

MIL-H-44099A  
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SUPERSEDING  
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## MILITARY SPECIFICATION

### HELMET, GROUND TROOPS AND PARACHUTISTS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This document covers a ballistic protective helmet consisting of a laminated coated aramid cloth shell with a replaceable suspension assembly, headband, and chin strap.

1.2 Classification. The helmet assembly shall be of one type and in the following sizes as specified (see 6.2).

X-Small  
Small  
Medium  
Large

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

2.1.1 Documents. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to U.S. Army Natick Research, Development, and Engineering Center, Natick, MA 01760-5014, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 8470

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## SPECIFICATIONS

## FEDERAL

- DDD-L-20 - Label: For Clothing, Equipage and Tentage  
(General Use)
- PPP-B-636 - Boxes, Shipping, Fiberboard
- PPP-C-843 - Cushioning Material, Cellulosic

## MILITARY

- MIL-R-3065 - Rubber, Fabricated Products
- MIL-L-35078 - Loads, Unit: Preparation of Semiperishable  
Subsistence Items; Clothing, Personal Equipment  
and Equipage; General Specification For
- MIL-C-44050 - Cloth, Ballistic, Aramid
- MIL-S-44091 - Strap, Chin, Ground Troops'-Parachutists' Helmet
- MIL-S-44097 - Suspension Assembly, Ground Troops'-Parachutists'  
Helmet
- MIL-H-44098 - Headband, Ground Troops'-Parachutists' Helmet
- MIL-C-46168 - Coating, Aliphatic Polyurethane, Chemical Agent  
Resistant
- MIL-P-46593 - Projectile, Calibers .22, .30, .50, and 20 mm  
Fragment-Simulating

## STANDARDS

## FEDERAL

- FED-STD-595 - Colors

## MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection  
by Attributes
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-147 - Palletized Unit Loads
- MIL-STD-662 - Ballistic Test for Armor
- MIL-STD-731 - Quality of Wood Members for Containers and  
Pallets

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## DRAWINGS

## U.S. ARMY NATICK RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER

2-1-1384	- Headband, Ground Troops'-Parachutists' Helmet
2-1-1385	- Clip, Spring, Headband
2-1-1386	- Suspension Assembly, Ground Troops'-Parachutists' Helmet; Assembly
2-1-1400	- Strap, Chin, Ground Troops'-Parachutists' Helmet
8-2-644	- Helmet, Ground Troops'-Parachutists'; Complete Assembly
8-2-645	- Helmet, Ground Troops'-Parachutists'; All Sizes
8-2-646	- Helmet, Ground Troops'-Parachutists'; Sizes: Extra Small, Small, Medium, Large
8-2-647	- Helmet, Ground Troops'-Parachutists'; A-Nut and Post
8-2-661	- Helmet, Ground Troops'-Parachutists'; Pinwheel Preform
8-2-668	- Dimensions for Examination of PASGT Helmet Shell Production Lots

(Copies of documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issues of the nongovernment documents which are current on the date of the solicitation.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- D 2000 - Classification System for Rubber Products in Automotive Applications
- D 3951 - Standard Practice for Commercial Packaging

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Technical society and technical association documents are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

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2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document shall take precedence. Nothing in this document, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 Guide samples. Samples, when furnished, are solely for guidance and information to the contractor (see 6.4). Variations from this document may appear in the sample, in which case this document shall govern.

3.2 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.3, 6.2, and 6.3).

3.3 Materials and components. All materials and components shall be as specified herein or on the applicable drawings (see 6.6).

3.3.1 Cloth, ballistic, aramid. The aramid ballistic cloth for the helmet shell shall conform to type II, class I of MIL-C-44050.

3.3.1.1 Laminating resin. The resin for coating and laminating the reinforcing material shall be a catalyzed system composed of 50 percent phenol formaldehyde and 50 percent polyvinyl butyral resins (see 6.5). The resin shall be pigmented to match the color of the coating specified in 3.3.4.

3.3.2 Rubber edging. The edging shall be made of a rubber compound matching color Olive Drab 34087 of FED-STD-595 and shall conform to the grade, type, class, and suffix requirements of 3BC615A14F17Z of ASTM D 2000 and MIL-R-3065. The suffix letter Z indicates the special requirement that the edging when used in conjunction with the specified adhesive in 3.3.3 and procedure specified in 3.4.2 shall meet the adhesion requirements of 3.5.3. The edging design and dimensions shall conform to Drawing 8-2-644. The length shall be sufficient to conform with the contours of the helmet. As an option, the edging may be a one-piece molded construction.

3.3.3 Adhesive. The adhesive for bonding the rubber edging shall be of a synthetic rubber base type.

3.3.4 Coating. The coating for finishing the helmet shell (see 3.4.3.2) shall conform to MIL-C-46168, color Olive Drab 34087 of FED-STD-595.

3.3.5 Texturing of coating. Texturing aggregate incorporated in the second coat (see 3.4.3.2) for the exterior of the helmet shall be silica sand or walnut shell flour.

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3.3.5.1 Sand texturing. The aggregate for sand texturing shall be banded silica sand that is water washed and kiln dried, free of salts and deleterious matter, and containing not more than 1.5 percent of dirt or foreign matter. The sand aggregate shall be that known commercially as No. 70 and shall have a screen analysis as follows:

<u>Sieve No. (U.S. STD)</u>	<u>Percent cumulative</u>
No. 40	0.5 maximum
No. 50	6.0 $\pm$ 3
No. 70	34.0 $\pm$ 5
No. 100	82.0 $\pm$ 5
No. 140	97.0 + 3, -5

The coating-sand mixture shall contain 6 pounds of sand to one base gallon of coating and shall be reduced to spraying consistency.

3.3.5.2 Walnut shell flour texturing. The aggregate for walnut shell flour texturing shall be 40/100 mesh walnut shell flour. The coating-walnut shell flour mixture shall contain 10 to 12 ounces of walnut shell flour per base gallon of coating.

3.3.6 Suspension assembly. The suspension assembly shall conform to MIL-S-44097.

3.3.7 Chin strap. The chin strap shall conform to MIL-S-44091.

3.3.8 Headband. The headband shall conform to MIL-H-44098.

3.4 Construction. The construction shall conform in all respects to Drawings 2-1-1384 through 2-1-1386, 2-1-1400, 8-2-644 through 8-2-647, 8-2-661, and 8-2-668, and as specified herein.

3.4.1 Helmet shell. The helmet shell shall be a laminated structure composed of resin coated reinforcing material compression molded by heat and pressure (see 6.5). The reinforcing material specified in 3.3.1 shall be coated on both sides with equal amounts of the laminating resin specified in 3.3.1.1 (see 4.4.1.2). The resin content of the coated reinforcing material shall be 15 to 18 percent solids by weight (volatile free), based on the uncoated reinforcing material weight, and the mix reduced to spraying consistency. A sample of coated material that has been subjected to 320°F for 5 minutes in a forced air circulating oven is considered as being volatile free.

