



U S S R S T A T E S T A N D A R D

ROLLED STEEL WITH ENHANCED STRENGTH

GENERAL SPECIFICATIONS

GOST 19281 – 89

Official Edition

**USSR STATE COMMITTEE
FOR PRODUCT QUALITY MANAGEMENT AND STANDARDS**

Moscow

ROLLED STEEL WITH ENHANCED STRENGTH**General specifications****GOST
19281 – 89**OKP (All-Union Product Classification Code) 09 2500, 09 3000, 09 7000, 11 2000

**Term from 01.01.91
until 01.01.96**

This Standard applies to thick-sheet, general-purpose wide-strip, shaped, graded steel and roll-formed sections made of steel with enhanced strength for welded, riveted or bolted constructions mainly used in products without additional heat treatment.

Regarding the chemical composition norms, this Standard also applies to thin sheets, ingots, slabs, blooms, forged pieces and stampings.

1. RANGE OF PRODUCTS

1.1. Rolled steel shall have the classes of strength 265, 295, 315, 325, 345, 355, 375, 390 and 440.

1.2. Shape, dimensions and maximum deviations of the rolled steel shall meet the requirements of GOST 8509 (for equal angles), GOST 8510 (for unequal angles), GOST 8239 (for I-beams), GOST 19425 (for I-beams and structural channels), GOST 26020 (for I-beams with parallel flanges), GOST 8240 (for structural channels), GOST 19903 (for rolled sheets), GOST 103 (for the strip) and GOST 82 (for general-purpose wide strips), GOST 7511, GOST 8278, GOST 8281, GOST 8282, GOST 8283, GOST 9234, GOST 10551, GOST 13229, GOST 14635, GOST 19771, GOST 19772 and GOST 25577 (for the roll-formed section), GOST 2590 (for the round bars), GOST 2591 (for the square bars) and GOST 21026 (for structural channel with a bent flange).

Official Edition© Standards Publishing House, 1989
© Standards Publishing House, 1991
Revised edition with Amendments

**This Standard may not be reproduced, in full or in part, reprinted or distributed
without the permission of Gosstandart of the USSR**

(Amended Wording, Amendment No. 1)

1.3. The rolled steel accuracy degrees regarding dimensions, flatness and curvature shall be specified in the customer's order within the limits of this Standard's product range. If the requirements are absent in the order, the accuracy degree shall be determined by the manufacturer.

1.4. Examples of conventional designations are given in Appendix 1.

2. TECHNICAL REQUIREMENTS

2.1. Characteristics of the basic modification

2.1.1. The basic chemical composition for each class of strength are given in Appendix 2.

Fraction of total mass of phosphorus in steel shall be no more than 0.035 %; that of sulfur shall be no more than 0.040 %.

Fraction of total mass of nitrogen in steel shall be no more than 0.012 %; that of arsenic shall be no more than 0.08 %. When steel is melted from Kerch ores, the fraction of total mass of arsenic shall be no more than 0.15 %, and the fraction of total mass of phosphorus shall be no more than 0.030 %.

The list of steel grades recommended for different classes of strength and thickness of shaped section and rolled section is given in Appendix 3; that of rolled sheet is given in Appendix 4.

2.1.2. Finished rolled stock shall be hot-rolled and heat-treated or shall be after controlled rolling according to the order. If the instructions are absent in the order, then the manufacturing technique shall be determined by the manufacturer.

2.1.3. The surface, the edge and the end rolled steel requirements shall correspond to GOST 14637 (for rolled sheet) and GOST 535 (for rolled section and shaped section).

(Amended Wording, Amendment No. 1)

2.1.4. Sheet delamination shall not be allowed.

2.1.5. The tension mechanical characteristics and bending test conditions shall meet the requirements of table 1 (for shaped section and rolled section) and table 2 (for rolled sheets, general-purpose wide strips and roll-formed sections).

The bending test of the shaped section and rolled sheets with maximum thickness of 20 mm may not be carried out at the manufacturing plant. Moreover, the norms established by the manufacturer shall be observed.

Table 1

Rolled section and shaped section mechanical characteristics

Class of strength	Maximum thickness of rolled steel in accordance with the given class of strength, in mm	Yield point σ_T , H/mm ² (kgf/mm ²)	Ultimate strength σ_B , H/mm ² (kgf/mm ²)	Relative elongation δ_5 , in %	Curvature before parallelism of the sides (<i>a</i> is the sample thickness, <i>d</i> is the swage diameter)
		Not less than			
265	100	265 (27)	430 (44)	21	<i>d</i> =2 <i>a</i>
295	100	295 (30)	430 (44)		
325	60	325 (33)	450 (46)		
345	20	345 (35)	480 (49)		
375	10	375 (38)	510 (52)		
390	20	390 (40)	530 (54)	18	

Note. When steel of grades 09Г2 and 09Г2Д with maximum thickness of 20 mm and class of strength 295 is ordered, the yield point shall be minimum 305 H/mm², and ultimate strength shall be minimum 440 H/mm².

