



H.P. WHITE LABORATORY, INC.

TEST PROCEDURE

BULLET RESISTANT HELMET

HPW-TP-0401.01B

October 1995

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LIST OF REVISIONS

Revision	Dated	Revisions
0401.01	January 1996	-NA-
0401.01A	February 1995	<p>-Editorial revisions throughout removing all back-face deformation criteria, replacing it with relative back-face deformation assessments.</p> <p>-Increased the number of back-face deformation shots from 4 per caliber to 5 and editorial revisions throughout reflecting that change.</p> <p>-Revisions of Figures 01 and 02 to accommodate crown, deformation shot.</p>
0401.01A	October 1995	<p>-Changed "Design Certification" to "Design Compliance" to eliminate implication of a "Certification" program or certifying authority.</p> <p>-Made the mandatory shot on suspension system fastener, last in shot sequence of any helmet sample to minimize possible disruption of suspension system prior to completion of test, thereby eliminating the need for additional sample(s).</p> <p>-Editorial revisions clarifying mounting of helmet designs with size adjustable, suspension systems.</p> <p>-Editorial revision to reaffirm deformation data recorded during deformation test portion is for information only and devoid of pass/fail criteria.</p> <p>-Revised Figures 01 and 02.</p> <p>-Addition of "List of Revision" (this sheet).</p> <p>-Grammatical corrections.</p> <p>-Changed velocity screen positions.</p>
	November 2000	<p>-Changes to Headform Drawing for Clarity Only.</p>

1.0 BACKGROUND

- 1.1 Helmets intended for use by law enforcement officers should provide some level of protection from a broad range of threats, including those incurred during high-speed pursuit, falls from motorcycles, assault with blunt instruments and bullet impacts. Such threats to the law enforcement officer differ from those of the military, whose principle concern is protection from fragmenting munitions. Military helmets, which are not intended to resist either bullet impacts or blunt trauma, are inappropriate for law enforcement usage.
- 1.2 Existing standards and test procedures intended to evaluate the ballistic protection limits of law enforcement helmets fall short of that goal. Critics of those standards object to their usage for one or both of two reasons:
 - 1.2.1 The testing setup, fixturing, and the testing procedure is prohibitively expensive, which tends to discourage testing of candidate helmets, inhibits the development and introduction of innovative changes or improvements to existing helmet designs. The most significant cost factor associated with existing standards is the measurement of the reaction (acceleration) of the human head. Evidence of this objection may be found in the conspicuous absence of testing to government helmet test standards existent since 1975.
 - 1.2.2 The Ballistic Resistance Testing portion of existing procedures measure the resistance of the helmet to bullet penetration, but do not measure the intrusion of the backface of the helmet into the protected area (blunt trauma). Results of Ballistic Resistance Testing of a broad range of helmets indicate that this deformation may be extreme and, perhaps, even lethal in nature.

2.0 SCOPE

- 2.1 The scope of this testing procedure is limited to evaluating the ballistic resistance of a helmet to penetration by bulleted ammunition **AND** the resistance of potentially lethal, backface intrusion of the helmet into the protected cavity as a result of non-penetrating bullet impacts.
 - 2.1.1 Specifically exempted from the scope of this procedure is any real or implied evaluation of the biomechanical threat, including head acceleration, associated with ballistic impacting of a helmet and any evaluation of the protection from that threat provided by the helmet assembly.

3.0 APPLICABILITY

- 3.1 This test procedure applies to helmets intended to resist the direct threats of ballistic impacts - bullet penetration and deformation of the helmet into the protected area.
- 3.2 This test procedure is **NOT** intended to evaluate the level of protection from collateral (biomechanical) effects of ballistic impacting, such as injuries to the brain or neck from accelerations of the helmet due to ballistic impact.
- 3.3 This test procedure is not intended to evaluate the level of protection provided by helmets impacted with other than ballistic projectiles, such as clubs or hand-thrown missiles, nor is this procedure intended to evaluate the protection from injuries due to decelerations from vehicular collisions, falls from vertical heights, or falls from moving vehicles.
- 3.4 While bullet resistant helmets **MAY** provide some level of protection from non-ballistic impacting and from the collateral, biomechanical injuries related to accelerations and decelerations of the head and helmet, no such protection is implied nor warranted by this test procedure. Concern for this type of protection should be evaluated using test methodologies and evaluation criteria specifically intended for that purpose.
- 3.5 The results of testing conducted in accordance with this procedure shall apply **ONLY** to the specific model of helmet tested (Paragraph 6.2). Any change in the construction of a helmet model certified as successfully complying with the requirements of this procedure, including - but not necessarily limited to - materials, configuration, suspension system, or hardware, shall require retesting of the revised model in accordance with the full range of the requirements of this procedure.

