

Contd., Table 9

Steel of grade	Area for use
35НГМЛ	Important loaded parts, to which high strength and sufficient viscosity is required to be present, working under the influence of static and dynamic loads.
20ДХЛ	-do-
08ГДНФЛ	Welded constructions, important parts with wall thickness upto 700 mm, to which high strength and sufficient viscosity required to be present, working under the influence of static and dynamic loads, during temperature upto 350 ⁰ C.
13ХНДФТЛ	Welded constructions, important load. Parts to which sufficient strength and viscosity is required to be present, working under the influence of state and dynamic load during temperature upto 500°C.
12ДН2ФЛ	Welded constructions, important load. Parts to which sufficient strength and viscosity is required to be present, working under the influence of static and dynamic load during temperature upto 400°C.
12ДХН1МФЛ	Welded constructions, important load. Parts to which sufficient strength and viscosity are required to be present, working under the influence of static and dynamic load.
23ХГС2МФЛ	Parts having important significance with wall thickness upto 30 mm, working at cyclic, and impact load and impact of wear and tear.
12Х7Г3СЛ	Critical high load parts with wall thickness up to 100 mm, working in static and dynamic loading conditions.
25Х2ГНМФЛ	Critical parts of with wall thickness upto 50 mm, working in static and dynamic loading conditions.
27Х5ГСМЛ	Critical high loading parts with wall thickness upto 50 mm, working in impact loading and impact of abrasive wear and tear.
30Х3С3ГМЛ	Critical high loading parts with wall thickness upto 30 mm, to which sufficient strength and viscosity is required to be present.
03Н12Х5М3ТЛ	Critical high loading parts with wall thickness upto 200 mm
03Н12Х5М3ТЮ Л	-do-

APPENDIX 2
Reference

AREA FOR USE OF ALLOY STEEL WITH SPECIAL CHARACTERISTICS

Table 10

Grade of steel	Steel grade	Main characteristics	Branches of application
Alloy with special characteristics			
Martensite	20X13Л	To some extent less corrosion in atmospheric conditions as compared with steel grade 15X13Л	Parts, subject to impact load (turbine blades, hydraulic press valves, cracking installation fittings, segments of nozzles, mold for glasses, frames of door, domestic use objects and others), and also units which are subjected to functioning in relation to slight corrosive medium (rain fall, moist, water solutions with organic acid layer during room temperature.
	08X14HДЛ	Corrosion resistance in sea water and atmospheric conditions corrosion resistance is higher than steel grades 15X13Л and 20X13Л	Parts operating in sea water (propeller and others)
	09X16H4БЛ	Corrosion – resistance. High strength during normal temperature, steady, against – oxidation in atmospheric conditions during temperature upto 500 ⁰ C.	Parts with increased strength for aviation, chemical and other branches of industries.

Contd of table 10

Grade of steel	Steel grade	Main characteristics	Branches of application
Martensite steel	09X17H3CJI	Corrosion – resistance steel. Highly durable during normal temperature.	Parts with increased durability for aviation, chemical and other branches of industry, working in medium of middle aggressive (nitrogen and week organic acids, organic and non-organic acid solutions)
	20X5MJI	Heat tolerance in hot petroleum fluids, containing sulphur compound. Heat tolerance up to 600 ⁰ C.	Accessories for oil refineries installation double furnace, body of pumps, and others. Parts, which are required for operation in oil refineries under pressure during temperature upto 550 ⁰ C.
	20X8BJI	Heat tolerance in more aggressive sulphur compound as compound with steel grade 20X5MJI. Heat tolerance up to 600 ⁰ C.	Those parts, operating in conditions of powerful sulfur petroleum fluids under pressure during temperature up to 575 ⁰ C.
	40X9C2JI	Heat tolerance during temperature up to 800 ⁰ C. Heat resistance up to 700 ⁰ C.	Parts, which are working for a long period under load during temperature upto 700 ⁰ C (motor valves, grate bar, and fastening parts)
	10X12HДJI	Cavitation proof. Corrosion and erosion proof under conditions of flowing water. Steel is not bent to tempering embitterment, and not susceptible to flocculation.	Welded structural working hydro turbine components, parts of hydro turbine (blades, parts with flow type parts), working in cavitational breakage.
	20X12BHMФJI	Corrosion – resistance steel heat tolerance up to 650 ⁰ C.	Casting parts of turbine (cylinders, nozzles, diaphragms and fitting) with working temperature upto 600 ⁰ C.

