling of any processing of signals from points, where this is contained within the overall software structure of FDCIE, and

— any other processing required for indications and/or the activation of outputs, subsequent to the fire alarm decision.

B.3 The intent of 4.4.1 is that the times associated with the above functions of FDCIE do not add a delay of more than 10 s to the approved detector signal processing, either to indicate the fire alarm condition or a new zone in alarm. Demonstration of compliance may be achieved by inspection of the design documentation or by testing with suitable means, such as a simulated detector, or both.

Annex C
(informative)

Explanation of fire detection zones and zonal indication of fire alarms

C.1 A fire detection zone will contain one or more fire detectors or manual call points, installed within a localized area of the protected premises. The requirements for grouping these into fire detection zones are more fully described in ISO 7240-14. In general, a protected premises is divided into zones in order to assist in

— the rapid location of the source of a fire alarm,

— assessing the size of the fire, and monitoring its rate of growth, and

— sub-dividing the installed system, for the purposes of alarm organization and fire protection measures.

C.2 The number of fire detectors or manual call points or both in a fire detection zone will vary, depending on the circumstances. More than one fire detection zone is not expected to be configured in a single volume, unless this is very large. It is assumed that a fire detection zone will not contain more than 32 fire detectors and/or manual call points, since this would correspond to an unacceptably large search area. Alarm zone limitations are also included in ISO 7240-14.

C.3 In this document, zones are the mandatory units for the discrete indication of fire alarms. The aim is to provide unique indications for the zones in which fire alarms originate, so that a multiplicity of alarm signals from fire detectors in one volume do not clutter an alphanumeric display and risk preventing the rapid recognition of new fire detection zones in alarm.

C.4 Fire detection zones may be sub-divided, such that signals from individual points, or groups of points, may also be identified at FDCIE, thus providing more detailed information on the location of an event, in addition to the indication of the affected fire detection zone.

Annex D
(informative)

Delays to outputs

D.1 General

D.1.1 In 4.4.11, which deals with delays to output signals, FDCIE is permitted to be configured at access level 3, so that the presence of a fire may be verified following an alarm, before automatic actions or an orderly evacuation of persons are carried out.

D.1.2 If the manufacturer declares that fire detectors and manual call points may be included in the same fire detection zone, and output delays may also be operative, FDCIE will need to be capable of distinguishing signals from manual call points from signals from fire detectors, in order that the requirements of 4.4.11.1 a) and b) may be met.

D.1.3 The maximum delay times quoted represent the upper limit of times and are not recommended times. Recommended times are given in application guidelines. Delays to signals from manual call points should be used only in exceptional circumstances.

D.1.4 Delays may be structured such that an initial short delay period may be extended by the use of a manual control, but the total delay should not exceed the specified maximum. It may also be desirable that the operation of any manual call point on the installation can override the delay, so that an alarm can be immediately raised if human inspection of an incident verifies that a fire exists.

D.1.5 It is recognized that delays may be permanently configured in the normal mode of operation of the equipment, and in such cases there is no need for a user control and no indication need be given. However, if (as under 4.4.11.2) there is provision at access level 2 to switch on delays (which may be in addition to delays which are normally configured), this state shall be indicated. It is common practice to switch on delays by a manual operation and to switch them off with a programmable timer, which should ideally have at least a seven-day capability. This is often referred to as “day/night” mode of operation. Such a mode need not only relate to switching delays on and off, but may also be used to change other operational parameters of the system (e.g. the sensitivity of fire detectors), provided that this is in accordance with other parts of ISO 7240.

D.2 Dependency on more than one alarm signal

D.2.1 In 4.4.12 FDCIE is permitted to be configured at access level 3 so that either the entry to the fire alarm condition, or automatic actions associated with a fire alarm, are dependent on more than one alarm signal. The intention is to reduce the incidence of unwanted alarms or to minimize their implications or both. Three general types of dependency are permitted, and these are briefly explained below. It is not precluded that more than one type may be concurrently used, e.g. type A could be combined with type B or type C. For information on the appropriate type or types to be employed in given circumstances, reference should be made to application guidelines.