Table 2

Mechanical characteristics of rolled sheet, strip, general-purpose wide strip and roll-formed section

Class of strength	Maximum thickness of rolled steel in accordance with the given class of strength, in mm	Yield point σ_T , H/mm ² (kgf/mm ²)	Ultimate strength σ_B , H/mm ² (kgf/mm ²)	Relative elongation δ_5 , in %	Curvature before parallelism of the sides (<i>a</i> is the sample thickness, <i>d</i> is the swage diameter)
		Not less than			
265	160	265 (27)	430 (44)	21	<i>d</i> =2 <i>a</i>
295	100	295 (30)	430 (44)		
315	60	315 (32)	450 (46)		
325	60	325 (33)	450 (46)		
345	32	345 (35)	490 (50)		
355	20	355 (36)	490 (50)	20	
375	50	375 (38)	510 (52)		
390	50	390 (40)	510 (52)	10	
440	32	440 (45)	590 (60)		

Note. When steel of grade 16ГC and class of strength 265 is ordered, the ultimate strength shall be a minimum of 450 H/mm². When steel of grades 09Г2 and 09Г2Д with maximum thickness of 20 mm and class of strength 295 is ordered, the yield point shall be minimum 305 H/mm², and ultimate strength shall be a minimum of 440 H/mm². When steel of grade 12ГC and class of strength 315 is ordered, the relative elongation shall be a minimum of 26 %. When steel of grade 09Г2C with thickness between 10 and 20 mm is ordered, the ultimate strength shall be a minimum of 470 H/mm². When steel of grades 17ГC and 17Г1C and class of strength 345 is ordered, the relative elongation shall be a minimum of 23 %.

When steel of grade 10XH/ДII and class of strength 345 is ordered the ultimate strength shall be a minimum of 470 H/mm² and the relative elongation shall be a minimum of 20 %.

(Amended Wording, Amendment No. 1)

Table 3

Chemical composition of low-alloyed grades of steel

Steel grade	Degree of deoxidation	Fraction of total mass of elements, in %							
		Carbon	Silicon	Manganese	Chrome	Nickel	Copper	Vanadium	Other elements
09Г2	Сп	No more than 0.12	0.17 to 0.37	1.4 to 1.8	No more than 0.30	No more than 0.30	No more than 0.30	—	—
09Г2Д		No more than 0.12	0.17 to 0.37	1.4 to 1.8	No more than 0.30	No more than 0.30	0.15 to 0.30	—	—
12ГС		0.09 to 0.15	0.5 to 0.8	0.8 to 1.2	No more than 0.30	No more than 0.30	No more than 0.30	—	—
16ГС		0.12 to 0.18	0.4 to 0.7	0.9 to 1.2	No more than 0.30	No more than 0.30	No more than 0.30	—	—
14Г2		0.12 to 0.18	0.17 to 0.37	1.2 to 1.6	No more than 0.30	No more than 0.30	No more than 0.30	—	—
17ГС		0.14 to 0.20	0.4 to 0.6	1.0 to 1.4	No more than 0.30	No more than 0.30	No more than 0.30	—	—
09Г2С		No more than 0.12	0.5 to 0.8	1.3 to 1.7	No more than 0.30	No more than 0.30	No more than 0.30	—	—
09Г2СД		No more than 0.12	0.5 to 0.8	1.3 to 1.7	No more than 0.30	No more than 0.30	0.15 to 0.30	—	—

Table 3 (cont.)

Steel grade	Degree of deoxidation	Fraction of total mass of elements, in %							
		Carbon	Silicon	Manganese	Chrome	Nickel	Copper	Vanadium	Other elements
14XГC	Cп	0.11 to 0.16	0.4 to 0.7	0.9 to 1.3	0.5 to 0.8	Maximum 0.30	Maximum 0.30	—	—
15XCHД		0.12 to 0.18	0.4 to 0.7	0.4 to 0.7	0.6 to 0.9	0.3 to 0.6	0.2 to 0.4	—	—
10XHДП		No more than 0.12	0.17 to 0.37	0.3 to 0.6	0.5 to 0.8	0.3 to 0.6	0.3 to 0.5	—	Phosphorus 0.07 to 0.12 Aluminum 0.08 to 0.15
17Г1C		0.15 to 0.20	0.4 to 0.6	1.15 to 1.6	No more than 0.30	No more than 0.30	No more than 0.30	—	—
10Г2C1		No more than 0.12	0.8 to 1.1	1.3 to 1.65	No more than 0.30	No more than 0.30	No more than 0.30	—	—
10Г2C1Д		No more than 0.12	0.8 to 1.1	1.3 to 1.65	No more than 0.30	No more than 0.30	0.15 to 0.30	—	—
15ГФ		0.12 to 0.18	0.17 to 0.37	0.9 to 1.2	No more than 0.30	No more than 0.30	No more than 0.30	0.05 to 0.12	—
15ГФД		0.12 to 0.18	0.17 to 0.37	0.9 to 1.2	No more than 0.30	No more than 0.30	0.15 to 0.30	0.05 to 0.12	—
10Г2Б		No more than 0.12	0.17 to 0.37	1.2 to 1.6	No more than 0.30	No more than 0.30	No more than 0.30	—	Niobium 0.02 to 0.05
10Г2БД		No more than 0.12	0.17 to 0.37	1.2 to 1.6	No more than 0.30	No more than 0.30	0.15 to 0.30	—	Niobium 0.02 to 0.05

Table 3 (cont.)