Contd.of Table 10

Grade of steel	Steel grade	Main characteristics	Branches of application
Martensite – Ferrite	15X13Л	Rust proof in atmospheric conditions, in river and tap water. Maximum rust proof is achieved by heat treatment and polishing	Parts with increased plasticity, subjected to drop test (turbine blades valves of hydraulic press, cracking – installation and others) and also units, subject to functioning with regard to poor aggressive medium (rainfall, moisture, water solutions with organic acid at room temperature)
Ferrite	15X25ТЛ	Rust proof, heat tolerance during temperature up to 1100 ⁰ C. possess satisfactory resistance for inter crystalline corrosion	Parts, are not subject to the influence of direct and indirect load (equipment for fusing nitrogen or phosphoric acid), many other parts of chemical machine industry, among them working in conditions of contact with carbonide, furnace fitting, plates and others).
Austenite – martensite	08X15H4ДМЛ	Rust proof in seawater and atmospheric conditions. As compared with steel 08X14HДЛ, it is less sensitive to stress concentrates.	Parts, working in sea water (heavy load propeller ice breaker and others)
	08X14H7МЛ	Rust proof.	Parts, which are working at room and low temperature (upto minus 196 ⁰ C).
	14X18H4Г4Л	Rust proof. Possess inclination to inter crystalline corrosion more than steel grade 10X18H9Л.	Fitting for chemical industries, collectors of exhaust system, furnace fitting parts and others.

Contd., of Table 10

Grade of steel	Steel grade	Main characteristics	Branches of application
Austenite - ferrite	12X25H5TMΦЛ	Rust proof. Heat resistance upto 600 ⁰ C.	Chemical industry fittings, aeronautical parts and other brackets of industries and also parts, working under high pressure upto 300 atmosphere (30 MPa)
	16X18H12C4TЮЛ	Rust – proof.	Welded unit, working in aggressive atmosphere, in particular for concentration of nitric acid during temperature of 105 ⁰ C.
	35X23H7CЛ	Rust - proof in sulphurous atmosphere, heat resistance during temperature up to 1000 ⁰ C.	Parts of tube steel of oil plants and other parts, working during temperature up to 1000 ⁰ C. Recommended to replace steel grade 40X24H12CЛ.
	40X24H12CЛ	Rust - proof heat tolerance during temperature upto 1000 ⁰ C, heat resistance.	Parts, working in high, temperature and presence (compressing blades and guide vane, furnace conveyor, screw conveyor, fastening parts and other)
	20X20H14C2Л	Steel, heat tolerance upto 1000 - 1050 ⁰ C, having resistance in carbonized atmosphere	Furnace conveyor, screw conveyor for segmentation and other parts, working at high temperatures in load condition.
	10X18H3Г3Д2Л	Cavitation resistant, having high erosion resistance compared with steel grade 10X12HДЛ	Cast blades and welded parts of working parts of hydro-turbine, working at stress, not exceeding 80 litres / hour in the area of 300 mm
Austenite	10X18H9Л	Rust proof, heat tolerance up to 750 ⁰ C. In sulfurous atmosphere it is not resistant when the carbon contents in steel is not more than 0.07%, resistance against inter crystalline corrosion	Fitting for chemical industries, collector of exhaust system, parts of furnace fittings, for containers, etching corrosion and other parts working in temperature up to 400 ⁰ C.

Contd., Table 10

Grade of steel	Steel grade	Main characteristics	Branches of application
Austenite	12X18H9TЛ	Rust – proof. Heat tolerance upto 750°C, heat resistance during temperature upto 600°C. Possesses high durability against gas and inter crystalline corrosion.	Fitting for chemical industries, collectors of exhaust system, part of furnace fittings, container and cover for ageing baskets and parts.
	10X18H11БЛ	Rust proof. Heat resistance upto 800°C. Insensitivity to the inter crystalline corrosion.	The same parts and also parts of gas turbine of different significance, parts of turbo-compressors, working at small loads. Parts of cellulose apparatus, nitrogen, food and soap manufacturing industries.
	07X17H16TЛ	Rust proof. Possesses small magnetic sensitivity, high stability against gas and inter crystalline corrosion, having good machinability by cutting.	Critical cast shaping parts, to which requirements are set for small magnetic sensitivity, high corrosion stability and good machinability by cutting.
	12X18H12M3TЛ	Rust proof, heat resistant, not subjected to inter crystalline corrosion during temperature upto 800°C.	Parts resistant, to phosphorous, formic, acetic and other acids, and also part, working for long periods under load during temperature upto 800°C.
	55X18Г14C2TЛ	Rust proof steel, heat tolerance up to temperature of 950°C, it is not resistant in sulfurous atmosphere.	Those parts, which are manufactured from steel grade 40X24H12CЛ
	15X23H18Л	Heat resistance upto 900°C. During temperature of 600 – 800 °C, prone to embrittlement due to formation of sigma - phase.	Installation parts for chemical, oil and automobile industries, gas line, heating chambers of exhaust vanes. Furnace fitting parts, which do not require high mechanical strength (may be used for heating resistance components).

