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Smoke and heat control systems —

Part 9: Specification for control equipment

Systèmes pour le contrôle des fumées et de la chaleur —

Partie 9: Spécifications pour les équipements de commande

Reference number
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Foreword

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

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

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

ISO 21927-9 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 11, *Smoke and heat control systems and components*.

ISO 21927 consists of the following parts, under the general title *Smoke and heat control systems*:

— *Part 1: Specification for smoke barriers*

— *Part 2: Specification for natural smoke and heat exhaust ventilators*

— *Part 3: Specification for powered smoke and heat exhaust ventilators*

— *Part 9: Specification for control equipment*

— *Part 10: Specification for power output devices*

Introduction

Smoke- and heat-control systems (SHCS) create and maintain smoke-free areas in a construction works by controlling smoke flow, thus improving the conditions for the safe escape and/or rescue of people and animals and the protection of property, and permit fire-fighting in the early stages of the fire. The use of smoke and heat exhaust ventilation systems (SHEVS) to create smoke-free areas beneath a buoyant smoke layer has become widespread. Their value in assisting in the evacuation of people from construction works, reducing fire damage and financial loss by preventing smoke logging, facilitating fire fighting, reducing roof temperatures and retarding the lateral spread of fire, is firmly established. For these benefits to be obtained, it is essential that smoke and heat exhaust ventilators operate fully and reliably whenever called upon to do so during their installed life. A heat and smoke exhaust ventilation system is a scheme of safety equipment intended to perform a positive role in a fire emergency.

Components for any smoke and heat control system are installed as part of a properly designed system.

Smoke and heat control systems help to:

— keep the escape and access routes free from smoke;

— facilitate fire fighting operations;

— delay and/or prevent flashover and thus full development of the fire;

— protect equipment and furnishings;

— reduce thermal effects on structural components during a fire;

— reduce damage caused by thermal decomposition products and hot gases.

Pressure differential systems are used to either positively pressurize spaces separated from the fire or to depressurize the space containing the fire in order to limit or prevent the flow of smoke and heat into adjacent spaces. A typical use would be to pressurize an escape stairwell in order to protect vertical means of escape.

Depending on the design of the system, natural or powered smoke and heat ventilators can be used in a smoke and heat control system.

Control equipment (c.e.) is required to control all components in a SHCS, such as:

— natural ventilators;

— powered ventilators;

— smoke barriers;

— smoke dampers;

— air inlets.

SHCS control equipment may also provide control for day-to-day ventilation and signals to other fire safety equipment under fire conditions.

SHCS control equipment may be for extra-low-voltage or low-voltage electrical systems or pneumatic systems or any combination of these.

Power output devices for control equipment are dealt with in ISO 21927-10.

Smoke and heat control systems —

Part 9:
Specification for control equipment

1 Scope

This part of ISO 21927 specifies the product performance requirements, classifications and test methods for control equipment designed for use in smoke- and heat-control systems (SHCS) in buildings.

2 Normative references

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

ISO 3098-2, *Technical product documentation — Lettering — Part 2: Latin alphabet, numerals and marks*

ISO 6988, *Metallic and other non-organic coatings — Sulfur dioxide test with general condensation of moisture*

ISO 7240-5:2003, *Fire detection and alarm systems — Part 5: Point-type heat detectors*

ISO 7240-6, *Fire detection and alarm systems — Part 6: Carbon monoxide fire detectors using electro-chemical cells*

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

ISO 7240-8, *Fire detection and alarm systems — Part 8: Carbon monoxide fire detectors using an electro-chemical cell in combination with a heat sensor*

ISO 7240-10, *Fire detection and alarm systems — Part 10: Point-type flame detectors*

ISO 7240-11:2005, *Fire detection and alarm systems — Part 11: Manual call points*

ISO 7240-12, *Fire detection and alarm systems — Part 12: Line type smoke detectors using a transmitted optical beam*

ISO 7240-15, *Fire detection and alarm systems — Part 15: Point type fire detectors using scattered light, transmitted light or ionization sensors in combination with a heat sensor*

ISO 7240-20, *Fire detection and alarm systems — Part 20: Aspirating smoke detectors*

ISO 7240-27, *Fire detection and alarm systems — Part 27: Point-type fire detectors using a scattered-light, transmitted-light or ionization smoke sensor, an electrochemical-cell carbon-monoxide sensor and a heat sensor*

ISO/IEC 17000, *Conformity assessment — Vocabulary and general principles*

ISO/IEC 17050-1, *Conformity assessment — Supplier's declaration of conformity — Part 1: General requirements*

ISO/IEC 17050-2, *Conformity assessment — Supplier's declaration of conformity — Part 2: Supporting documentation*

ISO 21927-3, *Smoke and heat control systems — Part 3: Specification for powered smoke and heat exhaust ventilators*

ISO 21927-10, *Smoke and heat control systems — Part 10: Specification for power output devices*

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

IEC 60068-1:1994, *Environmental testing — Part 1: General and guidance*

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

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

IEC 60068-2-47, *Environmental testing — Part 2-47: Test — Mounting of specimens for vibration, impact and similar dynamic tests*

IEC 60068-2-52:1996, *Environmental testing — Part 2: Tests — Test Kb: Salt mist, cyclic (sodium chloride solution)*

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

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

IEC 60529:1992, *Degrees of protection provided by enclosures (IP Code)*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

3.1.1
access level
one of several states of control equipment in which selected:

— controls can be operated

— manual operations can be carried out

— indications are visible

— information can be obtained

NOTE Further information is given in Annex A.

3.1.2
addressable point
point which can be individually identified at the control panel

3.1.3
basic control panel
b.c.p.
single-operation initiating device for a smoke and heat control system component, e.g. manual control point or single-use gas bottle assembly

NOTE A b.c.p. may be regarded as an emergency control panel.

3.1.4
compulsory indication
visual or audible indications (e.g. light-emitting indicator, label, alphanumeric display, sounder) required by this International Standard

NOTE If options with requirements are chosen, then indications required within those options are compulsory.

3.1.5
control equipment
c.e.
initiating device for a smoke and heat control system component, e.g. control panel, basic control panel, mechanical control panel

3.1.6
control panel
c.p.
multi-operation initiating device for a smoke and heat control system

3.1.7
fire condition
when a fire signal has been received and processed by the control equipment and the intended outputs and indications have been given

3.1.8
fire position
configuration of a smoke and heat control system component to be achieved and sustained while the system is venting smoke and heat

3.1.9
frangible element
component which, after receiving a blow or pressure, is physically broken or is visibly displaced by change of position and remains in that condition until replaced or reset

3.1.10
hierarchical system
networked system with one control panel designated as the main control panel which fulfils at least the following tasks:

— receives and transmit signals from/to other networked control equipment;

— displays the status of the networked control equipment.

3.1.11
manual control point
initiation device for a smoke and heat control system provided for use in an emergency by building occupants or fire fighters

3.1.12
mechanical control panel
m.c.p.
operation initiation device for a smoke and heat control system component where the initiation is provided through a mechanical linkage (e.g. by release of tension in a cable) between the control equipment and the component

3.1.13
networked system
system where control panels are interconnected and able to exchange information electronically

3.1.14
response time
period between the signal to operate being received by the control equipment and the achievement of the fire condition

3.1.15
site-specific data
information that the software uses and that is specific to an installation

NOTE This may include information such as allocation of devices to specific zones, time settings and sensitivity levels.

3.1.16
smoke- and heat-control system
SHCS
arrangement of components installed in a construction works to limit the effects of smoke and heat from a fire

3.1.17
smoke- and heat-exhaust ventilator
SHEV
device specially designed to move smoke and hot gases out of the construction works under conditions of fire

3.1.18
standby condition
quiescent condition when the control equipment is fully operational and waiting to receive a fire signal

3.1.19
transmission path
physical connection, external to the cabinet of the control equipment for the transmission of information and/or power between the control equipment and other components of a SHCS, and/or between parts of a control equipment contained in different cabinets

3.1.20
ventilator
device for enabling the movement of gases into or out of a construction works

3.1.21
zone
individual input or output, usually relating to a geographical sub-division of the protected premises

3.1.22
thermal release element
temperature-sensitive device which responds to initiate a subsequent action

3.2 Abbreviated terms

b.c.p. basic control panel

c.e. control equipment

c.i.e. control and indicating equipment (as specified in ISO 7240-2)

c.p. control panel

DP dual purpose

m.c.p. mechanical control panel

p.o.d. power output device

p.s.e. power supply equipment

SHCS smoke- and heat-control system

SHEV smoke- and heat-exhaust ventilator

SHEVS smoke- and heat-exhaust ventilation system

BMS Building Management System

4 General

4.1 Overview

Figure 1 illustrates the structure of this part of ISO 21927 and shows how and where the requirements for each type of control equipment are distributed.

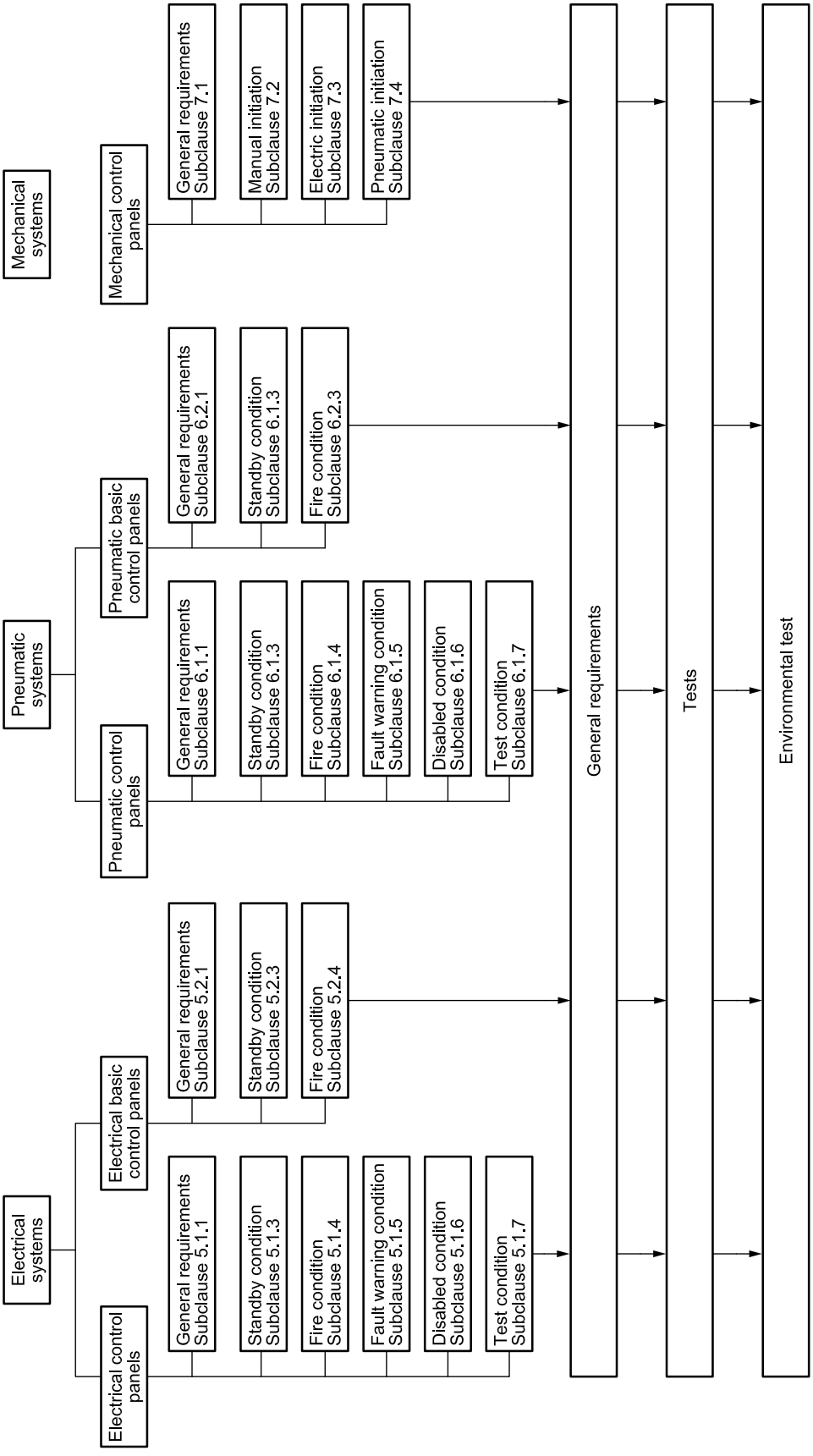


Figure 1 — Overview of the structure of this part of ISO 21927

4.2 Requirements

4.2.1 Optional functions

If an optional function with requirements is included in the control equipment, then it shall conform to all the corresponding requirements of this part of ISO 21927.

4.2.2 Additional functions

If functions additional to those specified in this part of ISO 21927 are provided (for example to control the additional use of a SHEVS for day-to-day comfort ventilation), they shall not jeopardize any of the requirements of this part of ISO 21927.

4.2.3 Types of control equipment

For the purposes of this part of ISO 21927, control equipment shall be typified as follows:

— Type A: mechanical control panels (m.c.p.);

— Type B: basic control panels (b.c.p.) and pneumatic-only control panels;

— Type C: control panels (c.p.) without direct connection for detectors (see Figure 2);

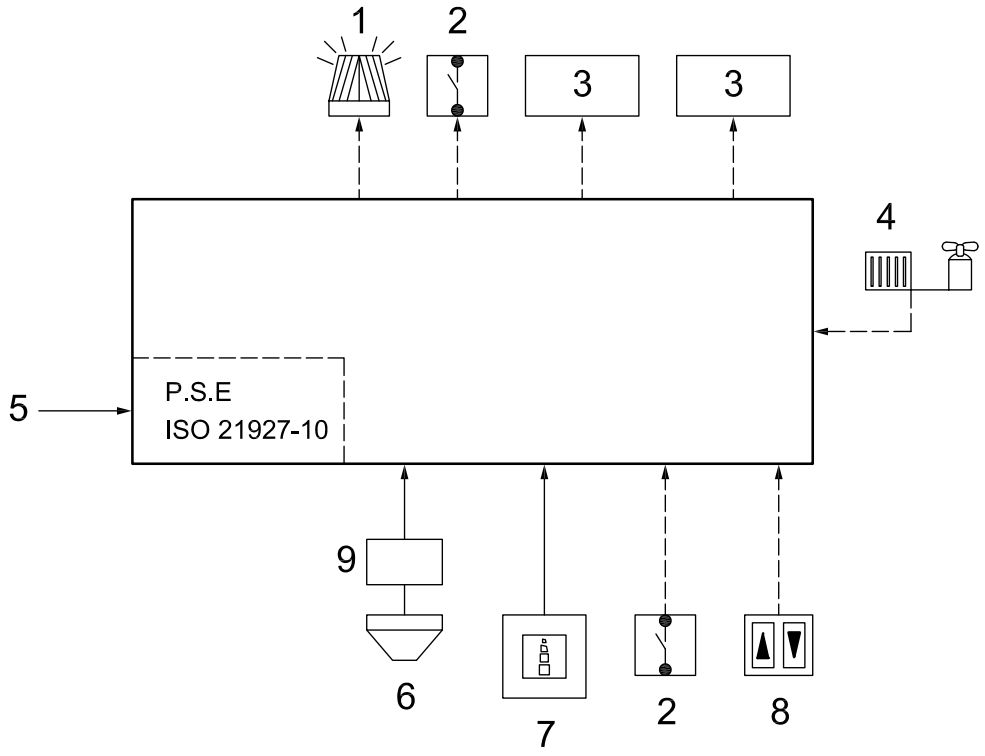
— Type D: control panels with direct connection for detectors (see Figure 3).