Steel grade	Degree of deoxidation	Fraction of total mass of elements, %							
		Carbon	Silicon	Manganese	Chrome	Nickel	Copper	Vanadium	Other elements
10XCHД	C _п	No more than 0.12	0.8 to 1.1	0.5 to 0.8	0.6 to 0.9	0.5 to 0.8	0.4 to 0.6	—	—
15Г2СФ		0.12 to 0.18	0.4 to 0.7	1.3 to 1.7	No more than 0.30	No more than 0.30	No more than 0.30	0.05 to 0.10	—
15Г2СФД		0.12 to 0.18	0.4 to 0.7	1.3 to 1.7	No more than 0.30	No more than 0.30	0.15 to 0.30	0.05 to 0.10	—
14Г2АФ		0.12 to 0.18	0.3 to 0.6	1.2 to 1.6	No more than 0.40	No more than 0.30	No more than 0.30	0.07 to 0.12	Nitrogen 0.015 to 0.025
12Г2Б		0.10 to 0.16	0.17 to 0.37	1.30 to 1.65	No more than 0.30	No more than 0.30	No more than 0.30	—	Niobium 0.02 to 0.04
16Г2АФ		0.14 to 0.20	0.3 to 0.6	1.3 to 1.7	No more than 0.40	No more than 0.30	No more than 0.30	0.08 to 0.14	Nitrogen 0.015 to 0.025
15Г2АФД	Пс	0.12 to 0.18	to 0.17	1.2 to 1.6	No more than 0.30	No more than 0.30	0.2 to 0.4	0.08 to 0.15	Nitrogen 0.015 to 0.030
14Г2АФД	C _п	0.12 to 0.18	0.3 to 0.6	1.2 to 1.6	No more than 0.40	No more than 0.30	0.15 to 0.30	0.07 to 0.12	Nitrogen 0.015 to 0.025
16Г2АФД		0.14 to 0.20	0.3 to 0.6	1.3 to 1.7	No more than 0.40	No more than 0.30	0.15.. 0.30	0.08 to 0.14	Nitrogen 0.015 to 0.025

Table 3 (cont.)

Steel grade	Degree of deoxidation	Fraction of total mass of elements. in %							
		Carbon	Silicon	Manganese	Chrome	Nickel	Copper	Vanadium	Other elements
18Г2АФ	Пс	0.14 to 0.22	No more than 0.17	1.3 to 1.7	No more than 0.30	No more than 0.30	No more than 0.30	0.08 to 0.15	Nitrogen 0.015 to 0.030
18Г2АФД		0.14 to 0.22	No more than 0.17	1.3 to 1.7	No more than 0.30	No more than 0.30	0.15 to 0.30	0.08 to 0.15	Nitrogen 0.015 to 0.030

Notes:

1. Nitrogen fraction of total mass in steel, undoped with nitrogen, shall be a maximum of 0.008 %. Maximum nitrogen fraction of total mass may be 0.012 %. In this case the rolled stock with any category shall meet the requirements of tables 6 and 7 regarding the norms of impact elasticity after strain aging.

2. Aluminum and titanium may be added to alloy, if maximum aluminum percentage is 0.05 % and maximum titanium percentage is 0.03 % in the rolled stock fraction of total mass.

3. Phosphorus, sulfur and arsenic fraction of total mass in steel shall meet clause 2.1.1.

(Amended Wording, Amendment No. 1)

p. 8 GOST 19281 – 89

2.2. Characteristics of modifications established at the customer's request

2.2.1. Rolled steel with regulated chemical composition.

Chemical composition of the heat ladle analysis shall meet the norms given in table 3. The element fraction of total mass permissible deviations in finished rolled steel from the norms, given in table 3, shall correspond to that in table 4.

Note. The grade of steel and weldability requirements shall be given in the order for rolled steel intended for welded constructions and designs of important purpose.

Table 4

Elements	Fraction of total mass permissible deviations of the elements, in %	Elements	Fraction of total mass permissible deviations of the elements, in %
Carbon	±0.02	Sulfur Phosphorus Nitrogen	+0.005
Manganese	+0.1		
Silicon Chrome Nickel Copper	±0.05	Vanadium	±0.02 –0.01
		Niobium	+0.010 –0.005

Note. Deviations of fraction of total mass of phosphorus +0.03 % and aluminum $\begin{smallmatrix} +0.03 \\ -0.01 \end{smallmatrix}$ may be allowed in rolled steel of grade 10XH/II.

2.2.2. Rolled steel with a limited phosphorus content (maximum 0.030 %) and sulfur content (maximum 0.035 %).

2.2.3. Rolled steel with guaranteed weldability.

The steel weldability shall be guaranteed by its manufacturing methods and chemical composition.

(Amended Wording, Amendment No. 1)

2.2.4. Normalized carbon equivalent Ce content in rolled steel shall be: maximum 0.49 for steel with class of strength 390 and maximum 0.51 for steel with class of strength 440.

2.2.5. Rolled steel with classes of strength 265, 295 and 315 (with minimum thickness of 20 mm); 325 (with minimum thickness of 10 mm); 345, 355, 375, 390 and 440 with the increased atmospheric corrosion resistance. Copper fraction of total mass in steel shall be 0.15-0.30 %. Letter Д shall be added to the class of strength designation (for example 265Д, 295Д).

Note. Rolled steel of grade 09Г2Д and class of strength 295 may be produced with a maximum thickness of 20 mm.

(Amended Wording, Amendment No. 1)

2.2.6. Rolled steel with classes of strength 315 and 345 with normalization or controlled rolling; with classes of strength 390 and 440 with thermal hardening or controlled rolling.