Contd., Table 10

Grade of steel	Steel grade	Main characteristics	Branches of application
Austenite	20X25H19C2Л	Rust proof, heat resistant upto temperature 1100 ⁰ C.	Converts for annealing, furnace, parts and boxes for case hardening.
	18X25H19CЛ	Rust – proof, acid resistance, heat tolerance.	Parts of steam and gas turbines boiler installations, rim and blades of compressors, and nozzle assembly of turbine and other parts, working during high temperature.
	45X17Г13H3ЮЛ	Rust – proof, corrosion proof in sulphurous atmosphere. Heat tolerance during temperature upto 900 ⁰ C, heat resistance	Parts of tempering hardened and connection of furnaces, hearth plates, containers, crucibles for salt bath furnace and other parts, working during high temperatures. It is recommended to replace steel grade 40X24H12CЛ
	35X18H24C2Л	Rust – proof. Heat resistance upto 1100 – 1200 ⁰ C temperature, heat tolerance. Heat resistance steel	Parts working during high temperature in highly load condition (furnace conveyors, worm conveyors, fastening parts)
	31X19H9MBБТЛ	Heat resistance steel	Working wheel of turbines, turbo compressors, turbine and adjusting apparatus
	12X18H12БЛ	Rust – proof, heat resistance up to 650 ⁰ C	Cast parts of power plant with prolonged jobs during 600 – 650 ⁰ C and restricted up to 700 ⁰ C.
	08X17H34B5T3Ю2 ПЛ	Heat resistance during temperature up to 1000 ⁰ C.	Nozzle and working blades of gas turbines, cast in block rotors and other parts, working during temperature up to 800 ⁰ C.
	15X18H22B6M2ПЛ	Heat resistance during temperature up to 1000 ⁰ C. Heat tolerance during temperature up to 800 ⁰ C.	Engine parts of aviation industries (working and nozzle blade of gas turbine and others)
	20X21H46B8ПЛ	Heat resistance during temperature up to 1000 ⁰ C. Heat tolerance during temperature up to 800 ⁰ C	Engine parts of aviation industries (working and nozzle blades of gas turbine and others)

Contd., Table 10

Grade of steel	Steel grade	Main characteristics	Branches of application
Austenite	110Г13Л	High resistance to wear during simultaneous action of high pressure or impact load.	Body of rotational and spherical grinder, jaw breaker, tram and railway indicators and cross connection, caterpillar tracks, star wheel, bucket excavators and other parts, working at impact wear.
	110Г13ФТЛ	High resistance to impact abrasive wear, high cold strength.	Body of rotational and spherical grinder, jaw breaker, tram and railway indicators and cross connections caterpillar tracks, star wheels, bucket excavators, and other parts, working at impact wear; parts of metallurgical and mining equipment.
	130Г14ХМФАЛ	High resistance to wear during simultaneous action of high pressure or impact load. High resistance (durability) against wear and tear, high cold strength. Retains high values of impact viscosity in stress conditions (in the process of operation of parts)	Body of rotational and spherical grinder, jaw breaker, tram and railway indicators and cross connections, caterpillar tracks, star wheels, bucket excavators and other parts, working at impact wear.
	120Г10ФЛ	High resistance against wear and tear.	Units of caterpillar (of tracks) and other parts, working in wear and tear conditions.
	110Г13Х2БРЛ	High resistance to wear during simultaneous operation of high pressure or impact loading	For special production.

