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BRANCH STANDARD, ARMOUR SHEETS AND PLATES FROM ALUMINIUM ALLOY, GRADE A6T - 101.

OST B3-75-77

SHEET

NO. OF SHEETS

14+2

12

INDEX 84/284872601-40001 K.P.

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SPECIFICATIONS

GRADE A6T-101

FROM ALUMINIUM ALLOY

ARMOUR SHEETS AND PLATES

BRANCH STANDARD

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BRANCH STANDARD

Present standard is applicable to sheets and plates from aluminum alloy grade A51-101 intended for the manufacture of armor components and design of articles for armor equipments.

I. RANGE

1.1. Thickness of sheets and plates should conform to those specified in Table I

Designation of semi finished items	Thickness	Width	Length.
Sheets	8 - 10	1200-2000	2000-6000
Plates	II - 32	1200-2000	2000-6000

Example for specifying the designations of plates from aluminum alloy grade A51-101 without plate, of thickness 20mm, width 1200mm and length 6000mm in hardened and artificially aged conditions:

Plate A51-101T1 20 x 1200 x 6000 OSI B3-75

1.2. Sheets and plates are supplied with measured lengths on the with multiple measurements within the limits of standard lengths with an interval of 500mm.

1.3. Tolerances in dimensions of sheets and plates should conform to those specified in Table 2.

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- 1.4. Sheets and plates should be cut at take right angles. Oblique cut should not take the sheet or plate beyond lower limit of given length.
- 1.5. Plates with thickness above 15mm should be supplied without cut edges:
- 1.6. Mass of the given sheets on plates is obtained by calculation. During the calculation assume:
Density of the material - 2.78 gms/cc;
Thickness of sheet or plate as equal nominal thickness plus half of upper tolerance limit.
Length and width of sheet or plate, equal to nominal size, plus half tolerance limits on length and width.
- 1.7. Ordering quantity of every standard size should not be less than 2.44 tonnes.

TABLE 2.

Thickness	Tolerance on thickness	Width	Tolerance on width	Tolerance on length
8 - 10	+ 0.5 from	1200 - 1300	+ 30	+ 50
	+ 0.8 above	1300 - 2000		
11 - 15	+ 0.8	1200 - 1300	+ 30	+ 50
	- 0.2	1300 - 2000		
	+ 1.5	1300 - 2000		
	- 0.5	1300 - 2000		
16 - 25	+ 1.0	1200 - 1300	+ 130	+ 50
	- 0.5	1300 - 2000		
	+ 2.0	1300 - 2000		
	- 1.0	1300 - 2000		
26 - 32	+ 1.0	1200 - 1300	+ 130	+ 50
	+ 1.5	1300 - 2000		

2. TECHNICAL REQUIREMENTS

- 2.1. Sheets and plates should be manufactured in accordance with the requirements of the present standard as per technical manuals and approved in the establishment order and agreed with the customer's representative on his requirements.
- 2.2. Chemical composition of sheets and plates from aluminum alloy grade AL-101 should conform to the requirements of the standard technical manuals.
- 2.3. Sheets and plates are manufactured without plating.
- 2.4. Sheets and plates are supplied after hardening and I stage artificial ageing.
- 2.5. Sheets and plates should be stress relieved after hardening.
- 2.6. Mechanical properties of sheets and plates in ready for supply condition should not be beyond the requirements in Table 4.

TABLE 4

Thickness of sheet or plate in mm	Ultimate strength MPa (kgf/cm ²)	Yield strength MPa (kgf/cm ²)	Elongation %	Hardness Value BHN	Impact strength (kgf-cm)
8-15	470 (48.0)	372-4 (38.0)	6.0	138	0.6

TABLE 4 CONTINUED.