2.2.7. Rolled steel for products in modification XJI with heat treatment or controlled rolling indicated in the order.

2.2.8. Rolled steel with classes of strength 390 and 440. The ultimate strength upper limit shall be restricted by values that exceed those specified in tables 1 and 2 by 180 H/mm^2 .

2.2.9. Rolled steel with standardized impact strength.

Rolled steel shall be produced according to the categories specified in table 5 depending on the impact-bending test requirements. The impact elasticity standards are given in tables 6 and 7.

2.2.10. Rolled steel with scale clearing.

2.2.11. Rolled steel with burr grinding and without the end contortion.

2.2.12. Rolled steel with the ultrasonic control of entirety. Class of sheet entirety shall be established by agreement between the manufacturer and the customer according to GOST 22727. The edge zones shall be controlled at the customer's order.

(Amended Wording, Amendment No. 1)

2.2.13. Rolled steel with the regulated yield upper limit.

2.3. Marking and packing of rolled steel shall be in accordance with GOST 7566.

3. ACCEPTANCE PROCEDURE

3.1. Rolled steel acceptance procedure shall be in accordance with GOST 7566 with additions. Rolled steel shall be accepted in batches. A batch shall consist of rolled steel with the same class of strength, the same thickness, the same heat treatment conditions and the same basic chemical composition. Weight of a batch shall not exceed 350 metric tons.

A rolled steel batch with regulated chemical composition and teemed in ingots shall in addition consist of the same ladle sample. The carbon fraction of steel total mass maximum difference shall be 0.04 %, and manganese fraction of total mass maximum difference shall be 0.15 % according to the ladle analysis in the rolled steel batch produced in continuous-casting plant (MHJ3).

Each rolled steel batch shall have a quality certificate with the following data:

Trade mark or name and trade mark of the manufacturer;

The name of the customer;

Number of the order;

The quality certificate's issuing date;

Number of the freight car or hauling unit;

The name of the production, dimensions, quantity of places, their common mass,

Table 5

Standardized characteristics	Category														
	1	2	3	4		6	7	8	9	10	11	12	13	14	15
Impact elasticity KCU at a temperature of 20° C	+									+					
Impact elasticity after strain aging		+								+	+	+	+	+	+
Impact elasticity KCU at a temperature of -20° C			+								+				
-40°C				+								+			
-50°C					+								+		
-60°C						+								+	
-70°C							+								+
Impact elasticity KCV at a temperature of 0° C								+							
-20°C									+						

Notes:

1. When rolled steel with a category that provides for the testing of the samples with the stress concentrator of type V is ordered, the customer may simultaneously require one of the categories that provides for testing of the samples with the stress concentrator of type U.

2. Rolled section with categories 5-7 and 13-15 shall not be produced. Shaped section with categories 5-7 and 13-15 shall be produced with a maximum thickness of 11 mm.

Table 6

Impact elasticity of plates and general-purpose wide strips

Class of strength	Rolled steel thickness, in mm	Impact elasticity KCU, J/cm ² (kgf·m/cm ²), at a temperature, in ° C			Impact elasticity KCV, J/cm ² (kgf·m /cm ²), at temperature, in ° C		Impact elasticity KCU, J/cm ² (kgf·m/cm ²), after strain aging at a temperature, in ° C
		20	−40	−70	0	−20	20
		Minimum					
265	No more than 5 Over 5 up to 10 Over 10 up to 20 Over 20 up to 160	— 79 (8.0) 69 (7.0) 59 (6.0)	— — — 29 (3.0)	— — — 24 (2.5)	— — — —	— — — —	29 (3.0)
295	No more than 5 Over 5 up to 10 Over 10 up to 20 Over 20 up to 32 Over 32 up to 60 Over 60 up to 100	— — — 59 (6.0) 59 (6.0) 59 (6.0)	— 34 (3.5) 29 (3.0) 29 (3.0) 29 (3.0) 29 (3.0)	— — — 24 (2.5) 24 (2.5) 24 (2.5)	— — — — — —	— — — — — —	29 (3.0)
315	No more than 5 Over 5 up to 10 Over 10 up to 20 Over 20 up to 32 Over 32 up to 60	— — 59 (6.0) 59 (6.0) 59 (6.0)	— — 29 (3.0) 29 (3.0) 29 (3.0)	— — 24 (2.5) 24 (2.5) 24 (2.5)	— — — — —	— — — — —	29 (3.0)
325	No more than 5 Over 5 up to 10 Over 10 up to 20 Over 20 up to 32 Over 32 up to 60	59 (6.0) 59 (6.0) 59 (6.0) 59 (6.0) 59 (6.0)	39 (4.0) 39 (4.0) 34 (3.5) 29 (3.0) 29 (3.0)	29 (3.0) 29 (3.0) 29 (3.0) 24 (2.5) 24 (2.5)	— — — — —	— — — — —	29 (3.0)

Table 6 (cont.)

