INCH-POUND

MIL-DTL-32375A (MR)
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SUPERSEDING
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w/AMENDMENT 1
11 December 2012

DETAIL SPECIFICATION

ARMOR PLATE, ALUMINUM ALLOY, 7056 and 7085, UNWELDABLE APPLIQUE

This specification is approved for use by 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 AA7056 and AA7085 wrought aluminum alloy armor plate for non-fusion welded applications in nominal thicknesses from 0.500 to 3.000 inch, inclusive (see 6.2). The fusion weldability of these wrought aluminum alloy armors has not been tested or analyzed over this nominal thickness range. Therefore, these alloys should only be used as appliqué armor until a weldability study has been completed with acceptable results

1.2 Classification. The wrought aluminum armor should be of the following class and tempers (Types), as specified (see 6.2).

1.2.1 Class I. Wrought aluminum armor that conforms to the Aluminum Association designation for the 7085 aluminum alloy. The applicable gauge range for Class I is 0.500-3.000 inches.

1.2.1.1 Type A. Type A has a temper designation of T711 which is a high-strength temper designed for maximum resistance to armor piercing (AP) projectiles.

1.2.1.2 Type B. Type B has a temper designation of T721 which is designed for maximum resistance to blast.

Comments, suggestions, or questions on this document should be addressed to: Director, U.S. Army Research Laboratory, Weapons and Materials Research Directorate, Materials and Manufacturing Technology Branch, Specifications and Standards Office, Attn: RDRL-WMM-D, Aberdeen Proving Ground, MD 21005-5069 or emailed to richard.j.squillacioti.civ@mail.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil/.

AMSC N/A FSC 9535

1.2.2 Class II. Wrought aluminum armor that conforms to the Aluminum Association designation for the 7056 aluminum alloy. The applicable gauge range for Class II is 0.500-3.000 inches.

1.2.2.1 Type A. Type A has a temper designation of T761 which is a high-strength temper designed for maximum resistance to armor piercing (AP) projectiles.

1.2.2.2 Type B. Type B has a temper designation of T721 which is designed for maximum resistance to blast.

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.

DEPARTMENT OF DEFENSE STANDARDS

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

(Copies of these documents are available online at http://quicksearch.dla.mil/.)

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.

THE ALUMINUM ASSOCIATION, INC.

AA ANSI H35.2(M) - Dimensional Tolerances for Aluminum Mill Products

(Copies of these documents are available online at http://www.aluminum.org).

ASTM INTERNATIONAL

ASTM B557 - Standard Test Methods for Tension Testing Wrought and Cast Aluminum and Magnesium-Alloy Products

ASTM E34 - Standard Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys

ASTM E607	-	Standard Test Method for Atomic Emission Spectrometric Analysis of Aluminum Alloys by the Point-to-Plane Technique, Nitrogen Atmosphere
ASTM E716	-	Standard Practices for Sampling Aluminum and Aluminum Alloys for Spectrochemical Analysis
ASTM E1251	-	Standard Test Method for Analysis of Aluminum and Aluminum Alloys by Atomic Emission Spectrometry

(Copies of these documents are available from http://www.astm.org.)

SAE INTERNATIONAL

AMS 2750	-	Pyrometry
AMS 2772	-	Heat Treatment of Aluminum Alloy Raw Materials

(Copies of these documents are available from http://www.sae.org.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, 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 First article. When specified in the contract or purchase order (see 6.2), first article testing shall be required and all test samples required by this specification shall be made available to the contracting officer or his authorized representative for approval in accordance with 4.3. First article testing shall be completed before production material is submitted for acceptance testing. The approval of the first article samples authorizes commencement of production but does not relieve the supplier of the responsibility to comply with all the applicable provisions of this specification. The first article samples and acceptance test plates shall be manufactured by the process proposed for use on production items.

3.2 Chemical composition. The chemical composition of the plates shall be within the limits shown in Table I. The limits specified in Table I were taken from Aluminum Association (AA) registered composition limits for Aluminum Alloys. A certification of conformance of the chemical composition of the alloy shall be furnished with the ballistic test plates.

3.3 Mechanical properties. Unless otherwise specified in the contract or order (see 6.2), the mechanical properties of the test specimen taken in the longitudinal direction shall meet the minimum mechanical properties listed in Table IIa and Table IIb. If mechanical property requirements differ from those contained in Table IIa or Table IIb or if any other properties are required, the ballistic requirements shall be negotiated between the procuring activity and the supplier.

3.4 Ballistic limit. The protection ballistic limit, BL(P), shall be as specified in Appendix A. When a complete penetration cannot be obtained for any class of armor material, the following

rule shall be in effect until a new ballistic acceptance round can be developed and utilized. When the ballistic velocities of four (4) partial penetrations are above the minimum ballistic requirement for the specific thickness, the material shall be certified as acceptable with a V_{50} (which obviously cannot be explicitly determined) above the minimum requirement.

TABLE I. Chemical composition, weight percent. 1/ 2/

ELEMENTS	SYMBOL	Class I 7085 ALLOY	Class II 7056 ALLOY
Silicon	Si	0.06	0.10
Iron	Fe	0.08	0.12
Copper	Cu	1.3 - 2.0	1.2 - 1.9
Manganese	Mn	0.04	0.20
Magnesium	Mg	1.2 - 1.8	1.5 - 2.3
Chromium	Cr	0.04	---
Zinc	Zn	7.0 – 8.0	8.5 - 9.7
Titanium	Ti	0.06	0.08
Zirconium	Zr	0.08 – 0.15	0.05 – 0.15
Other, max. Each	---	0.05	0.05
Other, max. Total 3/	---	0.15	0.15
Aluminum	Al	Remainder	Remainder

1/ Except for "Aluminum" and "others", analysis normally is made for elements for which specific limits are shown.
2/ Where single units are shown, these indicate the maximum amounts permitted.
3/ The sum of those "others" metallic elements 0.010 percent or more each, expressed to the second decimal before determining the sum.

TABLE IIa. Minimum mechanical properties for Class I, Al 7085 1/, 2/

Thickness, inches	Tensile Strength, ksi		Yield Strength, 0.2% Offset, ksi		Elongation percent	
	Al 7085		Al 7085		Al 7085	
	Type A	Type B	Type A	Type B	Type A	Type B
0.500 to 1.500, incl.	80	68	74	60	11	12
1.501 to 2.000, incl.	78	67	73	59	11	12
2.001 to 3.000, incl.	77	67	72	58	10	11

1/ The gage length shall be 1.400 inch for plates having a nominal thickness of 0.500 inch.
2/ Values are taken in the Longitudinal Transverse Direction (LT).

