

INCH-POUND

MIL-DTL-46593B (MR)

6 July 2006

SUPERSEDING

MIL-P-46593A (MU)

12 October 1962

w/AMENDMENT 1

12 October 1964

DETAIL SPECIFICATION

PROJECTILE, CALIBERS .22, .30, .50, AND 20MM FRAGMENT-SIMULATING

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

1. SCOPE

1.1 Scope. This specification covers fragment-simulating projectiles used in ballistic testing (see 6.1).

1.2 Classification. The fragment-simulating projectiles are classified as follows:

Caliber - .22 Type 1 Projectile for Armor Plate (see Fig. 1 or 5)

Caliber - .22 Type 2 Projectile for Body Armor (see Fig. 1 or 5)

Caliber - .30 (see Fig. 2 or 5)

Caliber - .50 (see Fig. 3 or 5)

20MM – (see Fig. 4 or 5)

Comments, suggestions, or questions on this document should be addressed to: Director, U.S. Army Research Laboratory, Weapons and Materials Research Directorate, Materials Applications Branch, Specifications and Standards Office, Attn: AMSRD-ARL-WM-MC, Aberdeen Proving Ground, MD 21005-5069 or emailed to rsquilla@arl.army.mil . Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil/ .
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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

INTERNATIONAL STANDARDIZATION AGREEMENTS

ISO 9001 - Quality Management Systems - Requirements

(Copies of this document are available from <http://www.iso.ch> or from the International Organization for Standardization American National Standards Institute 11 West 42nd Street, 13th Floor New York, New York, United States, 10036.)

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-32033 - Lubricating Oil, General Purpose, Preservative
(Water-Displacing, Low Temperature)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-1916 - DoD Preferred Methods for Acceptance of Product

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

American Society for Quality (ASQ)

ASQC-A8402 - Quality Management and Quality Assurance - Vocabulary
(DoD Adopted)

(Copies of this document are available from www.asq.org or American Society for Quality, 600 Plankinton Avenue, Milwaukee, WI 53203.)

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ASME INTERNATIONAL

ASME B46.1 - Surface Texture, (Surface Roughness, Waviness and Lay)
(DoD Adopted)

(Copies of this document are available from www.asme.org or ASME International, Three Park Avenue, New York, NY 10016-5990)

ASTM INTERNATIONAL

ASTM A751 - Steel Products, Practices, and Terminology for Chemical Analysis of. (DoD Adopted)

(Copies of these documents are available from www.astm.org or ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959.)

2.4 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 takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Material Composition. The fragment-simulating projectile (FSP) shall be manufactured from cold rolled, annealed steel conforming to compositions 4337H or 4340H for the following FSPs: Caliber .22 Type 1; Caliber .30; Caliber .50; and 20MM. The Caliber .22 Type 2 FSP shall be manufactured as stated above or from other steels that are capable of hardness uniformity within hardness values indicated in Table I.

3.2 Hardness. The fragment-simulating projectile shall be fully quenched and tempered to a Rockwell hardness value as shown in Table I.