See Annex B for a summary of the functions relevant to each type.

NOTE 1 When a type D panel is used without detectors, it may also be considered a type C panel.

NOTE 2 Manual control points are not classified as types A to D except for indoor or outdoor use according to ISO 7240-11.

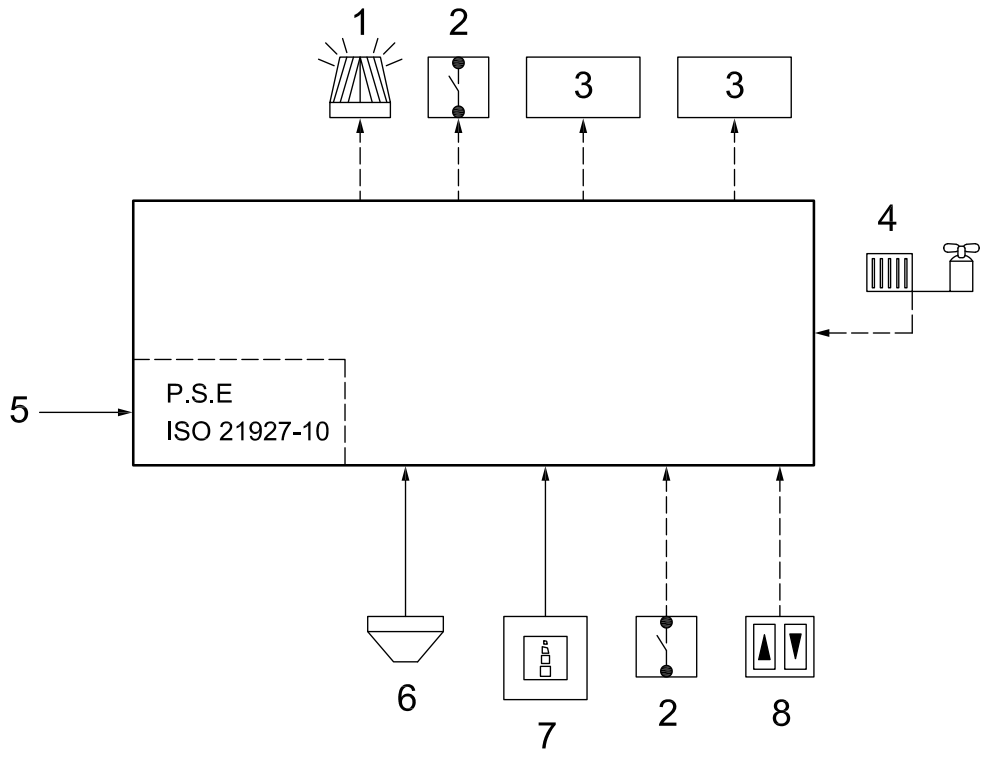
NOTE 3 Thermal release elements are not classified as types A to D except for the nominal release temperature.



Key

1 sounder/lamp
2 potential free contact
3 SHCS component
4 wind/rain detector
5 230 V/400 VAC main power supply
6 detector (ISO 7240)
7 manual control point
8 vent button
9 c.i.e. (ISO 7240)

Figure 2 — Example of a type C control panel



Key

1 sounder/lamp
2 potential free contact
3 SHCS component
4 wind/rain detector
5 230 V/400 VAC main power supply
6 detector (ISO 7240)
7 manual control point
8 vent button

Figure 3 — Example of a type D control panel

4.2.4 Operational reliability

4.2.4.1 For the purposes of this part of ISO 21927, control equipment shall be classified in one of the following reliability classes (Re):

— Re A: as declared by the manufacturer (A > 50);

— Re 50;

— Re 1000.

The designations A, 50, and 1000 will represent the number of operating cycles in the fire condition.

This test shall not be applied for manual control points.

4.2.4.2 When control equipment, intended for smoke control purposes only, is tested in accordance with 13.1, the number of operating cycles in the fire condition shall conform to 4.2.4.1.

4.2.4.3 Control equipment that is also intended to provide additional control when in the standby condition (e.g. to use dual-purpose ventilators for day-to-day comfort ventilation) shall be cycled an additional 10 000 times in the standby condition prior to performing the operating cycles in the fire condition in accordance with 4.2.4.2. Such equipment shall be identified by the addition of DP to the reliability class, e.g. Re 1000DP.

4.2.5 Priority

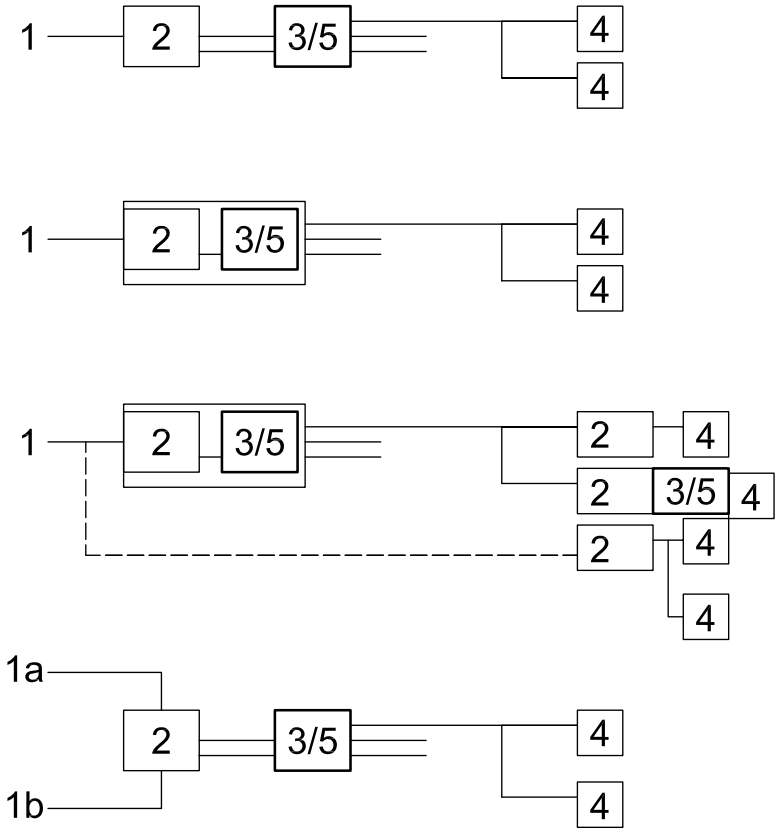
The fire condition shall have the highest priority. Any fire signal shall switch the control equipment into the fire condition regardless of the condition at the time, unless the fire signal has been disabled. Priority between fire signals shall be declared in the user documentation.

4.2.6 Use for other purposes

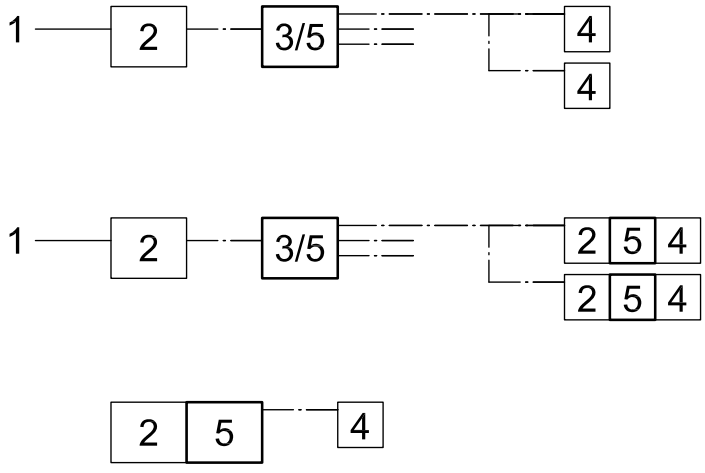
Smoke- and heat-control systems (SHCS) may be used for functions other than smoke control (e.g. to provide comfort ventilation); however, the primary purpose of the system should always be for the control of smoke and heat. These additional functions may be signalled by sensors or switches directly connected to, and controlled by the control equipment. The control equipment may be linked to other systems such as a Building Management System (BMS) to facilitate these functions. Failure of sensors or switches or connection to other systems not controlling smoke and heat shall not affect the operation of the control equipment in the fire condition. Any control equipment used in an SHCS shall conform to the requirements of this part of ISO 21927. All input signals to the control equipment that initiate the fire condition shall come directly from the detection source (e.g. c.i.e., manual control point) and be monitored in accordance with Table 1.

4.2.7 Type and location of control equipment

For the purposes of this part of ISO 21927, the control equipment shall comprise at least one enclosure. Several components with their own enclosures (e.g. manual control points for different zones) may be electrically and/or pneumatically connected to the primary enclosure (see Figure 4).



a) Electrical



b) Pneumatic

NOTE A pneumatic p.o.d. may be a compressor set, air receiver or gas bottle, as appropriate.

Key

1	main supply	4	actuator, motor, solenoid, etc.
2	power output devices (p.o.d.)	5	b.c.p.
3	control panel		

_____ Electrical requirement

_ _ _ _ _ _ _ Electrical option

_ · _ · _ · _ Pneumatic

Figure 4 — Examples showing typical locations and interrelationships of the c.p. with other components of a smoke and heat control system

5 Electrical systems

5.1 Electrical control panels

5.1.1 General requirements

5.1.1.1 It shall be possible for the c.p. to be in any combination of the following functional conditions simultaneously:

— fire condition;

— fault warning condition;

— disablement condition (if provided);

— test condition (if provided).

5.1.1.2 A single short-circuit or interruption in any individual electrical transmission path to or from the c.p. shall not prevent the correct operation, as specified by the manufacturer, of more than one of the following functions:

— automatic detection of fire (type D);

— operation of basic control panels;

— transmission or reception of signals to or from input/output devices;

— initiation of operation of ancillary equipment.

and

— all devices rendered inoperative by the fault shall be intended to operate together; and

— all devices rendered inoperative by the fault shall fulfil the same function.

5.1.2 General requirements for indications

5.1.2.1 Display of functional conditions

The c.p. shall be capable of unambiguously indicating the following functional conditions, as described in 5.1.3 to 5.1.7:

— standby condition;

— fire condition;

— fault warning condition;

— disablement condition (if provided);

— test condition (if provided).

5.1.2.2 Incorrect operation indication (option with requirements)

The control equipment shall provide indication of incorrect operation of all SHCS components including dampers as well as fault indication according to ISO 21927-3.

In standby condition, incorrect operation indication shall be provided for each zone by a yellow light-emitting indicator. It shall indicate that at least one device in the zone is not in the correct standby position. Incorrect operation indication may be shared with fault indication, with the incorrect operation fault indication flashing. Priority goes to fault indication, if shared. For powered ventilators, the light-emitting indicator shall indicate an electrical fan fault. For dampers it shall indicate that the damper blades are not in the correct position.

In the fire condition, incorrect operation condition shall be provided for each zone by a separate red light-emitting indicator. It shall indicate that at least one device in the zone is not in the correct activated position. Incorrect position indication shall be flashing and correct activated position indication shall be steady. For powered ventilators, the light-emitting indicator shall indicate that fan pressure or air flow is not detected. For dampers it shall indicate that the damper blades are not in the correct activated position.

5.1.2.3 Display of indications

All compulsory indications shall be clearly identifiable, except where otherwise specified in this part of ISO 21927. All compulsory indications of each SHCS control zone shall be displayed together at least once. There is no objection to controls or indications being repeated in other enclosures, e.g. a remote fireman′s override panel.

5.1.2.4 Additional indications

Where indications are used in addition to compulsory indications and/or indications in options with requirements, these shall be clearly labelled.

The type, location and labelling of the additional indications should be designed to avoid contradiction or confusion with compulsory indications.

5.1.2.5 Indications by means of light-emitting indicators

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

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

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

— at a distance of up to 0,8 m for other indications.

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

5.1.2.6 Indications on alphanumeric displays (option with requirements)

5.1.2.6.1 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 the fields relating to that functional condition are grouped.

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

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

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

5.1.2.6.5 A field shall be capable of containing either:

— at least 16 characters where the display uses a cross-reference to other information to identify the location,

or

— at least 40 characters, where the display is intended to include complete information on the location.

5.1.2.6.6 Compulsory indications on an alphanumeric display shall be legible for at least 1 h following the display of a new indication of fire or fault, at a distance of up to 0,8 m, 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.

Following this period, the brightness may be reduced, but the indications shall remain legible at 5 lx to 100 lx, at the above distance and angles. If the brightness is reduced, 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.

5.1.2.7 Audible indications (option with requirements)

5.1.2.7.1 Audible indicators shall be part of the c.p. The same device may be used for fire alarm and fault warning indications.

5.1.2.7.2 The sound may be the same or different for each indication. If the sound is different, then the fire alarm shall have priority.

5.1.2.8 Testing of indicators (option with requirements)

All compulsory visual and audible indicators and the indicators provided with an option with requirements shall be tested by manual operation at access level 1 or 2.

5.1.3 Standby condition

A green visual indication shall be given by means of a separate light-emitting indicator while the c.p. is supplied with power.

Where the green indication is provided instead on a manual control point, this means that the c.p. is fully active. This indication may be in the form of labels which shall be no smaller than 12 mm × 12 mm.

If light-emitting indicators are used, they shall conform to 5.1.2.5.

