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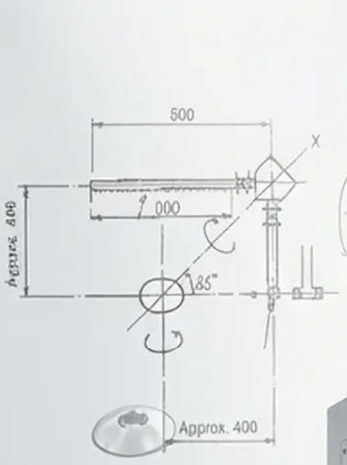

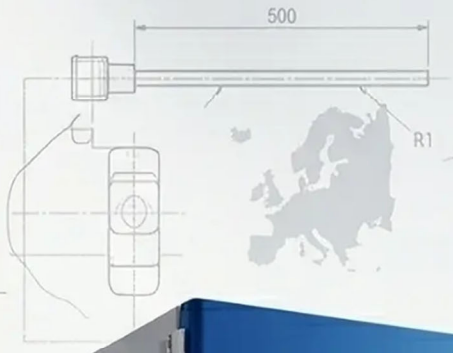

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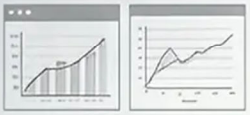

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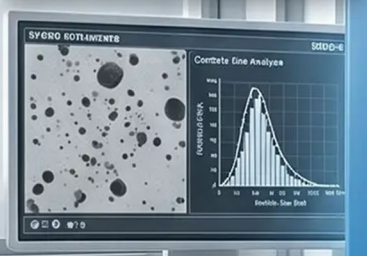

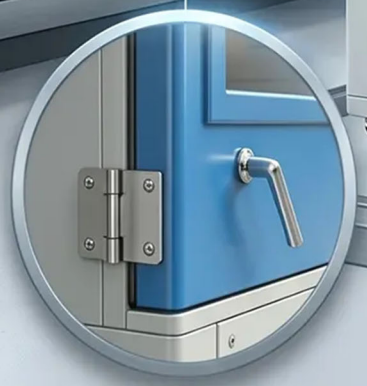

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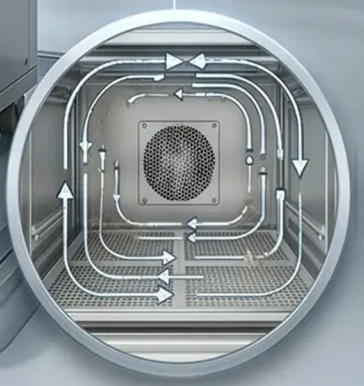

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Road vehicles — Environmental conditions and testing for electrical and electronic equipment

Part 4: Climatic loads

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This British Standard is the UK implementation of ISO 16750-4:2010. It supersedes BS ISO 16750-4:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AUE/16, Electrical and electronic equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Part 4: Climatic loads

Véhicules routiers — Spécifications d'environnement et essais de l'équipement électrique et électronique —

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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.

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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 16750-4 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This third edition cancels and replaces the second edition (ISO 16750-4:2006), which has been technically revised.

ISO 16750 consists of the following parts, under the general title *Road vehicles — Environmental conditions and testing for electrical and electronic equipment*:

— *Part 1: General*

— *Part 2: Electrical loads*

— *Part 3: Mechanical loads*

— *Part 4: Climatic loads*

— *Part 5: Chemical loads*

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INTERNATIONAL STANDARD **ISO 16750-4:2010(E)**

Road vehicles — Environmental conditions and testing for electrical and electronic equipment —

Part 4: Climatic loads

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1 Scope

This part of ISO 16750 applies to electrical and electronic systems/components for road vehicles. This part of ISO 16750 describes the potential environmental stresses and specifies tests and requirements recommended for the specific mounting location on/in the road vehicle.

This part of ISO 16750 describes climatic loads.

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 16750-1, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 1: General*

ISO 16750-2, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 2: Electrical loads*

ISO 20653, *Road vehicles — Degrees of protection (IP-Code) — Protection of electrical equipment against foreign objects, water and access*

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

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

IEC 60068-2-11, *Environmental testing — Part 2-11: Tests — Test Ka: Salt mist*

IEC 60068-2-14, *Environmental testing — Part 2-14: Tests — Test N: Change of temperature*

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

IEC 60068-2-38, *Environmental testing — Part 2-38: Tests — Test Z/AD: Composite temperature/humidity cyclic test*

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

IEC 60068-2-60, *Environmental testing — Part 2: Tests — Test Ke: Flowing mixed gas corrosion test*

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

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16750-1 apply.

4 Operating temperature ranges

The applicable operating temperature ranges shall be chosen from Table 1 and shall be given in the specification of the device under test (DUT).

Table 1 — Operating temperature ranges

Code	Minimum operating temperature T_{min} °C	Maximum operating temperature T_{max} °C
A	–20	65
B	–30	65
C	–40	65
D		70
E		75
F		80
G		85
H		90
I		95
J		100
K		105
L		110
M		115
N		120
O		125
P		130
Q		140
R		150
S		155
T		160
Z	as agreed upon	

In the case of hot-soak requirements, add 15 °C to the maximum operating temperature, T_{max}. See 5.3.1.

The paint repair temperature, T_{maxPR}, can be higher than the operating temperature and shall be given in the specification of the DUT. An applicable test shall be agreed between supplier and vehicle manufacturer.

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5 Tests and requirements

5.1 Tests at constant temperature

5.1.1 Low-temperature tests

5.1.1.1 Storage test

5.1.1.1.1 Purpose

This test simulates the exposure of the DUT to low temperatures without electrical operation, e.g. during shipment of the system/component. Failure mode is insufficient frost resistance, e.g. the freezing of liquid crystal displays.