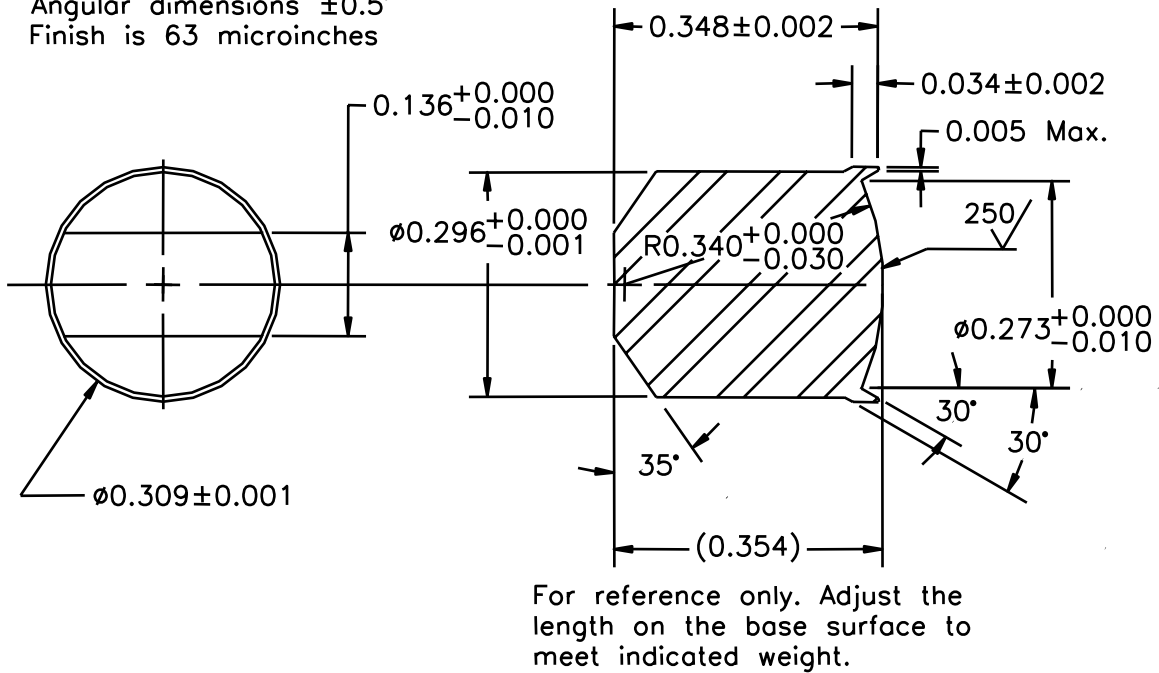
TABLE I - Hardness

<u>PROJECTILE</u>	<u>ROCKWELL HARDNESS C</u>
Caliber .22 Type 1	30 +/- 1
Caliber .22 Type 2	27 +/- 3
Caliber .30	30 +/- 1
Caliber .50	30 +/- 1
20MM	30 +/- 1

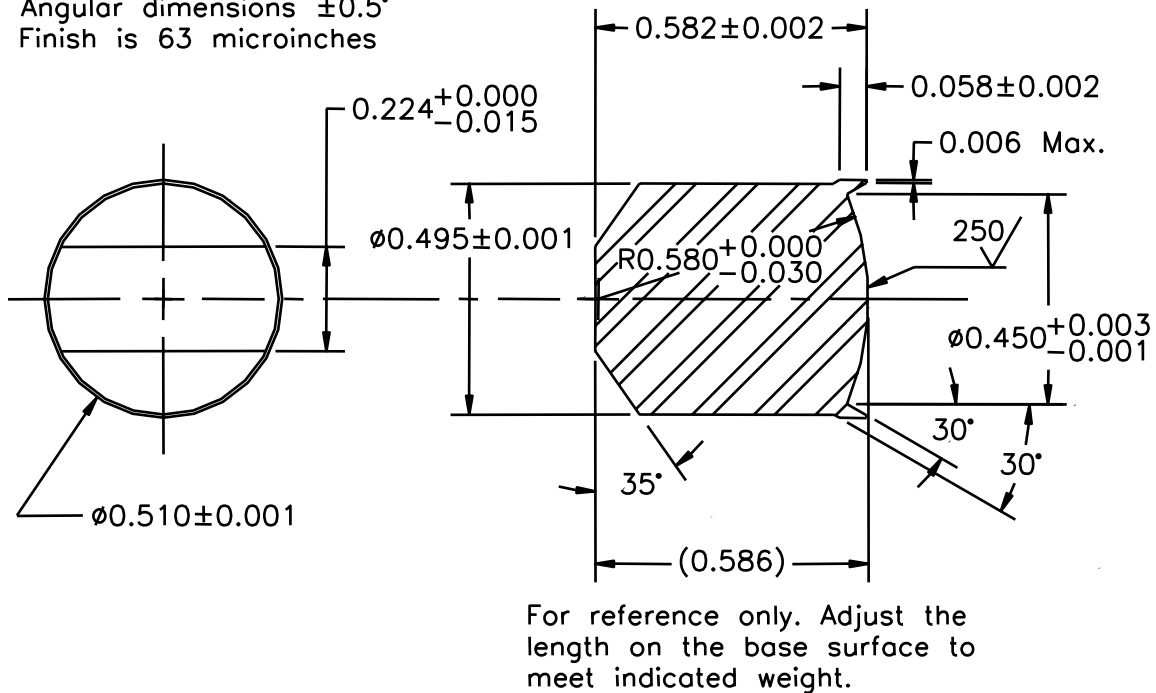
3.3 Weight. The fragment-simulating projectiles shall be of the weight shown in Table II. For those designs that will utilize a sabot fragment-simulating projectile the mass shall be as specified in Table III.