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3.4.1.1 Forming of shell before molding. Forming of the helmet shell shall be accomplished using either pinwheel preform or a combination of pinwheel preforms and rectangular panels. For either method, fastening devices such as staples are not permitted unless they are in the trim area. Application of resin shall not be permitted in this operation. Spot welding or sewing with thread is permitted, provided that evidence of these methods is not visible on the outside surface of the finished helmet.

3.4.1.1.1 Pinwheel preform construction. The pinwheel preforms shall be similar in configuration to that shown on Drawing 8-2-661 but may vary in size. The pinwheels shall each be one continuous, integral piece of fabric. To facilitate forming of the preform, the pinwheels may be cut up to within 2 1/2 inches of the center of the pinwheel, leaving an uncut area measuring 5 inches minimum across in any direction. There shall be no more than eight legs, of approximate equal dimensions, on each pinwheel. A maximum of two pinwheels, other than the innermost or outermost preform layer, may be formed by using two half pinwheels joined together with a minimum 3 inch by 5 inch rectangle of the same material used for the pinwheels. The 5 inch dimension shall be centered and parallel to the butted joint of the two half pinwheels. These segmented pinwheel layers may be located anywhere within the preform lay-up. The pinwheel preforms shall be assembled with three crown plies similar to Drawing 8-2-661 so that there are not less than 19 layers of fabric throughout any cross-sectional area of the shell. The pinwheel preforms shall be superimposed over each other such that the gaps of each layer are offset from the gaps of all other layers. The 19 layers of fabric required throughout may be obtained by the use of 16 pinwheel preforms when they are properly formed and superimposed on each other. Gaps in the pinwheel preforms shall not exceed 3/32 inch in width. There shall be no pleat, wrinkle, or crease greater than 1/2 inch width. Any pleat, wrinkle, or crease 1/2 inch or less in length shall be smooth.

3.4.1.1.2 Combination pinwheel preform and rectangular panel construction. The combination pinwheel preform and rectangular panel construction shall consist of a single outer and a single inner fabric layer of pinwheel construction, conforming to the same requirements as specified in 3.4.1.1.1, with rectangular panels sandwiched between. The panels shall be rectangular in shape, cut in the warp and filling direction, and the size may vary providing that no dimension is less than 3 inches. In addition to rectangular panels, the crown may contain circular or oval shaped plies providing that the radius to any point on the periphery is not less than 2 1/2 inches. The individual preform layers shall be superimposed over each other such that the gaps of any two adjacent layers are offset by a minimum of 1/2 inch. The panels shall be laid up so that there are not less than 19 layers of fabric, including the inner and outer pinwheel layers, throughout

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any cross-sectional area of the shell. There shall be no pleat, wrinkle, or crease greater than 1/2 inch in length. Any pleat, wrinkle, or crease 1/2 inch or less in length shall be smooth.

3.4.1.1.3 Approval of helmet shell preform. Prior to beginning production under any contract, the following shall be submitted to the contracting activity for examination for compliance with the specified requirements:

- a. One complete set of individual pieces to be used to form one preform assembly for each size helmet.
- b. One completely assembled preform for each size helmet for which the pieces were furnished in 3.4.1.1.3.a.
- c. One molded helmet for each completely assembled preform.
- d. One completely finished helmet shell of each size being procured.

Approval by the Government of the individual pieces and the preform assembly required above will authorize the contractor to use his preforming method in production (see 6.2). Approval of the preforming method does not relieve the contractor from meeting any of the requirements specified herein. Any changes to the preforming method shall require reapproval.

3.4.1.2 Molding of shell. The shell shall be formed during a single molding cycle that is defined as the time between the closing and opening of the mold one time only (breathing, degassing, or pinching off is not considered opening or closing the mold in this context). The shell shall not be remolded after this single molding cycle. The outer and inner surfaces of the molded shell shall be smooth, and the edge shall be finished smooth and even with no exposed ends of the fabric fibers showing. Both the inside and outside surfaces shall be free from any hole, void, delamination, blister, cracking, dry spot, area of non-resin flow, and also any pit greater than 1/8 inch in diameter and the depth of one ply. Permissible gaps and pits shall be filled with epoxy resin to provide a smooth and continuous surface. There shall be no pleat, wrinkle, or crease on the inside or outside of the helmet shell, except as allowed in 3.4.1.1.1 or 3.4.1.1.2. Before further processing is undertaken, the contractor is responsible for 100 percent inspection immediately after the molding cycle for delamination and blisters (see 4.4.2.2). Delamination and blisters, as well as evidence of delaminations and blisters, are not acceptable; neither is any shell that contains a delamination or blister as a result of the molding operation and was modified by any means prior to finishing.

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3.4.1.3 Holes for attachment of components. Holes for attaching the helmet components shall be drilled and shall be accomplished before finishing. There shall be no delamination of the shell material as a result of the drilling operation.

3.4.2 Assembly of rubber edging to helmet shell. The contacting surface (both edging and helmet) shall be thoroughly cleaned, and the edging abraded prior to application of adhesive. The rubber edging shall be applied to the edge of the helmet, using adhesive specified in 3.3.3 and in the manner shown on Drawing 8-2-644, leaving no unadhered rubber edging on the periphery of the helmet shell greater than 1/8 inch. The rubber edging shall be centered on the edge of the helmet around the entire periphery.

3.4.3 Finish of helmet shell with edging installed.

3.4.3.1 Outside surface preparation. Prior to application of protective coating, all permissible surface gaps and pits on the outside surface of the helmet shell shall be filled with epoxy resin composition to provide a smooth and continuous surface. Cutting and filling of blisters of any size is not permissible. The outside surface of the shell shall be prepared for painting as required in order to meet the performance requirements for finish. If surface preparation includes abrading, abrading to the point where the aramid cloth fibers become visibly cut and raised shall be prohibited, and dust from the abrading operation shall be completely removed before application of the coating. The prepared surface shall not be allowed to become contaminated by oil, grease, dust, or other foreign matter prior to painting.

3.4.3.2 Coating of helmet shell outer surface. Following the surface preparation specified in 3.4.3.1 and after application of suitable primer, if used, one or more coats of the coating specified in 3.3.4 shall be applied to the outside surface of the helmet shell including the outside side edge of the edging. The coating shall completely and uniformly cover the shell surface and edging. A coat of the same coating containing the texturing aggregate specified in 3.3.5 shall be applied uniformly on the outside surface of the helmet shell including the outside side edge of the edging.