D.2.2 **Type A dependency** (see 4.4.12.1) provides for delayed operation following a first fire signal, which would normally be interpreted as a fire alarm. The entry to the fire alarm condition usually occurs on the receipt of further fire signals from the same fire detector. A common technique with two-state smoke detectors is to automatically reset the fire detection zone following the first fire signal, then interpret a subsequent fire signal as a fire alarm. Alternative signal processing techniques may also be

employed. One aim is to permit a transient concentration of aerosol (e.g. fumes from cooking) to dissipate naturally, or be cleared by a person before resulting in a fire alarm. FDCIE shall be capable of receiving a second fire signal from the same fire detector within 60 s, and this effectively sets the maximum processing delays which may be introduced within FDCIE and the fire detector. There is no requirement to provide an indication of the first fire signal, but in some applications, it may be appropriate to provide a local (e.g. an audible) warning. The benefits are reduced if the time period for dependency following a first fire signal is too long, and a maximum of 30 min is specified.

D.2.3 Type B dependency (see 4.4.12.2) provides for the entry to the fire alarm condition to depend on a fire signal from two or more fire detectors. In this case, the first fire signal shall be indicated, but not in the same manner as in the fire alarm condition. Except in special cases, fire detectors should be located in the same fire volume, i.e. with smoke detectors the combustion products should be free to diffuse from a source of combustion to more than one fire detector or identifiable sampling point, and with flame detectors the source of a fire should be visible from more than one detector. If the fire detectors are in different fire detection zones, these fire detection zones are co-sited in such a way to meet the above criteria. It shall be possible to manually cancel the first alarm state at access level 2. The first alarm state may also be automatically cancelled with a minimum dependency time period of 5 min. This time period depends on the fire detection application, and it may need to be significantly longer in order to detect slowly developing fires.

D.2.4 Type C dependency (see 4.4.12.3.) also depends on a fire signal from two or more points, but these may be fire detectors or manual call points. In this case, FDCIE enters the fire alarm condition on the first alarm, but the activation of mandatory outputs could be inhibited. In the case of fire detectors, the same siting considerations apply as for type B dependency. Delays to outputs (as under 4.4.11) are commonly used in conjunction with type C dependency, to provide for the automatic activation of outputs should a second fire signal not be received before the delay expires.

Annex E
(informative)

Fault recognition and indication

E.1 In 4.5, the faults most likely to occur in a fire alarm system are required to be recognized and indicated, so that they may be repaired as soon as possible. These include the following:

— certain faults within FDCIE itself, and, in transmission paths, between parts of FDCIE contained in more than one cabinet;

— faults in transmission paths to other components of an installed system, where these are in different cabinets to that of FDCIE;

— faults in other components of an installed system, as defined in ISO 7240-1.

The faults fall into three classes, which are described in

— 4.5.2 and 4.5.3, for faults in specified functions,

— 4.5.4, for total loss of power supply (option with requirements), and

— 4.5.5, for system fault.

E.2 These classes differ in the implications of the fault, hence the reason for the different requirements. Faults according to 4.5.2 and 4.5.3 are assumed to affect only the specified function, the rest of FDCIE and its connected system remaining fully operational. Faults according to 4.5.4 and 4.5.5 can lead to a partial or total loss of all the functions of FDCIE.

E.3 This document does not define the technical means for recognizing faults. It defines those faults which are to be recognized and how these are to be indicated. For example, the monitoring for short circuits or interruptions in transmission paths may be carried out by FDCIE or by other components of the connected system. However, all the recognized faults have to be indicated on FDCIE.

E.4 The monitoring for faults within other components of the installed system could be at intervals less frequent than 100 s. FDCIE has to indicate a fault within 100 s of receiving a signal from this component.

E.5 Both automatic and manual reset are possible on the same FDCIE, since it could be desirable that certain fault indications reset automatically, while others are latched until a manual reset. In the case of a system fault, only a manual reset is permitted, because of the special implications.

