

## Steel grade 20 (domestic analogues: steel 15 , steel 25 ) **Steel grade 20**

### **Grade : Structural carbon steel of high quality \\\ Grade: Structural carbon steel of high quality**

#### **Use in industry:**

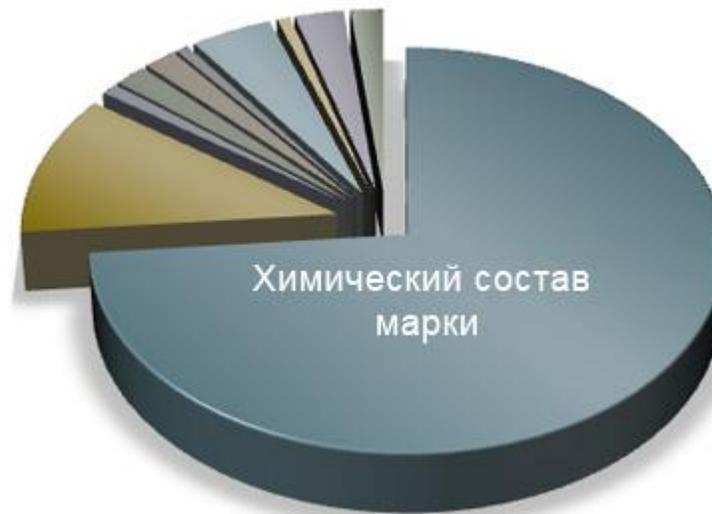
**20A:** after normalization or without heat treatment, crane hooks, couplings, bearing shells and other parts operating at temperatures from -40 to 450 ° C under pressure, after XTO - gears, worms and other parts that are subject to high requirements surface hardness with low core strength;

**20kp, 20ps:** without heat treatment or normalization - branch pipes, fittings, forks, bolts, flanges, apparatus cases and other parts made of boiling steel, operating from -20 to 425 ° C, after carburizing and cyanidation - parts from which high surface hardness and low core strength (axles, fasteners, pins, sprockets)

**Delivery type:** long products, including shaped steel: GOST 1050-88 , GOST 2590-2006 , GOST 2591-2006 , GOST 2879-2006 , GOST 8509-93 , GOST 8510-86 , GOST 8240-97 , GOST 8239-89 . Calibrated bar GOST 7417-75 , GOST 8559-75 , GOST 8560-78 , GOST 10702-78 . Polished rod and silver GOST 14955-77 , Thick sheet GOST 1577-93 , GOST 19903-74 , Thin sheet GOST 16523-97 . Tape GOST 6009-74 , GOST 10234-77 , GOST 103-2006 , GOST 82-70 . Wire GOST 5663-79 , GOST 17305-91 . Forgings and forged blanks GOST 8479-70 . **Pipes GOST 10704-91 , GOST 10705-80** , GOST 8731-74 , GOST 8732-78 , GOST 8733-74 , GOST 5654-76 , GOST 550-75 .

### **Chemical compound in % steel grade 20 Chemical composition in % of steel grade 20**

<b>C</b>	0.17 - 0.24
<b>Si</b>	0.17 - 0.37
<b>Mn</b>	0.35 - 0.65
<b>Ni</b>	up to 0.25
<b>S</b>	up to 0.04
<b>P</b>	up to 0.04
<b>Cr</b>	up to 0.25
<b>Cu</b>	up to 0.25
<b>As</b>	up to 0.08
<b>Fe</b>	~98



