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WITHDRAWAL

March 2012

Personal Body Armour

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Mars 2012

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Personal Body Armour

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PERSONAL BODY ARMOUR

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PERSONAL BODY ARMOUR

INTRODUCTION

Personal body armour is protective clothing intended to protect a specified part of the torso against penetration and severe blunt trauma effects generated by bullets, while ensuring that the movement of the wearer is not unduly restricted, that is, providing comfortable protection.

Protection is achieved by the use of a clothing assembly, which may contain materials, material combinations, component assemblies or a series of separate items.

The protection rating required by the wearers shall be determined from the specific firearm threats they are likely to encounter.

The objectives of this standard are to describe reproducible tests that evaluate personal body armour's bullet resistance and that can be used by all parties involved in the manufacture and the use of body armour, to assess protection ratings based on performance requirements, and to make it easy for the user to test and evaluate various personal body armour.

1. SCOPE

1.1 This standard states minimum and user-specified requirements for personal body armour. This standard describes four protection ratings, each with a corresponding threat description. This standard specifies the Duty Handgun and Duty Submachine Gun protection ratings. This standard also permits User-specified Handgun and User-specified Submachine Gun protection ratings.

1.2 This standard allows for the evaluation of personal body armour against a minimum requirement (duty handgun) and if specified, an additional duty submachine gun or user-specified protection rating. Appendix A of this standard describes the protection ratings and threat descriptions.

1.3 This standard includes three distinct test methods that may be specified by the user (par. 5.1) depending on which is the most appropriate for their application.

1.4 Although this standard includes the option of a test block or mannequin and outlines test procedures for panels, the complete garment must be tested to ensure compliance with this standard.

1.5 This standard also incorporates a mandatory wet (spray) test and also an optional water immersion test procedure that can be specified by the user for all three tests listed in par. 5.1.

1.6 Although it may be recognized that personal body armour may offer some protection against common knife attacks, particularly slashing type actions, this standard does not cover this type of testing.

1.7 In the cases of user-defined handguns, shotguns and machine guns, rigid plates may be tested using this method.

1.8 The testing and evaluation of a product against this standard may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this standard has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any applicable regulatory requirements prior to its use.

2. REFERENCED PUBLICATIONS

2.1 The following publications are referenced in this standard:

2.1.1 Canadian General Standards Board (CGSB)

CAN/CGSB-4.2 — Textile Test Methods:

No. 2 — Conditioning Textile Materials for Testing.

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2.1.2 International Organization for Standardization (ISO)

ISO 9001 — Quality systems — Model for quality assurance in design, development, production, installation and servicing

or

ISO 9002 — Quality systems — Model for quality assurance in production, installation and servicing.

2.1.3 U.S. Department of Defense

MIL-STD 662F — V_{50} Ballistic Test for Armor.

2.1.4 A reference to a regulation is always to the latest issue. A dated reference is to the issue specified. An undated reference is to the latest issue, unless otherwise specified by the authority applying this standard. The sources are given in the Notes Section.

3. DEFINITIONS

3.1 The following definitions apply in this standard:

Angle of Impact (Angle d'impact)

The angle between the axis of the bullet and the perpendicular to the plane tangent at the point of impact (Figure 1).

Area of Coverage (Aire de couverture)

The area in square centimetres of the personal body armour that meets or exceeds the rating of the personal body armour.

Back Face (Surface arrière)

The surface of a test specimen designed to be positioned next to the body.

Backing Material (Matériau de renforcement)

A material placed next to the back face of the test specimen and used to capture the indentation resulting from the impact.

Bullet-Resistant Design (Modèle pare-balles)

A manufacturer's designation for a garment (the number, the name or other descriptive caption) that is constructed from bullet-resistant panels and/or rigid plates.

Bullet-Resistant Panel (Panneau pare-balles)

A removable bullet-resistant component of a complete garment. A panel is a unique construction that can include a specific number of layers of one or more types of fabric and/or bullet-resistant materials assembled in a specific manner. A panel includes all the coverings but not the carrier.

(Bullet) Velocity (Vitesse [de la balle])

The velocity as measured 2.5 ± 0.1 m in front of the target by a suitable device providing the required accuracy. When using light screens, measure to the middle of the two screens.

Carrier (Matériel de soutien)

A component of a complete garment that contains the ballistic panels and holds them snugly to the torso.

Complete Garment (Vêtement complet)

The bullet-resistant panels and the carrier. It may also include bullet-resistant or other accessories.

Fair Shot (Tir correct)

A shot that meets the requirements of the test procedure as specified in par. 5.1.1.3, 5.1.2.3, or 5.1.3.3, depending on the test.

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Indentation Depth (Profondeur de pénétration)

The maximum depth of the depression made in the backing material measured from the undistorted front surface (Figure 2).

(Main) Ballistic Panels (Panneaux pare-balles [principaux])

The front and/or back torso protective panels.

Mannequin (Mannequin)

A (correctly proportioned) torso-like physical model of an adult human that can be fitted with a curved test block (clay) used in the ballistic resistance testing of complete garments. The body armour mannequin could be adjustable in size and position so that garment samples of a number of sizes could be tested at any required impact points.

Manufacturer's Code (Code du fabricant)

An identification that allows the manufacturer to trace the protective material to its source.

Normal Impact (Impact normal)

The intended impact angle of the bullet with the target surface is not more than 3°. Impacts that are deliberately intended to strike at angles of more than 3° may be considered as "normal" provided they are recorded in the final report.

Perforation (Perforation)

A perforation has occurred if

a. the bullet or any part of it has completely passed through the test specimen,

b. where a rigid panel is incorporated into the armour, any part of that panel, for example, rigid material, breaks away and is found in the clay backing of the test block which backs the armour in the test.

Perforation has not occurred if none of the above criteria is fulfilled.

Personal Body Armour (Gilet de protection balistique)

Personal body armour is protective clothing intended to protect a specified part of the torso against penetration and severe blunt trauma effects generated by bullets. It typically includes the bullet-resistant panels and the carriers containing the panels.

Protection Rating (Classe de protection)

The protection rating is an identifier that describes the amount of resistance to penetration and back-face deformation an item of personal body armour provides.

Rigid Plate (Plaque rigide)

Generally a hard bullet-resistant accessory for a complete garment. A plate is a unique construction that can include hard materials such as ceramic, steel, titanium, etc. and/or layers of one or more types of bullet-resistant materials assembled in a specific manner. Rigid plates are usually intended to stop rifle fire and/or armour piercing rounds.

Separation Distance (Distance de séparation)

The distance between the centres of any two hits or the centre of any one hit and the edge of the test specimen.

Shoot Pack (Panneau d'essai de tir)

A representative of a bullet-resistant panel, 400 × 400 mm, manufactured for quality assurance and development testing.

Strike Face (Surface de frappe)

The surface of a test specimen designed to face the attack.

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Symbols and Abbreviations (Symboles et abréviations)

g A bullet's mass in grams
gr A bullet's mass in grains
m/s A bullet's velocity in metres per second
ft/s A bullet's velocity in feet per second

Note: 1 g = 15.4324 gr, 1 gr = 0.06480 g

Test Block (Bloc d'essai)

A box or rigid frame closed on one side that contains backing material used for mounting ballistic panels and/or complete garments for the purpose of ballistic testing.

Test Range (Distance d'essai)

The distance between the muzzle of the barrel and the strike face.

Test Specimens (Spécimens d'essai)

A test specimen may be the complete garment, the bullet-resistant design, the bullet-resistant panel or the shoot pack, as specified in this standard.

Threat Description (Menace désignée)

The threat description identifies the type, the rate of fire and the velocity of the ammunition used to test each of the four protection ratings listed in this standard.

Unfair Shot (Tir incorrect)

A shot that does not conform to the criteria specified (see par. 5.1.1.3, 5.1.2.3, or 5.1.3.3, depending on the test).

V_{pass} (V_p) ($V_{acceptation}$ [V_p])

The velocity selected for a particular bullet for the pass/fail proof testing of a test specimen (Appendix A).

V_{50} (V_{50})

The velocity at which, using the named projectile and test specimen, the estimated probability of perforation is 0.5, that is, the velocity at which 50% of the bullets would perforate and 50% would be stopped. (The definition of the word "estimated" is that used in statistical analysis.)

4. DETAILED REQUIREMENTS

4.1 **Minimum Requirements** — As a minimum, the test specimen shall meet the V_{pass} (V_p) requirements for both the dry test condition for the Duty Handgun Protection Rating as specified in par. 4.1.1 and the wet (spray) test as specified in par. 4.1.2. Testing shall be in accordance with par. 5.1.1. For the complete garment the front and rear torso bullet-resistant panels shall be used in the test. If the front and rear bullet-resistant panels are of the same construction, as attested to by the manufacturer, one armour set may be used to complete the test. If the front and rear bullet-resistant panels are of different construction, as attested to by the manufacturer, each panel shall be completely tested. Unless otherwise specified by the user (par. 9.1.3), additional ballistic panels such as shoulder, neck, and groin panels shall be deemed to meet the ballistic requirements of this standard if they are of the same construction as the torso panels.

4.1.1 ***Repetitive Single Shot Pass/Fail V_{pass} (V_p) — Duty Handgun*** (Mandatory requirements and test regardless of the protection rating.) — The test specimen shall meet the following requirements for the threat description as specified in Appendix A when tested in accordance with par. 5.1.1:

— no perforation for fair shots, and

— the indentation depth shall be as specified, in Appendix A.

4.1.2 ***Wet (Spray) Test*** — (Mandatory requirement and test regardless of the protection rating.) — The test specimen shall meet the minimum requirements of par. 4.1.1 when conditioned as specified in par. 5.1.1.2 a. ii. If the test specimen meets the wet (spray) test, it is not deemed to meet the dry test requirements (par. 9.1.6).

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4.2 **User-specified Water Immersion Test (Optional)** — If specified, the test specimen may be conditioned in accordance with par. 5.1.1.2 a. iii., 5.1.2.2 a. iii., or 5.1.3.2 a. iii., depending on the test, and shall meet the minimum requirements as specified in par. 4.1, or as specified by the user (par. 9.1.1 and 9.1.2). If the test specimen meets the requirements for the water immersion test, then it will be deemed to meet both the dry test and the wet (spray) test requirement (par. 9.1.6).

4.3 **User-specified Requirements (Optional)** — Additional threats and protection ratings as described in Appendix A may be specified by the user (par. 9.1.1 and 9.1.2). When specified by the user (par. 9.1.5), the test specimen shall also meet one or more of the requirements in par. 4.3.1 (Repetitive Single Shot Pass/Fail V_{pass} [V_p] for the User-specified Handgun), par. 4.3.2 (Repetitive Single Shot V_{50} for the Duty Handgun or the User-specified Handgun), par. 4.3.3 (Rapid Fire Multihit V_{pass} [V_p] for the Duty Submachine Gun or the User-specified Submachine Gun) when tested in accordance with par. 5.1.1, 5.1.2, or 5.1.3, respectively. For the complete garment the front and rear torso bullet-resistant panels shall be used in the test. If the front and rear bullet-resistant panels are of the same construction, as attested to by the manufacturer, one armour set may be used to complete each test. If the front and rear bullet-resistant panels are of different construction, as attested to by the manufacturer, each panel shall be completely tested. Unless otherwise specified by the user (par. 9.1.3), additional ballistic panels such as shoulder, neck, and groin panels shall be deemed to meet the ballistic requirements of this standard if they are of the same construction as the torso panels.

4.3.1 ***User-specified Handgun*** — When the User-specified Handgun protection rating is specified, the test specimen shall meet, as a minimum, the same threat as the duty handgun plus any additional test rounds representing a user-specified increase in threat. When tested in accordance with par. 5.1.1, the requirements for all the test rounds shall be

— no perforation for fair shots, and

— the indentation depth shall be as specified by the user and may not be a requirement.

4.3.2 ***Repetitive Single Shot V_{50}*** — When a V_{50} test is specified, the test specimen shall also meet the requirements and the V_{50} ratings as specified by the user when tested in accordance with par. 5.1.2 and, as a minimum, the duty handgun V_{pass} (V_p) requirements must also be met. For a complete garment the front and rear torso bullet-resistant panels shall be used in the test. If the front and rear bullet-resistant panels are of the same construction, as attested to by the manufacturer, one armour set may be used to complete each test. If the front and rear bullet-resistant panels are of different construction, as attested to by the manufacturer, each panel shall be completely tested. Unless otherwise specified by the user (par. 9.1.3), additional ballistic panels such as shoulder, neck, and groin panels shall be deemed to meet the ballistic requirements of this standard if they are of the same construction as the torso panels.

4.3.3 ***Rapid Fire Multihit V_{pass} (V_p)*** — The test specimen shall meet the requirements for both dry and wet (spray) tests below when tested in accordance with par. 5.1.3. For a complete garment the front and rear torso bullet-resistant panels with any rigid plates removed shall be used in the test. If the front and rear bullet-resistant panels are of the same construction, as attested to by the manufacturer, one armour set may be used to complete each test. If the front and rear bullet-resistant panels are of different construction, as attested to by the manufacturer, each panel shall be completely tested. Unless otherwise specified by the user (par. 9.1.3), additional ballistic panels such as shoulder, neck, and groin panels shall be deemed to meet the ballistic requirements of this standard if they are of the same construction as the torso panels.

