INTERNATIONAL STANDARD

ISO 6182-3

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Fire protection — Automatic sprinkler systems —

Part 3:

Requirements and test methods for dry pipe valves

Protection contre l'incendie — Systèmes d'extinction automatiques du type sprinkler —
Partie 3: Prescriptions et méthodes d'essai des postes de contrôle sous air

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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.

International Standard ISO 6182-3 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Sub-Committee SC 5, *Fixed fire extinguishing systems*.

ISO 6182 consists of the following parts, under the general title *Fire protection — Automatic sprinkler systems*:

— *Part 1: Requirements and test methods for sprinklers*

— *Part 2: Requirements and test methods for wet alarm valves, retard chambers and water motor alarms*

— *Part 3: Requirements and test methods for dry pipe valves*

— *Part 4: Requirements and test methods for quick-opening devices*

— *Part 5: Requirements and test methods for deluge valves*

Annex A of this part of ISO 6182 is for information only.

Introduction

ISO 6182 comprises several parts prepared by ISO/TC 21 covering components for automatic sprinkler systems.

ISO 6182 is included in a series of International Standards planned to cover:

— carbon dioxide systems (ISO 6183);

— explosion protection systems (ISO 6184);

— foam systems (ISO 7076).

Fire protection — Automatic sprinkler systems —

Part 3:
Requirements and test methods for dry pipe valves

1 Scope

This part of ISO 6182 gives performance and other requirements, recommendations, and tests for dry pipe valves and relevant trim, as specified by the manufacturers, used in dry pipe automatic sprinkler systems for fire protection service.

Performance and test requirements for other auxiliary components or attachments to dry pipe valves are not covered by this part of ISO 6182.

All pressure data in this part of ISO 6182 are given as gauge pressure in bar[1].

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 6182. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 6182 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 37:1977, *Rubber, vulcanized — Determination of tensile stress-strain properties.*

ISO 898-1:1988, *Mechanical properties of fasteners — Part 1: Bolts, screws and studs.*

ISO 898-2:1992, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread.*

1) 1 bar = 10^5 Pa = 0,1 MPa

3 Definitions

For the purposes of this part of ISO 6182, the following definitions apply.

3.1 alarm device: Mechanical or electrical device to sound an alarm upon operation of the dry pipe valve.

3.2 anti-reseat latch: Mechanism that prevents the sealing assembly from returning to its set position after operation.

3.3 automatic drain valve: Normally open device that automatically drains water from and vents the intermediate chamber of a dry pipe valve to the atmosphere when the dry pipe valve is in the ready position, and limits water flow from the chamber after the dry pipe valve has tripped.

3.4 clapper: A type of sealing assembly (see 3.17).

3.5 corrosion-resistant material: Corrosion-resistant materials shall be either:

— metallics of bronze, brass, Monel metal, austenitic steel, or equivalent; or

— plastics conforming with the requirements of 6.2 and 6.3.

3.6 differential: Ratio of service pressure to system air pressure (expressed as gauge pressures) at the trip point (see 3.22).

3.7 dry pipe valve: Valve of the check type in which air pressure in the sprinkler system prevents water from filling the system. Loss or partial loss of air pressure in the system causes automatic operation

of the dry pipe valve admitting water into the system.

3.8 differential-type dry pipe valve: Type of dry pipe valve in which air pressure in the system acts directly and/or indirectly on the sealing assembly to maintain it in the closed position. The air seat of the sealing assembly is of equal or larger diameter than the diameter of the water seat of the sealing assembly, with the two separated by an intermediate chamber maintained at atmospheric pressure.

3.9 flow velocity: The rate of water flow through a dry pipe valve expressed as the equivalent water velocity through a pipe of the same nominal size as the dry pipe valve.

3.10 intermediate chamber: That part of a dry pipe valve which separates the air and/or water sealing assembly seating surfaces and is at atmospheric pressure when the valve is in the ready condition.

3.11 leak point: System air pressure for a specific service pressure at which water begins to flow from the intermediate chamber, automatic drain valve or alarm connection.

3.12 mechanical-type dry pipe valve: Type of dry pipe valve in which the air pressure in the system acts on the sealing assembly and linking mechanism to maintain it in the closed position.

