GOST : 1789-70

Title : BERYLLIUM BRONZE STRIPS AND TAPES

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USSR STATE STANDARD

Beryllium Bronze Strips and Tapes Technical Conditions	GOST 1789-70 (СТ СЭВ 467-77) This supercedes GOST 1789-60

Valid upto 01.01.1984

The present standard relates to beryllium bronze strips and tapes used in instrument - making for the manufacture of different parts including springs.

This standard is in full conformity with СТ СЭВ 467-77 and lays down additional requirements as to assortment and technical specifications.

Annexure 1(a) contains correlation between the requirements of СТ СЭВ 467-77 and those of the present standard.

1. Assortment

1.1. Thickness of strips and tapes and tolerance in thickness must conform to the requirements specified in Table 1.

Table 1

mm

Tolerance in thickness

Thickness	Strips		Tapes	
	Normal Manufacturing Accuracy H (N)	Improved Manufacturing Accuracy П (P)	Normal Manufacturing Accuracy H (N)	Improved Manufacturing Accuracy П (P)
0,02 0,03 0,04 0,05 0,06 0,07 0,08 0,09	—	—	—	—0,01
0,10 0,11 0,12 0,13 0,14			—0,02	—0,015
0,15 0,16 0,18 0,20 0,22 0,23	—0,03	—0,02	—0,03	—0,02
0,25 0,28 0,30 0,32	—0,04	—0,3		
0,35 0,40	—0,05	—0,4	—0,04	—0,03
0,45 0,50	—0,06		—0,05	—0,04
0,55 0,60 0,65 0,70 0,75 0,80 0,85	—0,07	—	—0,06	—0,05

Table 1 Contd.

mm

Thickness	Tolerance in thickness			
	Strips		Tapes	
	Normal Manufacturing Accuracy H (N)	Improved Manufacturing Accuracy (P)	Normal Manufacturing Accuracy H (N)	Improved Manufacturing Accuracy (P)
0.90	-0.08	-	-0.06	-0.05
1.00				
1.10	-0.09		-0.07	-0.06
1.20				
1.30				
1.40			-0.09	-0.08
1.50				
1.60	-0.10			
1.70				
1.80			-	-
1.90				
2.00				
2.20				
2.50	-0.12			
2.80				
3.00				
3.2	-0.13	-	-	-
3.5				
4.0	-0.18			
4.5	-0.20			
5.0				
5.5	-0.24			
6.0	-0.25			

Note: Annexure 1, lists theoretical weight.

1.2. Strip width and tolerance in width in relation to thickness should conform to the requirements specified in Table 2.

Table 2

mm

Strip width	Tolerance in width for strip thickness			
	upto 1.5	over 1.5 upto 3.0	Over 3.0 upto 5.0	over 5.0 upto 6.0
40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100	+1	+2	-	-
110, 120, 130, 140, 150, 160, 170.			+2	+5
180, 190, 200, 250, 300	+2	+3	+3	+6

1.3. Strip length and tolerance in length in relation to the material condition and strip thickness should conform to the requirements specified in Table 3.

Table 3

mm

Material Condition	Strip thickness	Strip length	Tolerance in strip
Soft (tempered)	0.15-6.0	200-500	+5
Hard (deformed after tempering by 30 to 40 %)	0.15-1.50	200-600	+5
	1.60-6.0	500-1500	+10

1.4. Strips must be made available with uniform length, multiples of uniform length and nonuniform length.

1.5. Tape width and tolerance in tape width in relation to thickness should conform to the requirements specified in Table 4.

Table 4

mm

Tape width	Tolerance in tape width for tape thickness	
	upto 1 incl.	over 1
10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 30, 32, 34, 36, 38, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120, 130, 140, 150, 160, 170	-0.5	-0.8
180, 190, 200, 250, 300	-0.8	-1.0

Note: Tapes of thickness less than 0.10 mm are made to 10 to 100 mm width, tapes of thickness 0.10 to 0.45 mm incl. to 10 to 250 mm width and tapes of thickness 0.50 mm and over to 20 to 300 mm width.

1.6. Tape length should be not less than 5 m. Upto 10 % of a batch may consist of tapes of shorter length subject to a minimum length of 1 m.

Examples of conventional designation.

Strips of beryllium bronze grade Бр. Б 2, soft (tempered) 0.30 mm thick; 80 mm wide with normal manufacturing accuracy.

Strip Бр. Б2 - М - 30 x 80 - Н GOST 1789-70

Tape made out of beryllium bronze grade Бр. Б2, soft, 0.50 mm thick, 200 mm wide, with normal manufacturing accuracy:

Tape Бр. Б 2 - М - 0.50 x 200-Н GOST 1789-70

-Do- grade Бр.Б HT 1.9 hard (deformed after hardening by 30 to 40 %) 0.50 mm thick, 200 mm wide with improved manufacturing accuracy.