NOTE Where the secondary power supply to the c.p. has a limited period of operation, e.g. when batteries are used, the green indication can be switched off to save power while the c.p. is in fault condition due to the loss of the primary power supply.

Any kind of information may be displayed in the standby position. However, no indications shall be given which could be confused with indications used in the:

— fire condition;

— fault warning condition;

— disablement condition;

— test condition.

5.1.4 Fire condition

5.1.4.1 Reception and processing of fire signals (inputs)

5.1.4.1.1 The c.p. shall be capable of receiving, processing and interpreting relevant initiating signals. Any signal from one input shall not falsify the processing, storage, interpretation and/or indication of signals from other inputs, e.g. fire alarm systems, smoke detectors, sprinkler flow switches, manual operations, wind detectors.

Manual operation may be from manual switches on the c.p., separate switch panels, manual control points, etc. A single manual operation may control the complete system or a zone or group of equipment.

5.1.4.1.2 The response time of the c.p. shall not exceed 10 s.

5.1.4.1.3 All fire signals shall have priority over any other signal.

5.1.4.1.4 Detectors used with type D control panels shall conform to the relevant part of one of the following: ISO 7240-5, ISO 7240-6, ISO 7240-7, ISO 7240-8, ISO 7240-10, ISO 7240-12, ISO 7240-15, ISO 7240-20, or ISO 7240-27.

5.1.4.1.5 The c.p. may have the facility to delay operation of some or all outputs following the response time to meet system design requirements. The maximum delay time provided shall be stated in the user documentation in 8.3.

5.1.4.2 Control panel outputs

5.1.4.2.1 The c.p. shall be capable of providing relevant initiation signals to SHCS components.

5.1.4.2.2 Where power to SHCS components is provided through the c.p., the c.p. shall be capable of switching and maintaining the rated power output.

5.1.4.2.3 All fire outputs shall have priority over any other output.

5.1.4.3 Visual indication

Visual indication shall be provided by means of a separate red light-emitting indicator for:

— the fire condition activation;

— the fire position of the SHCS device(s) (if provided); this indication may flash to show a device or devices not in the fire position.

If light-emitting indicators are used, they shall conform to 5.1.2.5.

Visual indication may be provided by a single red indicator for the entire system or separate red indicators for separate zones or groups of equipment.

This indication may be implemented within the manual control point. This indication may be in the form of labels which shall be no smaller than 12 mm × 12 mm.

5.1.4.4 Audible indication (option with requirements)

The c.p. may have provision for the audible indication of the fire condition at the c.p. and/or a remote location. In this case, the following shall apply:

a) The minimum sound level, measured under anechoic conditions at a distance of up to 1 m, with any access door on the c.p. closed, shall be 60 dB(A) or 85 dB(A).

NOTE The provision for two sets of audible indications enables a c.p. to be installed in areas that are normally occupied (such as a security room).

b) It shall be possible to silence the audible indication at access level 1 or 2.

c) The audible indication shall not be silenced automatically, although it may be silenced automatically if the c.p. is manually reset from the fire condition.

d) If the audible indication is used for more than one zone following silencing, it shall be possible to automatically re-sound the audible indication by an actuation in another zone.

5.1.4.5 Output to the fire alarm condition (option with requirements)

At least one output signalling the fire condition shall be provided, conforming to the requirements of 5.1.4.6.

5.1.4.6 Output to systems other than SHCS (option with requirements)

The c.p. may have provision for the transmission of fire condition signals to other systems. Failure of these other systems shall not affect the c.p.

NOTE For example, this can be achieved using a potential free contact or optocoupler.

5.1.4.7 Deadlock (option with requirements)

5.1.4.7.1 The connected SHCS components might fail to operate at the first attempt, for instance in the case of iced flaps to ventilators. To overcome this, the c.p. shall regularly repeat the operation of selected outputs for a set period of time.

5.1.4.7.2 The output to actuators shall be repeated at least once every 2 min for a period of at least 30 min (type A).

5.1.4.7.3 The output to solenoids or electromagnets shall be repeated with a pulse of at least 2 s every 10 s for at least 2 min (type B).

NOTE The choice of deadlock type is made by the manufacturer (either or both) and should be described in the user documentation.

5.1.4.8 Reset from the fire condition

Following a reset operation, the indication of the correct functional conditions corresponding to any received signals shall either remain or be re-established within 120 s.

NOTE This time is made up of 20 s for the reset process and 100 s for the processing of signals (see 5.1.5.1.1).

5.1.4.9 Co-incidence detection (type D — option with requirements)

Following the receipt of a signal from a fire detector, and until one or more confirmatory signals are received from the same or other points, the c.p. may have provision to inhibit either the indication of the fire alarm condition or the operation of one or more outputs.

In these cases, at least the following shall apply:

a) it shall be possible to select the feature at access level 3 for individual zones;

b) the inhibition of one output signal shall not affect the other outputs.

5.1.4.10 Dependency on more than one alarm signal (option with requirements)

A c.p. may be capable of receiving more than one alarm signal and of initiating a range of outputs depending upon the signal or signals received.

In these cases, at least the following shall apply:

a) once the correct output or outputs are determined, any further alarm signals (other than from manual fireman's override switches) shall not change the outputs;

b) the cause and effect conditions shall be stated in the design documentation;

c) it shall only be possible to change the cause and effect conditions at access level 3 or 4.

5.1.5 Fault warning condition

5.1.5.1 Reception and processing of fault signals

5.1.5.1.1 The c.p. shall enter the fault warning condition within 100 s of receiving signals which are interpreted as a fault.

5.1.5.1.2 The c.p. shall be capable of simultaneously recognizing all the faults specified in 5.1.5.1.3 and 5.1.5.2, though recognition of a fault in a given zone or function may be prevented by one or more of the following:

a) the presence of fire alarm signals from the same zone;

b) the disablement of the corresponding zone or function (if provided);

c) the testing of the corresponding zone or function (if provided);

d) fault warning routing equipment.

5.1.5.1.3 All cable faults indicated in Table 1 shall lead to the c.p. going into the fault warning condition, unless the SHCS goes automatically to its fire condition in case of failure.

Table 1 — Monitoring of cable faults

Any line (if provided) between	Interruption	Short-circuit
c.p. <-> actuator / drive / motor / solenoid electromagnet	C	C**
c.p. <-> detector or c.i.e. (ISO 7240)	C	C*
c.p. <-> wind detector (if used in fire condition)	C***	C****
c.p. <-> manual control point	C	C*
c.p. <-> separate c.p. or b.c.p. or m.c.p.	C	C*
c.p. <-> separate p.s.e.	C	C
c.p.<-> SHCS component position indicating contact	C	C

C	Compulsory.
C*	Short-circuit between conductors for initiation of the SHCS only.
C**	Where the ventilators are partially open for day-to-day ventilation, monitoring is not required until they are in their closed or fully open position.
C***	Only the power supply conductors need to be monitored as long as any data conductors are included within the same cable, and data failure results in activating the relevant outputs in the fire condition.

NOTE Interruption in accordance with this part of ISO 21927 is a break in continuity in any single conductors required for fire condition operation of the system and incorrect position indication (if used).

5.1.5.1.4 In the case of a single output from the c.p. to actuators, drives or motors using more than two terminals, interruption shall mean a break in continuity in all conductors.

5.1.5.2 Earth fault indication (option with requirement)

At least one common indication shall be provided for any single earth fault which affects a compulsory function and which is not otherwise indicated as a fault of a supervised function.

5.1.5.3 Visual indication

5.1.5.3.1 The presence of fault, as specified in 5.1.5.1.3 and 5.1.5.2, shall be indicated without prior manual intervention. The fault warning condition is established when the following are present:

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

and/or

b) a visual indication by means of a separate yellow light-emitting indicator for each recognized fault;

and

c) an audible indication, as specified in 5.1.5.4 (option with requirements).

This visual indication may be provided at a manual control point. It may be in the form of labels that shall be no smaller than 12 mm × 12 mm.

5.1.5.3.2 The visual indication specified in 5.1.5.3.1 may be provided by:

a) dedicated light-emitting indicators;

or

b) light-emitting indication shared with test and/or disablement condition and/or incorrect position condition light-emitting indicators and with the conditions distinguished by means of variation of display, e.g. steady, slow flash, fast flash.

5.1.5.4 Audible indication (option with requirements)

The c.p. may have provision for the audible indication of the fault condition at the c.p. and/or a remote location. In this case the following shall apply:

a) The minimum sound level, measured under anechoic conditions at a distance of up to 1 m, with any access door on the c.p. closed, shall be 50 dB(A).

b) It shall be possible to silence the audible indication of faults manually at access level 1 or 2. The same manual operation may be used as for silencing in the fire condition.

c) The audible indication shall be silenced automatically if the c.p. is automatically reset from the fault warning condition.

d) If the audible indication is used for more than one zone following silencing, it shall be possible to automatically re-sound the audible indication for each newly recognized fault.

5.1.5.5 Output of the fault condition (option with requirements)

The c.p. may have provision for the transmission of fault condition signals to controls for other systems. Failure of these other systems shall not adversely affect the c.p. The output signal shall also be given if the c.p. is de-energized.

NOTE For example, this can be achieved using a potential free contact or optocoupler.

5.1.5.6 Reset of fault indications

5.1.5.6.1 It shall be possible to reset fault indications such as those under under 5.1.5.3 and 5.1.5.4 once the fault has been cleared:

a) automatically when faults are no longer recognized;

and/or

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

5.1.5.6.2 Following reset, the indication of the correct functional conditions, corresponding to any received signals, shall either remain or be re-established within 120 s.

NOTE This time is made up of 20 s for the reset process and 100 s for the processing of fault signals (see 5.1.5.1.1).

5.1.6 Disablement condition (option with requirements)

5.1.6.1 General requirements

In some situations (e.g. during routine maintenance), inputs and/or outputs may be disabled at the c.p. Disabling an input or output shall only affect the input or output being disabled. The c.p. shall have provision to independently disable and re-enable each input and/or output used in the fire condition only manually at access level 2 or 3.

5.1.6.2 Visual indication

5.1.6.2.1 The disabled SHCS shall be indicated by:

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

and/or

b) a visual indication by means of a separate yellow light-emitting indicator for each recognized disablement (this indication may be provided at a manual control point).

5.1.6.2.2 The visual indication specified in 5.1.6.2.1 may be provided by:

a) dedicated light-emitting indicators;

or

b) light-emitting indication shared with fault and/or test condition and/or incorrect position condition light-emitting indicators and with the conditions distinguished by means of variation of display, e.g. steady, slow flash, fast flash.

5.1.6.3 Output of the disablement condition (option with requirements)

The c.p. may have provision for the transmission of disablement condition signals to other systems. Failure of these other systems shall not adversely affect the c.p.

NOTE For example, this can be achieved using a potential free contact or optocoupler.

5.1.7 Test condition (option with requirements)

5.1.7.1 General requirements

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

a) the c.p. shall be in test condition while one or more zones are 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 zone individually;

d) zones in the test state shall not prevent the compulsory indications and outputs from zones not in the test state;

e) signals from a zone under test shall not lead to the operation of the outputs to the SHCS, except temporarily to test their functioning in relation to the corresponding zone.

5.1.7.2 Visual indication

The test condition shall be indicated visibly on the c.p. The visual indication shall be yellow and may be provided by:

a) dedicated light-emitting indicators;

b) light-emitting indication shared with fault and/or disablement condition and/or incorrect position condition light-emitting indicators and with the conditions distinguished by means of variation of display, e.g. steady, slow flash, fast flash (this indication may be provided at a manual control point).

5.1.7.3 Output of the test condition (option with requirements)

The c.p. may have provision for the transmission of test condition signals to other systems. Failure of these other systems shall not affect the c.p.

NOTE For example, this can be achieved using a potential free contact or optocoupler.

5.2 Electrical basic control panels

5.2.1 General requirements

5.2.1.1 Basic control panels are only intended for use on fail-safe SHCSs.

5.2.1.2 The b.c.p. shall have a minimum of fire condition and standby condition. If any further functional conditions are provided, they shall conform to the requirements of the relevant sub-clauses of 5.1. However, indication may be provided by means of suitable labelling of the correct colour.

5.2.2 General requirements for indications

5.2.2.1 Display of indications

All compulsory indications shall be clearly identifiable. These may be in the form of labels that shall be no smaller than 12 mm × 12 mm. If light-emitting indicators are used, they shall conform to 5.1.2.5.

5.2.2.2 Additional indications

Indications used in addition to compulsory indications shall not result in contradiction or confusion.

5.2.2.3 Audible indications (option with requirements)

5.2.2.3.1 Audible indicators shall be part of the c.p. The same device may be used for fire alarm and fault warning indications.

NOTE The sound can be the same or different for each indication.

5.2.2.3.2 The minimum sound level, measured under anechoic conditions at a distance of 1 m, with any access door on the c.p. closed, shall be:

— 60 dB(A) for fire alarm indications;

— 50 dB(A) for fault warning indications.

5.2.2.4 Testing of indicators (option with requirements)

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

5.2.3 Standby condition

A green visual indication shall be given while the c.p. is supplied with power.

5.2.4 Fire condition

5.2.4.1 A red visual indication shall be given when the control equipment is in the fire condition.

5.2.4.2 Reception and processing of fire signals

5.2.4.2.1 The b.c.p. shall be capable of receiving no more than one external initiating signal.

5.2.4.2.2 The c.p. shall enter the fire condition within 10 s of an initiating device being activated.

5.2.4.2.3 The fire signal shall have priority over any other signal.

5.2.4.3 Audible indication (option with requirements)

The b.c.p. may have provision for the audible indication of the fire condition at the b.c.p. and/or remote location. In this case, the following shall apply:

a) It shall be possible to silence the audible indication at access level 1 or 2.

b) The audible indication shall not be silenced automatically, although it may be silenced automatically if the c.p. is manually reset from the fire condition.

c) If the audible indication is used for more than one zone following silencing, it shall be possible to automatically re-sound the audible indication by an actuation in another zone.

5.2.4.4 Output of the fire condition (option with requirements)

At least one output signalling the fire condition shall be provided and this shall be activated within 10 s of initiation.

5.2.4.5 Reset from the fire condition

Following a reset operation, the indication of the correct functional conditions corresponding to any received signals shall either remain or be re-established within 20 s.

5.3 Manual control point

5.3.1 Types of activation

5.3.1.1 Direct operation, type A: an electrical manual control point in which the change to the fire condition is automatic (i.e. without the need for further manual action) when the frangible element is broken or displaced.