3.4.4 Installation of suspension assembly. The suspension assembly shall be installed in the helmet as shown on Drawing 8-2-644. The size of the suspension assembly shall match the size of the helmet. Each A-nut shall be positioned in the orientation shown, and each screw shall be securely tightened. Screws may or may not be painted when helmet is finished.

3.4.5 Installation of chin strap. The chin strap shall be installed on the helmet as shown on Drawing 8-2-644. The screws shall be securely tightened.

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3.4.6 Placement of headband. The headband shall be placed in the helmet between the suspension assembly and the crown of the helmet.

3.5 Performance.

3.5.1 Water immersion. The coating on the outside surface of the helmet shall show no evidence of softening, peeling, or blistering when tested as specified in 4.4.5.

3.5.2 Ballistic resistance. The  $V_{50}$  ballistic limit for each helmet shall be not less than 2,000 feet per second when tested as specified in 4.4.5.

3.5.3 Adhesion of rubber edging.

3.5.3.1 Initial adhesion. The rubber edging shall remain firmly bonded to the helmet when tested as specified in 4.4.5. Unbonded areas up to a total of 2 inches in length will be permitted, providing no individual unbonded area is more than 1/2 inch in length and 1/8 inch in width. Unbonded areas shall have a minimum of 1/2 inch bonded area between them.

3.5.3.2 Adhesion of the rubber edging after heat aging. The edging shall not peel back more than 1/4 inch when tested as specified in 4.4.5.

3.6 Weight. The weight of the finished helmet assembly with suspension assembly and chin strap shall be as follows:

<u>Size</u>	<u>Weight (ounces), maximum</u>
X-Small	50
Small	51
Medium	53
Large	57

3.7 Marking.

3.7.1 Molded-in marking. The helmet shall be marked in the inside crown area with the applicable size using the letters XS, S, M, or L; the contractor's trademark or symbol; and the mold number and year of manufacture. The marking shall be accomplished by a "molded in" process.

3.7.2 Ink markings. The helmet shall be marked for identification in the location shown on Drawing 8-2-644, and the marking shall conform to type IV, class 5 of DDD-L-20.

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3.8 Instruction booklet. An instruction booklet shall be furnished by the contractor with each helmet. The booklet shall be placed in the helmet as specified in 5.1.1. The booklet size, contents, printing, collations, folding, and stitching shall be in accordance with the standard sample (see 6.4). Paper for the cover shall be commercial grade cover stock, 130 pounds basis weight, 20 by 26 inches per 1000 sheets, in the approximate color of the standard sample (see 4.4.1.2). The text paper shall be white, commercial offset No. 2 grade, 60 pound basis weight, 25 by 28 inches per 500 sheets (see 4.4.1.2).

3.9 Repairs. Except as otherwise specified herein, repairs are not allowed to be made to the helmet assembly.

3.10 Workmanship. The finished helmet shall conform to the quality of product established by this document, and the occurrence of defects shall not exceed the specified quality levels.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this document where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this document shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirement in the document shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Certificates of compliance. When certificates of compliance are submitted, the Government reserves the right to inspect such items to determine the validity of the certification.

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4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 First article inspection. When a first article is required (see 6.2), it shall be examined for the defects specified in 4.4.2.3, 4.4.3, and 4.4.4 and tested for the characteristics specified in table V. The presence of any defect or failure to pass any test shall be cause for rejection of the first article.

4.4 Quality conformance inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with MIL-STD-105.

4.4.1 Component and material inspection. In accordance with 4.1, components and materials shall be inspected in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this document or applicable purchase document.

4.4.1.1 Dimensional examination of components. The components listed in table I shall be examined for all dimensions. The sample unit shall be as designated in table I. The sample size for the designated lot size shall be as shown below. The lot shall be unacceptable if one or more dimensions fail to meet the requirement on one or more sample units.

<u>Lot size</u>	<u>Sample size</u>
800 or less	2
801 up to and including 22,000	3
22,001 and more	5

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TABLE I. Inspection of components for dimensions

Component	Dimensional requirement	Requirements applicable to individual unit	Number determinations per unit	Results reported numerically to nearest	Sample unit
A-nut	Dwg 8-2-647	X	<u>1/</u>	<u>2/</u>	1
Post	Dwg 8-2-647	X	<u>1/</u>	<u>2/</u>	1
Edging	Dwg 8-2-644	X	<u>1/</u>	<u>2/</u>	<u>3/</u>
Suspension system	Dwg 2-1-1386	X	<u>1/</u>	<u>2/</u>	1
Chin strap	Dwg 2-1-1400	X	<u>1/</u>	<u>2/</u>	1
Headband	Dwg 2-1-1384	X	<u>1/</u>	<u>2/</u>	1
Clip	Dwg 2-1-1385	X	<u>1/</u>	<u>2/</u>	1

1/ One determination shall be made for each dimension.

2/ Unless otherwise specified, results shall be reported to the nearest 0.001 inch, 1/64 inch, or 1 degree as applicable.

3/ The sample unit shall be 1 yard or one molded edging.

4.4.1.2 Certification. The contractor shall furnish a certificate of compliance with each shipment or lot certifying the following:

a. That the laminating resin used is a catalyzed system composed of 50 percent phenol formaldehyde and 50 percent polyvinyl butyral resins as specified in 3.3.1.1.

b. That the distribution and content of resin coating meets the requirements specified in 3.4.1.

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c. That the paper used in the instruction booklet meets the requirements specified in 3.8.

d. That the screws for mounting the suspension assembly and chin strap conform to the contractor's part number specified on Drawing 8-2-644.

4.4.2 In-process inspection. In-process inspection shall be performed on the individual layers that will be used to form an assembled preform and also on preform assemblies before molding to verify compliance with the Government approved method and the requirements specified in 3.4.1.1.1 or 3.4.1.1.2 as applicable. Every preform assembly shall be examined for the critical defects in table II. All preform assemblies with any critical defect shall be rejected.

TABLE II. Preform assembly defects

Examine	Defect	Classification
Construction	Number of plies of aramid cloth is not as approved	<u>Critical</u> X
	Composition of material is not as specified	X
	Final configuration is not as approved	X

4.4.2.1 Mold and hole location authorization. Prior to beginning production under any contract (see 6.2), one helmet shell produced from each mold shall be submitted directly off the mold (with the only finishing operation being holes drilled) to the contracting activity for examination for conformance to the specified shell dimensions and hole locations. Approval of the shell will authorize that mold for use in production under that contract. Any change to the mold, drilling process, molding process, or materials shall require reauthorization.