Annex F
(informative)

Systems related to the supervisory signal condition

In 4.8, the supervisory signal condition refers to “other life safety or property protection systems” which may be monitored by FDCIE. The following are examples of such systems:

— guard tour systems;

— fire suppression systems, such as the monitoring of

  — valve position,

  — water temperature,

  — water pressure, or

  — pump conditions;

— air handling systems, such as the monitoring of

  — damper positions, or

  — fan operation.

Annex G
(informative)

Standardized input/output interface for the connection of ancillary equipment (e.g. fire brigade panel)

G.1 The input/output interface is an optional part of FDCIE which transmits information on the status of FDCIE to ancillary equipment. It is also capable of receiving signals and activating the appropriate functions on FDCIE. The ancillary equipment is not a part of FDCIE for the purposes of this part of ISO 7240, although it may be mechanically integrated with FDCIE in the same cabinet.

G.2 In 4.9, functions which are to be included in the interface are specified. All the specified functions are to be included if a manufacturer declares compliance with this option. The requirements for fire brigade panels differ within the ISO countries, because of differences in national fire fighting practices. Rather than attempting to harmonize fire brigade panels at an international level, an interface has been specified which implements the more common functions used in the ISO countries. Consequently, more input and output functions have been specified than may be needed for any given piece of equipment.

G.3 It might not be necessary to call up this option for the connection of ancillary equipment (e.g. a fire brigade panel) which conforms to specific application guidelines or local regulations. As an option without requirements, a sub-set of the functions listed may be provided for this purpose.

G.4 No electrical specifications for the interface are given in this document. In 8.4 b), it is required that the manufacturer's technical documentation give sufficient information to permit the specification of compatible ancillary equipment.

Annex H
(informative)

Explanation of access levels

H.1 Access levels are defined for the indications and controls relating to mandatory functions. In some cases, alternatives are offered (e.g. access level 1 or 2). This is because either may be appropriate in different operational circumstances. The purpose of the different access levels is not defined here. However, in general they are expected to be used as follows.

H.2 Access level 1: By members of the general public, or persons having a general responsibility for safety supervision, who might be expected to investigate and initially respond to a fire alarm or a fault warning.

NOTE It is not the intention that controls and indicators are available to members of the general public who are not expected to investigate and respond to a fire alarm or fault warning. Specific requirements for access are generally part of the design solution for the FDAS.

H.3 Access level 2: By persons having a specific responsibility for safety, and who are trained and authorized to operate FDCIE in the

— quiescent condition,

— fire alarm condition,

— fault warning condition,

— disabled condition,

— test condition, and

— supervisory condition.

H.4 Access level 3: By persons who are trained and authorized to

— re-configure the site-specific data held within FDCIE or controlled by it (e.g. labelling, zoning, alarm organization), and

— maintain FDCIE in accordance with the manufacturer's published instructions and data.

H.5 Access level 4: By persons who are trained and authorized by the manufacturer either to repair FDCIE, or to alter its firmware, thereby changing its basic mode of operation

H.6 See 4.10 for the minimum requirements for accessibility. Only access levels 1 and 2 have a strict hierarchy. Examples of special procedures for entry to access level 2 or to access level 3 or both, are the use of

— mechanical keys,

— a keyboard and codes, or

— access cards.

H.7 Examples of special means for entry to access level 4 are the use of

— mechanical keys,

— tools, or

— an external programming device.

H.8 It may be acceptable that the entry to access level 4 requires only a simple tool, such as a screwdriver, after access level 2 or 3 has been reached. For example, the manufacturer may declare in his documentation which parts of FDCIE are not user-serviceable, and the entry to access level 4 may then be controlled by management of the user. It is also considered acceptable to use external tools to carry out certain functions at access level 3, e.g. to program site specific data.

H.9 It may be desirable in certain circumstances that FDCIE have additional access levels within access level 2, or access level 3 (e.g. 2A and 2B), which would permit different classes of authorized user to have access to a selected group of controls or functions. This is not excluded by this document. The exact configuration will depend on the type of installation, the way FDCIE is used, and the complexity of the functions provided.