3.5 Thermal processing. Heat treatment shall conform to the requirements of SAE AMS 2750 and SAE AMS 2772 and shall be such as to enable the material to meet the requirements of these specifications.

3.6 Dimensions. Dimensions for plates delivered for fabrication shall have an overall dimension tolerance of +0.500/-0.000 for width and length unless otherwise specified in the contract or order (see 6.2).

TABLE IIb. Minimum mechanical properties for Class II, Al 7056 [1/, 2/]

Thickness, inches	Tensile Strength, ksi		Yield Strength, 0.2% Offset, ksi		Elongation percent	
	Al 7056		Al 7056		Al 7056	
	Type A	Type B	Type A	Type B	Type A	Type B
0.500 to 0.999, incl.	TBD [3/]	TBD [3/]	TBD [3/]	TBD [3/]	TBD [3/]	TBD [3/]
1.000 to 2.000, incl.	80	64	77	56	7	11
2.001 to 3.000, incl.	80	64	77	56	7	11

[1/] The gage length shall be 1.400 inch for plates having a nominal thickness of 0.500 inch.
[2/] Values are taken in the Longitudinal Transverse Direction (LT).
[3/] If the Contract or Purchase Order requires plate in the ordered thickness of 0.500 to 1.000, incl. the minimum mechanical properties shall be listed in the Contract or purchase order (see 6.2).

3.6.1 Tolerances. Unless otherwise specified in the contract or order (see 6.2), the plates shall not vary from the specified ordered dimensions by an amount greater than that specified by AA ANSI H35.2(M), except for thickness, as specified in Table III.

TABLE III. Thickness tolerances.

Ordered Thickness (Inches)		SPECIFIED WIDTH (Inches)								
		OVER	0.00	39.38	59.07	78.75	98.44	118.12	137.81	157.49
		THRU	39.37	59.06	78.74	98.43	118.11	137.80	157.48	177.17
OVER	THRU	TOLERANCES - INCHES (PLUS)								
0.500	1.000		0.031	0.031	0.037	0.043	0.051	0.060	0.070	0.085
1.001	1.575		0.039	0.039	0.047	0.055	0.065	0.075	0.090	0.105
1.576	2.362		0.055	0.055	0.060	0.070	0.085	0.100	0.115	---
2.363	3.000		0.075	0.075	0.085	0.100	0.105	0.125	---	---

3.7 Marking for identification. Unless otherwise specified in the contract or purchase order (see 6.2) each plate shall be marked on one plate edge with the manufacturer's name or CAGE code, the basic number of this specification, the plate thickness in inches, the alloy designation and the lot number or code relating to the lot number (see 4.2). The height of the characters shall be 3/8 of an inch or greater. Each plate shall be marked in lengthwise rows of characters recurring at intervals not greater than 3 feet, the rows being spaced not more than 6 inches apart and alternately staggered. The characters shall be not less than 3/8 inch in height and shall be applied using a suitable marking fluid whose residue shall contain no more than traces of halogen-bearing compounds and shall be capable of being removed in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the plate material or its performance and shall be sufficiently stable to withstand normal handling.

3.7.1 Ballistic test plates. In addition to the markings in 3.7, each ballistic test plate shall be marked with the letters PRE for First Article test plates and ACC for Acceptance test plates. This

marking shall be impression stamped on the edge in letters 3/8 inch high or greater. Ballistic retest plates shall be marked "R1" and "R2" respectively (see A.5.2).

3.8 Ballistic test plate information. For each lot of aluminum alloy armor a properly completed Aluminum Armor Test Data Form (See Figure 1) shall be submitted with each ballistic test plate that represents that particular processing lot.

3.9 Workmanship. Plate produced under this specification shall be uniform in quality and clean, smooth and sufficiently free from buckles, blisters, hard spots, damaged ends, laminations and other defects which may affect its use.

3.9.1 Imperfections. The depth of surface scratches, nicks, pits or gouges shall not reduce the plate thickness below the allowable minimum thickness. Isolated individual pits over 0.015 inches deep but not over 0.030 inches deep and not within 6 inches of each other and do not violate the minimum allowable thickness, are acceptable.

4. VERIFICATION

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

a. First article inspection (see 4.3).
b. Production inspection (see 4.4).

4.2 Lot. A lot shall consist of all plates of the same alloy and ordered thickness which has been processed together by the same mill practice. Unless otherwise specified in the contract or purchase order (see 6.2), the weight of the finished plate in the lot shall not exceed 50,000 pounds and shall be submitted for inspection as a unit.

4.3 First article inspection. First article inspection, except as otherwise indicated in this specification, shall utilize the same requirements, inspection, and test methods as the production acceptance inspection shown in 4.4.

4.4 Production inspection. Production inspection or conformance acceptance inspection shall include the examination of 4.6 and the tests of 4.7.

4.5 Sampling.

4.5.1 First article inspection.

4.5.1.1 Chemical composition. One (1) sample for chemical analysis shall be removed from each plate selected for ballistic testing and shall meet the requirements of 3.2 when tested as specified in 4.7.1.

4.5.1.2 Mechanical properties. One tension test specimen shall be removed from each plate that has been selected for ballistic testing and shall meet the requirements when tested as specified in 4.7.2.

REQUEST FOR BALLISTIC TEST OF ALUMINUM ALLOY 70xx ARMOR											
FIRING RECORD:								**DATE:**			
Plate MANUFACTURER / PRODUCER:								**PRIME CONTRACTOR:**			
Name:								Name:			
Address:								Address:			
POC:								POC:			
Phone No:								Phone No:			
Fax No:								Fax No:			
SPECIFICATION: MIL-DTL- 32375 (MR)								**REVISION: A**		**AMENDMENT:**	
CONTRACT NO:								ATC PROJECT NO:			
DCAS REGION:								BALLISTIC TEST CONTRACT NO:			
TEST ITEM IDENTIFICATION:											
Lot No. Class:			Type: Plate No.					Ordered Thickness		Alloy and Temper	
PURPOSE: ___ Acceptance ___ First Article ___ Development											
SAMPLE: ___ Primary ___ Retest (Firing Record No. of Failed Sample_____)											
CHEMICAL ANALYSIS:				**OTHERS (list below):**						Al :	
Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Zr			
MECHANICAL PROPERTIES:											
UTS (ksi):				0.2% YS (ksi):						Elongation (%):	
BALLISTIC TEST RESULTS:											
Test	Projectile	Obl. (deg)	Actual Thickness (in)	Required V_{50} (fps)	Actual V_{50} (fps)	Pass/ Fail	Notes				
LOTS REPRESENTED BY:			Reduced Testing				Audit Testing				
Lot [met] [failed to meet] the ballistic requirements of specification MIL-DTL- 32375A MR).											
Government Representative			Date		Supplier Representative				Date		

FIGURE 1. Aluminum Armor Test Data Form.

