 <p><b>VPAM</b> Vereinigung der Prüfstellen für angriffs- hemmende Materialien und Konstruktionen</p>	<p><b>Testing guideline</b> special protected vehicles - standards, classifications and testing methods -</p>	<p><b>VPAM</b> <b>BRV 2009</b> status: 14.05.2009</p>
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## Testing guideline

### "special protected vehicles"

("Sondergeschützte Fahrzeuge")

bullet resistance

**Englische Übersetzung; es gilt immer die deutsche Originalfassung!**  
**English translation; however the original German version always prevails!**


**Publisher:**

**Association of test laboratories for bullet resistant  
materials and constructions (VPAM)**

**(Vereinigung der Prüfstellen für angriffshemmende  
Materialien und Konstruktionen (VPAM))**

Version: 14.05.2009

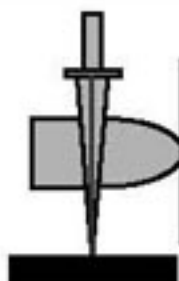
Rough translation: June 2010, Beschussamt Mellrichstadt

 <b>VPAM</b> Vereinigung der Prüfstellen für angriffs- hemmende Materialien und Konstruktionen	<b>Testing guideline</b> <b>special protected vehicles</b> <b>- standards, classifications and</b> <b>testing methods -</b>	<b>VPAM</b> <b>BRV 2009</b> status: 14.05.2009
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First edition of the VPAM BRV 2009: 14.05.2009

### Proof of change

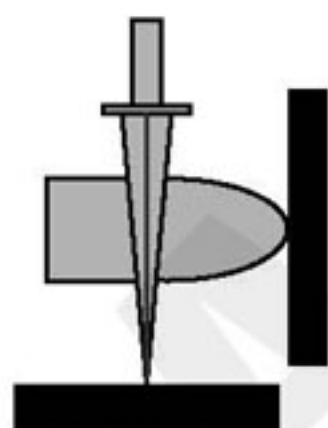
revision		Revisions took place at following numerics
no.	date	

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## Foreword

This guideline is designed by the Association of test laboratories for bullet resistant materials and constructions (VPAM).

### Reference source of the VPAM - BRV 2009:



**VPAM**

Vereinigung der  
Prüfstellen für angriffs-  
hemmende Materialien  
und Konstruktionen

Office

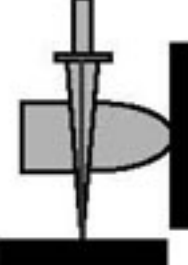
**Deutsche Hochschule der Polizei**  
**Polizeitechnisches Institut**  
**Postfach 48 03 53**  
**48080 Münster**  
**Germany**

Tel.: +49 (0) 25 01 806-259

Fax: +49 (0) 25 01 806-239


E-Mail: [pti@dhpol.de](mailto:pti@dhpol.de)

Internet: [www.vpam.eu](http://www.vpam.eu) or [www.dhpol.de](http://www.dhpol.de)

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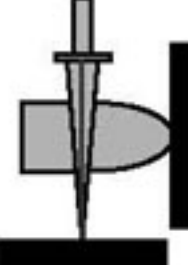
## Introduction

In this guideline product-specific requirements according to the bullet-resistance (ballistic protection), the testing methods and the classification of special protected vehicles are defined.

Requirements to the blast protection are explained in the guideline ERV 2009.

The basic information about ballistic testing and/or conformity evaluations of materials, constructions and products protecting against firearm attacks are described in the VPAM – APR 2006 (“Allgemeine Prüfgrundlagen für ballistische Material-, Konstruktions- und Produktprüfungen”) and this guideline.



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## 1 Purpose

This guideline for special protected vehicles regulates the testing procedure. The aims are on the one hand to guarantee reproducible results due to the standardization of the testing and the expenditure in testing. On the other hand it enables the customer and user of these vehicles to get more transparency on the market by enabling an objective comparison of the products of various offering companies being tested according to the same guidelines.

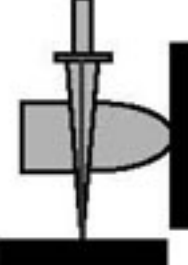
Bullet-resistant (special protected) vehicles shall protect individuals as well as their material assets against bullets of short and long firearms (ballistic protection).

Bullet-resistant vehicles have to avoid the intrusion of bullets from all directions. A ballistic testing with negative angles of inclination (Appendix 1) is only implemented upon request.