4.0 DISCUSSION

- 4.1 Requirements of this test procedure are voluntary in nature, but may be made mandatory by competent authorities responsible for supervising helmet procurements.
- 4.2 Ballistic and riot resistance evaluations of helmet face shields are not included in these procedures, but are evaluated by H.P. White Laboratory, Inc. test procedure HPW-TP-0402.00.
- 4.3 These test procedures are designed to evaluate the resistance of the helmet to ballistic penetration, and to provide objective baseline data with regard to backface deformation (blunt trauma). Ballistic deformation data derived during the "Backface Deformation" portion of this procedure are recorded to provide the user with information helpful in determining the **RELATIVE PERFORMANCE** of individual helmet designs and constructions. Inasmuch as no known definitive data exists which quantitatively establishes acceptable limits of the magnitude of cranial deformation, this procedure **DOES NOT** establish acceptable and unacceptable limits of helmet deformation performance.

4.4 To the maximum extent possible, this procedure relies on materials, techniques, and processes currently used in the testing of similar commodities.

4.4.1 The projectile types and velocities used to evaluate helmets are those used and recognized by the National Institute of Justice standard for evaluating body armor, NIJ-STD-0101, BALLISTIC RESISTANCE OF POLICE BODY ARMOR, dated April 1987.

4.4.2 The headform used by this procedure to evaluate the ballistic resistance of helmets is a modification of the headform specified by NIJ-STD-0106, BALLISTIC HELMETS, dated December 1981.

4.4.3 The materials and procedures used to evaluate the backface deformation of the helmets are the same as those used for evaluating the backface deformation of body armor when subjected to ballistic impact as specified by NIJ-STD-0101. This material medium determines the **MAXIMUM** backface deformation regardless of the tendency of the helmet material to recover to its original shape and orientation.

4.5 This test procedure is intended to:

4.5.1 Evaluate the bullet resistance of a helmet design to five spaced ballistic impacts, per caliber, based on the threat level the helmet is designed to protect against.

4.5.2 Provide objective data with respect to the deformation resistance of a helmet design, and its ability to resist backface deformation from five spaced ballistic impacts, per caliber, based on the threat level the helmet is designed to protect against.

4.5.3 Ensure the uniformity and consistency of the helmet construction.

4.6 This procedure is intended as a one-time evaluation of the protection inherent in a particular helmet configuration. This initial design compliance test shall be termed "**DESIGN COMPLIANCE**". Continued compliance testing of production units of a helmet design having previously satisfied the initial design compliance are left to the voluntary discretion of the manufacturer and/or the requirements established by procurement authorities. Compliance testing of production units to the requirements of this procedure shall be termed a "**PERFORMANCE ASSURANCE TEST**".

4.7 Inasmuch as non-invasive injuries to the head, neck, and back from accelerations related to ballistic impacting of the helmet are not related to the ballistic resistance of the helmet, nor can those effects be fairly attributed solely to the helmet, measurements of those dynamic effects are not included in this procedure.

5.0 APPLICABLE STANDARDS

- 5.1 The latest revisions of the following documents apply to the materials and procedures of this procedure:
- 5.1.1 ANSI/SAAMI Z299.1-1992, Voluntary Industry Performance Standards for Pressure and Velocity of Rimfire Sporting Ammunition for the use of Commercial Manufacturers.
 - 5.1.2 ANSI/SAAMI Z299.3-1993, Voluntary Industry Performance Standards for Pressure and Velocity of Centerfire Pistol and Revolver Ammunition for the use of Commercial Manufacturers.
 - 5.1.3 ANSI/SAAMI Z299.4-1992, Voluntary Industry Performance Standards for Pressure and Velocity of Centerfire Rifle Sporting Ammunition for the use of Commercial Manufacturers.
 - 5.1.4 ANSI/SAAMI Z299.2-1992, Voluntary Industry Performance Standards for Pressure and Velocity of Shotshell Ammunition for the use of Commercial Manufacturers.
 - 5.1.5 NIJ-STD-0101, Ballistic Resistance of Police Body Armor (latest revision).
 - 5.1.6 NIJ-STD-0106, Ballistic Helmets (latest revision)

6.0 GLOSSARY OF TERMS

- 6.1 **DEFORMATION** - Maximum depth of indentation of the clay backing material below its pre-test surface level.
- 6.2 **MODEL** - A specific design of helmet whose shape, materials, construction, or suspension system differ from any other helmet. (Note: Variations in shape to accommodate differing head sizes do not constitute a change in helmet model.)
- 6.3 **PENETRATION** - Any perforation of the witness panel through which the light from a 40 watt lamp is visible. In the absence of a witness panel during Deformation Testing, any bullet, bullet fragment, or SPALL from the helmet assembly which impacts the clay deformation medium shall be termed to have penetrated.
- 6.4 **SHOT, FAIR** - An unyawed projectile of the specified construction and specified velocity impacting at the specified angle of obliquity and intended shot impact location on the sample, also to include:
- 6.4.1 An otherwise fair shot, but yawed projectile, which produces a penetration shall be declared a fair shot.
 - 6.4.2 An otherwise fair shot, striking at a greater angle of obliquity than that specified which produces a penetration shall be declared a fair shot.
 - 6.4.3 An otherwise fair shot, striking at less than the specified velocity which produces a penetration shall be declared a fair shot.
 - 6.4.4 An otherwise fair shot, striking at velocities greater than the specified maximum velocity which **DOES NOT** penetrate shall be declared a fair shot.