5.3.1.2 Indirect operation, type B: an electrical manual control point in which the change to the fire condition requires a separate manual operation of the operating element by the user after the frangible element is broken or displaced and in which unintended resetting is prevented.

5.3.1.3 Indirect operation, type C: an electrical manual control point in which the change to or from the fire condition requires a separate manual operation of the operating element by the user after the frangible element is broken or displaced.

5.3.2 Types of manual control point

5.3.2.1 Type I

Type I is a manual control point providing manual control and indication, i.e. indication of standby, fault and fire conditions; this type shall be equipped with the following operation and indication elements:

— frangible element;

— triggering element;

— resetting element;

— red light-emitting indicator for “fire”;

— green light-emitting indicator for “standby”;

— yellow light-emitting indicator for “fault”;

Additional indications may be used. The colours green and red shall not be used for additional visual indications.

5.3.2.2 Type II

Type II is a manual control point providing control only. This type of manual control point shall be equipped with the following operation and indication elements:

— frangible element;

— triggering element;

— red light-emitting indicator for “fire”;

— resetting element (optional).

Additional indication may be used. The colour red shall not be used for additional visual indications. The colour green shall only be used to indicate the standby condition.

5.3.3 Indications and functions

5.3.3.1 Visual indication shall conform to the requirements of 5.1.2.5.

5.3.3.2 Standby condition

The standby state of the SHEV shall be easily visible to the user. The frangible element shall be visible in the standby condition and shall not be broken or deformed.

Type I manual control points shall indicate the standby condition by a green light-emitting indication or in the form of labels that are no smaller than 12 mm × 12 mm.

5.3.3.3 Fire condition

The fire condition of the SHEV shall be indicated by a constant red light-emitting indicator or by a red light-emitting indicator with a blinking frequency of at least 1 Hz and a pulse-pause proportion higher than 1:100. This indication may be in the form of labels that shall be no smaller than 12 mm × 12 mm.

Type I manual control points shall indicate general faults by a constant yellow light-emitting indicator or by a yellow light-emitting indicator with a blinking frequency of at least 1 Hz and a pulse-pause proportion higher than 1:100. This indication may be in the form of labels that shall be no smaller than 12 mm × 12 mm.

5.3.3.4 Resetting elements

Mechanical resetting shall be as follows:

Type A shall be designed to be reset by inserting a new frangible element or by resetting the frangible element and type B by resetting the release element in its standby position and by changing or resetting the frangible element.

Type A and B shall be designed so that they cannot be unintentionally reset when the housing is closed, even if the frangible element is broken. Resetting without destruction shall necessitate the use of a special tool.

Type C shall be designed to be reset without the use of special tools once the frangible element is broken.

5.3.3.5 Test facility for inspection

The manual control point shall be equipped with a device for testing its usability. The test shall:

a) simulate the fire condition without breaking the frangible element;

b) enable reset of the manual control point without breaking the frangible element;

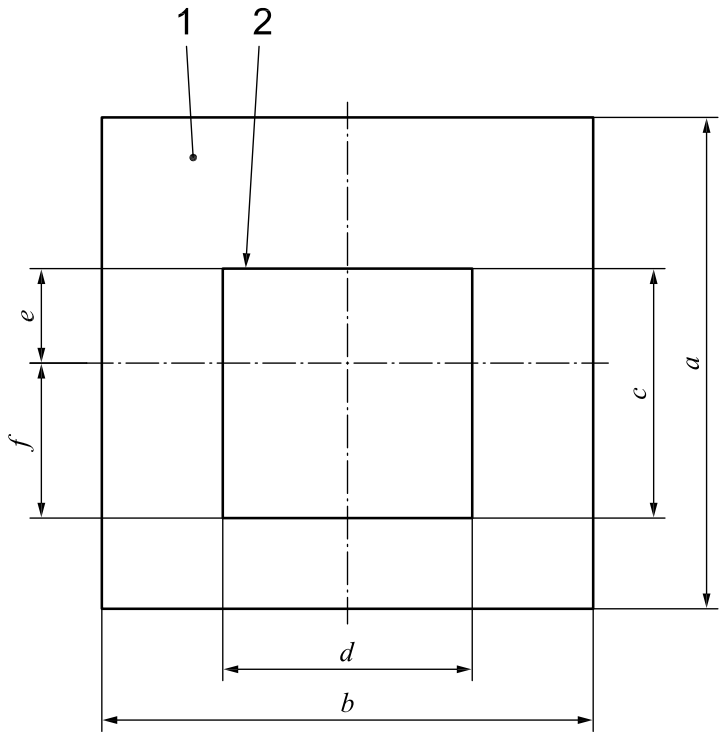
c) require the use of a special tool for the operation and/or resetting of the manual control point.

5.3.4 Enclosure

5.3.4.1 Dimensions

The dimensions of the front face and the operation face shall lie within the limits shown in Figure 5 and Table 2. A tolerance of ±5 % may be applied where not otherwise specified.

Manual control points shall be designed to be mounted in accordance with the manufacturer's instructions, with the front face at least 15 mm proud of the surrounding face.



Key

1 front face

2 operating face

Figure 5 — Front face of manual control point

Table 2 — Dimensions of front face

Dimension	Letter in Figure 5	Measurement Square, rectangular or round operating face
Height of front face	a	85 mm ≤ a ≤ 150 mm
Width of front face	b	85 mm ≤ b ≤ 150 mm
Ratio of width to height of front face	a/b	0,95 ≤ a/b ≤ 1,05
Height of operating face	c	34 mm ≤ cx ≤ 0,8 × a
Width of operating face	d	34 mm ≤ dx ≤ 0,8 × a
Ratio of width to height of operating face	d/c	0,95 mm ≤ d/c ≤ 1,05
Maximum vertical off-set of operating face	$\|f\text{-}e\|$ (g)	≤ 0,16 mm × a mm

5.3.4.2 Colours

The following colours shall be used:

— visual operation board: clean white to RAL 9010;

— lettering: deep black to RAL 9005;

— housing: deep orange to RAL 2011.

5.3.4.3 Lettering on front face

On the front face above the operating face and vertically centred, wording naming the system (e.g. smoke control) shall be written. The lettering shall be in accordance with ISO 3098-2 (preferably “Lettering B vertical”). The height of the letters shall be between $0{,}1 \times a$ and $0{,}15 \times a$, where “a” represents the height of the front face.

Further lettering on the surface of the front face is restricted to below the centre of the operating face.

5.3.4.4 Lettering on the operating face

Lettering on the operating face which does not represent direct operating instructions (such as manufacturers' logos or service addresses) shall not exceed 10 % of the surface of the operating face.

6 Pneumatic systems

6.1 Pneumatic control panels

6.1.1 General requirements

6.1.1.1 If functions other than those specified in this part of ISO 21927 are provided, they shall not jeopardize any requirements of this part of ISO 21927.

6.1.1.2 It shall be possible for the c.p. to be any combination of the following functional conditions simultaneously:

— fire condition;

— fault warning condition (if provided);

— disablement condition (if provided);

— test condition (if provided).

Pneumatic control panels may be used on fail-safe or non-fail-safe smoke and heat control systems. In case of non-fail-safe systems, the tube between the pneumatic p.o.d. and the c.p. shall be monitored by a pressure gauge on the front of the c.p. unless the p.o.d. and the c.p. are in the same enclosure. If a circular gauge is used, the minimum diameter of the pressure gauge shall be 40 mm. If an alphanumeric display is used, it shall conform to 5.1.2.6. The minimum pressure level shall be indicated.

6.1.1.3 The time delay between initiation (manual, electric or pneumatic) and commencement of the output to the SHCS shall be no more than 10 s.

6.1.1.4 The c.p. may be totally pneumatic or electropneumatic. Where an electrical supply is provided to the c.p. (except solely as a means of initiation), compulsory indications shall be provided by means of light-emitting indicators.

6.1.1.5 The c.p. shall have a minimum of fire condition and standby condition. If any further functional conditions are provided, they shall conform to the requirements of the relevant sub-clauses of 5.1.

6.1.1.6 An isolation valve may be fitted to the air supply for maintenance purposes. Any such valve shall bear clear indication of the open and isolated positions and shall be lockable in the open position.

6.1.1.7 In the event of loss of supply gas pressure from a compressed air system or a multiple-use gas bottle, the c.p. shall maintain its pre-existing status and respond correctly to operation of the manual initiation device or receipt of an automatic signal. Upon reinstatement of the design supply pressure, it shall operate normally without manual intervention.

6.1.1.8 In the event of total loss of electrical power, the c.p. shall:

— maintain its pre-existing status; or

— enter the fire condition within 10 s; and

— operate normally without manual intervention upon reinstatement of power.

6.1.2 General requirements for indications

6.1.2.1 Display of functional conditions

The c.p. shall be capable of unambiguously indicating the following functional conditions:

— standby condition;

— fire condition;

— fault warning condition (if provided);

— disablement condition (if provided);

— test condition (if provided).

6.1.2.2 Display of indications

All compulsory indications shall be clearly identifiable, except where otherwise specified in this part of ISO 21927. All compulsory indications for each SHCS zone shall be displayed together at least once in either the respective SHCS zone or a single location.

6.1.2.3 Indications on alphanumeric displays

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 the fields relating to that functional condition are grouped.

6.1.2.4 Additional indications

Indications used in addition to compulsory indications should not result in contradiction or confusion.

6.1.2.5 Indications by means of light-emitting indicators

Compulsory indications from light-emitting indicators shall conform to the requirements 5.1.2.5.

6.1.2.6 Indications by label

Where indications are provided by means of a label or similar device, the visible area shall be at least 12 mm × 12 mm.

6.1.2.7 Indications on alphanumeric displays (option with requirements)

Indications on alphanumeric displays shall conform to the requirements of 5.1.2.6.

6.1.2.8 Audible indications (option with requirements)

Audible indicators shall conform to the requirements of 5.1.2.7.

6.1.2.9 Testing of indicators (option with requirements)

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

6.1.3 Standby condition

6.1.3.1 Visual indication

6.1.3.1.1 A green visual indication shall be given to indicate the standby condition.

6.1.3.1.2 Any kind of information may be displayed in the standby position. However, no indications shall be given which could be confused with indications used in the following:

— fire condition;

— fault warning condition;

— disablement condition;

— test condition.

6.1.4 Fire condition

6.1.4.1 Reception and processing of fire signals (inputs)

6.1.4.1.1 The c.p. shall be capable of receiving, processing and interpreting relevant initiating signals. Any signal from one input shall not falsify the processing, storage, interpretation and/or indication of signals from other inputs, e.g. fire alarm systems, sprinkler flow switches, manual operations.

6.1.4.1.2 The response time of the c.p. shall not exceed 10 s.

6.1.4.1.3 All fire signals shall have priority over any other signal.

6.1.4.2 Control panel outputs

6.1.4.2.1 The c.p. shall be capable of supplying and releasing gas pressure to SHCS components and providing any warning or information outputs specified.

6.1.4.2.2 The c.p. shall be capable of switching and maintaining the rated gas pressure.

6.1.4.2.3 All fire outputs shall have priority over any other output.

6.1.4.3 Visual indication

Visual indication shall be red for the fire condition.

NOTE Visual indication can be provided by a single red indicator for the entire system or separate red indicators for separate zones or groups of equipment.

6.1.4.4 Audible indication (option with requirements)

If the c.p. has an electrical supply, it may have provision for the audible indication of the fire condition at the c.p. and/or a remote location. In this case, the following shall apply:

a) It shall be possible to silence the audible indication at access level 1 or 2.

b) The audible indication shall not be silenced automatically until the c.p. is manually reset from the fire condition.

c) If the audible indication is used for more than one zone following silencing, the audible indication shall automatically re-sound upon an actuation in another zone.

6.1.4.5 Output to systems other than SHCS (option with requirements)

The c.p. may have provision for the transmission of fire condition signals to other systems. Failure of these other systems shall not affect the c.p.

6.1.4.6 Reset from the fire condition

Following a reset operation, the indication of the correct functional conditions corresponding to any received signals shall either remain or be re-established within 20 s.

6.1.5 Fault warning condition (option with requirements)

6.1.5.1 Reception and processing of fault signals

6.1.5.1.1 The c.p. shall enter the fault warning condition when signals are received which, after any necessary processing, are interpreted as a fault.

6.1.5.1.2 The c.p. shall be capable of recognizing low gas supply pressure if the system is not fail-safe, except in the case of single-use gas bottles, and the faults specified in 6.1.5.1.3, with the exception that the recognition of a fault in a given zone or function may be prevented by one or more of the following:

a) the presence of fire signals from the same zone;

b) the disablement of the corresponding zone or function (if provided);

c) the testing of the corresponding zone or function (if provided).

6.1.5.1.3 Any interruption or short-circuit between the c.p. and a p.o.d. or electrical initiation device shall be indicated within 100 s of its occurrence unless the SHCS goes automatically to its fire condition.

6.1.5.2 Visual indication

6.1.5.2.1 The presence of fault shall be indicated without prior manual intervention. The fault warning condition is established when the following are present:

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

and/or

b) a visual indication by means of a separate yellow light-emitting indicator for each recognized fault;

c) an audible indication, as specified in 6.1.5.3 (option with requirements).

6.1.5.2.2 The visual indication specified in 6.1.5.2.1 may be provided by:

a) dedicated light-emitting indicators;

b) light-emitting indication shared with test and/or disablement condition light-emitting indicators;

c) light-emitting indication shared with test and/or disablement condition light-emitting indicators and with the conditions distinguished by means of variation of display, e.g. steady, slow flash, fast flash;

d) light-emitting indication shared with device position indication and with incorrect device position in the standby condition indicated by flashing (if provided).

6.1.5.3 Audible indication (option with requirements)

6.1.5.3.1 It shall be possible to silence the audible indication of faults manually at access level 1 or 2. The same manual operation may be used as for silencing in the fire condition

6.1.5.3.2 The audible indication shall be silenced automatically if the c.p. is automatically reset from the fault warning condition.

6.1.5.3.3 If the audible indication is used for more than one zone following silencing, it shall be possible to automatically re-sound the audible indication for each newly recognized fault.

6.1.5.4 Output of the fault condition (option with requirements)

The c.p. may have provision for the transmission of fault condition signals to other systems. Failure of these other systems shall not adversely affect the c.p. The output signal shall also be given if the c.p. is de-energized or fails.

NOTE For example, this can be achieved using a potential free contact or optocoupler.