5.1.1.1.2 Test method

Perform the test in accordance with IEC 60068-2-1, Test A, at a temperature of –40 °C for a duration of 24 h unless otherwise specified in the DUT specification. The operating mode of the DUT is 1.1, as defined in ISO 16750-1.

5.1.1.1.3 Requirement

The minimum functional status shall be class C, as defined in ISO 16750-1.

5.1.1.2 Operation test

5.1.1.2.1 Purpose

This test simulates the exposure of the DUT to low temperatures with electrical operation, e.g. the use of the system/components at very low ambient temperature. Failure mode is electrical malfunction caused by low temperature, e.g. the freezing of capacitors with liquid electrolyte.

5.1.1.2.2 Test method

Perform the test in accordance with IEC 60068-2-1, Test A, at the minimum operating temperature, T_{min}, for a duration of 24 h. The operating mode of the DUT is 3.2, as defined in ISO 16750-1.

5.1.1.2.3 Requirement

The functional status shall be class A, as defined in ISO 16750-1.

5.1.2 High-temperature tests

5.1.2.1 Storage test

5.1.2.1.1 Purpose

This test simulates the exposure of the DUT to high temperatures without electrical operation, e.g. during the shipment of the system/component. Failure mode is insufficient heat resistance, e.g. the warping of plastic housings.

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5.1.2.1.2 Test method

Perform the test in accordance with IEC 60068-2-2, Test B, at a temperature of 85 °C for a duration of 48 h unless otherwise specified in the DUT specification. The operating mode of the DUT is 1.1, as defined in ISO 16750-1.

5.1.2.1.3 Requirement

The functional status shall be class C, as defined in ISO 16750-1.

5.1.2.2 Operation test

5.1.2.2.1 Purpose

This test simulates the exposure of the DUT to high temperatures with electrical operation, e.g. the use of the system/components at very high ambient temperature. Failure mode is electrical malfunction caused by high temperature, e.g. the thermal degradation of components.

5.1.2.2.2 Test method

Perform the test in accordance with IEC 60068-2-2, Test B, at the maximum operating temperature, T_{max}, for a duration of 96 h. Use operating mode 3.2, as defined in ISO 16750-1.

5.1.2.2.3 Requirement

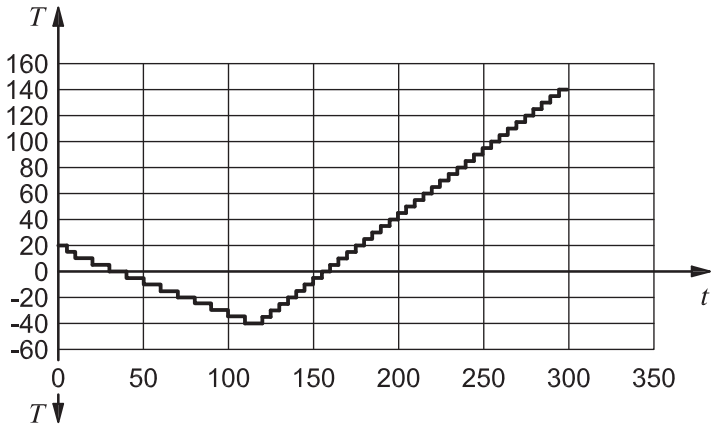
The functional status shall be class A, as defined in ISO 16750-1.

5.2 Temperature step test

5.2.1 Purpose

This test checks the mechanical and electrical device for malfunctions which may occur within a small section of the operating temperature range.

Figure 1 illustrates the temperature step test, using code Q as specified in Table 1.



Key

T temperature, in °C

t time, in min

Figure 1 — Example of temperature step test, using code Q in accordance with Table 1

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5.2.2 Test method

Install the DUT in a temperature chamber, decrease the temperature in steps of 5 °C from 20 °C to T_{min}, and then increase the temperature in steps of 5 °C from T_{min} to T_{max} (see Table 1). Wait at each step until the DUT has reached the new temperature. Perform functional tests operating mode 3.2 in accordance with ISO 16750-1 at minimum supply voltage, U_{Smin}, and at maximum supply voltage, U_{Smax}, in accordance with the specified ISO 16750-2 code letter, at each new temperature step. Switch the DUT off during transition to the next temperature.

5.2.3 Requirement

The DUT shall take up its normal function at each temperature between T_{min} and T_{max}, i.e. the functional status shall be class A, as defined in ISO 16750-1.

5.3 Temperature cycling tests

5.3.1 Temperature cycle with specified change rate

5.3.1.1 Purpose

This test simulates varying temperatures with electrical operation of the DUT, e.g. during the use of the system/components at changing ambient temperature. If a system/component is exposed to hot-soak temperatures (e.g. engine-mounted systems/components), an additional short temperature peak is added during the high-temperature phase of the profile to ensure proper function during short temperature peaks. The electrical operation is switched off during phases of decreasing temperature in order to avoid electrical heat dissipation of the system/component, which would inhibit reaching T_{min} inside the system/component. Failure mode is electrical malfunction during temperature change.

NOTE This test is not intended to be a life test.

5.3.1.2 Test method

Perform the temperature cycling in accordance with IEC 60068-2-14, Test Nb.

Operate the DUT electrically (functional test) after the whole device has reached T_{min} for the shortest possible duration in order to check the correct function of the device. In addition, operate it electrically between 210 min and 410 min of the cycle (see Figure 2). Use operating mode 3.2, as defined in ISO 16750-1, for the phases with electrical operation.

The changes in temperature shall correspond to the specifications given in Table 2. For tests including hot-soak temperature, T_{maxHS}, see Table 3. Figure 3 illustrates the temperature cycle with hot-soak phase, using code F as specified in Table 1.

