STEEL CASTINGS
GENERAL SPECIFICATIONS

GOST 977 – 88

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GOST 977 – 88 Steel casting – general Specification

In which place	Type	Should be as
Para 1.3. Table 1. Column « Silicon » for steel 08ГДНФЛ	1.15 – 0.40	0.15 – 0.40
Para 1.4. Table 3. Column «permissible deviation, %, for higher limits of contents" for fraction of total mass of silicon upto 0.50 %	+ 0.01	+ 0.10
Para 3.3. Table 7. Description column	Elongation σ, %	Elongation δ, %

ИУС No. 5 1990

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

STEEL CASTINGS **GOST**
General specifications **977-88**

ОКП 411200

Effective from 01.01.1990

The present standard covers steel castings, which are manufactured by all casting methods from the structural non-alloy, alloy, and alloy with special properties of steel castings.

1. GRADES

1.1. The following grades of steel are specified for manufacturing steel castings:

Structural non – alloyed:

15Л, 20Л, 25Л, 30Л, 35Л, 40Л, 45Л, 50Л;

Structural alloyed:

20ГЛ, 35ГЛ, 20ГСЛ, 30ГСЛ, 20Г1ФЛ, 20ФЛ, 30ХГСФЛ, 45ФЛ, 32Х06Л, 40ХЛ, 20ХМЛ, 20ХМФЛ, 20ГНМФЛ, 35ХМЛ, 30ХНМЛ, 35ХГСЛ, 35НГМЛ, 20ДХЛ, 08ГДНФЛ, 13ХНДФТЛ, 12ДН2ФЛ, 12ДХН1МФЛ, 23ХГС2МФЛ, 12Х7Г3СЛ, 25Х2ГНМФЛ, 27Х5ГСМЛ, 30Х3С3ГМЛ, 03Н12Х5М3ТЛ, 03Н12Х5М3ТЮЛ:

Structural alloyed, used under the contractual obligations between the countries – members of (СЭВ) council for mutual economic assistance.

15ГЛ, 30ГЛ, 45ГЛ, 70ГЛ, 55СЛ, 40Г1, 5ФЛ, 15ФЛ, 30ХЛ, 25ХГЛ, 35ХГЛ, 50ХГЛ, 60ХГЛ, 70Х2ГЛ, 35ХГФЛ, 40ХФЛ, 30ХМЛ, 40ХМЛ, 40ХНЛ, 40ХН2Л, 30ХГ1, 5МФРЛ, 75ХНМФЛ, 40ГТЛ, 20ГНМЮЛ;

Alloy with special characteristics:

a) Martensite class

20Х13Л, 08Х14НДЛ, 09Х16Н4БЛ, 09Х17Н3СЛ, 10Х12НДЛ – corrosion resistant; 20Х5МЛ, 20Х8ВЛ, 40Х9С2Л – heat resistant; 20Х12ВНМФЛ – heat proof; 85Х4М5Ф2В6Л (Р6М5Л), 90Х4М4Ф2В6Л (Р6М4Ф2Л) – fast cutting.

б) Martensite – Ferrite class

15Х13Л – corrosion resistant;

в) Ferrite class

15Х25ТЛ – corrosion resistant;

г) Austenite– Martensite class

08Х15Н4ДМЛ, 08Х14Н7МЛ, 14Х18Н4Г4Л – corrosion resistant;

д) Austenite – Ferrite class

12Х25Н5ТМФЛ, 16Х18Н12С4ТЮЛ, 10Х18Н3Г3Д2Л – corrosion resistant; 35Х23Н7СЛ, 40Х24Н12СЛ, 20Х20Н14С2Л – heat resistant.

е) Austenite class

10Х18Н9Л, 12Х18Н9ТЛ, 10Х18Н11БЛ, 07Х17Н16ТЛ, 12Х18Н12М3ТЛ – corrosion resistant; 55Х18Г14С2ТЛ, 15Х23Н18Л, 20Х25Н19С2Л, 18Х25Н19СЛ, 45Х17Г13Н3ЮЛ – heat resistant; 35Х18Н24С2Л, 31Х19Н9МВБТЛ, 12Х18Н12БЛ, 08Х17Н34В5Т3Ю2РЛ, 15Х18Н22В6М2РЛ, 20Х21Н46В8РЛ – heat resistant; 110Г13Л, 110Г13Х2БРЛ, 110Г13ФТЛ, 130Г14ХМФАЛ, 120Г10ФЛ – wear resistant.

Alloy with special characteristics, used under the contractual obligations between the countries – members of (СЭВ) council for mutual economic assistance.

а) Martensite – Ferrite class

15Х14НЛ, 08Х12Н4ГСМЛ – corrosion resistant.

б) Austenite – Ferrite class

12Х21Н5Г2СЛ, 12Х21Н5Г2СТЛ, 12Х21Н5Г2СМ2Л, 12Х19Н7Г2САЛ, 12Х21Н5Г2САЛ, 07Х18Н10Г2С2М2Л, 15Х18Н10Г2С2М2Л, 15Х18Н10Г2С2М2ТЛ – corrosion resistant.

The area of usage of structural alloy steel is given in appendix 1, alloys with special characteristics is given in appendix 2.

1.2 The steel should be melted in furnaces with main lining, melting of steel in furnaces is permitted with acid lining under the conditions fulfilled as per the present standard.

NOTE: The possibility of application of Converter steel should be indicated in the design document (КД) and (or) standard technical documentation (НТД)

1.3 Chemical composition of structural non-alloy and alloy steel should be in accordance with table 1, alloy steel with special composition – as per table 2.

Table 1

Grade of steel			Fraction of total mass of element, %					
ОКП code	Designation as per GOST 977	Designation as per СТ СЭВ	Carbon	Manganese	Silicon	Phosphor	Sulphur	Chromium
						Not more than		
Structured Non – alloy steel								
411200	15Л	52731/51731	0.12 – 0.20	0.45 – 0.90	0.20 –0.52	As per table 4	As per table 4	-
	20Л	-	0.17 – 0.25	0.45 – 0.90	0.20 – 0.52	As per table 4	As per table 4	-
	25Л	52821/51821	0.22 – 0.30	0.45 – 0.90	0.20 – 0.52	As per table 4	As per table 4	-
	30Л	-	0.27 – 0.35	0.45 – 0.90	0.20 – 0.52	As per table 4	As per table 4	-
	35Л	52831/51831	0.32 – 0.40	0.45 – 0.90	0.20 – 0.52	As per table 4	As per table 4	-
	40Л	52861/51861	0.37 – 0.45	0.45 – 0.90	0.20 – 0.52	As per table 4	As per table 4	-
	45Л	52862/51862	0.42 – 0.50	0.45 – 0.90	0.20 – 0.52	As per table 4	As per table 4	-
	50Л	-	0.47 – 0.55	0.45 – 0.90	0.20 – 0.52	As per table 4	As per table 4	-
Structured Alloy Steel								
411220	20ГЛ	52763	0.15 - 0.25	1.20 – 1.60	0.20 – 0.40	0.040	0.040	-
	35ГЛ	52833	0.30 – 0.40	1.20 – 1.60	0.20 – 0.40	0.040	0.040	-
	20ГСЛ	-	0.16 – 0.22	1.00 – 1.30	0.60 – 0.80	0.030	0.030	-
	30ГСЛ	52834	0.25 – 0.35	1.10 – 1.40	0.60 – 0.80	0.040	0.040	-
	20Г1ФЛ	55244	0.16 – 0.25	0.90 – 1.40	0.20 – 0.50	0.050	0.050	-
	20ФЛ	55242	0.14 – 0.25	0.70 – 1.20	0.20 – 0.52	0.050	0.050	-
	30ХГСФЛ	55142	0.25 – 0.35	1.00 – 1.50	0.40 – 0.60	0.050	0.050	0.30 – 0.50
	45ФЛ	55243	0.42 – 0.50	0.40 – 0.90	0.20 – 0.52	As per table 4	As per table 4	-
	32Х06Л	-	0.25 – 0.35	0.40 – 0.90	0.20 – 0.40	0.050	0.050	0.50 – 0.80