4.5.1.3 Ballistic tests. Two plates, 12 inches by 36 inches of each thickness to be supplied on the contract, shall be submitted for ballistic testing in accordance with Appendix A. The orientation of these plates with respect to the rolling direction shall be at the option of the producer.

4.5.2 Production inspection.

4.5.2.1 Chemical composition. The sample shall meet the chemical composition requirements of 3.2 when tested as specified in 4.7.1.

4.5.2.1.1 Ingot analysis. At least one sample shall be taken from the molten metal representing the ingots poured as a unit from the same source molten metal. Complete ingot analysis records shall be available to the Government at the producer's facility.

4.5.2.1.2 Product analysis. When sampling has not been made in accordance with 4.5.2.1.1, one sample shall be randomly taken for each 4,000 pounds or less in a lot. Complete product analysis records shall be available to the Government at the contractor's facility.

4.5.2.2 Mechanical properties. Samples for tension tests shall be selected from each lot in accordance with Table IV. Each sample shall be randomly selected from a different plate in the lot, and only one tension test specimen shall be made from each sample. The sample shall meet the requirements when tested as specified in 4.7.2.

TABLE IV. Number of tension tests.

Lot size, pounds	Minimum number of samples 1/
To 8,000, incl.	2
8,001 to 12,000, incl.	3
12,001 to 20,000, incl.	4
20,001 up	5

1/ If a lot consists of only one plate, one sample shall be required.

4.5.2.3 Ballistic testing. One plate, 12 inches by 36 inches, shall be randomly selected from each lot for ballistic testing. The orientation of the plate with respect to the rolling direction shall be at the option of the producer (see 6.2). The sample shall meet the requirements when tested as specified in 4.7.3.

4.6 Examination.

4.6.1 Visual. Each plate shall be examined for compliance with the identification marking (see 3.7) and workmanship (see 3.9) requirements.

4.6.2 Dimensions. Plates within a lot shall be measured to determine compliance with requirements of paragraph 3.6 in accordance with the sampling procedures approved by the procuring activity (see 6.2).

4.7 Test specimens.

4.7.1 Chemical composition. Samples for chemical analysis shall be prepared and tested in accordance with one or more ASTM methods of E34, E607, E716, and E1251. In case of dispute, analysis by method E34 shall be the basis for acceptance or rejection.

4.7.2 Mechanical properties. Tension test specimens shall be prepared and tested in accordance with ASTM B557. Specimens shall be taken in the longitudinal direction (LT). For material less than 0.500 inch in thickness, a standard rectangular tension test specimen shall be used. For plate in nominal thickness 0.500 to 1.500 inches, inclusive, tension test specimens shall be taken with the axis midway between the two plate surfaces. For plate in nominal thickness greater than 1.500 inches, the axis of the tension test specimen shall be three-fourths of the distance from one surface to the other.

4.7.3 Ballistic testing. The ordered thickness specified in the contract shall be used to determine the test projectile in accordance with Table V. Ballistic testing shall be in accordance with Appendix A. Test plate thickness, as measured by the ballistic testing agency, shall be used in conjunction with Table V and Appendix A to determine the required V_{50} protection ballistic limit for that plate. Thickness shall be determined as the average of at least four thickness measurements read on a deep throat micrometer or by means of an ultrasonic device to the nearest 0.001 of an inch and rounded off to the nearest 0.005 of an inch. Measurements shall be made on the intended impact area. In those cases where the BL(P) is within ±10 fps of the minimum required value for the measured average thickness (to the nearest 0.005-inch), an interpolation of the appropriate ballistic limit table shall be performed. The average plate thickness, computed to the nearest 0.001-inch, shall be used to determine the minimum required BL(P) for that plate.

4.7.3.1 Ballistic testing facility. Unless otherwise specified in the contract or purchase order (see 6.2), the ballistic test plates shall be forwarded to the Commander, U.S. Army Aberdeen Test Center, 400 Colleran Road, Bldg. 358, ATTN: CSTE-DTC-AT-SL-V (K. Beavers), Armor Acceptance – B690, Aberdeen Proving Ground, MD 21005-5059 for ballistic testing for first article or lot acceptance.

4.7.3.2 Incomplete penetrations. When a complete penetration cannot be obtained, the following rule shall be in effect until a new ballistic acceptance round can be developed and utilized. When the ballistic velocities of four (4) partial penetrations are above the minimum ballistic requirement for the specific thickness, the material shall be certified as acceptable with a V_{50} (which obviously cannot be explicitly determined) above the minimum requirement.

4.8 Rejection and retest. Unless otherwise specified in the contract or order (see 6.2) and except as specified in 4.7.2 and 4.7.3, rejection and retest shall be conducted in accordance with 4.8.1, 4.8.1.1, and 4.8.2.

4.8.1 Rejection of first article plates. When one or more first article test specimens fail to meet the requirements of 4.3, the product lot and process, represented by the test plates or specimens shall be subject to rejection except as otherwise provided in a sampling plan approved by the procuring activity and in requirements of 4.8.1.1.

TABLE V. Acceptance ballistic test plates.

Ordered Thickness, Inches	Projectile	Angle of Obliquity in Degrees	CLASS I & II TYPE A	CLASS I & II TYPE B
0.500 - 0.749	Cal. .30 AP M2	30	Table A-I	Table A-I
0.750 - 0.950	Cal. .50 FSP	0	Table A-II	Table A-II
0.951 - 1.500	20-mm FSP	0	Table A-III	Table A-III
0.750 - 1.500	Cal. .30 AP M2	0	Table A-IV	Table A-IV
1.501 - 2.500	Cal. .50 AP M2	0	Table A-V	Table A-V
2.501 – 3.000	Cal. .50 AP M2	0	N/A	Table A-V
2.501 – 3.000	14.5-mm BS-41	0	Table A-VI	N/A

4.8.1.1 Retest of first article samples. Resubmission and retest of first article samples shall not be made until the manufacturer has made necessary corrections in the processing of the material to the satisfaction of the procuring activity. If one of the retest specimens fails the lot shall be permanently rejected with no further testing permitted.