3.13 priming water: Water used to seal a sealing assembly and prevent cementation of working parts.

3.14 rated working pressure: Maximum service pressure at which a dry pipe valve is intended to operate.

3.15 ready condition: State of a dry pipe valve installed in a piping system and filled with air or inert gas at a predetermined pressure, to maintain the dry pipe valve in a closed position and prevent the downstream pipework filling with water.

3.16 reinforced elastomeric sealing element: Element of clapper, clapper assembly or seat seals in a composite of an elastomeric compound with one or more other components that increase the tensile strength of the combination to at least twice that of the elastomeric material alone.

3.17 sealing assembly: Main movable sealing element (such as a clapper) of the valve, which maintains air pressure in the system piping.

3.18 sealing assembly seat ring: Main fixed sealing element of a dry pipe valve, which maintains air pressure in the system piping.

3.19 service pressure: Static water pressure at the inlet to a dry pipe valve when the valve is in the ready condition.

3.20 system air pressure: Static air pressure at the main outlet of a dry pipe valve in the ready condition.

3.21 trim: External equipment and pipework, excluding the main installation pipework, fitted to a dry pipe valve.

3.22 trip point: Point at which a dry pipe valve operates, admitting water into the sprinkler system installation, measured in terms of the system air pressure and service pressure.

3.23 water motor alarm: Hydraulically actuated device which provides a local audible alarm as a result of flow through a dry pipe valve.

3.24 water motor transmitter: Hydraulically actuated device which generates an electrical current for a remote alarm as a result of operation of the dry pipe valve.

4 Dry pipe valve requirements

4.1 Nominal sizes

The nominal size of a dry pipe valve shall be the nominal diameter of the inlet and outlet connections, i.e. the pipe size for which the connections are intended. Sizes shall be 40 mm, 50 mm, 65 mm, 80 mm, 100 mm, 125 mm, 150 mm, 200 mm or 250 mm.

NOTE 1 The diameter of the waterway through the sealing assembly seat ring may be less than the nominal size.

4.2 Connections

All connections shall be suitable for use at the rated working pressure of the dry pipe valve.

NOTE 2 The dimensions of all connections should conform to International Standards where these exist. National standards may be used where International Standards are not appropriate.

4.3 Rated working pressures

The rated working pressure shall be not less than 12 bar (1,2 MPa).

Inlet and outlet connections may be machined for lower working pressure to match installation equipment of a lower working pressure, in which case the valve shall be marked with the lower working pressure [see 7.2 f)].

4.4 Bodies and covers

4.4.1 If non-metallic materials (other than gaskets and seals) or metals with a melting point of less than 800 °C (other than gaskets and seals) form part of the dry valve body or cover, the assembled valve, after subjection to the fire exposure test of 6.12, shall withstand a hydrostatic pressure test without permanent deformation or failure and the sealing assembly shall open freely and fully.

4.4.2 The body and cover shall be made of a material with corrosion resistance at least equivalent to that of cast iron. For extreme corrosion conditions, other materials can be necessary.

4.4.3 It shall not be possible to assemble the dry pipe valve with the cover plate in a position which either improperly indicates flow direction or so affects the operation of the dry pipe valve that it does not meet the requirements of this part of ISO 6182 [see 7.2 d) and 7.2 h)].

4.5 Strength

4.5.1 The assembled dry pipe valve, with the sealing assembly open, shall withstand, without rupture, an internal hydrostatic pressure of four times the rated working pressure for a period of 5 min when tested in accordance with 6.8.

4.5.2 The calculated design load of any fastener, neglecting the force required to compress the gasket, shall not exceed the minimum tensile strength specified in ISO 898-1 and ISO 898-2 when the dry pipe valve is pressurized to four times the rated working pressure. The area of the application of pressure shall be calculated as follows.

a) If a full-face gasket is used, the area of application is that extending out to a line defined by the inner edge of the bolts.

b) If an "O"-ring seal or ring gasket is used, the area of application is that extending out to the centre-line of the "O"-ring or gasket.

4.6 Drains

4.6.1 Dry pipe valve

The dry pipe valve shall be provided with a tapped opening to drain water from the valve body when the valve is installed in any position specified or recommended by the manufacturer. The minimum opening size shall be 20 mm nominal.

