

SECRET/CLASSIFIED

NUMBER GOST B 21967-76

SHEET 1 OF 2

SUPERSEDES.

GOST B 21967-76

BULLET PROOF ARMOUR STEEL PLATE.

I - 3870

TRANSLATED	F.K. GOPALAN	<i>F.K. Gopal</i>		Ordnance Factory Project Hyderabad.
AUTHENTICATED	VICTOR			
TYPED	T. GIRI KOMAR.	<i>T. Giri</i>	11/85	
EDITED	SEBASTIAN	<i>Seb</i>	21.2.85	APPROVED
	NAME	SIGN.	DATE	

Bullet proof armour steel plate specifications GOST B 21967-76

Non observance of this standard is punishable by law.

Present standard refers to armour plates made from steel of grades 2H, 43TCM and 55K as per GOST B19526-74, intended for bullet proof and structural parts of high, medium and low hardness, to be used in armour equipments.

1. CLASSIFICATION.

1.1 Depending upon the purpose and rated characteristics plates are divided into groups in conformity with table 1.

Table 1

Group according to purpose	Purpose of plates	Rated characteristics of plates					For blanks and specimens (after hardening and tempering)		
		Chemical composition	Surface	Dimensions	Hardness of plates in supply condition	Hardness	Fracture	Firing	
1.	Plates for bullet proof parts of high hardness	+	+	+	+	+	-	+	
2.	Plates for bullet proof of medium hardness	+	+	+	+	+	+	+	
3.	Plates for structural ^{parts} of high, medium and low hardness	+	+	+	+	-	-	-	

* For plates with thickness of 16mm and more

Note: sign + characteristic is rated
sign - not specified.

marked sign

2. RANGE OF SIZES.

2.1 Plates are manufactured with thickness of 4-25mm.

2.2 Nominal dimensions of plates (width, length-measured or multiple to ^{blanks} ~~panels~~ according to location and spacing of blanks approved and agreed with the manufacturer) are determined upon the agreement between the manufacturer and consumer.

In nominal dimensions of plate include technological allowances and samples, required during production of parts and their testing.

2.3 Limit deviations of plate thickness should correspond to table 2.

Table 2

Nominal thickness of plate	Limit deviation	Width of plate upto
4-9	+1,25	
10-17	+1,50	1500
18-24	+1,75 -0,25	
25 25	+1,75 -0,50	2200

NOTE: Positive limit deviations of plate thickness are increased by 0.1mm for each additional 100mm of plate width if the width is beyond the one, indicated in table 2.

- 2.4 Plates are supplied with trimmed or untrimmed edges. If the parts of plate are corresponding to top and base of ingot, they should be trimmed. Manufacturer should ensure nominal dimensions of plate after trimming the lateral sides.
- 2.5 Plates may be supplied unmeasured as well as with cut outs in the place of sampling, bringing the plate beyond the limits of nominal dimensions, provided that a complete set of main blanks as per order and also cutting out of parts stipulated in the agreed cutting lay out are ensured.
- 2.6 Flatness should correspond to the standard flatness GOST 19903-74 for plates having thickness 7-25mm and non-flatness, for plates with thickness 6mm, should not exceed =5% per 1 meter length. Nonflatness of plates with thickness 4 and 5mm as well as 20 and 25mm made from Steel 43ГCM is determined with the consent of parties.

3. TECHNICAL REQUIREMENTS.

- 3.1 Chemical composition of steel should comply with GOST B 19526-74.
- 3.2 The length of lamination on edges of plates after trimming or when cutting at the plant-consumer should not exceed:
- For armour parts of high hardness:
- Unilinear - 150mm;
- Multilinear- not permissible.
- For armour parts of medium hardness and structural parts:
- Unilinear - 220mm
- Multilinear-one lamination 150mm, for the rest 75mm.

Lamination of length each 20mm and less are not considered.

NOTE: Two or several laminations, arranged in a same plane are taken as one lamination if distance between their ends do not exceed half of the thickness of plate.

Laminations arranged one over the other in the same section by thickness are considered as multilinear laminations. Distance between two maximum distant ends of laminations in one section by thickness is considered as the length of sections of multilinear laminations.

3.3 On edges of armour parts with medium hardness and on structural parts, unilinear lamination with length of more than 220 upto 400mm may be repaired by cutting out and welding in conformity with standard technical documentation, stipulated in reference appendix. Unilinear laminations on edges, which are in the zone of weld joint with length upto 400mm are allowed without repair.