Tape Бр.Б.HT.1.9 - T - 0.50 X 200 - В GOST 1789-70.

* missing 2 sentences.

1.7. The order must specify the bronze grade, dimensions of strips and tapes, manufacturing accuracy and material condition.

2. Technical Requirements

2.1. Chemical composition of strips and tapes made out of beryllium bronze of grades Бр.Б 2, Бр.Б HT 1.9 and Бр.Б HT 1.7 must conform to the requirements of GOST 18175-72.

2.2. Strips and tapes as supplied must be: soft (tempered) -M- out of bronze of grades Бр Б2 and Бр Б HT 1.9 or hard (deformed after annealing by 30 to 40 %) - T - out of bronze of grades Бр.Б 2, Бр. Б HT 1.7 and Бр.Б HT 1.9.

2.3. Surface of strips and tapes must be clean and smooth and free from flaws, cracks, blisters, blowholes, dents and corrosion spots.

Insignificant surface defects (pinholes, scratches and roughness) which when dressed for control inspection do not result in tolerance in thickness being exceeded, as well as temper colour, reddening and local darkening are acceptable in strips and tapes.

The surface quality of strips and tapes may, if necessary, be verified with reference to control specimens acceptable to manufacturer and customer.

2.4. Edges of strips and tapes must be evenly trimmed and free from cracks and peeling. Wavy, torn and ruptured edges are unacceptable.

2.5. Edge curvature in strips must not exceed 4 mm per metre of length and in tapes 3 mm per metre of length.

2.6. Mechanical properties of strips and tapes must conform to the requirements specified in Table 5.

Table 5

Bronze grade	Material condition	Thickness of strips and tapes, mm	Ultimate tensile strength σ_B, kgf/mm^2	Relative elongation δ_B, % not less than	Vickers hardness HV
Бр.Б2	Soft (after tempering	Less than 1.5	-	-	Not more than 130
		0.15 to 0.25	40 to 60	20	
		over 0.25		30	
Бр.БНТ 1.9	Soft (after tempering)	Less than 0.15	-	-	Not more than 120
		0.15 to 0.25	40 to 60	20	
		over 0.25		30	
Бр.Б2	Hard (deformed after tempering by 30 to 40 %)	Less than 0.15	-	-	Not less than 170
		0.15 to 0.25	60 to 90	-	
		over 0.25	65 to 95	2.5	
Бр.БНТ 1.9		Less than 0.15	-	-	Not less than 160
		0.15 to 0.25	60 to 90	-	
		over 0.25	65 to 95	2.5	
Бр.БНТ 1.7		Less than 0.15	-	-	Not less than 150
		0.15 to 0.25	60 to 95	-	
		over 0.25		2.5	

Note:

1. Tapes less than 0.15 mm thick are not subjected to tensile test.

2. Hardness of strips and tapes of thickness 0.10 to 0.20 mm inclusive is verified on a ПМТ - 3 testing machine with a load of 0.2 kgf. The load is 0.02 kgf for strips and tapes of thickness 0.09 mm and less. Hardness number must correspond to the value measured with a diamond pyramid (Vickèr's hardness).

3. Hardness numbers for tapes of thickness less than 0.05 mm as well as ultimate tensile strength and relative a elongation for strips and tapes of thickness 0.15 to 0.25 mm are optional for one year from the date of introduction of the present standard (i.e. from 01.01.1970).

2.7. Depth of spinning (by Erichsen test) with a punch of 10 mm radius for strips and tapes of thickness 0.10 to 0.25 mm must conform to the values shown in Table 6.

Table 6

Bronze grade	Material condition	Depth of spinning in mm, not less than
Бр.Б2 Бр.БНТ 1.9	Soft (tempered)	8
Бр.Б2 Бр.БНТ 1.9 Бр.БНТ 1.7	Hard (deformed after tempering by 30 to 40 %)	3

2.8. Strips and tapes must lend themselves to dispersion hardening. Mechanical properties of samples drawn from strips and tapes after dispersion hardening must conform to the requirements specified in Table 7.

