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**Pyrotechnic articles — Pyrotechnic  
articles for vehicles —**

Part 9:  
**Requirements and categorization for  
actuators**

*Articles pyrotechniques — Articles pyrotechniques pour véhicules —  
Partie 9: Exigences relatives aux actionneurs et leur classement en  
catégories*



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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.

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 14451-9 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 212, *Pyrotechnic articles*, in collaboration with Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 12, *Passive safety crash protection systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

ISO 14451 consists of the following parts, under the general title *Pyrotechnic articles — Pyrotechnic articles for vehicles*:

- *Part 1: Terminology*
- *Part 2: Test methods*
- *Part 3: Labelling*
- *Part 4: Requirements and categorization for micro gas generators*
- *Part 5: Requirements and categorization for airbag gas generators*
- *Part 6: Requirements and categorization for airbag modules*
- *Part 7: Requirements and categorization for seatbelt pretensioners*
- *Part 8: Requirements and categorization for igniters*
- *Part 9: Requirements and categorization for actuators*
- *Part 10: Requirements and categorization for semi-finished products*

# Pyrotechnic articles — Pyrotechnic articles for vehicles —

## Part 9: Requirements and categorization for actuators

### 1 Scope

This part of ISO 14451 specifies the types and order of tests to be applied to the actuators and sets out the associated acceptance criteria and means of categorization.

This part of ISO 14451 applies to type tests.

This part of ISO 14451 is not applicable to articles containing military explosives or commercial blasting agents except for black powder or flash composition.

### 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 14451-1, *Pyrotechnic articles — Pyrotechnic articles for vehicles — Part 1: Terminology*

ISO 14451-2:2013, *Pyrotechnic articles — Pyrotechnic articles for vehicles — Part 2: Test methods*

ISO 14451-4:2013, *Pyrotechnic articles — Pyrotechnic articles for vehicles — Part 4: Requirements and categorization for micro gas generators*

ISO 14451-8:2013, *Pyrotechnic articles — Pyrotechnic articles for vehicles — Part 8: Requirements and categorization for igniters*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14451-1 apply.

### 4 Requirements and acceptance criteria

#### 4.1 General

Actuators shall meet the requirements specified in [4.2](#) to [4.8](#), taking into account the test matrix of [Clause 5](#).

#### 4.2 Verification of design and documentation

Documentation shall be complete as specified in ISO 14451-2:2013, 4.1.

#### 4.3 Drop test

##### 4.3.1 Requirements

Actuators shall be tested as specified in ISO 14451-2:2013, 4.2.

#### 4.3.2 Acceptance criteria

No ignition of the actuator shall occur.

No spill out of the pyrotechnic composition from the actuator shall occur.

### 4.4 Vibration and temperature test

#### 4.4.1 Requirements

Actuators shall be tested as specified in ISO 14451-2:2013, 4.3.

If all gas generators/igniters contained in the actuator are already successfully tested according to ISO 14451-4:2013, 4.4 or according to ISO 14451-8:2013, 4.3, the vibration and temperature test should be considered passed for the actuator as well.

#### 4.4.2 Acceptance criteria

No ignition of the actuator shall occur.

No spill out of the pyrotechnic composition from the actuator shall occur.

### 4.5 Thermal humidity cycling test

#### 4.5.1 Requirements

Actuators shall be tested as specified in ISO 14451-2:2013, 4.4.

If all gas generators/igniters contained in the actuator are already successfully tested according to ISO 14451-4:2013, 4.5 or according to ISO 14451-8:2013, 4.4, the thermal humidity cycling test should be considered passed for the actuator as well.

#### 4.5.2 Acceptance criteria

No ignition of the actuator shall occur.

### 4.6 Electrostatic discharge (ESD) test

#### 4.6.1 Requirements

Actuators shall be tested as specified in ISO 14451-2:2013, 4.5.

If all igniters contained in the actuator are already successfully tested according to ISO 14451-8:2013, 4.5, the ESD test should be considered passed for the actuator as well.

#### 4.6.2 Acceptance criteria

No ignition of the actuator shall occur.

### 4.7 Fire test

#### 4.7.1 Requirements

Actuators shall be tested as specified in ISO 14451-2:2013, 4.6 with the following heating rate and in a position that can be maintained without any fixation, considering the function, the shape and the connecting wire. This position shall be described in the technical documentation.

— **Heating rate:** 80K/min.

The number of burners shall be adequate to the dimensions of the actuator to completely engulf the actuator by the flames.

#### 4.7.2 Acceptance criteria

Only foreseeable fragmentation or foreseeable opening of the actuator shall occur.

### 4.8 Functioning test

#### 4.8.1 Requirements

Actuators shall be tested as specified in ISO 14451-2:2013, 4.9 in a position that can be maintained without any fixation, considering the function, the shape and the connecting wire. This position shall be described in the technical documentation.

When multi-stage actuators are tested, the delay between ignition of stage 1 and the following stages shall be 5 ms or in accordance with the product specification or requirements.

#### 4.8.2 Acceptance criteria

The actuator shall show the intended behaviour corresponding to the intended process of fragmentation or opening.

## 5 Test matrix

Table 1 shows a test matrix which summarizes all tests in an overview. Test samples have been numbered from 1 to 10 for easier reference. The roman numbers in the Table indicate in which sequence the same sample will undergo different examinations.

Table 1 — Test matrix

	Test methods of ISO 14451-2:2013	Requirements of ISO 14451-9:2013	Unexposed actua- tors			Exposed actua- tors		
			1 to 3	4	5	6 to 8	9	10
Sample number			1 to 3	4	5	6 to 8	9	10
Possibility to reuse the test from sub-level(s) for the assessment of the actuator. See specific relevant test requirement			NO	YES	NO	NO	YES	YES
Verification of design and documentation	4.1	4.2	I	I	I	I	I	I
Drop test	4.2	4.3				II		
Vibration and temperature test	4.3	4.4					II	
Thermal humidity cycling test	4.4	4.5						II
Electrostatic discharge (ESD) test	4.5	4.6		II				
Fire test	4.6	4.7			II			
Functioning test	4.9	4.8	II				III	III

## 6 Categorization

6.1 Actuators are categorized as follows:

- Category P1: Actuators that present a low hazard;
- Category P2: Actuators that are intended for handling or use only by persons with specialist knowledge.

6.2 The assignment to P1 or P2 of the actuator is done according to the following criteria when tested under functioning test (see 4.8):

- P1 criterion: The distance from the initial location to the first impact on the ground of the actuator or any fragment shall be not more than 15 m.
- P2 criterion: If P1 criterion is not fulfilled.

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