4.8.2 Ballistic. Rejection and retest of ballistic test plates shall be in accordance with A.5.2.

4.9 Reduced testing. At the discretion of the procuring activity (see 6.2), the amount of testing may be reduced provided the results on consecutive lots indicate that a uniform product meeting the testing requirements is being produced and providing the manufacturer agrees to maintain the same manufacturing procedures. Testing for a given plate thickness shall return to standard (non-reduced testing) conditions of one plate per lot, whenever a ballistic test plate fails to meet ballistic requirements.

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 components are 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 armor specified herein as Type A is intended for lightweight applications where resistance to ball and armor piercing types of ammunition and multiple hit capabilities are required. The armor specified herein as Type B is intended for use on combat and tactical vehicles to protect the occupants from underbody threats (blast).

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number and date of this specification.
(b) Specify choice of alloy, and ordered thickness (see 1.1)
(c) Specify classification (see 1.2).
(d) When first article is required (see 3.1).
(e) Special mechanical properties and ballistic requirements, if required (see 3.3 and Table 2b, footnote 3).
(f) Dimension and tolerance requirements if other than in 3.6 and 3.6.1.
(g) If markings are different (see 3.7).
(h) If the weight of finished plate can exceed 50,000 pounds (see 4.2).
(i) The orientation of the ballistic plate is different (see 4.5.2.3).
(j) Dimensional sampling procedure approved by the procuring activity (see 4.6.2).
(k) If approval was requested and received for a different ballistic testing facility (see 4.7.3.1)
(l) Rejection and retest requirement, if other than in 4.8.
(m) If reduced testing is allowed (see 4.9).
(n) Packaging requirements (see 5.1).

6.3 Metric units. When metric divisions are required, units for inch, foot, foot-pounds, feet per second, and pounds per square inch may be converted to the metric equivalent by multiplying them by the following conversion factors:

English	Multiply by	Equals	Metric SI unit
inch	0.0254	=	meter (m)
foot	0.3048	=	meter (m)
pound	0.4536	=	kilogram (kg)
foot-lb	1.3558	=	joule (j)
feet/second	0.3048	=	meter per second (m/s)
pounds/sq. inch	0.00689	=	Mega Pascal (MPa)

6.4 Subject term (key word) listing.

Ballistic testing
Caliber .30 AP M2
Caliber .50 AP M2
Caliber .50 FSP
Military vehicles
20-mm FSP

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.

APPENDIX A

BALLISTIC TESTING OF ARMOR PLATE, ALUMINUM ALLOY, 7056 and 7085, UNWELDABLE APPLIQUE

A.1 SCOPE

A.1.1 Scope. This appendix covers the minimum ballistic limits for acceptable requirements of aluminum alloy armor plate, un-weldable, 7056 and 7085 when tested in accordance with the provisions of this specification. When there is mutual agreement between contractor and procuring activity, this appendix becomes a mandatory part of this specification and the information contained herein is intended for compliance.

A.2 APPLICABLE DOCUMENTS

A.2.1 Government documents.

A.2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified (see 6.2), the issues of these documents are those cited in the solicitation or contract.

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-662 - V50 Ballistic Test for Armor

(Copies of these documents are available online at http://quicksearch.dla.mil/.)

A.3 DEFINITIONS

A.3.1 Complete penetration, (CP). A complete penetration occurs when the impacting projectile, or any fragment thereof, or any fragment of the test specimen perforates the witness plate, resulting in a crack or hole which permits light passage when a 60-watt, 110-volt bulb is placed proximate to the witness plate.

A.3.2 Fair impact. An impact may be considered fair when an un-yawed fragment simulator or test projectile strikes an unsupported area of the target material at a specified obliquity at a distance of at least two projectile diameters from any previous impact or disturbed area resulting from an impact, or from any crack, or from any edge of the test specimen.

A.3.3 Gap. A gap is the difference in fps between the high partial penetration velocity and the low complete penetration velocity used to compute the ballistic limit when the high partial penetration velocity is lower than the low complete penetration velocity.

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A.3.4 Partial penetration, (PP). Any impact which is not a complete penetration may be considered a partial penetration.

A.3.5 Witness plate. A thin sheet located behind and parallel to the ballistic test sample which is used to detect penetrating projectiles or spall.

A.4 REQUIREMENTS

A.4.1 Resistance to penetration. The minimum required V50 ballistic limit shall be in accordance with the values shown in tables A-I through A-VI.

A.5 TESTS

A.5.1 Ballistic tests. Testing shall be in accordance with MIL-STD-662, V50 Ballistic Test for Armor, except that nothing in this procedure shall be construed to supersede or invalidate the requirements of this specification.

A.5.1.1 Temperature Conditioning. Prior to the test, the test item(s) shall be temperature conditioned at least eight hours. Thermostatic control shall be such that the average temperature of the item during the test shall be 72 ± 15°F (22 ± 8°C).

A.5.1.2 Protection ballistic limit, BL(P).

A.5.1.2.1 Normal circumstances. The BL(P) shall consist of an equal number of fair impact complete and partial penetration velocities attained by the up-and-down firing method. All BL(P)'s shall be computed using the highest partial penetration velocities and the lowest complete penetration velocities. Firing shall continue until either a 4-round BL(P) having a maximum velocity spread of 60 fps or a 6-round BL(P) having a maximum velocity spread of 90 fps has been attained, whichever comes first in the normal sequence of firing. If both occur simultaneously, the 6-round BL(P) shall be reported.

A.5.1.2.2 Large zone of mixed results. In the event that the zone of mixed results (difference between the high partial penetration velocity and the low complete penetration velocity, the PP[P] velocity being higher than the low CP[P] velocity) exceeds 90 fps, the firing data shall be compared with the specification minimum ballistic requirements. If the lowest complete penetration velocity is equal to or above the minimum specified ballistic limit velocity for the plate thickness, the ballistic limit shall be computed on the basis of 4- or 6-rounds using the smallest possible velocity spread. If the lowest complete penetration velocity is below the minimum allowable ballistic limit velocity, then testing shall continue until a 10-round ballistic limit has been attained using the smallest possible velocity spread. Ten-round ballistic limits shall be reported as agreed upon between the contractor and procuring activity.