Contd., Table 1

Grade of steel			Fraction of total mass of element, %						
Code OKП	Designation as per GOST 977	Designation as per CT СЭВ	Nickel	Molybdenum	Vanadium	Copper	Titanium	Boron	Aluminum
Structural Non – alloy steel									
411220	15Л	52731/51731	-	-	-	-	-	-	-
	20Л	-	-	-	-	-	-	-	-
	25Л	52821/51821	-	-	-	-	-	-	-
	30Л	-	-	-	-	-	-	-	-
	35Л	52831/51831	-	-	-	-	-	-	-
	40Л	52861/51861	-	-	-	-	-	-	-
	45Л	52862/51862	-	-	-	-	-	-	-
	50Л	-	-	-	-	-	-	-	-
Structural Alloy steel									
411220	20ГЛ	52763	-	-	-	-	-	-	-
	35ГЛ	52833	-	-	-	-	-	-	-
	20ГСЛ	-	-	-	-	-	-	-	-
	30ГСЛ	52834	-	-	-	-	-	-	-
	20Г1ФЛ	55244	-	-	0.06 – 0.12	-	Not more than 0.05	-	-
	20ФЛ	55242	-	-	0.06 – 0.12	-	-	-	-
	30ХГСФЛ	55142	-	-	0.06 – 0.12	-	-	-	-
	45ФЛ	55243	-	-	0.05 – 0.10	-	Not more than 0.03	-	-
	32Х06Л	-	-	-	-	-	-	-	-

Contd., Table 1

Grade of steel			Fraction of total mass of element, %					
OKП code	Designation as per GOST 977	Designation as per CT СЭВ	Carbon	Manganese	Silicon	Phosphor	Sulphur	Chromium
						Not more than		
411220	40ХЛ	55111	0.35 – 0.45	0.40 – 0.90	0.20 – 0.40	0.040	0.040	0.80 – 1.10
	20ХМЛ	-	0.15 – 0.25	0.40 – 0.90	0.20 – 0.42	0.040	0.040	0.40 – 0.70
	20ХМФЛ	-	0.18 – 0.25	0.60 – 0.90	0.20 – 0.40	0.025	0.025	0.90 – 1.20
	20ГНМФЛ	-	0.14 – 0.22	0.70 – 1.20	0.20 – 0.40	0.030	0.030	Not more than 0.30
	35ХМЛ	55432	0.30 – 0.40	0.40 – 0.90	0.20 – 0.40	0.040	0.040	0.80 – 1.10
	30ХНМЛ	55711	0.25 – 0.35	0.40 – 0.90	0.20 – 0.40	0.040	0.040	1.30 – 1.60
	35ХГСЛ	55812	0.30 – 0.40	1.00 – 1.30	0.60 – 0.80	0.040	0.040	0.60 – 0.90
	35НГМЛ	-	0.32 – 0.42	0.80 – 1.20	0.20 – 0.40	0.040	0.040	-
	20ДХЛ	-	0.15 – 0.25	0.50 – 0.80	0.20 – 0.40	0.040	0.040	0.80 – 1.10
	08ГДНФЛ	55781	Not more than 0.10	0.60 – 1.00	1.15 – 0.40	0.035	0.035	-
	13ХНДФТЛ	55782	Not more than 0.16	0.40 – 0.90	0.20 – 0.40	0.030	0.030	0.15 – 0.40
	12ДН2ФЛ	55783	0.08 – 0.16	0.40 – 0.90	0.20 – 0.40	0.035	0.035	-
	12ДХН1МФЛ	55761	0.10 – 0.18	0.30 – 0.55	0.20 – 0.40	0.030	0.030	1.20 – 1.70
	23ХГС2МФЛ	55451	0.18 – 0.24	0.50 – 0.80	1.80 – 2.00	0.025	0.025	0.60 – 0.90
	12Х7Г3СЛ	-	0.10 – 0.15	3.00 – 3.50	0.80 – 1.20	0.020	0.020	7.00 – 7.50
	25Х2ГНМФЛ	-	0.22 – 0.30	0.70 – 1.10	0.30 – 0.70	0.025	0.025	1.40 – 2.00
	27Х5ГСМЛ	-	0.24 – 0.28	0.90 – 1.20	0.90 – 1.20	0.020	0.020	5.00 – 5.50
	30Х3С3ГМЛ	-	0.29 – 0.33	0.70 – 1.20	2.80 – 3.20	0.020	0.020	2.80 – 3.20
	03Н12Х5М3ТЛ	-	0.01 – 0.04	Not more than 0.20	Not more than 0.20	0.015	0.015	4.50 – 5.00
	03Н12Х5М3ТЮЛ	-	0.01 – 0.04	Not more than 0.20	Not more than 0.20	0.015	0.015	4.50 – 5.00