4.4.2.2 Visual examination of helmet shell prior to finishing (immediately off the mold). Prior to the finishing operation, every helmet shell shall be examined for any evidence of a blister or delamination. Any blister or

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delamination, as well as any evidence of a blister or delamination that was modified by any means after molding (see 3.4.1.2) shall be classified as a defect, and the shell shall be rejected. At its discretion, the Government may verify the results of the contractor's examination by 100 percent examination or by sampling inspection. The Government may, at its discretion, reject the lot immediately when one defective helmet shell is found.

4.4.2.3 Dimensional examination of helmet shell production lots after drilling of holes. The helmet shell shall be examined to determine if the shell thickness, hole locations, hole diameters, peripheral contour, and inside height dimensions conform to the dimensional requirements specified on Drawing 8-2-668. Any of these dimensions exceeding the specified tolerance shall be classified as a defect. The lot shall be expressed in units of helmet shells of one size only. The sample unit shall be one helmet shell after drilling of holes (without rubber edging). The inspection level shall be S-1 and the acceptable quality level (AQL), expressed in terms of defects per hundred units, shall be 6.5. For each production lot of helmet shells, the contractor shall furnish a certificate of compliance certifying that the manufacturing process, materials, and molds or dies have not been changed from that used in the initial production lot.

4.4.2.3.1 Shell thickness. The thickness of the helmet shell shall be measured to the nearest 0.001 inch at five different locations. One measurement shall be taken at the approximate top center of the helmet, and the other four measurements shall be taken in the approximate center of each of the four quadrants not less than 3 1/2 inches from the top center. All five measurements shall be averaged. An average thickness not within tolerances shall be scored as a defect.

4.4.2.3.2 Hole location. Reference Drawing 8-2-668. Chord dimensions between holes, taken from the inside of the helmet shell, shall be checked and any failure to conform to any of the dimensions shown below shall be scored as a defect.

<u>Size</u>	<u>A1 to A2</u> (inches)	<u>A2 to A4</u> (inches)	<u>A4 to A5</u> (inches)	<u>Tolerance</u> (inches)
X-Small	3 11/32	4 5/8	3 3/4	± 1/8
Small	3 1/2	4 27/32	3 3/4	± 1/8
Medium	3 17/32	5	4	± 1/8
Large	3 13/16	5 3/16	4 1/32	± 1/8

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It is suggested that measurements can be taken by inserting the screws into the A-nuts and backing the screw until it is flush with the inside surface of the helmet. Dividers shall be used in measuring the chord distance from the center to center of the screws involved.

4.4.2.3.3 Peripheral contour. The peripheral contour dimensions shall be checked by measuring the inside length of the helmet between the points of 0° and at 180° as shown on Drawing 8-2-668. The inside width shall be measured between the points at 90° and at 270° as shown on Drawing 8-2-668. Any failure to conform to any of the following applicable dimensions shall be scored as a defect.

<u>Size</u>	<u>Length</u> (inches)	<u>Width</u> (inches)	<u>Tolerance</u> (inches)
X-Small	9 9/16	8 3/16	-1/16, + 3/16
Small	9 17/32	8 9/32	-1/16, + 3/16
Medium	10	8 19/32	-1/16, + 3/16
Large	10 3/8	8 29/32	-1/16, + 3/16

4.4.2.3.4 Inside height dimensions. If all ten benchmarks appear on the helmet shell, the measurement of the height dimension is not necessary.

4.4.2.4 Visual examination of helmet shell with rubber edging prior to application of protective coating. Prior to application of the protective coating, the helmet shell with rubber edging shall be examined for the defects listed in table III. The lot size shall be expressed in units of helmet shells of one size only. The sample unit shall be one helmet shell. The inspection level shall be II and the AQL, expressed in terms of defects per hundred units, shall be 2.5 for major defects and 6.5 for total defects. When an asterisk appears in the classification column, the defect shall be classified as follows:

- Major - When seriously affecting appearance or serviceability.
- Minor - When not seriously affecting appearance or serviceability.

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TABLE III. Helmet shell (prior to protective coating) defects

Examine	Defect	Classification	
		Major	Minor
Helmet shell (exterior and interior)	Any fabric fibers visibly cut or raised on the shell body		*
	Any surface dent, depression, or area not smooth		*
	Any delamination or blister	X	
	Any evidence of cracking		*
	Any evidence of dry spot, any area of nonresin flow or other molding deficiency		*
	Any fabric gap, any pit except those specified as permissible (see 3.4.1.1.1, 3.4.1.1.2, and 3.4.1.2)	X	
	Any raised pleat or wrinkle, or any crease (groove) longer than 1/2 inch but less than 1 inch		X
	Any raised pleat or wrinkle, or any crease (groove) 1/2 inch or less in length that is not smooth		X
	Any raised pleat or wrinkle, or any crease (groove) 1 inch or longer	X	
	Any permissible gap or pit not resin filled as specified (see 3.4.1.2)		X
	Any unauthorized repair or reworking	X	
	Any evidence of metallic fasteners	X	
	Any benchmark omitted or obliterated <u>1/</u>	X	
	Rubber edging	Any cut, tear, or hole	X
Any area not adhered to shell greater than 1/2 inch in length and 1/8 inch in width			X
Ends not butted together:			
- open by more than 1/8 inch		X	
- open 1/16 inch up to 1/8 inch			X
Butt joint not in rear of helmet			X
Not one piece		X	

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1/ There are a total of 10 benchmarks: five inside the helmet shell and a corresponding five bench marks on the outside helmet shell.

4.4.3 End item visual examination. The completed helmet assembly including headband (see 3.3.8) shall be examined for the defects listed in table IV. The lot size shall be expressed in units of complete helmets of one size only. The sample unit shall be one helmet complete with all components. The inspection level shall be II and the AQL, expressed in terms of defects per hundred units, shall be 2.5 for major defects and 10.0 for total defects.

TABLE IV. End item visual defects

Examine	Defect	Classification	
		Major	Minor
Finish on exterior, and edging of helmet	Any scuffed area or scratch		X
	Thin film (shell showing through)		X
	Finish wet or tacky to the touch	X	
	Coating-texturing aggregate omitted	X	
	Coating-texturing aggregate not uniformly distributed		X
	Coating-texturing aggregate overrun extending beyond edge onto interior surface of helmet		X
	Coating furrows, flakes, or peels when scratched with fingernail		X
	Blemish, such as peeling, blistering, or flaking	X	
	Not a smooth, uniform coating (i.e., run or sag affecting an area more than one square inch) <u>1/</u>		X
	Foreign matter embedded in or appearing on the finish, such as dirt, stain, oil, or grease		X
	Color of finish not as specified		X
	Any unauthorized repair	X	

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TABLE IV. End item visual defects - Continued