Foreign analogues stamps steel grade 20 Foreign analogues of the steel grade 20	
<b>USA</b>	1020, 1023, 1024, G10200, G10230, H10200, M1020, M1023
<b>Germany</b>	1.0402, 1.0405, 1.1151, C22, C22E, C22R, Ck22, Cm22, Cq22, St35, St45-8
<b>Japan</b>	S20C, S20CK, S22C, STB410, STKM12A, STKM12A-S, STKM13B, STKM13B-W
<b>France</b>	1C22, 2C22, AF42, AF42C20, C20, C22, C22E, C25E, XC15, XC18, XC25
<b>England</b>	050A20, 055M15, 070M20, 070M26, 1449-22CS, 1449-22HS, 1C22, 22HS, 430, C22, C22E
<b>European Union</b>	1.1151, 2C22, C20E2C, C22, C22E
<b>Italy</b>	C18, C20, C21, C22, C22E, C22R, C25, C25E
<b>Belgium</b>	C25-1, C25-2
<b>Spain</b>	1C22, C22, C25k, F.112, F.1120
<b>China</b>	<b>20, 20G, 20R, 20Z</b>
<b>Sweden</b>	1450
<b>Bulgaria</b>	20, C22, C22E
<b>Hungary</b>	A45.47, C22E
<b>Poland</b>	20, K18
<b>Romania</b>	OLC20, OLC20X
<b>Czech</b>	12022, 12024
<b>Australia</b>	1020, M1020
<b>Switzerland</b>	Ck22
<b>South Korea</b>	SM20C, SM20CK, SM22C

Properties and useful information:

**Specific gravity of steel 20:** 7.85 g / cm<sup>3</sup>

**Material hardness:** HB 10<sup>-1</sup> = 163 MPa

**Critical point temperature:**  $Ac_1 = 735$ ,  $Ac_3 (Ac_m) = 850$ ,  $Ar_3 (Arc_m) = 835$ ,  $Ar_1 = 680$  Forging temperature, °C: beginning 1280, end 750, cooling in air

1.7 and  $K_{ub}$  1.6

**Weldability of the material:** without restrictions, except for parts after chemical-thermal treatment. Welding methods: RDS, ADS submerged arc and gas shielded, KTS

**Floken sensitivity:** not sensitive. Tendency

**to temper brittleness:** not prone.

Additional information on steel grade 20: Features of steel 20 hydro erosion

Mechanical properties steel 20 at T 20 ° C Mechanical properties of steel 20 at T 20 ° C					
GOST	Delivery status	$\sigma_v$ (MPa)	$\delta_5$ (%)	$\psi$ (%)	HB (no more)
1050-74	Calibrated steel: hot rolled, forged and silver 2nd category after normalization 5th category after hard work 5th category after annealing or high tempering	410490390	25721	554050	
10702-78	Steel calibrated and calibrated with special finishes: after tempering or annealing after spheroidizing annealing work hardened without heat treatment	390-490340-440490	7	505040	163163207
1577-81	Strips normalized or hot rolled	410	25	55	
4041-71	Heat-treated sheet 1-2 category	340-490	28		127

Mechanical properties forgings from steel 20 Mechanical properties of forgings made of steel 20								
heat treatment	KP	Section, mm	$\sigma_{0.2}$ , MPa	$\sigma_v$ , MPa	$\delta_5$ , %	$\psi$ , %	KCU, J/m2	HB, no more
Normalization	175	<100	175	350	28	55	64	101-143
	175	100-300	175	350	24	50	59	101-143
	175	300-500	175	350	22	45	54	101-143
	175	500-800	175	350	20	40	49	101-143
	195	<100	195	390	26	55	59	111-156
	195	100-300	195	390	23	fifty	54	111-156
	215	<100	215	430	24	53	54	123-167

	215	100-300	215	430	twenty	48	49	123-167
hardening. Vacation	245	100-300	245	470	19	42	39	143-179

Mechanical properties steel 20 after XTO Mechanical properties of steel 20 after CTO								
Section, mm	$\sigma_{0.2}$ , MPa	$\sigma_v$ , MPa	$\delta_5$ , %	$\psi$ , %	KCU, J/m <sup>2</sup>	HB	HRC	
Carburizing 920-950 °C, air. Hardening 800-820 °C, water. Vacation 180-200 °C, air.								
fifty	290-340	490-590	eighteen	45	54	156	55-63	

Limit endurance steel 20 The endurance limit of steel is 20						
$\sigma_{-1}$ , MPa	$\sigma_{-1}$ , MPa	n	$\delta_5$ , MPa	$\sigma_{0.2}$ , MPa	Heat treatment, steel condition	
206		1E+7	500	320		
245			520	310		
225			490	280		
205	127				Normalization 910 C, vacation 620 C.	
193			420	280		
255	451				Carburizing 930 C, hardening 810 C, tempering 190 C.	