4.3.3.1 *Duty Submachine Gun* — When the Duty Submachine Gun protection rating is specified, the test specimen shall meet the following requirements for the threat description as specified in Appendix A:

— the test specimen shall be capable of stopping three fair groupings of the ammunition specified in Appendix A, fired at the test specimen in accordance with Figure 6,

— no perforation for fair shots, and

— the indentation depth shall be as specified by the user and may not be a requirement.

4.3.3.2 *User-specified Submachine Gun* — When the User-specified Submachine Gun protection rating is specified, the test specimen shall meet the following requirements for the threat description as specified in Appendix A:

— the test specimen shall be capable of stopping three fair groupings of the ammunition specified in Appendix A, fired at the test specimen in accordance with Figure 6,

— no perforation for fair shots, and

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— the indentation depth shall be as specified by the user and may not be a requirement.

4.3.4 ***Wet (Spray) Test*** — If additional user-specified requirements (par. 4.3) are specified, the test specimen shall also meet one or more of the minimum requirements of par. 4.3.1, 4.3.2 or 4.3.3 when conditioned as specified in par. 5.1.2.2 a. ii. or 5.1.3.2 a. ii. If the test specimen meets the requirements of the Wet (spray) test, it is not deemed to meet the dry test requirements (par. 9.1.6).

5. TEST METHODS

5.1 **General** — Three test methods are described and shall be used depending on the protection rating required (section 4). They are

Test Method 1 — Repetitive Single Shot Pass/Fail V_{pass} (V_p),
Test Method 2 (Optional) — Repetitive Single Shot V_{50}, and
Test Method 3 (Optional) — Rapid Fire Multihit V_{pass} (V_p).

5.1.1 *Test Method 1 — Repetitive Single Shot Pass/Fail V_{pass} (V_p)*

5.1.1.1 *Apparatus*

a. Test Block or Mannequin — Two options are available for testing (par. 9.1.7), depending on whether the bullet-resistant panels or the complete garment is tested.

i. To test bullet-resistant panels, a rigid frame with an internal measurement of at least 300 mm square and a thickness of at least 100 mm shall be used. This frame shall be closed on one face. The frame shall be filled with backing material, ensuring that it contains no air pockets or imperfections that may affect the indentations created by the impact of the bullet.

ii. To test a complete garment, a specially designed mannequin[1] or suitably modified test block of the appropriate size and meeting the requirements of par. 5.1.1.1 a. i. shall be used. (Refer to Figure 3 and Figures B1 and B2). The complete garment shall be mounted on the mannequin using its own means of attachment.

b. Test Specimen Retention System — When testing a bullet-resistant panel, the test specimen shall be retained with at least two and no more than five suitably positioned straps, elastic or equivalent, that do not interfere with the firing pattern. Additionally, no individual hit shall fall within 50 mm of any retaining strap or band. When the mannequin is used, only the retention system of the garment is to be used to retain the test specimen.

c. Velocity Measurement Device — Velocity shall be measured within an accuracy of ±0.2%; for example, a true velocity of 1000 m/s shall be measured within an accuracy of ±2 m/s.

d. Test Ranges — The test ranges are

— 5 ± 0.2 m for handguns and shotguns

— 15 ± 0.2 m for rifles.

The actual test range length shall be reported on the test report. The operator should be aware that ballistic debris may cause inaccurate velocity readings unless precautions are taken.

5.1.1.2 *Preparation for Testing*

a. Conditioning

i. Dry Test Specimen — Before the test, store the specimen for at least 24 h at 20 ± 2°C and 65 ± 5% Relative Humidity (RH) in accordance with CAN/CGSB-4.2 No. 2. After conditioning, seal the test specimen in a sealable plastic bag and do not remove it until immediately before testing.

ii. Wet (Spray) Test Specimen — The complete garment shall be conditioned by subjecting both sides of each armour part to a water spray under the following conditions:

— The specimen shall be oriented at 45° as per Figure 4.

[1] *Goldorac, available from Bosik Consultants Ltd., 5460 Old Mill Way, Manotick, ON K4M 1C1, has been found suitable.*

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— The spray nozzles shall be of such size and spaced so that 10 ± 2 L of water per hour falls uniformly on each 0.1 m^2 of spray booth floor area. Orient the nozzles so that when the droplets strike the armour surface they fall by gravitational force.

— Each surface of each armour part shall be sprayed for 10 ± 1 min. Spray the strike face last. The armour shall be drained for 5 ± 0.5 min. Ballistic testing shall begin no later than 5 min after the completion of the draining period. The first shot shall be fired within 5 min of the completion of the draining period, and the final shot shall be fired not more than 40 min later. Start the test shot sequence at the top of the panel and work down to the bottom. If the testing has not been completed in the time permitted, the test data shall be discarded and wet (spray) testing must begin again with new armour. The test specimen shall not be re-sprayed for further testing.

iii. Water Immersion Test Specimen — Submerge the test specimen vertically in water with the top of the specimen 5 cm below the water surface at 15 to 20°C for 1 h ± 5 min. Remove it from the water and hold it vertically and allow it to drain for 3 ± 0.5 min before testing begins. The test as determined by the test method specified (Test Method 1, 2 or 3) is then carried out. The first shot shall be fired within 5 min of the completion of the draining period, and the final shot shall be fired not more than 40 min later.[2] Start the test shot sequence at the top of the panel and work down to the bottom. Measure back-face deformations after completion of the wet test.

b. Backing Material[3]

i. Calibration — The clay must be scraped prior to the calibration measurement so that the procedure is the same for measuring the indentation depth during panel testing. The consistency of the clay in the block or mannequin (par. 5.1.1.1 a.) during the test shall be such that when a 1043 ± 5 g steel ball[4 and 5] with a diameter of 63.5 ± 0.05 mm is dropped free fall from a height of 2000 ± 5 mm, as measured from the surface of the backing material and the lower surface of the ball, the average depth of the indentations from three such drops shall be 20 ± 3 mm. This condition shall apply throughout the duration of the testing procedure as described in par. 5.1.1.3 (Figure 5). Two or more test blocks may be used to conduct a complete test series. Each block must be in calibration during the whole time it is used to do the tests; therefore, each block should be checked for calibration before any testing on it, as well as after a test series is complete.

ii. The separation distance between any indentation centre shall be greater than or equal to 90 mm. The distance from the centre of any indentation to any edge shall be greater than or equal to 60 mm.

5.1.1.3 *Procedure*

a. Backing Material — Ensure that the box of backing material is rigidly mounted in the appropriate position and the test specimen, when fastened to it, is in full contact with the backing material. If the test specimen is not flat, shape the backing material to achieve full contact. Restore the original surface before each test sequence.

b. Number of Shots — A complete test consists of the minimum of fair shots of each bullet specified[6] in the following table:

TABLE 1a

Test Round Angles

	Impact Angles		
Handgun Test Round	0°	30°	60°
9 mm	3	2	2
.357	5	0	0
User specified	3	2	2

[2] *If the final shot cannot be fired within 45 min of the completion of the draining period, the extra time to complete the test (to a total maximum of 60 min) shall be reported.*

[3] *Roma Plastilina No. 1 modelling clay is the only material that has been found to meet these requirements and can be preconditioned by altering its temperature or with the addition of oil.*

[4] *If the weight of the ball is too heavy, it is permissible to grind it to bring into tolerance. Care must be taken to ensure a "flat" is not created.*

[5] *Sphere refRB-63.5 from SKF, supplied by SKF-Kugellager-Fabriken GmbH, D 70336 Stuttgart, has been found satisfactory.*

[6] 9 mm *bullet: Hornaday,* 124 gr, *FMJ #35577B, and .357 bullet: JSP Speer,* 158 gr, *have been found to be suitable.*

Withdrawn/Retirée

c. Hit Location

i. The separation distance shall be at least 50 mm from any edge of the bullet-resistant panel and at least 75 mm from any other hit.

ii. Suspected weak point areas as defined by the user (such as front closure, shaped areas and seams) (par. 9.1.10) shall be identified to be targeted to ensure that the weakest point is equivalent to the rest of the armour. In the case of overlap, the overlap is not considered to be an edge, that is, a test shot can be placed directly on the overlap edge.

iii. When the panels are too small to meet the separation distances of i., additional panels shall be used, and this reported. If the ballistic panel to be tested is too small to meet the requirement of a fair test, refer to par. 4.3.

d. 0° Shots — There shall be a maximum of seven shots per panel with no overlap of damage between shots.

e. Angle Shots

i. The angle of impact shall be towards the centre of the test specimen. The angle can be obtained by turning the block and/or the mannequin 30 ± 3° from the perpendicular (for 30° shots) and by turning the block and/or the mannequin 60 ± 3° from the perpendicular (for 60° shots).

ii. The angle of impact may be measured by any suitable means that does not in itself cause projectile instability and that is accurate within ±3°.

f. Normal Impacts — All impacts that are included in the computations are to be normal impacts. Angles of more than 3° must, however, be recorded clearly in the final report.

g. Criteria for Fair/Unfair Shots — The angle of impact and the hit location of the shots must conform to this standard for a fair shot as specified in par. 5.1.1.3 c. and d. If the angle of impact and the hit location of the shot conform to this standard, but the velocity is either above or below the specified limit, there are circumstances in which the unfair shot can be accepted. These are defined below and summarized in Table 1b.

If the velocity is above that specified but there is no perforation and the indentation depth in the backing material is within the specified limit, this will count as a pass.

If the velocity is below that specified but perforation occurs, or no perforation occurs but the indentation depth is above the specified limit, this will constitute a failure.

In all other circumstances, the unfair shot will not count and the shot must be repeated.

TABLE 1b

Criteria for Accepting Unfair Shots for V_{Pass} (V_p)

Impact Velocity	No perforation Mean indentation depth as specified in Appendix A	Perforation and/or indentation depth not acceptable as specified in Appendix A
Too high	Fair shot Therefore considered a pass	Unfair shot Therefore shoot again
Too low	Unfair shot Therefore shoot again	Fair shot Therefore considered a failure

h. Test Specimen Repositioning — Reposition and flatten the test specimen after each shot to ensure consistency. After each shot, restore the test specimen as closely as practical to its original state, ensuring that the layers are smoothed as flat as possible and are positioned relative to one another and to the carrier (for the complete garment).

i. Measurement for Indentation Depth — After the 0° angle of impact test sequence, measure and record the indentation depth in the backing material resulting from each fair, non-penetrating, shot as shown in Figure 2. The measuring probe shall have a ball point with a nominal diameter of 5 mm.[7] The cavities shall then be filled in, the surface flattened, and smoothed, ready for the next test sequence.

[7] *Mutitoyo dial indicator point #101185, available from Outillage industriel Québec ltée, 395, avenue Marconi, Sainte-Foy, Québec G1N 4A5, telephone (418) 683-2527, has been found suitable.*

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j. The temperature of the backing material shall be measured at least before and after completion of the test. The temperature shall be measured at least 2.5 cm from the edge and 2 cm into the clay surface, in degrees Celsius.

k. Any perforation from a fair shot will cause immediate cessation of the testing and failure of the test specimen.

l. Record the range temperature and percent RH at the beginning and completion of the test.

5.1.2 ***Test Method 2 (Optional) — Repetitive Single Shot V_{50}***

5.1.2.1 *Apparatus*

a. Test Block or Mannequin — Two options are available for testing (par. 9.1.7) depending on whether the bullet-resistant panels or the complete garment is tested.

i. To test bullet-resistant panels, a rigid frame with an internal measurement of at least 300 mm square and a thickness of at least 100 mm shall be used. This frame shall be closed on one face. The frame shall be filled with backing material, ensuring that it contains no air pockets or imperfections that may affect the indentations created by the impact of the bullet.

ii. To test a complete garment, a specially designed mannequin[1] or suitably modified test block of the appropriate size and meeting the requirements of par. 5.1.2.1 a. i. shall be used. (Refer to Figure 3 and Figures B1 and B2). The complete garment shall be mounted on the mannequin using its own means of attachment.

b. Test Specimen Retention System — When testing a bullet-resistant panel, the test specimen shall be retained with at least two and no more than five suitably positioned straps, elastic or equivalent, that do not interfere with the firing pattern. Additionally, no individual hit shall fall within 50 mm of any retaining strap or band. When the mannequin is used, only the retention system of the garment is to be used to retain the test specimen.

c. Velocity Measurement Device — Velocity shall be measured within an accuracy of ±0.2%; for example, a true velocity of 1000 m/s shall be measured within an accuracy of ±2 m/s.

d. Test Ranges — The test ranges are

— 5 ± 0.2 m for handguns and shotguns

— 15 ± 0.2 m for rifles.

The actual test range length shall be reported on the test report. The operator should be aware that ballistic debris may cause inaccurate velocity readings unless precautions are taken.

5.1.2.2 *Preparation for Testing*

a. Conditioning

i. Dry Test Specimen — Before the test, store the specimen for at least 24 h at 20 ± 2°C and 65 ± 5% RH in accordance with CAN/CGSB-4.2 No. 2. After conditioning, seal the test specimen in a sealable plastic bag and do not remove it until immediately before testing.

ii. Wet (Spray) Test Specimen — The complete garment shall be conditioned by subjecting both sides of each armour part to a water spray under the following conditions:

— The specimen shall be oriented at 45° as per Figure 4.