Contd., Table 10

Martensite	85X4M5Φ2B6Л (P6M5Л)	High wear resistant, heat proof.	Cast tools, which are obtained by subsequent method of plastic hot deformations (forging, hot extrusion) and or cast metal cutting tool (used for castings of 1 st group).
	90X4M4Φ2B6Л (P6M4Φ2Л)	High wear resistant, heat proof.	- do -
Alloy with special characteristics, used in contract Between CMEA countries			
Martensite – Ferrite	15X14HЛ	Rust proof in water, moisture, diluted nitric acid and poor organic acids; high resistance against cavitation.	Used under contract obligations
	08X12H4ГCMЛ	Rust proof in water, moisture diluted nitric acid and organic acids	Used under contract obligations
Austenite – Ferrite	12X21H5Г2CЛ	Rust – proof in water, in nitric acid, diluted sulphuric acid and mild or diluted organic acids	Used under contract obligations
	12X21H5Г2CTЛ	Rust proof in air, in nitric acid, diluted sulphuric acid and mild or diluted organic acids, highly resistant against inter crystalline corrosion than steel 10X18H9Л	Used under contract obligations

Contd.,

Grade of steel	Steel grade	Main characteristics	Branches of application
Austenite – Ferrite	12X21H5Г2СМ2Л	Rust proof in series of non-organic and organic acids	Used under contract obligations
	12X19H7Г2СЛ	Rust proof in air, in nitric acid, diluted sulfuric acid and mild or diluted organic acids	-do –
	12X21H5Г2СЛ	Rust proof in air, in nitric acid, very diluted sulfuric acid and mild or diluted organic acids	-do –
	07X18H10Г2С2М2Л	Rust proof in series of non-organic and organic acids, more resistant against inter crystalline corrosion than steel grade 15X18H10Г2С2М2Л	-do –
	15X18H10Г2С2М2Л	Rust proof in series of non-organic and organic acids	- do-
	15X18H10Г2С2М2ТЛ	Rust proof in series of non-organic and organic acids, more resistant against inter crystalline corrosion than steel grade 15X18H10Г2С2М2Л	-do –

APPENDIX 3
For reference

CONDITIONS OF HEAT TREATMENT OF STRUCTURAL

Table 11

Grade of steel	Mode of heat treatment			
	Normalizing and tempering		Hardening and tempering	
	Normalizing	Tempering	Hardening	Tempering
	Temperature, °C			
15Л	910 - 930 or 910 - 930	- 670 - 690	- -	- -
20Л	880 - 900 or 880 - 900	- 630 - 650	- -	- -
25Л	880 - 900	610 - 630	870 - 890	610 - 630
30Л	880 - 900	610 - 630	860 - 880	610 - 630
35Л	860 - 880	600 - 630	860 - 880	600 - 630
40Л	860 - 880	600 - 630	860 - 880	600 - 630
45Л	860 - 880	600 - 630	860 - 880	600 - 630
50Л	860 - 880	600 - 630	860 - 880	600 - 630
20ГЛ	880 - 900	600 - 650	870 - 890	620 - 650
35ГЛ	880 - 900	600 - 650	850 - 860	600 - 650
20ГСЛ	870 - 890	570 - 600	-	-
30ГСЛ	870 - 890	570 - 600	920 - 950	570 - 650
20Г1ФЛ	930 - 970	600 - 650	-	-
20ФЛ	920 - 960	600 - 650	-	-
30ХГСФЛ	900 - 930	600 - 650	900 - 920	630 - 670
45ФЛ	880 - 920	600 - 650	880 - 920	600 - 650
32Х06Л	-	-	890 - 910	620 - 660
40ХЛ	-	-	850 - 870	600 - 650
20ХМЛ	880 - 890	600 - 650	-	-
20ХМФЛ	970 - 1000 and 960 - 980	710 - 740	-	-
20ГНМФЛ	910 - 930	600 - 650	910 - 930	640 - 660
35ХМЛ	860 - 880	600 - 650	860 - 870	600 - 650
30ХНМЛ	860 - 880	600 - 650	860 - 870	600 - 650
35ХГСЛ	870 - 890	570 - 600	870 - 880	630 - 670
35НГМЛ	-	-	860 - 880	600 - 650
20ДХЛ	880 - 890	560 - 600	880 - 890	560 - 600
08ГДНФЛ	920 - 950 or 920 - 950	- 590 - 650	- -	- -
13ХНДФТЛ	950 - 970 or 900 - 920	- 530 - 560	- -	- -
12ДН2ФЛ	910 - 930	530 - 560 or	-	-
	Preliminary treatment		Final treatment	
	940 - 950	-	890 - 910	560 - 600
12ДХН1МФЛ	940 - 960 or 890 - 910	- 520 - 630	- 890 - 910	- 520 - 630
	Preliminary treatment		Final treatment	
23ХГС2МФЛ	1000 - 1040	720 - 740	1000 - 1020	180 - 220