Table 7

Bronze grade	Material condition	Strip or tape thickness, mm	Ultimate strength B, kgf/mm^2	Relative elongation % not o, more than	Vicker's hardness by diamond pyramid not more than	Permissible (maximum) loads in determining hardness, kgf		
						Strip or tape thickness mm		
						0.25 to 0.35	0.40 to 0.55	0.60 and over
Бр.Б2	Refined (after tempering)	less than 0.15	-	-	330	5	-	-
		0.15 to 0.25	110 to 150	-				
		over 0.25	115 to 150	2.0				
Бр. БНТ 1.9		less than 0.15	-	-	330	-	10	-
		0.15 to 0.25	110 to 150	-				
		over 0.25	115 to 150	2.0				
Бр. Б2	Refined (after deformation by 30 to 40%)	less than 0.15	-	-	360	-	-	30
		0.15 to 0.25	115 to 160	-				
		over 0.25	120 to 160	1.5				
Бр. БНТ 1.9		less than 0.15	-	-	360	-	-	30
		0.15 to 0.25	115 to 160	-				
		over 0.25	120 to 160	1.5				
Бр. БНТ 1.7		less than 0.15	-	-	340	-	-	30
		0.15 to 0.25	110 to 150	-				
		over 0.25		2-0				

Note:

1. Tapes of thickness less than 0.15 mm are not subjected to tensile test.
2. Hardness of strips and tapes of thickness 0.10 to 0.20 mm inclusive is verified on a ПМТ - 3 testing machine with a load of 0.2 kgf. The load is 0.02 kgf for strips and tapes of thickness 0.09 mm and less. Hardness number must correspond to the value measured with a diamond pyramid (Vicker's hardness).
3. Hardness numbers for tapes of thickness less than 0.05 mm as well as ultimate tensile strength and relative elongation for strips and tapes of thickness 0.15 to 0.25 mm are optional for one year from the date of introduction of the present standard (i.e., from 01.01.1970).
4. Annexure 3 is a reference Table for yield limit and modulus of elasticity.

2.9. Hardened strips and tapes of thickness upto 0.15 mm inclusive must withstand a bend test in the cold condition upto 90° around a mandrel of diameter equal to twice the thickness of the strip (or tape) without forming cracks.

2.10. Microstructure of strips and tapes made out of beryllium bronze of all grades after dispersion hardening must have a uniform distribution of β-phase inclusions. If the customer so desires, strips and tapes must be supplied with regulated grain size. Microstructure and grain size must conform to master specimens agreed upon mutually. Erichsen test (Metallurygy)-A test in which a piece of metal sheet is pressed into a cup by means of a plunger; used to estimate the suitability of sheet for pressing or drawing operations.

Note:

1. Microstructure is checked at customer's request specified in the order.
2. Average grain size must not exceed 50 microns if the customer so stipulates.

This parameter is in force since 1.1 1972.

2.11. Fracture in strips and tapes must be clean and dense and free from peeling, holes and extraneous inclusions. Peeling to a total length not exceeding 2 mm is permitted in the fracture of each specimen.

Note:

Strips and tapes of thickness less than 1 mm are not subjected to fracture test.

2.12 The finished product must have been accepted by the quality control department of the manufacturing organisation. The manufacturer must guarantee conformity of strips and tapes with the requirements of the present standard.

3. Test Procedure

3.1. The customer must follow the rules for sampling and the test procedure given below for carrying out control check of the quality of strips and tapes supplied to him in conformity with the requirements of the present standard.

Note: If the customer so stipulates with proper justification, a batch should consist of beryllium bronze from a single melt.

3.2. A batch of strips and tapes must weigh no more than 500 kg and must consist of strips and tapes of a single grade of bronze, a single thickness, a single manufacturing accuracy and of a single material condition.

3.3. Every single strip and every single roll of tape must be subjected to inspection and dimensional check.

3.4. Strip and tape thickness must be measured at a distance of not less than 50 mm from the end and not less than 10 mm from the edge.

Tapes of width 20 mm and less are measured in the middle for thickness. Thickness must be measured at both ends of each tape and in the central part at not less than three places.

3.5. Three samples are selected from each batch for tensile test on strips and tapes.

Tensile test on strips and tapes is conducted as per GOST 1497-73 and GOST 11701-66. Short 12.5 mm wide testpieces types I and II are tested as per GOST 11701-66.

3.6. Two samples are selected from each batch for the Erichsen test with spherical spinning tool.

3.7. Three samples are selected from each batch in the condition as supplied and three after dispersion hardening for carrying out hardness tests on strips and tapes. Hardness test on strips and tapes of thickness upto and including 0.25 mm is conducted as per GOST 9450-76. GOST 2999-75 is fdllowed for thickness over 0.25 mm.

3.8. Two samples are cut from the strips and tapes in the direction of rolling for the bend test in accordance with GOST 14019-68.

Note. Bend test is carried out if specified by the customer in the order.

3.9. Chemical composition and bronze is determined in accordance with GOST 493-79.

3.10. Three samples are selected from a batch for checking fracture quality. Peeling is checked in the fracture across the rolling visually. Magnifying devices with magnification by five times may be used. Fracture quality may also be checked with reference to a master specimen mutually acceptable to manufacturer and customer.

3.11. If unsatisfactory test results are obtained in respect of even a single parameter the particular test is repeated on twice the number of samples drawn from the same batch.

The repeat test results are final.