— The spray nozzles shall be of such size and spaced so that 10 ± 2 L of water per hour falls uniformly on each 0.1 m^2 of spray booth floor area. Orient the nozzles so that when the droplets strike the armour surface they fall by gravitational force.

— Each surface of each armour part shall be sprayed for 10 ± 1 min. Spray the strike face last. The armour shall be drained for 5 ± 0.5 min. Ballistic testing shall begin no later than 5 min after the completion of the draining period. The first shot shall be fired within 5 min of the completion of the draining period, and the final shot shall be fired not more than 40 min later. Start the test shot sequence at the top of the panel and work down to the bottom. If the testing has not been completed in the time permitted, the test data shall be discarded and wet (spray) testing must begin again with new armour. The test specimen shall not be re-sprayed for further testing.

iii. Water Immersion Test Specimen — Submerge the test specimen vertically in water with the top of the specimen 5 cm below the water surface at 15 to 20°C for 1 h ± 5 min. Remove it from the water and hold it vertically and allow it to drain for 3 ± 0.5 min before testing begins. The test as determined by the test

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method specified (Test Method 1, 2 or 3) is then carried out. The first shot shall be fired within 5 min of the completion of the draining period, and the final shot shall be fired not more than 40 min later.[2] Start the test shot sequence at the top of the panel and work down to the bottom. Measure back-face deformations after completion of the wet test.

b. Backing Material[3]

i. Calibration — The clay must be scraped prior to the calibration measurement so that the procedure is the same for measuring the indentation depth during panel testing. The consistency of the clay in the block or mannequin (par. 5.1.2.1 a.) during the test shall be such that when a 1043 ± 5 g steel ball[4 and 5] with a diameter of 63.5 ± 0.05 mm is dropped free fall from a height of 2000 ± 5 mm, as measured from the surface of the backing material and the lower surface of the ball, the average depth of the indentations from three such drops shall be 20 ± 3 mm. This condition shall apply throughout the duration of the testing procedure as described in par. 5.1.2.3 (Figure 5). Two or more test blocks may be used to conduct a complete test series. Each block must be in calibration during the whole time it is used to do the tests; therefore, each block should be checked for calibration before any testing on it, as well as after a test series is complete.

ii. The separation distance between any indentation centre shall be greater than or equal to 90 mm. The distance from the centre of any indentation to any edge shall be greater than or equal to 60 mm.

5.1.2.3 *Procedure*

a. Backing Material — Ensure that the box of backing material is rigidly mounted in the appropriate position and the test specimen, fastened to it, is in full contact with the backing material. If the test specimen is not flat, shape the backing material to achieve full contact. Restore the original surface before each test sequence.

b. Hit Location — The separation distance shall be at least 50 mm from any edge of the bullet-resistant panel and at least 75 mm from any other hit.

c. Normal Impacts — All impacts that are included in the computations are to be normal impacts.

d. Criteria for Fair/Unfair Shots — The angle of impact and hit location of the shots shall be as specified in par. 5.1.2.3 b. and c.

e. Measurement of V_{50} — Test using the up and down firing sequence of MIL-STD-662F. An even number of fair shots, at least six, shall be used in the calculation. More than six shots may be required to meet this criteria. Half the shots must perforate the target material. Half the shots must not perforate the target material. For a six-shot V_{50}, the measurement is the arithmetic mean of the three highest non-perforations and three lowest perforations. The highest recorded velocity of the group (half perforations and half non-perforations) must not be more than 40 m/s higher than the lowest in the group.[8]

f. Test Specimen Repositioning — Reposition and flatten the test specimen after each shot to ensure consistency. After each shot, restore the test specimen as closely as practical to its original state, ensuring that the layers are smoothed as flat as possible and are positioned relative to one another and to the carrier (for the complete garment).

g. The temperature of the backing material shall be measured at least before and after completion of the test. The temperature shall be measured at least 2.5 cm from the edge and 2 cm into the clay surface, in degrees Celsius.

h. Record the range temperature and percent RH at the beginning and completion of the test.

5.1.3 ***Test Method 3 (Optional) — Rapid Fire Multihit V_{pass} (V_p)***

5.1.3.1 *Apparatus*

a. Test Block or Mannequin — Two options are available for testing (par. 9.1.7) depending on whether the bullet-resistant panels or the complete garment is tested.

i. To test bullet-resistant panels, a rigid frame with an internal measurement of at least 300 mm square and a thickness of at least 100 mm shall be used. This frame shall be closed on one face. The frame shall be filled with backing material, ensuring that it contains no air pockets or imperfections that may affect the indentations created by the impact of the bullet.

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[8] *For V_{50} testing, no correction for velocity loss due to air drag between the timing point and the target is required.*

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ii. To test a complete garment, a specially designed mannequin[1] or suitably modified test block of the appropriate size, meeting the requirements of par. 5.1.3.1 a. i. shall be used. (Refer to Figure 3 and Figures B1 and B2). The complete garment shall be mounted on the mannequin using its own means of attachment.

b. Test Specimen Retention System — When testing a bullet-resistant panel, the test specimen shall be retained with at least two and no more than five suitably positioned straps, elastic or equivalent, that do not interfere with the firing pattern. Additionally, no individual hit shall fall within 50 mm of any retaining strap or band. When the mannequin is used, only the retention system of the garment shall be used to retain the test specimen.

c. Velocity Measurement Device — Velocity shall be measured within an accuracy of ±0.2%; for example, a true velocity of 1000 m/s shall be measured within an accuracy of ±2 m/s. The velocity of each round in the three round or multi-hit test must be measured with the specified accuracy.

d. Test Ranges — The test ranges are

— 5 ± 0.2 m for handguns and shotguns

— 15 ± 0.2 m for rifles.

The actual test range length shall be reported on the test report. The operator should be aware that ballistic debris may cause inaccurate velocity readings unless precautions are taken.

5.1.3.2 *Preparation for Testing*

a. Conditioning

i. Dry Test Specimen — Before the test, store the specimen for at least 24 h at 20 ± 2°C and 65 ± 5% RH in accordance with CAN/CGSB-4.2 No. 2. After conditioning, seal the test specimen in a sealable plastic bag and do not remove it until immediately before testing.

ii. Wet (Spray) Test Specimen — The complete garment shall be conditioned by subjecting both sides of each armour part to a water spray under the following conditions:

— The specimen shall be oriented at 45° as per Figure 4.

— The spray nozzles shall be of such size and spaced so that 10 ± 2 L of water per hour falls uniformly on each 0.1 m^2 of spray booth floor area. Orient the nozzles so that when the droplets strike the armour surface they fall by gravitational force.

— Each surface of each armour part shall be sprayed for 10 ± 1 min. Spray the strike face last. The armour shall be drained for 5 ± 0.5 min. Ballistic testing shall begin no later than 5 min after the completion of the draining period. The first shot shall be fired within 5 min of the completion of the draining period, and the final shot shall be fired not more than 40 min later. Start the test shot sequence at the top of the panel and work down to the bottom. If the testing has not been completed in the time permitted, the test data shall be discarded and wet (spray) testing must begin again with new armour. The test specimen shall not be re-sprayed for further testing.

iii. Water Immersion Test Specimens — Submerge the test specimen vertically in water with the top of the specimen 5 cm below the water surface at 15 to 20°C for 1 h ± 5 min. Remove it from the water and hold it vertically and allow it to drain for 3 ± 0.5 min before testing begins. The test as determined by the test method specified (Test Method 1, 2 or 3) is then carried out. The first shot shall be fired within 5 min of the completion of the draining period, and the final shot shall be fired not more than 40 min later.[2] Start the test shot sequence at the top of the panel and work down to the bottom. Measure back-face deformations after completion of the wet test.

b. Backing Material[3]

i. Calibration — The clay must be scraped prior to the calibration measurement so that the procedure is the same for measuring the indentation depth during panel testing. The consistency of the clay in the block or mannequin (par. 5.1.3.1 a.) during the test shall be such that when a 1043 ± 5 g steel ball[4 and 5] with a diameter of 63.5 ± 0.05 mm is dropped free fall from a height of 2000 ± 5 mm, as measured from the surface of the backing material and the lower surface of the ball, the average depth of the indentations from three such drops shall be 20 ± 3 mm. This condition shall apply throughout the duration of the testing procedure as described in par. 5.1.3.3 (Figure 5). Two or more test blocks may be used to conduct a complete test series.

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Each block must be in calibration during the whole time it is used to do the tests; therefore, each block should be checked for calibration before any testing on it, as well as after a test series is complete.

ii. The separation distance between any indentation centre shall be greater than or equal to 90 mm. The distance from the centre of any indentation to any edge shall be greater than or equal to 60 mm.

5.1.3.3 *Procedure*

a. Backing Material — Ensure that the box of backing material is rigidly mounted in the appropriate position and that the test specimen, when fastened to it, is in full contact with the backing material. If the test specimen is not flat, shape the backing material to achieve full contact. Restore the original surface before each test sequence.

b. Hit Location

i. All shots shall be 0° shots. There shall be a minimum of three fair groupings per panel. A grouping consists of three bullets fired in a rapid burst as per Appendix A. The nominal rate of fire shall be 800 ± 50 rounds/min.

ii. The three shot groupings and locations shall be as per Figure 6. The three shot groupings shall strike the test specimen not less than 50 mm from any given edge of the bullet-resistant panels and at least 75 mm from any other grouping.

iii. Suspected weak point areas as defined by the user (such as front closure, shaped areas and seams) (par. 9.1.10) shall be identified to be targeted to ensure that the weakest point is equivalent to the rest of the armour. In the case of overlap, the overlap is not considered to be an edge, that is, a test shot can be placed directly on the overlap edge.

iv. If specified (par. 9.1.8), a three-round burst shall be fired at the (optional) groin protector.

v. After each grouping (as above), measure and record the indentation depth of the backing material resulting from each fair, non-penetrating shot, as shown in Figure 2. The measuring probe shall have a ball point with a nominal diameter of 5 mm.[7] The cavities shall then be filled in, the surface flattened and smoothed, ready for the next test.

vi. Any perforation from a fair shot will cause immediate cessation of the testing and failure of the test specimen.

c. Normal Impacts — All impacts that are included in the computations are to be normal impacts. Angles of more than 3° must, however, be recorded clearly in the final report.

d. Criteria for Fair/Unfair Shots — The angle of impact and the hit location of the shots must conform to this standard for a fair shot as specified in par. 5.1.3.3 b. and c. If the angle of impact and the hit location of the shot conform to this standard but the velocity is either above or below the specified limit, there are circumstances in which the unfair shot can be accepted. These are defined below and summarized in Table 1c.

If the velocity is above that specified but there is no perforation and the indentation depth in the backing material is within the specified limit, this will count as a pass.

If the velocity is below that specified but perforation occurs, or no perforation occurs but the indentation depth is above the specified limit, this will constitute a failure.

In all other circumstances, the unfair shot will not count, and the shot must be repeated.

TABLE 1c

Criteria for Accepting Unfair Shots for V_{pass} (V_p)

Impact Velocity	No perforation Mean indentation depth as specified in Appendix A	Perforation and/or indentation depth not acceptable as specified in Appendix A
Too high	Fair shot Therefore considered a pass	Unfair shot Therefore shoot again
Too low	Unfair shot Therefore shoot again	Fair shot Therefore considered a failure

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e. Test Specimen Repositioning — Reposition and flatten the test specimen after each grouping to ensure consistency. After each shot, restore the test specimen as closely as practical to its original state, ensuring that the layers are smoothed as flat as possible and are positioned relative to one another and to the carrier (for the complete garment).

f. Measurement for Indentation Depth — After the completion of shooting, measure and record the indentation depth in the backing material resulting from each fair, non-penetrating, 0° angle of impact shot.

g. The temperature of the backing material shall be measured at least before and after completion of the test. The temperature shall be measured at least 2.5 cm from the edge and 2 cm into the clay surface, in degrees Celsius.

h. Record the range temperature and percent RH at the beginning and completion of the test.

6. QUALITY ASSURANCE

6.1 It is recommended that the fibre producer and the fabric producer be registered to at least ISO 9002.

6.2 It is recommended that the fabric scouring and finishing be performed by a facility registered to at least ISO 9002.

6.3 It is recommended that the personal body armour manufacturer submitting the armour for testing submit their current copy of ISO 9002:1994 registration certificate.

6.4 All ballistic testing facilities should be recognized as competent in their fields of endeavour and be able to provide certification that they are accredited to recognized standards and/or a Quality Assurance Program.

7. REPORT

It is recommended that the Report Pages in Appendix C of this standard be used.

7.1 For each test specimen tested, a complete test report shall include:

7.1.1 Copies of test reports on each ballistic panel tested (detailed in par. 7.2)

7.1.2 Copies of all manufacturer's supplied data and attestations (detailed in par. 7.3).

7.2 For each test specimen tested, report the following information:

7.2.1 Protection rating tested for.

7.2.2 The threat description and protection rating, that is, the ammunition used, including the type, the calibre, the mass (in grams or grains), the manufacturer and the lot number.

7.2.3 The name of the test method conducted:

— Test Method 1 — Repetitive Single Shot Pass/Fail V_{pass} (V_p) Test

— Test Method 2 (Optional) — Repetitive Single Shot V_{50} Test

— Test Method 3 (Optional) — Rapid Fire Multihit V_{pass} (V_p) Test.

