INTERNATIONAL STANDARD

ISO 12097-3

First edition
2002-06-15

Road vehicles — Airbag components —

Part 3:
Testing of inflator assemblies

Véhicules routiers — Composants des sacs gonflables —

Partie 3: Essais des générateurs de gaz

Reference number
ISO 12097-3:2002(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

Contents

Page

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 3.

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 part of ISO 12097 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12097-3 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 12, *Passive safety crash protection systems*.

ISO 12097 consists of the following parts, under the general title *Road vehicles — Airbag components*:

— *Part 1: Vocabulary*

— *Part 2: Testing of airbag modules*

— *Part 3: Testing of inflator assemblies*

Annex A forms a normative part of this part of ISO 12097. Annex B is for information only.

Road vehicles — Airbag components —

Part 3:
Testing of inflator assemblies

CAUTION — There is a possibility of accidental firing of the airbag during any of the tests described in this part of ISO 12097. Appropriate precautions should therefore be taken both in terms of handling the inflator assembly and in terms of the design of test equipment.

1 Scope

This part of ISO 12097 establishes uniform test methods and specifies environmental procedures and requirements for the inflator assemblies of airbag modules in road vehicles.

NOTE For testing of the inflator assembly as part of the airbag module, see ISO 12097-2.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 12097. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 12097 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 12097-1, *Road vehicles — Airbag components — Part 1: Vocabulary*

ISO 6487, *Road vehicles — Measurement techniques in impact tests — Instrumentation*

ISO 11452 (all parts), *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy*

IEC 60068-2, *Environmental testing — Part 2: Tests*

3 Terms and definitions

For the purposes of this part of ISO 12097, the terms and definitions given in ISO 12097-1 and the following, apply.

3.1
trigger device
device that activates the inflator assembly (IA)

4 General requirements

The IA shall be designed such that, when handled appropriately, no dangers arise for persons or objects. The IA manufacturer shall produce and make available appropriate handling instructions.

The gas concentrations and the amount of particles measured immediately after the ignition of an IA (or complete module) shall not occur in concentrations that, with the current state of knowledge, can be considered as toxic to humans within 30 min of exposure in an enclosed room having a volume of 2,5 m^3.

The gas and particulates arising from the ignition of an IA (or complete module) shall not have a strong irritating effect on a person.

The IA, complete with squib, if applicable, shall not be ignited by electromagnetic coupling or interference voltages.

5 General test conditions

5.1 Purpose of environmental testing

Environmental tests simulate the effects of environmental loads on the IA with respect to its

— functional behaviour, and

— service life.

They are based on the typical life-cycle of an IA covering shipping, storage, mounting on the module, operation, maintenance and repair of the vehicle.

The complete environmental test programme is composed of individual test methods which simulate automobile-related influences such as mechanical shocks and vibration, heat, cold and humidity.

Simulating the total service life may require more severe test levels than those seen in real world conditions to accelerate ageing and degradation processes.

The environmental test programme for IAs as specified in this part of ISO 12097 shall be a minimum requirement to ensure the verification of its environmental robustness.

Table 1 gives an overview of the complete test programme applied to three identical test samples.

Table 2 lists the performance tests which shall be applied to three exposed samples and nine (or ten, see 7.4.4) unexposed samples.

The supplementary performance tests given in Table 3 shall be performed on the trigger device and the IA housing.

Table 1 — Inflator assembly environmental test programme

Test sequence	Test	Subclause	Sample number												
			Exposed samples			Unexposed samples									
			1	2	3	4	5	6	7	8	9	10	11	12	13
1	Drop test	6.2	**X**	**X**	**X**										
2	Mechanical impact test	6.3	**X**	**X**	**X**										
3	Vacuum test	6.4	**X**	**X**	**X**										
4	Simultaneous vibration temperature test	6.5	**X**	**X**	**X**										
5	Thermal humidity cycling	6.6	**X**	**X**	**X**										