NOTE 3 If the drain opening on the valve is to be used for draining pipework, then the size of the opening should comply with any national standard which may be applicable (see 4.2).

4.6.2 Automatic drain valves for intermediate chambers

4.6.2.1 The intermediate chamber of a dry pipe shall be provided with an automatic drain valve.

4.6.2.2 Automatic flow or velocity drain type valves employed for normally venting intermediate chambers shall close at a pressure of not more than 1,4 bar (0,14 MPa) with a flow rate through the drain valve just prior to closure of between 0,13 l/s and 0,63 l/s.

4.6.2.3 Automatic drain valves shall remain closed during system drainage until the pressure effective at the sealing mechanism (e.g. ball) becomes less than 1,4 bar (0,14 MPa) and shall open at a pressure between 0,035 bar (0,003 5 MPa) and 1,4 bar (0,14 MPa).

4.6.2.4 The flow through an open end or velocity type drain valve shall not exceed 0,63 l/s at any service pressure up to the rated working pressure.

4.7 Access for maintenance

Means shall be provided to permit access to working parts and to allow removal of the sealing assembly.

NOTE 4 Any method adopted should permit ready maintenance by one person with a minimum of down-time.

With the exception of the valve seat, all parts intended for field replacement shall be capable of being disassembled and reassembled with tools normally employed by the trade.

4.8 Connections

4.8.1 If priming water is required to seal the air seat an external means shall be provided to allow priming water to enter.

4.8.2 To prevent water columning and to facilitate water level checking, one or more ports shall be provided.

4.8.3 Suitable means shall be provided to facilitate alarm testing without tripping the valve.

4.8.4 Means shall be provided to drain the pipe automatically between the alarm shut-off valve and the alarm device.

4.8.5 Differential-type valves shall be provided with a means of venting water from the intermediate chamber and also of preventing the build-up of a partial vacuum between the upstream and downstream sealing elements of the sealing assembly.

4.8.6 All dry pipe valve assemblies shall be provided with a means of sounding an alarm to indicate a fault if water enters the dowstream piping to an elevation of greater than 0,50 m above the sealing assembly.

4.9 Components

4.9.1 Where practicable, the design of any component which can normally be disassembled during servicing shall be such that it cannot be reassembled wrongly, without providing an external visual indication when the dry pipe valve is returned to service.

While the dry pipe valve is in the ready condition, it should not be possible to interfere with the valve operating mechanism by external tampering.

4.9.2 All components shall be non-detachable on operation of the valve.

4.9.3 Springs and diaphragms shall not fracture or rupture during 5 000 cycles of normal operation when tested in accordance with 6.1. Failure of diaphragms shall not prevent the dry pipe valve from opening fully.

4.9.4 There shall be no visible damage to the sealing elements of the dry pipe valve after testing for the operational requirements of 4.13 in accordance with 6.9.

4.9.5 The clapper or clapper assembly and any points of contact shall be located so that impact or the reaction of the water will not permanently twist, bend or fracture the parts after testing for the operational requirements of 4.13 in accordance with 6.9 and after the test of 6.11.

4.9.6 Seat rings not made of bronze shall have corrosion resistance at least equivalent to that of bronze. In addition, any part and its bearing, where rotation or sliding motion is required, shall either be made of a corrosion-resistant material or shall be fitted with brushings, inserts or other parts made of corrosion-resistant materials, at those points where freedom of movement is required.

4.9.7 Dry pipe valves in which

— the differential ratio of the sealing assembly exceeds 1,16 to 1 for a service pressure range of 1,4 bar to 12 bar as measured by sealing assembly opening and pressure equalization above and below the sealing assembly, or

— the system pipework drain is located upstream of the sealing assembly,

shall be provided with a latch or other device which prevents the dry pipe valve from resetting automatically and which allows drainage until it is manually reset when tested in accordance with 6.9 and 6.10.

4.9.8 Dry pipe valves with the sealing assembly open shall withstand, without leakage, permanent distortion or rupture, an internal hydrostatic pressure of twice the rated working pressure for a period of 5 min when tested in accordance with 6.7.1. Following this test, valves shall comply with the requirements of 4.13.2 or 4.13.3 at a service pressure of 2 bar (0,2 MPa) when tested in accordance with 6.9.