Thickness of sheet or plate in mm	Ultimate strength Mpa (kgf/cm ²)	Yield strength Mpa (kgf/cm ²)	Elongation %	Hardness value HBN	Impact strength kgm/cm ² .
16-32	470.4 (48.0)	372.4 (38.0)	6.0	138	0.5
26-32	470.4 (48.0)	372.4 (38.0)	5.0	138	0.45

2.7. Bullet proof resistance of the semi finished items should be checked on shelling boards subjected to additional artificial ageing as per stage II and should ensure acceptable damage during firing trials and in correspondence with norms, shown, in Table 5.

Table-5

Type calibre of bullet and testing equipment.	Thickness of shelling board mm	Angle of impactor with shelling board degree.	Firing range M during velocity 25 = 817m/Sec. average	Qty of the remaining damages of shelling board pieces, Min.
5 - 32 12.7 mm Machine gun	8	82	75	3
	10	79	75	3
	12	76	75	3
	15	72	75	3
	20	63	75	3
	23	58	75	3
No. 1, 2, 3	8	82	75	3
	10	79	75	3
	12	76	75	3
	15	72	75	3
	20	63	75	3
	23	58	75	3
No. 1, 2, 3	8	82	75	3
	10	79	75	3
	12	76	75	3
	15	72	75	3
	20	63	75	3
	23	58	75	3

NOTES:

1. SHELLING of boards of thickness 12mm should be carried out in the direction transverse to the direction of

2.9. Cracks, pin holes, corrosion, pit marks and slag oxide inclusions are not allowed on the surfaces of sheets and plates.

Thickness of shelling board mm.	Hardness value BHN	Diameter of indentation mm.
8 - 20	131 - 156	5.20 - 4.80
21 - 32	137 - 163	5.10 - 4.70

TABLE 6

2.8. Hardness of shelling boards after additional artificial ageing to II stage should conform to the requirements of Table 6.

For lesser distances acceptable damages are considered to be passed (see appendix on firing trials). For defect damage, shots are to be repeated.

Shelling boards of other thickness should be fired at along the direction of rolling.

The damages are considered to be acceptable, if the distance from the edge of the board to the edge of damage and also between neighbouring damages along the straight arc is not less than twice the calibre of the bullet.

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Type of Heat treatment	Temperature °C	Thickness mm	Soaking time Min.
Hardening	470 ± 5	Upto 10	10 - 30
		10 - 20	30 - 75
		20 - 30	75 - 90
		30 - 50	90 - 120
		50 - 75	120 - 150
		75 - 100	150 - 180
		100 - 200	150 - 240
			1320
			180
		Ageing I Stage	80 - 100
II STAGE	170		

2.10. Dressing of surface defects are allowed to be carried out with scrapers or abrasive wheels not bigger than No.50. Within actual limits of allowance on faces and edges, defects caused by manufacturing process are allowed on the edges and faces of sheets with ensured possibilities of cutting rectangular sheet, plate of nominal dimensions. Non flatness should not exceed:

- For sheets with thickness upto 10.5 - Requirements as per GOST 21631-76.

- For plates with thickness from 11 to 20mm; Along the long side 12mm Along the short side 16mm

- For plates with thickness | Above all the four sides above 20mm and upto 32mm; 16mm; 16mm;

Heat treatment of sheets and plates should be carried out as per conditions reproduced in TABLE 7

Table-7

3. ACCEPTANCE RULES

- 3.1. Sheets and plates should be offered in batches for acceptance to the service technical inspection and to representative of the customer in accordance with the requirements of the present standard.
Every batch should be offered by the supplier with accompanying documents and test records.
- 3.2. Batches should consist of sheets and plates of the same thicknesses and widths, rolled out from ingots of same melting and heat treated in the same charge.
- 3.3. Every melting of alloy is subjected to chemical analysis on samples picked out from liquid metal at the time of making ingots.
- 3.4. Every sheet and plate is subjected to checking of dimensions, non flatness and surface conditions.
- 3.5. Testing of mechanical properties in ready for supplies condition is carried out:
- During tensile tests - On one sample cut across the direction of rolling from one sheet or plate of every charge;
- During impact strength tests and hardness checking - on template (sample), cut from one sheet or plate of every charge;
Impact strength is determined on three samples, cut across the direction of rolling.
- 3.6. If unsatisfactory results are obtained during testing

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4.1. Chemical composition of alloy is determined in accordance with the existing standards on methods of chemical analysis, alloying elements and impurities in castings and wrought aluminum alloys.