Table 2 — Performance test programme

Test Sequence	Test	Subclause	Sample number												
			Exposed samples			Unexposed samples									
			1	2	3	4	5	6	7	8	9	10	11	12	13
1	ESD test	7.1							X	X	X				
2	EMC test	7.2											X	X	X
3	Tank test at	7.3													
	— (– 35 ± 2,5) °C		X			X									
	— (23 ± 5) °C			X			X								
	— (85 ± 2,5) °C				X			X							
4	Gas and solid analyses	7.3.5.6 7.3.5.7	x	x	x	x	x	x							
5	Bonfire test	7.4							X	X	X	(X)			

Table 3 — Supplementary performance tests

Test sequence	Test	Subclause	
1	Trigger device testing	7.5	Statistical procedures
2	Burst test	7.6	

5.2 Test sequence

The test purpose and sequence are based on life-cycle considerations and on possible failure mechanisms.

— The drop test and the mechanical impact test reflect handling, transportation and mounting conditions that occur mainly during an early stage of the life cycle.

— The vacuum test simulates transportation in partially pressurized aircraft and driving at high altitudes.

— The simultaneous vibration temperature test simulates the combined action of vibration and temperature that occurs during the life cycle in a vehicle. Dynamic loads during driving can be typically described as broadband random vibrations with increased vibration levels at several characteristic frequency ranges. Such loads may cause friction, abrasion, fatigue and other damaging effects. It is important to apply vibrations to the test sample at various temperatures, as many of the materials, especially polymers, vary their mechanical behaviour with temperature. A simultaneous vibration/temperature regime therefore simulates appropriately the real vehicle environment.

— The thermal humidity test simulates changing climatic influences with special emphasis on the penetration of water into the IA during periods when the IA temperature is below the dew point temperature of the surrounding air. This test can cause electrical failures as well as material swelling, shrinking and corrosion, and can also promote biodeterioration such as fouling.

5.3 Measurements and test report

The following items shall be measured and recorded on a data sheet before or during, or both before and during, each test of Table 1:

- test number, sample number, test temperature and date;
- visual inspection of the samples and, if necessary, photographic documentation;
- definition of the three main axes (see example in Figure 1);
- ambient temperature during test, in degrees Celsius (°C);
- squib resistance of the inflator assembly, if applicable.

All relevant observations and unusual events shall be noted and included in the test report.

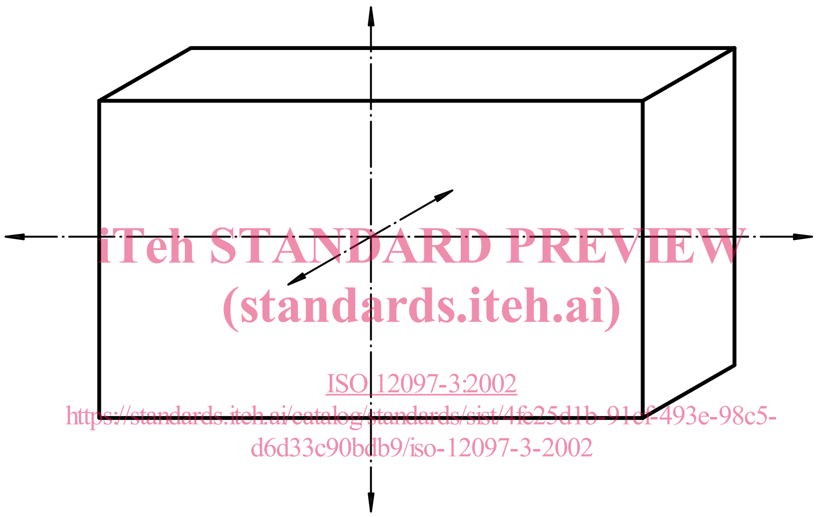


Figure 1 — Definition of IA main axes

5.4 Test programme

This part of ISO 12097 specifies a test programme with 12 identical samples of an inflator assembly (possibly 13 in the case of the bonfire test, see 7.4.3), numbered in accordance with Table 1 and Table 2:

- three IAs are subjected to the environmental test programme (multiple exposure);
- nine (or ten) IAs are unexposed samples.

The plug and the ignition cable shall be connected, if applicable; a test current (see Figure 2 for an example) shall be applied according to the system used (with the exception of the mechanical impact test, the drop test and the vacuum test). After each test, measure and record the squib resistance, where applicable.