Class of strength	Rolled steel thickness, in mm	Impact elasticity KCU, J/cm ² (kgf·m /cm ²), at temperature, in ° C			Impact elasticity KCV, J/cm ² (kgf·m /cm ²), at temperature, in ° C		Impact elasticity KCU, J/cm ² (kgf·m/cm ²), after strain aging at a temperature, in ° C
		20	–40	1 – 70	0	–20	20
		Minimum					
345	No more than 5	64 (6.5)	39 (4.0)	29 (3.0)	–	–	29 (3.0)
	Over 5 up to 10	64 (6.5)	39 (4.0)	29 (3.0)	–	–	
	Over 10 up to 20	–	29 (3.0)	29 (3.0)	40 (4.0)	40 (4.0)	
	Over 20 up to 32	–	29 (3.0)	29 (3.0)	40 (4.0)	40 (4.0)	
355	No more than 5	–	–	–	–	–	29 (3.0)
	Over 5 up to 10	–	–	–	–	–	
	Over 10 up to 20	–	29 (3.0)	–	–	–	
375	No more than 5	–	39 (4.0)	34 (3.5)	–	–	29 (3.0)
	Over 5 up to 10	–	39 (4.0)	34 (3.5)	–	–	
	Over 10 up to 20	–	39 (4.0)	29 (3.0)	–	–	
	Over 20 up to 32	–	39 (4.0)	29 (3.0)	–	–	
	Over 32 up to 50	–	39 (4.0)	29 (3.0)	–	–	
390	No more than 5	–	44 (4.5)	34 (3.5)	–	–	29 (3.0)
	Over 5 up to 10	–	44 (4.5)	34 (3.5)	–	–	
	Over 10 up to 15	–	39 (4.0)	29 (3.0)	40 (4.0)	–	
	Over 15 up to 32	–	39 (4.0)	29 (3.0)	40 (4.0)	40 (4.0)	
	Over 32 up to 50	–	39 (4.0)	29 (3.0)	40 (4.0)	40 (4.0)	
440	No more than 5	–	44 (4.5)	34 (3.5)	–	–	29 (3.0)
	Over 5 up to 10	–	44 (4.5)	34 (3.5)	–	–	
	Over 10 up to 20	–	39 (4.0)	29 (3.0)	–	–	
	Over 20 up to 32	–	39 (4.0)	29 (3.0)	–	–	

Notes:

1. If the norms KCV are absent, then the impact elasticity shall be defined before 01.01.93 to collect data. After that, the norms will be established. Test results shall be recorded in the quality certificate.

2. The impact elasticity values KCU for the order category 3 shall be not less than the norms established for the order category 4. The impact elasticity values KCU for the order categories 5 and 6 shall be not less than the norms established for the order category 7.

3. The impact elasticity KCU shall be a minimum of 34 J/cm² at a temperature of minus 40 °C and a minimum of 29 J/cm² at a temperature of minus 70 °C for rolled stock with class of strength 265 made of steel grade 09Г2Д.

steel a class of strength 265 of steel of grade 09Г2С the Impact elasticity KCU at temperature a minus 40 °C shall be not less than 34 J/cm², at temperature a minus 70 °C - not less than 29 Дж/cm².

4. Minimum impact elasticity value KCU shall be 39 J/cm² at a temperature of minus 40 °C for rolled stock with class of strength 295 made of steel grades 09Г2 and 09Г2Д with thickness between 20 and 32 mm inclusive.

5. The impact elasticity value KCU at a test temperature of minus 40 °C shall decrease by 5 J/cm² for rolled stock with class of strength 325 made of steel grade 14Г2 with thickness between 5 and 20 mm.

6. The impact elasticity value KCU at a test temperature of minus 40°C shall be minimum 44 J/cm² for rolled stock with class of strength 345 made of steel grade 17TC with thickness between 5 and 20 mm inclusive. The impact elasticity value KCU at a test temperature of minus 70 °C shall be a minimum of 34 J/cm² for rolled stock made of steel grade 09Г2С.

7. The impact elasticity norms KCU at a test temperature of minus 70 °C for rolled stock with all classes of strength with regulated chemical composition made of steel grades 09Г2, 14Г2 12ГГ, 17ГГ, 17Г1С, 15ГФ, 15Г2СФ, 10Г2Б, 12Г2Б, 14ХГС and 10ХНДП before 01.01.93 shall not be a rejection characteristic and shall only be determined as the statistical data.

8. The impact elasticity value KCU at a test temperature of minus 40 °C shall be a minimum of 49 J/cm² for rolled stock with a class of strength 390 made of steel grade 10XCHD with thickness between 15 and 40 mm inclusive.

Impact elasticity of rolled section, strip and shaped section

Table 7

Class of strength	Rolled stock thickness, in mm	Impact elasticity KCU, J/cm ² (kgf·m/cm ²), at a temperature, in °C			Impact elasticity KCV, J/cm ² (kgf·m/cm ²), at a temperature, in °C		Impact elasticity KCU, J/cm ² (kgf·m/cm ²), after strain aging at a temperature, in °C
		20	−40	−70	0	−20	20
		Minimum					
265	No more than 20	98 (10.0)	—	—	—	—	29 (3.0)
	Over 20 up to 32 inclusive.	—	29 (3.0)	—	—	—	
	Over 32 up to 100 inclusive	59 (6.0)	29 (3.0)	—	—	—	
295	No more than 10	98 (10.0)	39 (4.0)	29 (3.0)	—	—	29 (3.0)
	Over 10 up to 20 inclusive	98 (10.0)	29 (3.0)	29 (3.0)	—	—	
	Over 20 up to 32 inclusive	—	29 (3.0)	—	—	—	
	Over 32 up to 60 inclusive	59 (6.0)	29 (3.0)	—	—	—	
	Over 60 up to 100 inclusive	59 (6.0)	29 (3.0)	—	—	—	

Table 7(cont.)