6.1.5.5 Reset of fault indications

6.1.5.5.1 It shall be possible to reset indications of faults once the fault has been cleared:

a) automatically when faults are no longer recognized, and/or

b) by manual operation at access level 1 or 2, which may be the same as that used for resetting from the fire condition.

6.1.5.5.2 Following reset, the indication of the correct functional conditions corresponding to any received signals shall either remain or be re-established within 20 s.

6.1.6 Disablement condition (option with requirements)

6.1.6.1 General requirements

In some situations (e.g. during routine maintenance), inputs or outputs may be disabled at the c.p. Disabling of an input or output shall only affect the input or output being disabled. The c.p. shall have provision to independently disable and re-enable each input and/or output used in the fire condition at access level 2 or 3.

6.1.6.2 Visual indication

6.1.6.2.1 A general or specific disablement condition shall be indicated visibly in yellow on the c.p. in accordance with 5.1.2.5.

6.1.6.2.2 The disabled SHCS shall be indicated by:

a) a visual indication by means of a single indicator (the general disablement warning indicator);

and/or

b) a visual indication by means of a separate indicator for each recognized disablement.

6.1.6.2.3 The visual indication specified in 6.1.6.2.1 may be provided by:

a) a label;

b) dedicated light-emitting indicators;

c) light-emitting indication shared with fault warning and/or test condition light-emitting indicators;

d) light-emitting indication shared with fault warning and/or test condition light-emitting indicators and with the conditions distinguished by means of variation of display, e.g. steady, slow flash, fast flash.

6.1.6.3 Audible indication (option with requirements)

6.1.6.3.1 It shall be possible to silence the audible indication of faults manually at access level 1 or 2. The same manual operation may be used as for silencing the fire condition.

6.1.6.3.2 If the audible indication is used for more than one zone following silencing, the audible indication shall automatically re-sound for each newly recognized fault.

6.1.6.4 Output of the disablement condition (option with requirements)

The c.p. may have provision for the transmission of disablement condition signals to other systems. Failure of these other systems shall not adversely affect the c.p.

NOTE For example, this can be achieved using a potential free contact or optocoupler.

6.1.7 Test condition (option with requirements)

6.1.7.1 General requirements

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

a) the c.p. shall be in test condition while one or more zones are 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 zone individually;

d) zones in the test state shall not prevent the operation of compulsory indications and outputs from zones not in the test state;

e) signals from a zone under test shall not lead to the operation of the outputs to the SHCS, except temporarily to test their functioning in relation to the corresponding zone.

6.1.7.2 Visual indication

The test condition shall be indicated visibly on the c.p.

The visual indication shall be yellow and may be provided by:

a) a label;

b) dedicated light-emitting indicators;

c) light-emitting indication shared with fault warning and/or disablement condition light-emitting indicators;

d) light-emitting indication shared with fault warning and/or disablement condition light-emitting indicators and with the conditions distinguished by means of variation of display, e.g. steady, slow flash, fast flash.

6.1.8 Lettering on front face

On the front face above the operating face and vertically centred, wording naming the system (e.g. smoke control) shall be written. The lettering shall be in accordance with ISO 3098-2 (preferably “Lettering B vertical”). The height of the letters shall be at least 15 mm. Further lettering on the surface of the front face is restricted to below the centre of the operating face.

6.1.9 Lettering on operating face

Lettering on the operating face which does not represent direct operating instructions (such as manufacturers' logos or service addresses) shall not exceed 10 % of the surface of the operating face.

NOTE The term “operating face” and “front face” is similar to Figure 5.

6.2 Pneumatic basic control panels

6.2.1 General requirements

6.2.1.1 Pneumatic basic control panels may be used on fail-safe or non-fail-safe smoke and heat control systems. In case of non-fail-safe systems, the tube between the pneumatic p.o.d. and the b.c.p. shall be monitored by a pressure gauge on the front of the b.c.p. unless the p.o.d. and the b.c.p. are in the same enclosure. Minimum diameter of the pressure gauge shall be 40 mm. The minimum pressure level shall be indicated.

6.2.1.2 Indication of standby condition on the b.c.p. shall be green. Indication of fire condition on the b.c.p. shall be red.

NOTE No indication is required for any part of the b.c.p mounted within a SHEV.

6.2.1.3 For manual initiation, the force required shall not exceed:

— finger lever: 50 N;

— hand lever: 100 N;

— push button: 30 N;

— pull release handle: 100 N.

Manual initiation shall be at access level 1 and shall necessitate the use of a tool or the breaking of a frangible element or seal.

The b.c.p. should be designed so that initiation can be achieved without risk of injury to the operator.

6.2.1.4 Manual, electric or pneumatic initiation shall only initiate operation of the b.c.p. to the fire condition. Reset to standby position shall be at access level 2 or 3.

6.2.1.5 The time delay between initiation (manual, electric or pneumatic) and commencement of the release to the SHEV shall be no more than 10 s.

6.2.1.6 The b.c.p shall have a minimum of fire condition and standby condition. If any further functional conditions are provided, they shall conform to the requirements of the relevant sub-clauses of 6.1. However, indication may be provided by means of suitable labelling of the correct colour.

6.2.2 General requirements for indications

6.2.2.1 Display of indications

6.2.2.1.1 Compulsory indications

All compulsory indications shall be clearly identifiable. These may be in the form of green labels for standby condition and red labels for fire condition. The labels shall be no smaller than 12 mm × 12 mm. If light-emitting indicators are used, they shall conform to 5.1.2.5.

6.2.2.1.2 Additional indications

Indications in addition to compulsory indications should be designed to avoid contradiction or confusion.

6.2.2.1.3 Pressure gauges

When pressure gauges are used for indication (to monitor the line), they shall be equipped with a 3/2 way test valve accessible at access level 2 or 3. Both the maximum and the minimum pressure for correct operation shall be clearly labelled.

6.2.3 Fire condition

6.2.3.1 Reception and processing of fire signals

6.2.3.1.1 The b.c.p. shall be capable of receiving no more than one external initiating signal in addition to the manual initiation described in 6.2.1.3.

6.2.3.1.2 If the b.c.p. is able to receive an external initiating signal (pneumatic or electric), the fire position shall be indicated.

6.2.3.1.3 All fire signals shall have priority over any other signal.

6.2.3.2 Output of the fire condition (option with requirements)

At least one output signalling the fire condition shall be provided and this shall be activated within 10 s of initiation.

6.2.3.3 Reset from the fire condition

Following a reset operation, the indication of the correct functional conditions corresponding to any received signals shall either remain or be re-established within 20 s.

6.2.4 Lettering on front face

On the front face above the operating face and vertically centred, wording naming the system (e.g. smoke control) and naming the principle of function described in 6.2.1.3, e.g. “pull to release”, shall be written. The lettering shall be in accordance with ISO 3098-2 (preferably “Lettering B vertical“). The height of the letters shall be at least 15 mm. Further lettering on the surface of the front face is restricted to below the centre of the operating face.

6.2.5 Lettering on operating face

Lettering on the operating face which does not represent direct operating instructions (such as manufacturers' logos or service addresses) shall not exceed 10 % of the surface of the operating face.

NOTE The term “operating face” and “front face” is similar to Figure 5.

6.3 Thermal release element for pneumatic systems

6.3.1 Response time

The release behaviour for each test shall conform to $(Y + 37) / 0{,}35 \geq X$ where Y is the nominal operating temperature of the thermal element and X is the release time, in seconds, when tested in accordance with 13.2.8.2.

6.3.2 Operational reliability

For the purposes of operational reliability, the thermal release element shall be classified as one of the following reliability classes (Re):

— Re A: as declared by the manufacturer ($A > 50$);

— Re 50;

— Re 1000.

The designation A, 50, and 1000 will represent the number of operating cycles in the fire condition.

Control equipment, intended for smoke control purposes only, when tested in accordance with 13.2.8.1, shall complete the number of operating cycles in the fire condition conforming to the reliability class chosen.

6.3.3 Performance parameters under fire conditions

The nominal release temperature for each test shall not vary by more than –3 °C to +8 °C, when tested in accordance with 13.2.8.3.

6.3.4 Durability test

The thermal release element shall be tested in accordance with 13.6, 13.8, 13.10 (class 4) and 13.11 (class 4).

7 Mechanical control panels (m.c.p.)

7.1 General requirements

7.1.1 Mechanical control panels shall have fail-safe operation and the SHEV shall go to the fire position upon change of state in the mechanical connection. If an electrical remote initiation is provided, the loss of electrical power shall lead to a fail-safe operation and the SHEV shall go to the fire position. If a pneumatic remote initiation is provided, the loss of pneumatic pressure shall lead to a fail-safe operation and the SHEV shall go to the fire position.

7.1.2 The maximum opening of the SHEV shall not be limited by the m.c.p.

7.1.3 The m.c.p. shall be capable of receiving no more than two external initiating signals.

7.1.4 The response time of the m.c.p. shall be no more than 1 s.

7.1.5 The means of initiation shall only initiate operation of the m.c.p. to the fire condition. Reset to the standby condition shall be initiated by other means at access level 2 or 3.

7.1.6 The means of initiation shall not be used as all or part of the energy required to move the SHEV to the fire position.

7.1.7 Where external initiation is used, no manual initiation device shall move. The reset device may move but shall not present a risk of injury.

7.1.8 When the m.c.p. includes a manual operation device, the fire position and the standby position shall be clearly indicated on the m.c.p.

All compulsory indications shall be clearly identifiable. These may be in the form of labels that shall be no smaller than 12 mm × 12 mm. If light-emitting indicators are used, they shall conform to 5.1.2.5. Indication shall be green for standby and red for fire condition.

7.1.9 The manufacturer shall declare:

— the minimum force in the operating medium (e.g. tension in a cable);

— the maximum operating force in the operating medium. This shall be no greater than 1 500 N;

— the rated static force in the operating medium. This shall be at least 3 000 N;

— the maximum movement available between the standby and fire conditions.

7.2 Manual initiation

7.2.1 Operation of the m.c.p. may require the breaking of a frangible element or of a seal.

The m.c.p. should be arranged so that the initiation can be achieved without risk of injury to the operator.

7.2.2 The force required for manual initiation shall not exceed:

— ‘pull release’ handle: 100 N;

— finger lever: 50 N;

— hand lever: 100 N;

— push button: 30 N.

7.3 Electric initiation

7.3.1 m.c.p. with electric initiation shall be capable of receiving initiating signals from all types of electric c.p.

7.3.2 The manufacturer shall declare the maximum and minimum ratings for the input (voltage and current).

7.4 Pneumatic initiation

7.4.1 An m.c.p. with pneumatic initiation shall be capable of receiving initiating signals from all types of pneumatic c.p.

7.4.2 The maximum and minimum ratings for the input (pressure and volume) shall be included in the user documentation in 8.3.

7.5 Lettering on front face

On the front face above the operating face and vertically centred, wording naming the system (e.g. smoke control) and naming the principle of function described in 7.2.2, e.g. “pull to release”, shall be written. The lettering shall be in accordance with ISO 3098-2 (preferably “Lettering B vertical“). The height of the letters shall be at least 15 mm. Further lettering on the surface of the front face is restricted to below the centre of the operating face.

7.6 Lettering on operating face

Lettering on the operating face which does not represent direct operating instructions (such as manufacturers' logos or service addresses) shall not exceed 10 % of the surface of the operating face.

NOTE The term “operating face” and “front face” is similar to Figure 5.

8 Design and documentation requirements

8.1 General requirements

The c.p. shall conform to the requirements of Clause 8 relevant to the technology used.

NOTE Some requirements can be verified by testing. Others can only be verified by inspection of the design and its accompanying documentation because of the impracticability of testing all possible combinations of functions and establishing the long-term reliability of the c.p.

8.2 Classification and testing

8.2.1 The control panel shall be classified in accordance with its intended in-use environmental conditions. The classification shall be as described in Table 3.

Table 3 — Classification of c.p.

Class	Environment	Temperature range (°C)	Minimum IP rating [a] (electrical enclosures)
1	Internal, clean, low temperature	−5 to +40	30
2	Internal, clean, high temperature	−5 to +75	42
3	Internal – corrosive or humid, or external	−5 to +75	54
4	External – corrosive	−25 to +75	65
[a] In accordance with IEC 60529			

8.2.2 The c.p. shall be tested in accordance with Clauses 12 and 13. The test shall be selected to match the classification in Table 3 in accordance with Tables 4 and 5.

8.3 Documentation

8.3.1 User documentation

Installation and user documentation shall comprise at least the following:

a) a general description of the equipment, including a list of the optional functions with requirements of this part of ISO 21927 and any other functions;

b) technical specifications of the inputs and outputs of the c.p., sufficient to enable an assessment of the mechanical, electrical, pneumatic and software compatibility with other components of the system, including where relevant:

   — power requirements for recommended operation;

   — maximum number of zones (addressable points per transmission path);

   — maximum number of zones (addressable points per c.p.);

   — maximum and minimum ratings for each input and output;

   — fuse ratings;

c) installation information, including:

   — the environmental class in accordance with 8.2.1;

   — type classification in accordance with 4.2.3;

   — if the c.p. is contained in more than one enclosure, how it may conform to 8.4.2 and 8.6.2;

   — mounting instructions;

   — instructions for connecting the inputs and outputs (e.g. cable diameter);

   — instructions that the c.p. or b.c.p. is to be located in a safe place, protected from the effects of fire and smoke;

d) configuring and commissioning instructions;

e) operating instructions, e.g., for m.c.p., the maximum winding speed;

f) maintenance information.

8.3.2 Design documentation

The manufacturer shall prepare design documentation, which shall be submitted to the testing authority together with the c.p. This documentation shall include drawings, parts lists, block diagrams, circuit diagrams, information on the communication parameters employed on each data transmission path and a functional description such that compliance with this part of ISO 21927 may be checked and that a general assessment of the mechanical and electrical design is made possible.

8.4 Mechanical design requirements

8.4.1 The enclosure of an electrical c.p. shall have a minimum IP rating in accordance with the environmental class specified in Table 3.

8.4.2 The c.p. may be housed in more than one enclosure.

8.4.3 The terminations for transmission paths and any fuses shall be clearly labelled.

8.4.4 All control panels with manual controls intended for use in the fire condition (except by the fire service) shall be deep orange (RAL 2011).

8.5 Electrical and other design requirements

8.5.1 The interruption in supply of power as described in 4.1 of ISO 21927-10:2011 shall not change any indications and/or the state of any outputs, except those relating to the power supplies.

8.5.2 If the c.p. has provision for disconnecting or adjusting the primary or secondary power source, this shall only be possible at access level 3 or 4.

