MIL-A-46077D
28 April 1978
SUPERSEDING
MIL-T-46077C
14 April 1978

MILITARY SPECIFICATION

ARMOR PLATE, TITANIUM ALLOY, WELDABLE

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

1. SCOPE

1.1 Scope. This specification covers a weldable wrought titanium alloy armor plate in the mill annealed condition. The nominal thicknesses of armor plate covered by this specification are one-quarter to two and one-quarter inches, inclusive.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

STANDARDS

FEDERAL
Fed. Test Method Std. No. 151 - Metals; Test Methods

MILITARY
MIL-STD-129 - Marking for Shipment and Storage

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

FSC 9535

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Army Materials and Mechanics Research Center, Watertown, MA 02172 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 480 - General Requirements for Flat-Rolled Stainless and Heat Resisting Steel Plate, Sheet, and Strip
E 8 - Tension Testing of Metallic Materials

(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 specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.

TOP 2-2-710 - Test Operating Procedure for Vehicular Armor

(Application for copies should be addressed to the U. S. Army Test and Evaluation Command, Aberdeen Proving Ground, MD 21005.)

3. REQUIREMENTS

3.1 First article. When specified (see 6.1), the contractor shall furnish a sample or samples for first article inspection and approval. The contractor shall comply with this requirement at the time of his first order or contract and at any time that the supplier has not furnished wrought armor in the applicable thickness range under this specification within a period of 18 months (see 4.4).

3.2 Chemical composition. The chemical composition of the plates shall be as specified in table I.

Table I. Chemical composition - percent by weight

Al[1/]	V[1/]	C	O	N	H	Fe	Ti	Other[3/]	
								Each	Total
5.5-6.5	3.5-4.5	0.04 max	0.14 max	0.02 max	0.0125 max	0.25 max	Rem[2/]	0.10 max	0.40 max

1/ Allowable variation under minimum or over maximum for aluminum shall be 0.40 percent and for vanadium 0.15 percent, however, variation shall not be both above and below on separate determinations for each element.

2/ Titanium is determined by differences.

3/ Other elements need not be anlyzed nor reported unless otherwise specified.

3.3 Mechanical properties. The mechanical properties determined in the transverse direction shall be as specified in table II.

Table II. Transverse mechanical properties - minimum

Thickness	Yield strength psi 0.2% offset	Tensile strength psi	Elongation percent	Reduction in area percent
1/4 to 1 inch[1/]	120,000	130,000	14	30
Over 1 to 1-3/4 incl.	115,000	125,000	12	25
Over 1-3/4	110,000	120,000	10	20

1/ On plate thicknesses 0.375 inch or less the sheet type specimen may be used. The minimum elongation shall be 12 percent and there shall be no reduction in area requirement when the sheet type specimen is used.

3.4 Ballistic requirements. The minimum ballistic limits (at 0° obliquity) shall be in accordance with the values shown in tables VI through XI.

3.5 Dimensions. Unless otherwise specified in the contract or order, dimensions and tolerances shall be as specified in table III.

Table III. Dimensional tolerances

Thickness range (inch)		Tolerance (inch)[1/]
From	Up to	
0.250	0.375	+0.046
0.375	0.750	+0.054
0.750	1.000	+0.060
1.000	2.250	+0.070

1/ The entire range has a minus tolerance of 0.010 inch.

3.6 Marking for identification. Each plate shall be marked with the manufacturer's name or trademark, the basic number of this specification, the plate thickness in inches and the lot number. The characters shall be not less than 3/8 inch in height. Unless otherwise specified in the contract or order (see 6.2) no impression stamping shall be used.

3.6.1 Marking of ballistic test plates. In addition to the marking specified in 3.6 each ballistic test plate shall be marked with the letters PRE if a first article test plate and ACC if an acceptance test plate. When practicable, the marking shall be impression stamped on the edge of ballistic test plates.