A.5.1.2.3 Reduction of large velocity gap in borderline cases. If the ballistic limit, which has been determined, is within ± 10 fps from the minimum allowable ballistic limit and a gap exists which is greater than 25 fps, then another round, or rounds, shall be fired

to reduce the gap to 25 fps or less. The ballistic limit shall then be recomputed using the above criteria. The recomputed BL(P) shall be reported as the BL(P) of the plate (in borderline cases, a reduction of the gap between the high partial penetration velocity and the low complete velocity should result in a better evaluation of the BL(P)).

A.5.2 Rejection and retest of ballistic plates.

A.5.2.1 First article tests (rejection). Unless otherwise specified in the contract or order, failure of any of the first article test plates to meet the minimum ballistic requirements shown in the appendix of this specification indicates failure of the product and process.

A.5.2.2 First article (retests). Resubmission of ballistic retest plates shall not be made until the manufacturer has made the necessary corrections in the processing of the material to the satisfaction of the procuring activity. Two retest plates shall be submitted for first article testing, and both tests shall pass; otherwise, the armor material shall be rejected.

A.5.2.3 Acceptance tests (rejection). Unless otherwise specified in the contract or order, failure of a test plate to meet the ballistic requirements indicates failure of the lot; however, the final decision shall depend on the outcome of retests, if submitted.

A.5.2.4 Acceptance tests (retests). If a test plate representing a lot fails to meet the ballistic requirement, the manufacturer, upon notification of the failure may submit at his expense two additional test plates from the same lot for ballistic retest. If either of these plates fails the ballistic test, the lot shall be rejected. The manufacturer may elect to resubmit the lot after retreatment of the entire lot by submitting two additional test plates. If either of these plates fails, the lot shall be permanently rejected.

A.5.3 Disposal of ballistic test plates.

A.5.3.1 First article test plates. Upon request of the applicant within 15 days after ballistic testing, first article plates shall be returned "as is" to the applicant, at his expense, unless the plates were destroyed in testing.

A.5.3.2 Acceptance test plates. Acceptance test plates that comply with the requirements of this specification are considered part of the lot they represent, and ownership of the test plates passes to the Government with the acceptance of that lot. Acceptance test plates that fail to comply with the requirements of this specification including the plates utilized for acceptance retests are considered part of the lot they represent and remain the property of the producer. The now rejected lot also remains the property of the producer. The failed plates shall be returned, upon request, as in A.5.3.1.

APPENDIX A

TABLE A-I. Minimum required ballistic limits - caliber .30 AP M2 projectiles at 30° obliquity.

Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps	
	Type A	Type B		Type A	Type B		Type A	Type B
0.475	1580	1481	0.580	1822	1679	0.685	2035	1856
0.480	1592	1491	0.585	1832	1688	0.690	2044	1864
0.485	1604	1501	0.590	1843	1697	0.695	2054	1872
0.490	1617	1511	0.595	1854	1705	0.700	2063	1880
0.495	1629	1520	0.600	1864	1714	0.705	2073	1888
0.500 [1/]	1641	1530	0.605	1875	1723	0.710	2082	1896
0.505	1653	1540	0.610	1885	1731	0.715	2092	1904
0.510	1664	1550	0.615	1895	1740	0.720	2101	1911
0.515	1676	1559	0.620	1906	1748	0.725	2110	1919
0.520	1688	1569	0.625	1916	1757	0.730	2120	1927
0.525	1699	1578	0.630	1926	1765	0.735	2129	1935
0.530	1711	1588	0.635	1936	1774	0.740	2138	1942
0.535	1722	1597	0.640	1946	1782	0.745	2147	1950
0.540	1733	1606	0.645	1956	1791	0.749 [2/]	2154	1956
0.545	1745	1616	0.650	1966	1799	0.755	2165	1965
0.550	1756	1625	0.655	1976	1807	0.760	2174	1973
0.555	1767	1634	0.660	1986	1815	0.765	2183	1980
0.560	1778	1643	0.665	1996	1824	0.770	2192	1988
0.565	1789	1652	0.670	2006	1832	0.775	2201	1995
0.570	1800	1661	0.675	2015	1840	0.780	2210	2003
0.575	1811	1670	0.680	2025	1848	0.785	2219	2010

[1/] Specification (Type A & B) requirements begin for this ordered thickness.
[2/] Specification (Type A & B) requirements end for this ordered thickness.

Note: Tabulated values on either side of the ordered thicknesses are for interpolation of BL(P) requirements on undersize or oversize plates.

APPENDIX A

TABLE A-II. Minimum required ballistic limits – caliber .50 fragment simulating projectiles at 0° obliquity.

Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps	
	Type A	Type B		Type A	Type B		Type A	Type B
0.730	1916	1858	0.815	2287	2191	0.900	2730	2583
0.735	1936	1876	0.820	2311	2212	0.905	2759	2608
0.740	1956	1894	0.825	2335	2234	0.910	2787	2634
0.745	1976	1913	0.830	2359	2255	0.915	2817	2659
0.750 [1/]	1997	1931	0.835	2384	2277	0.920	2846	2685
0.755	2018	1950	0.840	2409	2299	0.925	2876	2711
0.760	2039	1969	0.845	2434	2322	0.930	2906	2738
0.765	2061	1988	0.850	2460	2344	0.935	2936	2764
0.770	2082	2008	0.855	2486	2367	0.940	2967	2791
0.775	2104	2027	0.860	2512	2390	0.945	2998	2819
0.780	2126	2047	0.865	2538	2414	0.950 [2/]	3030	2846
0.785	2148	2067	0.870	2565	2437	0.955	3061	2874
0.790	2171	2087	0.875	2591	2461	0.960	3093	2902
0.795	2193	2107	0.880	2619	2485	0.965	3126	2930
0.800	2216	2128	0.885	2646	2509	0.970	3159	2959
0.805	2240	2149	0.890	2674	2533	0.975	3192	2987
0.810	2263	2169	0.895	2702	2558	0.980	3225	3016

[1/] Specification (Type A & B) requirements begin for this ordered thickness.
[2/] Specification (Type A & B) requirements end for this ordered thickness.

Note: Tabulated values on either side of the ordered thicknesses are for interpolation of BL(P) requirements on undersize or oversize plates.

TABLE A-III. Minimum required ballistic limits – 20mm fragment simulating projectiles at 0° obliquity.

Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps	
	Type A	Type B		Type A	Type B		Type A	Type B
0.930	1311	1255	1.130	1694	1622	1.330	2188	2097
0.935	1319	1263	1.135	1705	1633	1.335	2202	2111
0.940	1328	1271	1.140	1716	1643	1.340	2217	2124
0.945	1336	1279	1.145	1727	1654	1.345	2231	2138
0.951 [1/]	1347	1289	1.150	1738	1664	1.350	2245	2152
0.955	1354	1296	1.155	1749	1675	1.355	2260	2166
0.960	1362	1304	1.160	1760	1686	1.360	2274	2179
0.965	1371	1313	1.165	1771	1697	1.365	2289	2194
0.970	1380	1321	1.170	1783	1708	1.370	2303	2208
0.975	1389	1330	1.175	1794	1719	1.375	2318	2222
0.980	1398	1338	1.180	1806	1730	1.380	2333	2236
0.985	1407	1347	1.185	1817	1741	1.385	2348	2251
0.990	1416	1355	1.190	1829	1752	1.390	2363	2265
0.995	1425	1364	1.195	1841	1763	1.395	2378	2280
1.000	1434	1373	1.200	1853	1775	1.400	2394	2294
1.005	1443	1382	1.205	1864	1786	1.405	2409	2309
1.010	1452	1391	1.210	1876	1798	1.410	2424	2324
1.015	1462	1400	1.215	1889	1809	1.415	2440	2339
1.020	1471	1409	1.220	1901	1821	1.420	2456	2354
1.025	1481	1418	1.225	1913	1833	1.425	2471	2369
1.030	1490	1427	1.230	1925	1844	1.430	2487	2384
1.035	1500	1436	1.235	1938	1856	1.435	2503	2400
1.040	1509	1445	1.240	1950	1868	1.440	2519	2415
1.045	1519	1455	1.245	1963	1880	1.445	2536	2431
1.050	1529	1464	1.250	1975	1892	1.450	2552	2446
1.055	1539	1473	1.255	1988	1905	1.455	2568	2462
1.060	1548	1483	1.260	2001	1917	1.460	2585	2478
1.065	1558	1492	1.265	2013	1929	1.465	2601	2494
1.070	1568	1502	1.270	2026	1942	1.470	2618	2510
1.075	1578	1512	1.275	2039	1954	1.475	2635	2526
1.080	1589	1521	1.280	2053	1967	1.480	2652	2542
1.085	1599	1531	1.285	2066	1979	1.485	2669	2559
1.090	1609	1541	1.290	2079	1992	1.490	2686	2575
1.095	1619	1551	1.295	2092	2005	1.495	2703	2592
1.100	1630	1561	1.300	2106	2018	1.500 [2/]	2721	2609
1.105	1640	1571	1.305	2119	2031	1.505	2738	2625
1.110	1651	1581	1.310	2133	2044	1.510	2756	2642
1.115	1661	1591	1.315	2147	2057	1.515	2774	2659
1.120	1672	1602	1.320	2160	2070	1.520	2791	2676
1.125	1683	1612	1.325	2174	2084	1.525	2809	2694

[1/] Specification (Type A & B) requirements begin for this ordered thickness.
[2/] Specification (Type A & B) requirements end for this ordered thickness.

Note: Tabulated values on either side of the ordered thicknesses are for interpolation of BL(P) requirements on undersize or oversize plates.

TABLE A-IV. Minimum required ballistic limits - caliber .30 AP M2 projectiles at 0° obliquity.

Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps	
	Type A	Type B		Type A	Type B		Type A	Type B
0.730	1912	1787	0.910	2192	2040	1.090	2440	2265
0.735	1920	1794	0.915	2199	2046	1.095	2446	2271
0.740	1928	1802	0.920	2206	2053	1.100	2453	2277
0.745	1937	1809	0.925	2214	2059	1.105	2459	2282
0.750 1/	1945	1816	0.930	2221	2066	1.110	2466	2288
0.755	1953	1824	0.935	2228	2072	1.115	2472	2294
0.760	1961	1831	0.940	2235	2079	1.120	2479	2300
0.765	1969	1839	0.945	2242	2085	1.125	2485	2306
0.770	1977	1846	0.950	2249	2092	1.130	2492	2312
0.775	1985	1853	0.955	2256	2098	1.135	2498	2318
0.780	1994	1860	0.960	2263	2105	1.140	2504	2323
0.785	2002	1868	0.965	2270	2111	1.145	2511	2329
0.790	2009	1875	0.970	2278	2117	1.150	2517	2335
0.795	2017	1882	0.975	2284	2124	1.155	2523	2341
0.800	2025	1889	0.980	2291	2130	1.160	2530	2346
0.805	2033	1896	0.985	2298	2136	1.165	2536	2352
0.810	2041	1903	0.990	2305	2143	1.170	2542	2358
0.815	2049	1910	0.995	2312	2149	1.175	2549	2364
0.820	2057	1917	1.000	2319	2155	1.180	2555	2369
0.825	2064	1924	1.005	2326	2161	1.185	2561	2375
0.830	2072	1931	1.010	2333	2168	1.190	2567	2381
0.835	2080	1938	1.015	2340	2174	1.195	2574	2386
0.840	2087	1945	1.020	2347	2180	1.200	2580	2392
0.845	2095	1952	1.025	2353	2186	1.205	2586	2397
0.850	2103	1959	1.030	2360	2192	1.210	2592	2403
0.855	2110	1966	1.035	2367	2198	1.215	2598	2409
0.860	2118	1973	1.040	2374	2205	1.220	2604	2414
0.865	2125	1979	1.045	2380	2211	1.225	2611	2420
0.870	2133	1986	1.050	2387	2217	1.230	2617	2425
0.875	2140	1993	1.055	2394	2223	1.235	2623	2431
0.880	2148	2000	1.060	2400	2229	1.240	2629	2436
0.885	2155	2006	1.065	2407	2235	1.245	2635	2442
0.890	2162	2013	1.070	2414	2241	1.250	2641	2447
0.895	2170	2020	1.075	2420	2247	1.255	2647	2453
0.900	2177	2026	1.080	2427	2253	1.260	2653	2458
0.905	2185	2033	1.085	2433	2259	1.265	2659	2464

1/ Specification (Type A & B) requirements begin for this ordered thickness.

Note: Tabulated values on either side of the ordered thicknesses are for interpolation of BL(P) requirements on undersize or oversize plates.