7.2.4 Type of test conducted (dry, wet [spray] or water immersion).

7.2.5 The temperature in degrees Celsius and the percent relative humidity for the range.

7.2.6 Whether the test block or mannequin was used.

7.2.7 The test range, in metres.

7.2.8 The temperature of the backing material, as measured at least before and after completion of the test, in degrees Celsius.

7.2.9 The number and the angle of shots.

7.2.10 The velocity (in metres per second) and angle of incidence for each shot, together with observations on penetration or its absence.

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7.2.11 The indentation depth of each 0° shot and the average of these shots, in millimetres.

7.2.12 Where applicable, the average V_{50} result, all shot velocities, the six shots selected to determine the V_{50} including the low complete and high partial velocities, and the range of velocity.

7.2.13 If suspected weak areas are identified, record a description of panels and test shot locations when tested to par. 5.1.1.3 c. ii. or 5.1.3.3 b. iii.

7.2.14 Results of the tests if bullet-resistant panels other than the front and rear torso panels are tested (par. 4.1).

7.2.15 The number of this standard: CAN/CGSB-179.1-2001.

7.2.16 The date of the test.

7.2.17 The name of the operator.

7.2.18 The name of the testing laboratory and its statement of accreditation.

7.3 For each test specimen, the manufacturer will provide the sample identification, which will include:

- Lot number
- Date of manufacture (year/month/day)
- Construction as attested to (see par. 4.1)
- Style number
- Threat description
- Protection rating
- Number of layers
- Areal density
- Thread count
- Sequence of layers and material
- Stitching pattern
- Feathering.

8. PREPARATION FOR DELIVERY

8.1 **Packaging, Packing and Marking** — Unless otherwise specified (par. 9.1.9), normal commercial packaging, packing and marking shall be acceptable.

8.2 **Labelling** — In addition to complying with the labelling requirements of any relevant Acts or Regulations, each garment shall be suitably labelled to show the following information.

Unless otherwise specified by the user (par. 9.1.11), the labelling shall be in both English and French. It shall be clear and durable and in a readable type size in accordance with the requirements set forth below.

It is recommended that the labelling examples and label checklist in Appendix D of this standard be used.

8.2.1 ***Bullet-Resistant Panels*** — Each bullet-resistant panel of the personal body armour that is large enough to support a full detailed label shall have a label permanently attached to one of the panel's surfaces and contain the following information:

- Bullet-resistant design, that is, model and style identification of the personal body armour
- Protection rating including the test rounds, velocity and designations wet (spray) or water immersion tests
- Area of coverage expressed in square centimetres (square inches)
- Size
- Manufacturer's code

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— Date of manufacture (year/month/day)

— Date of issue (year/month/day)

— Identification of the Strike or Back Face

— Serial number or traceable means of identification

— Name and address of the manufacturer and if applicable, brand and address of branded reseller

— If the construction of the bullet-resistant panel varies producing areas of coverage with reduced protection, e.g. feathering, the following warning shall be included:

"This panel has a lower protection rating in some areas."

Manufacturers shall identify areas of reduced protection by some means, for example, a line of stitching or a silk screened indicator marking.

— A statement in type at least 6 mm high stating:

"For proper bullet protection, replacement panels and carriers shall meet the manufacturer's specifications in all respects."

— A statement in type at least 6 mm high stating:

"Do not place hard objects between the body and back face of the armour."

— Panels with dimensions less than the size of a full detailed label shall have a label permanently attached with a statement similar to the following:

"Refer to front or rear panel labels for details."

8.2.2 Carriers made to accept removable bullet-resistant panels shall have label(s) on the body side surface of the carrier. If the carrier is one piece (that is, all parts are sewn together into one garment), one label in conformance with the requirements of this section is sufficient. If the carrying system separates into more than one part, each part shall be labelled. The label shall contain at least the following information:

— Brand and address of original manufacturer/seller

— Size

— Date of issue (year/month/day)

— Bullet-resistant design

— A statement telling the user to look at the bullet-resistant panels to determine the protection provided

— Care instructions for the carrier

— A statement in type at least 6 mm high stating:

"Garment provides no bullet protection without bullet-resistant panels."

Carrier pieces with dimensions less than the size of a full detailed label shall have a label permanently attached with a statement similar to the following:

"Refer to front or rear carrier labels for details."

8.2.3 Complete garments with non-removable bullet-resistant panels shall in addition to the requirements below have visible labels that are in conformance with the requirements in par. 8.2.1 and 8.2.2.

9. NOTES

9.1 **Options** — The following options must be specified by the purchaser (end-user) in the application of this standard:

9.1.1 Protection rating (par. 4.2, 4.3 and Appendix A).

9.1.2 Threats description (par. 4.2, 4.3 and Appendix A).

9.1.3 Additional ballistic panels tested, if specified (par. 4.1, 4.3, 4.3.2 and 4.3.3).

Withdrawn/Retiree

9.1.4 Test specimen description — complete garment, bullet-resistant design, bullet-resistant panel or shoot pack (par. 4.1).

9.1.5 Test Method 1 (Repetitive Single Shot Pass/Fail V_{pass} [V_p]) (par. 5.1.1)

Test Method 2 (Repetitive Single Shot V_{50}) (par. 5.1.2)

Test Method 3 (Rapid Fire Multihit V_{pass} [V_p]) (par. 5.1.3).

9.1.6 Wet test type (par. 4.1.2, 4.2 or 4.3.4).

9.1.7 Test block or mannequin (par. 5.1.1.1 a., 5.1.2.1 a., 5.1.3.1 a.).

9.1.8 Testing of optional groin protector, if specified (par. 5.1.3.3 b. iv.).

9.1.9 Packaging, packing and marking, if normal commercial practice is not suitable (par. 8.1).

9.1.10 Suspected weak points, if any, as defined in par. 5.1.1.3 c. ii. or 5.1.3.3 b. iii.

9.1.11 Language of label, if other than in both English and French (par. 8.2).

9.2 **Related Publications**

9.2.1 U.S. Congress, Office of Technology Assessment

Police Body Armor Standards and Testing: Volume 1, OTA-ISC-534 (Washington D.C.: U.S. Government Printing Office, August 1992).

9.2.2 U.S. Department of Justice, National Institute of Justice (NIJ)

NIJ 0101.03 — Ballistic Resistance of Police Body Armour.

9.2.3 International Organization for Standardization (ISO)

ISO/DIS 14876-1 — Protective clothing — Body armour — Part 1: General requirements

ISO/DIS 14876-2.2 — Protective clothing — Body armour — Part 2: Bullet resistance — Requirements and test methods.

9.2.4 Police Scientific Development Branch (PSDB)

PSDB Ballistic Body Armour Standard Publication No. 12/93.

9.2.5 Safety Standards for Body Armour, Report of Anthony Bleetman, May 1, 1996, prepared for the Police Federation on the Instruction of John Harrison, Secretary, Public Order Working Group.

9.3 **Sources of Referenced Publications**

9.3.1 The publication referenced in par. 2.1.1 may be obtained from the Canadian General Standards Board, Sales Centre, Ottawa, Canada K1A 1G6. Telephone (819) 956-0425 or 1-800-665-CGSB (Canada only). Fax (819) 956-5644.

9.3.2 The publications referenced in par. 2.1.2 and 9.2.3 may be obtained from the IHS Canada, 240 Catherine Street, Suite 305, Ottawa, Ontario K2P 2G8. Telephone (613) 237-4250 or 1-800-854-7179. Fax (613) 237-4251.

9.3.3 The publication referenced in par. 2.1.3 may be obtained from DODSSP, Building 4/Section D, 700 Robbins Avenue, Philadelphia, PA 19111-5098, U.S.A. Telephone (215) 697-2179. Fax (215) 697-1462.

9.3.4 The publication referenced in par. 9.2.1 may be obtained by contacting New Orders, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954, U.S.A. Telephone (202) 512-1800. Fax (202) 512-2250.

9.3.5 The publication referenced in par. 9.2.2 may be obtained from the National Law Enforcement and Corrections Technology Center, P.O. Box 1160, Rockville, MD 20489-1160, U.S.A. Telephone (301) 519-5060 or 1-800-248-2742. Fax (301) 519-5149.

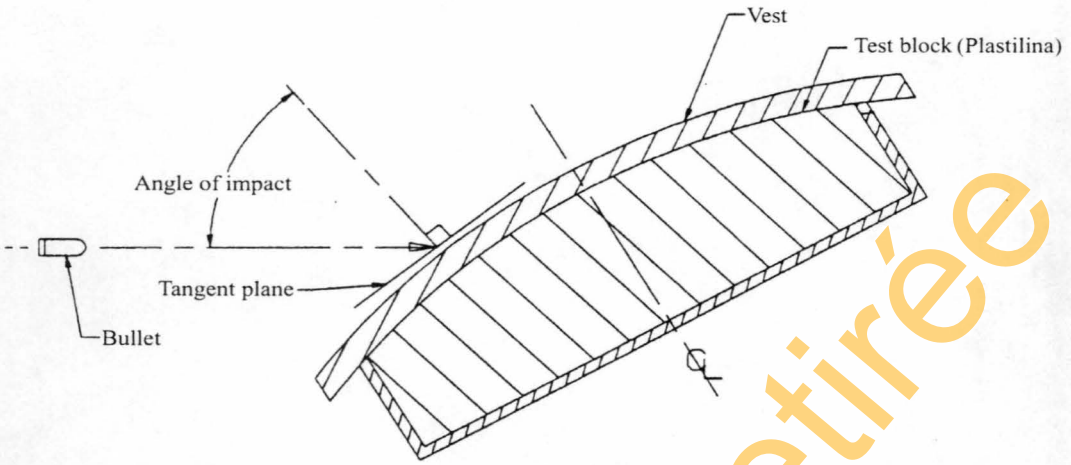
Withdrawn/Retirée

9.3.6 The publication referenced in par. 9.2.4 may be obtained from PSDB, Woodcock Hill, Sandridge, St. Albans, Hertfordshire AL4 9HQ, U.K. Telephone 011-44-01727-865051. Fax 011-44-01727-816233.

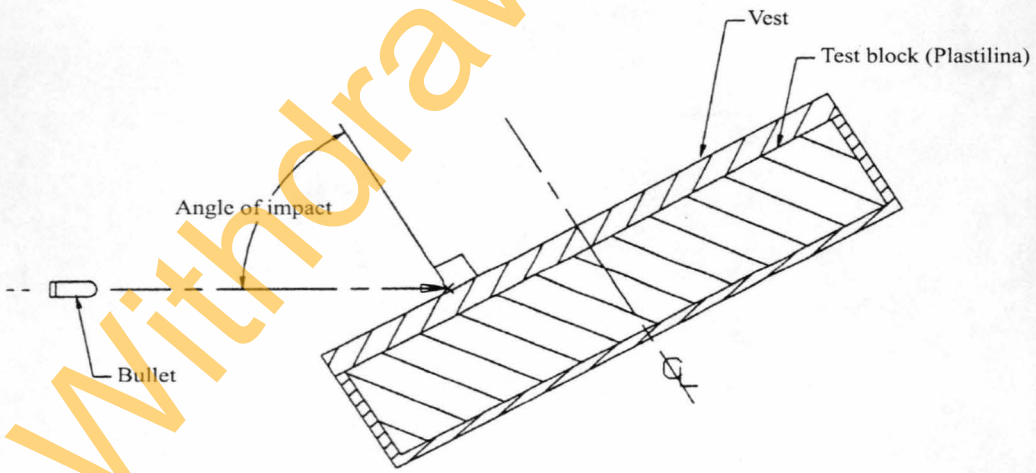
9.3.7 The publication referenced in par. 9.2.5 may be obtained by contacting Accident and Emergency Department, University Hospital Birmingham NHS Trust, Reddlebarn Road, Selly Oak, Birmingham B29 6JD, U.K. Telephone 011-44-0121-627-1627 (extension 2529).