4.2. Dimensions are measured with measuring instruments

4. METHODS OF CHECKING.

3.7. Testing of hardness and bullet proof properties is carried out on two shelling boards (templates) of size $500 \pm 50 \times 400 \pm 50$ mm (Dimension 500mm along the direction of rolling) selected from every batch according to the choice of the customer's representative.

3.8. If the results of hardness testing are unsatisfactory, repeated heat treatment and hardness testing may be carried out on the same shelling boards (templates) or on shelling boards selected from the same sheets and plates.

Changing the shelling boards for firing tests should be done only with the permission of customer's representative

of mechanical properties, it is allowed to carry out retesting on twice the number of samples from each sheet or plate showing unsatisfactory results. Results from retesting are considered final. Repeated heat treatment with subsequent testings in the same order is allowed.

3.7. Testing of hardness and bullet proof properties is carried out on two shelling boards (templates) of size $500 \pm 50 \times 400 \pm 50$ mm (Dimension 500mm along the direction of rolling) selected from every batch according to the choice of the customer's representative.

3.8. If the results of hardness testing are unsatisfactory, repeated heat treatment and hardness testing may be carried out on the same shelling boards (templates) or on shelling boards selected from the same sheets and plates.

Changing the shelling boards for firing tests should be done only with the permission of customer's representative

ensuring:

Accuracy in the measurements of thickness, equal to 0.1mm;

Accuracy in the measurements of width and length equal to 1mm.

4.3. Non flatness is checked by measuring the distance from the surface plate to the lower surface edge of sheet or plate on all the four sides when the sheets or plates are laid freely on surface table.

4.4. Surfaces of sheets and plates should be examined visually.

4.5. During tensile testing, mechanical properties are determined as per GOST 1497-75;

For sheets - on flat "Short" test pieces, TYPE I; For plates - on cylindrical short test pieces

TYPE III.

4.6. Impact strength is determined as per GOST 9454-78.

4.7. Hardness is determined as per GOST 9012-59.

4.8. Bullet proof properties is determined in accordance with the requirements of the present standard. Requirements to the firing grounds, and their equipments, weapons, ammunitions, preparations for the test, the test and working out the results of the tests are in accordance with the existing standard technical manuals.

Testing of shelling board may be carried out with reduced charge when the firing distance is changed.

4.9. The damage is acceptable when the bulges are without surface ruptures and cracks or when the surface ruptures and cracks are not through (appendix 3). If the visual determination of the character of damage is difficult, inspection should be carried out by pouring kerosene or by sitting the piece of damage with subsequent polishing.

5. MARKING, PACKING AND TRANSPORTATION

5.1. On one of the corners and at a distance not more than 25mm from the edge along the width of every sheet and plate, markings showing the alloy grade, delivery conditions, batch number, serial number of sheets and plates in the batch and thickness of sheet or plate should be punched; Marks of service Technical inspection and optional of the customer's representative.

5.2. Packing and transportation marking of sheets and plates should be carried out in accordance with the requirements of the existing standard technical manuals.

Sheets and plates are transported by all kinds of transports. During transportation sheets and plates should be protected from atmospheric precipitation.

Packed and unpacked sheets and plates during transportation should be fastened to ensure their

their protection from mechanical damages.

5.3. Every batch of sheets and plates should be accompanied by certificates, certifying the conformity of sheets and plates to the requirements of the present standard, indicating:

Name of the manufacturing firm;

Alloy grade and delivery conditions;

Final report, that chemical composition conforms to the requirements of the present standard;

Dimensions of sheets and plates;

Batch number and Coiling number;
Number of sheets and plates and mass of batch;

Results of testing of mechanical properties -

maximum and minimum values;

Actual condition of II stage artificial ageing

of shelling boards for special testings;

Hardness value of shelling board after II stage

artificial ageing;

Present standard number;

Final report, that results of special tests conform

to the requirements of the present standard showing

the number of damage,

Certificate should have the signatures of

service technical inspection and of representative

of customer of manufacturing firm.