According to this guideline the following partial areas of special protected vehicles, referring to one of the listed classes in 4.1, have to be tested.

- roof area
- side parts till door sills with A-, B-, C- (and D-) pillars, including doors with glazing
- front side with windscreen
- rear side till undercarriage, with back window
- undercarriage including door sills

It is only allowed to test the roof area under an angle of 45 degrees in the specified class. At the classes VR 9 and VR 10 of this guideline, the windscreen can be tested parallel to the vehicles longitudinal axis. These exceptional cases have to be explicitly pointed out in the test report and the test certificate respectively the verification certificate.

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## 2 Normative references

The following normative documents contain regulations which are part of this guideline due to the reference in this text. Dated references do not comprehend future amendments or revisions of this publication.

Contractual partners, using this guideline, are recommended to check the possibility to use the latest version of the following normative documents.

Is the reference not dated, the latest version related to the normative document has to be used.

- VPAM – APR 2006, general basics for material, construction and product testing
- VPAM – PM 2007, bullet-resistant, plate shaped materials
- DIN EN 10204, metallic products – sorts of verification certificates
- TDCC, dimension sheets of the Permanent International Commission for Firearms Testing (C.I.P.)

## 3 Terms and definitions

Basic terms and definitions are determined in the APR 2006. Additionally following terms and definitions are valid for the use of this testing guideline:

### 3.1 Special protected vehicles

Special protected (armoured) vehicles according to this guideline are vehicles guarding from attacks with firearms.

### 3.2 Angle of impact

Angle between the direction of the bullet and the respective vehicle axis according to Appendix 1.



## 4 Requirements, classifications and testing conditions

### 4.1 General Requirements, classifications and testing conditions

Bullet-resistant vehicles or parts of a vehicle, which are meant to resist defined attack-conditions are scheduled in the following table

Table 1: definition of classes

Testing level according to APR 2006	Classes according to BRV 2009
1	VR 1
2	VR 2
3	VR 3
4	VR 4
5	VR 5
6	VR 6
7	VR 7
8	VR 8
9	VR 9
10	VR 10

Testings according to other testing levels of the APR 2006 are also possible.

Materials and material compositions used for the armour of a vehicle generally must have a testing certificate / verification certificate of a type test according to PM 2007 or EN 1063 by an approved laboratory, as far as the testing criteria of the PM 2007 or the EN 1063 are identical with those of the BRV 2009. This type test must be at least the class, the vehicle test is submitted.

If an individual certification for materials and material compositions is impossible, these have to be tested during the vehicles ballistic test in their final construction.

Ambient temperature  $23 \pm 5$  °C. Differing temperatures are permitted. The ambient temperature has to be noted in the test report as well as the test certificate.

### 4.2 Classification

The classification indication (example):

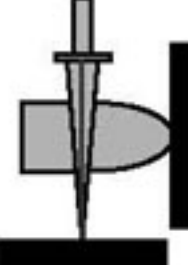
BRV 2009-VR 4,

addition:

Roof-test was executed according this class with an impact angle of 45°

Testing of the windscreen was executed parallel to the vehicles longitudinal axis



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## 5 Testing equipment

Testing and measuring equipment as well as the methods of testing a bullet-resistant vehicle are defined in VPAM – APR 2006, no. 5 and 6.

It has to be ensured that all parameters specified in VPAM – APR 2006, no. 4.1, table 1 are fulfilled.

### 5.1 Measuring and target configuration

The impact velocity of each shot has to be detected.

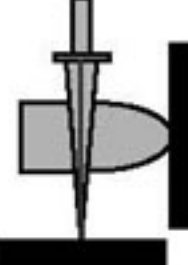
Note: In the exceptional case, that it is impossible to detect the impact velocity because of technical reasons (e.g. door sill area, roof), it must be ensured that only tested ammunition with an average value according to no. 4.1, table 1 of the APR 2006 is used. A note has to be added to the protocol, that the measurement of the impact velocity could not be performed.

### 5.2 Witness plate

The witness plate must be composed of a material<sup>2</sup> which reliably indicates a full penetration of a vertical hit with a Diabolo, Fabr. RWS/R 10, Cal. 4.5mm, mass 0.5g and an impact energy of 6 Joule (155m/s).

The witness plate is to be placed in the vehicles inside, directly behind the tested area / impact point.