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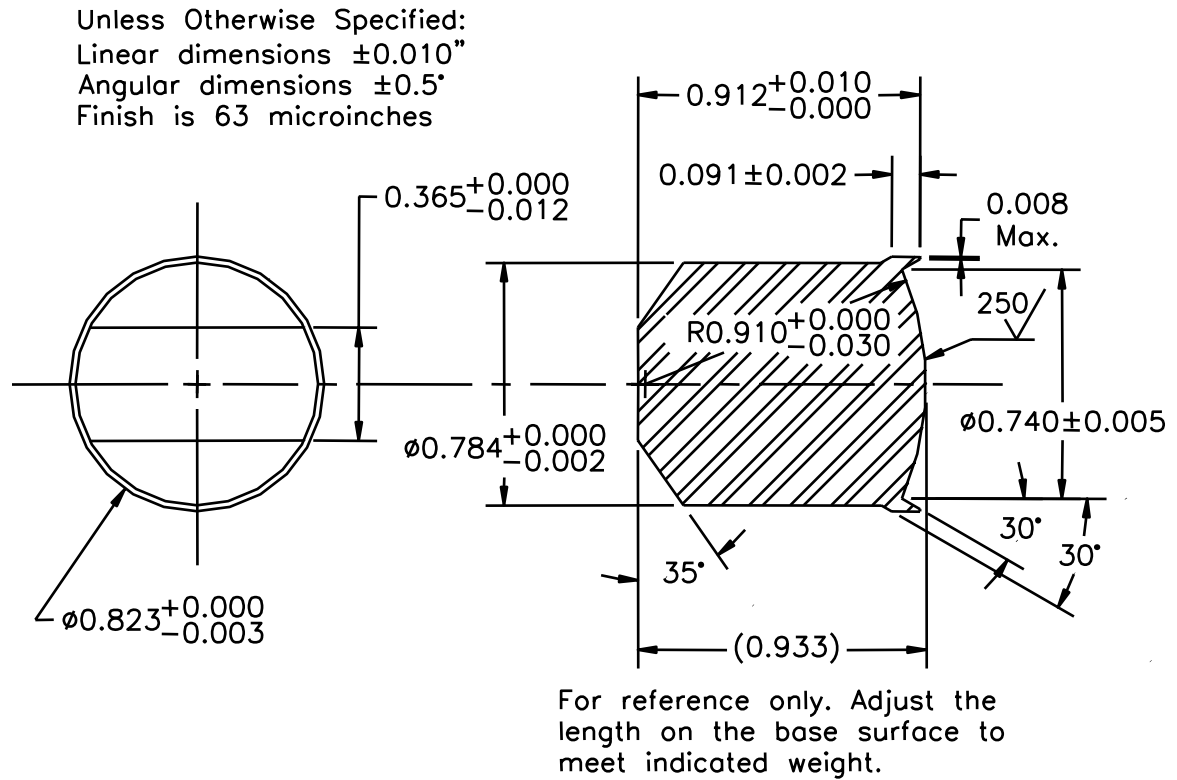
Unless Otherwise Specified:
 Linear dimensions ± 0.010 "
 Angular dimensions $\pm 0.5^\circ$
 Finish is 63 microinches

FIGURE 2. Fragment-simulating caliber .30.