3.7 Reheating. Unless otherwise approved by the procuring activity, after the mill annealing treatment, material shall not be reheated for straightening or other mill processing above the annealing temperature or 100°F below the beta transus whichever is less. If material is retreated above the annealing temperature, it shall be recorded and tested as a separate lot.

3.8 Ballistic test plate information. A Check List for Armor Data, form TAC 3983, properly executed shall be submitted with each ballistic test plate.

3.9 Workmanship. The material produced under this specification shall be uniform in quality and condition, and free from defects detrimental to fabricability or serviceability such as hard spots, laminations, inclusions, pits, folds, seams and cracks.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 The above paragraph is applicable to all tests except ballistic tests which shall be performed at a Government approved facility selected by the procuring activity.

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

1. First article inspection (see 4.4).
2. Quality conformance inspection (see 4.5).

4.3 Lot. A lot shall consist of all plates of the same nominal thickness from the same melt which has been processed together as a unit.

4.4 Sampling.

4.4.1 For first article inspection.

4.4.1.1 Chemical analysis. A sample for chemical analysis shall be taken from each ballistic test plate.

4.4.1.2 Mechanical properties. At least one tension test specimen shall be taken from each ballistic test plate. The location and type of specimens shall be as specified in 4.4.2.2 and 4.4.2.3.

4.4.1.3 Ballistic test samples. Two plates, of the thickness to be supplied on the contract, shall be submitted to a Government approved facility for ballistic tests. One sample shall be taken from the first plate fabricated and one from the last plate fabricated in the initial lot produced. When only one plate is fabricated, the samples shall be taken from opposite ends of the plate. The plates shall be 12 inches by 12 inches for thicknesses less than 5/8 inch and 18 inches by 12 inches for thicknesses 5/8 inch and greater. When more than one thickness is involved, first article approval may be obtained for the size ranges listed below by submission of plates of one specified thickness within each range.

Table IV. First article approval thickness range (inches)

Thickness ranges (inches)	Ballistic test projectile type
0.200 to 0.249	Cal. 30FS
0.250 to 0.370	Cal .30AP, M2/Cal. 30FS
0.371 to 0.650	Cal .30AP, M2/Cal. 50FS
0.651 to 0.750	Cal .30AP, M2/20mm, FS
0.751 to 1.000	Cal .50AP, M2/20mm, FS
1.001 to 1.699	Cal .50AP, M2
1.700 to 2.250	20mmAP, M95

4.4.2 Sampling for quality conformance acceptance testing.

4.4.2.1 For chemical analysis. A sample sufficient to perform the analysis required to determine compliance with 3.2 shall be selected from each lot.

4.4.2.2 For mechanical properties.

4.4.2.2.1 Number of samples. At least two samples shall be taken from each lot. If a lot consists of only one plate, only one sample shall be selected. At least one tension test specimen shall be made from each sample.

4.4.2.2.2 Types of test specimens. Tension test specimens shall conform to the largest obtainable round specimen shown in ASTM E 8 except that the sheet type specimen may be used on thicknesses of 0.375 inch and less.

4.4.2.2.3 Location of test specimens. Tension test specimens shall be taken from the plate transverse to the principal rolling direction with the central longitudinal axis midway between the top and bottom surfaces of the plate.

4.4.2.3 For ballistic testing. One plate, 12 inches by 12 inches for thicknesses less than 5/8 inch or 18 inches by 12 inches for thicknesses 5/8 inch and greater, by the thickness of the plate represented shall be selected from every five lots of material of the same thickness. Lots represented by an acceptance ballistic test shall have been manufactured using the same heat treatment and other processing within standard mill parameters of a fixed process.

4.5 Examination.

4.5.1 Visual. Each plate in each lot shall be visually examined for compliance with the requirements for workmanship (see 3.9).

4.5.2 Dimensions. All plates shall be subject to inspection for compliance with the dimensional and tolerance requirements (see 3.5).

4.5.3 Preparation for delivery. Prior to shipment, examination shall be made to determine compliance with the requirements of section 5.