Contd., Table 1

Grade of steel			Fraction of total mass of element, %						
OKП code	Designation as per GOST 977	Designation as per CT СЭВ	Nickel	Molybdenum	Vanadium	Copper	Titanium	Boron	Aluminum
411220	40ХЛ	55111	-	-	-	-	-	-	-
	20ХМЛ	-	-	0.40 – 0.60	-	-	-	-	-
	20ХМФЛ	-	-	0.50 – 0.70	0.20 – 0.30	-	-	-	-
	20ГНМФЛ	-	0.70 – 1.00	0.15 – 0.25	0.06 – 0.12	-	-	-	-
	35ХМЛ	55432		0.20 – 0.30	-	-	-	-	-
	30ХНМЛ	55711	1.30 – 1.60	0.20 – 0.30	-	-	-	-	-
	35ХГСЛ	55812	-	-	-	-	-	-	-
	35НГМЛ	-	0.80 – 1.20	0.15 – 0.25	-	-	-	-	-
	20ДХЛ	-	-	-	-	1.40 – 1.60	-	-	-
	08ГДНФЛ	55781	1.15 – 1.55	-	As per calculation 0.10	0.80 – 1.20	-	-	-
	13ХНДФТЛ	55782	1.20 – 1.60	-	0.06 – 0.12	0.65 – 0.90	0.04 – 0.10	-	-
	12ДН2ФЛ	55783	1.80 – 2.20	-	0.08 – 0.15	1.20 – 1.50	-	-	-
	12ДХН1МФЛ	55761	1.40 – 1.80	0.20 – 0.30	0.08 – 0.15	0.40 – 0.65	-	-	-
	23ХГС2МФЛ	55451	-	0.25 – 0.30	0.10 – 0.15	-	-	-	-
	12Х7Г3СЛ	-	-	-	-	-	-	-	-
	25Х2ГНМФЛ	-	0.30 – 0.90	0.20 – 0.50	0.04 – 0.20	-	-	-	-
	27Х5ГСМЛ	-	-	0.55 – 0.60	-	-	-	-	-
	30Х3С3ГМЛ	-	-	0.50 – 0.60	-	-	-	-	-
	03Н12Х5М3ТЛ	-	12.00 – 12.50	2.50 – 3.00	-	-	0.70 – 0.90	-	-
	03Н12Х5М3ТЮЛ	-	12.00 – 12.50	2.50 – 3.00	-	-	0.70 – 0.90	-	0.25 – 0.45

Contd., Table 1

Grade of steel			Fraction of total mass of element %					
OKПcode	Designation as per GOST 977	Designation as per CT СЭВ	Carbon	Manganese	Silicon	Phosphor	Sulphur	Chromium
						Maximum		
Structural alloy steel, used in CMEA countries								
411220	15ГЛ	52711	0.12 – 0.18	0.70 – 1.00	0.30 – 0.60	0.040	0.040	-
	30ГЛ	52832	0.25 – 0.32	1.40 – 1.70	0.20 – 0.50	0.040	0.040	-
	45ГЛ	52864	0.40 – 0.50	0.80 – 1.20	0.20 - 0.50	0.040	0.040	-
	70ГЛ	51931	0.65 – 0.80	1.10 – 1.60	0.20 - 0.50	0.045	0.045	-
	55СЛ	51891	0.52 - 0.60	0.50 - 0.80	0.50 - 0.70	0.045	0.045	-
	40Г1.5ФЛ	55241	0.35 – 0.45	1.60 - 1.90	0.20 - 0.50	0.040	0.040	-
	15ХЛ	55115	0.12 – 0.18	0.40 - 0.60	0.20 - 0.50	0.040	0.040	0.50 - 0.80
	30ХЛ	55116	0.25 – 0.35	0.50 - 0.90	0.20 - 0.50	0.040	0.040	0.50 - 0.80
	25ХГЛ	55117	0.20 – 0.30	0.85 - 1.15	0.20 - 0.50	0.040	0.040	0.90 - 1.30
	35ХГЛ	55118	0.30 – 0.45	0.60 - 0.90	0.50 - 0.75	0.040	0.040	0.50 - 0.80
	50ХГЛ	55114	0.45 – 0.60	0.50 - 0.90	0.20 - 0.50	0.040	0.040	0.60 - 0.90
	60ХГЛ	55112	0.50 – 0.65	0.90 - 1.30	0.20 - 0.50	0.050	0.050	0.90 - 1.30
	70Х2ГЛ	55113	0.60 – 0.75	0.80 - 1.20	0.20 - 0.50	0.050	0.050	1.80 - 2.20
	35ХГФЛ	55141	0.28 – 0.38	1.00 - 1.40	0.20 - 0.50	0.040	0.040	0.20 - 0.60
	40ХФЛ	55181	0.35 – 0.45	0.50 - 0.80	0.20 - 0.50	0.040	0.040	1.00 - 1.40
	30ХМЛ	55433	0.25 – 0.35	0.50 - 0.80	0.20 - 0.50	0.040	0.040	0.80 - 1.20
	40ХМЛ	55434	0.38 – 0.45	0.50 - 0.80	0.20 - 0.50	0.040	0.040	0.80 - 1.20
	40ХНЛ	55811	0.35 – 0.45	0.40 - 0.90	0.20 - 0.50	0.040	0.040	0.50 - 0.80
	40ХН2Л	55813	0.35 – 0.45	0.60 - 0.90	0.20 - 0.50	0.045	0.045	0.40 - 0.70
	30ХГ1.5МФРЛ	55471	0.25 – 0.32	1.40 - 1.80	0.40 - 0.60	0.030	0.025	0.50 - 1.00

Contd., Table 1

Grade of steel			Fraction of total mass of element %						
OKП code	Designation as per GOST 977	Designation as per CT СЭВ	Nickel	Molybdenum	Vanadium	Copper	Titanium	Boron	Aluminum
Structural alloy steel, used in CMEA countries									
411220	15ГЛ	52711	-	-	-	-	-	-	-
	30ГЛ	52832	-	-	-	-	-	-	-
	45ГЛ	52864	-	-	-	-	-	-	-
	70ГЛ	51931	-	-	-	-	-	-	-
	55СЛ	51891	-	-	-	-	-	-	-
	40Г1.5ФЛ	55241	-	-	0.10 – 0.20	-	-	-	-
	15ХЛ	55115	-	-	-	-	-	-	-
	30ХЛ	55116	-	-	-	-	-	-	-
	25ХГЛ	55117	-	-	-	-	-	-	-
	35ХГЛ	55118	-	-	-	-	-	-	-
	50ХГЛ	55114	-	-	-	-	-	-	-
	60ХГЛ	55112	-	-	-	-	-	-	-
	70Х2ГЛ	55113	-	-	-	-	-	-	-
	35ХГФЛ	55141	-	-	0.10 – 0.25	-	-	-	-
	40ХФЛ	55181	-	-	0.15 – 0.30	-	-	-	-
	30ХМЛ	55433	-	0.20 – 0.30	-	-	-	-	-
	40ХМЛ	55434	-	0.20 – 0.30	-	-	-	-	-
	40ХНЛ	55811	1.00 - 1.50	-	-	-	-	-	-
	40ХН2Л	55813	1.60 – 2.00	-	-	-	-	-	-
	30ХГ1.5МФРЛ	55471	-	0.40 – 0.60	0.20 – 0.40	-	-	0.006 - 0.010	-

Contd., table 1

Grade of steel			Fraction of total mass of element %					
OKП code	Designation as per GOST 977	Designation as per CT CЭB	Carbon	Manganese	Silicon	Phosphorous	Sulphur	Chromium
						Maximum		
411220	75ХНМФЛ	55762	0.70 – 0.85	0.60 – 0.90	0.20 – 0.50	0.050	0.050	1.30 – 1.70
	40ГТЛ	55771	0.34 – 0.42	1.20 – 1.60	0.20 – 0.50	0.045	0.045	-
	20ГНМЮЛ	55772	0.16 – 0.23	1.10 – 1.60	0.20 – 0.50	0.035	0.035	-