Mechanical properties marks 20 at elevated temperatures Mechanical properties of Grade 20 at elevated temperatures					
Test temperature, °C	$\sigma_{0.2}$ , MPa	$\sigma_v$ , MPa	$\delta_5$ , %	$\psi$ , %	KCU, J / cm <sup>2</sup>
twenty	280	430	34	67	218
200	230	405	28	67	186
300	170	415	29	64	188
400	150	340	39	81	100
500	140	245	40	86	88
700		130	39	94	
800		89	51	96	
900		75	55	100	
1000		47	63	100	
1100		30	59	100	
1200		20	64	100	

Impact strength KCU (J/cm <sup>3</sup> ) at low temperatures °C					
GOST	Delivery status	Section, mm	KCU at +20	KCU at -40	KCU at -60
19281-73	Sections and shapes	from 5 to 10 from 10 to 20 incl. from 20 to 100 incl.	64 5959	39 3434	34 29-
19282-73	Sheets and stripes	5 to 10 10 to 60 incl.	64 59	39 34	34 29
	Sheets after hardening, tempering (Samples transverse)	from 10 to 60 incl.	-	49	29

Physical properties steel 20										
Test temperature, °C	twenty	100	200	300	400	500	600	700	800	900
Modulus of normal elasticity, E, GPa	212	208	203	197	189	177	163	140		
Modulus of elasticity in torsion shear G, GPa	78	77	76	73	69	66	59			
Density, $\pi_v$ , kg / m <sup>3</sup>	7859	7834	7803	7770	7736	7699	7659	7917	7624	7600
Thermal conductivity coefficient $\lambda$ , W/(m °C)		51	49	44	43	39	36	32	26	26
Oud. electrical resistance, R, (p, NΩ m)		219	292	381	487	601	758	925	1094	1135
Linear expansion coefficient, $\phi$ , (10-6 1/°C)	12.3	13.1	13.8	14.3	14.8	15.1	15.2			
Specific heat, C, J/(kg °C)	486	498	514	533	555	584	636	703	703	695

**Description of steel 20:** In general, steel 20 is widely used in boiler building, for pipes and heating pipelines for various purposes, in addition, the industry produces rods and sheets. After carburizing and cyanidation, this steel can be used to produce parts that require a high surface hardness and a low core strength is allowed: cam rollers, axles, fasteners, spindles, pins, sprockets, studs, link forks and gear shifting rollers, valve lifters, rollers oil pumps, spring pins, lightly loaded gears and other parts of automotive and agricultural engineering.

A wide range of rolled products is made from steel 20, of course, the features of steel of this grade are taken into account. So forgings from this grade can only be made of strength categories 175, 195, 215, 245 with a thickness of forgings from 100 to 300 mm, to obtain forgings with a higher strength category, it is necessary to use another steel. For the manufacture of forgings, blooms or ingots of steel, rolled or forged billets, or billets cast on a continuous casting line of steel, and any other types of rolled products are used.

Straight-seam pipe from grade 20 is created by electric welding from sheets or rolls of steel, while designating such a pipe, its diameter, wall thickness, length, accuracy class, GOST are written, for example: straight-seam pipe with a thickness of 89 mm, a

wall of 4 mm, a measured length of 6 meters II class of accuracy, which was made according to group B GOST 10507-80 is designated as follows:

89x4x6000 II GOST 10704-91

B-20 GOST 10507-80

Seamless pipes are produced by hot deformation, and they must have the following properties: tensile strength 412 MPa, yield strength 245 MPa, relative elongation 21%, Brinell hardness 4.8.