Annex I
(informative)

Integrity of transmission paths

I.1 In 4.17.2, providing a capability in FDCIE to limit the consequences of faults in detection circuits, or in other transmission paths, is addressed.

I.2 If the manufacturer declares that points covering more than one fire detection zone may be connected to a detection circuit, or that components performing more than one function may be connected to a transmission path, at least the following measures should be taken.

— The relevant detection circuits, or transmission paths should be capable of being installed as loops.

— The interfaces of FDCIE should be capable of independently powering and receiving signals from each end of a loop.

— Compatible devices should be available for installation on detection circuits, or transmission paths, which are capable of automatically isolating short circuits. These devices may be physically incorporated within other components of ISO 7240.

I.3 Similar considerations apply to 4.17.3, which relates to limiting the consequences of faults in transmission paths between different parts of FDCIE contained in more than one cabinet.

Annex J
(informative)

Design requirements for software-controlled fire detection control and indicating equipment

J.1 FDCIE could incorporate software-controlled elements, which are required to fulfil mandatory requirements of this document, but which are supplied to the manufacturer. A good example is an alphanumeric display module, but there are many possibilities, including both physical modules and embedded software (e.g. operating systems). Such elements may be traded world-wide as commodity items, and detailed software documentation (and for that matter details of the hardware design) might not be available to FDCIE manufacturer. It is not the intention of this document to forbid the use of appropriate technology, and in such cases the detailed requirements for documentation and design of 8.2 and 8.4 may be relaxed, at the discretion of the testing authority. However, it is expected that products from third parties which are designed and produced exclusively for a FDCIE be fully documented and fulfil the requirements. The manufacturer has to ensure that the element is of proven reliability and is suitable for the application. Proven reliability can be assumed if the components under question are freely available on the market and there is sufficient field experience (e.g. ≥1 year). The interface with the main application has to be clearly and comprehensively specified, and this documentation has to be available to the testing authority.

J.2 In 4.18.2, program monitoring is dealt with. The program is the software necessary for FDCIE to carry out mandatory functions (including any declared options with requirements). The execution of the entire program has to be monitored, and this can include software which runs in more than one processor and software in elements supplied to manufacturer. It is up to the manufacturer and the testing authority to agree how comprehensive the degree of monitoring needs to be, but in the case of an alphanumeric display module, it is considered to be sufficient to routinely check that data written to the module may be read back from it.

J.3 In 4.18.2.3, it is required that, in the event of a failure of program execution, FDCIE enters a safe state. The safe state is defined by the manufacturer, but it is expected that it will not result in the false activation of mandatory outputs, nor give a false impression to a user that FDCIE remains operational if it is not. In practice, it may be acceptable either to stop, or automatically restart the program execution. If there is a possibility that memory may have been corrupted, the restart procedure should check the contents of this memory and, if necessary, re-initialize running data to ensure that FDCIE enters a safe operating state. Even if program execution is successfully restarted, it is important that the user be made aware of the incident. For this reason, it could be advantageous for FDCIE to be capable of automatically recording details of the restart event. In any event, the system fault indication has to be latched until a manual intervention.

J.4 In 4.18.3.1, it is required that all executable code and data necessary to comply with this document be held in memory which is capable of continuous, unmaintained, reliable operation for a period of at least 10 years. In the existing state of the art, memory with moving mechanical parts is not believed to be sufficiently reliable. The use of tapes, or magnetic or optical data discs, for the storage of programs and data are therefore not considered to be acceptable at the time of publication.

Bibliography

[1] ISO 9001, *Quality management systems — Requirements*

[2] ISO 7240-7, *Fire detection and alarm systems — Part 7: Point-type smoke detectors using scattered light, transmitted light or ionization*

NATIONAL ANNEX K

(*National Foreword*)

K-1 BIS CERTIFICATION MARKING

The product conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

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This Indian Standard has been developed from Doc No.: CED 22 (23151).

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