The long period of electrical operation is started at 20 °C in order to allow possible condensation of humidity on the DUT. A permanent operation starting at T_{min} would prevent this due to the electrical power dissipation.

Additional drying of the test chamber air is not permitted.

Perform 30 test cycles as specified.

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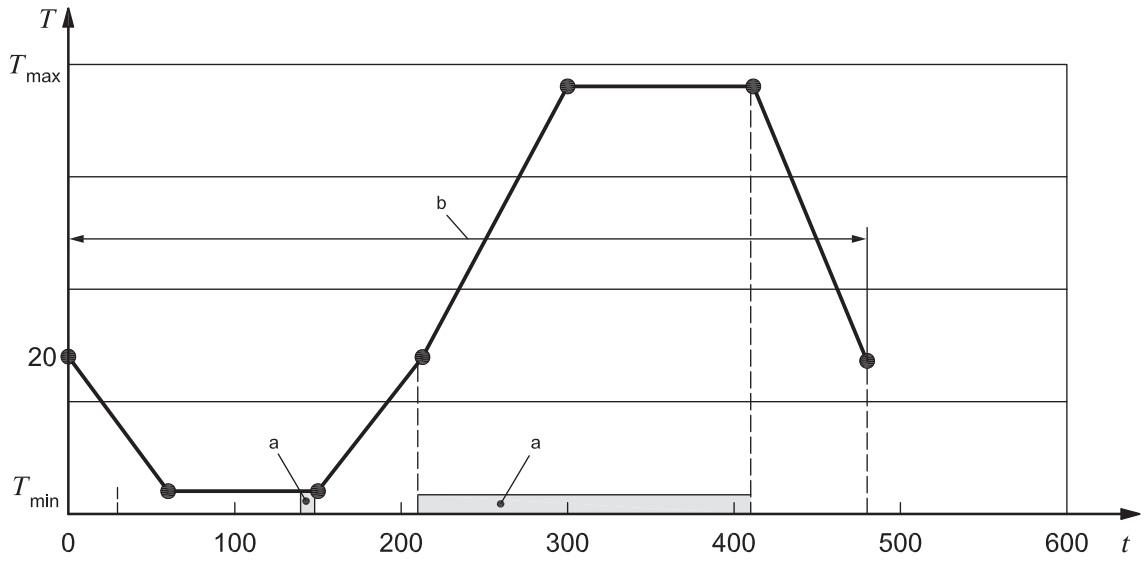

Key

T temperature, in °C

t time, in min

T_{min} minimum operating temperature, in °C (see Table 1)

T_{max} maximum operating temperature, in °C (see Table 1)

a Operating mode 3.2 in accordance with ISO 16750-1.

b One cycle.

Figure 2 — Temperature cycles with specified change rate

Table 2 — Temperatures and time duration for temperature cycling (see Figure 2)

Time min	**Temperature** °C
0	20
60	T_{min}
150	T_{min}
210	20
300	T_{max}
410	T_{max}
480	20
NOTE Codes are in accordance with Table 1 (codes A to T). In the vehicle environment, some equipment might experience different conditions regarding temperatures, temperature gradients and duration: in all these cases, code Z is used.	

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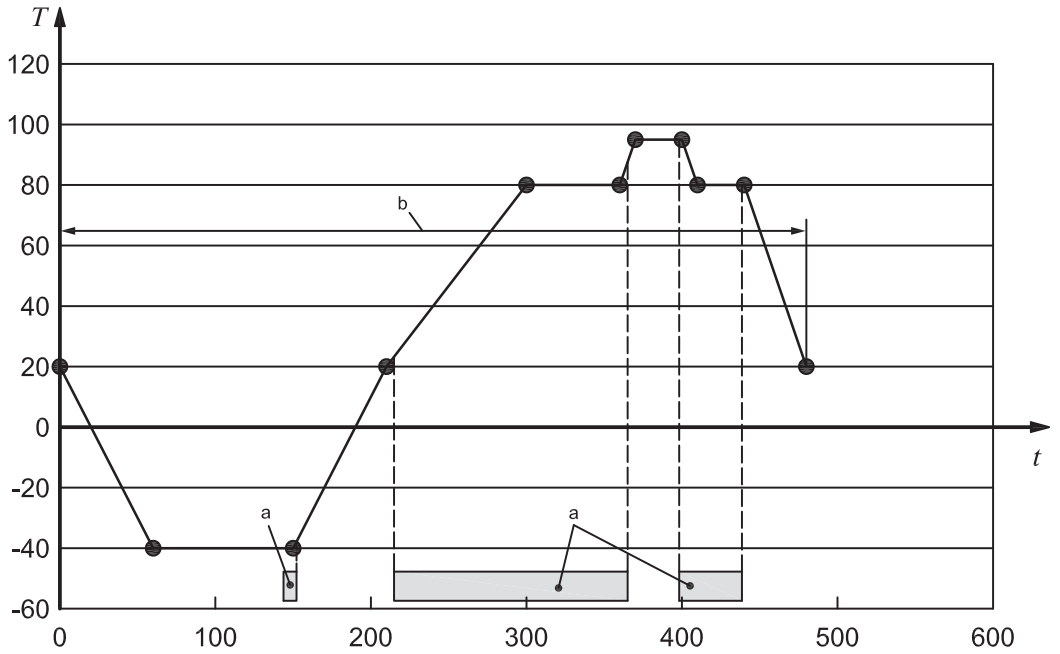

Key

T temperature, in °C

t time, in min

a Functional test operating mode 3.2 in accordance with ISO 16750-1.

b One cycle.