4.6 Tests (first article and quality conformance).

4.6.1 Chemical composition. Samples for chemical analysis shall be prepared and tested in accordance with method 111 or method 112 of Fed. Test Method Std. No. 151. In case of dispute, method 111 shall be used as the basis for acceptance or rejection.

4.6.2 Mechanical properties. Samples for mechanical properties tests shall be prepared and tested in accordance with ASTM E 8. The strain rate shall not exceed 0.005 in./in./min. up to yield strength.

4.6.3 Ballistic tests. Ballistic test plates shall be tested at an approved facility designated by the procuring activity. Plate thickness as determined by the ballistic test agency shall be used to determine the required protection ballistic limit for the plate and shall be taken as the average of 4 thickness measurements read to the nearest 0.001 inch and the average reported to the nearest 0.005 inch. At least one measurement will be taken along each edge of the plate at a distance of at least one inch from the edge. When two types of projectiles are listed, the Government reserves the right to use either or both projectiles at the discretion of the procuring activity. The V_{50} ballistic tests shall be performed in accordance with USATECOM Material Test Procedures for Vehicular Armor, TOP 2-2-710.

4.6.4 Reduced testing for acceptance. Upon the approval of the procuring activity, reduction in the amount of testing may be authorized provided the results on consecutive lots indicate that a uniform product meeting the requirements is being produced.

4.7 Rejection.

4.7.1 First article. Failure of the first article samples to meet any of the requirements of this specification indicates failure of the process.

4.7.2 Retests. Resubmission of first article samples shall not be made until the contractor has made necessary corrections in processing the material to the satisfaction of the procuring activity.

4.7.3 Quality conformance

4.7.3.1 Examination. A lot shall be subject to rejection for failure to meet the visual and dimensional requirements when examined in accordance with 4.5.

4.7.3.2 Tests. A lot shall be subject to rejection for failure to meet any of the test requirements when tested in accordance with 4.6. In case of failure of a ballistic test plate, the four lots not originally tested for ballistic properties shall be individually tested in accordance with this specification.

4.7.3.3 Retests. Retests shall be conducted in accordance with the general section of Fed. Test Method Std. No. 151.

4.7 3.3.1 Ballistic retests. In the event of failure of any one or all of the ballistic test plates, the failed lot(s) may be reprocessed and two plates submitted for retest from each reprocessed lot. If a failure then occurs, the lot shall be permanently rejected.

5. PACKAGING

5.1 Packing.

5.1.1 Level C. Plates shall be packed for shipment in accordance with commercial practice to ensure carrier acceptance and safe delivery to destination.

5.2 Marking for shipment. In addition to any special marking specified in the invitation for bids, contract or order, all shipments shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification.
b. When first article sample is required (see 3.1).
c. Dimensions and tolerances required (see 3.5 and 6.5).
d. When impression sampling is permissible (see 3.6).
e. When reheating is allowed (see 3.7).
f. Name of inspection agency when inspection shall be performed by other than the contractor (see 4.1).
g. Destination of ballistic test plates (see 4.1.1).
h. Additional marking, if required (see 5.2).

6.2 Definitions.

6.2.1 Fair impact. A fair impact is an impact resulting from the striking of the test plate by a projectile in normal flight (no yawing or tumbling) and separated from another impact or the edge of the plate, hole, crack, or spalled area by an undisturbed area of at least one caliber.

6.2.2 Witness plate. A witness plate is normally a 0.014 inch thick sheet of 5052 H36 aluminum alloy (or a 0.020 inch thick sheet of 2024-T3) aluminum alloy placed 6-inches behind and parallel to the test plate or other ballistic sample.

6.2.3 Complete penetration, protection, CP(P). A protection complete penetration is a penetration in which the projectile or one or more fragments of a projectile or plate pass beyond the back of the test plate and perforates the witness plate.

6.2.4 Partial penetration, protection, PP(P). A partial penetration is any impact that is not a complete penetration.

6.2.5 V50 protection ballistic limit, BL(P). A BL(P) shall consist of an equal number of complete and partial penetrations 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. Table V delineates the order of priority.