- 6.5 **SHOT, UNFAIR** - Any of the following categories of shots shall be declared unfair and shall not be used in evaluating the test samples.
- 6.5.1 Any shot which penetrates at a velocity greater than the maximum specified.
 - 6.5.2 Any shot which does not penetrate at a velocity less than the minimum specified.
 - 6.5.3 Any shot which does not penetrate and is yawed more than 3 degrees.
 - 6.5.4 Any shot which does not penetrate whose striking angle of obliquity is more than 3 degrees.
 - 6.5.5 **WITH THE EXCEPTION OF THE REQUIRED SHOT TO A HELMET SUSPENSION SYSTEM FASTENER (SEE 9.2.4.1)**, any otherwise fair shot which penetrates a test sample by striking that sample within 1.5 inches of the edge of the sample (center of impact to edge) or within 3.0 inches of another shot (center-to-center of impacts)
 - 6.5.6 Any otherwise fair shot which penetrates a test sample that has been previously impacted with five or more prior shots.
- 6.6 **WITNESS PANEL** - A sheet of 0.020 inch thick, 2024T3 aluminum used in the bullet resistance test portion of this procedure to confirm or deny bullet penetration.

7.0 TEST SAMPLING

- 7.1 Helmets submitted for testing in accordance with this procedure shall be complete assemblies as offered for sale by the manufacturer, including, but not necessarily limited to, visors (if applicable), suspension systems, and manufacturer's markings. Unit and departmental logos and markings requested by the customer are exempted.
- 7.2 Four helmets of each design (model) shall constitute a ballistic sample for Threat Levels I, IIA, II and IIIA and two helmets of each design (model) shall constitute a ballistic sample for Threat Levels III and IV. An additional helmet should be included for contingencies.
- 7.3 The helmets, of the test sample, shall all be of a uniform size equivalent to a "7-1/4" hat size (head dimensions of 23-3/4 inch circumference, 6-15/16 inch width, and 8-3/8 inch length).

8.0 REQUIREMENTS

- 8.1 The **BALLISTIC PENETRATION RESISTANCE TEST** portion of this procedure requires that each of two helmets be subjected to a total of five fair ballistic impacts from one of the two calibers of ammunition specified by a ballistic protection threat level (i.e., front, back, left and right circumferential quadrants and crown). Two helmets, one for each of two calibers of ammunition representing each ballistic protection threat (Level I, IIA, II, IIIA) are required (see Table I). Each of the two helmets tested to a particular ballistic protection threat level (I, IIA, II, IIIA) must satisfy the testing requirements of Paragraph 9.2.
- 8.2 The **DEFORMATION RESISTANCE TEST** portion of this procedure requires that each of two helmets be subjected to a total of five ballistic impacts from one of the two calibers of ammunition specified by a ballistic protection threat level. The front, back, left and right circumferential quadrants and crown region on each of the two helmets (representing one threat level) shall be ballistically impacted. Resultant deformation (blunt trauma) for non-penetrating impacts shall be measured and recorded. Ballistic penetration shall constitute a failure. Deformation resistance testing shall be conducted in accordance with the requirements of Paragraph 9.3.
- 8.3 A separate helmet shall be used to conduct Penetration Tests with each caliber of threat, and a separate helmet of the sampling shall be used to conduct Deformation Tests with each caliber of threat.

9.0 TEST PROCEDURES

- 9.1 Unless otherwise specified, testing is to be conducted with test samples which have been thoroughly temperature conditioned at +70.0 (+ 5.0) degrees Fahrenheit for a minimum of 4.0 hours. Subsequent to temperature conditioning, the test samples shall be wet-conditioned, so that water spray is applied to the outer helmet shell only in accordance with the wet armor conditioning procedures of NIJ-STD-0101. Helmet samples will be tested in an environment with an ambient air temperature of +70.0 (+ 10.0) degrees Fahrenheit.

9.2 **HELMET PENETRATION TEST**

- 9.2.1 In preparation for these tests, five impact areas are to be marked on each helmet.

Crown- Six inch diameter circle centered about a point on the top of the helmet which intersects the coronal and sagittal centerline.

Front- 45 degrees on either side of the sagittal centerline extending from the crown marking to the lower edge.

Rear- 45 degrees on either side of the sagittal centerline extending from the crown marking to the lower edge.

Sides- The right and left side areas between the front and rear areas extending from the crown to the lower edge.

- 9.2.2 Position the appropriate (sagittal, coronal, or crown) 0.020 inch thick 2024T3 aluminum witness panel into the slots of the witness panel holder (Figure 2).