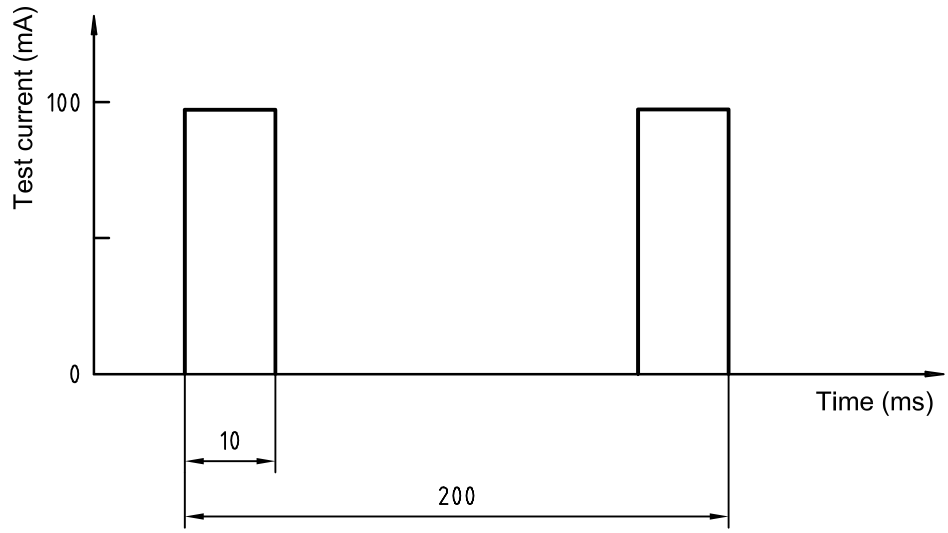


Figure 2 — Example of a test current for environmental simulation

6 Environmental testing

6.1 General

The following test procedures are based mainly on those of IEC 60068-2 (see the Bibliography). Certain modifications to that basic standard were adopted for this part of ISO 12097 in order to recognize vehicle-specific conditions.

6.2 Drop test

6.2.1 Purpose

The purpose of this test is to determine whether the IA experiences any detrimental effect when dropped from a specified height and at specified orientations.

6.2.2 Equipment

A steel impact plate of a minimum of 1 m × 1 m with at least 10 mm thickness, resting on a solid floor, with a fixture that supports the sample at the specified height, shall be used.

6.2.3 Test samples

Three IAs shall be tested under the conditions specified in 6.2.4 and in accordance with Table 1.

6.2.4 Test conditions

The drop height shall be $1^{+0,2}_{0}$ m.

The ambient temperature shall be (23 ± 5) °C.

6.2.5 Test procedure

Mount test sample No. 1 onto the support fixture at the specified height above the impact plate and oriented such that it will fall in one of the six directions indicated in Figure 1. Disarm the trigger device, if included in the IA.

Release the IA, allowing it to free fall onto the impact plate. Repeat the test using the same sample oriented to fall in the opposite direction.

Repeat the test twice more, once using sample No. 2 and once using sample No. 3, each time along one of the remaining directions indicated in Figure 1.

6.2.6 Requirements

On completion of the test, the IA shall be intact.

Any visible damage shall be noted. The unit under test shall continue to be made to undergo the test programme in accordance with Table 1, even if there is visible damage.

It is permissible to repair any IA damage that prevents mounting, in order that the test can proceed.

6.3 Mechanical impact test

6.3.1 Purpose

The purpose of this test is to determine whether the complete IA experiences any detrimental effect when subjected to a series of shock impacts at normal and extreme temperatures.

6.3.2 Equipment

A climatic chamber capable of controlling the test conditions according to 6.3.4 shall be used.

A shock testing machine that allows fastening of an IA to its fixture or table shall be used.

The characteristics of the shock testing machine shall be such that it can be determined whether the true value of the actual pulse as measured in the intended direction at the check point is within the tolerances required by Figure 3.