Table V. Ballistic limits (protection criteria)

No. of rounds in (BL(P)	Maximum allowable velocity spread (fps)	Maximum No. of rounds to be used
4	60	12 1/
6	90	12
10	125 2/	As required

1/ Firing shall continue until either a 4-round or 6-round BL(P) has been attained, whichever comes first in the firing order. If these occur simultaneously the 6-round BL(P) shall be reported. If after 12 rounds have been fired and neither a 4 or 6 round BL(P) has been determined, then firing shall continue until a 10-round BL(P), having a maximum velocity spread of 125 fps, has been determined.

2/ In the event that a high partial penetration velocity occurs which is more than 125 fps above the low complete penetration velocity then the ballistic limit shall consist of the 5 highest partial penetration velocities and the 5 lowest complete penetration velocities. The maximum velocity spread should be kept as small as possible without deviating from the normal up-and-down method of firing.

3/ In the event that after following the above procedures the BL(P) is less than 25 fps above the minimum required BL(P) and a gap (high partial penetration velocity less than the low complete penetration velocity) of 25 fps or more exists in the velocities used to compute the BL(P), then one or more rounds will be fired to reduce the gap to less than 25 fps. The BL(P) will then be recomputed as before using the highest partial penetration velocities and the lowest complete penetration velocities. The recomputed BL(P) will be the one reported on the firing record.

6.3 Ownership of ballistic test plates. First article and test plates that comply with the requirements of this specification are considered as part of the lot of titanium armor they represent, and ownership of them passes to the Government upon acceptance. Test plates that fail to comply with the requirements of this specification are considered as part of the lot they represent and remain the property of the producer just as does the rejectable lot they represent.

6.4 Relationship of mechanical properties to ballistic requirements. The minimum mechanical properties specified may not assure titanium armor plate meeting the specified ballistic requirements.

6.5 Plate tolerances. Titanium alloy plate is normally specified to tolerances established for corrosion resisting steel plate as specified in the applicable sections of ASTM A 480 for thickness, width, length, camber, and flatness.

Custodians:
Army - MR
Navy - OS
Air Force - 11

Review activities:
Army - AT, AV, TE
Navy - AS
DSA - IS

Preparing activity:
Army - MR

Project No. 9535-0261

Table VI. Minimum required V_{50} ballistic limits (protection criteria), firing obliquity: 0°; projectile: caliber .30 AP M2

Thickness, (inch)	Required BL(P), fps	Thickness, (inch)	Required BL(P), fps	Thickness (inch)	Required BL(P), fps
0.200	886	0.405	1783	0.610	2368
.205	918	.410	1799	.615	2380
.210	949	.415	1815	.620	2393
.215	979	.420	1832	.625	2405
.220	1008	.425	1848	.630	2417
.225	1036	.430	1864	.635	2430
.230	1063	.435	1879	.640	2442
.235	1090	.440	1895	.645	2454
.240	1116	.445	1910	.650	2466
.245	1142	.450	1926	.655	2478
1/ .250	1167	.455	1941	.660	2490
.255	1192	.460	1956	.665	2502
.260	1216	.465	1971	.670	2514
.265	1239	.470	1986	.675	2526
.270	1263	.475	2001	.680	2537
.275	1286	.480	2016	.685	2549
.280	1308	.485	2031	.690	2561
.285	1330	.490	2045	.695	2572
.290	1352	.495	2059	.700	2584
.295	1373	.500	2074	.705	2595
.300	1394	.505	2088	.710	2607
.305	1415	.510	2102	.715	2618
.310	1436	.515	2116	.720	2630
.315	1456	.520	2130	.725	2641
.320	1476	.525	2144	.730	2652
.325	1496	.530	2158	.735	2663
.330	1515	.535	2171	.740	2674
.335	1534	.540	2185	.745	2686
.340	1553	.545	2199	2/ .750	2697
.345	1572	.550	2212	.755	2708
.350	1591	.555	2225	.760	2719
.355	1609	.560	2239	.765	2730
.360	1627	.565	2252	.770	2740
.365	1645	.570	2265	.775	2751
.370	1663	.575	2278	.780	2762
.375	1681	.580	2291	.785	2773
.380	1698	.585	2304	.790	2784
.385	1715	.590	2317	.795	2794
.390	1732	.595	2330	.800	2805
.395	1749	.600	2342	.805	2816
.400	1766	.605	2355	.810	2826