Contd., table 1

Grade of steel			Fraction of total mass of component %						
OKП code	Designation as per GOST 977	Designation as per CT CЭB	Nickel	Molybdenum	Vanadium	Copper	Titanium	Boron	Aluminum
411220	75ХНМФЛ	55762	0.50 – 0.80	0.40 – 0.60	0.10 – 0.25	-	-	-	-
	40ГТЛ	55771	-	-	-	-	0.02 – 0.10	-	-
	20ГНМЮЛ	55772	0.30 – 0.50	0.15 – 0.30	-	-	-	-	Not less than 0.01

Note:

1. The permissible contents and necessity of checking of presence of components, which are not alloys, is specified in КД (DESIGN DOCUMENT) and (or) НТД (standard technical document).
2. As per the requirements of user, the contents of sulphur and phosphorous in alloy structural steels may be placed not more than 0.030%.
3. During smelting of alloy steel in furnaces with acid lining, the permissible fraction of total mass of sulphur and phosphorous may be increased upto 0.010% for each, provided, the specifications of the remaining requirements of the present standard are ensured.
4. For steel grade 40ХНЛ, introduction of titanium is permissible upto 0.15% with the aim of increasing its mechanical properties.
5. For steel grades 15Л, 25Л, 35Л, 40Л, 45Л designation are given as per CT CЭB 4559-84 and for other steels – as per CT CЭB 4561-84.

Class of steel	OKП code	Grade of steel		Fraction of total mass				
		Designation as per GOST 977	Designation as per CT СЭВ 4563-84	Carbon	Silicon	Manganese	Chromium	Nickel
Alloy steels								
Martensite	411240	20Х13Л	58113	0.16 - 0.25	0.20- 0.80	0.30 - 0.80	12.0 – 14.0	-
		08Х14НДЛ	-	Max. 0.08	Max. 0.40	0.50 – 0.80	13.0 - 14.5	1.20 – 1.60
		09Х16Н4БЛ	-	0.05 – 0.13	0.20 – 0.60	0.30 – 0.60	15.0 – 17.0	3.50 – 4.50
		09Х17Н3СЛ	-	0.05 – 0.12	0.80 – 1.50	0.30 – 0.80	15.0 – 18.0	2.80 – 3.80
		20Х5МЛ	-	0.15 - 0.25	0.35– 0.70	0.40 – 0.60	4.0 - 6.5	-
		20Х8ВЛ	-	0.15 - 0.25	0.30 – 0.60	0.30 – 0.50	7.5 – 9.0	-
		40Х9С2Л	-	0.35 - 0.50	2.00 – 3.00	0.30 – 0.70	8.0 – 10.0	-
		20Х12ВНМФЛ	-	0.17 – 0.23	0.20 – 0.60	0.50 – 0.90	10.5 – 12.5	0.50 – 0.90
		10Х12НДЛ	-	Max. 0.10	0.17 – 0.40	0.20 – 0.60	12.0 – 13.0	1.00 – 1.50
Martensite – Ferrite	411240	15Х13Л	58112	Max. 0.15	0.20 – 0.80	0.30 – 0.80	12.0 – 14.0	-
Ferrite	411240	15Х25ТЛ	-	0.10 – 0.20	0.50 – 1.20	0.50 – 1.80	23.0 – 27.0	-
Austenite – martensite	411240	08Х15Н4ДМЛ	-	Max. 0.08	Max. 0.40	1.00 – 1.50	14.0 – 16.0	3.50 – 3.90
		08Х14Н7МЛ	-	Max. 0.08	0.20 – 0.75	0.30 – 0.90	13.0 – 15.0	6.00- 8.50
		14Х18Н4Г4Л	-	Max. 0.14	0.20 – 1.00	4.00 – 5.00	16.0 – 20.0	4.00- 5.00

Table – 2

of element %											
Molybdenum	Vanadium	Tungsten	Titanium	Niobium	Boron	Nitrogen	Aluminum	Copper	Cerium	Sulphur	Phosphorous
										Maximum	
with special properties											
-	-	-	-	-	-	-	-	-	-	0.025	0.030
-	-	-	-	-	-	-	-	0.80-1.20	-	0.025	0.025
-	-	-	-	0.05-0.20	-	-	-	-	-	0.025	0.030
-	-	-	-	-	-	-	-	-	-	0.030	0.035
0.40-0.65	-	-	-	-	-	-	-	-	-	0.040	0.040
-	-	1.25-1.75	-	-	-	-	-	-	-	0.035	0.040
-	-	-	-	-	-	-	-	-	-	0.030	0.035
0.50-0.70	0.15-0.30	0.70-1.10	-	-	-	-	-	-	-	0.025	0.030
-	-	-	-	-	-	-	-	0.80-1.10	-	0.025	0.025
-	-	-	-	-	-	-	-	-	-	0.025	0.030
-	-	-	0.40-0.80	-	-	-	-	-	-	0.030	0.035
0.30-0.45	-	-	-	-	-	-	-	1.00-1.40	-	0.025	0.025
0.50-1.00	-	-	-	-	-	-	-	-	-	0.030	0.030
-	-	-	-	-	-	-	-	-	-	0.030	0.035

Class of steel	OKП code	Grade of steel		Fraction of total mass				
		Designation as per GOST 977	Designation as per CT СЭВ 4563-84	Carbon	Silicon	Manganese	Chromium	Nickel
Austenite - Ferrite	411240	12Х25Н5ТМФЛ	-	Max., 0.12	0.20 – 1.00	0.30 – 0.80	23.5 – 26.0	5.00 – 6.50
		16Х18Н12С4ТЮЛ	-	0.13 – 0.19	3.80 – 4.50	0.50 – 1.00	17.0 – 19.0	11.00 – 13.00
		35Х23Н7СЛ	-	Max., 0.35	0.50 – 1.20	0.50 – 0.85	21.0 – 25.0	6.00 – 8.00
		40Х24Н12СЛ	-	Max., 0.40	0.50 – 1.50	0.30 – 0.80	22.0 – 26.0	11.00 – 13.00
		20Х20Н14С2Л	-	Max., 0.20	2.00 – 3.00	Max., 1.50	19.0 – 22.0	12.00 – 15.00
		10Х18Н3Г3Д2Л	-	Max., 0.10	Max., 0.60	2.30 – 3.00	13.0 – 19.0	3.00 – 3.50
Austenite	411240	10Х18Н9Л	58762 58511	Max., 0.14	0.20 – 1.00	1.00 – 2.00	17.0 – 20.0	8.00 – 11.00
		12Х18Н9ТЛ	58561	Max., 0.12	0.20 – 1.00	1.00 – 2.00	17.0 – 20.0	8.00 – 11.00
		10Х18Н11БЛ	-	Max., 0.10	0.20 – 1.00	1.00 – 2.00	17.0 – 20.0	8.00 – 12.00
		07Х17Н16ТЛ	-	0.04 – 0.10	0.20 – 0.60	1.00 – 2.00	16.0 – 18.0	15.00 – 17.00
		12Х18Н12М3ТЛ	-	Max., 0.12	0.20 – 1.00	1.00 – 2.00	16.0 – 19.0	11.00 – 13.00
		55Х18Г14С2ТЛ	-	0.45 – 0.65	1.50 – 2.50	12.00 – 16.00	16.0- 19.0	-
		15Х23Н18Л	-	0.10 – 0.20	0.20 – 1.00	1.00 – 2.00	22.0 – 25.0	17.00 – 20.00
		20Х25Н19С2Л	-	Max., 0.20	2.00- 3. 00	0.50 1.50	23.0- 27.0	18.00- 20.00
		18Х25Н19СЛ	-	Max., 0.18	0.80 – 2.00	0.70 – 1.50	22.0 – 26.0	17.00 – 21.00
		45Х17Г13Н3ЮЛ	-	0.40 – 0.50	0.80 – 1.50	12.00 – 15.00	16.0 – 18.0	2.50 – 3.50