3.4 Total length of edge sections on a part with lamination should not exceed 0.2 perimeter of plate or part.

3.5 Repair of lamination is carried out while making the parts.

3.6 Plate surface should be clean. Flaws cracks, rolled scales, backfins fissures are not allowed on the plate surface. Fine non-continuous layer of scales (thickness not exceeding 0.3mm) which do not prevent detecting surface defects as well as ripples (traces due to scales) and dents due to mechanical processes which do not bring the plates beyond limit of negative thickness deviation

are allowed.

- 3.7 Dressing of defects including cracks which are in a depth not exceeding 5% of nominal thickness, is allowed on plates surface. Area of dressing for one defect should not exceed 150cm². Total area of dressing of defects on each plate should not exceed 2% of the plate area as well as 2% for each square meter of area of plate.

NOTE: That part of area, on which the ^{depth} ~~depth~~ of defects going beyond the limits of negative deviation is taken for calculation area of separate defect and total area of defects.

- 3.8 Area of dressing of defects (cracks, backfins flas fissures and others) ^h ~~h~~ which do not bring the plate beyond the limits of negative thickness deviation is not restricted.

- 3.9 Dressing the defects to a depth upto 10% of the nominal thickness is allowed on plate surface for parts of structural purpose. Area of dressing is not restricted.

- 3.10 Supply of plates without cutting-out defect spots is allowed; provided that unuseable part of area does not exceed 25% of plate area (not considering the wastes on cutting along edges).

Defective spots are marked with paint on marked surface of plate. Unuseable part is not considered for supply.

If unuseable area of plate is more than 25% of the area, plate should be cut. Dimensions of such unmeasured plates should correspond to or should be multiples of the main blanks, stipulated in the agreed cutting layout.

Plates after flame cutting are subjected to additional tempering of edges at the manufacturer.

3.11 Plates are subjected to high tempering. On mutual consent of parties, plates are gradually cooled, normalized as well as finally heat treatment (plates for parts of ^{medium} ~~carbon~~ hardness)

Table 3

Type of heat treatment	Purpose of plates	Nominal thickness	Hardness of plates HB	Type of heat treatment of blank for testing	Hardness HB blank for testing
After high tempering normalization	For parts of high hardness	4-7 8-14 15-22	Not exceeding 255 Minimum 3.8	Hardening and low tempering	2.7-2.9 2.75-3.1 2.75-3.2
After gradual quenching	For parts of medium hardness	8-25	Not exceeding 269 Minimum 3.8	Hardening and high tempering	3.3-3.6
In heat treated condition (hardening and high tempering)	For armour plate of medium hardness	8-25	Not exceeding 255 Minimum 3.6		3.3-3.6

3.12 Hardness of plates in heat treated conditions heat treated blanks for forming test and heat treated technological testing samples as per fracture should conform to table 4.

3.13 Type of fracture of technological sample from plates with thickness of 16mm and more for parts of medium hardness, should comply with table 4.

Table 4.

Type of fracture	Number	Rating of MSIKK suitability
Fibriform fracture .	1	Suitable
Fibriform fracture with crystalline pittings or swarfs on the area not exceeding 20% of fracture surface.	2	Suitable
Fibriform fracture with crystalline pittings or swarfs swarfs on the area exceeding 20% of fracture surface or crystalline section-	3	Retreatment

3.13.1 All area of fracture including draw zone is considered the fracture are.

3.13.2 Crystalline sections are defined as those sharply out lines sections of fracture surface, having crystalline structure with area exceeding 10mm² for each section.

- 3.14 Plates should withstand bullet firing on blanks using full or recalculated charge.

4. ACCEPTANCE RULES.

- 4.1 Plates are presented for acceptance in melts when the melting capacity of furnace is above 100t, melt may be presented in parts. Each part should be not less than 1/3 of the melt and is considered as independent melt.

- 4.2 Weight of plate for the supply is determined by calculation:

Specific gravity of metal - 7.85 g/cm^3 .

Thickness of plate - nominal thickness plus half of the algebraic sum of tolerances.

Length of width of plate - nominal plus half of tolerances of length and width.

Weight of unmeasured plates and plates with unrectified defects, as well as blanks is determined as the sum of the weight of blanks arranged for suitable part of plate.

Weight of blanks is taken from the list attached to the corresponding cut-out lay out.