8.5.3 Any automatic detector included in an SHCS used to bring the control equipment into the fire condition shall conform to the relevant part of ISO 7240.

8.6 Integrity of transmission paths

8.6.1 A fault in any transmission path between the c.p. and other components of

a) the SHCS, and

b) the fire alarm system

shall not affect the correct functioning of the c.p. or of any other transmission path.

8.6.2 If the manufacturer's documentation shows that a c.p. contained in more than one enclosure 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 enclosures does not affect more than one function, e.g. vents in one zone, and shall be detected within 100 s.

8.6.3 If the c.p. is designed to be used with a power supply contained in a separate enclosure, 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 the c.p.

8.7 Accessibility of indications and controls (see also Annex A)

8.7.1 All compulsory indications shall be visible at access level 1 without prior manual intervention.

8.7.2 Compulsory indications and manual controls at access level 1 shall also be accessible at access level 2.

9 Additional requirements for software-controlled control panels

9.1 General requirements

The c.p. may contain elements which are controlled by software to fulfil requirements of this part of ISO 21927. In this case, the c.p. shall conform to the requirements of Clause 9, as well as Clauses 4 and 5, where relevant to the technology used.

9.2 Software documentation

9.2.1 The manufacturer shall prepare documentation that gives an overview of the software design, which shall be provided with the c.p. for testing. This shall comprise at least the following:

a) a functional description of the main program flow, including:

— a brief description of each module and the tasks it performs;

— the way in which the modules interact;

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

— the overall hierarchy of the program.

The functional description of the main program flow shall be explained using a clear methodology appropriate to the nature of the software, e.g. graphical representations of the system design.

b) a description of which areas of memory are used to store the program, site-specific data and running data;

Where dynamic memory management is employed, a separation shall be implemented between the program, site-specific data and running data, and this shall be described in connection with the method of memory allocation.

c) a description of how the software interacts with the hardware of the c.p.

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

a) a description of each module of the program, as it is implemented in the source code of the program, containing the following:

— the name of the module;

— the date and/or version reference;

— a description of the tasks performed;

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

b) the source code listing, including all global and local variables, constants and labels used, and sufficient comment for the program flow to be recognized;

c) details of any software tools used in the preparation of the program (e.g. high-level design tools, compilers, assemblers).

9.3 Software design

To ensure the reliability of the c.p., the following requirements for software design shall apply:

a) the software shall have a modular structure;

b) the design of the interfaces for manually and automatically generated data shall prevent invalid data from causing an error in the program execution;

c) the software shall be designed to avoid the occurrence of a deadlock in the program flow.

9.4 Program monitoring

9.4.1 The execution of the program shall be monitored in accordance with 9.4.2 or 9.4.3. If routines associated with the main functions of the program are no longer executed, either or both of the following shall apply:

a) the c.p. shall indicate a system fault;

b) the c.p. shall enter the fault warning condition and indicate faults of affected supervised functions, where only these functions are affected.

9.4.2 If the program executes in one processor, the execution of the routines as in 9.4.1 shall be monitored by a monitoring device as in 9.4.4.

9.4.3 If the program executes in more than one processor, the execution of the routines as in 9.4.1 shall be monitored in each processor. A monitoring device as in 9.4.4 shall be associated with one or more processors, and at least one such processor shall monitor the functioning of any processor not associated with such a monitoring device.

9.4.4 The monitoring device of 9.4.2 and 9.4.3 shall be either:

— an additional device, with a time base independent of that of the monitored system, or

— a part of the processor which has its own time base (e.g. internal RC Oscillator) and an external time base (e.g. crystal).

9.4.5 In the event of a system fault as specified in 9.4.1 a), the program execution shall automatically attempt to restart and the following shall apply:

— If the program execution is successfully restarted at the first attempt, the fault indicator may be reset automatically or manually.

— If the program execution fails after ten consecutive attempts, the fault signal shall only be reset manually at access level 3.

It may be necessary in some circumstances to stop the program until manual operation at access level 3 is completed.

NOTE This means that, if a failure of program execution is detected, the c.p. will enter a safe state. The safe state is defined by the manufacturer, but it is expected that it will not result in the false initiation of mandatory outputs nor give a false impression to a user that the c.p. remains operational if it is not.

9.4.6 The manufacturer shall provide means for creating a fault to enable testing as required in 9.4.5.

9.5 The storage of programs and data

9.5.1 All executable code and data necessary to comply with this part of ISO 21927 shall be held in memory which is capable of continuous, maintenance-free, reliable operation for a period of at least 10 years.

9.5.2 For the program, the following requirements shall apply:

a) The program shall be held in non-volatile memory, which can only be written at access level 4.

b) It shall be possible to identify the version reference or references of the program at least at access level 3. The version reference or references shall be in accordance with the documentation of 9.2.1.

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

The alterations of site-specific data for operation of the SHCS shall only be possible at access level 3 or 4 and;

a) The alteration of site-specific data shall not affect the structure of the program.

b) 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 2 weeks.

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

d) The site-specific data shall be given a version reference, which shall be updated during/after each set of alterations.

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

9.6 The monitoring of memory contents

The contents of the memories containing the program and 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.

10 Additional requirements for networked systems

10.1 General requirements

The control system may be networked, with an exchange of signals and information between c.p. through electronic packets of data. In this case the system shall conform to the requirements of this clause as well as those of the remainder of this part of ISO 21927 relevant to the technology used.

10.2 Fault condition

A fault on any networked control equipment other than the main c.p. in a hierarchical system shall not adversely affect the operation of the network nor of any other networked control equipment A fault in any networked control equipment shall result in a fault indication in accordance with 5.1.2 and 5.1.5.

10.3 Connection to other bus systems

A networked c.p. may also be connected to an external bus system, e.g. a BMS system. In this case, the external bus system shall be kept separate or, if compatible, shall be connected by an interface to ensure that only relevant data is transmitted. A fault on the external system shall not affect fire operation.

10.4 Maximum cable length

The manufacturer shall declare the maximum cable lengths and cable types necessary to ensure reliable data transfer.

11 Marking

The c.p. or b.c.p. shall be marked with the following:

a) the name or trade mark of the supplier, and

b) the type and model; and

c) Type from 4.2.3;

d) Type from 5.3.1 and 5.3.2 (for manual control points);

e) a reference to this International Standard, i.e. ISO 21927-9.

12 General test requirements

12.1 Standard atmospheric conditions for testing

Unless otherwise stated in a test procedure, the test specimen shall be tested after it has been left to stabilize in the standard atmospheric conditions for testing as described in IEC 60068-1:1994 as follows:

a) temperature: 15 °C to 35 °C;

b) relative humidity: 25 % to 75 %;

c) air pressure: 86 kPa to 106 kPa.

During any one test, the temperature and humidity shall be constant within a tolerance of ± 15 % and shall not go outside the ranges given in a) and b) for each environmental test where the standard atmospheric conditions are applied.

12.2 Provision for tests

The c.p. submitted shall be representative of the manufacturer's normal product range and shall include all the claimed options.

12.3 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 recommended by the manufacturer.

12.4 Electrical connection

If the test procedure requires the specimen to be operating, it shall be connected to a suitable power supply unless the p.o.d. is integrated where the connection to the power supply shall be via that p.o.d.

All inputs and outputs shall be connected to appropriate cables and equipment or to dummy loads corresponding to the minimum and maximum loads, all as specified by the manufacturer. Equipment other than the c.p. may be kept in the standard atmospheric condition during the tests.

12.5 Selection of tests

12.5.1 Manual control points shall receive a visual inspection and undergo functional tests in accordance with this part of ISO 21927.

The environmental tests for manual control points shall conform to the requirements of ISO 7240-11:

— number and series of specimen;

— test schedule;

— mounting.

All other control equipment shall undergo functional and environmental tests in accordance with this part of ISO 21927.

12.5.2 One, two or three specimens may be supplied for environmental testing. The tests to be applied are shown in Tables 4 and 5.

NOTE Where the p.s.e. and c.p. are of different classes and are contained in the same housing, the class recommended by the manufacturer applies.

Table 4 — Environmental tests for electrical c.p. and b.c.p.

Test	Class of c.p.				Operational or endurance	Clause number
	1	2	3	4		
Cold	✓	✓	✓	✓	Operational	13.3
Damp heat, steady state	✓	✓	✓	✓	Operational	13.4
Impact	✓	✓	✓	✓	Operational	13.5
Vibration, sinusoidal	✓	✓	✓	✓	Operational	13.6
Damp heat, steady state	×	✓	✓	✓	Endurance	13.7
Vibration, sinusoidal	✓	✓	✓	✓	Endurance	13.8
Dry heat	×	✓	✓	✓	Operational	13.9
SO_2 corrosion	×	×	✓	✓	Endurance	13.10
Salt spray testing	×	×	×	✓	Endurance	13.11
Protection against water (IP rating)	×	✓	✓	✓	Operational	13.12
Protection against substance (IP rating)	×	✓	✓	✓	Operational	13.13
EMC	✓	✓	✓	✓	Operational	13.14

Key

✓ test required

× test not required

Table 5 — Environmental tests for m.c.p. and pneumatic c.p. and b.c.p.

Test	Class of c.p.				Operational or endurance	Clause number
	1	2	3	4		
Cold	✓	✓	✓	✓	Operational	13.3
Damp heat, steady state	✓	✓	✓	✓	Operational	13.4
Impact	C	C	C	C	Operational	13.5
Vibration, sinusoidal	✓	✓	✓	✓	Operational	13.6
Damp heat, steady state	×	✓	✓	✓	Endurance	13.7
Vibration, sinusoidal	✓	✓	✓	✓	Endurance	13.8
Dry heat	×	✓	✓	✓	Operational	13.9
SO_2 corrosion	×	×	✓	✓	Endurance	13.10
Salt spray testing	×	×	×	✓	Endurance	13.11
Protection against water (IP rating)	×	C	C	C	Operational	13.12
Protection against substance (IP rating)	×	C	C	C	Operational	13.13
EMC	C	C	C	C	Operational	13.14

Key

C only applicable for control equipment including electrical component.

✓ test required

× test not required

12.5.3 Tests for one specimen

If a single specimen is supplied for environmental testing, it shall be subjected to all of the environmental tests, which may be in any order. The specimen shall be functionally tested before and after each environmental test. Functional tests before and after the series of environmental tests shall be the full functional test. Functional tests between environmental tests shall be the reduced functional test. The functional test after one environmental test may be taken as the functional test before the next environmental test.

12.5.4 Tests for more than one specimen

If more than one specimen is supplied for environmental testing, they may be tested in any order. Functionality shall be tested before and after each environmental test. Functional tests before and after the series of environmental tests shall be the full functional test. Functional tests between environmental tests shall be the reduced functional test. For each specimen, the functional test after one environmental test may be taken as the functional test before the next environmental test.

12.5.5 Requirements

During the environmental tests, the specimen shall not change status, except when such a change is required by the test procedure or when the change is an intended result of the functional test.

Any mechanical damage to the specimen, observed following the environmental tests, shall not prevent the control equipment from conforming to the requirements of this part of ISO 21927.

When subjected to the functional test, each specimen shall respond correctly.

13 Tests

13.1 Reliability test

Before functional and environmental testing, one specimen shall be subjected to a reliability test.

Under maximum load conditions and the duty cycle recommended by the manufacturer, the specimen shall be operated the number of times required for the Re rating selected. At the end of the test, the specimen shall retain full output load.

NOTE For c.p. incorporating a p.o.d., a separate bypass power supply can be used for this test.

13.2 Functional test

13.2.1 Objective of the test

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

Equipment shall be tested in either standby or operational condition and functions and indications shall operate as specified in the design documentation.

13.2.2 Electrical functional test

13.2.2.1 Full functional test

The object of this test is to demonstrate that equipment operates as described in the manufacturer's documentation and in accordance with this part of ISO 21927.

Under the conditions described in 12.1, the c.p. shall perform all functions required by Clause 5.

13.2.2.2 Reduced functional test

The reduced functional test consists of one operating cycle from the standby to the fire condition.

13.2.3 Pneumatic functional tests

13.2.3.1 Full functional test

The object of the test is to demonstrate the ability of the c.p. output circuit to function correctly.

The specimen shall be tested at the maximum input and output pressures stated in the user documentation. The test shall be performed using every output from the c.p.

The load shall be established by connecting a constant load to the output, e.g. by using an actuator and weight.

The test sample shall be operated and show correct functionality.

The c.p. shall be pressurized to 1,5 times the maximum pressure without damage.

13.2.3.2 Reduced functional test

The reduced functional test consists of one operating cycle from the standby to the fire condition.

13.2.4 Single-use gas bottle assembly functional tests

13.2.4.1 Full functional test

Single-use gas bottle assemblies shall be tested five times at the minimum temperature and five times at the maximum temperature in accordance with their classification in Table 3.

NOTE A new gas bottle is required for each operation.

After this procedure the gas bottle assembly shall be tested for operation at an increased load. This shall be achieved using an identical type of gas bottle to the previous tests, but with a second identical seal fitted so that the needle has to puncture both seals for operation.

For all tests the test load (e.g. an actuator and weight) shall operate correctly.

13.2.4.2 Reduced functional test

The reduced functional test consists of one operating cycle.

13.2.5 Single-use/multi-use gas bottle assembly with thermal initiation functional tests

13.2.5.1 Full functional test

The complete assembly, including thermal element, triggering mechanism and gas bottle, shall be examined and tested.

The gas bottle assembly shall be tested before and after environmental test conditioning using the following three tests:

— For single-use gas bottles, check operation of the puncturing device. The needle shall extend into the bottle so that the needle bevel is below the pressure relief device.

— Check that pressure is released from the gas bottle to the compulsory output upon operation of the thermal device.

— Check exchangeability of the thermal element and the gas bottle, and that any debris from use does not prevent correct fitting.

In addition, the gas bottle assembly shall be tested once, as follows, under normal ambient conditions:

— Check correct priority and operation of switching from primary gas supply (if provided) to gas bottle upon operation of the thermal device.

— Measure the dynamic response behaviour of the thermal device six times in accordance with the requirements of ISO 7240-5:2003, 5.4.2. The specimen shall be installed in a heat tunnel in its most unfavourable position. The release value shall be measured at a rate of rise of 20 °C/min. The release behaviour for each test shall conform to $(Y + 37) / 0{,}35 \geq X$ where Y is the nominal operating temperature of the thermal element and X is the release time, in seconds.