Withdrawn/Retirée

Angle of Impact (Curved Block)



Angle of Impact (Flat Block)

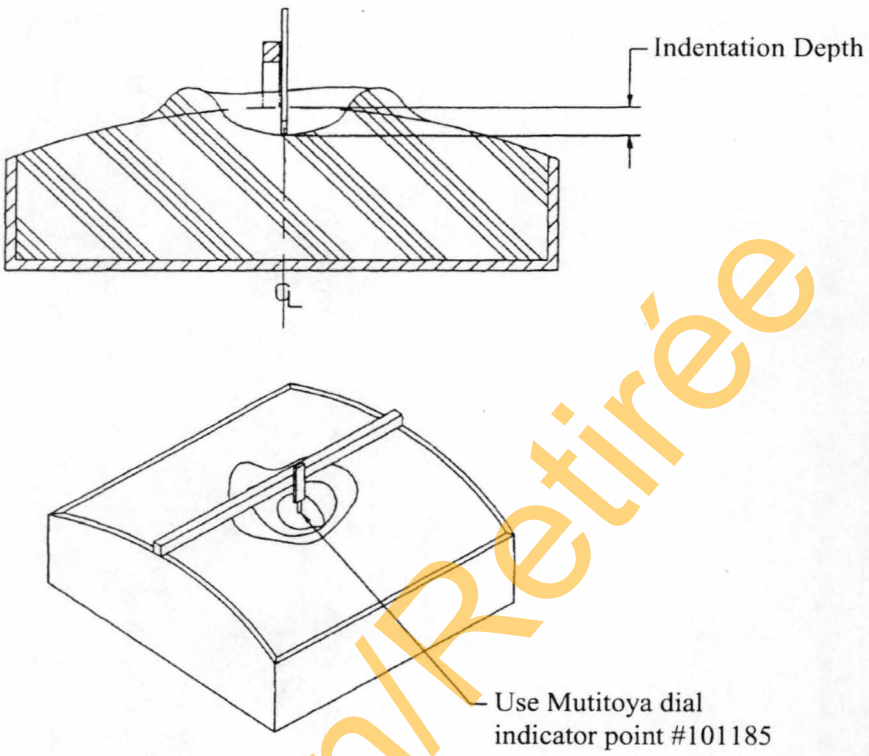


Withdrawn/Retirée

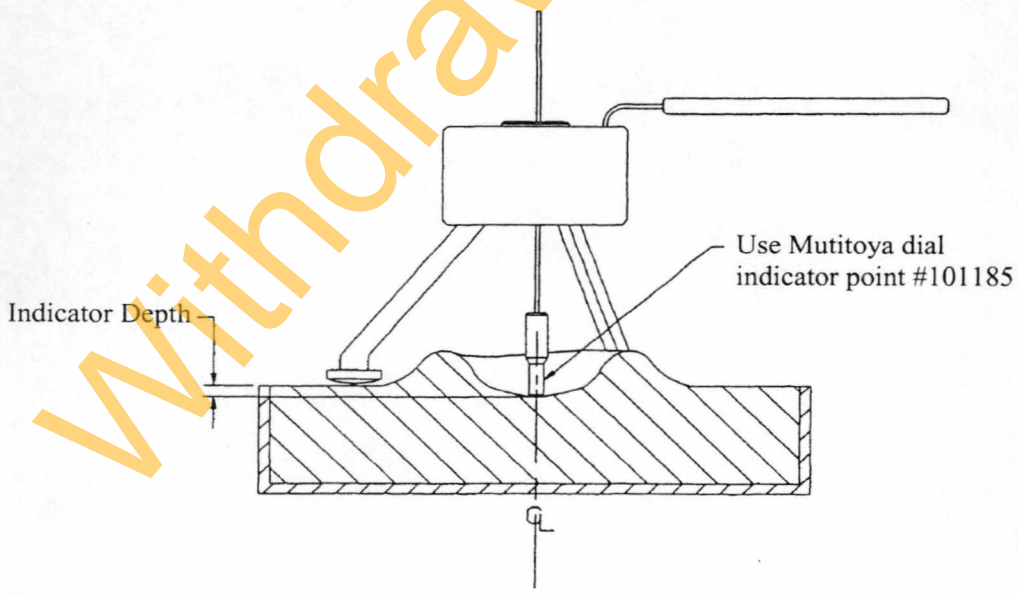
FIGURE 1

Angle of Impact
Viewed From Top of Block or Mannequin Including Test Specimen

Indentation Depth Measurement (Curved Block)



Indentation Depth Measurement (Flat Block)



Withdrawn/Retirée

FIGURE 2

Indentation Depth

	A
Handgun	5 m
Rifle	15 m

Ballistic Test Set-up #2

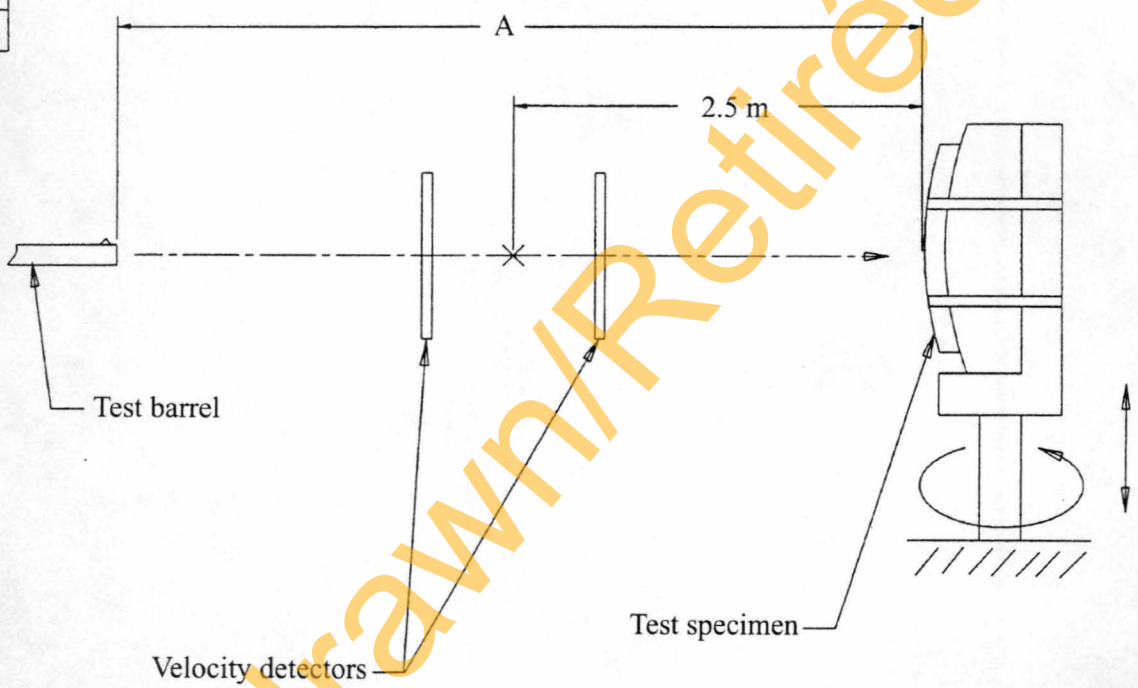
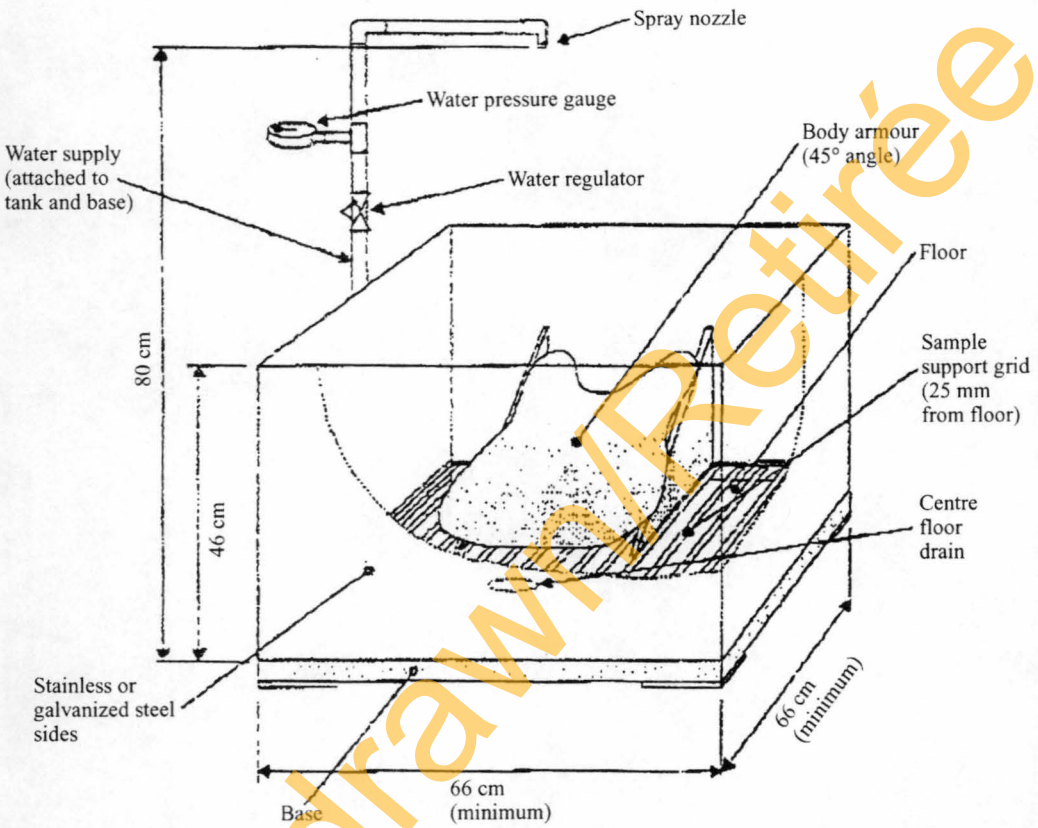


FIGURE 3
Ballistic Test Set-up

Withdrawn/Retirée



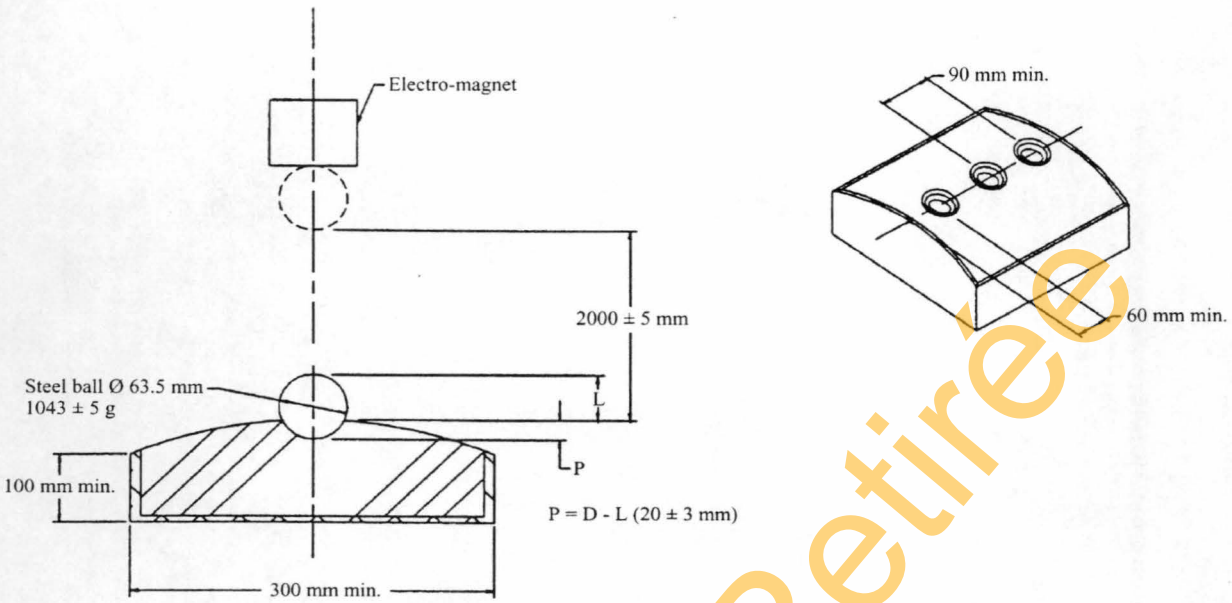
(Not to scale)

FIGURE 4

Spray Test Tank

Withdrawn/Retirée

Conditioning/Calibration (Curved Block)



Conditioning/Calibration (Flat Block)