- 9.2.3 The helmet test samples shall be positioned on a rigidly mounted headform complying with Figure 1 at a distance of 16.5 feet from the muzzle of a test barrel to produce zero degree obliquity impacts. The manufacturer-installed strapping system and/or suspension system-and only that system - shall be used to affix the helmet to the headform. The strapping system shall be adjusted to insure a proper "snug" fitting on the headform. For adjustable helmet suspension systems, the test agency will adjust suspension system strapping to the **MAXIMUM** allowable extent so as to achieve the minimum distance and airspace between the suspension crown and the interior helmet shell surface. Velocity screens shall be positioned at 6.5 and 9.5 feet from the muzzle in order to compute bullet velocities 8.0 feet from the muzzle.
- 9.2.4 Fire one shot of the appropriate ballistic threat within each of the five required impact locations, subject only to the fair/unfair shot definitions of Paragraph 6.0, except that;
- 9.2.4.1 **THE LAST** of the five fair shots must be on, or in-line with a suspension system fastener. This is a mandatory requirements which preempts the unfair shot definition restricting the area within 1.5 inches of the edge of the helmet (Paragraph 6.5.5). This shot is **FIRED LAST TO ENSURE THE STRUCTURAL INTEGRITY OF THE HELMET SUSPENSION SYSTEM DURING TESTING.**
- 9.2.5 After each shot, the helmet shall be removed from the headform, the witness panel inspected and a determination of penetration made. Witness panels that indicate a penetration, and any loose material within the helmet cavity, shall be retained for future reference. The helmet strapping system shall also be inspected after each shot; however, no repairs, replacements, or adjustments beyond re-tightening of the chin strap shall be made.
- 9.2.5.1 Should the helmet be dismounted from the headform due to ballistic impacting, the occurrence shall be noted, the helmet remounted (limited only to the requirements of Paragraph 9.2.5), and testing continued without penalty.
- 9.2.6 The helmet shall then be remounted in accordance with Paragraph 9.2.3 in preparation for the next shot.
- 9.2.7 Additional shots within one or more of the defined locations may be necessitated as a result of the first shot being declared "unfair". Should one or more of those additional shots be declared a "penetration", those shots shall be declared "unfair" as well. If there has been no prior fair shot penetration, a penetration by a second shot at any location shall cause the testing of that helmet to be declared "inconclusive". Testing of any helmet declared "inconclusive" shall be repeated in its entirety with a new (untested) helmet of the same style, model, and size.
- 9.2.8 Data for all shots - fair and unfair - shall be reported, but only the first shot, in any impact area, shall be used to fail the design.
- 9.2.9 Once testing of a helmet sample has been initiated, testing shall continue until all required locations have been impacted, regardless of the pass/fail results of those shots.

9.3 HELMET DEFORMATION TEST

9.3.1 In preparation for these tests, the five impact areas are to be marked on each helmet.

Crown - Six inch diameter circle centered about a point on the top of the helmet which intersects the coronal and sagittal centerline.

Front- 45 degrees on either side of the sagittal centerline extending from the crown marking to the lower edge.

Rear- 45 degrees on either side of the sagittal centerline extending from the crown marking to the lower edge.

Sides- The right and left side areas between the front and rear areas extending from the crown to the lower edge.

9.3.2 The channels (slots) in both the coronal and sagittal planes (Figure 1) of the headform intended for use in the Deformation Testing shall be packed with Plastilina Number 1 modeling clay, ensuring there are no voids, cavities, or depressions in the final contoured assembly.

9.3.3 The clay filled headforms AND a 12 inch x 12 inch x 4 inch, wood framed drop verification sample of the clay shall be simultaneously temperature conditioned for a minimum for 4 hours. The conditioning temperature shall be adjusted as necessary to meet the clay medium conditioning requirements of Paragraph 9.3.4 and NIJ-STD-0101.03.

9.3.4 Prior to initiation of testing, the drop verification sample shall be drop tested to confirm its plasticity. A 2.2 pound, 1.75 inch diameter, steel cylinder with a hemispherical end shall be dropped from a vertical height of 78.7 inches to impact the clay surface at a zero degree obliquity, with its hemispherical end, at three locations whose center-to-center and center-to-edge of clay distance is not less than 3.0 inches. The depth of each of the three resultant depressions shall be 1.0 ± 0.1 inch (25 ± 3 mm).

9.3.5 The helmet test samples shall be positioned on a rigidly mounted clay-filled test headform complying with Figure 1 at a distance of 16.5 feet from the muzzle of a test barrel to produce zero degree obliquity impacts. The manufacturer-installed strapping system and/or suspension system - and only that system - shall be used to affix the helmet to the headform. The strapping system shall be adjusted to insure a proper "snug" fitting on the headform. For adjustable helmet suspension systems, the test agency will adjust suspension system strapping to the **MAXIMUM** allowable extent so as to achieve the minimum distance and airspace between the suspension crown and the interior helmet shell surface. Velocity screens shall be positioned at 6.5 and 9.5 feet from the muzzle in order to compute bullet velocities 8.0 feet from the muzzle.