Contd., Table 2

of element %											
Molybdenum	Vanadium	Tungsten	Titanium	Niobium	Boron	Nitrogen	Aluminum	Copper	Cerium	Sulphur	Phosphorous
										Maximum	
0.06 - 0.12	0.07- 0.15	-	0.08- 0.20	-	-	0.08- 0.20	-	-	-	0.030	0.030
-	-	-	0.40- 0.70	-	-	-	0.13- 0.35	-	-	0.030	0.030
-	-	-	-	-	-	-	-	-	-	0.035	0.035
-	-	-	-	-	-	-	-	-	-	0.030	0.035
-	-	-	-	-	-	-	-	-	-	0.025	0.035
-	-	-	-	-	-	-	-	1.80- 2.20		0.030	0.030
-	-	-	-	-	-	-	-	-	-	0.030	0.035
-	-	-	From (5xC) to 0.70	-	-	-	-	-	-	0.030	0.035
-	-	-	-	0.45- 0.90	-	-	-	-	-	0.030	0.035
-	-	-	0.005- 0.150	-	-	-	-	-	-	-	0.035
3.00- 4.00	-	-	from (5xC) to 0.70	-	-	-	-	-	-	0.030	0.035
-	-	-	0.10 – 0.30	-	-	-	-	-	-	0.030	0.040
-	-	-	-	-	-	-	-	-	-	0.030	0.030
-	-	-	-	-	-	-	-	-	-	0.030	0.035
-	-	-	-	-	-	-	-	-	-	0.030	0.035
-	-	-	-	-	-	-	0.60- 1.00	-	-	0.030	0.035

Class of steel	OKП code	Grade of steel		Fraction of total mass				
		Designation as per GOST 977	Designation as per CT СЭВ 4563-84	Carbon	Silicon	Manganese	Chromium	Nickel
Austenite	411240	35Х18Н24С2Л	-	0.30 – 0.40	2.00 – 3.00	Max., 1.50	17.0 – 20.00	23.00 – 25.00
		31Х19Н9МВБТЛ	-	0.26 – 0.35	Max., 0.80	0.80 – 1.50	18.0 – 20.0	8.00 – 10.00
		12Х18Н12БЛ	-	Max., 0.12	Max., 0.55	0.50 – 1.00	17.0 – 19. 0	11.0 – 13.00
		08Х17Н34В5Т3Ю2РЛ	-	Max., 0.08	0.20 – 0.50	0.30 – 0.60	15.0 – 18.0	32.00 – 35.00
		15Х18Н22В6М2РЛ	-	0.10 – 0.20	0.20 – 0.60	0.30 – 0.60	16.0 – 18. 0	20.00 – 24.00
		20Х21Н46В8РЛ	-	0.10 – 0.25	0.20 – 0.80	0.30 – 0.80	19.0 – 22.0	43.00 – 48.00
	411250	110Г13Л	-	0.90 – 1.50	0.30 – 1.00	11.50 – 15.00	Max., 1.0	Max., 1.00
		110Г13Х2БРЛ	-	0.90 – 1.50	0.30 – 1.00	11.50 – 14.50	1.0 – 2.0	Max., 0.50
		110Г13ФТЛ	-	0.90 – 1.30	0.40 – 0.90	11.50 – 14.50	-	-
		130Г14ХМФАЛ	-	1.20 – 1.40	Max., 0.60	12.50 – 15.00	1.0 – 1.5	Max., 1.00
		120Г10ФЛ	-	0.90 – 1.40	0.20 – 0.90	8.50 – 12.00	Max., 1.0	Max., 1.00
Martensite	411260	85Х4М5Ф2В6Л (Р6М5Л)	-	0.82 – 0.90	Max., 0.50	Max., 0.50	3.8 – 4.4	Max., 0.40
		90Х4М4Ф2В6Л (Р6М4Ф2Л	-	0.85 – 0.95	0.20 – 0.40	0.40 – 0.70	3.0 – 4.0	-
Alloy steel with special properties used								
Martensite-ferrite	411240	15Х14НЛ	58411	Max 0.15	Max 0.60	0.40-0.90	12,0-15.0	0,70-1.20

Contd., Table 2

of element %											
Molybdenum	Vanadium	Tungsten	Titanium	Niobium	Boron	Nitrogen	Aluminum	Copper	Cerium	Sulphur	Phosphorous
										Maximum	
-	-	-	-	-	-	-	-	-	-	0.030	0.035
1.00-1.50	-	1.00-1.50	0.20-0.50	0.20-0.50	-	-	-	-	-	0.020	0.035
-	-	-	-	0.70-1.10	-	-	-	-	-	0.025	0.020
-	-	4.50-5.50	2.60-3.20	-	Max. 0.05	-	1.70-2.10	-	Max 0.01	0.010	0.010
2.00-3.00	-	5.00-7.00	-	-	Max, 0.01	-	-	-	-	0.030	0.035
-	-	7.00-9.00	-	-	Max, 0.06	-	-	-	-	0.035	0.040
-	-	-	-	-	-	-	-	-	-	0.050	0.120
-	-	-	-	0.08-0.12	0.001-0.006	-	-	-	-	0.050	0.120
-	0.10-0.30	-	0.01-0.05	-	-	-	-	-	-	0.050	0.120
0.20-0.30	0.08-0.12	-	-	-	-	0.025-0.050	-	-	-	0.050	0.070
-	0.03-0.12	-	Max. 0.15	Max. 0.01	-	Max, 0.03	-	Max, 0.7	-	0.050	0.120
4.80-5.30	1.70-2.10	5.50-6.50	-	-	-	-	-	-	-	0.025	0.030
3.00-4.00	2.00-2.60	5.00-7.00	-	-	-	-	-	-	-	0.040	0.040
in the contract of council for mutual economic assistance countries (СЭВ)											
-	-	-	-	-	-	-	-	-	-	0.035	0.035