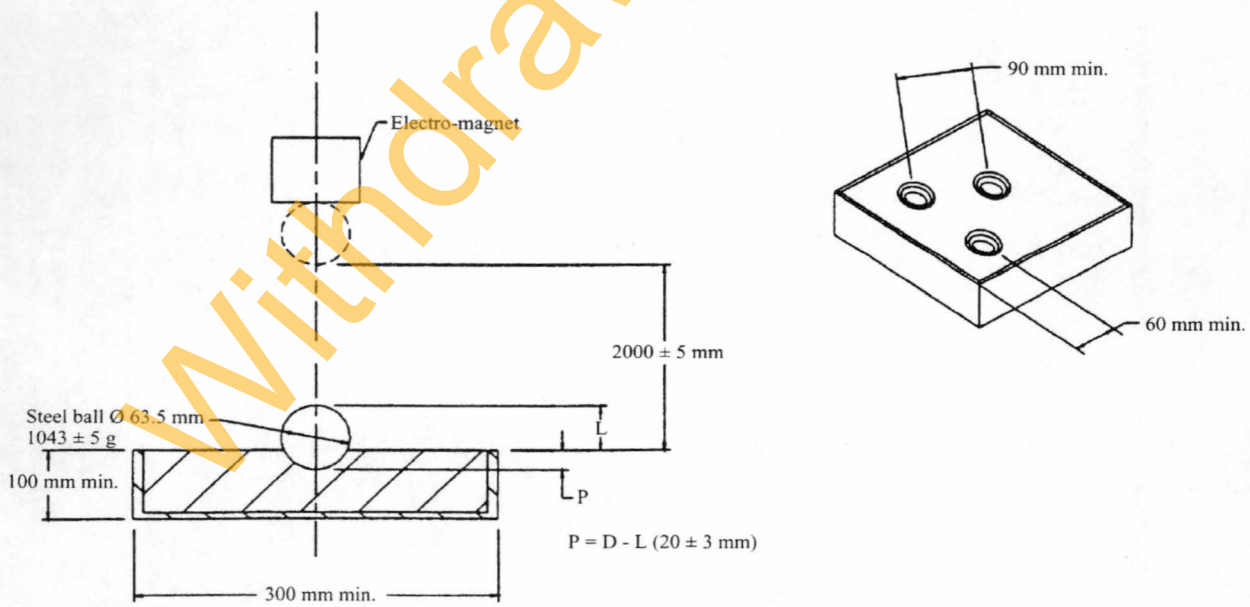
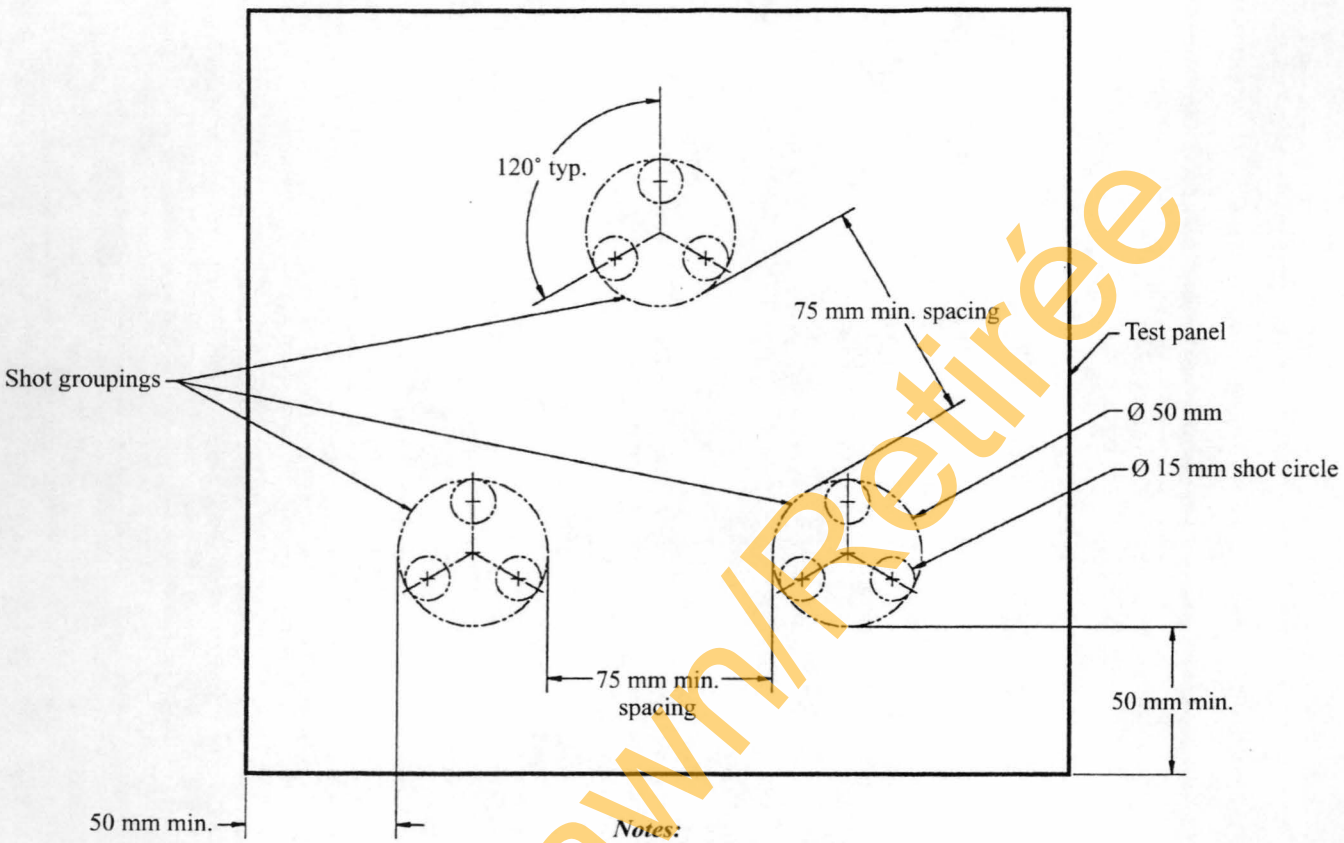


FIGURE 5

Calibration of Test Block

Withdrawn/Retirée

Rapid Fire Multi-shot Grouping



Notes:
(1) Shot within 15 mm *circle*
(2) Group consists of 3 shots within 50 mm *circle*
(3) Group to group minimum distance = 75 mm
(4) Minimum distance from group to edge of panel = 50 mm

FIGURE 6

Rapid Fire Multi-shot Grouping

Withdrawn/Retirée

PROTECTION RATINGS, TESTS, THREAT DESCRIPTIONS AND REQUIREMENTS FOR PERSONAL BODY ARMOUR

(This Appendix forms a mandatory part of the standard.
Also refer to section 4 and par. 9.1 of this standard.)

A1. This standard describes four PROTECTION RATINGS, each with a corresponding THREAT DESCRIPTION. Two of the protection ratings have complete threat descriptions: the duty handgun and the duty submachine gun.

As a minimum, the requirements for the duty handgun PROTECTION RATING are required by this standard. The remaining three protection ratings are specified by the user (optional) (for example, a customer agency such as a police department, etc.). Two protection ratings, identified by the modifiers USER-SPECIFIED, enable users to have armour custom manufactured to meet very specific higher threat levels that the user identifies as a THREAT DESCRIPTION. The specifically made armour can be then tested and certified in accordance with this standard.

The four protection ratings are as follows:

— Duty handgun

— User-specified handgun

— Duty submachine gun

— User-specified submachine gun.

A1.1 The protection ratings and their corresponding threat descriptions, with a summary of the tests and the requirements are shown in Table A1.

Withdrawn/Retired

TABLE A1

Protection Ratings, Tests, Threat Descriptions and Requirements for Personal Body Armour (Note 1)

Protection Rating (Note 2)	Applicable Test	Test Method Reference	Threat Description	Requirement
Duty Handgun (Mandatory)	**Test Method #1 — Repetitive Single Shot V_{pass} (V_p)** — mandatory	Par. 5.1.1	**First Test Round (Note 3)** — .357 Magnum jacketed soft point, minimum/maximum velocity 425 – 440 m/s (1394 – 1444 ft/s) maximum rifling twist length 476 mm (≤1:18 in) — 158 ± 2 gr bullet mass (10.23 g)	**V_{pass} (V_p)** — no perforation for fair shots — the mean indentation depth shall not exceed 44 mm with no individual results exceeding 50 mm
Duty Handgun (Optional)	**Test Method #2 — Repetitive Single Shot V_{50}** — mandatory if specified	Par. 5.1.2	**Second Test Round (Note 3)** — 9 × 19 mm, full metal jacket, minimum/maximum velocity 358 – 373 m/s (1174 – 1224 ft/s), maximum rifling twist length 250 mm (≤1:10 in) — 124 ± 2 gr bullet mass (8.03 g)	**V_{50}** — shall meet the requirements as specified by the user
User-specified Handgun (Optional)	**Test Method #1 — Repetitive Single Shot V_{pass} (V_p)** — mandatory	Par. 5.1.1	Same as specified for the Duty Handgun including, in addition, user-specified test rounds with higher threat level.	**V_{pass} (V_p)** — no perforation for fair shots — the mean indentation depth shall not exceed 44 mm with no individual results exceeding 50 mm
	Test Method #2 — Repetitive Single Shot V_{50} — mandatory if specified	Par. 5.1.2		**V_{50}** — shall meet the requirements as specified by the user

Note 1: *Refer also to Section 4 of this standard for requirements and to Section 5 for testing.*

Note 2: *As a minimum, the test specimen, regardless of the protection rating, shall meet the V_{pass} (V_p) requirements for the Duty Handgun when tested against the duty handgun threat descriptions. Additional protection ratings and threat descriptions as described in this Appendix may be specified by the user. When specified by the user, the test specimen shall also meet one or more of the requirements for V_{pass} (V_p) for the User-specified Handgun, the V_{50} for the Duty Handgun, the V_{50} for the User-specified Handgun, the rapid fire multihit V_{pass} (V_p) for the Duty Submachine Gun or the rapid fire multihit V_{pass} (V_p) for the User-specified Submachine Gun. When specified by the user, the test specimen shall also meet the requirements of the Water Immersion Test.*

Note 3: *All test round ammunition shall use standard commercial projectiles (bullet) with typical gilding metal (copper-zinc alloy) jackets (envelope) and lead alloy cores without special hardening or softening features. Ammunition manufacturers may be requested to provide specifications on test round ammunition. Test round ammunition may have to be hand loaded in order to obtain required test velocities. Care must be taken when hand loading to ensure that the maximum safe chamber pressures of the test weapon are not exceeded.*

Note 4: *A Heckler and Koch 9 mm submachine gun, model number MP-5, capable of three-round burst or fully automatic, with a rate of fire of 800 ± 50 rounds per minute, has been found suitable.*

Withdrawn/Retirée

TABLE A1 (con't)

Protection Ratings, Tests, Threat Descriptions and Requirements for Personal Body Armour (Note 1)

Protection Rating (Note 2)	Applicable Test	Test Method Reference	Threat Description	Requirement
Duty Submachine Gun (Optional)	**Test Method #3 — Rapid Fire Multihit V_{pass} (V_p)** — mandatory	Par. 5.1.3	Rapid fire using a 9 mm test round specified for the duty handgun, with an increased velocity of 396 – 427 m/s (1299 – 1401 ft/s) with a nominal rate of fire at 800 ± 50 rounds per minute with the shots grouped in a maximum 5 cm diameter area plus a minimum spread of 5 cm. (Note 4)	**Multihit** — no perforation for fair shots — the indentation depth shall be as specified by the user and may not be a requirement — the test specimen shall be capable of stopping three-round bursts of the specified ammunition fired at the test specimen such that the maximum spread of the impacted bullets does not exceed 10 cm
User-specified Submachine Gun (Optional)	**Test Method #3 — Rapid Fire Multihit V_{pass} (V_p)** — mandatory	Par. 5.1.3	Same as described for the duty submachine gun, with a user-specified increase in threat. (Higher velocity or firing rate and/or more penetrating round)	**Multihit** — the indentation depth shall be as specified by the user and may not be a requirement — the test specimen shall be capable of stopping three-round bursts of the specified ammunition fired at the test specimen such that the maximum spread of the impacted bullets does not exceed 10 cm

Note 1: *Refer also to Section 4 of this standard for requirements and to Section 5 for testing.*

Note 2: *As a minimum, the test specimen, regardless of the protection rating, shall meet the V_{pass} (V_p) requirements for the Duty Handgun when tested against the duty handgun threat descriptions. Additional protection ratings and threat descriptions as described in this Appendix may be specified by the user. When specified by the user, the test specimen shall also meet one or more of the requirements for V_{pass} (V_p) for the User-specified Handgun, the V_{50} for the Duty Handgun, the V_{50} for the User-specified Handgun, the rapid fire multihit V_{pass} (V_p) for the Duty Submachine Gun or the rapid fire multihit V_{pass} (V_p) for the User-specified Submachine Gun. When specified by the user, the test specimen shall also meet the requirements of the Water Immersion Test.*

Note 3: *All test round ammunition shall use standard commercial projectiles (bullet) with typical gilding metal (copper-zinc alloy) jackets (envelope) and lead alloy cores without special hardening or softening features. Ammunition manufacturers may be requested to provide specifications on test round ammunition. Test round ammunition may have to be hand loaded in order to obtain required test velocities. Care must be taken when hand loading to ensure that the maximum safe chamber pressures of the test weapon are not exceeded.*

Note 4: *A Heckler and Koch* 9 mm *submachine gun, model number MP-5, capable of three-round burst or fully automatic, with a rate of fire of 800 ± 50 rounds per minute, has been found suitable.*

Withdrawn/Retirée

MANNEQUIN TEST SET UP

(This appendix forms a mandatory part of this standard.
Also refer to par. 5.1.1.1, 5.1.2.1 or 5.1.3.1, depending on the test)