- 4.3 Acceptance of plates according to chemical composition fracture, firing test as well as checking for the requirements of basic parameters as per technology, is carried out by TID and customer representative.

Acceptance of plates as per dimension surface inspection is carried out by TID and by customer representative at random.

NOTE: Deviation from production technology is not the reason for rejecting the melt for firing test when all other requirements of the present standard are met. In this case the melt is considered as suitable if firing test result is found satisfactory.

4.4 Melts are considered as suitable if the inspection blanks do not have recorded sub-standard damages.

5. TEST METHODS.

5.1 Selection of ladle samples for chemical analysis is carried out as per GOST 7565-73.

5.2 Visual inspection of surface is carried without the aid of any magnifying devices.

5.3 Length, width and non-squareness of plates are measured with measuring tools in conformity with GOST 19903-74.

5.4 Mean arithmetic value of four measurements of opposite sides at a distance of 40-100mm ^{from} edge is taken for determination of thickness of plate and blank for bullet proof testing. Increase of plys limit deviation by 0.25, is allowed for one measurement, provided that, the mean thickness of plate should not go beyond the established limit deviations:

Local deviations, specified in point 3.7 are not considered.

- 5.5 , At least two plates from melt are checked as per ECST 9C12-59 for hardness or by non-destructive method, ensuring the required accuracy of measurement.
- 5.6 Selection of blanks for bullet-proof test.
- 5.6.1 Test pieces of ingot are selected by customer's representative.
- 5.6.2 According to selection made by the customer's representative one blank with the size of not less than 600x800mm is cut from the end of a plate (its middle third by width) corresponding to the head part of test ingot or top part of plate, rolled from the main slab.
- 5.6.3 Selection of blanks from the melt, having carbon content in lower limit and by 0.01% higher than the lower limit, is carried out from blanks corresponding to top or bottom part of ingot.
- Without consent of customer's representative, manufacturer is not allowed to reject or replace the new blank, cut out from test ingot selected by customer's representative for bullet proof test.
- 5.7 Thickness of blanks for bullet proof test should correspond to the thickness on which all melt would be rolled. If the melt, rolled in plates of various thickness, bullet proof test is carried out on blanks with thickness chosen by the manufacturer in conformity with table 5.

Table 5

Blank thickness in mm	Permissible rolling thickness in mm	mm <i>Note</i>
from 4 to 6	4-6	
» 7 » 9	1-9	
» 10	10	For blank from plates of high and medium hardness
12	12	
13-14	10-14	
15-16	15-16	
18	18	
20	20-22	
22	22	
25	25	For blanks from plates of medium hardness

5.8 Blanks for bullet proof testing are subjected to heat treatment in conformity with standard technical documentation. Blanks, before sending for the test should be dressed and straightened.

Blanks ~~may~~ ^{may} be heat treated again before the testing for ensuring the given hardness and type of fracture not exceeding one time. Number of tempering is not restricted.

5.9 Check the thickness, non squareness and hardness of heat treated blanks as well as fracture of samples for plates of medium hardness with thickness of 16-25mm for bullet proof testing.

5.10 Non squareness of blanks should not exceed 6mm

5.11 Limit deviations of blanks on thickness should correspond to table 6.

Table 6

Nominal thickness of plate	Limit deviation
4-14	+0.7
15 and above	+1.0

Negative deviation is not restricted if agreed by the manufacturer.

If limit deviation exceeds 0.7mm it is allowed for each deviation increase by 0.1mm over 0.7mm to reduce the firing distance by:

5mm- for thickness 13-15mm

10mm- for other thickness.

Correct the mean velocity of firing V_{25cp} for each 0.1mm of increase in thickness of blank in compliance with the established procedure.

5.12 Blank hardness for bullet proof testing should correspond to table 3. The hardness of blanks is measured at four points along the edge at a distance of 60-70mm from the edge or on samples for fracture testing, at places dressed before complete deviation of the decarbonized layer.

5.13 Type of fracture of blanks for bullet proof test should comply with table 4. Type of fracture of blank is checked on samples, cut out from blank cross wise to roll direction:
Size of samples- not less than 200mm²
width -60mm
thickness- equal to the blank thickness;
depth of incomplete cut- not exceeding 1/3 of width.

Samples are crushed statically by applying load at temperature not less than 0°C. Heating of samples before testing is not allowed.

5.14 Blenks for bullet proofness test which meet the require
ments of points 5.9-5.12 are subjected to the test according
to conditions given in table 7-10.