Examine	Defect	Classification	
		Major	Minor
Hardware (general)	Any sharp edge or burr		X
	Any A-nut not secured in the orientation specified		X
	Any screw not securely tightened		X
	Any hardware component not finished as specified		X
Suspension assembly	Peripheral band not a taut fit between any two attachment points (see note)	X	
	NOTE: If the suspension assembly can be pressed flat against the helmet shell and remains flat against the shell after pressure is released, it is not a taut fit.		
	Not attached in correct orientation (i.e., adjustment strap not at rear of helmet)	X	
Chin strap assembly	Any component incorrectly installed on helmet (e.g., long strap on left side of helmet in lieu of right, short strap installed with snap fastener facing inside of helmet in lieu of outside)	X	
Headband	Any required component or operation omitted (unless otherwise classified herein)	X	
	Any component misplaced or not assembled as specified (unless otherwise classified herein)	X	
	Pile fastener tape not attached with pile facing the leather	X	
	Color of any component not as specified		X
	Needle chews	X	

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TABLE IV. End item visual defects - Continued

Examine	Defect	Classification	
		<u>Major</u>	<u>Minor</u>
Headband - continued	Any unauthorized repair	X	
	Buckle not attached in orientation specified in Drawing 2-1-1384	X	
Identification label (printing) and molded-in markings	Omitted, incorrect, illegible, or not as specified		X
Instruction booklet	Omitted, printing or figures illegible or not as specified, any page omitted		X
Workmanship, exterior and interior including rubber edging	(All defects listed and classified in 4.4.2.4 shall apply for this workmanship examination)		

1/ The helmet shall be examined from a distance of approximately 3 feet.

4.4.4 End item weight examination. The helmet assembly shall be examined for compliance with the weight requirement in 3.6. The lot size shall be expressed in units of complete helmets of one size only. The sample unit shall be one helmet complete with all components except the instruction booklet and the headband. Any helmet exceeding the weight requirement shall be classified as a defect. The inspection level shall be S-3 and the AQL, expressed in terms of defects per hundred units, shall be 4.0.

4.4.5 End item testing. The end item shall be tested for the characteristics listed in table V. The lot size shall be expressed in units of helmet assemblies of one size only. The sample unit for each test shall be one helmet. For all testing, the inspection level shall be S-2 and the AQL, expressed in terms of defects per hundred units, shall be 2.5. Any ballistic test failure shall be cause for rejection of the lot.

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TABLE V. End item tests

Characteristic	Requirement paragraph	Test method	Number of determinations per sample unit	Results reported as pass or fail
Water immersion	3.5.1	4.5.1	1	X
Ballistic resistance	3.5.2	4.5.2	1	X
Adhesion of rubber edging before aging <sup>1/</sup>	3.5.3.1	4.5.3.1	1	X
Adhesion of rubber edging after aging <sup>1/</sup>	3.5.3.2	4.5.3.2	2	X

<sup>1/</sup> The helmets used for ballistic resistance testing may also be used afterwards for the rubber edging tests.

4.4.6 Packaging examination. The fully packaged end items shall be examined for the defects listed below. The lot size shall be expressed in units of shipping containers. The sample unit shall be one shipping container fully packaged. The inspection level shall be S-2 and the AQL, expressed in terms of defects per hundred units, shall be 2.5.

<u>Examine</u>	<u>Defect</u>
Marking (exterior and interior)	Omitted; incorrect; illegible; of improper size, location, sequence, or method of application
Materials	Any component missing, damaged, or not as specified

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ExamineDefect

## Workmanship

Helmets not wrapped as specified  
 Inadequate application of components, such as incomplete sealing or closure of flap, improper taping, loose strapping, or inadequate stapling  
 Load not bonded as specified  
 Bulged or distorted container  
 Tape not adhering to boxes  
 Cushioning sticking to helmet (result from wet touch-ups)

## Content

Number of helmets per container is more or less than required

4.4.7 Palletization examination. The fully packaged and palletized end items shall be examined for the defects listed below. The lot size shall be expressed in units of palletized unit loads. The sample unit shall be one palletized unit load, fully packaged. The inspection level shall be S-1 and the AQL, expressed in terms of defects per hundred units, shall be 6.5.

ExamineDefect

## Finished dimensions

Length, width, or height exceeds specified maximum requirement

## Palletization

Pallet pattern not as specified  
 Interlocking of loads not as specified  
 Load not bonded with required straps as specified

## Weight

Exceeds maximum load limits

## Marking

Omitted; incorrect; illegible; of improper size, location, sequence, or method of application

4.5 Methods of inspection.

4.5.1 Water immersion test. Immerse the helmet in tap water at 60° to 80°F for 16 hours minimum. At expiration of this time, remove the helmet and allow to air dry for 12 hours minimum or force air dry for 6 hours minimum under the same temperature conditions. The coating on the outside surface of the helmet shall be examined. Any evidence of softening, blistering, or peeling shall be considered a test failure.

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4.5.2 Ballistic resistance test. The ballistic resistance shall be conducted in accordance with MIL-STD-662 except as specified in 4.5.2.1. The fragment simulating projectile shall be the .22 caliber, type 2 conforming to MIL-P-46593 except as modified by figure 1 of this document, and it shall weigh 17 grains  $\pm$  0.25 grain. Test reports shall contain all individual values utilized in expressing the V50 ballistic resistance for each helmet. Any helmet having a V50 ballistic resistance below the requirement in 3.5.2 shall be considered a test failure.

4.5.2.1 Ballistic test method. The helmet shall be stored in the ballistic test chamber for not less than 24 hours prior to testing. The helmet shall be subdivided by marking the outside surface into five sections: a top section and four side sections. The top section shall be a 4-inch diameter circle with the top bench mark being the center point. The four side sections shall be the areas below the top section and between the 0-90°, 90-180°, 180-270°, and 270-360° bench marks. The side sections shall be formed by drawing lines from the peripheral bench marks to the top center bench mark. A minimum of two fair impacts, randomly placed, shall be fired in each section, except that one of the two fair impacts in the top section shall be at the approximate center crown point. The impact points shall be a minimum distance of 1 1/2 inches from each other and from holes. An impact shall be invalid if the impact point is in an area of delamination caused by a previous impact. The helmet shall be rigidly mounted with the area of impact normal to the line of fire. The witness plate shall be rigidly mounted inside the helmet 2 inches behind the area of impact.

4.5.2.1.1 Barrel. The barrel shall be a .30 caliber rifled barrel with a one-in-sixteen twist. The barrel length shall be 28 inches. The barrel shall be chambered to accommodate firing the specified sabot.

4.5.2.1.2 Yaw card measurement system. The utilization of a yaw card in determining yaw shall be performed as follows:

a. The yaw card shall be placed directly in front of the test sample with the emulsion side facing the sample. (The yaw card will be devoid of any markings.) Kodak photographic paper, single weight, kodabromid, or equal, may be used for the yaw card.

b. After the test, the yaw card shall be carefully measured to determine the largest dimension of the hole caused by penetration of the projectile. An optical magnification device with a magnification between 5X and 10X shall be used for making this measurement. This measurement shall be compared to the X-axis on figure 3. The Y-axis of figure 3 shall be used for determining the degree of the yaw.