Contd., of Table 11

Grade of steel	Mode of heat treatment			
	Normalizing and tempering		Hardening and tempering	
	Normalizing	Tempering	Hardening	Tempering
	Temperature, °C			
12X7Г3СЛ	Preliminary treatment		Final treatment	
	940 - 960	650 - 720	880 - 900	200 - 250
25X2ГНМФЛ ¹	Preliminary treatment		Final treatment	
	900 - 950	650 - 700	880 - 920	630 - 700
25X2ГНМФЛ ²	Preliminary treatment		Final treatment	
	900 - 950	660 - 680	900 - 950	260 - 300
27X5ГСМЛ	Preliminary treatment		Final treatment	
	970 - 990	700 - 720	980 - 1000	200 - 220
30X3С3ГМЛ	Preliminary treatment		Final treatment	
	970 - 990	700 - 720	980 - 1000	200 - 220
Structural alloy steel used in contract between CMEA countries				
15ГЛ	900-920	550-650	-	-
30ГЛ	860-890	550-650	840-860	570-610
45ГЛ	870-890	570-600	840-860	600-650
70ГЛ	790-820	580-650	-	-
55СЛ	840-880	650-720	820-850	650-720
40Г1.5ФЛ	-	-	860-870	640-660
15ХЛ	900-930	550-650	-	-
30ХЛ	900-920	550-650	890-910	620-660
25ХГЛ	-	-	860-890	500-680
35ХГЛ	850-880	550-650	840-860	500-680
50ХГЛ	820-850	620-650	830-850	620-650
60ХГЛ	850-890	630-680	-	-
70Х2ГЛ	820-860	630-680	-	-
35ХГФЛ	850-890	700-740	840-880	700-740
40ХФЛ	870-890	500-520	870-890	500-520
30ХМЛ	850-890	550-650	840-870	530-670
40ХМЛ	850-880	550-650	830-860	530-670
40ХНЛ	860-900	550-650	830-870	550-650
40ХН2Л	860-900	550-650	830-870	550-650
30ХГ1.5МФРЛ	910-960	-	870-890	220-280
40ГТЛ	870-920	620-660	680-880	620-660
75ХНМФЛ	840-870	630-670	-	-
20ГНМЮЛ	880-920	600-700	-	-

^{1, 2} Conditions of heat treatment, ensuring attainment of the level of mechanical characteristics is indicated in table 7.

NOTE:

- For steel grade 40ХФЛ it is permitted to temper after normalizing.
- For steel grade 23ХГС2МФЛ the indicated conditions of preliminary heat treatment may be replaced by hardening with tempering, annealing or tempering.
- For steel grades 03Н12Х5М3ТЛ and 03Н12Х5М3ТЮЛ, it is recommended to apply heat treatment as per conditions: Homogenization at temperature of 1180 – 1200⁰ C; hardening with 1000⁰ C; age hardening at temperature 500⁰ C.

APPENDIX 4
*Recommended*HEAT TREATMENT CONDITIONS OF ALLOY STEEL
WITH SPECIAL CHARACTERISTICS

Table 12

Grade of steel	Grade	Recommended heat treatment mode
Martensite	20X5MЛ	Annealing at temperature 940 – 960°C, normalizing 940 – 960°C, cooling in air; tempering at 680 – 720°C, cooling in air.
	20X8БЛ	- do -
	20X13Л	Annealing at 940 – 960 °C; hardening at 1040 – 1060°C, cooling in oil or in air; tempering 740 – 760°C, cooling in air.
	08X14НДЛ	Hardening 1000 – 1200°C, cooling in air; tempering 660 – 700°C, cooling in air.
	09X16H4БЛ ¹	Normalizing at 1040 – 1060°C, cooling in air; tempering at 600 – 620°C, cooling in air; hardening at 950 – 1050°C, cooling in oil or in air; tempering at 660 – 620°C, cooling in air.
	09X16H4БЛ ²	Normalizing at 1040 – 1060°C cooling in air; tempering at 600 – 620°C, cooling in air; hardening at 950 – 1050°C, cooling in oil; tempering at 290 – 310°C, cooling in air.
	09X17H3СЛ ¹	Annealing at 660 – 670°C; hardening 1040 – 1060°C cooling in oil; Tempering 300 – 350°C, cooling in air.
	09X17H3СЛ ²	Hardening at 1040 – 1060°C, cooling in oil; tempering at 540 – 560°C cooling in air.
	09X17H3СЛ ³	Tempering at 670 – 690°C, cooling in air.
	40X9C2Л	Without heat treatment
	10X12НДЛ	Normalizing 940 – 960°C, cooling in air or hardening at 950 – 1050°C temperature, cooling at the rate of 30 °C / per hour; tempering 650 – 680°C.
	20X12BHMΦЛ	Annealing, tempering at 710 – 730°C, 10 – 15 hours cooling in furnace upto 200°C; repeated normalizing 1100 and 1050°C, cooling at the rate of not less than