Figure 3 — Example of a temperature cycle with hot-soak phase, using code F in accordance with Table 1

Table 3 — Temperatures and time duration for temperature cycling with hot-soak phase (see Figure 3)

Time min	**Temperature** °C
0	+20
60	–40
150	–40
210	+20
300	+80
360	+80
370	+95[a]
400	+95[a]
410	+80
440	+80
480	+20
NOTE This table illustrates code F as specified in Table 1.	
[a] Hot-soak temperature.	

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5.3.1.3 Requirement

The functional status shall be class A, as defined in ISO 16750-1.

5.3.2 Rapid change of temperature with specified transition duration

5.3.2.1 Purpose

This is an accelerated test which simulates a very high number of slow temperature cycles in the vehicle. The acceleration is possible due to a much higher temperature change rate and a bigger temperature change in one cycle in comparison with real vehicle stress. Failure modes are cracking of materials or seal failures caused by ageing and different temperature expansion coefficients. Because this test creates mechanical defects (cracks), electrical operation is not required.

5.3.2.2 Test method

Perform the temperature cycling in accordance with IEC 60068-2-14, Test Na.

Raise the temperature from T_{min} to T_{max} within 30 s or less. Keep the DUT at T_{min} or T_{max} for a given soak time after thermal stability is obtained. The soak time can be agreed between customer and supplier, or the exposure time can be chosen among the values 20 min, 40 min, 60 min or 90 min, depending on its size and other properties of the DUT. Use operating mode 1.1, as defined in ISO 16750-1. See Table 4 for the number of cycles.

Upon agreement, this test may be performed during the development of a DUT with opened housing or without housing.

5.3.2.3 Requirement

The minimum functional status shall be class C, as defined in ISO 16750-1.

5.4 Ice water shock test

5.4.1 Purpose

This test simulates a thermal shock induced by ice water and applies to products in the splash areas of the vehicle. The purpose of this test is to simulate ice water splashing over a hot system/component. This happens when driving on wet roads during the winter. Failure modes are mechanical cracking of materials or seal failures caused by different temperature expansion coefficients. An additional failure mode not addressed in 5.3.2.1 is a loss of tightness and the intrusion of water into the system/component.

There are two possible methods for performing the test (see 5.4.2 and 5.4.3).

NOTE This is not a corrosion test.

5.4.2 Splash water test

5.4.2.1 Test method

Heat the DUT in a hot air oven at T_{max} for the specified holding time, t_{h}. Then splash the DUT with ice water for 3 s.

If the DUT is splashed in the vehicle from only one direction, splash it from this direction only while it is in an as-installed position. If the equipment is splashed from various directions in the vehicle, then these directions shall be taken into account. In this case, use a new DUT for each splash direction. The width of the splash directed at the DUT shall always be greater than the width of the DUT. If the DUTs to be splashed prove too big for one jet, arrange several jets in a row to produce a line of splash impact on the DUT. See Figures 4 to 6.

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Test parameters include:

— number of cycles: 100;

— holding time, t_h, at T_{max}: 1 h or until DUT temperature stabilization is reached;

— transition duration: < 20 s (for manual transition of DUT between temperature storage and splashing);

— test fluid: de-ionized water;

— water temperature: 0 °C to +4 °C;

— water flow: between 3 l and 4 l per 3 s (splash duration);

— distance between jet and DUT surface: (325 ± 25) mm (water shall be applied over the complete width of the DUT);

— operating modes: see Figure 5;

— orientation of the DUT: as in the vehicle.

NOTE It is permissible to add substances such as colours or salt to the water in order to improve the detectability.