Class of strength	Rolled stock thickness, in mm	Impact elasticity KCU, J/cm ² (kgf·m/cm ²), at a temperature, in ° C			Impact elasticity KCV, J/cm ² (kgf·m/cm ²), at a temperature, in ° C		Impact elasticity KCU, J/cm ² (kgf·m/cm ²), after strain aging at a temperature, in ° C
		20	−40	−70	0	−20	20
		Minimum					
325	No more than 5	64 (6.5)	34 (3.5)	34 (3.5)	34 (3.5)	34 (3.5)	29 (3.0)
	Over 5 up to 10 inclusive	64 (6.5)	34 (3.5)	34 (3.5)	34 (3.5)	34 (3.5)	
	Over 10 up to 20 inclusive	59 (6.0)	29 (3.0)	29 (3.0)	34 (3.5)	34 (3.5)	
	Over 20 up to 32 inclusive	59 (6.0)	29 (3.0)	—	—	—	
	Over 32 up to 60 inclusive	59 (6.0)	29 (3.0)	—	—	—	
345	No more than 5	64 (6.5)	39 (4.0)	29 (3.0)	40 (4.0)	40 (4.0)	29 (3.0)
	Over 5 up to 10 inclusive	64 (6.5)	39 (4.0)	29 (3.0)	40 (4.0)	40 (4.0)	
	Over 10 up to 20 inclusive	—	29 (3.0)	—	—	—	
375	No more than 5	—	39 (4.0)	—	—	—	29 (3.0)
	Over 5 up to 10	—	39 (4.0)	—	—	—	
	10	—	29 (3.0)	—	—	—	
390	No more than 5	—	39 (4.0)	34 (3.5)	—	—	29 (3.0)
	Over 5 up to 10 inclusive	—	39 (4.0)	34 (3.5)	—	—	
	Over 10 up to 15 inclusive	—	34 (3.5)	29 (3.0)	—	—	
	Over 15 up to 20 inclusive	—	34 (3.5)	—	—	—	
		—	34 (3.5)	—	—	—	

Notes:

1. If the norms KCV are absent, the impact elasticity shall be defined before 01.01.93 to collect data. After that, the norms will be established. The test results shall be recorded in the quality certificate.

2. The impact elasticity values KCU for the order category 3 shall be not less than the norms established for the order category 4. The impact elasticity values KCU for the order categories 5 and 6 shall be not less than the norms established for the order category 7.

3. The impact elasticity values KCU for rolled stock with class of strength 325 made of steel grade 09Г2Д with thickness between 5 and 32 mm inclusive at a temperature of minus 40 °C shall increase by 5 J/cm².

4. The impact elasticity KCU for rolled stock with class of strength 345 made of steel grade 09Г2С with thickness between 5 and 10 mm inclusive at a temperature of minus 40 °C shall be a minimum of 34 J/cm².

5. The impact elasticity KCU for rolled stock with a class of strength 390 made of steel grade 10XCHД with thickness between 5 and 10 mm inclusive at the test temperature of minus 40 °C shall be a minimum of 49 J/cm². The impact elasticity KCU for rolled stock with thickness between 10 and 15 mm inclusive shall be a minimum of 49 J/cm².

(Amended Wording, Amendment No. 1)

Mass and, in case of delivery by (theoretical) mass, the sign TM;

Class of strength;

Actual chemical composition;

Accuracy of rolling;

Mechanical characteristics;

Type of flatness for the sheet;

Character of edge for the sheet;

Group of surface quality for rolled stock;

Type of heat treatment (when the rolled steel is delivered in the heat-treated condition);

Number of the specifications or reference document;

Quality control stamp.

In addition, the test results for the indicators ordered shall be specified in the quality certificate for rolled steel with characteristics established by the customer according to clause 2.2.

Grade of steel, chemical composition and number of melt, number of a batch, if the melt is divided into batches shall be specified in the quality certificate for rolled steel accepted with regulated chemical composition. The additional designation Cв. shall be assigned for rolled steel with assured weldability.

(Amended Wording, Amendment No. 1)

3.2. Two bars or two sheets, two strips and one roll shall be selected from each batch for rolled steel quality monitoring.

3.3. If test results are unsatisfactory against even one of the indicators, then a re-test shall be carried out according to GOST 7566.

4. QUALITY CONTROL

4.1. Sampling for defining the chemical composition shall be carried out in accordance with GOST 7565.

4.2. The steel chemical analysis shall be carried out in accordance with GOST 22536.0-GOST 22536.12, GOST 27809, GOST 12346, GOST 12347, GOST 12348, GOST 12350, GOST 12351, GOST 12352, GOST 12355, GOST 12356, GOST 12357, GOST 12358, GOST 12359, GOST 12361, GOST 12364 and GOST 18895 or other methods ensuring the required accuracy of analysis.

Where disputes arise over the quality evaluation, it shall be carried out with methods established in this Standard.

(Amended Wording, Amendment No. 1)

4.3. Carbon equivalent (Ce) shall be calculated using the formula

$$C_9 = C + \frac{Mn}{6} + \frac{Si}{24} + \frac{Cr}{5} + \frac{Ni}{40} + \frac{Cu}{13} + \frac{V}{14} + \frac{P}{2},$$

where C, Mn, Si, Cr, Ni, Cu, V and P are the fractions of total mass of carbon, manganese, silicon, chrome, nickel, copper, vanadium and phosphorus.

4.4. Quality monitoring of the rolled sheet surface and dimensions shall be in accordance with GOST 14637, and that of the rolled section shall be in accordance with GOST 535.