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sheet

APPENDIX - I (COMPULSORY)
 CHART OF DAMAGES - CAUSED BY ARMOUR PIERCING
 BULLETS DURING FIRING TESTS ON COMPONENTS.

All SHEET No. OF BOOKS	SIGNATURE	DATE	OST B3 - 75 - 77	13
No.	Description of the damage	Assessment		
1.	No bulge on the rear face.	Acceptable.		
2.	Bulge of any size on rear face	Acceptable.		
3.	Bulge of any size on rear face with surface ruptures and cracks which are not through. In doubtful cases damages should be checked with kerosene - kerosene should not seep.	Acceptable.		
4.	Bulge of any size on rear face with radial ruptures and cracks. In doubtful cases, damages should be checked with kerosene - kerosene should seep.	Defeat.		
5.	On rear face, outlined plug without piercing.	Defeat.		
6.	On rear face, bulge of any size with rupture on circumference with outlined splitting.	Defeat.		
7.	Splitting of any form and size on the rear side without piercing the armour	Defeat.		
8.	On rear face, through piercing with clear on ruptured edges or knocked out plug, on coming out of the bullet from the rear side	Defeat.		
9.	Through piercing with splitting of any form and depth on rear side	Defeat.		
10.	Breakage of plate through cracks, exceeding value of damage which may be caused by firing test.	Defeat.		

No.	DOCUMENT	Registration No. of sheets	Number of sheets	No. of sheets
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Approved by			
SPECIFICATION No. 051 B3-75-77		Date 9-11-87	
ARMORED VEHICLE PROJECT AVADI		Compiled by <i>[Signature]</i>	
		Translated by <i>[Signature]</i>	
		Date 11/87	
		Authenticating by <i>[Signature]</i>	

Appendix to
 Chemical composition of
 Alloy Grade A5T IOI

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APPENDIX TO OST B3 - 75 - 77

CHEMICAL COMPOSITION OF ALLOYS GRADE A5T IOI

Mass Portion of Elements, %

Basic Constituents

Zinc	Magnesium	Manganese	Chromium	Titanium	Zirconium	Berillium	Aluminum	Admixture	Maximum
5.40	2.40	0.10	0.12	0.03	0.07	0.0002	Rest	0.20	0.30
6.20	3.00	0.30	0.25	0.10	0.12	0.0050			0.20

Remarks : Berillium content is taken into consideration and chemical analysis is not determined.

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ARMURED VEHICLE PROJECT AVADI	Translated by	Sarkar	

CHEMICAL COMPOSITION OF ALLOY
GRADE A B I - 101
OSI B3-75-77

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*Approved by
C. Williams
on 29/4/88*

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CHEMICAL COMPOSITION OF ALLOY OF GRADE ABT-101

Fraction of total mass of elements, %

Basic components.							Impurity, not more than.			
Zinc	Magnesium	Manganese	Chromium	Titanium	Zirconium	Beryllium	Aluminium	Copper	Iron	Silicon
5.40-	2.40-	0.10-	0.12-	0.03-	0.07-	0.0002-	Remaining (balance)	0.20	0.30	0.20
6.20	3.00	0.30	0.25	0.10	0.12	0.0050				

NOTE: Berillium is introduced as per calculation and not determined by the chemical analysis.

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NOTE OF THE CONTENT OF ALBUM.

Sl. no.	Nomenclature of the document.	Calculation number.	Total no. of sheets in the album	Sht. numbers in the album
1.	Appendix to OST B3-75-77 "Chemical composition of alloy of grade AP1-101".	1607 c	2	1-2

Total No of sheets - 2.

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