Dimensions in millimetres

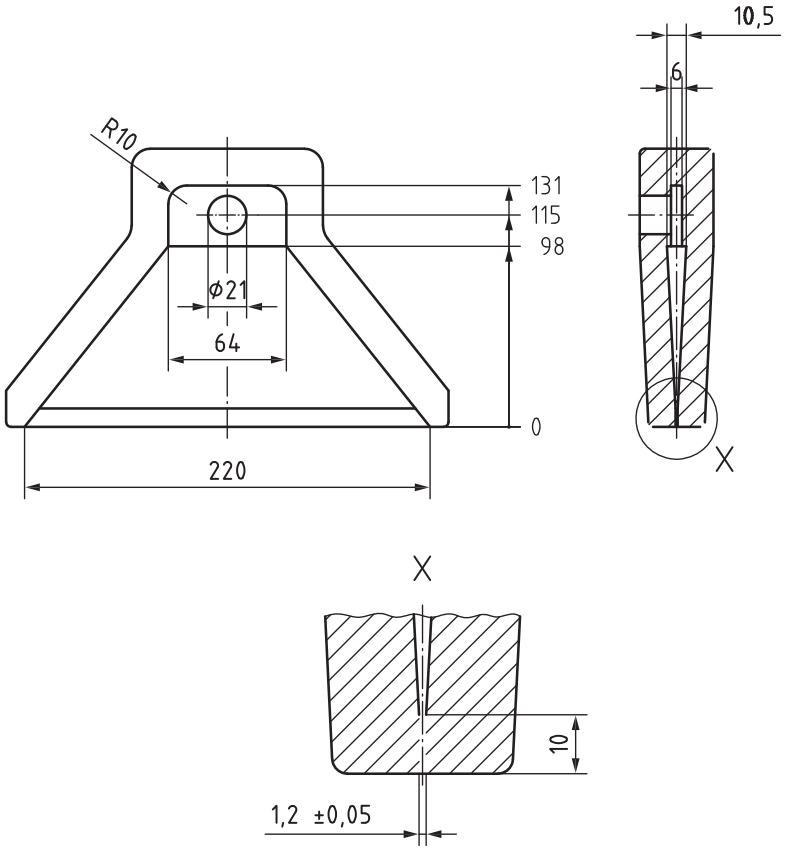

Figure 4 — Jet

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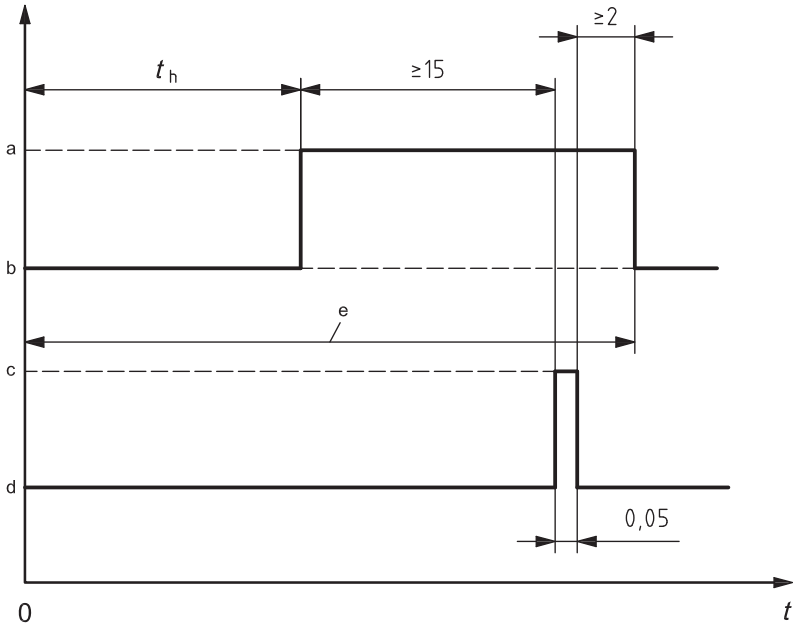


Key

t time, in min

t_h holding time, in min

a Operating mode 3.2 in accordance with ISO 16750-1.

b Operating mode 1.2 in accordance with ISO 16750-1.

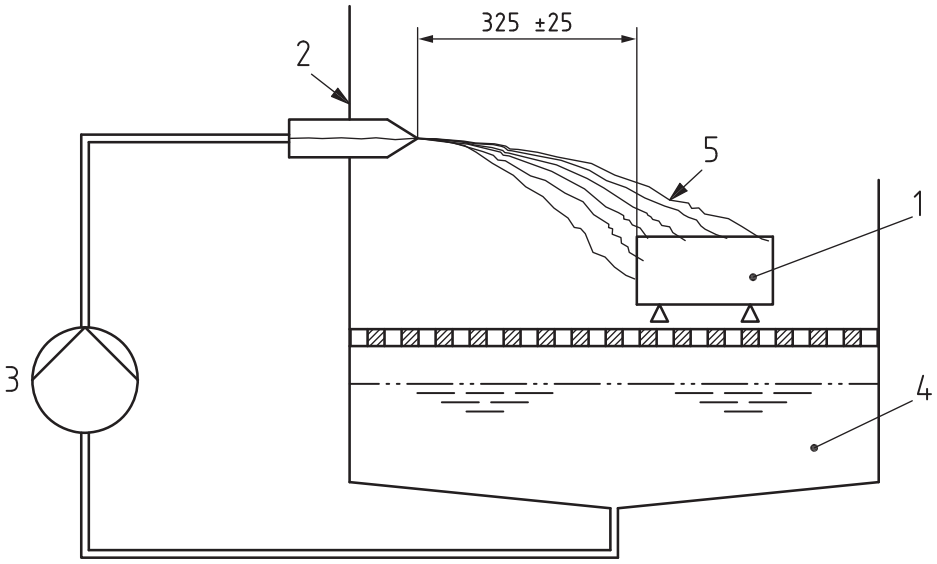
c Splash on.

d Splash off.

e One cycle.

Figure 5 — Test cycle for splash water test

Dimensions in millimetres



Key

1 DUT

2 slot jet

3 pump

4 splash water

5 splash

Figure 6 — Test set-up for splash water test

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5.4.2.2 Requirement

The functional status shall be class A during the operating mode 3.2, as defined in ISO 16750-1.

5.4.3 Submersion test

5.4.3.1 Test method

Connect the DUT to the test equipment. Operate the DUT in a hot air oven at T_{max} for the specified holding time, t_h. With the device still operating, submerge it for 5 min in an ice water tank at least 10 mm deep.

Test parameters include:

— number of cycles: 10;

— holding time, t_h, at T_{max}: 1 h or until DUT temperature stabilization is reached;

— transition duration: < 20 s;

— test fluid: de-ionized water;

— water temperature: 0 °C to +4 °C;

— immersion time: 5 min;

— operating mode: 3.2 in accordance with ISO 16750-1;

— orientation of the DUT: as in the vehicle.

5.4.3.2 Requirement

The functional status shall be class A, as defined in ISO 16750-1.

5.5 Salt spray tests

5.5.1 Corrosion test

5.5.1.1 Purpose

This test checks the resistance of materials and surface coatings of a system/component to salt mist and salt water on streets in winter. This test generates corrosion similar to reality. Failure mode is corrosion.

Visual examination as detailed below shall allow identification, appearance, workmanship and finish of the item to be checked against the relevant specification.

5.5.1.2 Test method

Perform the test in accordance with IEC 60068-2-52, Test Kb. Select a severity from Table 4 and Annex A. Use operating mode 1.2, as defined in ISO 16750-1.

Carry out a visual examination with the naked eye, at normal strength of vision, with normal colour perception, at the most favourable distance and with suitable illumination.