Unless Otherwise Specified:
 Linear dimensions ± 0.010 "
 Angular dimensions $\pm 0.5^\circ$
 Finish is 63 microinches

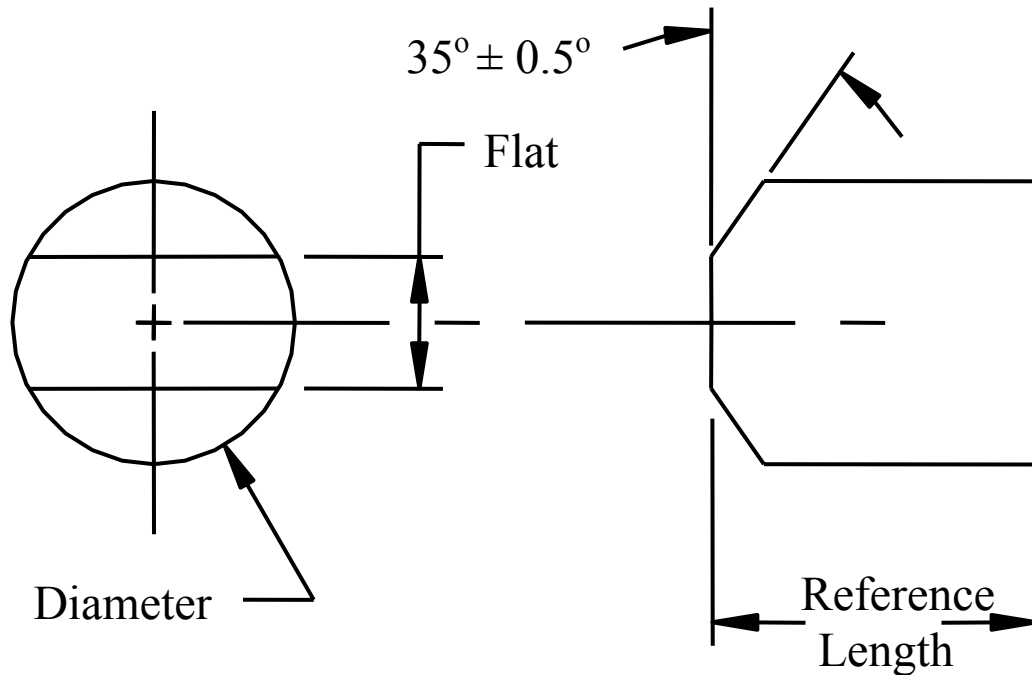
FIGURE 3. Fragment-simulating caliber .50.

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FIGURE 4. Fragment-simulating 20MM.TABLE III. Dimensions for Fragment Simulating Projectiles for Saboted Launch.

FSP Type	Diameter (inches)	Flat (inches)	Reference Length (inches)	Mass (grains)
Caliber .22 (Type 1 and 2)	$0.215 + 0.001$	$0.100 - 0.010$	0.250	17.0 ± 0.5
Caliber .30	$0.296 - 0.001$	$0.136 - 0.010$	0.340	44.0 ± 0.5
Caliber .50	0.495 ± 0.001	$0.224 - 0.015$	0.580	207.0 ± 2.0
20MM	$0.784 - 0.002$	$0.365 - 0.012$	0.900	830.0 ± 4.0

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NOTES:

1. No substitutions for steel.
2. Finish is 63 microinches.
3. Length is for reference only. Adjust length on the base surface to meet indicated weight.
4. Hardness is Rockwell C scale 30.0 ± 1.0 for all except the .22 caliber Type 2, which is Rockwell C 27.0 ± 3.0 .