4.9.9 Mechanical-type dry pipe valves shall withstand, without leakage, permanent distortion or structural failure, an internal hydrostatic pressure of twice the rated working pressure for 2 h applied at the upstream end with the sealing assembly closed and the downstream end vented when tested in accordance with 6.7.3. Following this test, dry pipe valves shall comply with the requirements of 4.13.3 at a service pressure of 2 bar (0,2 MPa) when tested in accordance with 6.9.

4.9.10 Dry pipe valves fitted with a latch shall withstand, without leakage, permanent distortion or structural failure, an internal hydrostatic pressure of twice the maximum recommended installation air pressure for a period of 5 min applied at the downstream end with the sealing assembly closed and the upstream end vented when tested in accordance with 6.7.4. Following this test, dry pipe valves shall comply with the requirements of 4.13.2 or 4.13.3 at a service pressure of 2 bar (0,2 MPa) when tested in accordance with 6.9.

4.9.11 Dry pipe valves not fitted with a latch shall withstand, without permanent distortion or structural failure, an internal hydrostatic pressure of twice the rated working pressure for a period of 5 min applied at the downstream end with the sealing assembly closed and the upstream end vented, when tested in accordance with 6.7.5. Following this test, valves shall comply with the requirements of 4.13.2 or 4.13.3 at a service pressure of 2 bar (0,2 MPa) when tested in accordance with 6.9.

4.10 Non-metallic components (excluding gaskets and seals)

4.10.1 After ageing of its non-metallic parts as described in 6.2 and 6.3 (using separate samples), a dry pipe valve shall meet the requirements of 4.13 and 4.16 when tested in accordance with 6.7 and 6.9.

4.10.2 There shall be no cracking, warping, creep, or other signs of deterioration which would preclude the proper operation of the device.

4.11 Sealing assembly elements

4.11.1 Sealing surfaces shall prevent leakage of water into the alarm port in excess of 3 ml/min when the dry pipe valve is tested in accordance with 6.9.

Valve sealing surfaces shall be able to withstand ordinary wear and tear, rough usage, compression stresses and damage due to pipe scale or foreign matter carried by the water.

4.11.2 A seal made of elastomeric or other resilient materials shall not adhere to the mating surface when tested in accordance with 6.4.

NOTE 5 Where the same design of seat is used for more than one size of dry pipe valve, only a sample of the size with the highest stress on the seating surface need be tested.

4.11.3 Any non-reinforced elastomer forming the seal shall have the following properties when tested in accordance with 6.4.3 and the appropriate section of ISO 37:

a) maximum set of 5 mm when 25 mm long marks are stretched to 75 mm, held for 2 min, and measured 2 min after release; and

b) either:

1) minimum tensile strength 100 bar (10 MPa) and minimum ultimate elongation 300 % (25 mm to 100 mm), or

2) minimum tensile strength 150 bar (15 MPa) and minimum ultimate elongation 200 % (25 mm to 75 mm);

and after exposure to oxygen for 96 h at (70 ± 1,5) °C and 20 bar (2,0 MPa),

c) the tensile strength and ultimate elongation shall not be less than 70 % of the corresponding properties of specimens which have not been heated in oxygen, and any change in hardness shall not be greater than 5 type A durometer units;

and after immersion in distilled water at (97,5 ± 2,5) °C for 70 h,

d) the tensile strength and ultimate elongation shall not be less than 70 % of the corresponding properties of specimens which have not been heated in water and the change of volume of the specimens shall not be greater than 20 %.

4.11.4 A reinforced elastomeric sealing element (of clapper, clapper assembly or seat seal) shall be capable of being flexed without cracking or breaking and shall have a change in volumetric expansion not greater than 20 % when tested in accordance with 6.4.2.

4.12 Clearances

NOTE 6 Clearances are necessary between moving parts and between moving and stationary parts so that corrosion or deposits of foreign matter within an assembly will not render a dry pipe valve sluggish in action or inoperative.

4.12.1 The radial clearance between a hinged sealing assembly and the inside walls of cast iron bodies, in every position except the wide open position excluding moving catches and latching mechanisms, shall be not less than 19 mm. If both the body and sealing assembly are of a non-ferrous material, stainless steel, or a combination, such clearance shall be not less than 9 mm. For sealing assembly hinge boss areas, the radial clearance shall be not less than 12 mm for cast iron valves or 6 mm if body and sealing assembly are of non-ferrous material, stainless steel, or a combination. [See figure 1 a)].