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5.5.1.3 Requirement

There shall be no changes that could impair normal performance, e.g. sealing function, marking and labelling shall remain visible.

The minimum functional status shall be class C, as defined in ISO 16750-1.

5.5.2 Leakage and function test

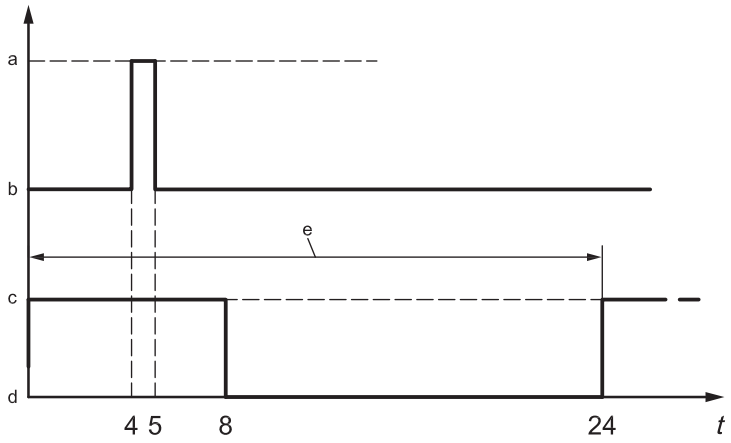
5.5.2.1 Purpose

This test checks the resistance of a system/component to salt mist and salt water on winter streets. Failure mode is electrical malfunction due to leakage currents caused by the ingress of salt water.

5.5.2.2 Test method

Perform the test cycle shown in Figure 7, based on IEC 60068-2-11, Test Ka. The duration of one cycle is 24 h. Spray the DUT for 8 h, then stop spraying for a rest period of 16 h. Operate the DUT with operating mode 3.2 in accordance with ISO 16750-1 between the fourth and fifth hour of each cycle.

Test duration: 6 cycles correspond to 6 days as a minimum.



Key

t time, in h

a Operating mode 3.2 in accordance with ISO 16750-1.

b Operating mode 1.2 in accordance with ISO 16750-1.

c Salt spray on.

d Salt spray off.

e One cycle.

Figure 7 — Test cycle for the salt spray test

5.5.2.3 Requirement

Intrusion of salt water into the housing is not permitted.

Functional status class A is required in phases with electrical operation (mode 3.2), as defined in ISO 16750-1.

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5.6 Humid heat, cyclic test

5.6.1 Purpose

This test simulates the use of the system/component under cyclic high ambient humidity. The failure modes addressed are electrical malfunction(s) caused by moisture, e.g. leakage current caused by a printed circuit board which is soaked with moisture. An additional failure mode is a breathing effect which transports moisture inside the housing when the air inside the system/components cools down and ambient air with high humidity is drawn into the system/components.

5.6.2 Test method

5.6.2.1 General

Perform the following tests based on Table 4 and Annex A.

5.6.2.2 Test 1: Damp heat cyclic test

Perform the test as specified in IEC 60068-2-30, Test Db, Variant 1:

— upper temperature: +55 °C;

— number of cycles: 6.

Perform a functional test (operating mode 3.2 in accordance with ISO 16750-1) when the maximum cycle temperature is reached.

5.6.2.3 Test 2: Composite temperature/humidity cyclic test

Perform the test as specified in IEC 60068-2-38, Test Z/AD.

Perform a functional test (operating mode 3.2 in accordance with ISO 16750-1) when the maximum cycle temperature is reached.

5.6.2.4 Test 3: Dewing test

Perform the test with reference to IEC 60068-2-30, Test Db, using the variant illustrated in Figure 8:

— upper temperature: +80 °C;

— number of cycles: 5.

Use operating mode 2.1 in accordance with ISO 16750-1 during the complete test sequence.

The temperature and humidity profile has been defined to generate a dewing effect similar to that in the vehicle environment.