9.3.6 Fire one shot of the appropriate ballistic threat within each of the five required impact locations, subject only to the fair/unfair shot definitions of Paragraph 6.0.

9.3.7 After each shot, the helmet shall be removed from the headform, and the depth of the depression (if any) with respect to the original surface of the clay determined. Maximum deformation shall be recorded to the nearest millimeter (mm). In making this determination, any clay surrounding the impression which has been raised above the original level of the surface (cratering) shall be ignored. Measurements of the magnitude of the resultant depression (if any) shall be made from a point originating from a radius flush and consistent with the contour of the pre-shot clay surface. If required, the clay shall be replaced and/or smoothed prior to the next shot. The helmet strapping system shall also be inspected after each shot; however, no repairs, replacements, or adjustments beyond re-tightening of the chin strap shall be made.

9.3.7.1 Should the helmet be dismounted from the headform due to ballistic impacting, the occurrence shall be noted, the helmet remounted (limited only to the requirements of Paragraph 9.2.5), and testing continued without penalty.

9.3.8 The helmet shall then be remounted in accordance with Paragraph 9.3.5 in preparation for the next shot.

9.3.9 Additional shots within one or more of the defined Locations may be necessitated as a result of the first shot being declared "unfair". Should one or more of those additional shots be declared a "penetration", those shots shall be declared "unfair" as well. If there has been no prior fair shot penetration, a penetration by a second shot at any location shall cause the testing of that helmet to be declared "inconclusive". Testing of any helmet declared "inconclusive" shall be repeated in its entirety with a new (untested) helmet sample.

9.3.10 Data for all shots - fair and unfair - shall be reported, but only a penetration or excessive deformation (if established by the sponsoring authority/agency) of the first shot, in any impact area, shall be used to fail the design.

9.3.11 Once testing of a helmet sample has been initiated, testing shall continue until all required locations have been impacted, regardless of the pass/fail results of those shots.

9.4 **EXTREME HOT/COLD TESTING (OPTIONAL)**

9.4.1 This testing may be requested by the end-product user or manufacturer to replicate expected field conditions and operating temperatures. This test is considered to be an optional test and **NOT** a replacement or substitute test for the Design Evaluation Testing contained in Paragraphs 9.2 and 9.3. Should such optional Hot/Cold Testing be required, testing will be conducted in accordance with Paragraphs 9.2 and 9.3 except:

9.4.1.1 Wet conditioning **SHALL NOT** be performed on samples to be COLD conditioned.

9.4.1.2 Helmet samples will be thoroughly conditioned at $+120 \pm 3$ and/or -20 ± 3 degrees Fahrenheit for a minimum period of 4 hours prior to testing. Headforms **SHALL NOT** be temperature conditioned with helmets, but rather be maintained at ambient air temperature of $+70 \pm 10$ degrees Fahrenheit (Penetration Test), or at the

temperature at which the clay drop verification sample produced acceptable drop results (Deformation Test).

9.4.1.3 All testing must be completed within 30 minutes of removal of the test sample from the conditioning environment. Samples not completely tested within the 30 minute requirement shall be reconditioned for a minimum of 4 hours, at which time testing will be completed.

9.4.1.4 The test environment will be maintained at $+70 \pm 10$ degrees Fahrenheit.

10.0 DESIGN ACCEPTANCE (REJECTION)

- 10.1 Penetration by any fair shot, during Penetration or Deformation Testing, shall deny compliance of the helmet model design to this test standard.
- 10.2 Any deformation measurement in excess of that established by the sponsoring Authority/agency (**IF ANY**) shall deny compliance of the helmet model design.
- 10.3 If maximum deformation (blunt trauma) limits have not been established, deformation measurements will be provided for **INFORMATIONAL PURPOSES ONLY** and **SHALL NOT** be used to deny compliance of the helmet model design.

11.0 DATA

- 11.1 Prior to initiating these test procedures, the test helmets will be visually inspected. Recorded data of that inspection will include, but will not necessarily be limited to, the following:
 - 11.1.1 Manufacturer, Model Number, Serial Number and Lot Number.
 - 11.1.2 Description including:
 - 11.1.2.1 Size.
 - 11.1.2.2 Material (i.e., steel, aramid, polyethylene, etc.)
 - 11.1.2.3 Weight.
 - 11.1.2.4 Strapping System.
 - 11.1.2.5 Suspension System.
 - 11.1.2.6 Fittings and Accessories.
 - 11.1.2.7 Labelling.
 - 11.1.2.8 Any visual differences or discrepancies in the helmets.
 - 11.1.2.9 Drop Weight Verification.
 - 11.1.3 Level of Ballistic Protection claimed by the manufacturer.
 - 11.1.4 Acceptable limits of deformation - if made known to the testing agency.