4.5. Rolled steel delamination during cutting shall be controlled by visual observation of the ends and edges without the use the magnifying devices.

If necessary, the quality of metal on the sheet edges and general-purpose strips shall be checked by shaving. Chip bifurcation shall indicate that the metal is broken.

4.5.1. The ultrasonic control of the rolled sheet entirety shall be carried out according to GOST 22727.

4.6. Sampling and specimen manufacturing for mechanical and technological tests shall be carried out in accordance with GOST 7564. Samples shall be cut out from shaped section and general-purpose strip lengthways, from rolled sheets shall be cut out across the rolling directions. During impact bending testing of the samples with an acute notch, they shall be selected along the rolling direction.

If the rolled steel diameter or side of square are more than that specified in tables 1 and 7 then the mechanical characteristics may be determined on the samples cut from the blanks. The blanks shall be forged or rolled with the dimensions given in tables 1 and 7. The mechanical characteristic norms in this case shall meet tables 1 and 7.

(Amended Wording, Amendment No. 1)

4.7. One sample shall be selected from each bar, sheet, general-purpose strip and roll to test the elongation and bend. Two samples for each temperature shall be selected to test impact elasticity. Quality of roll-formed sections shall be checked on the blank.

4.8. Rolled steel tensile test shall be carried out on samples with five-aliquot length in accordance with GOST 1497.

(Amended Wording, Amendment No. 1)

4.9. Bending test shall be carried out in accordance with GOST 14019.

4.10. Rolled steel impact elasticity with maximum nominal thickness of 10 mm inclusive shall be defined on samples of types 1, 2 or 3, and for categories 8 and 9 of types 11, 12 and 13 in accordance with GOST 9454. Impact elasticity of rolled steel with minimum thickness of 10 mm shall be defined on samples of type 1, and that for categories 8 and 9 of type 11 shall be defined in accordance with GOST 9454.

Impact elasticity of shaped and strip sections with thickness of 3-4 mm, of rolled sheets with maximum thickness of 5 mm may be determined on samples with a width equal to the rolled stock thickness.

(Amended Wording, Amendment No. 1)

4.11. Impact elasticity after strain aging shall be determined in accordance with GOST 7268 on the samples with concentrator of type U. The sample thickness shall meet the given in clause 4.10.

4.12. Impact elasticity of one sample may be reduced by 15 % when the samples with the concentrator of type U are tested. Impact elasticity of one sample may be reduced by 30 % when the samples with the concentrator of type V are tested. The test result average value shall not be lower than the norms of tables 6 and 7.

4.13. If the manufacturer uses the statistic and other non-destructive methods of mechanical characteristic quality monitoring according to the specifications and technical documentation, he does not have to carry out the mechanical characteristic monitoring according to the technique stipulated in this Standard. The manufacturer shall guarantee that the production shall comply with the requirements of this Standard. Where disputes arise over the evaluation of rolled stock quality and during periodic production quality testing, the quality monitoring stipulated in this Standard may be used.

5. TRANSPORTATION AND STORAGE

5.1. Transportation and storage of rolled stock shall be in accordance with GOST 7566, and that of roll-formed sections shall be in accordance with GOST 11474.

EXAMPLES OF CONVENTIONAL DESIGNATIONS

Hot-rolled shaped section of usual rolling accuracy (B), I-beam number 30 in accordance with GOST 8239-89, class of strength 345:

$$\text{Двутавр} \frac{30 - B \text{ ГОСТ } 8239 - 89}{345 \text{ ГОСТ } 19281 - 89}.$$

Hot-rolled shaped section of increased rolling accuracy (Б), structural channel number 20 with parallel flanges (П) in accordance with GOST 8240-89, class of strength 315:

$$\text{Швеллер} \frac{20П - Б \text{ ГОСТ } 8240 - 89}{315 \text{ ГОСТ } 19281 - 89}.$$

Hot-rolled shaped section of usual rolling accuracy (B), unequal angular with the dimensions of 63×40×4 mm in accordance with GOST 8510-86, class of strength 345:

$$\text{Уголок} \frac{63 \times 40 \times 4 - B \text{ ГОСТ } 8510 - 86}{345 \text{ ГОСТ } 19281 - 89}.$$

Hot-rolled square bar of usual rolling accuracy (B), with the side of the square equal to 50 mm in accordance with GOST 2591-88, class of strength 315:

$$\text{Квадрат} \frac{50 - B \text{ ГОСТ } 8510 - 86}{315 \text{ ГОСТ } 19281 - 89}.$$

Hot-rolled round bar of usual rolling accuracy (B), with the diameter of 40 mm in accordance with GOST 2590-88, of the first group 1, of the ninth category, class of strength 345:

$$\text{Круг} \frac{40 - B \text{ ГОСТ } 2590 - 88}{345 - 9 - 1 \text{ ГОСТ } 19281 - 89}.$$

Rolled steel sheet, normalized, of increased rolling accuracy (A), with high flatness (ПБ), with sheared edge (О) with dimension of 8×1100×5 000 mm in accordance with GOST 19903-74, class of strength 390 made of steel of grade 10XCHД:

$$\text{Лист} \frac{A - ПБ - О - 8 \times 1100 \times 5000 \text{ ГОСТ } 19903 - 74}{390 - 10X0XC \text{ ГОСТ } 19281 - 89}.$$