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c. Yaw shall be measured at intervals no less than those indicated below. When the barrel is new, a minimum of 25 shots shall be fired to "break in" the barrel. Measurement of yaw shall be five successive shots at each interval.

Measurement interval

1. After "break-in" period
2. After 250 shots
3. After 500 shots
4. After 750 shots
5. After 1,000 shots
6. After 1,000 shots, every 100 shots thereafter

d. In the event that any shot fired indicates yaw greater than  $5^{\circ}$ , it shall not be used to calculate V50 ballistic resistance, and the barrel shall be rechecked for affect on yaw as follows: fire five shots, if three shots exhibit yaw, discard the barrel, and if one or more shots exhibit yaw, investigate cause and correct.

e. In case of dispute concerning a particular barrel, yaw shall be measured by a photographic measurement system using a multiflash light source to determine projectile velocity and yaw. Yaw will be measured by the system to an accuracy of 0.5 degree.

4.5.2.1.3 Sabot. A sabot shall be used in loading and firing the projectile. The sabot shall be manufactured to conform to figure 2. The projectile shall be loaded in such a manner that the whole body of the projectile is in the sabot except for the gas ring. The projectile shall be loaded so that the base of the projectile is in contact with the pusher plate (see 4.5.2.1.4).

4.5.2.1.4 Pusher plate. A pusher plate shall be utilized and placed flush with the edge of the throat of the cartridge. The pusher plate shall have the following characteristics:

- a. Diameter - 0.304 inch (reference dimension).
- b. Thickness - 0.050 inch (reference dimension).
- c. Material - Aluminum, 7075T6 or 6061T6.

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4.5.2.1.5 Location of rifle, triggering devices, and target material. The following dimensions may be varied slightly to fit individual conditions and range arrangement, but the accuracy of measurements must be maintained. The first triggering device shall be located 5 feet forward of the rifle muzzle and perpendicular to the trajectory of the projectile. The second triggering device shall be 10 feet forward of the rifle muzzle. It is mandatory that the 5 foot separation between the first and second triggering devices be maintained to a tolerance of 0.125 inch. The test item shall be 12.5 feet forward of the rifle muzzle and perpendicular to the trajectory of the projectile.

4.5.2.1.6 Ballistic limit protection, BL(P). The protection ballistic limit, BL(P), for each test target material shall be the average of 10 fair impact velocities consisting of the five lowest velocity complete penetrations and the five highest partial penetration velocities provided that the spread for the 10 velocities is not greater than 125 fps. In cases where the zone of mixed results is greater than 125 fps (i.e., the highest partial penetration velocity is higher than the lowest complete penetration velocity), the BL(P) shall be the average of 14 fair impact velocities consisting of the seven lowest complete penetration velocities and the seven highest partial penetration velocities. If the 14-round limit cannot be attained within a velocity spread of 150 fps or less, retesting shall be required.

#### 4.5.3 Adhesion of rubber edging test.

4.5.3.1 Initial adhesion. The adhesion of the edging shall be determined by manual and visual inspection of the edges of the rubber edging on both the outside and inside of the helmet. A section or area of the edging shall be considered unbonded when the edge can be rolled back on itself and away from the helmet by the ball of the thumb or finger. Any nonconformance to the requirements specified in 3.5.3.1 shall be considered a test failure.

4.5.3.2 Adhesion after heat aging. After the helmet has been heat aged in a circulating air oven at  $160 \pm 5^{\circ}\text{F}$  for 4 hours and allowed to cool to room temperature, using a sharp knife, cut through the edging along the outer corner for a distance of 2 inches. At one end of the cut, make another cut through and across the outer side of the edging and peel it back to form a tab approximately 1/2 inch in length. Attach a 1.5-pound weight to the tab and arrange the helmet and weight so that the pull is at right angles to the plane of the glue line under test. Make suitable gage marks on the specimen for the measurement of the amount of peeling during the test. Allow the weight to hang for 1 hour, and measure the amount of peeling back of the tab to determine conformance to the requirement in 3.5.3.2. The test shall be performed at two different locations on the helmet, and the two results shall be averaged.

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## 5. PACKAGING

5.1 Preservation. Preservation shall be level A or Commercial, as specified (see 6.2).

5.1.1 Level A. An instruction booklet shall be placed in the helmet between the suspension assembly and the crown of the helmet. Each helmet shall be completely wrapped in a 1/4-inch thickness of cellulosic cushioning material conforming to type II, class B of PPP-C-843. The cushioning pad shall measure 28 inches in length by 24 inches in width. The wrap shall be accomplished by placing the crown of the helmet in the center of the pad with the visor (front edge) facing any corner of the pad. Each corner of the cushioning pad shall then be folded to the inside of the helmet.

5.1.2 Commercial. The helmets shall be preserved in accordance with ASTM D 3951.

5.2 Packing. Packing shall be level A, B, or Commercial, as specified (see 6.2).

5.2.1 Level A packing. Ten helmets of one size only, preserved as specified in 5.1, shall be packed in a fiberboard shipping container conforming to style RSC-L, grade V2s of PPP-B-636. The inside of each shipping container shall be fitted with a box liner conforming to type CF, class weather-resistant, variety DW, grade V15c of PPP-B-636. Level A unit packs shall be packed with the visor upright, five in length, two in width, and one in depth within a shipping container. During the packing operation, the wrapped helmets shall be nested with the back of the helmet resting on the bottom of the shipping container. Inside dimensions of each container shall be approximately 22 inches in length, 20 1/2 inches in width, and 11 1/2 inches in depth. Approximate dimensions are furnished as a guide only. Each shipping container shall be closed in accordance with method III, waterproofed in accordance with method V, and reinforced as specified in the appendix of PPP-B-636. Toward the end of the contract, or when there are less than the required amount per container of the same size, mixed sizes may be packed within the same container. Shipping containers shall be arranged in unit loads in accordance with MIL-L-35078 for the type and class of load specified (see 6.2). Strapping shall be limited to nonmetallic strapping, except for type II, class F loads.

5.2.2 Level B packing. Ten helmets of one size only, preserved as specified in 5.1, shall be packed in a fiberboard shipping container conforming to style RSC-L, type CF (variety SW) or SF, class domestic, grade 275 of PPP-B-636. The inside of each container shall be fitted with a box liner conforming to type CF, class domestic, variety DW, grade 275 of PPP-B-636. Level A unit packs shall be packed with the visor upright, five in

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length, two in width, and one in depth within a shipping container. During the packing operation, the wrapped helmets shall be nested with the back of the helmet resting on the bottom of the shipping container. Inside dimensions of each container shall be approximately 22 inches in length, 20 1/2 inches in width, and 11 1/2 inches in depth. Approximate dimensions are furnished as a guide only. Each shipping container shall be closed in accordance with method II as specified in the appendix of PPP-B-636. Toward the end of the contract, or when there are less than the required amount per container of the same size, mixed sizes may be packed within the same container.