- 11.2 The ballistic test data sheet shall include, but shall not necessarily be limited to, the following:
- 11.2.1 Level of ballistic protection being tested.
 - 11.2.2 Manufacturer, model, lot number and serial number (if helmets are serialized) of the test sample.
 - 11.2.3 Velocity and impact location of each shot.
 - 11.2.4 "Fair" or "Unfair" characterization for each shot.
 - 11.2.5 "Penetration" or "Non-Penetration" of each shot.
 - 11.2.6 Clay deformation of each shot fired in Deformation Testing.
 - 11.2.7 Environmental conditions and temperature conditioning of the test samples.

12.0 REPORTING

- 12.1 The Final Report of testing shall include a narrative of the test, including the identity of the party authorizing the test, the results of testing, and the data records of Paragraph 11.0, above.
- 12.1.1 If backface deformation acceptance criteria has been furnished to the testing agency, the Final Report shall include a statement from the testing agency certifying or denying compliance of the performance of the helmet DESIGN with the applicable requirements.
 - 12.1.2 If backface deformation acceptance criteria has not been furnished to the testing agency, the Final Report will document deformation results without any comment or statement relating to the suitability of the helmet design with respect to helmet deformation resistance performance.

13.0 AVAILABILITY

- 13.1 Additional copies of this procedure may be obtained from:

H.P. White Laboratory, Inc.
3114 Scarboro Road
Street, Maryland 21154-1822
Tel. (410) 838-6550
Fax. (410) 838-2802
www.hpwhite.com

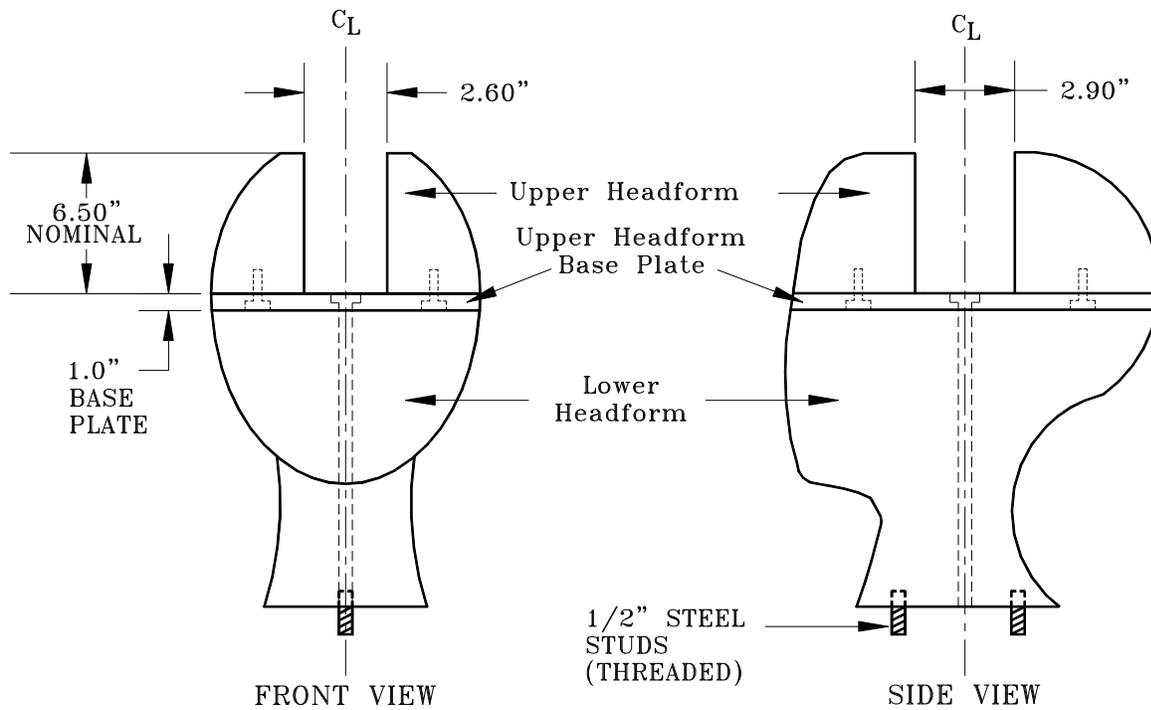
14.0 REVISIONS

- 14.1 It is to be anticipated that changing technologies and field conditions may require revision of this procedure. In support of that revision, interested parties are encouraged to submit comments and recommendations to the addressee of Paragraph 13.1.