Class of steel	OKП Code	Grade of steel		Fraction of total mass				
		Designation as per GOST 977	Designation as per CT СЭВ 4563-84	Carbon	Silicon	Manganese	Chromium	Nickel
Martensite - ferrite	411240	08Х12Н4ГСМЛ	58711	Max 0.08	Max 1.00	Max 1.50	11.5-13.5	3.50-5.00
Austenite - ferrite	411240	12Х21Н5Г2СЛ	58451	Max 0.12	Max 1.50	Max 2.00	20.0-22.0	4.50-6.00
		12Х21Н5Г2СТЛ	58461	Max 0.12	Max 1.50	Max 2.00	20.0-22.0	4.50-6.00
		12Х21Н5Г2СМ2Л	58761	Max 0.12	Max 1.50	Max 2.00	20.0-22.0	4.50-6.00
		12Х19Н7Г2САЛ	58462	Max 0.12	Max 1.50	Max 2.00	18.0-20.0	6.00-8.00
		12Х21Н5Г2САЛ	58463	Max 0.12	Max 1.50	Max 2.00	20.0-22.0	4.00-6.00
		07Х18Н10Г2С2М2Л	58763	Max 0.07	Max 2.00	Max 2.00	17.0-19.0	9.00-12.00
		15Х18Н10Г2С2М2Л	58764	Max 0.15	Max 2.00	Max 2.00	17.0-19.0	9.00-12.00
		15Х18Н10Г2С2М2ТЛ	58765	Max 0.15	Max 2.00	Max 2.00	17.0-19.0	9.00-12.00

Note:

1. The presence of components, which are not alloy, their permissible content, and necessity
2. In the steel grade 20Х5МЛ molybdenum may be replaced by titanium in the quantity of not
3. In the steel grade 10Х18Н9Л for necessity of ensuring greater resistance against inter
4. In steel grade 20Х13Л, during smelting in induction furnace increase of fraction of total mass
5. In steel grade 12Х18Н12БЛ, Fraction of total mass of phosphor should not be more than
6. In steel grade 12Х21Н5Г2СТЛ and 15Х18Н10Г2С2М2ТЛ, use of niobium with titanium
7. In steel grades 08Х17Н34В5Т3Ю2РЛ, 15Х18Н22В6М2РЛ, 20Х21Н46В8РЛ contents and document (НТД)

Table – 2

of element %											
Molybdenum	Vanadium	Tungsten	Titanium	Niobium	Boron	Nitrogen	Aluminum	Copper	Cerium	Sulphur	Phosphorous
										Maximum	
Max 1.00	-	-	-	-	-	-	-	-	-	0.035	0.035
-	-	-	-	-	-	-	-	-	-	0.035	0.045
-	-	-	From (4XC) to 0.70	-	-	-	-	-	-	0.035	0.045
1.80-2.20	-	-	-	-	-	-	-	-	-	0.035	0.045
-	-	-	-	-	-	0.10–0.20	-	-	-	0.040	0.040
-	-	-	-	-	-	0.10–0.20	-	-	-	0.040	0.040
2.00-2.50	-	-	-	-	-	-	-	-	-	0.040	0.040
2.00-2.50	-	-	-	-	-	-	-	-	-	0.040	0.040
2.00-2.50	-	-	From 5XX C-0. 03) to 0.80	-	-	-	-	-	-	0.040	0.040

of checking is specified in design document (КД) and (or) standard technical document (НТД).

more than 0.1% during working condition of parts at temperature of not more than 425^0 C.

crystalline corrosion, carbon contents may be placed not more than 0.07%.

of sulphur upto 0.030% is permissible.

0.040%.

in quantity from (8XC) upto 1.20% is permissible for stabilization instead of titanium.

necessity of checking of cerium and boron is given in design documents (КД) and standard technical

Example of conventional designation of steels

25Л GOST 977 – 88
23ХГС2МФЛ GOST 977 – 88
20Х25Н19С2Л. GOST 977 – 88

Example of conventional designation of steels for casting meant for articles, subject to acceptance by customer representative.

25Л К20 GOST 977 – 88
23ХГС2МФЛ КТ 110 GOST 977 – 88

In the grade designation of steel, the first number indicates average or maximum (during absence of lower limit) fraction of total mass of carbon in hundred fraction of percent (%); letter with digits denotes: А – nitrogen, Б – niobium, В – Tungsten, Г – manganese, Д – Copper, М – molybdenum, Н – nickel, Р – boron, С – silicon, Т – titanium, Ф – Vanadium, Х - chromium, Ю – aluminum, Л – casting. The number, which appears after the letters indicates the approximate mass fraction of total mass of alloy element, in %.

Indexes «К» and «КТ» is the conventional designation of strength category, and the following number indicates the value of required yield point. Index «К» indicates material in annealed, normalized or tempered condition; index «КТ» - afterhardening and tempering.

1.4 The permissible deviation of alloy elements from the normal chemical composition is given in table 1, the value indicated in table 3 should not be exceeded.

Table 3

Chemical component	Fraction of total mass of element, %	Permissible deviation, in %	
		For lower content limit	For higher content limit
Carbon	Upto 0.25	- 0.02	+ 0.01
	Above 0.25 upto 0.50	- 0.03	+ 0.02
	Above 0.50	- 0.04	+ 0.03
Silicon	Upto 0.50	- 0.05	+ 0.01
	Above 0.50 upto 0.90	- 0.08	+ 0.15
	Above 0.90 upto 1.30	- 0.15	+ 0.20
	Above 1.30	- 0.15	+ 0.25
Manganese	Upto 0.50	- 0.07	+ 0.10
	Above 0.50 upto 0.90	- 0.10	+ 0.18
	Above 0.90	- 0.12	+ 0.25

Contd., Table 3

Chemical component	Fraction of total mass component %	Permissible deviation in, %	
		For lower content limit	For higher content limit
Chromium	Upto 1.00	- 0.07	+ 0.10
	Above 1.00 upto 2.00	- 0.10	+ 0.15
	Above 2.00	- 0.15	+ 0.20
Nickel	Up to 1.00	- 0.10	+ 0.15
	Above 1.00 upto 2.00	- 0.15	+ 0.20
	Above 2.00	- 0.20	+ 0.25
Molybdenum	Upto 0.20	- 0.03	+ 0.03
	Above 0.20	- 0.05	+ 0.05
Vanadium	Upto 0.20	- 0.03	+ 0.03
	Above 0.20	- 0.05	+ 0.05
Copper	For all contents of component	- 0.10	+ 0.10
Titanium	For all contents of component	- 0.02	+ 0.02
Aluminum	For all contents of component	- 0.01	+ 0.01

Fraction of total mass of sulphur and phosphorous in the structural non-alloy steel upto 01.01.92 should be in accordance with the requirements indicated in table 4, from 01.01.92 – as indicated in table 4 a.