5.2.2.1 Weather-resistant fiberboard containers. When specified (see 6.2), the shipping container shall be a grade V3c, V3s, or V4s fiberboard box fabricated in accordance with PPP-B-636 and closed in accordance with method III as specified in the appendix of PPP-B-636.

5.2.3 Commercial packing. Helmets, preserved as specified in 5.1, shall be packed in accordance with ASTM D 3951.

5.3 Palletization. When specified (see 6.2), helmets packed as specified in 5.2.2 and 5.2.3, shall be palletized on a 4-way entry pallet in accordance with load type Ia of MIL-STD-147. Pallet type shall be type I (4-way entry), type IV or type V in accordance with MIL-STD-147. Pallets shall be fabricated from wood groups I, II, III, or IV of MIL-STD-731. Each prepared load shall be bonded with primary and secondary straps in accordance with bonding means K and L or film bonding means O or P. Pallet pattern shall be number 90 in accordance with appendix of MIL-STD-147.

5.4 Marking. In addition to any special marking required by the contract or purchase order, shipping containers and palletized unit loads shall be marked in accordance with MIL-STD-129 or ASTM D 3951, as applicable.

5.4.1 Labels, mixed sizes. Each shipping container packed with mixed sizes shall have securely attached to the end and side, directly under the printing or stenciling, a white paper label 5 by 4 inches, with the words "MIXED NSN's" plainly printed or stamped thereon and under these words shall be legibly printed or stamped the correct quantity and NSN's contained therein.

## 6. NOTES

6.1 Intended use. The helmet is intended for use by ground troops and parachutists to provide ballistic protection.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this document.
- b. Size required (see 1.2).

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- c. When a first article is required (see 3.2, 4.3, and 6.3).
- d. Helmet shell preform approval (see 3.4.1.1.3).
- e. Mold and hole location authorization (see 4.4.2.1).
- f. Selection of applicable levels of preservation and packing (see 5.1 and 5.2).
- g. Type and class of unit load required (see 5.2.1).
- h. When weather-resistant grade fiberboard shipping containers are required for level B packing (see 5.2.2.1).
- i. When palletization is required (see 5.3).
- j. When ordering helmets for parachutists (see 6.8).

6.3 First article. When a first article is required, it shall be inspected and approved under the appropriate provisions of FAR 52.209-4. The first article should be a preproduction sample consisting of one shell (after outside preparation and before painting) plus five completed helmets. The contracting officer should include specific instructions in all acquisition instruments regarding arrangements for selection, inspection, and approval of the first article.

6.4 Guide sample. For access to samples, address the contracting activity issuing the invitation for bids.

6.5 Laminating resin system formulation. The following resin system formulation has been used to make acceptable helmets. Any contractor electing to use this formulation in part or in total does so with the knowledge that the Government is not liable for any expense or adverse results arising from its use.

<u>Components</u>	<u>Parts by weight</u>	<u>Percent of total solids</u>
Polyvinyl butyral (18-20% hydroxyl)	868 (25% solids in ethanol)	47.2
Phenol formaldehyde	100 (57% solids in ethanol)	12.4
Trimethylol phenol	267 (60% solids in ethanol)	34.8
Phthalic anhydride	25.6	5.6
Methanol	51.2	
TOTALS	<u>1311.8</u>	<u>100.0</u>

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6.6 Recycled material. It is encouraged that recycled material be used when practical as long as it meets the requirements of this document (see 3.3).

6.7 Rubber edging. Contractors are advised to be circumspect in the selection of the edging to be used and in the conduct of bonding operations. One prime factor in obtaining good adhesion is that the content of plasticizers, softeners, and extenders in the edging material be kept low. It is important also that the specified abrading be done across the full width of the edging; for this purpose, it is suggested that the edging channel be opened up flat and that a fine wire wheel, 0.004-inch diameter wire, of a 1 1/2 inch minimum width be used across the full width of the edging channel. Solvent cleaning is preferably done by a cloth wipe rather than by flooding.

6.8 Parachutists' helmet (see 6.2). The parachutists' helmet requires the following additional components:

- a. Pad (MIL-P-44081).
- b. Strap retention/with 5/8 inch screw (MIL-S-44022).