TABLE I. BALLISTIC PROTECTION/THREAT LEVELS

Level (a)	Test Ammunition			Required Bullet Velocity (fps)		Required Shots	
	Caliber	Bullet Weight (gr)	Type	Minimum	Maximum	Penetration (b)	Deformation (b)
I	.22 LR	40	Lead	1050	1100	5	5
	.38 Special	158	RN Lead	850	900	5	5
IIA	9x19mm	124	FMJ	1090	1140	5	5
	.357 Magnum	158	JSP	1250	1300	5	5
II	9x19mm	124	FMJ	1175	1225	5	5
	.357 Magnum	158	JSP	1395	1445	5	5
IIIA	9x19mm	124	FMJ	1400	1450	5	5
	.44 Magnum	240	SWC-GC	1400	1450	5	5
III	7.62x51mm	150	Ball, M80	2750	2800	5	5
IV	.30-06	166	AP	2850	2900	5	5
V	Special Category(c)		-	-	-	5	5

(a) Duplicate of ballistic threats and velocities as specified by NIJ-STD-0101.03, BALLISTIC RESISTANCE OF POLICE BODY ARMOR.
 (b) One (1) shot in each quadrant and helmet crown.
 (c) This procedure may be used to test the resistance of other bulletted ammunition or Fragment Simulating Projectiles (FSP) conforming to MIL-P-46593A or Drawing HPW-02-010-00.



NOTES:

1. Overall dimensions comply with NIJ-STD-0106.01 (size 7 1/4)
2. Upper portions, including base plate, of 6061-T6 aluminum or equivalent
3. Lower Headform of USG Epoxy #308