Testing conditions with full charge firing of
plates for parts of high hardness.

Table 7.

Nominal thickness in mm	Type and bullet calibre	Drawing and index of cartridge	Average velocity of bullet in m/sec	Angle from normal in degrees	Distance in M	Impact speed in m/sec
4	Light	Drawing		0	325	613.5
5	model	3-04705,			200	702
6	of	type 5	847.5		125	760
8	1908g	index			75	803
9	7.62mm calibre	57-E.323			50	825
10	Armour piercing incendiary bullet	Drawing 3-014812A index 57-53 322.		27	100	792
12					75	803
13	5-32 of		847.5	0	300	654
14	7.12.5 caliber			23	75	803
15	armour piercing incendiary bullet	Lettered 5 Drawing 3-016113, 3-24465	817.5	32	75	
16				30		799
18	5-32 of 12.7 mm caliber	Index 57B-542		29		
20				23		
22				23		

Table 7a

Nominal thickness in mm	Type and bullet caliber	Cartridge drawing	Average velocity of bullet V_{sep} in m/sec	Angle from normal in degrees	Distance in M	Impact speed in M/sec
8	Armour piercing	Drawing 3-020170,		35		
9	incendiary bullet	3-253319	807.5	30		
10	of 7.62 mm caliber	5-32		26	75	770
12				22		
13				21		

Table :8

Testing conditions bullet proof testing with recalculated charge for pairs of high hardness

Nominal thickness in mm	Type and caliber of bullet	Drawing and index of cartridge	Angle from normal in degrees	Average speed of bullet V_{sep} m/sec with distance	
				30M	55M
4	Light model of 1908 type 7.62 mm caliber	Drawing 3-014705 type B index 57-H-323	0	630	633.5
5				721	725
6				781	785
8				825	829.5
9				847.5	851.5
10	Armour piercing	Drawing 3-014812	27	870	813.5
12	incendiary bullet	A, index 57-322	0	829	832
13	of 7.62 mm caliber	53		670	673.5
14			23	829	832
15	Armour piercing	Drawing 3-016113,	32		
16	incendiary bullet	letter B-3	30	808	810
18	bullet	323-24465 index 57-53	29		
20	5-32 of 12.7 mm caliber	542			
22			23		

Table 8a

Nominal thickness in mm	Type and caliber of bullet	Drawing of cartridge	Angle from normal in degrees	Average velocity of bullet V_{50m} m/s with distance 50m
8	Armour piercing incendiary bullet <i>5-31</i> of 7.62mm caliber	Drawing 3-020170,	35	789.0
9		2-25329	26	
12			22	
13			21	

Conditions of full charge bullet proof testing of plates for parts of medium hardness. Table :9

Nominal thickness in mm	Type and caliber of bullet	Drawing and index number of cartridge	Average velocity of bullet V_{50m} m/sec	Angle from normal in degrees	Distance in mm	Impact speed in m/sec
8	Light model of 1908 <i>48ar</i> of 7.62mm caliber	Drawing 3-014705, letter <i>5</i> index 57-H 323	847.5	0	180	717
10				35	100	792
16	Armour piercing incendiary bullet <i>5-31</i> of 12.7mm cartridge	Drawing 3-016113, letter <i>5</i> index 3-24465 57-53-542	817.5	38		
20				35	798	799
27				27	100	

Five registered bullets are fired to the blank of high and medium hardness and seven to the blank of medium hardness with thickness 16mm and more.

NOTE: Selection of equipments for the tests, indicated in table 7 is subjected to their availability in the plant.

Conditions of bullet proof testing with ^{recalculated} charge ^{of plates} parts of medium hardness. Table 10.

Nominal thickness	Type and caliber of bullet	Drawing and index number of cartridge	Angle from normal in degrees	Average velocity of bullet $V_{50\%}$ / sec from distance	
				50M	55M
8	Light model of 1908 ^{year} 7.62mm caliber	Drawing 3-014705, letter <i>B</i> index 57-H-323	0	736	740
10	Armour piercing incendiary bullet <i>B-32</i> of 7.62mm caliber	Drawing 3-014833 A index 57- <i>B3</i> -322	35	810	813.5
16	Armour piercing incendiary bullet <i>B-32</i> 7.62mm caliber	Letter <i>B</i> drawing 3-	38	808	810
20		016113, 3-	35		
25		24465, index 57- <i>B3</i> -542	27		

5.15 Evaluation of damage of the plates for meeting specifications is determined during firing according to the scale of damages given in table 11.