Appendix to table 12

Grade of steel	Grade	Recommended heat treatment mode
Martensite	20X12BHMΦЛ	300°C/ hour, blow air; Tempering at 710 – 730°C, 10 – 15 hours, cooling in furnace upto 200°C, small casting (thickness of wall upto 5 mm) may be subject to single normalizing at temperature of 1070 – 1090°C.
Martensite – Ferrite	15X13Л	Annealing at temperature 940 – 960°C; hardening at 1040 – 1060°C, cooling in water, oil or in air, tempering at 740 – 760°C, cooling in air.
Ferrite	15X25ТЛ	Without heat treatment
Austenite – martensite	08X15H4Д4Л	Hardening at 1030 – 1050°C, cooling in air. Tempering at 600 – 620°C, with cooling in air.
	08X14H17МЛ	Hardening at 1090 – 1110°C in inert environment, cooling in air, cold hardening at minus 50 – 70°C. Tempering at 250 – 350°C cooling in air.
	14X18H4Г4Л	Hardening at 1020 – 1070°C, cooling in water
Austenite – Ferrite	12X25H5TMΦЛ	Hardening at 1140 – 1160°C with cooling in furnace up to 970 – 990°C and further in oil.
	35X23H7СЛ	Without heat treatment
	40X21H12СЛ	Hardening at 1040 – 1060°C, cooling in water, oil or air.
	20X20H14C2Л	Normalizing at 1100 – 1150°C cooling in air.
	16X18H12C4ТЮЛ	Hardening at 1150 – 1200°C cooling in air
	10X18H3Г3Д2Л	Normalizing 1070 – 1100°C, cooling in air, tempering (1 st time) 790 – 810°C, cooling upto 20 ⁰ C, tempering (2 nd time) during 590 – 610°C
Austenite	10X18H9Л	Hardening at 1050 – 1100°C, cooling in water, oil or in air.
	07X17H16ТЛ	Hardening at 1050 – 1100°C, cooling in water
	12X18H9ТЛ	Hardening at 1050 – 1100°C, cooling in water, oil or air.

Appendix to table 12

Grade of steel	Grade	Recommended heat treatment mode
Austenite	10X18H11БЛ	Hardening at 1100 – 1150°C, cooling in water
	12X18H12M3ТЛ	Hardening at 1100 – 1150°C, cooling in water
	55X18Г14С2ТЛ	Without heat treatment
	15X23H18Л	Hardening at 1050 – 1100°C, cooling in water
	20X25H19С2Л	Hardening at 1090 – 1110°C, cooling in water
	18X25H19СЛ	Hardening at 1090 – 1110°C, cooling in water oil or in air
	45X17Г13H3ЮЛ	Without heat treatment
	15X18H22B6M2PЛ	Ageing at 790 – 810°C, for 12 – 16 hours cooling in air.
	08X17H34B5T3Ю2PЛ	Hardening at 1140 – 1160°C, cooling in water age hardening 740 – 760°C, 32 hours
	20X21H46B8PЛ	Ageing at 890 – 910°C, for 5 hours cooling in air.
	35X18H24C2Л	Hardening at 1140 – 1160°C, cooling in water
	31X19H9MBBTЛ	Hardening at 1150 – 1180°C, cooling in water, age hardening 700 – 800°C
	12X18H12БЛ	Hardening at 1170 – 1190°C, cooling in air; double age hardening 790 – 810°C, 10 hours and 740 – 760°C, 16 hours
	110Г13Х2БРЛ	Hardening at 1050 – 1100°C, cooling in water
	110Г13ФТЛ	Hardening at 1050 – 1100°C, cooling in water
	130Г14ХМФАЛ	Hardening at 1120 – 1150°C, cooling in water
120Г10ФЛ	Hardening at 1050 – 1100°C, cooling in water	
110Г13Л	Hardening at 1050 – 1100°C, cooling in water	
Martensite	85X4M5Φ2b6Л (P6M5Л)	Annealing at 860 – 880°C, hold it at same mode then cooling at furnace upto 740 – 760°C, hold it at same mode, cooling in furnace upto 500°C, cooling in air.
	90X4M4Φ2B6Л (P6M4Φ2Л)	Annealing at temperature 860 – 880°C, hold it at same mode, cooling at furnace up to 740 – 760°C, hold it at same mode, cooling at furnace upto 500°C, cooling in air.