<sup>2</sup> e.g. Lexan membrane type 8010-112 (polycarbonate membrane 0.5mm), supplier: Sahlberg GmbH & Co. KG, 85619 Feldkirchen bei München, Germany

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## 6 Method of testing

### 6.1 General

As far as test methods and parameters are not described in this testing guideline, they have to be taken out of the VPAM - APR 2006.

The method of testing for special protected vehicles consists of following parts:

1. testing of the materials
2. expertise of the integrated armour
3. procedure of the vehicles ballistic test

### 6.2 Testing of the materials

The materials used for the armour of the vehicle have to achieve the standards of chapter 4.1 of this guideline.

### 6.3 Inspection of the integrated armour

As soon as the armour is mounted, the testing institute has to conduct an inspection. All armored areas of the vehicle have to be visible at the date of the inspection.

The appraisal consists of an analysis of the armours weak spots. The findings of the inspection determine the points and the angles of impact for the vehicles ballistic test.

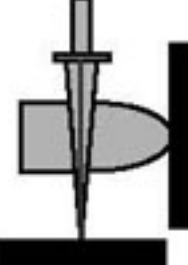
Points and angles of impact have to be defined. Target points have to be marked before firing at the accordant location. Target points are particularly areas of the vehicle, where the projectile

- has least resistance
- induces an unintentional opening of the door
- induces damages, which allow an unintentional opening of the door

Common target points on the vehicle normally are:

- seam areas between doors and pillars (A, B, C, D)
- areas at the nontransparent part, where the armour is slotted, overlapping or welded as well as in the region of apertures
- mounting of the side mirrors
- mounting of the roof armour
- areas of the locks
- seam areas around the vehicle glazing



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The vehicle manufacturer has to ensure, that no relevant modification affecting the test results being performed between the date of the expertise and the vehicle testing.

#### **6.4 Test vehicle**

The protected device, generally the passenger compartment, of the prepared vehicle being tested, has to be completed and entirely equipped.

It is permitted to present the vehicle for the testing without the engine and without the undercarriage. In case of an absent undercarriage the vehicle is to mount on a mobile frame.

Is the tested vehicle completely equipped, the applicant has to ensure that the testing will not cause danger, for example by additives or operating materials.

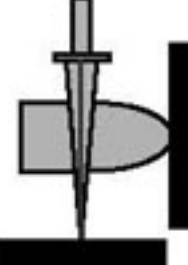
The doors of the vehicle have to be closed but not locked, the movable window panes are in the closed position.

#### **6.5 Positioning of the weapon / the weapon system to the test vehicle**

When shooting an entire vehicle the positioning of the weapon / weapon system and the test vehicle has to be adjusted, that the target points, angles of impact and the required distance between the hits, defined during the inspection, are adhered to.

#### **6.6 Number of hits and distance between the hits**

- On sufficiently large areas (e.g. nontransparent door area, roof) three shots with a range of minimum 120 mm between the centers of the impact points have to be fired
- Additional in the range of minimum 150 mm next to one of the above-named hits, three shots with a range of minimum three, but maximum four, diameters between the centers of the calibers have to be fired
- If a linear area is not long enough (e.g. seam areas between doors and pillars) the distance between the centers of the impact points is minimum three diameter of the caliber
- Testing the transition region between the glazing and the nontransparent area a range of minimum 120 mm between the centers of the impact points has to be adhered

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- If there are plane areas with linear sections, e.g. overlap, butt joints, welded joints, these sections have to be tested under an angle of impact with the maximum expected probability of full penetration defined by the testing institute. The same applies to seam areas of door stops, front lid stops and luggage compartment stops.

The number of shots fired on the vehicle is chosen so, that a classification can be executed with reliability.

### **6.7 Declaration of the test result**

After each shot the back side of the witness plate has to be scanned for damage and evaluated. Is a full penetration detected, the location of the projectile, the fragments of the projectile and / or separated parts (e.g. splinters) have to be identified and noted in the test report. The evaluation of a full penetration exclusively acts in accordance to the condition of the full penetration indicator.

## **7 Evaluation and documentation of the testing, test certificate**

Evaluation and documentation of the testing have to be performed according to VPAM – APR 2006, no. 7.