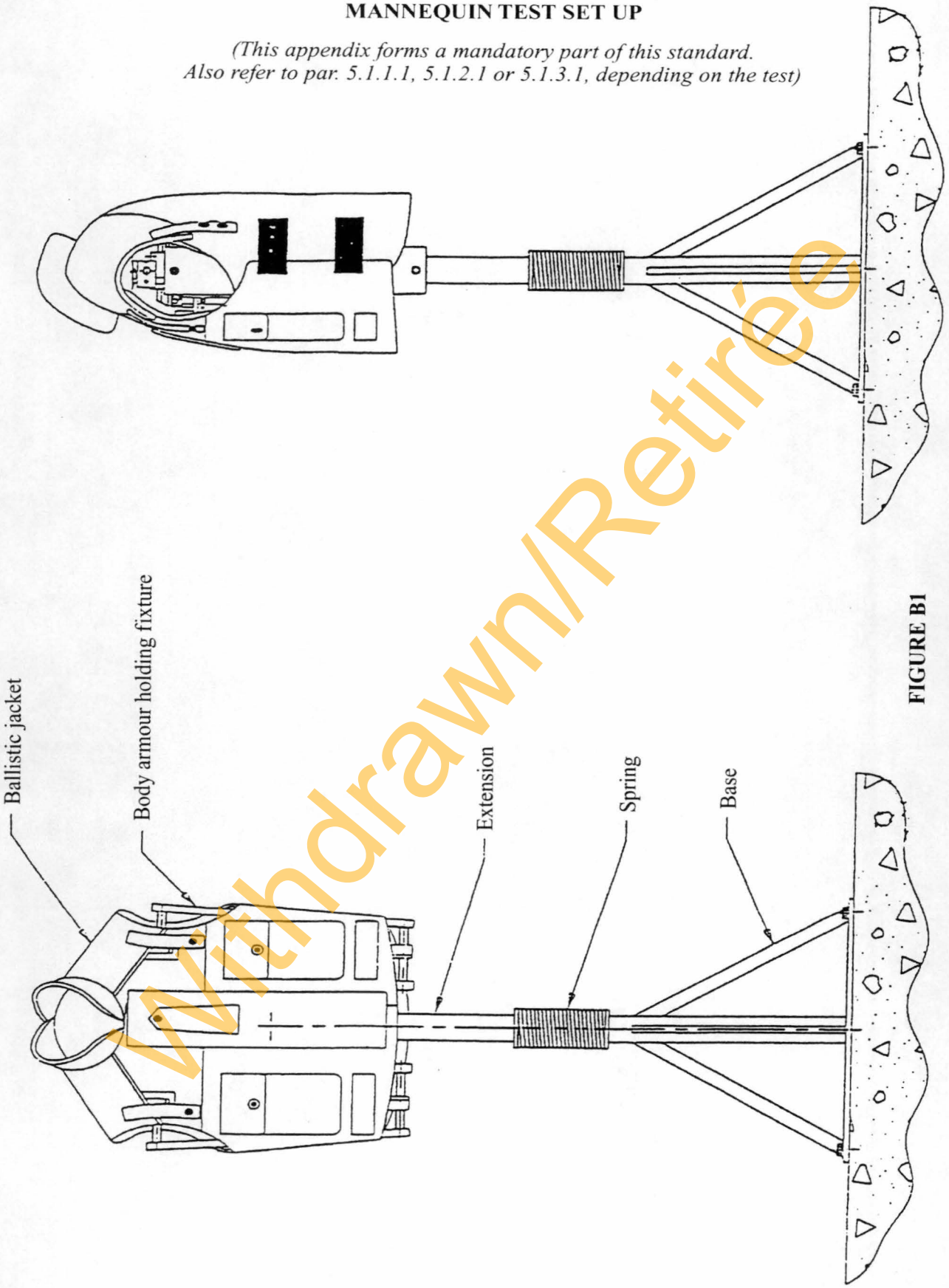


FIGURE B1
Mannequin Test Set-up

Withdrawn/Retirée

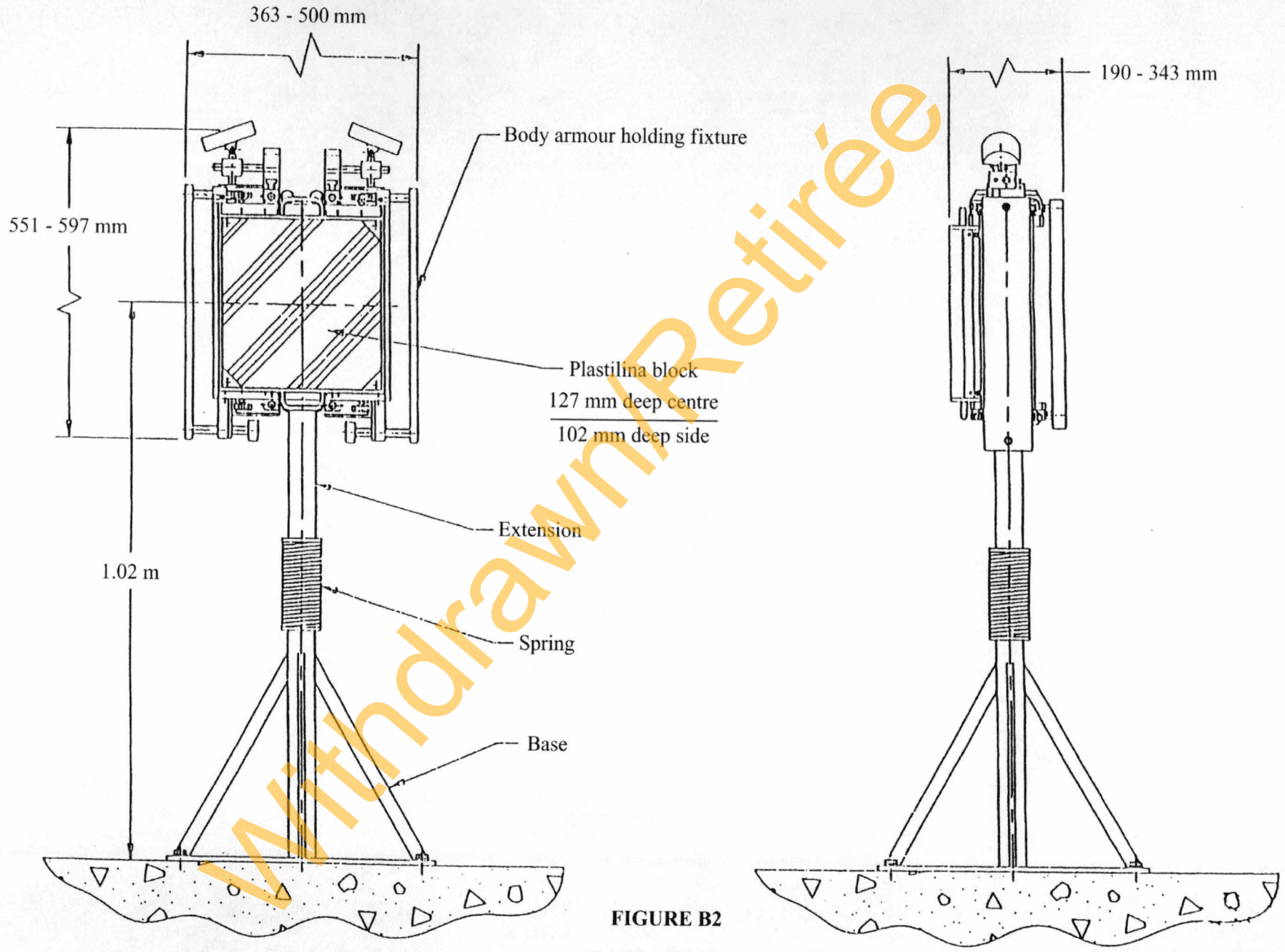


FIGURE B2

Test Block Set-up

Withdrawn/Retirée

(This appendix does not form a mandatory part of this standard. Also refer to section 7 of this standard.)

Test Report Form C1

Date of Test:	Operator:
Name of Laboratory:	Laboratory Accreditation:
Number of Standard: CAN/CGSB-179.1-2001	

Test specimen (par. 7.2)	
Manufacturer:	
Lot #:	Date of Manufacture:
Manufacturer's Specifications:	
Part Tested:	

Protection Rating (par. 7.2.1)	
Duty Handgun	Duty Submachine Gun
User-specified Handgun	User-specified Submachine Gun

Threat Description/Ammunition Description (par. 7.2.2)	
Ammunition Used:	Type:
Manufacturer:	Lot #:
Calibre:	Mass:

Test Method and Conditions			
Test Method Used (par. 7.2.3)	Method 1	Method 2	Method 3
Type of Test (par. 7.2.4)	Dry	Wet (spray)	Water Immersion
Temperature/Humidity (par. 7.2.5)	Temp (°C)	Relative Humidity (%)	
Apparatus Used (par. 7.2.6)	Block / Mannequin		
Test Range (m) (par. 7.2.7)			
Temperature of Backing (par. 7.2.8)	Before Test:	Intervals:	After Test:
Shots (par. 7.2.9)	Number:	Angle:	

Note: The numbers in brackets correspond to the paragraph number in section 7 of the standard.

Withdrawn/Retirée

Test Report Form C2

Test Results							
Shot #	Velocity (m/s) (par. 7.2.10)	Angle of Incidence (par. 7.2.10)	Penetration (Y/N) (par. 7.2.10)	Depth of Indentation of 0° shots min./max. (mm) (par. 7.2.11)	Separation from nearest edge or other hit (mm)	Fair Shot (Y/N)	Comments Pass/Fail
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
				Average			

Withdrawn/Retirée

Test Report Form C3

V_{50} Test Results (par. 7.2.12)				**Suspected Weak Area Results** (par. 7.1.13)
Shots Used (min. 6)	Velocity (m/s)	Penetration (Y/N)	Comments	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Highest Velocity (par. 5.1.2.3 e.)				
Lowest Velocity (par. 5.1.2.3 e.)				
Difference				
Mean				

Withdrawn/Retirée

Backing Material Calibration Report Form C4

(Refer to par. 5.1.1.2 b. i., 5.1.2.2 b. i. and 5.1.3.2 b. i. of this standard.)

1. Backing Material's Drop Test Result — Prior to Shooting

Date:	Drop Weight (g):
Time:	Drop Height (cm):
Temperature of Backing Material (°C):	Indentation Depth: 20 ± 3 mm

Indentation Depth	Distance from indentation centre to any edge (must be ≥60 mm)	Distance between any indentation centre (must be ≥90 mm)
1.		
2.		
3.		

2. Backing Material's Drop Test Result — After Completion of Shooting

Date:	Drop Weight (g):
Heure:	Drop Height (cm):
Temperature of Backing Material (°C):	Indentation Depth: 20 ± 3 mm

Indentation Depth	Distance from indentation centre to any edge (must be ≥60 mm)	Distance between any indentation centre (must be ≥90 mm)
1.		
2.		
3.		

Withdrawn/Retirée

SAMPLE LABELS AND LABEL INSPECTION CHECKLIST

(This appendix does not form a mandatory part of this standard.)

Label D1 — Sample Label for Bullet-Resistant Panels (par. 8.2.1)

****THIS PANEL HAS A LOWER PROTECTION RATING IN SOME AREAS**

This armour construction meets the requirements of CAN/CGSB-179.1,

Protection Rating: Duty Handgun

Tested against the following test rounds:
.357 Magnum, 158 grain, JSP* at 425 – 440 m/s (1394 – 1444 ft/s)
9 mm, 124 grain, FMJ* at 358 – 373 m/s (1174 – 1224 ft/s)
*JSP, jacketed soft point, *FMJ full-metal jacket

Model: XXXXXXXXX — (manufacturer's model and style designation)
Area of Coverage: XX sq. cm (sq. inches) — (area of rated ballistic coverage as above)
Size: XXXX
Code: XXXXXX — (manufacturer's code XXXXX)
Date of Manufacture: xx/xx/xx **Date of Issue:** xx/xx/xx
Serial number: XXXXX — (manufacturer's traceable identification number or code)
Manufactured by: XXXXXXXXXXXXXXXXXXXXX
Address: Street and Number, City, Province
Address: Postal Code and Country
Reseller of Armour: XXXXXXXXXXXXXXXXXX — (Name or Brand)
Address: Street and Number, City, Province
Address: Postal Code and Country

FOR PROPER BULLET PROTECTION, REPLACEMENT PANELS AND CARRIERS SHALL MEET THE MANUFACTURER'S SPECIFICATONS IN ALL RESPECTS.

DO NOT PLACE HARD OBJECTS BETWEEN THE BODY AND THE BACK FACE OF THE ARMOUR

Notes:
** — *(if applicable)*

Withdrawn/Retirée

THE USER SHOULD LOOK AT THE BULLET-RESISTANT PANELS INSTALLED IN THIS CARRIER TO

1. INSURE THAT THE BULLET-RESISTANT PANELS ARE RATED FOR THIS CARRIER

2. DETERMINE THE RATING OF PROTECTION AFFORDED BY THIS SYSTEM

Protection Rating: Duty Handgun
Tested against the following test rounds:
.357 Magnum, 158 grain, JSP* at 425 – 440 m/s (1394 – 1444 ft/s)
9 mm, 124 grain, FMJ* at 358 – 373 m/s (1174 – 1224 ft/s)
*JSP, jacketed soft point, *FMJ full-metal jacket

Manufactured by: XXXXXXXXXXXXXXXXXXXXX
Address: Street and Number, City, Province
Address: Postal Code and Country
Reseller of Armour: XXXXXXXXXXXXXXXXXX — (Name or Brand)
Address: Street and Number, City, Province
Address: Postal Code and Country
Size: XXXX **Date of Issue:** xx/xx/xx
Model: XXXXXXXXX — (manufacturer's model and style designation)
Care Instructions: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

GARMENT PROVIDES NO BULLET PROTECTION WITHOUT BULLET-RESISTANT PANELS

Withdrawn/Retirée

Label Inspection Checklist

		Acceptable	Unacceptable	Included	Not Included
1)	Manufacturer's Name	☐	☐	☐	☐
2)	Manufacturer's Address	☐	☐	☐	☐
3)	Carrier Name	☐	☐	☐	☐
4)	Panel Series Number	☐	☐	☐	☐
5)	Model Number	☐	☐	☐	☐
6)	Area of Coverage (cm^2 or in^2)	☐	☐	☐	☐
7)	Lot Number	☐	☐	☐	☐
8)	Size	☐	☐	☐	☐
9)	Style	☐	☐	☐	☐
10)	Date of Manufacture (Y/M/D)	☐	☐	☐	☐
11)	Protection Rating	☐	☐	☐	☐
12)	Number of Layers	☐	☐	☐	☐
13)	ISO Registration (Y/M/D)	☐	☐	☐	☐
14)	ISO Serial Number and Logo	☐	☐	☐	☐
15)	Wear Face (Strike Face)	☐	☐	☐	☐
16)	Hard Object Warning (Hazard)	☐	☐	☐	☐
17)	Care Instructions	☐	☐	☐	☐
18)	Neck and Groin Protection Labels	☐	☐	☐	☐
19)	Legibility of Label	☐	☐	☐	☐
20	Copy of Label for Records	☐	☐	☐	☐