— Measure the static response behaviour of the thermal device three times in accordance with the requirements of ISO 7240-5:2003, 5.3. The nominal release temperature for each test shall not vary by more than –3 °C to +8 °C.

NOTE For safety reasons, empty gas bottles can be used for measurements in the heat tunnel.

13.2.5.2 Reduced functional test

The reduced functional test consists of one operating cycle.

13.2.6 Single-use/multi-use gas bottle assembly with manual-initiation functional tests

13.2.6.1 Full functional test

The complete manual triggering mechanism, including gas bottle, shall be examined and tested.

The gas bottle assembly shall be tested before and after environmental test conditioning with the following four tests:

— Check operation of frangible element (if fitted) using the test methods of ISO 7240-11:2005, Annexes A and B. When tested to Annex A, the frangible element shall break or be displaced to allow triggering. When tested to Annex B, the element shall not break or be displaced when subjected to a force rising at no more than 5 Ns^{-1} to 22,5 $\pm$ 2,5 N and maintained at this level for 5 s before releasing at no more than 5 Ns^{-1}. Operation of the frangible element shall not risk causing injury to the operator.

— For single-use gas bottles, check operation of the puncturing device. The needle shall extend into the bottle so that the needle bevel is below the pressure relief device.

— Check that pressure is released from the gas bottle to the compulsory output upon operation of the triggering mechanism.

— Check exchangeability of the frangible element and the gas bottle, and that debris from use does not prevent correct fitting.

In addition, the gas bottle assembly shall be tested once as follows under normal ambient conditions:

— Check correct priority and operation of switching from primary gas supply (if provided) to gas bottle.

— Check that the triggering mechanism actuation force does not exceed 30 N for a push button or 50 N for a finger pull or 100 N for a hand pull. At least five actuations shall be performed after the cold environmental test.

13.2.6.2 Reduced functional test

The reduced functional test consists of one operating cycle.

13.2.7 Mechanical control panel functional tests

13.2.7.1 Full functional test

The test sample shall be operated for a period of 50 (Re 50) or 1 000 (Re 1000) cycles. For Re A panels the number of cycles shall be as stated in the user documentation.

If the c.p. is also intended for control of daily ventilation, an additional 10 000 cycles are required.

Panels shall be tested with the rated maximum operating force in the operating medium (e.g. cable), maximum length and maximum number of deflection points of minimum dimension (e.g. pulleys).

The system shall be loaded with the rated static force in the operating medium for a period of 5 min followed by 1 cycle at the rated maximum operating force.

Typical test equipment for cable systems is shown in Figures 6 a) and 6 b).

The winding speed for reset shall be 60 rev/min (±10 rev/min).

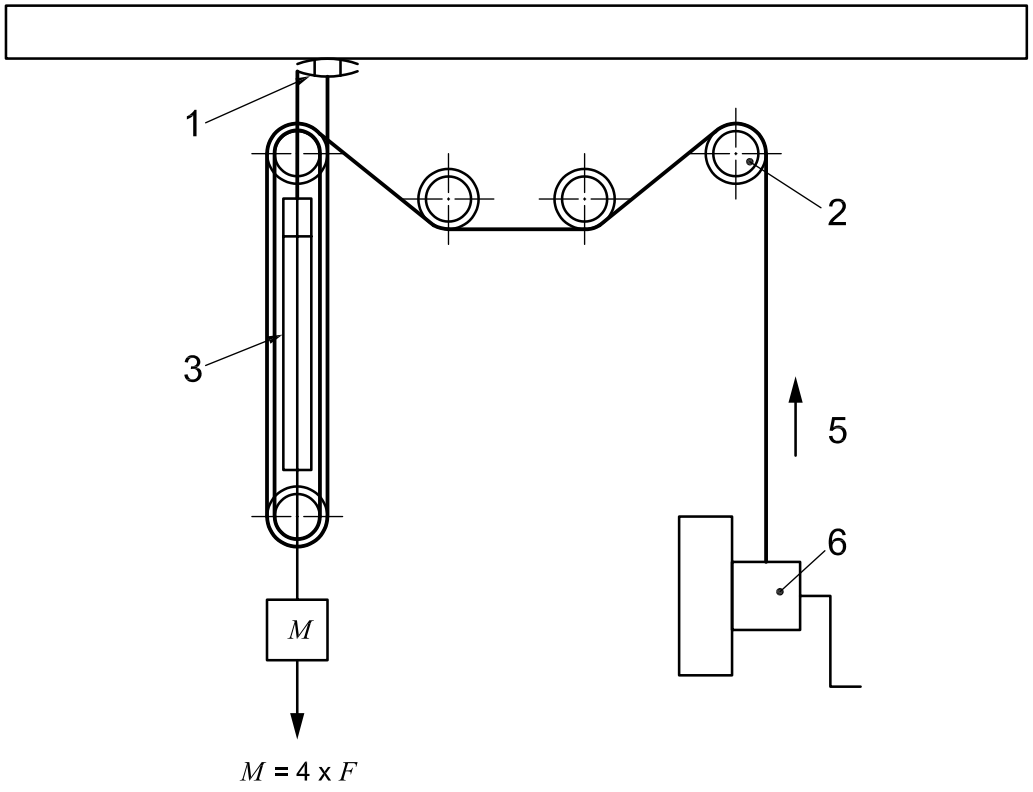
If cable is used, it shall be fully rolled and unrolled in each cycle.

No dysfunction shall occur in the course of the test.

At the end of the test, the characteristics in 7.1.4 and 7.1.9 shall be measured. These characteristics shall remain within the rated values.

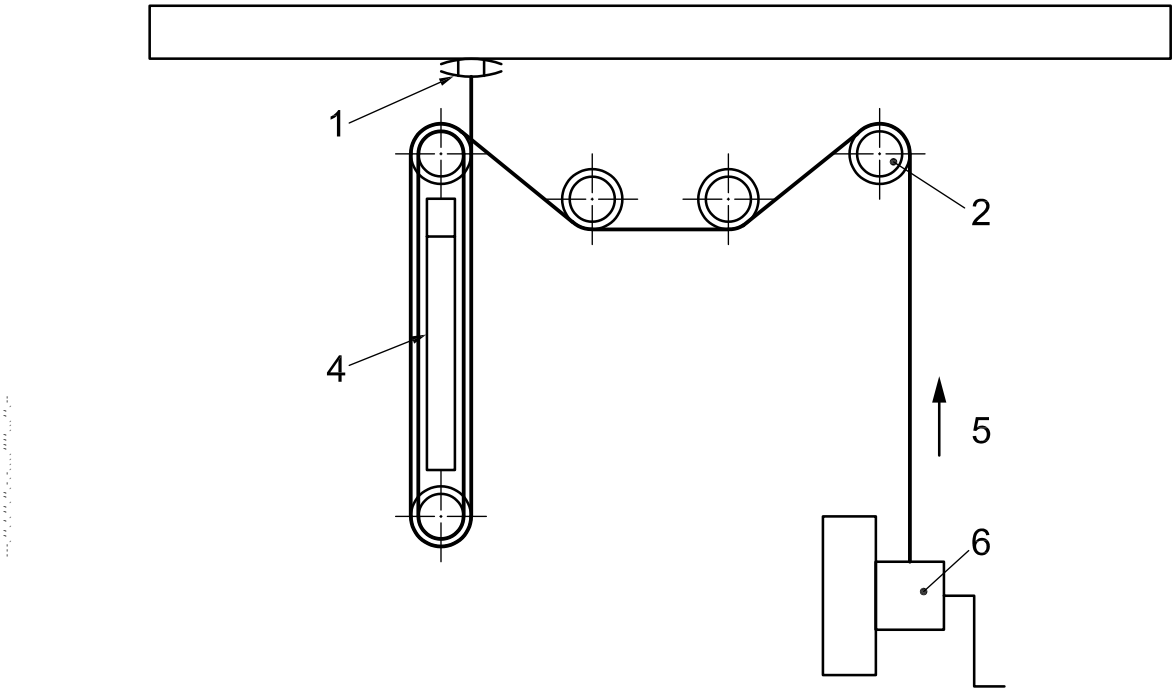
13.2.7.2 Reduced functional test

The reduced functional test consists of one operating cycle.



a) Typical test equipment for cable m.c.p. functional test using hanging weight to provide test load

Figure 6 — Typical test equipment for cable m.c.p. functional test (*continued*)



b) Typical test equipment for cable m.c.p. functional test using cylinder to provide test load

Key

1 load cell or spring balance to measure tension force
2 pulley of minimum diameter recommended by manufacturer
3 cylinder to limit rate of descent
4 cylinder to provide load
5 manufacturer's declared maximum tension (F)
6 m.c.p.

Figure 6 — Typical test equipment for cable m.c.p. functional test

13.2.8 Thermal release elements functional tests

13.2.8.1 Reliability test

Under the conditions described in 12.1 to 12.4, the complete assembly, including thermal element, triggering mechanism and gas bottle, shall be examined and tested.

The thermal release element shall be tested before and after environmental test conditioning using the following three tests:

— Check operation of the puncturing device. The needle shall extend into the bottle so that the needle bevel is below the pressure relief device.

— Check that pressure is released from the gas bottle to the compulsory output upon operation of the thermal device.

— Check exchangeability of the thermal element and the gas bottle, and that any debris from use does not prevent correct fitting.

13.2.8.2 Measurement of the response behaviour (time)

Measure the dynamic response behaviour of the thermal device six times in accordance with the requirements of ISO 7240-5:2003, 5.4.2. The specimen shall be installed in a heat tunnel in its most unfavourable position. The release value shall be measured at a rate of rise of 20 °C/min. The release behaviour for each test shall conform to $(Y + 37) / 0{,}35 \geq X$ where Y is the nominal operating temperature of the thermal element and X is the release time, in seconds.

13.2.8.3 Measurement of the response behaviour (temperature)

Measure the static response behaviour of the thermal device three times in accordance with the requirements of ISO 7240-5:2003, 5.3. The nominal release temperature for each test shall not vary by more than –3 °C to +8 °C.

NOTE For safety reasons, empty gas bottles can be used for measurements in the heat tunnel.

13.3 Cold (operational)

13.3.1 Object of the 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.

13.3.2 Test procedure

13.3.2.1 General

Testing shall be carried out in accordance with the test procedures with gradual changes in temperature described in IEC 60068-2-1, with the modifications and additions given in 13.3.2. Test Ad shall be used for heat-dissipating specimens and test Ab shall be used for non-heat-dissipating specimens.

13.3.2.2 Initial examination

Before conditioning, subject the specimen to the functional test required by 13.2.

13.3.2.2.1 State of the specimen during conditioning

The specimen shall be mounted in accordance with 12.3, connected in accordance with 12.4 and shall be in operation.

13.3.2.2.2 Conditioning

Apply the conditioning given in Table 6.

Table 6 — Conditioning for cold (operational) test

Environmental class	1	2	3	4
Temperature (°C)	–5	–5	–5	–25
Duration (h)	16	16	16	16

13.3.2.2.3 Measurements during conditioning

For electrical control equipment, monitor the specimen during the conditioning period to check that the output voltage is within the limits stated in the user documentation. During the last hour of the conditioning period, subject the specimen to the reduced functional test.

For pneumatic c.e., monitor the specimen during the conditioning period to check that the available pressure is within the limits stated in the used documentation.

13.3.2.2.4 Final measurements

At the end of the conditioning period, re-establish the standard atmospheric conditions described in 12.1 within a period of 2 h. Within 30 min of the end of this recovery period, inspect the specimen visually for mechanical damage both externally and internally and complete the full or reduced functional test as appropriate.

13.4 Damp heat, steady state (operational)

13.4.1 Object of the test

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

13.4.2 Procedure

13.4.2.1 General

Testing shall be carried out in accordance with the procedures specified in IEC 60068-2-78 with the modifications and additions given in 13.4.2.

13.4.2.2 Initial examination

Before conditioning, subject the specimen to the functional test required by 13.2.

13.4.2.3 State of the specimen during conditioning

The specimen shall be mounted in accordance with 12.3, connected in accordance with 12.4 and shall be in operation.

13.4.2.4 Conditioning

Apply the following severity of conditioning:

— temperature: 40 °C ± 2 °C;

— relative humidity: $\left(93^{+2}_{-3}\right)$ % ;

— duration: 4 d.

Precondition the specimen at the conditioning temperature (40 °C ± 2 °C) at ambient humidity until temperature stability has been reached before raising the humidity to prevent the formation of water droplets on the specimen. This preconditioning period is in addition to the 4 d duration.

13.4.2.5 Measurements during conditioning

For electrical c.p., monitor the specimen during the conditioning period to check that the output voltage is within the specifications. During the last hour of the conditioning period, subject the specimen to the reduced functional test.

For pneumatic c.p., monitor the specimen during the conditioning period to check that the available pressure is within the specifications.

13.4.2.6 Final measurements

At the end of the conditioning period, re-establish the standard atmospheric conditions described in 12.1 within a period of 2 h. Within 30 min of the end of this recovery period, inspect the specimen visually for mechanical damage both externally and internally and complete the full or reduced functional test as appropriate.

13.5 Impact (operational)

13.5.1 Object of the test

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

13.5.2 Test procedure

13.5.2.1 General

Testing shall be carried out using the test apparatus and procedure in accordance with IEC 60068-2-75, Test Ehb, with the modifications and additions given in 13.5.2.4.

13.5.2.2 Initial examination

Before conditioning, subject the specimen to the functional test required by 13.2.

13.5.2.3 State of the specimen during conditioning

The specimen shall be mounted in accordance with 12.3, connected in accordance with 12.4 and shall be in operation.

13.5.2.4 Conditioning

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

For all such surfaces, three blows shall be applied to any point(s) considered likely to cause damage to or impair the operation of the specimen.

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

Apply the following severity of conditioning:

— impact energy: 0,5 J ± 0,04 J;

— number of impacts per point: 3.

13.5.2.5 Measurements during conditioning

Monitor the specimen during the conditioning period to check that the outputs are within the specifications and ensure that results of three blows do not influence subsequent series.

13.5.2.6 Final measurements

Within 30 min of the end of the test, inspect the specimen visually for mechanical damage both externally and internally and complete the full or reduced functional test as appropriate.

13.6 Vibration, sinusoidal (operational)

13.6.1 Object of the test

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

13.6.2 Test procedure

13.6.2.1 General

Testing shall be carried out in accordance with the procedure described in IEC 60068-2-6 with the modifications and additions given in 13.6.2.5.

NOTE The vibration operational test can 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.

13.6.2.2 Initial examination

Before conditioning, subject the specimen to the functional test required by 13.2.