TABLE A-IV. Minimum required ballistic limits - caliber .30 AP M2 projectiles at 0° obliquity (continued).

Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps	
	Type A	Type B		Type A	Type B		Type A	Type B
1.270	2665	2469	1.355	2765	2560	1.440	2861	2648
1.275	2671	2475	1.360	2771	2566	1.445	2867	2653
1.280	2677	2480	1.365	2776	2571	1.450	2872	2658
1.285	2683	2486	1.370	2782	2576	1.455	2878	2663
1.290	2689	2491	1.375	2788	2581	1.460	2884	2668
1.295	2695	2496	1.380	2794	2586	1.465	2889	2673
1.300	2701	2502	1.385	2799	2592	1.470	2895	2678
1.305	2707	2507	1.390	2805	2597	1.475	2900	2683
1.310	2712	2513	1.395	2811	2602	1.480	2906	2688
1.315	2718	2518	1.400	2816	2607	1.485	2911	2693
1.320	2724	2523	1.405	2822	2612	1.490	2917	2698
1.325	2730	2529	1.410	2828	2617	1.495	2922	2703
1.330	2736	2534	1.415	2833	2623	1.500 [2/]	2928	2708
1.335	2742	2539	1.420	2839	2628	1.505	2933	2713
1.340	2748	2544	1.425	2845	2633	1.510	2938	2718
1.345	2753	2550	1.430	2850	2638	1.515	2944	2723
1.350	2759	2555	1.435	2856	2643	1.520	2949	2728

[2/] Specification (Type A & B) requirements end for this ordered thickness.

Note: Tabulated values on either side of the ordered thicknesses are for interpolation of BL(P) requirements on undersize or oversize plates.

TABLE A-V. Minimum required ballistic limits - caliber .50 AP M2 projectiles at 0° obliquity.

Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps	
	Type A	Type B		Type A	Type B		Type A	Type B
1.480	2080	1907	1.670	2258	2081	1.860	2423	2241
1.485	2085	1912	1.675	2262	2085	1.865	2427	2245
1.490	2090	1917	1.680	2267	2089	1.870	2431	2249
1.495	2095	1921	1.685	2271	2094	1.875	2435	2253
1.501 1/	2100	1927	1.690	2276	2098	1.880	2439	2257
1.505	2104	1931	1.695	2280	2102	1.885	2444	2261
1.510	2109	1936	1.700	2285	2107	1.890	2448	2265
1.515	2114	1940	1.705	2289	2111	1.895	2452	2269
1.520	2119	1945	1.710	2294	2115	1.900	2456	2273
1.525	2124	1950	1.715	2298	2120	1.905	2460	2277
1.530	2128	1954	1.720	2302	2124	1.910	2464	2281
1.535	2133	1959	1.725	2307	2128	1.915	2468	2285
1.540	2138	1964	1.730	2311	2132	1.920	2472	2289
1.545	2143	1968	1.735	2316	2137	1.925	2477	2293
1.550	2147	1973	1.740	2320	2141	1.930	2481	2297
1.555	2152	1977	1.745	2324	2145	1.935	2485	2301
1.560	2157	1982	1.750	2329	2149	1.940	2489	2305
1.565	2161	1987	1.755	2333	2154	1.945	2493	2309
1.570	2166	1991	1.760	2337	2158	1.950	2497	2313
1.575	2171	1996	1.765	2342	2162	1.955	2501	2317
1.580	2175	2000	1.770	2346	2166	1.960	2505	2320
1.585	2180	2005	1.775	2350	2170	1.965	2509	2324
1.590	2185	2009	1.780	2355	2175	1.970	2513	2328
1.595	2189	2014	1.785	2359	2179	1.975	2517	2332
1.600	2194	2018	1.790	2363	2183	1.980	2521	2336
1.605	2199	2023	1.795	2368	2187	1.985	2525	2340
1.610	2203	2027	1.800	2372	2191	1.990	2529	2344
1.615	2208	2032	1.805	2376	2195	1.995	2533	2348
1.620	2213	2036	1.810	2380	2200	2.000	2537	2352
1.625	2217	2041	1.815	2385	2204	2.005	2541	2355
1.630	2222	2045	1.820	2389	2208	2.010	2545	2359
1.635	2226	2050	1.825	2393	2212	2.015	2549	2363
1.640	2231	2054	1.830	2397	2216	2.020	2553	2367
1.645	2235	2059	1.835	2402	2220	2.025	2557	2371
1.650	2240	2063	1.840	2406	2224	2.030	2561	2375
1.655	2244	2067	1.845	2410	2228	2.035	2565	2379
1.660	2249	2072	1.850	2414	2232	2.040	2569	2382
1.665	2253	2076	1.855	2419	2237	2.045	2573	2386

1/ Specification (Type A & B) requirements begin for this ordered thickness.

Note: Tabulated values on either side of the ordered thicknesses are for interpolation of BL(P) requirements on undersize or oversize plates.

TABLE A-V. Minimum required ballistic limits - caliber .50 AP M2 projectiles at 0° obliquity (continued).

Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps		Thickness, inches	Required BL(P), fps	
	Type A	Type B		Type A	Type B		Type A	Type B
2.050	2577	2390	2.225	2711	2520	2.400	2839	2643
2.055	2581	2394	2.230	2715	2523	2.405	2843	2647
2.060	2585	2398	2.235	2719	2527	2.410	2847	2650
2.065	2589	2401	2.240	2723	2531	2.415	2850	2653
2.070	2593	2405	2.245	2726	2534	2.420	2854	2657
2.075	2597	2409	2.250	2730	2538	2.425	2857	2660
2.080	2601	2413	2.255	2734	2541	2.430	2861	2664
2.085	2604	2416	2.260	2737	2545	2.435	2864	2667
2.090	2608	2420	2.265	2741	2548	2.440	2868	2671
2.095	2612	2424	2.270	2745	2552	2.445	2871	2674
2.100	2616	2428	2.275	2749	2556	2.450	2875	2677
2.105	2620	2432	2.280	2752	2559	2.455	2878	2681
2.110	2624	2435	2.285	2756	2563	2.460	2882	2684
2.115	2628	2439	2.290	2760	2566	2.465	2885	2687
2.120	2632	2443	2.295	2763	2570	2.470	2889	2691
2.125	2635	2446	2.300	2767	2573	2.475	2892	2694
2.130	2639	2450	2.305	2771	2577	2.480	2896	2698
2.135	2643	2454	2.310	2774	2580	2.485	2899	2701
2.140	2647	2458	2.315	2778	2584	2.490	2903	2704
2.145	2651	2461	2.320	2782	2587	2.495	2906	2708
2.150	2655	2465	2.325	2785	2591	2.500 [2/]	2910	2711
2.155	2658	2469	2.330	2789	2594	2.505	2913	2714
2.160	2662	2472	2.335	2793	2598	2.510	2917	2718
2.165	2666	2476	2.340	2796	2601	2.515	2920	2721
2.170	2670	2480	2.345	2800	2605	2.520	2924	2724
2.175	2674	2483	2.350	2803	2608	2.525	**N/A**	2728
2.180	2677	2487	2.355	2807	2612	2.530	**N/A**	2731
2.185	2681	2491	2.360	2811	2615	2.535	**N/A**	2734
2.190	2685	2494	2.365	2814	2619	2.540	**N/A**	2738
2.195	2689	2498	2.370	2818	2622	2.545	**N/A**	2741
2.200	2693	2502	2.375	2821	2626	2.550	**N/A**	2744
2.205	2696	2505	2.380	2825	2629	2.555	**N/A**	2748
2.210	2700	2509	2.385	2829	2633	2.560	**N/A**	2751
2.215	2704	2512	2.390	2832	2636	2.565	**N/A**	2754
2.220	2708	2516	2.395	2836	2640	2.570	**N/A**	2758

[2/] Type A requirements end for this ordered thickness

Note: Tabulated values on either side of the ordered thicknesses are for interpolation of BL(P) requirements on undersize or oversize plates.

TABLE A-V. Minimum required ballistic limits for Type B only - caliber .50 AP M2 projectiles at 0° obliquity (continued).

Thickness, inches	Required BL(P), fps Type B	Thickness, inches	Required BL(P), fps Type B	Thickness, inches	Required BL(P), fps Type B
2.575	2761	2.730	2861	2.885	2958
2.580	2764	2.735	2865	2.890	2961
2.585	2768	2.740	2868	2.895	2964
2.590	2771	2.745	2871	2.900	2967
2.595	2774	2.750	2874	2.905	2971
2.600	2777	2.755	2877	2.910	2974
2.605	2781	2.760	2880	2.915	2977
2.610	2784	2.765	2884	2.920	2980
2.615	2787	2.770	2887	2.925	2983
2.620	2790	2.775	2890	2.930	2986
2.625	2794	2.780	2893	2.935	2989
2.630	2797	2.785	2896	2.940	2992
2.635	2800	2.790	2899	2.945	2995
2.640	2803	2.795	2902	2.950	2998
2.645	2807	2.800	2906	2.955	3001
2.650	2810	2.805	2909	2.960	3004
2.655	2813	2.810	2912	2.965	3007
2.660	2816	2.815	2915	2.970	3010
2.665	2820	2.820	2918	2.975	3013
2.670	2823	2.825	2921	2.980	3016
2.675	2826	2.830	2924	2.985	3019
2.680	2829	2.835	2927	2.990	3022
2.685	2833	2.840	2930	2.995	3025
2.690	2836	2.845	2934	3.000 [2/]	3028
2.695	2839	2.850	2937	3.005	3031
2.700	2842	2.855	2940	3.010	3034
2.705	2845	2.860	2943	3.015	3037
2.710	2849	2.865	2946	3.020	3040
2.715	2852	2.870	2949	3.025	3043
2.720	2855	2.875	2952	3.030	3046
2.725	2858	2.880	2955	3.035	3049

[2/] Type B requirements end for this ordered thickness.

Note: Tabulated values on either side of the ordered thicknesses are for interpolation of BL(P) requirements on undersize or oversize plates.

APPENDIX A

TABLE A-VI. Minimum required ballistic limits – 14.5-mm BS-41 projectiles at 0° obliquity.

Thickness, inches	Required BL(P), fps Type A	Thickness, inches	Required BL(P), fps Type A	Thickness, inches	Required BL(P), fps Type A
2.480	2684	2.665	2796	2.850	2903
2.485	2687	2.670	2799	2.855	2906
2.490	2690	2.675	2802	2.860	2909
2.495	2693	2.680	2805	2.865	2912
2.501 1/	2697	2.685	2808	2.870	2915
2.505	2699	2.690	2810	2.875	2918
2.510	2702	2.695	2813	2.880	2920
2.515	2705	2.700	2816	2.885	2923
2.520	2708	2.705	2819	2.890	2926
2.525	2711	2.710	2822	2.895	2929
2.530	2714	2.715	2825	2.900	2932
2.535	2717	2.720	2828	2.905	2935
2.540	2721	2.725	2831	2.910	2937
2.545	2724	2.730	2834	2.915	2940
2.550	2727	2.735	2837	2.920	2943
2.555	2730	2.740	2840	2.925	2946
2.560	2733	2.745	2843	2.930	2949
2.565	2736	2.750	2846	2.935	2952
2.570	2739	2.755	2849	2.940	2954
2.575	2742	2.760	2851	2.945	2957
2.580	2745	2.765	2854	2.950	2960
2.585	2748	2.770	2857	2.955	2963
2.590	2751	2.775	2860	2.960	2966
2.595	2754	2.780	2863	2.965	2968
2.600	2757	2.785	2866	2.970	2971
2.605	2760	2.790	2869	2.975	2974
2.610	2763	2.795	2872	2.980	2977
2.615	2766	2.800	2875	2.985	2979
2.620	2769	2.805	2878	2.990	2982
2.625	2772	2.810	2880	2.995	2985
2.630	2775	2.815	2883	3.000 2/	2988
2.635	2778	2.820	2886	3.005	2991
2.640	2781	2.825	2889	3.010	2993
2.645	2784	2.830	2892	3.015	2996
2.650	2787	2.835	2895	3.020	2999
2.655	2790	2.840	2898	3.025	3002
2.660	2793	2.845	2900	3.030	3004

1/ Type A requirements begin for this ordered thickness.
2/ Type A requirements end for this ordered thickness.

Note: Tabulated values on either side of the ordered thicknesses are for interpolation of BL(P) requirements on undersize or oversize plates.

CONCLUDING MATERIAL

Custodians:
Army – MR

Preparing activity:
ARMY – MR
(Project 9535-2016-001)

Review activities:
Army – AR, AT, AV, TE
DLA – IS

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 https://assist.dla.mil/.