Table 11.

Scale for finding the fire damage with armour piece and
ordnance bullets while testing the plates by
firing.

Description of damage	Estimation
1. From the rear side, no bulges <i>bulges</i>	meeting the specifications
2. From the rear side, small <i>small</i> bulge of any size	"
3. From the rear side bulge of any size with radial blind flaws or small fissures while firing with ordinary bullet or with flaws, blind fissures or cracks while firing with a armour piercing bullet. In doubtful cases firing damage from ordinary or armour piercing bullets can be checked with kerosene-kerosene is not leaked	"
4. From the rear side bulge of any size with radial through fissures and cracks. In doubtful case, damage from ordinary and armour piercing bullet is checked with kerosene. Kerosene is leaking	Not meeting the specifications
5. From the rear side, outline of small plug from <i>from</i> without piercing	Not in condition
6. From the rear side bulge of any size with fissure around the circle out line of scabbing	"
7. Scabbing of any shape and size from the rear size <i>size</i> without piercing of plate	"
8. Through bullet hole with fine <i>fine</i> or flaw edges from the rear side or knocked out plug or appearance of core of armour piercing bullet from the rear size <i>size</i>	"
9. Through bullet hole with scabbles of any shape and depth from the rear side or through bullet hole from the firing of ordinary bullet with one or several ring laminations along the section of bullet hole	"
10. Split of the blank or through cracks, going beyond the limits of damage in the firing test result	Not meeting specifications.

5.16 Unaccounted firings (if the speed each is measured) are those firing in which the following are obtained:

Damages which meet specifications at speeds lower by 10m/sec than the tabulated.

Damages which do not meet specifications (except damages '10 of table 11) at speeds higher by 10m/sec than the tabulated.

Unaccounted firing is repeated.

5.17 If test results are found unsatisfactory the test should be repeated with double the number of blanks. When the test results are found unsatisfactory even for one of the blanks melt is rejected as bullet proof armour plate of given thickness, but can be presented as bullet proof armour plate in other thickness or as structural armour plate.

Testing of each plate is allowed. Armour plates, blanks of which did not withstand the firing test, are rejected.

5.18 Blank which did not pass the test is not allowed for reheat treatment and retest.

Before retest, ingots, slabs or plates may be rejected at the discretion of manufacturer.

In case of unsatisfactory results of retest of plate made from ingots of 6 ton and more, rejection of top/bottom and other slabs (plates) may be carried out and the remaining part of melt may be retested as the independent melt.

Results of this test in double the number of blanks are considered as final.

- 5.19 At the customer's report upto 25% of melt of each thickness group (but not less than one melt per quarter of a year) is test additionally for determining the limit value when the standard damage is obtained with confirmation of this limit value ~~by~~ two firings, during regular firing critical angles are determined and during testing according to normal—the limit distance.

6. MARKING PACKING AND TRANSPORTATION

- 6.1 Plates are marked with melt and ingot numbers, year of manufacture of plates and conventional designation of steel as per GOST 19525-74.

Structural armour steel plates are additionally marked with letter K by stamping or painting. Place meant for marking is enclosed with paint.

- 6.2 Each batch of plates should be accompanied with certificate ^t certifying the conformity of batch of plates to the requirements of the present standard and order.

Following are mentioned in the certificate:

Chemical composition;

hardness of plates;

conditions of heat treatment of plates (during supply of plates in heat treated condition)

Samples and blanks

Results of all inspection tests for hardness, fracture, firing.

While supplying the plates with defects distributed in the limits of nominal dimensions of plates, indicate the number of parts (blanks) or which suitable part of plate is marked is indicated in the certificate.

6.3 Plates are shipped by any means of transport.

S E C R E T
COPY NO:00059
GROUP:011.

Correction to GOST 21967-76. Bullet proof armour steel plate Specifications.

In what plate	Printed		Should be	
Table 8	Nominal thickness in mm	Angle from normal in degrees	Nominal thickness in mm	Angle from normal in degrees
	10	27	10	27
	12	0	12	27
	13		13	0
	14	23	14	23
Table 8a	20		20	23
	22	23	22	23
	Nominal thickness in mm	Angle from normal in degrees	Nominal thickness in mm	Angle from normal in degrees
	9	26	9	30
			10	26
Table 9	Nominal thickness in mm	xxxxx	Nominal thickness in mm	
	27		25	