13.6.2.3 State of the specimen during conditioning

The specimen shall be mounted in accordance with 12.3, connected in accordance with 12.4 and be in operation.

13.6.2.4 Conditioning

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

Apply the following severity of conditioning:

— frequency range: 10 Hz to 150 Hz;

— acceleration amplitude: 0,981 ms^{-2} (0,1 g_n);

— number of axes: 3;

— number of sweep cycles per axis: 1 for each functional condition;

— sweep rate: 1 octave per minute.

13.6.2.5 Measurements during conditioning

Monitor the specimen during the conditioning period to check that the outputs are within the specifications.

13.6.3 Final measurements

At the end of the conditioning period, re-establish the standard atmospheric conditions described in 12.1 within a period of 2 h. Within 30 min of the end of this recovery period, inspect the specimen visually for mechanical damage both externally and internally and complete the full or reduced functional test as appropriate.

13.7 Damp heat, steady state (endurance)

13.7.1 Object of the test

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

13.7.2 Procedure

13.7.2.1 General

Testing shall be carried out in accordance with the test procedure described in IEC 60068-2-78 with the modifications and additions given in 13.7.2.4.

13.7.2.2 Initial examination

Before conditioning, subject the specimen to the functional test in accordance with 13.2.

13.7.2.3 State of the specimen during conditioning

The specimen shall be mounted in accordance with 12.3. The specimen shall not be supplied with power during conditioning.

13.7.2.4 Conditioning

Apply the following severity of conditioning:

— temperature: 40 °C ± 2 °C;

— relative humidity: $\left(93^{+2}_{-3}\right)$ % ;

— duration: 21 d.

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

13.7.2.5 Final measurements

At the end of the conditioning period, re-establish the standard atmospheric conditions described in 12.1 within a period of 2 h. Within 30 min of the end of this recovery period, inspect the specimen visually for mechanical damage both externally and internally and complete the full or reduced functional test as appropriate.

13.8 Vibration, sinusoidal (endurance)

13.8.1 Object of the test

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

13.8.2 Test procedure

13.8.2.1 General

Testing shall be carried out in accordance with the test procedure described in IEC 60068-2-6 with the modifications and additions given in 13.8.2.4.

NOTE The vibration endurance test can 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.

13.8.2.2 Initial examination

Before conditioning, subject the specimen to the functional test required by 13.2.

13.8.2.3 State of the specimen during conditioning

The specimen shall be mounted in accordance with 12.3 and in accordance with IEC 60068-2-47, connected in accordance with 12.4 and shall not be in operation. The specimen shall not be supplied with power during conditioning.

13.8.2.4 Conditioning

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

Apply the following severity of conditioning:

— frequency range: 10 Hz to 150 Hz;

— acceleration amplitude: 4,905 ms^{-2} (0,5 g_n);

— number of axes : 3;

— number of sweep cycles: 20 per axis;

— sweep rate: 1 octave per axis.

13.8.2.5 Final measurements

At the end of the conditioning period, re-establish the standard atmospheric conditions described in 12.1 within a period of 2 h. Within 30 min of the end of this recovery period, inspect the specimen visually for mechanical damage both externally and internally and complete the full or reduced functional test as appropriate.

13.9 Dry heat (operational)

13.9.1 Object of the test

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

13.9.2 Test procedure

13.9.2.1 General

Testing shall be carried out in accordance with the test procedures with gradual changes in temperature described in IEC 60068-2-1, with the modifications and additions given in 13.9.2.4. Test Bd shall be used for heat-dissipating specimens and test Bb shall be used for non-heat-dissipating specimens.

13.9.2.2 Initial examination

Before conditioning, subject the specimen to the functional test required by 13.2.

13.9.2.3 State of the specimen during conditioning

The specimen shall be mounted as specified in 12.3, connected as specified in 12.4 and shall be in operation.

13.9.2.4 Conditioning

The specimen shall be conditioned in accordance with Table 7.

Table 7 — Dry heat conditioning

Environmental class	1	2	3	4
Temperature	No test	+75 °C	+75 °C	+75 °C
Duration		2 h	2 h	2 h

13.9.2.5 Measurements during conditioning

Monitor the specimen during the conditioning period to check that the outputs are within the limits stated in the user documentation. During the last hour of the conditioning period, subject the specimen to the reduced functional test.

13.9.2.6 Final measurements

At the end of the conditioning period, re-establish the standard atmospheric conditions described in 12.1 within a period of 2 h. Within 30 min of the end of this recovery period, inspect the specimen visually for mechanical damage both externally and internally and complete the full or reduced functional test as appropriate.

13.10 SO_2 corrosion

13.10.1 Object of the test

The object of the test is to demonstrate whether the equipment can withstand corrosive effects caused by air pollution.

13.10.2 Test procedure

13.10.2.1 General

Testing shall be carried out in accordance with the procedures described in ISO 6988 with the modifications and additions given in 13.10.2.4.

13.10.2.2 Initial examination

Before conditioning, subject the specimen to the functional test required by 13.2.

13.10.2.3 State of the specimen during conditioning

The specimen shall be mounted in accordance with 12.3, connected in accordance with 12.4 and shall not be in operation.

13.10.2.4 Conditioning

The specimen shall be conditioned in accordance with Table 8.

Table 8 — Conditioning for SO_2 corrosion test

Environmental class	1	2	3	4
Theoretical SO_2^- Concentration at the beginning of a cycle	**No test**	**No test**	0,67 Vol.-%	0,67 Vol.-%
Cycle 1. test section 2. test section			 8 h 16 h	 8 h 16 h
Test cycles			20	20
Climate 1. test section 2. test section			 (40 ± 3) °C ca. 100 % RH (18 to 28)°C RH ≤ 75 %	 (40 ± 3) °C ca. 100 % RH (18 to 28) °C RH ≤ 75 %
Soil water in the test chamber[a]			0,67 Vol.-%	0,67 Vol.-%

[a] Distilled water is added to the base of the chamber until it fills the specified percentage volume of the chamber.

13.10.2.5 Measurements during conditioning

No measurements are necessary during this period.

13.10.2.6 Final measurements

At the end of the conditioning period, re-establish the standard atmospheric conditions described in 12.1 within a period of 24 h. Within 30 min of the end of this recovery period, inspect the specimen visually for mechanical damage both externally and internally and complete the full or reduced functional test as appropriate.

13.11 Salt spray testing

13.11.1 Object of the test

The object of the test is to demonstrate how the equipment withstands a saliferous atmosphere.

13.11.2 Test procedure

13.11.2.1 General

Testing shall be carried out in accordance with the procedures described in IEC 60068-2-52 with the modifications and additions given in 13.11.2.4.

13.11.2.2 Initial examination

Before conditioning, subject the specimen to the functional test required by 13.2.

13.11.2.3 State of the specimen during conditioning

The specimen shall be mounted in accordance with 12.3, connected in accordance with 12.4 and shall not be in operation. Connection to the electrical p.o.d. shall be made by untinned stranded copper wire.

13.11.2.4 Conditioning

The specimen shall be conditioned in accordance with Table 9.

Table 9 — Conditioning for salt spray test

Environmental class	1	2	3	4
Total duration	No test			28 d
Number of cycles				4
Salt concentration pH-value of the saline solution temperature duration per cycle				5 Vol.% 6,2 to 7,2 (15 to 35)°C 2 h
Damp heat: Temperature Relative humidity Duration per cycle				40 °C 93 % 166 h

13.11.2.5 Measurements during conditioning

No measurements are required during this period.

13.11.2.6 Final measurements

After the test procedure, the specimen shall be handled in accordance with IEC 60068-2-52:1996, Clause 10. Within 30 min of the end of the recovery period, inspect the specimen visually for mechanical damage both externally and internally and complete the full or reduced functional test as appropriate.

13.12 Protection against water (IP rating)

13.12.1 Object of the test

The object of the test is to demonstrate whether the equipment can withstand water penetration.

13.12.2 Test procedure

13.12.2.1 General

Testing shall be carried out in accordance with the procedures described in IEC 60529 with the modifications and additions given in 13.12.2.4.

13.12.2.2 Initial examination

Before conditioning, subject the specimen to the functional test required by 13.2.

13.12.2.3 State of the specimen during conditioning

The specimen shall be mounted in accordance with 12.3 with all additional weather protection and be connected in accordance with 12.4.

13.12.2.4 Conditioning

The specimen shall be conditioned in accordance with the conditions specified in IEC 60529 for the IP rating stated in the user documentation.

13.12.2.5 Measurements during conditioning

Monitor the specimen during the conditioning period to check that the output voltage is within the limits stated in the user documentation. The status of the equipment shall not change.

13.12.2.6 Final measurements

At the end of the conditioning period, re-establish the standard atmospheric conditions described in 12.1 within a period of 2 h. Within 30 min of the end of this recovery period, inspect the specimen visually for mechanical damage both externally and internally and complete the full or reduced functional test as appropriate.

13.13 Protection against substances (IP rating)

13.13.1 Object of the test

The object of the test is to demonstrate whether the equipment is protected against substances.

13.13.2 Test procedure

13.13.2.1 General

Testing shall be carried out in accordance with the procedures described in IEC 60529 with the modifications and additions given in 13.13.2.4.

13.13.2.2 Initial examination

Before conditioning, subject the specimen to the functional test required by 13.2.

13.13.2.3 State of the specimen during conditioning

The specimen shall be mounted in accordance with 12.3 and connected in accordance with 12.4.

13.13.2.4 Conditioning

The specimen shall be conditioned in accordance with the conditions specified in IEC 60529 for the IP rating stated in the user documentation.

13.13.2.5 Measurements during conditioning

The status of the equipment shall not change.

13.13.2.6 Final measurements

At the end of the conditioning period, re-establish the standard atmospheric conditions described in 12.1 within a period of 2 h. Within 30 min of the end of this recovery period, inspect the specimen visually for mechanical damage both externally and internally and complete the full or reduced functional test as appropriate.

13.14 EMC immunity tests (operational)

The following EMC immunity tests shall be in accordance with EN 50130-4. The equipment shall be in the standby condition:

a) mains voltage variations;

b) mains supply voltage dips and interruptions;

c) electrostatic discharge;

d) radiated electromagnetic fields;

e) conducted disturbances induced by electromagnetic fields;

f) fast transient bursts;

g) slow high-energy voltage surges.

If the equipment has a number of identical types of inputs or outputs, then the last three tests shall be applied to one of each type.

The connections to the various inputs shall be made with unscreened cables unless the manufacturer's installation data recommends that only screened cables be used.

The equipment shall maintain its current status throughout the tests.

14 Conformity assessment

14.1 General

Compliance of control equipment with the requirements of this part of ISO 21927 shall be demonstrated by

— type testing, and

— factory production control by the manufacturer.

The control equipment shall be type tested in accordance with this part of ISO 21927.

The control equipment shall continuously conform to the type-testing samples for which compliance with this part of ISO 21927 has been verified.

However, where the manufacturer uses control equipment already shown to conform to the requirements relevant for that control equipment (e.g. by CE marking), it is not necessary to repeat the evaluation that led to such conformity.

14.2 Type testing

14.2.1 Type testing performed on first application of this part of ISO 21927, shall demonstrate conformity with this part of ISO 21927. All characteristics given in this part of ISO 21927 shall be subject to this type testing.

14.2.2 Tests previously performed in accordance with the provisions of this part of ISO 21927 may be taken into account providing they were made to the same or a more rigorous test method on the same control equipment or control equipment of similar design, construction and functionality, such that the results are applicable to the control equipment in question.

In addition, type testing shall be performed at the beginning of the production of a new product type or at the beginning of a new method of production where these can affect the stated properties.

14.3 Factory production control (FPC)

A factory production control (FPC) system as described in ISO 9001, and made specifically to the requirements of this part of ISO 21927, shall be considered to satisfy the requirements of this part of ISO 21927.

Annex A
(normative)

Explanation of access levels

NOTE See 3.1.1 and 8.7.

This part of ISO 21927 defines access levels for the indications and controls relating to compulsory 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 by this part of ISO 21927. However, in general they are expected to be used as follows.

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.

Access level 2:

By persons having a specific responsibility for safety, and who are trained and authorized to operate the c.p. in the:

— standby condition;

— fire condition;

— fault warning condition;

— disablement condition;

— test condition.

Access level 3:

By persons who are trained and authorized to:

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

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

Access level 4:

By persons who are trained and authorized by the manufacturer either to repair the c.p. or to alter its software, thereby changing its basic mode of operation.

Sub-clause 8.7 defines 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 and/or to access level 3 are:

— mechanical keys;

— codes with at least three manual sequential operations;

— access cards.

Examples of special means for entry to access level 4 are:

— mechanical keys;

— tools;

— an external programming device.

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 documentation which parts of the c.p. are not user-serviceable, and the entry to access level 4 may then be controlled by management of the user. External tools may also be used for certain functions at access level 3, e.g. to program site-specific data.

It may be desirable in certain circumstances for the c.p. to have additional access levels within access level 2 or access level 3 (e.g. 2A and 2B), which would enable different classes of authorized users to have access to a selected group of controls or functions. The exact configuration will depend on the type of installation, the way the c.p. is used, and the complexity of the functions provided.

Annex B
(informative)

Summary of functions

NOTE See 4.2.3.

Table B.1 provides a summary of the functions covered by this part of ISO 21927 and whether they are compulsory or optional.

Table B.1 — Summary of functions

Function	Type			
	A	B	C	D
Remote fire initiation	O	O	C	C
Fire condition indication (red)	C	C	C	C
Standby condition indication (green)	C	C	C	C
Fault condition indication (yellow)	X	O	C	C
Disable condition indication (yellow)	X	O	O	O
Operation indication	X	X	O	O
Equipment status indication (in standby condition) (green)	X	X	O	O
Response time	≤1 s	≤10 s	≤10 s	≤10 s
Fire detector monitoring	X	X	X	C
Non-fire usage	X	O	O	O
Transmission path monitoring	X	X	C	C
Deadlock	X	X	O	O
Output to other systems	X	X	O	O
Manual operation	C	O	O	O
Reset c.p.	C	C	C	C

X = Not required

C = Compulsory

O = Optional (with requirements)

NOTE Indications on Type B panels may be provided by labelling the controls instead of the indicator lamps.

Bibliography

[1] ISO 3098-2, *Technical product documentation — Lettering — Part 2: Latin alphabet, numerals and marks*

[2] ISO 7240-2, *Fire detection and alarm systems — Part 2: Control and indicating equipment*

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

ICS 13.220.20

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