21) Inspector's Name

_____

22) Test Agency

_____

Withdrawn/Retirée

Liste de vérification pour étiquettes

		Acceptable	Non acceptable	Inclus	Non inclus
1)	Nom du fabricant	☐	☐	☐	☐
2)	Adresse du fabricant	☐	☐	☐	☐
3)	Identification du matériel de soutien	☐	☐	☐	☐
4)	Numéro de série des panneaux	☐	☐	☐	☐
5)	Numéro de modèle	☐	☐	☐	☐
6)	Aire de couverture (cm^2 ou in^2)	☐	☐	☐	☐
7)	Numéro de lot	☐	☐	☐	☐
8)	Taille	☐	☐	☐	☐
9)	Style	☐	☐	☐	☐
10)	Date de fabrication (A/M/J)	☐	☐	☐	☐
11)	Classe de protection	☐	☐	☐	☐
12)	Nombre d'épaisseurs	☐	☐	☐	☐
13)	Enregistrement ISO (A/M/J)	☐	☐	☐	☐
14)	Numéro de série et Logo ISO	☐	☐	☐	☐
15)	Surface d'usure (Surface de frappe)	☐	☐	☐	☐
16)	Avertissement — Objets durs (Dangers)	☐	☐	☐	☐
17)	Instructions d'entretien	☐	☐	☐	☐
18)	Étiquettes — Protection cou et aine	☐	☐	☐	☐
19)	Lisibilité de l'étiquette	☐	☐	☐	☐
20	Copie de l'étiquette pour les dossiers	☐	☐	☐	☐
21)	Nom de l'inspecteur				

22) Organisme d'essai

Withdrawn/Retirée

L'UTILISATEUR DOIT REGARDER LES PANNEAUX PARE-BALLES RETENUS PAR LE MATÉRIEL DE SOUTIEN POUR:

1. S'ASSURER QUE LES PANNEAUX CONVIENNENT AU MATÉRIEL DE SOUTIEN

2. DÉTERMINER LA CLASSE DE PROTECTION OFFERTE PAR LE SYSTÈME

Classe de protection: Pistolet de service
Mis à l'essai avec les munitions suivantes:
balle .357 Magnum, 158 grains, JSP* à 425 – 440 m/s (1394 – 1444 pi/s)
balle 9 mm, 124 grains, FMJ* à 358 – 373 m/s (1174 – 1224 pi/s)
*JSP, balle semi-blindée, *FMJ, balle blindée

Fabriqué par: XXXXXXXXXXXXXXXXXXXXX
Adresse: rue et numéro, ville, province
Adresse: code postal et pays
Revendeur du gilet: XXXXXXXXXXXXXXXXXX — (nom ou marque)
Adresse: rue et numéro, ville, province
Adresse: code postal et pays
Taille: XXXX **Date d'émission:** xx/xx/xx
Modèle: XXXXXXXXX — (modèle du fabricant et désignation de style)
Instructions d'entretien: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

LE VÊTEMENT NE FOURNIT AUCUNE PROTECTION BALISTIQUE SANS LES PANNEAUX PARE-BALLES

Withdrawn/Retirée

EXEMPLES D'ÉTIQUETTES ET LISTE DE VÉRIFICATION POUR ÉTIQUETTES

(La présente annexe ne constitue pas une partie obligatoire de la norme)

Étiquette D1 — Exemple d'étiquette pour les panneaux pare-balles (al. 8.2.1)

****CE PANNEAU A UNE CLASSE DE PROTECTION INFÉRIEURE À CERTAINS ENDROITS**

Ce gilet respecte les exigences de la norme CAN/CGSB 179.1,
Classe de protection: Pistolet de service
Mis à l'essai avec les munitions suivantes:
balle .357 Magnum, 158 grains, JSP* à 425 – 440 m/s (1394 – 1444 pi/s)
balle 9 mm, 124 grains, FMJ* à 358 – 373 m/s (1174 – 1224 pi/s)
*JSP, balle semi-blindée, *FMJ, balle blindée

Modèle: XXXXXXXXX — (modèle du fabricant et désignation de style)
Aire de couverture: XX cm carrés (po carrés) — (aire de couverture balistique nominale selon indications ci-dessus)
Taille: XXXX
Code: XXXXXX — (code du fabricant XXXXX)
Date de fabrication: xx/xx/xx **Date d'émission:** xx/xx/xx
Numéro de série: XXXXX — (numéro ou code d'identification du fabricant retraçable)
Fabriqué par: XXXXXXXXXXXXXXXXXXXXXX
Adresse: rue et numéro, ville, province
Adresse: code postal et pays
Revendeur du gilet: XXXXXXXXXXXXXXXXXXX — (nom ou marque)
Adresse: rue et numéro, ville, province
Adresse: code postal et pays

POUR UNE PROTECTION ADÉQUATE CONTRE LES BALLES, LES PANNEAUX DE REMPLACEMENT ET LE MATÉRIEL DE SOUTIEN DOIVENT RESPECTER TOUTES LES SPÉCIFICATIONS DU FABRICANT.

NE PAS METTRE D'OBJETS DURS ENTRE LE CORPS ET LA SURFACE ARRIÈRE DU GILET

Remarques:
** — *(le cas échéant)*

Withdrawn/Retirée

Formulaire de rapport sur l'étalonnage du matériau de renforcement C4

(Voir al. 5.1.1.2 b. i., 5.1.2.2 b. i. et 5.1.3.2 b. i. de la présente norme.)

1. Résultat de l'essai de chute du matériau de renforcement — Avant le tir

Date:	Masse tombante (g):
Heure:	Hauteur de chute (cm):
Température du matériau de renforcement (°C):	Profondeur de pénétration: 20 ± 3 mm

Profondeur de pénétration	Distance entre un centre de pénétration et tout bord (doit être ≥60 mm)	Distance entre deux centres de pénétration (doit être ≥90 mm)
1.		
2.		
3.		

2. Résultat de l'essai de chute du matériau de renforcement — Après le tir

Date:	Masse tombante (g):
Heure:	Hauteur de chute (cm):
Température du matériau de renforcement (°C):	Profondeur de pénétration: 20 ± 3 mm

Profondeur de pénétration	Distance entre un centre de pénétration et tout bord (doit être ≥60 mm)	Distance entre deux centres de pénétration (doit être ≥90 mm)
1.		
2.		
3.		

Withdrawn/Retirée

Formulaire de rapport d'essai C3

Résultats de l'essai à V_{50} (al. 7.2.12)				**Résultats — Points faibles possibles** (al. 7.1.13)
Tirs utilisés (min. 6)	Vitesse (m/s)	Pénétration (O/N)	Commentaires	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Vitesse la plus élevée (al. 5.1.2.3 e.)				
Vitesse la moins élevée (al. 5.1.2.3 e.)				
Différence				
Moyenne				

Withdrawn/Retirée

Formulaire de rapport d'essai C2

Résultats de l'essai							
Tir nº	Vitesse (m/s) (al. 7.2.10)	Angle d'incidence (al. 7.2.10)	Pénétration (O/N) (al. 7.2.10)	Profondeur de pénétration des tirs à angle de 0° min./max. (mm) (al. 7.2.11)	Séparation du bord le plus près ou d'un autre point d'impact (mm)	Tir correct (O/N)	Commentaires Acceptation/Rejet
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
				Moyenne			

Withdrawn/Retirée

Formulaire de rapport d'essai C1

Date de l'essai:	Opérateur:
Nom du laboratoire:	Accréditation du laboratoire:
Numéro de la norme: CAN/CGSB-179.1-2001	

Spécimen d'essai (par. 7.2)	
Fabricant:	
N° de lot:	Date de fabrication:
Spécifications du fabricant:	
Partie mise à l'essai:	

Classe de protection (al. 7.2.1)	
Pistolet de service	Mitraillette de service
Pistolet précisé par l'utilisateur	Mitraillette précisée par l'utilisateur

Menace désignée/Description des munitions (al. 7.2.2)	
Munitions utilisées:	Type:
Fabricant:	N° de lot:
Calibre:	Masse:

Méthode d'essai et conditions			
Méthode d'essai utilisée (al. 7.2.3)	Méthode 1	Méthode 2	Méthode 3
Type d'essai (al. 7.2.4)	À sec	Au mouillé par pulvériation	D'immersion dans l'eau
Température/Humidité (al. 7.2.5)	Température (°C)	Humidité relative (%)	
Appareillage utilisé (al. 7.2.6)	Bloc	Mannequin	
Distance d'essai (m) (al. 7.2.7)			
Température du matériau de renforcement (al. 7.2.8)	Avant essai:	Intervalles:	Après essai:
Tirs (al. 7.2.9)	Nombre:	Angle:	

Remarque: *Les numéros entre parenthèses correspondent aux numéros d'alinéa de la section 7 de la norme.*

Withdrawn/Retirée

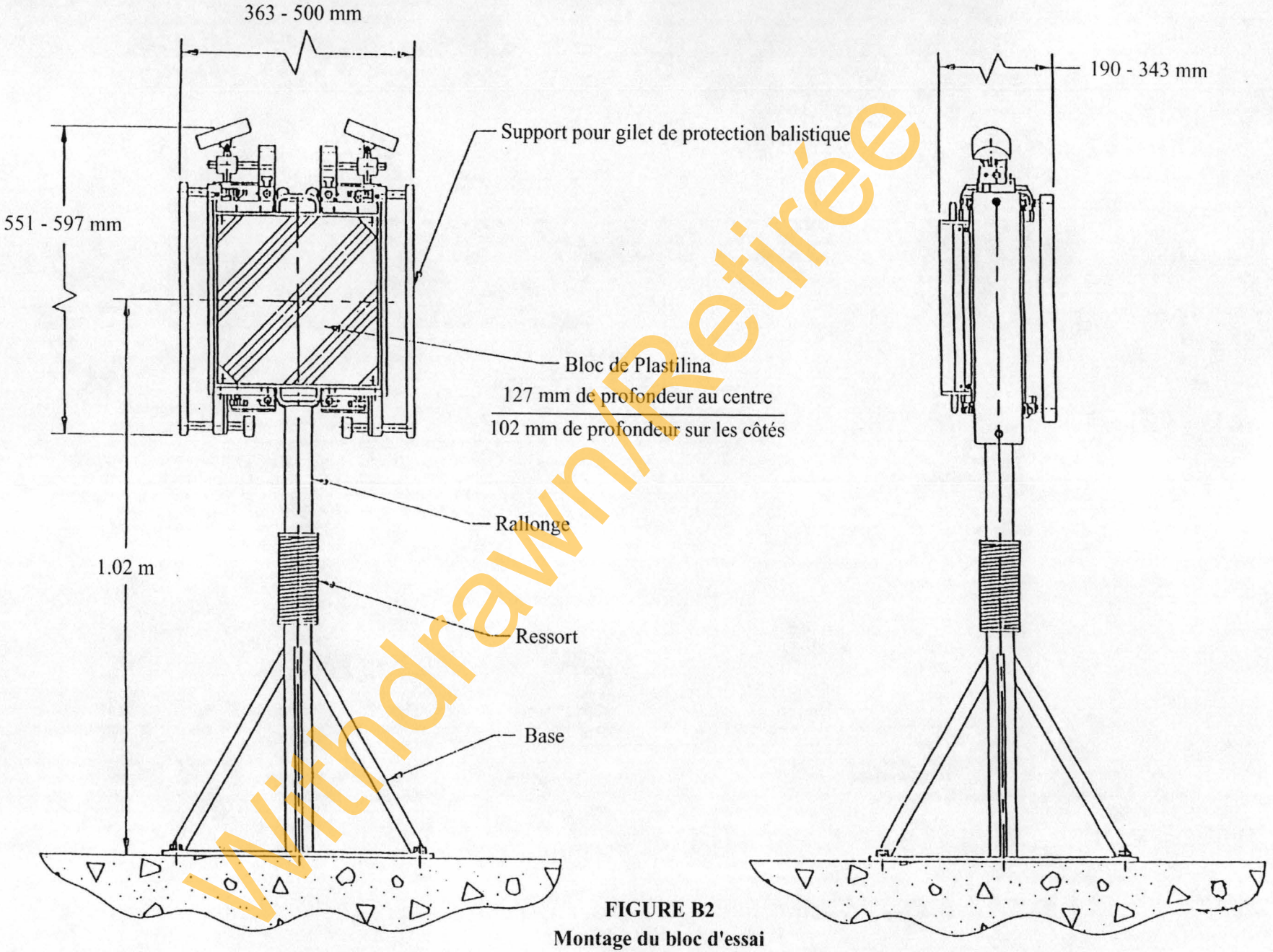


FIGURE B2
Montage du bloc d'essai

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