Table 4

Casting group	Fraction of total mass of impurities, % maximum in steel					
	Basic	Acid	Conversion	Basic	Acid	Conversion
	Sulphur			Phosphorous		
1	0.050	0.060	0.060	0.050	0.060	0.080
2	0.045	0.060	0.050	0.040	0.060	0.070
3	0.045	0.050	-	0.040	0.050	-

Note: As per the requirement of the customer, the contents of sulphur in steels of grade 15Л, 25Л, 35Л, 40Л, 45Л and 45ФЛ should not be more than 0.040%.

Table 4a

Casting group	Fraction of total mass of impurities, % maximum in steel					
	Basic	Acid	Martin bare	Basic	Acid	Martin bare
	Sulphur			Phosphorous		
1	0.040	0.060	0.050	0.040	0.060	0.050
2	0.035	0.060	0.045	0.035	0.060	0.040
3	0.030	0.050	0.045	0.030	0.050	0.040

Deviation of alloy components from the norms of chemical composition as indicated in table 2 is permissible, but should not exceed the values indicated in table 5.

Table 5

Chemical component	Fraction of total mass component %	Permissible deviation in, %	
		For minimum limit	For maximum limit
Carbon	Upto 0.12	-	+ 0.01
	Above 0.12	- 0.02	+ 0.02
Manganese	Upto 0.90	- 0.10	+ 0.10
	Above 0.90 to 8.00	- 0.12	+ 0.20
	Above 8.00	- 0.50	+ 0.50
Silicon	Upto 0.90	- 0.10	+ 0.10
	Above 0.90	- 0.10	+ 0.20
Chromium	Upto 5.00	- 0.20	+ 0.20
	Above 5.00 to 20.00	- 0.50	+ 0.50
	Above 20.00	- 1.00	+ 1.00
Nickel	Upto 1.00	- 0.10	+ 0.10
	Above 1.00 to 2.00	- 0.15	+ 0.10
	Above 2.00 to 3.00	- 0.20	+ 0.20
	Above 3.00 to 6.00	- 0.25	+ 0.20
	Above 6.00	- 0.50	+ 0.50
Molybdenum	For all contents of component	- 0.02	+ 0.02
Titanium	Upto 0.50	- 0.03	+ 0.03
	Above 0.50 to 1.0	- 0.05	+ 0.05
	Above 1.0	- 0.10	+ 0.10
Vanadium	For all contents of component	- 0.02	+ 0.03

Contd., Table 5

Chemical component	Fraction of total mass of component, %	Permissible deviation in, %	
		For minimum limit	For maximum limit
Tungsten	For all contents of component	- 0.05	+ 0.05
Niobium	For all contents of component	- 0.02	+ 0.02
Copper	For all contents of component	- 0.1	+ 0.1

Note:

1. For steel grade 85Х4М5Ф2В6Л (Р6М5Л) deviation of fraction of total mass of vanadium ± 0.1% is permissible.

2. For steel grade 90Х4М4Ф2В6Л (Р6М4Ф2Л) deviation of fraction of total mass of vanadium - minus 0.2; plus 0.1%.

2. MAIN PARAMETERS AND DIMENSIONS

2.1. Depending on the purpose and requirement of the parts, castings are divided into three groups in accordance with table 6.

Table 6

Castings group	Purpose	Characteristics of casting	List of characteristics of quality to be checked
1	Casting for general purpose	Casting for parts, configuration and dimensions which are determined only structural and terminological reasons	Appearance, dimensions, chemical composition
2	Casting of critical and special purpose	Casting for parts, meant for strength and working at static load	Appearance, dimensions, chemical composition mechanical characteristics, yield point or ultimate strength and elongation

Contd., Table 6

Castings group	Purpose	Characteristics of casting	List of characteristics of quality to be checked
3	Casting of highly critical and specific purposes	Casting for parts, meant for strength and working at cyclic and dynamic loads.	Appearances, dimensions, chemical composition mechanical properties, yield point or ultimate strength and elongation and impact strength.

Note:

1. In case of necessity for introduction of additional point, which are not indicated in table 6 for the given groups of casting, their appearance and conformity of norms should be indicated in design document (КД) and (or) in standard technical document (НТД).

As per the requirement of the user, in the number of additional checking points, the following point, may be added: Hardness, fracture of material, mechanical characteristics, for casting with wall thickness more than 100 mm, mechanical characteristics at high and low temperatures, leak proofness, microstructure, density, corrosion resistance, heat resistance, resistance against inter crystalline corrosion and others.

For casting of 3rd groups, meant for items, subject to acceptance by customer representative, working at low temperature and subject to dynamic loading, if indications in design document (КД) and (or) standard technical document (НТД) impact strength of steel is determined at temperature of minus 50^0C. Norms of impact strength during this, is indicated in design document (КД) and (or) standard technical document (НТД) for specific products.

2. The possibility of specifying relative contraction as a parameter to be controlled instead of elongation is indicated in design document (КД) and (or) standard technical document.

3. The possibility of increasing norms of strength with corresponding reduction of plasticity and strength is indicated design document (КД) and (or) in technical standard document.

4. Norms, possibility of reduction of mechanical characteristics level in samples, which are meant for casting is indicated in design document (КД).

5. For casting 2nd and 3rd groups, meant for items, which subject to acceptance by the customer representative, replacing «yield point» by point «ultimate strength» is permissible only as per the requirement of the customer representative.

Marking of casting in technical specifications of charts:
For casting 1st group:
Casting 1st groups GOST 977 – 88
For casting 2nd group:
Casting 2nd group GOST 977 – 88
For casting 3rd group:
Casting 3rd group GOST 977 – 88

2.2 Casting group, steel grade, additional checking points and requirement are indicated in design document (КД) and (or) in technical standard document (НТД) During continuous mass

production, division of casting as per groups is not carried out, List of characteristics to be checked are specified in the drawing on castings.

3. TECHNICAL REQUIREMENTS

3.1. Casting is prepared in accordance with the requirements of present standard, design document (КД) and (or) technical standard document, approved in established order.

3.2. Casting should be subject to heat treatment. Recommended conditions of heat treatment of structural non-alloy and alloy steel are given in appendix 3, alloy steel with special composition in appendix 4.

As per the agreement between manufacturer and customer, it is permissible not to carryout heat treatment of casting of 1st group from the structural non-alloy and alloy steel and casting 1st to 3rd groups from the alloy steel and steel with special characteristics while ensuring mechanical and special composition of steel of technological smelting and shaping.

The number of permissible full heat treatment of casting should not be more than three, and for casting from the austenite-ferrite alloy steels with special composition – not more than two.

Note: Number of tempering or stabilizing annealing of casting with test piece of similar group after hardening or normalizing for obtaining required mechanical characteristics is not restricted.

3.3. Mechanical characteristics of structural non-alloy and alloy steel for casting with wall thickness upto 100 mm at room temperature after finishing the heat treatment should be in accordance with the norms indicated is table 7, and for alloy steel with special properties – as per table 8.

3.4. Configuration and dimensions of castings should be in accordance with the drawing, which are approved, in the set order.