Hot-rolled sheet of normal rolling accuracy (Б), with normal flatness (ПН), with mill edge (НО) with dimension of 16×1 200×6 000 mm in accordance with GOST 19903-74, class of strength 325 made of steel grade 16ГC, with guaranteed weldability, of 12 category:

$$\text{Лист} \frac{Б - ПН - НО - 16 \times 1200 \times 6000 \text{ ГОСТ } 19903 - 74}{325 - 16ГC - cв - 12 \text{ ГОСТ } 19281 - 89}.$$

(Amended Wording, Amendment No. 1)

BASIC CHEMICAL COMPOSITION OF STEEL

Table 8

Class of strength	Basic chemical composition, fraction of total mass, in %	Additional alloying
265, 295	C to 0.14 Si to 0.5 Mn to 1.6	Al to 0.03 Ti to 0.03
315	C to 0.18 Si to 0.7 Mn to 1.6	Al to 0.03 Ti to 0.03
325	C to 0.20 Si to 0.9 Mn to 1.6	Al to 0.03 Ti to 0.05 V to 0.10
345, 355, 375	C to 0.22 Si to 0.9 Mn to 1.6	Al to 0.03 Ti to 0.05 V to 0.10 Nb to 0.02 N to 0.03
375, 390	C to 0.22 Si to 1.1 Mn to 1.8	Al to 0.03 Ti to 0.05 V to 0.10 Nb to 0.03 N to 0.03
440	C to 0.22 Si to 1.1 Mn to 1.8	Al to 0.03 Ti to 0.05 V to 0.15 Nb to 0.05 N to 0.03

Note. In order to obtain the required level of properties, steel shall be processed with hot synthetic slag, evacuation, argon blow and steel inoculation with calcium and rare earth elements. Maximum 0.02 % of calcium and 0.05 % of rare earth elements shall be put in metal.

GRADES OF STEEL FOR ROLLED SECTION, STRIP AND SHAPED SECTION

Table 9

Class of strength	Rolled steel thickness in accordance with the given class of strength, in mm	Grades of steel ensuring the given class of strength with different thickness of rolled stock	Grades ensuring the given class of strength with hardening processing
205	No more than 20 Over 20 up to 100 inclusive	Ст3сп 09Г2С	—
295	No more than 20 Over 20 up to 32 inclusive Over 32 up to 100 inclusive	09Г2 09Г2С, 09Г2 10Г2С1	Ст3сп * — —
325	No more than 20 inclusive No more than 32 inclusive Over 10 up to 60 inclusive	09Г2С 14Г2, 15ГФ, 15ХСНД 10Г2С1	Ст3сп * — —
345	No more than 10 inclusive Over 10 up to 20 inclusive	09Г2С, 10Г2С1, 10ХНДП, 15ХСНД 15ГФ	09Г2 *, Ст3сп * Ст3сп *
375	No more than 10 inclusive	15ГФ, 10Г2Б	—
390	No more than 15 inclusive No more than 20 inclusive	10ХСНД 15Г2СФ	— —

* Regulated or controlled rolling, or accelerated cooling.

**GRADES OF STEEL FOR SHEET,
GENERAL-PURPOSE WIDE STRIP AND ROLL-FORMED SECTIONS**

Table 10

Class of strength	Rolled steel thickness in accordance with the given class of strength, in mm	Grades of steel ensuring the given class of strength with different thickness of rolled stock	Grades ensuring the given class of strength with hardening processing
265	No more than 20 inclusive Over 20 up to 160 inclusive	Ст3сп 09Г2С, 16ГС	- -
295	No more than 20 inclusive Over 20 up to 32 inclusive Over 32 up to 100 inclusive	09Г2 09Г2С, 09Г2, 16ГС 10Г2С1	Ст3сп* - -
315	No more than 10 inclusive Over 10 up to 20 inclusive Over 20 up to 60 inclusive	12ГС 16ГС 10Г2С1	Ст3сп* Ст3сп* 09Г2С *, 17Г1С*
325	No more than 10 Over 10 up to 20 inclusive Over 20 up to 32 inclusive 32 inclusive Over 20 up to 60 inclusive	16ГС 09Г2С, 17ГС, 10Г2С1 15ГФ 14Г2 10Г2С1	Ст3сп* Ст3сп* - - 17Г1С*
345	No more than 10 Over 10 up to 20 inclusive 32 inclusive	09Г2С, 17ГС, 10ХНДП, 10Г2С1, 14ХГС 15ГФ, 17Г1С 15ХСНД	Сд3СП* Ст3сп* 17П1С*
356	No more than 5 No more than 10 Over 10 up to 20 inclusive	10Г2С1 17Г1С 15ГФ	- - 17Г1С
375	No more than 10 Over 10 up to 32 Over 32 up to 50 inclusive	15ГФ, 10Г2Б 14Г2АФ 14Г2АФ	- 09Г2С* 17Г1С **
390	No more than 10 inclusive No more than 32 inclusive No more than 40 inclusive No more than 50 inclusive Over 32 up to 50 inclusive	12Г2Б 15Г2АФДП1С, 15Г2СФ 10ХСНД 14Г2АФ 16Г2АФ	- 14Г2 **, 10Г2С1 ** - - -
440	No more than 32 inclusive	16Г2АФ, 18Г2АФП1С	-

* Regulated or controlled rolling or accelerated cooling.

** Quenching plus tempering.

Appendixes 3 and 4. (Amended Wording, Amendment No. 1)