4.12.2 There shall be a diametrical clearance [see figure 1 b)] of not less than 6 mm between the inner edges of a seat ring and the metal parts of a hinged sealing assembly when the dry pipe valve is in the closed position.

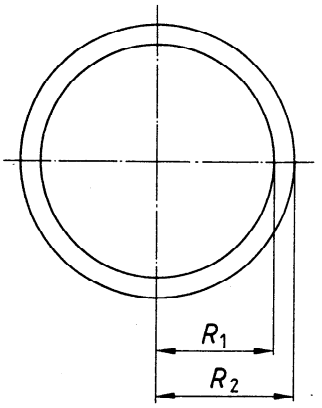
4.12.3 Any space in which the sealing assembly can trap debris beyond the dry pipe valve seat shall be not less than 3 mm deep.

4.12.4 The diametrical clearance [see figure 1 b)] between pins and their bearings shall be not less than 0,125 mm.

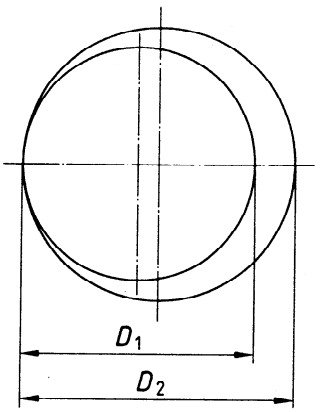
4.12.5 The total axial clearance, $l_2 - l_1$ [see figure 1 c)], between the clapper hinge and the adjacent dry pipe valve body bearing surfaces shall be not less than 0,25 mm.

4.12.6 Any reciprocating guide components in the main dry pipe valve body, the operation of which is essential to allow a dry pipe valve to open, shall have a minimum diametrical clearance of not less than 0,7 mm in that portion over which the moving component enters the fixed component and of not less than 0,125 mm in that portion of the moving component continuously in contact with the fixed component in the ready position.

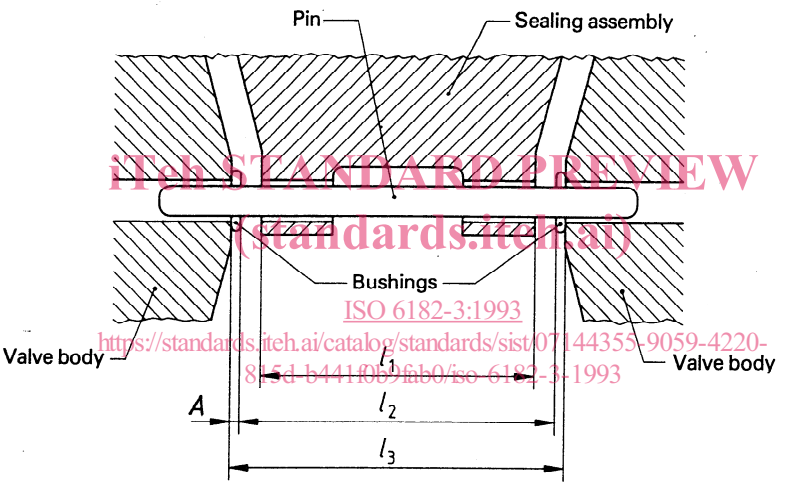
4.12.7 Clapper-guide bushings or hinge-pin bearings shall project a sufficient axial distance, A, to maintain not less than 3 mm clearance between ferrous metal parts. See figure 1 c).



a) Radial clearance = $R_2 - R_1$



b) Diametrical clearance = $D_2 - D_1$



c) Total axial clearance = $l_2 - l_1$; clearance, $A = \frac{l_3 - l_2}{2}$

Figure 1 — Clearances

4.13 Operational performance

4.13.1 A dry pipe valve with associated trim shall operate and provide an indication of operation by actuating mechanical and/or electrical alarm devices at any service pressure within the range of 1,4 bar (0,14 MPa) to rated working pressure, when tested in accordance with 6.9. The alarm devices shall sound for more than 50 % of the time for all flow conditions through a tripped valve.