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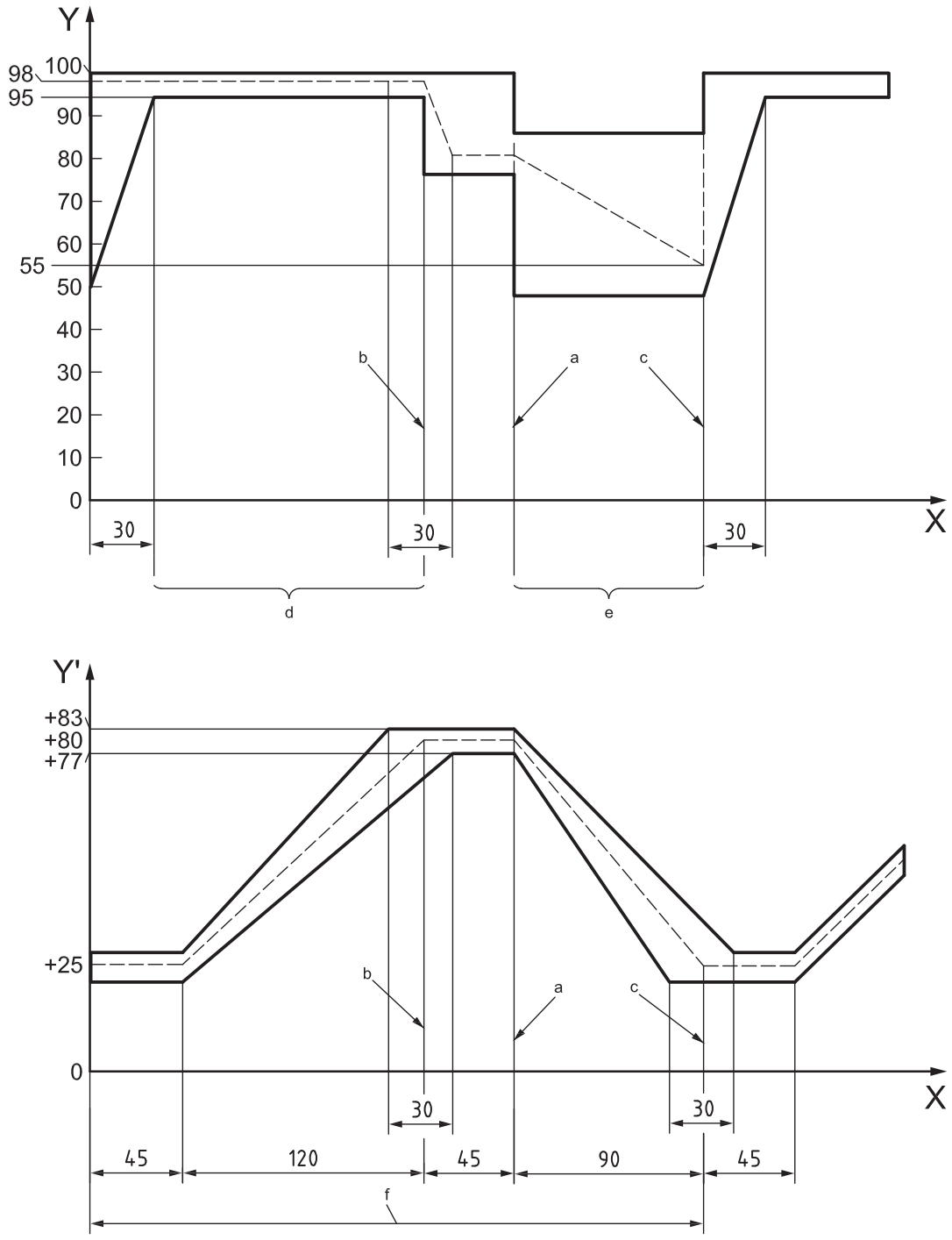

Key

X time, in min

Y relative humidity, in % RH

Y′ temperature, in °C

a Start of temperature fall.

b End of temperature rise.

c Recommended set value humidity/temperature.

d Condensation.

e Drying.

f One cycle.

Figure 8 — Dewing test cycle

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5.6.3 Requirement

The functional status shall be class A, as defined in ISO 16750-1, for test 1 and test 2.

The minimum functional status shall be class B, as defined in ISO 16750-1, for test 3.

5.7 Damp heat, steady-state test

5.7.1 Purpose

This test simulates the use of the system/component under steady high ambient humidity. Failure mode is electrical malfunction caused by moisture, e.g. leakage current caused by a printed circuit board which is soaked with moisture.

5.7.2 Test method

Perform the test in accordance with IEC 60068-2-78:

— test duration: 21 days;

— severity: (40 ± 2) °C and (85 ± 3) % humidity;

— operating mode:

  — operating mode 2.1 in accordance with ISO 16750-1 for a duration of 20 days and 23 h;

  — operating mode 3.2 in accordance with ISO 16750-1 for the last hour of the test.

5.7.3 Requirement

For systems which are powered while the engine is shut off, functional status shall be class A, as defined in ISO 16750-1, for the entire test duration. Other systems shall meet minimum functional status class C up to the last hour and class A for the last hour.

5.8 Corrosion test with flow of mixed gas

5.8.1 Purpose

This test simulates the use of the system/component in the presence of corrosive gases, e.g. in highly polluted atmospheres. Failure mode is electrical malfunction caused by insulating corrosion products on the surface of electrical contacts. This test is relevant for plug contacts and open switching contacts. Another failure mode is the penetration of protective (paint) coatings with subsequent corrosion of the structures below.

The application of this test shall be stated in the specification of the DUT.

5.8.2 Test method

Perform the test as specified in IEC 60068-2-60, Test Ke, method 4. The operating mode of the DUT shall be 1.1 in accordance with ISO 16750-1. The test duration is, respectively:

— 10 days for components intended for mounting in the passenger compartment or luggage/load compartment, and

— 21 days for all other mounting locations.

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5.8.3 Requirement

The minimum functional status shall be class C, as defined in ISO 16750-1.

5.9 Solar radiation

If required, resistance to solar radiation shall be ensured by the choice of a suitable material.

5.10 Dust test

5.10.1 Purpose

This test simulates a dust pumping effect caused by temperature changes inside the housing of the DUT, due to intermittent electrical operation. Failure mode is electrical or mechanical malfunction caused by dust, e.g. on the surface of electrical contacts. The application of this test shall be stated in the specification of the DUT.

5.10.2 Test method

Perform the test as specified in ISO 20653, using the variant described below.

As an alternative to the Arizona A2 test dust (i.e. test dust A2 in accordance with ISO 12103-1) that is specified in the ISO 20653 test method, the following test dust mixture may be used:

— 50 % by weight of limestone (with clay and sand), i.e. “unbaked Portland cement”, and

— 50 % fly ash with the following grain size distribution (in accordance with IEC 60068-2-68):

  — 33 % by weight u 32 µm;

  — 67 % by weight > 32 µm, but u 250 µm.

The test should be carried out oriented as mounted in the vehicle.

The test will consist of 20 cycles, each one as defined in Figure 9.

The cycle time and time of operating mode 3.2 shall be agreed between customer and supplier.