Figure 1: Headform - Penetration & Deformation Testing

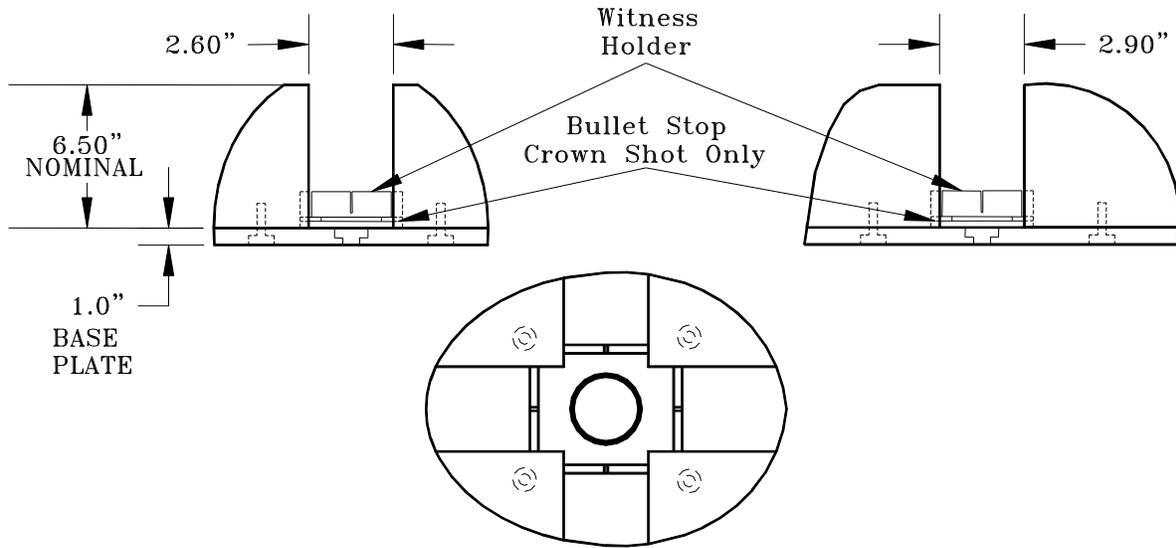


Figure 2A: Headform Configured for Penetration Testing

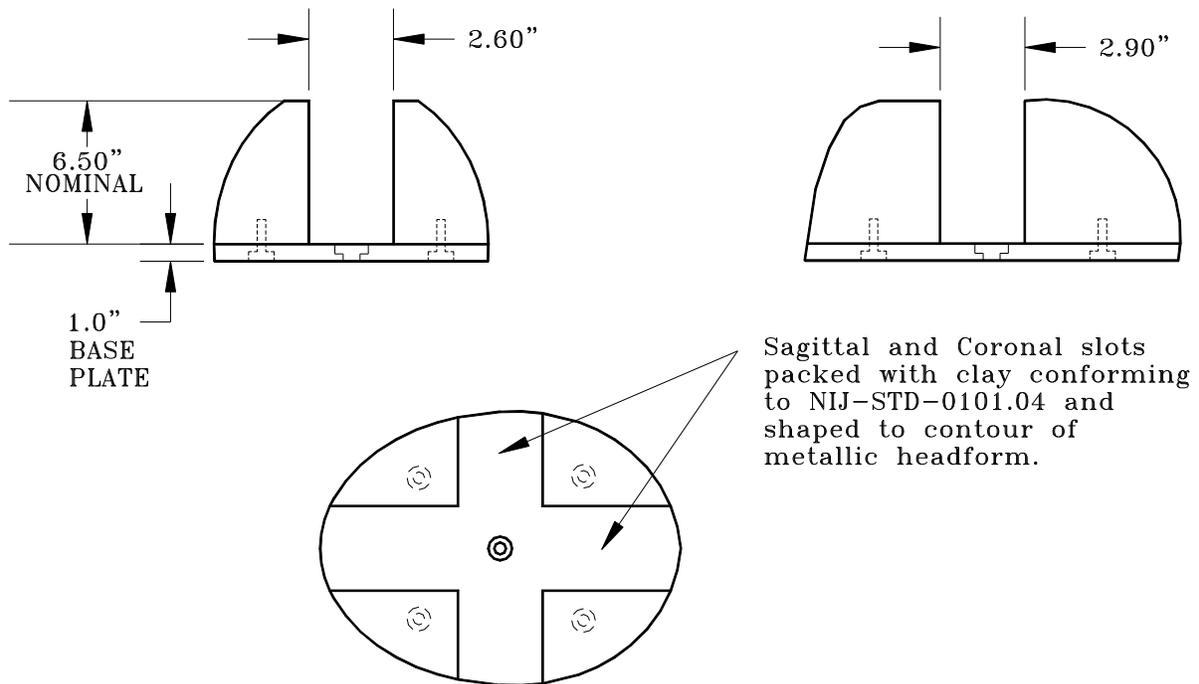
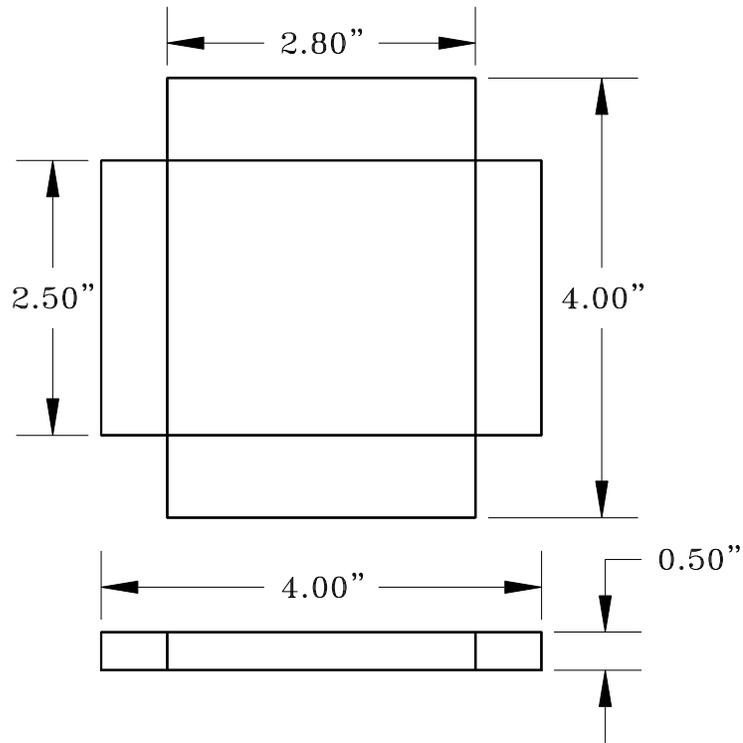


Figure 2B: Headform Configured for Deformation Testing

Figure 2: Upper Headform



**Figure 3: Mild Steel Bullet Stop - Penetration Testing
(Crown Shot Only)**

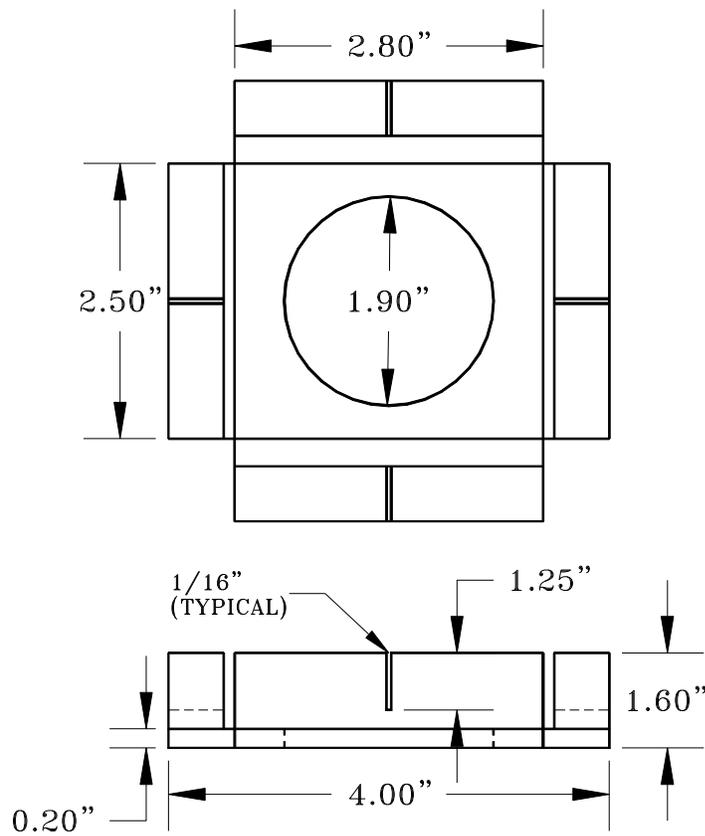


Figure 4: Penetration Test Witness Panel Holder (Mild Steel)