1/ Specification requirements begin with this ordered thickness.
2/ Specification requirements end with this ordered thickness.

Table VII. Minimum required V_{50} ballistic limits (protection criteria), firing obliquity: 0°; projectile: caliber .50 AP M2

Thickness, (inch)	Required BL(P), fps	Thickness, (inch)	Required BL(P), fps
0.730	1769	0.895	2068
.735	1778	.900	2076
.740	1788	.905	2084
1/ .745	1798	.910	2093
.750	1808	.915	2101
.755	1817	.920	2109
.760	1827	.925	2117
.765	1836	.930	2126
.770	1846	.935	2134
.775	1855	.940	2142
.780	1864	.945	2150
.785	1874	.950	2158
.790	1883	.955	2166
.795	1892	.960	2174
.800	1901	.965	2182
.805	1910	.970	2190
.810	1919	.975	2198
.815	1928	.980	2206
.820	1937	.985	2214
.825	1946	.990	2222
.830	1955	.995	2230
.835	1964	1.000	2237
.840	1973	1.005	2245
.845	1982	1.010	2253
.850	1990	1.015	2261
.855	1991	1.020	2268
.860	2008	1.025	2276
.865	2016	1.030	2284
.870	2025	1.035	2291
.875	2034	1.040	2299
.880	2042	1.045	2306
.885	2051	1.050	2314
.890	2059	1.055	2322

Table VII. Minimum required V_{50} ballistic limits (protection criteria), firing obliquity: 0°; projectile: caliber .50 AP M2 (cont'd)

Thickness, (inch)	Required BL(P), fps	Thickness (inch)	Required BL(P), fps
1.060	2329	1.260	2612
1.065	2337	1.265	2619
1.070	2344	1.270	2626
1.075	2352	1.275	2632
1.080	2359	1.280	2639
1.085	2366	1.285	2645
1.090	2374	1.290	2652
1.095	2381	1.295	2659
1.100	2388	1.300	2665
1.105	2396	1.305	2672
1.110	2403	1.310	2678
1.115	2410	1.315	2685
1.120	2417	1.320	2691
1.125	2425	1.325	2698
1.130	2432	1.330	2704
1.135	2439	1.335	2711
1.140	2446	1.340	2717
1.145	2453	1.345	2724
1.150	2460	1.350	2730
1.155	2468	1.355	2736
1.160	2475	1.360	2743
1.165	2482	1.365	2749
1.170	2489	1.370	2756
1.175	2496	1.375	2762
1.180	2503	1.380	2768
1.185	2510	1.385	2775
1.190	2517	1.390	2781
1.195	2524	1.395	2787
1.200	2530	1.399 2/	2793
1.205	2537	1.400	2794
1.210	2544	1.405	2800
1.215	2551	1.410	2806
1.220	2558	1.415	2812
1.225	2565	1.420	2818
1.230	2572	1.425	2825
1.235	2578	1.430	2831
1.240	2585	1.435	2837
1.245	2592	1.440	2843
1.250	2599	1.445	2849
1.255	2605		

1/ Specification requirements begin with this ordered thickness.

2/ Specification requirements end with this ordered thickness.

Note: The values on either side of the specification requirements are for interpolation of BL(P) requirements on undersize and oversize plates.