Figure 5. Fragment Simulating Projectiles for Saboted Launch

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as conformance inspection (see 4.2).

4.2 Conformance inspection. The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified (see 6.2), the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order (see 6.2). The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2.1 Inspection terms and definitions. Reference shall be made to ASQC-A8402 to define the inspection terms used.

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4.2.2 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be performed in accordance with ISO 9001.

4.3 Sampling.

4.3.1 Lot. A lot shall consist of all the fragment-simulating projectiles of the same caliber, type, and millimeter, fully quenched and tempered in the same batch.

4.3.2 Submittal of product. Unless otherwise specified (see 6.2), the contractor shall submit the product in accordance with MIL-STD-1916.

4.3.3 Examination. Examination shall be performed for the requirements of 3.3, 3.4, and 3.5 in accordance with MIL-STD-1916 with the specific acceptance level that is specified in the contract or purchase order (see 6.2). All nonconforming material shall be rejected. ASME-B46.1 shall be used as a basis of comparison for surface roughness determination.

4.3.4 Inspection testing. The following tests shall be performed in accordance with the provisions of 4.4 except as provided in ISO 9001.

4.3.4.1 Material composition. A sample shall be selected for chemical analysis from the bars used for manufacturing of the fragment-simulating projectiles prior to machining or from sufficient parts prior to heat-treating to form a sample of at least 2 ounces. Failure to comply with the requirements of 3.1 shall be cause for rejection of the lot.

4.3.4.2 Hardness.

4.3.4.2.1 Caliber .22 Type 1, calibers .30, .50 and 20MM fragment-simulating projectiles. Caliber .22 Type 1, calibers .30, .50 and 20MM fragment-simulating projectiles shall be one hundred percent tested for hardness for compliance with 3.2. All nonconforming material shall be rejected.

4.3.4.2.2 Caliber .22 Type 2 fragment-simulating projectiles. The hardness of the Caliber .22 Type 2 fragment-simulating projectiles shall be tested for compliance with 3.2 in accordance with MIL-STD-1916 with the specific acceptance level that is specified in the contract or purchase order (see 6.2). All nonconforming material shall be rejected.

4.3.5 Inspection equipment. The examination and tests shall be made using equipment approved by the Government.

4.4 Test methods.

4.4.1 Material composition. Chemical analysis for conformance to the material composition requirements of 3.1 shall be conducted on the sample in accordance with ASTM A751.

4.4.2 Hardness. A hardness testing machine shall be used to determine compliance with the hardness requirement of 3.2.

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5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The fragment-simulating projectiles covered by this specification are intended for use in ballistic testing of various materials.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of the specification.
- b. Caliber, type, millimeter, and if sabot is required (see 1.2).
- c. Inspection facilities (see 4.2).
- d. Inspection records (see 4.2).
- e. Inspection conditions (see 4.2.2).
- f. Submittal of product (see 4.3.2).
- g. Specific acceptance level for 3.3, 3.4, and 3.5 (see 4.3.3).
- h. Specific acceptance level for 3.2 (see 4.3.4.2.2).
- i. Packaging requirements (see 5.1).
- j. Marking requirements (see 6.3).
- k. Packing identification (see 6.4).

6.3 Marking. Suggested wording to be included in the contract or purchase order "Marking for shipment and storage shall be in accordance with MIL-STD-129" (see 6.2).

6.4 Packing identification. Suggested wording to be included in the contract or purchase order "Fragment-simulating projectiles shall be packed separately according to caliber and hardness value" (see 6.2).

6.4 Subject term (key word) listing.

Armor plate	Caliber .50
Ballistic testing	Fragment-simulating
Body armor	Projectile
Caliber .22	20MM
Caliber .30	

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6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Custodian:
Army – MR

Preparing activity:
Army – MR

Review activities:
Army – AV

(Project 1305-0251)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil/>.