The hits have to be numbered on the vehicles surface with arabic numerals and explicitly documented by taking photographs. Additional the used projectile with caliber specification, projectile velocity, location of the hits (declaration according to x-, y- and z-axis), vehicle direction and the inclination have to be recorded. A sample for the documentation of these data is attached (appendix 1).



## Appendix 1: documentation of the fired hits (sample)

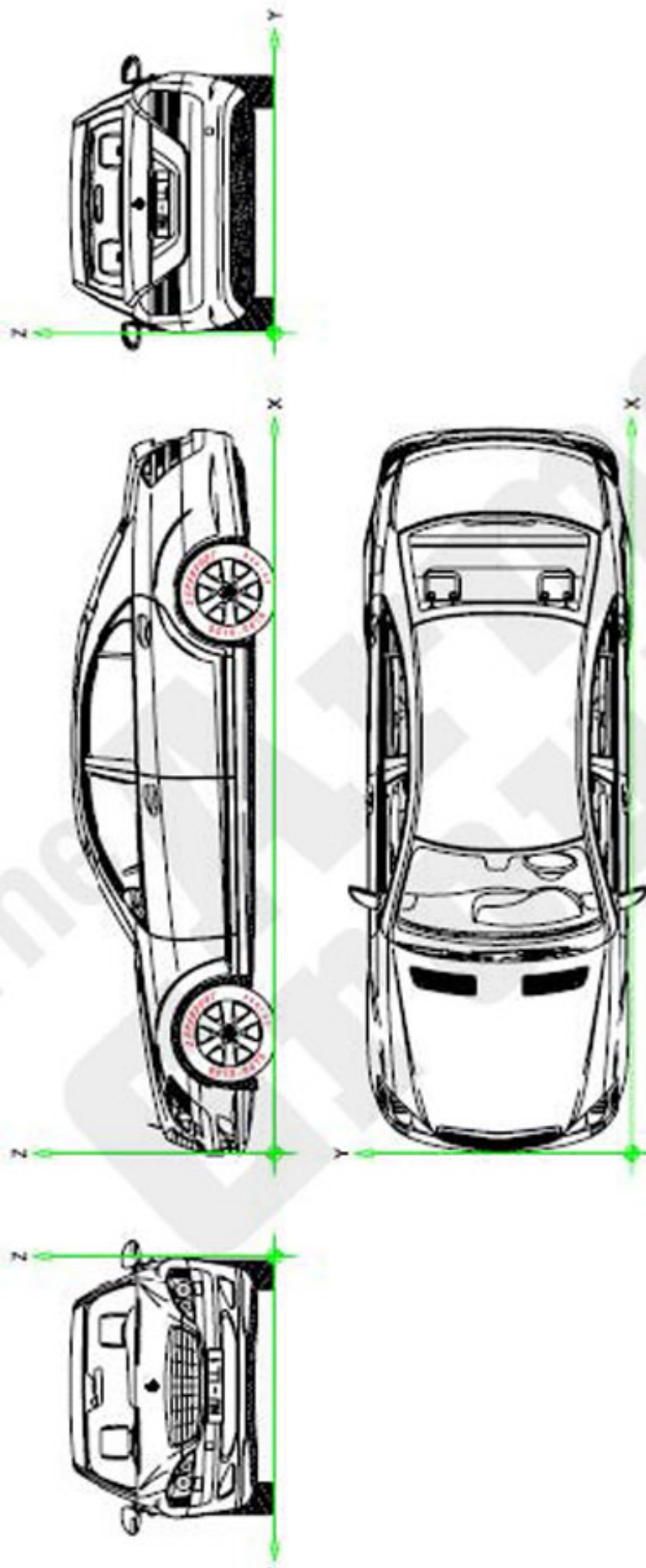



Fig.: 1: vehicle

positions of the hits					
Vehicle trademark	weapon:	date:	shots: from .... to .....		note:
			caliber:	tester:	table no.:

 <p><b>VPAM</b> Verknüpfung der Prüfstellen für raumgreifende Materialkennwerte und Konstruktion</p>	<p><b>Testing guideline</b> <b>special protected vehicles</b> - standards, classifications and testing methods -</p>	<p><b>VPAM</b> <b>BRV 2009</b> status: 14.05.2009</p>
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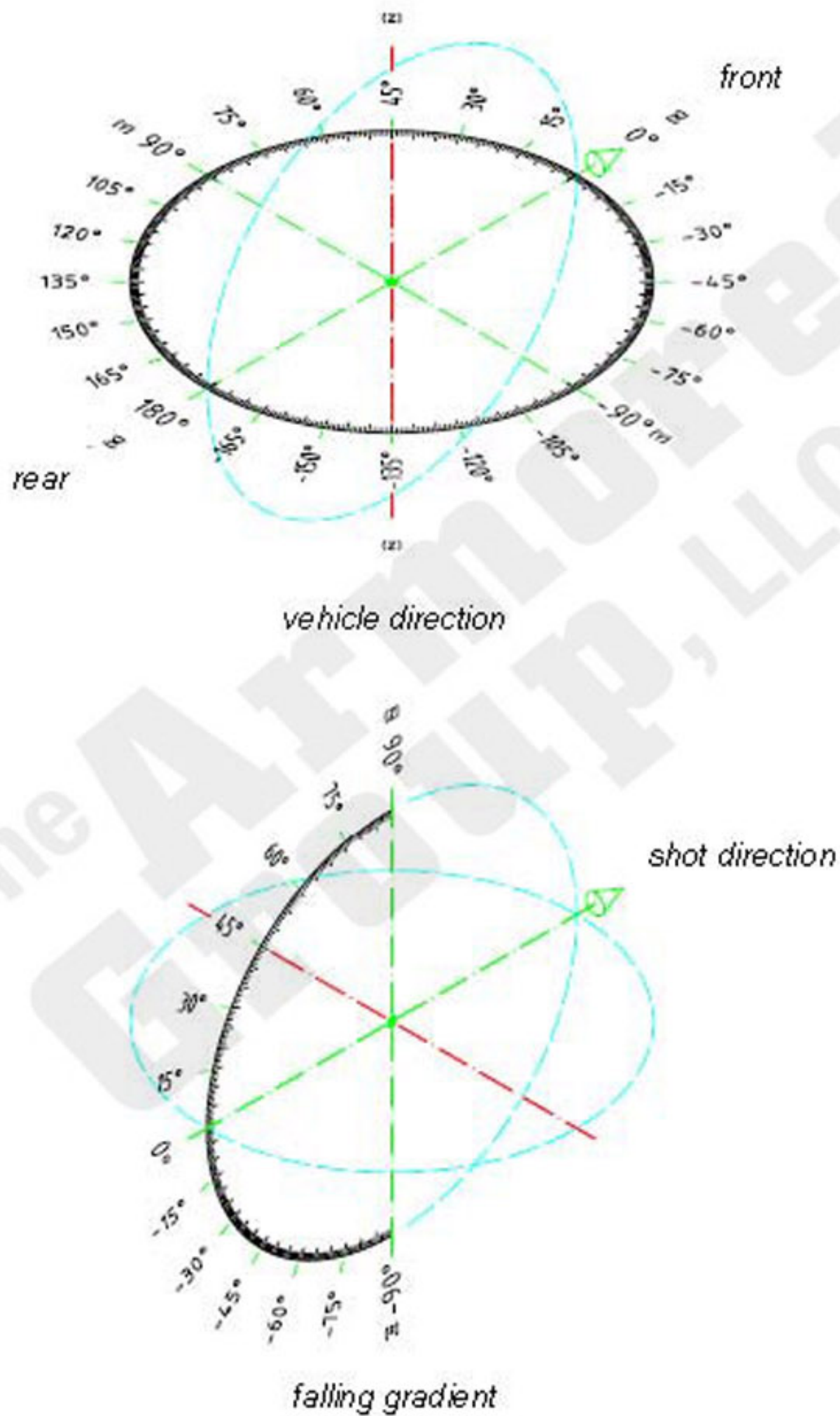



Fig. 2: determination of the angle

	<p align="center"><b>Testing guideline</b>  <b>special protected vehicles</b>  <b>- standards, classifications and testing methods -</b></p>	<p align="center"><b>VPAM</b>  <b>BRV 2009</b>          status: 14.05.2009</p>
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still appendix 1

### vehicle ballistic test file

vehicle-no.: \_\_\_\_\_

tester: \_\_\_\_\_

trademark: \_\_\_\_\_

date: \_\_\_\_\_

model: \_\_\_\_\_

ambient  
temperature: \_\_\_\_\_

table-no.: \_\_\_\_\_

number of shot	caliber, ammunition	velocity (m/s)	angle of impact (°)	full penetration yes / no	discription of hit positions	rating / note
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						