Table VIII. Minimum required V_{50} ballistic limits (protection criteria) firing obliquity 0°; projectile: 14.5 MM API B32

Thickness, (inch)	Required BL(P), fps	Thickness, (inch)	Required BL(P), fps	Thickness, (inch)	Required BL(P), fps
1.380	2438	1.610	2734	1.840	3002
1.385	2445	1.615	2740	1.845	3008
1.390	2451	1.620	2746	1.850	3013
1.395	2458	1.625	2753	1.855	3019
1/ 1.400	2465	1.630	2759	1.860	3024
1.405	2472	1.635	2765	1.865	3030
1.410	2478	1.640	2771	1.870	3036
1.415	2485	1.645	2777	1.875	3041
1.420	2492	1.650	2783	1.880	3047
1.425	2499	1.655	2789	1.885	3052
1.430	2505	1.660	2795	1.890	3057
1.435	2512	1.665	2801	1.895	3063
1.440	2518	1.670	2807	1.900	3068
1.445	2525	1.675	2813	1.905	3074
1.450	2532	1.680	2818	1.910	3079
1.455	2538	1.685	2824	1.915	3085
1.460	2545	1.690	2830	1.920	3090
1.465	2551	1.695	2836	1.925	3096
1.470	2558	1.700	2842	1.930	3101
1.475	2564	1.705	2848	1.935	3106
1.480	2571	1.710	2854	1.940	3112
1.485	2577	1.715	2860	1.945	3117
1.490	2584	1.720	2866	1.950	3122
1.495	2590	1.725	2871	1.955	3128
1.500	2597	1.730	2877	1.960	3133
1.505	2603	1.735	2883	1.965	3138
1.510	2609	1.740	2889	1.970	3144
1.515	2616	1.745	2895	1.975	3149
1.520	2622	1.750	2900	1.980	3154
1.525	2629	1.755	2906	1.985	3160
1.530	2635	1.760	2912	1.990	3165
1.535	2641	1.765	2918	1.995	3170
1.540	2648	1.770	2923	2.000	3176
1.545	2654	1.775	2929	2.005	3181
1.550	2660	1.780	2935	2.010	3186
1.555	2666	1.785	2940	2.015	3191
1.560	2673	1.790	2946	2.020	3197
1.565	2679	1.795	2952	2.025	3202
1.570	2685	1.800	2957	2.030	3207
1.575	2691	1.805	2963	2.035	3212
1.580	2697	1.810	2969	2/ 2.040	3218
1.585	2704	1.815	2974	2.045	3223
1.590	2710	1.820	2980	2.050	3228
1.595	2716	1.825	2986	2.055	3233
1.600	2722	1.830	2991	2.060	3238
1.605	2728	1.835	2997		

1/ Specification requirements begin with this ordered thickness.
2/ Specification requirements end with this ordered thickness.

Table IX. Minimum required V_{50} ballistic limits (protection criteria), firing obliquity: 0°; projectile: caliber .30 FSP

Thickness, (inch)	Required BL(P), fps	Thickness, (inch)	Required BL(P), fps
0.200	1431	0.295	2333
.205	1469	.300	2393
.210	1508	.305	2454
.215	1548	.310	2516
.220	1589	.315	2580
.225	1631	.320	2645
.230	1674	.325	2713
.235	1718	.330	2781
.240	1762	.335	2851
.245	1808	.340	2923
1/ .250	1855	.345	2997
.255	1904	.350	3072
.260	1953	.355	3150
.265	2004	.360	3229
.270	2055	.365	3310
.275	2108	2/ .370	3393
.280	2162	.375	3478
.285	2218	.380	3564
.290	2275		

1/ Specification requirements begin with this ordered thickness.

2/ Specification requirements end with this ordered thickness.