The check point is a fixing point of the IA nearest the centre of the table surface at the shock testing machine, unless there is a fixing point with a more rigid connection to the table, in which case this latter point shall be used. The frequency response of the overall shock testing machine, which includes the accelerometer, can have a significant effect on the accuracy, and shall be within the limits shown in Figure 4 and given in Table 4.

6.3.3 Test samples

Three IAs shall be tested under the conditions specified in 6.3.4 and in accordance with Table 1.

6.3.4 Test conditions

Each IA is subject to two successive shocks, which shall be applied in each direction of three mutually perpendicular axes of the IA (see Figure 1) at the following test temperatures (12 shocks at each test temperature for a total of 36 shocks):

— (− 35 ± 2,5) °C;

— (23 ± 5,0) °C;

— (85 ± 2,5) °C.

6.3.5 Test procedure

6.3.5.1 General

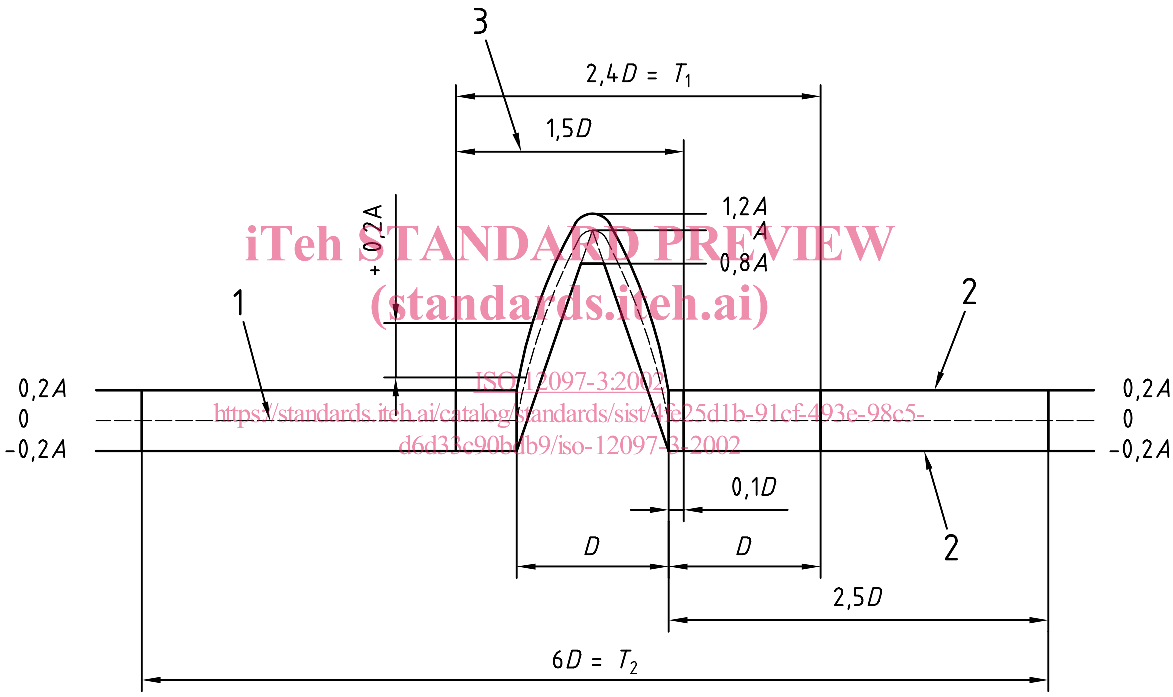
Mount the IA on the test rig and subject it to the test conditions given in 6.3.4.

IAs that include a trigger device shall be tested in the disarmed condition.

Before mounting, condition each sample in the climatic chamber at the required temperature for at least 4 h or, alternatively, for the temperature build-up time, t_e, determined in accordance with the procedure specified in annex A.

Consecutive impact tests may be conducted outside the climatic chamber. After 5 min, recondition the IA for 10 min or, alternatively, for t_e in accordance with annex A.