4. Marking, Packing, Transport and Storage.

4.1. Tapes must be wound into rolls of inside diameter not less than 150 mm tied up with metallic wire, packing tape or twine. The rolls must be wrapped in moisture-proof paper and packed in solid wooden boxes; strips are wrapped in moisture-proof paper and packed in solid boxes. Strips may also be bunched into packets with paper interleaving. The weight of a single packing case with strips or tapes should not exceed 80 kg.

4.2. Quality control stamp should be affixed at the end of each roll or strip.

4.3. A tag indicating the following particulars must be attached to each roll of tapes and each packet of strips.

a) manufacturer's name or trade-mark;

b) bronze grade;

c) strip or tape size;

d) manufacturing accuracy;

e) material condition;

f) batch number and

g) number of the present standard.

4.4. Strips tied up with packing tape, wire or twine into packets weighing not more than 80 kg as also rolls of tape 0.25 mm wide or more wrapped in waterproof paper or bundled into sacks tied up with wire or twine may be transported by rail road containers without packing in boxes. Short strips are packed separately.

When transported by containers, strips and tapes must be so placed and secured as to eliminate the possibility of their displacement within the container.

Strips and tapes must be protected against corrosion, contamination and mechanical damage.

Note: Strips and tapes packed in boxes may also be transported by containers.

4.5. A packing list containing the following particulars must be placed in each box or container.

a) manufacturer's name or trade-mark;

b) bronze grade;

c) strip or tape size;

d) manufacturing accuracy;

e) batch weight;

f) batch number and

g) number of the present standard.

These particulars must also be painted on each box.

4.6. Each batch of strips and tapes must be supported by a certificate attesting conformity with the requirements of the present standard and indicating:

a) manufacturer's name or trade-mark;

b) bronze grade;

c) strip or tape size;

d) manufacturing accuracy;

e) results of mechanical tests (at customer's request specified in the order).

f) batch weight;

g) batch number and

h) number of the present standard.

4.7. Strips and tapes in transit and storage must be protected against the action of moisture, dust and active chemical reagents.

Annexure 1 a

Reference

Correlation of CT C B 467-77 and

GOST 1789-70 Requirements

(Not Translated) Why not translated?

Theoretical weight of 1 m^2 of strips and tapes.

Стр. 12 ГОСТ 1789—70

Thickness of strip or tape, mm	Theoretical weight of 1 m2 in kg	Thickness of strip or tape, mm	Theoretical weight of 1 m2 in kg	Thickness of strip or tape, mm	Theoretical weight of 1 m2 in kg
0,02	0,164	0,28	2,30	1,10	11,48
0,03	0,246	0,30	2,46	1,50	12,30
0,04	0,328	0,35	2,87	1,60	13,12
0,05	0,410	0,40	3,28	1,70	13,94
0,06	0,492	0,45	3,69	1,80	14,76
0,07	0,574	0,50	4,10	1,90	15,58
0,08	0,656	0,55	4,51	2,00	16,40
0,09	0,738	0,60	4,92	2,20	18,04
0,10	0,82	0,65	5,33	2,50	20,50
0,11	0,90	0,70	5,74	2,80	22,96
0,12	0,98	0,75	6,15	3,00	24,60
0,13	1,07	0,80	6,56	3,2	26,24
0,14	1,15	0,85	6,97	3,5	28,70
0,15	1,23	0,90	7,38	4,0	32,80
0,16	1,31	1,00	8,20	4,5	36,90
0,18	1,48	1,10	9,02	5,0	41,00
0,20	1,64	1,20	9,84	5,5	45,10
0,22	1,80	1,30	10,66	6,0	49,20
0,25	2,05				

Примечание. Теоретическая масса вычислена по номинальной толщине полосы и ленты. Плотность бронзы принята равной 82 г/см³.

Note: Theoretical weight has been calculated on the basis of nominal thickness of strips and tapes. Density of bronze has been taken as 8.2 g/cm^3.

ПРИЛОЖЕНИЕ 2

Annexure 2 deleted

(Исключено, Изм. № 1).

Annexure 3

Reference Table for Yield Limit and Modulus of Elasticity of Beryllium Bronze

Bronze grade	Material condition	Yield Limit in tension, 0.2 kgf/mm^2	Modulus of elasticity by dynamic method E, kgf/mm^2
Бр. Б 2	Soft	20 to 35	9500 to 11500 (93 to 113)
Бр. БНТ 1.9	Hard	60 to 95	11000 to 12000
	After dispersion hardening from soft condition	90 to 160	10500 to 12500 (103 to 122)
	After dispersion hardening from hard condition	110 to 160	12000 to 13000
Бр.БНТ 1.7	Hard	50 to 85	11000 to 12000
	After dispersion hardening from hard condition	105 to 150	12000 to 13000