Table X. Minimum required V_{50} ballistic limits (protection criteria) firing obliquity: 0°; projectile: caliber .50 FSP

Thickness, (inch)	Required BL(P), fps	Thickness, (inch)	Required BL(P), fps
0.350	1754	0.510	2495
.355	1774	.515	2523
.360	1794	.520	2550
1/ .365	1814	.525	2578
1/ .370	1834	.530	2606
.375	1855	.535	2635
.380	1876	.540	2663
.385	1896	.545	2692
.390	1918	.550	2721
.395	1939	.555	2751
.400	1961	.560	2781
.405	1982	.565	2811
.410	2004	.570	2842
.415	2027	.575	2872
.420	2049	.580	2903
.425	2072	.585	2935
.430	2095	.590	2967
.435	2118	.595	2999
.440	2141	.600	3031
.445	2165	.605	3064
.450	2189	.610	3097
.455	2213	.615	3130
.460	2238	.620	3164
.465	2262	.625	3198
.470	2287	.630	3232
.475	2312	.635	3267
.480	2338	.640	3302
.485	2363	2/ .645	3338
.490	2389	2/ .650	3374
.495	2415	.655	3410
.500	2442	.660	3446
.505	2468		

1/ Specification requirements begin with this ordered thickness.

2/ Specification requirements end with this ordered thickness.

Table XI. Minimum required V_{50} ballistic limits (protection criteria), firing obliquity: 0°; projectile: 20 MM FSP

Thickness, (inch)	Required BL(P), fps	Thickness, (inch)	Required BL(P), fps
0.620	1900	0.840	2538
.625	1913	.845	2555
.630	1926	.850	2572
.635	1938	.855	2589
.640	1951	.860	2605
.645	1964	.865	2622
1/ .650	1977	.870	2640
.655	1991	.875	2657
.660	2004	.880	2674
.665	2017	.885	2692
.670	2031	.890	2709
.675	2044	.895	2727
.680	2058	.900	2745
.685	2071	.905	2762
.690	2085	.910	2780
.695	2099	.915	2798
.700	2113	.920	2817
.705	2127	.925	2835
.710	2141	.930	2853
.715	2155	.935	2872
.720	2169	.940	2891
.725	2183	.945	2909
.730	2198	.950	2928
.735	2212	.955	2947
.740	2227	.960	2966
.745	2242	.965	2986
.750	2256	.970	3005
.755	2271	.975	3024
.760	2286	.980	3044
.765	2301	.985	3064
.770	2316	.990	3084
.775	2332	.995	3104
.780	2347	2/ 1.000	3124
.785	2362	1.005	3144
.790	2378	1.010	3164
.795	2394	1.015	3185
.800	2409	1.020	3205
.805	2425	1.025	3226
.810	2441	1.030	3247
.815	2457	1.035	3268
.820	2473	1.040	3289
.825	2489	1.045	3310
.830	2506	1.050	3331
.835	2522	1.055	3353

1/ Specification requirements begin with this ordered thickness.

2/ Specification requirements end with this ordered thickness.

☆U.S. GOVERNMENT PRINTING OFFICE: 1978 — 703-122/2563

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS: This form is provided to solicit beneficial comments which may improve this document and enhance its use. DoD contractors, government activities, manufacturers, vendors, or other prospective users of the document are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity. A response will be provided to the submitter, when name and address is provided, within 30 days indicating that the 1426 was received and when any appropriate action on it will be completed.
NOTE: This form shall not be used to submit requests for waivers, deviations or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

DOCUMENT IDENTIFIER *(Number)* AND TITLE

MIL-A-46077D, Armor Plate, Titanium Alloy, Weldable

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

☐ VENDOR ☐ USER ☐ MANUFACTURER

1. ☐ HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? ☐ IS ANY PART OF IT TOO RIGID, RESTRICTIVE, LOOSE OR AMBIGUOUS? PLEASE EXPLAIN BELOW.

A. GIVE PARAGRAPH NUMBER AND WORDING

B. RECOMMENDED WORDING CHANGE

C. REASON FOR RECOMMENDED CHANGE(S)

2. REMARKS

SUBMITTED BY *(Printed or typed name and address — Optional)*	TELEPHONE NO.
	DATE

DD FORM 1426 1 OCT 76

EDITION OF 1 JAN 72 WILL BE USED UNTIL EXHAUSTED.