Contd., Table 12

Grade of steel	Grade	Recommended heat treatment mode
Alloy steel with special characteristics, used in contract between CMEA countries		
Martensite – Ferrite	15X14HЛ ¹	Normalizing temperature 930 – 950°C, cooling in air, tempering 680 – 740°C, cooling in furnace or in air.
	15X14HЛ ²	Homogenizing temperature 1020 – 1100°C, cooling in air, normalizing temperature 930 – 950°C, cooling in air, tempering 680 – 740°C, cooling in furnace or in air
	08X12H4ГCMЛ	Normalizing at temperature 950 – 1050°C, cooling in air or still cooling in air, tempering during temperature 570 – 620°C, cooling in furnace or in air.
Austenite - Martensite	12X21H5Г2CЛ	Hardening at 1050 – 1100°C, cooling in water or in air
	12X21H5Г2CTЛ	Hardening at 1050 – 1100°C, cooling in water or in air
	12X21H5Г2CM2Л	Hardening at 1050 – 1100°C, cooling in water or in air
	12X19H7Г2CAЛ	Hardening at 1050 – 1100°C, cooling in water or in air
	12X21H5Г2CAЛ	Hardening at 1050 – 1100°C, cooling in water or in air
	07X18H10Г2C2M2Л	Hardening at 1050 – 1100°C, cooling in water or in air
	15X18H10Г2C2M2Л	Hardening at 1050 – 1100°C, cooling in water or in air
	15X18H10Г2C2M2TЛ	Hardening at 1050 – 1100°C, cooling in water or in air

^{1, 2, 3} heat treatment modes ensuring the mechanical characteristics, indicated in table 8.

Replacement to GOST 977 – 75, GOST 2176 – 77.

REFERENCE TECHNICAL DOCUMENT

GOST standard number	Point number		GOST standard number	Point number
GOST 1497 – 84	5.5		GOST 12357 – 81	5.1
GOST 1763 – 68	5.10		GOST 12359 – 81	5.1
GOST 3212 – 80	3.4		GOST 20560 – 81	5.1
GOST 6032 – 84	5.12		GOST 22536.0 – 87	5.1
GOST 6130 – 71	5.11		GOST 22536.1 – 88	5.1
GOST 7565 – 81	4.4, 5.2		GOST 22536.2 – 87	5.1
GOST 9012 – 59	5.8		GOST 22536.3 – 88	5.1
GOST 9213 – 59	5.8		GOST 22536.4 – 88	5.1
GOST 9454 – 78	5.6		GOST 22536.5 – 87	5.1
GOST 9651 – 84	5.13		GOST 22536.7 – 88	5.1
GOST 10145 – 81	5.14		GOST 22536.8 – 87	5.1
GOST 11150 – 88	5.13		GOST 22536.9 – 88	5.1
GOST 12344 – 88	5.1		GOST 22536.10 – 88	5.1
GOST 12345 – 88	5.1		GOST 22536.11 – 87	5.1
GOST 12346 – 78	5.1		GOST 22536.12 – 88	5.1
GOST 12347 – 77	5.1		GOST 22536.14 – 88	5.1
GOST 12348 – 78	5.1		GOST 26645 – 85	3.4
GOST 12349 – 83	5.1		CT CЭB 4559-84	Introductory part
GOST 12350 – 78	5.1		CT CЭB 4561-84	Introductory part
GOST 12351 – 81	5.1		CT CЭB 4563-84	Introductory part
GOST 12352 – 81	5.1			
GOST 12354 – 81	5.1			
GOST 12355 – 78	5.1			
GOST 12356 – 81	5.1			