6.9 Subject term (key word) listing.

Body armor  
Headgear  
Helmet

6.10 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

## Custodians:

Army - GL  
Navy - NU  
Air Force - 99

## Preparing activity:

Army - GL  
Project No. 8470-0115

## Review activities:

Army - MD  
Navy - MC  
Air Force - 11, 82  
DLA - CT

## User activity:

Navy - YD



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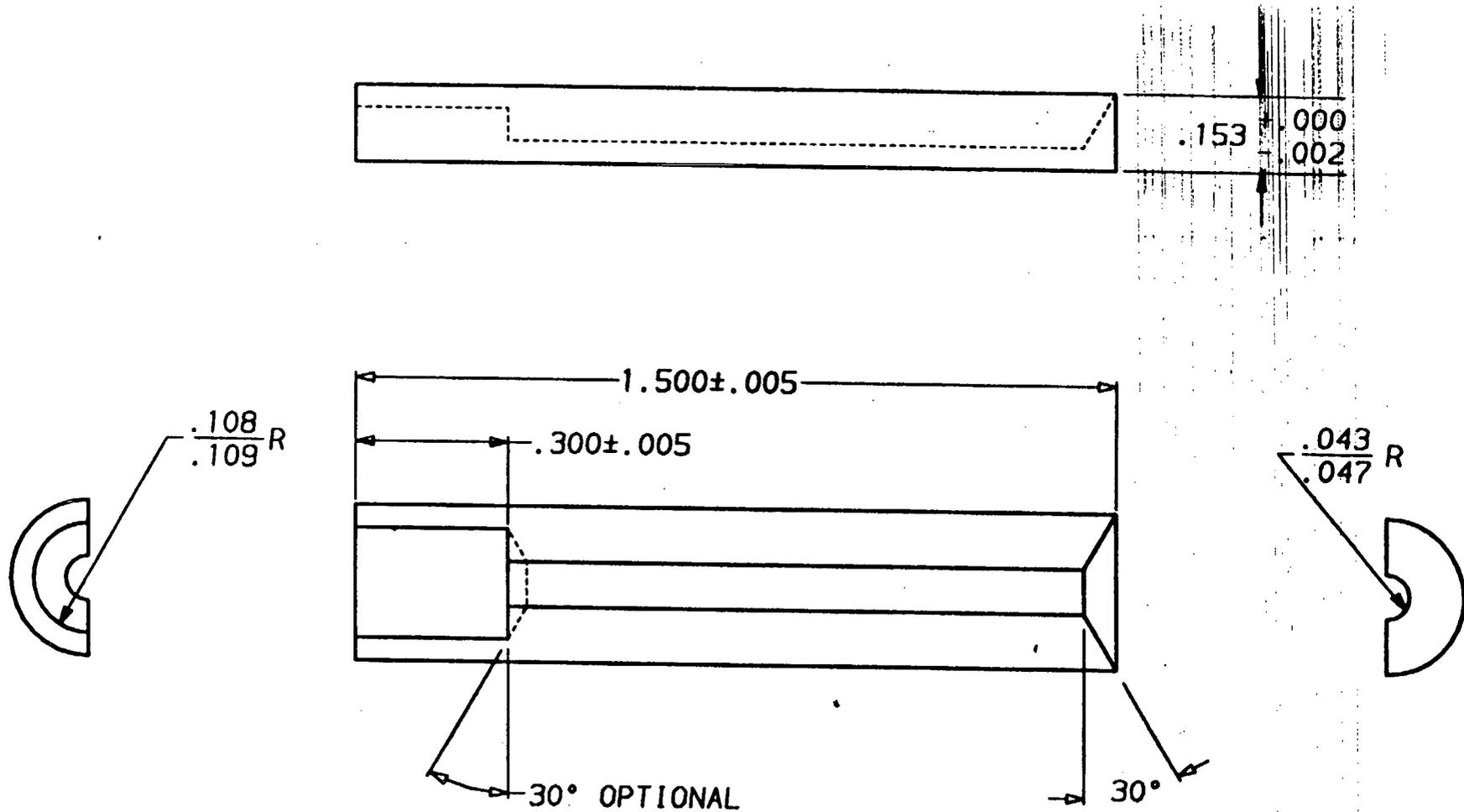
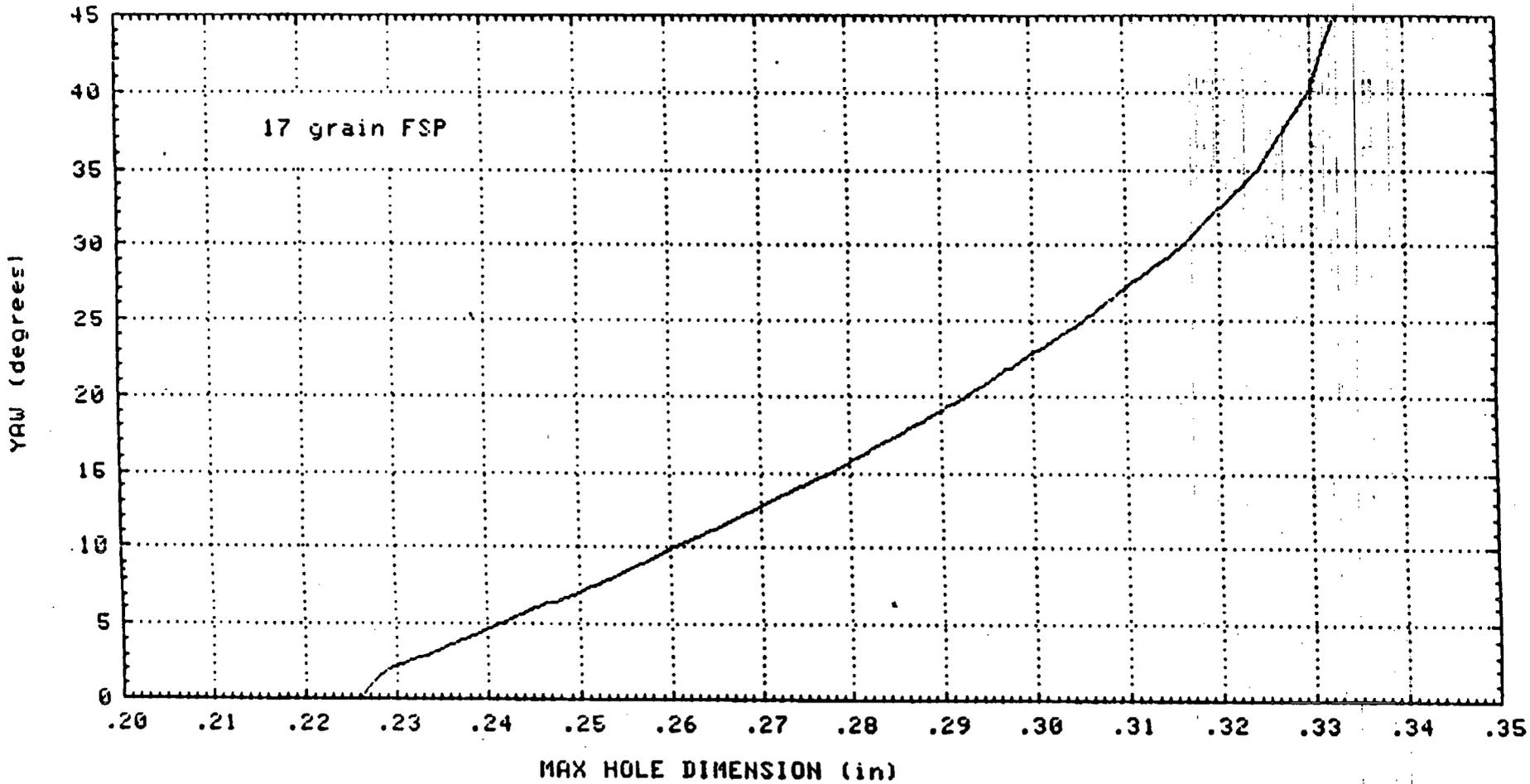


FIGURE 2. SABOT FOR 17 GRAIN FSP (FRAGMENT SIMULATED PROJECTILE)  
INJECTION MOLDED, TWO HALVES  
MATERIAL: POLYCARBONATE  
DIMENSIONS ARE IN INCHES

8-2-882

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FIGURE 3 PROJECTILE YAW VERSAS MAXIMUM HOLE DIMENSION

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

*(See Instructions - Reverse Side)*1. DOCUMENT NUMBER  
MIL-H-44099A2. DOCUMENT TITLE  
Helmet, Ground Troops and Parachutists

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

 VENDOR USER MANUFACTURER OTHER (Specify): \_\_\_\_\_

b. ADDRESS (Street, City, State, ZIP Code)

## 5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

## 6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

b. WORK TELEPHONE NUMBER (Include Area Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

8. DATE OF SUBMISSION (YYMMDD)