Description of steel 20: In general, steel 20 is widely used in boiler construction, for pipes and heating pipelines for various purposes, in addition, the industry produces a rod, sheet. After cementation and cyanidation, parts can be made of this steel that require high surface hardness and low core strength: cam rollers, axles, fasteners, spindles, fingers, sprockets, studs, thrust forks and gearshift rollers, valve tappets, oil pump rollers, spring fingers, low-loaded gears and other parts of automotive and agricultural machinery.

A rich assortment of rolled products is made from steel 20, of course, the peculiarities of this brand of steel are taken into account. So forgings from this brand can be made of strength categories only 175, 195, 215, 245 with a thickness of forgings from 100 to 300 mm, to obtain forgings with a higher strength category, it is already necessary to use another steel. For the manufacture of forgings, blums or steel ingots, rolled or forged blanks, or blanks cast on a continuous casting line of steel and any other types of rolled products are used.

Pipe pipes from 20 brands created by welding of sheets or coils of steel, while the designation of such pipe is its diameter, wall thickness, length, accuracy class, GOST, such as: steel pipes with a thickness of 89 mm and a wall of 4 mm, length 6 meters class II accuracy, which was made for the group B GOST 10507-80 indicated as follows:

89x4x6000 II GOST 10704-91

B-20 GOST 10507-80

Seamless pipes are made by the method of hot deformation, and they must have the following properties: temporary tear resistance of 412 MPa, yield strength of 245 MPa, elongation of 21%, Brinell hardness of 4.8.

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### Short designations:

$\sigma_{in}$	- tensile strength (ultimate tensile strength), MPa	$\Sigma$	- relative settlement at the appearance of the first crack, %
$\sigma_{0.05}$	- elastic limit, MPa	$\vartheta_l$	- torsion strength, maximum shear stress, MPa
$\sigma_{0.2}$	- conditional yield strength, MPa	$\sigma_{bend}$	- ultimate strength in bending, MPa
$\delta_5, \delta_4, \delta_{10}$	- relative elongation after rupture, %	$\sigma_{-1}$	- endurance limit during bending test with symmetrical loading cycle, MPa
$\sigma_{compress0.05}$ and $\sigma_{compress}$	- compressive yield strength, MPa	$\vartheta_{-1}$	- endurance limit during torsion test with a symmetrical loading cycle, MPa
$v$	- relative shift, %	$v$	- number of loading cycles
$\sigma_{in}$	- short-term strength limit, MPa	$R$ and	- electrical resistivity, Ohm m
$\psi$	- relative narrowing, %	$\rho$	
<b>KCU</b> and <b>KCV</b>	- impact strength, determined on a sample with concentrators, respectively, of the type U and V, J / cm <sup>2</sup>	<b>E</b>	- normal modulus of elasticity, GPa
$\sigma_T$	- limit of proportionality (yield strength for permanent deformation), MPa	<b>T</b>	- temperature at which the properties are obtained, deg
<b>HB</b>	- Brinell hardness	$\lambda$ and $L$	- coefficient of thermal conductivity (heat capacity of the material), W/(m °C)
<b>HV</b>	- Vickers hardness	<b>C</b>	- specific heat capacity of the material (range 20 ° - T ), [J / (kg deg)]
<b>HRC<sub>e</sub></b>	- Rockwell hardness, C scale	$\pi_v$ and	- density kg / m <sup>3</sup>
<b>HRB</b>	- Rockwell hardness, scale B	<b>r</b>	
<b>HSD</b>	- Shore hardness	<b>a</b>	- coefficient of temperature (linear) expansion (range 20 ° - T ), 1/°C
		$\sigma^t_T$	- ultimate strength, MPa
		<b>G</b>	- modulus of elasticity at shear by torsion, GPa