4.13.2 A differential-type valve shall have a working differential within the range 5:1 to 8,5:1 at 1,4 bar (0,14 MPa) service pressure and within the range of 5:1 to 6,5:1 at all higher service pressures when tested in accordance with 6.9. The difference between the leak-point and trip point shall not exceed 0,2 bar (0,02 MPa).

4.13.3 A mechanical-type dry pipe valve shall operate at an air pressure between 0,25 bar and 2 bar (0,025 MPa and 0,2 MPa) for all water pressures from 1,4 bar (0,14 MPa) to the rated working pressure when tested in accordance with 6.9.

4.14 Alarms

4.14.1 A dry pipe valve shall actuate its associated mechanical and electrical alarm devices at flow velocities through the valve up to 5 m/s, based on nominal pipe size, at inlet supply pressures of

1,4 bar (0,14 MPa) to the rated working pressure, when tested for operation in accordance with 6.9.

4.14.2 The dry pipe valve shall provide at least a pressure of 0,5 bar (0,05 MPa) at its alarm port at a service pressure of 1,4 bar (0,14 MPa) while actuating relevant alarm devices, when tested in accordance with 6.9.

NOTE 7 Requirements for water motor alarms are specified in ISO 6182-2.

4.15 Hydraulic friction loss

The maximum pressure loss across the dry pipe valve of the appropriate flow given in table 1 tested in accordance with 6.6 shall not exceed 0,4 bar (0,04 MPa). If the pressure loss exceeds 0,2 bar (0,02 MPa), the pressure loss shall be marked on the valve [see 7.2 j)] and the instruction chart shall include the pressure loss value (see clause 8).

Table 1 — Required flow rates for pressure drop determination

Nominal size mm	Flow rate l/min
40	400
50	600
65	800
80	1 300
100	2 200
125	3 500
150	5 000
200	8 700
250	14 000

4.16 Leakage

Leakage across the sealing assembly, into the intermediate chamber, or into the alarm port shall not exceed a rate of 3 ml/min when tested in accordance with 6.7.2. Leakage shall be automatically drained away.

4.17 Endurance test

NOTE 8 This test may be performed concurrently with the hydraulic friction loss test (see 6.5).

The dry pipe valve and its moving parts shall show no sign of distortion, cracks, loosening, separation, or other failure when tested in accordance with 6.6.

5 Production testing and quality control

It shall be the responsibility of the manufacturer to implement a quality control programme to ensure that his production continuously meets the requirements of this part of ISO 6182 in the same manner as the originally tested samples.

Every manufactured dry pipe valve shall pass a hydrostatic body test for a period not less than 1 min at twice the rated working pressure and a test to verify consistency of correct functioning.

6 Test methods

6.1 Spring and diaphragm test

See 4.9.3.

Subject the spring or diaphragm in the normal mounting to 5 000 cycles of normal operation. Operate the components at a rate not exceeding 6 cycles per minute. For sealing assembly springs, rotate the sealing assembly off the seat to a 45° angle and slowly return to the closed position. For internal bypass springs, operate the bypass from the full open position to the closed position.

6.2 Air-oven ageing for non-metallic components (excluding gaskets and seals)

See 4.10.

Age four samples of each component in an air oven at 120 °C ± 2 °C for 180 days. Support the components so that they do not touch each other or the sides of the oven. Remove the samples from the oven and allow to cool in air at 23 °C ± 2 ° C and relative humidity (50 ± 5) % for not less than 24 h before carrying out any test, measurement or examination.

If a material cannot withstand the temperature indicated without excessive softening, distortion, or deterioration, carry out an air-oven ageing test at a lower temperature, but not less than 70 °C, for a longer period of time. Calculate the duration of exposure D, in days, from:

$$D = 737\,000\ e^{-0,069\,3t}$$

where t is the test temperature, in degrees Celsius.

NOTE 9 This equation is based on the 10 °C rule, i.e. for every 10 °C rise, the rate of a chemical reaction is approximately doubled. When applied to plastics ageing, it is assumed that the life at a temperature, t, in degrees Celsius, is half the life at a temperature $(t - 10)$, in degrees Celsius.

Examine the component for cracking, warping, creep or other signs of deterioration which would preclude proper operation of the device.