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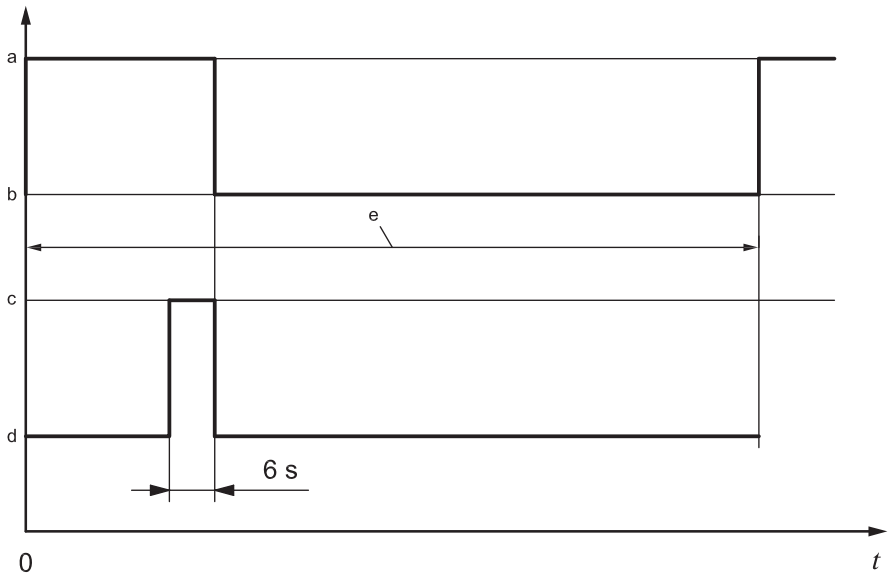

Key

t time, in min

a Operating mode 3.2 in accordance with ISO 16750-1.

b Operating mode 1.2 in accordance with ISO 16750-1.

c Dust circulation on.

d Dust circulation off.

e One cycle.

NOTE The recommended cycle time is 20 min. The recommended time of operating mode 3.2 is 5 min.

Figure 9 — Dust test (one time cycle)

5.10.3 Requirement

The functional status shall be class A, as defined in ISO 16750-1.

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6 Codes for climatic loads

Table 4 specifies codes, tests and requirements for climatic loads.

Table 4 — Codes, tests and requirements

Tests and requirements in accordance with		Code									
Subclause	**Parameter**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**Z**
5.1.1	Low temperature	yes	yes	yes	yes	yes	yes	yes	yes	yes	as agreed upon
5.1.2	High temperature	yes	yes	yes	yes	yes	yes	yes	yes	yes	
5.2	Temperature steps	yes	yes	yes	yes	yes	yes	yes	yes	yes	
5.3.1	Temperature cycling	yes	yes	yes	yes	yes	yes	yes	yes	yes	
5.3.2	Rapid change of temperature (number of cycles)	300	300	100	100	100	100	100	100	100	
5.4	Ice water shock	no	no	no	yes	yes	yes	no	yes	yes	
5.5.1	Salt spray, corrosion (severity)	4	—	—	4	5	—	—	4	5	
5.5.2	Salt spray, leakage and function	yes	no	no	yes	yes	no	no	yes	yes	
5.6	Humid heat, cyclic (test numbers)	2, 3	2, 3	1, 3	2, 3	2, 3	1, 3	1, 3	2, 3	2, 3	
5.7	Damp heat	yes	yes	yes	yes	yes	yes	yes	yes	yes	
5.9	Solar radiation	no	no	no	no	no	no	yes	yes	yes	
5.10	Dust test	yes	yes	yes	yes	yes	yes	yes	yes	yes	
NOTE The corrosion test with flow of mixed gas in 5.8 is not part of the basic coded specification.											

7 Protection against dust and water

Check the DUT in accordance with ISO 20653. See Annex A for the recommended degree of protection (IP-code).

8 Documentation

For documentation, the designations outlined in ISO 16750-1 shall be used.

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Annex A
(informative)

Usual tests and requirements for equipment depending on the mounting location

Table A.1 outlines the usual tests and requirements for equipment depending on the mounting location.

Table A.1 — Usual tests and requirements for equipment depending on the mounting location

Mounting location			Recommended operating temperature range[a]	Recommended climatic requirements[b]	Recommended protection against dust and water[c]
Engine compartment	to body		L, O	A, D	IP6K9K
	to frame		H	A, D	IP6K9K
	on flexible plenum chamber, not rigidly attached		L, O	A	IP6K9K
	in flexible plenum chamber, not rigidly attached		L, O	B	not specified
	on the engine		O, Q	A, D	IP6K9K
	in the engine		O, Q	B	not specified
	on the transmission/retarder		Q	A, D	IP6K9K
	in the transmission/retarder		Q	B	not specified
Passenger compartment	without special requirements		D	C	IP5K0
	exposed to direct solar radiation		H	G	IP5K0
	exposed to radiated heat		J	C	IP5K0
Luggage compartment/load compartment			E	C	IP5K0
Mounting on the exterior/ in cavities	to body		E	D, H	IP5K4K, IP6K9K
	to frame		E	D	IP5K4K, IP6K9K
	under body/wheel housing	sprung masses	H	E	IP5K4K, IP6K9K
		unsprung masses	H	E	IP6K9K
	in/on passenger compartment door		E	D, H	IP5K3
	to engine compartment cover		N	D, H	IP5K4K
	to luggage compartment lid/door		D, E	D, H	IP5K
	to trunk lid/door		D, E	D, H	IP5K3
	in cavity	open towards interior	D	C	IP5K0
		open towards exterior	D	E, I	IP5K4K
	in special compartments		Z	Z	not specified

[a] See Table 1.

[b] See Table 4.

[c] IP-code (see ISO 20653).

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Bibliography

[1] ISO 12103-1, *Road vehicles — Test dust for filter evaluation — Part 1: Arizona test dust*

[2] IEC 60068-2-68, *Environmental testing — Part 2-68: Tests — Test L: Dust and sand*

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