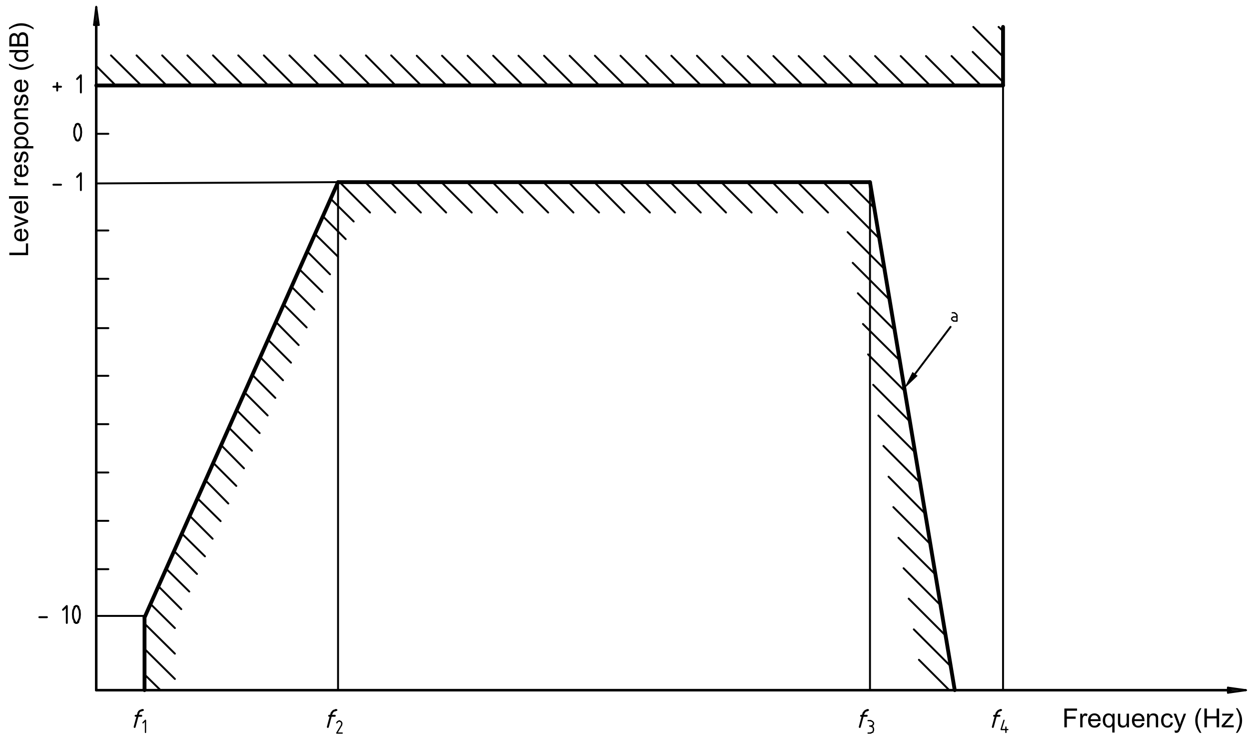
NOTE The reference point for t_e is within the propelling media.



Key

1 Nominal pulse
2 Limits of tolerance
3 Integration time
D Duration of nominal pulse.
A Peak acceleration of nominal pulse.
T_1 Minimum time during which the pulse shall be monitored for shocks produced using a conventional shock testing machine.
T_2 Minimum time during which the pulse shall be monitored for shocks produced using a vibration generator.

Figure 3 — Half-sine pulse



[a] 24 dB/octave

Figure 4 — Frequency response of the measuring system

Table 4 — Frequency characteristics of the measuring system

Duration of pulse ms	**Low-frequency cut-off** Hz		**High frequency cut-off** kHz	**Frequency beyond which response may rise above + 1 dB** kHz
	f_1	f_2	f_3	f_4
0,2	20	120	20	40
0,5	10	50	15	30
1	4	20	10	20
3	2	10	5	10
6	1	4	2	4
11	0,5	2	1	2
18 and 30	0,2	1	1	2
For shocks of duration $\leqslant$ 0,5 ms, the indicated values of f_3 and f_4 could be unnecessarily high. In such instances, the relevant specification should state the alternative values to be adopted.				

6.3.5.2 Basic pulse shape

The applied pulse shall be a half-sine (see Figure 3). The true value of the actual pulse shall be within the limits of tolerance shown by the solid line.