Tolerance of dimensions and weight of casting and also machining allowance should be in accordance with the requirements of GOST26645, draft angle – GOST 3212 or indicated in the design document (КД).

3.5. Casting should be dressed against the moulding mixture, scales and over heating. Riser and gate should be removed.

Place of cut of gate and riser, scabs and break through should be dressed or trimmed within the tolerance as per casting drawing.

Upon agreement between manufacturer and customer, over heating in the castings is allowed as specified in Design document and (or) standard technical documents.

Grade of steel	Strength category	Yield stress, σ_τ, M Pa	Ultimate strength, $^{\delta}{}_{\iota}$, M pa	Elongation δ, %	Reduction of area Ψ, %	Impact strength KCU k J / m^2
		Not less than				
	Normalization or normalization with tempering					
						Structural
15Л	К20	196	392	24	35	491
20Л	К20	216	412	22	35	491
25Л	К20	235	441	19	30	392
30Л	К25	255	471	17	30	343
35Л	К25	275	491	15	25	343
40Л	К30	294	520	14	25	294
45Л	К30	314	540	12	20	294
50Л	К30	334	569	11	20	245
						Structural
20ГЛ	К25	275	540	18	25	491
35ГЛ	К30	294	540	12	20	294
20ГСЛ	К30	294	540	18	30	294
30ГСЛ	К35	343	589	14	25	294
20Г1ФЛ	К30	314	510	17	25	491
20ФЛ	К30	294	491	18	35	491
30ХГСФЛ	К40	392	589	15	25	343
45ФЛ	К40	392	589	12	20	294
32Х06Л	-	-	-	-	-	-
40ХЛ	-	-	-	-	-	-
20ХМЛ	К25	245	441	18	30	294
20ХМФЛ	К25	275	491	16	35	294
20ГНМФЛ	К50	491	589	15	33	491
35ХМЛ	К40	392	589	12	20	294
30ХНМЛ	К55	540	687	12	20	294
35ХГСЛ	К35	343	589	14	25	294
35НГМЛ	-	-	-	-	-	-
20ДХЛ	К40	392	491	12	30	294
08ГДНФЛ	К35	343	441	18	30	491
13ХНДФТЛ	К40	392	491	18	30	491
12ДН2ФЛ	К55	540	638	12	20	294
12ДХН1МФЛ	К65	638	785	12	20	294
23ХГС2МФЛ						
12Х7Г3СЛ						
25Х2ГНМФЛ[1]						
25Х2ГНМФЛ[2]						
27Х5ГСМЛ						
30Х3С3ГМЛ						
03Н12Х5М3ТЛ						
03Н12Х5М3ТЮЛ						

Table 7

Strength category	Yield stress, σ_τ, M Pa	Ultimate strength, $^{\delta}_{t}$, M pa	Elongation, δ, %	Reduction of area Ψ, %	Impact strength KCU k J / m^2
	Not less than				
Hardening and tempering					
Non – alloy steel					
-	-	-	-	-	-
-	-	-	-	-	-
KT30	294	491	22	33	343
KT30	294	491	17	20	343
KT35	343	540	16	20	294
KT35	343	540	14	20	294
KT40	392	589	10	20	245
KT40	392	736	14	20	294
Alloy steel					
KT30	334	530	14	25	383
KT35	343	589	14	30	491
-	-	-	-	-	-
KT40	392	638	14	30	491
-	-	-	-	-	-
-	-	-	-	-	-
KT60	589	785	14	25	441
KT50	491	687	12	20	294
KT45	441	638	10	20	491
KT50	491	638	12	25	392
-	-	-	-	-	-
-	-	-	-	-	-
KT60	589	687	14	30	589
KT55	540	687	12	25	392
KT65	638	785	10	20	392
KT60	589	785	10	20	392
KT60	589	736	12	25	392
KT55	540	638	12	30	392
-	-	-	-	-	-
-	-	-	-	-	-
KT65	638	785	12	25	392
KT75	735	981	10	20	294
KT110	1079	1275	6	24	392
KT110	1079	1324	9	40	589
KT50	491	638	12	30	589
KT110	1079	1275	5	25	392
KT120	1177	1472	5	20	392
KT150	1472	1766	4	15	196
KT130	1275	1324	8	45	491
KT145	1422	1472	8	35	294

Grade of steel	Strength category	Yield stress, σ_τ, MPa	Ultimate strength $^{\delta}_{B}$, MPa	Elongation, δ, %	Reduction of area Ψ, %	Impact strength KCU k J / m^2
		Not less than				
	Normalizing or normalizing with tempering					
						Structural alloy steel used in
15ГЛ	К20	235	413	22	35	373
30ГЛ	К30	334	579	20	25	206
45ГЛ	К30	334	579	14	25	285
70ГЛ	-	-	785	4	-	-
55СЛ	К30	334	687	10	-	-
40Г1.5ФЛ	-	-	-	-	-	-
15ХЛ	К20	196	383	30	30	373
30ХЛ	К25	285	530	15	30	265
25ХГЛ	-	-	-	-	-	-
35ХГЛ	К30	334	628	14	25	137
50ХГЛ	-	-	687	5	-	-
60ХГЛ	-	-	785	4	-	285
70Х2ГЛ	-	-	785	4	-	-
35ХГФЛ	К40	392	638	13	-	285
40ХФЛ	К55	579	770	10	18	245
30ХМЛ	К25	285	530	18	25	304
40ХМЛ	К30	334	628	14	25	206
40ХНЛ	-	-	-	-	-	-
40ХН2Л	К35	373	638	15	25	285
30ХГ1.5МФРЛ	К65	638	981	4	5	49
75ХНМФЛ	-	-	981	3	-	-
40ГТЛ	К30	323	608	14	25	285
20ГНМЮЛ	К35	343	500	18	30	491

[1, 2] Characteristics of mechanical composition obtained during heat treatment, indicated in

3.6 Removal of seeders and heads are carried out by any method till completion of heat treatment.

Removal of seeders and heads by flame cutting should be carried out till completion of heat treatment.

Removal of seeders and heads by flame cutting after completion of heat treatment should be indicated in the design document КД and standard technical documentation НТД.

3.7 Surface defects in the shape of blowholes, seams, shrink hole, scab etc; which are exceeding in depth, machining allowance is not permissible on the relevant surface of casting to be machined.

Blowholes are permissible on the machining surfaces of casting, which do not influence the working capacity and durability of parts, dimensions and position indicated in the design document КД on casting.

Contd., of table 7

Strength category	Yield stress, σ_τ, MPa	Ultimate strength $^{\delta}_{B}$, MPa	Elongation, δ, %	Reduction of area, Ψ, %	Impact strength KCU k J / m^2
	Not less than				
Hardening and tempering					
CMEA countries – (СЭВ)					
-	-	-	-	-	-
КТ45	481	628	16	20	235
КТ30	334	628	13	20	285
-	-	-	-	-	-
КТ40	392	736	12	-	-
КТ50	520	819	8	20	285
-	-	-	-	-	-
КТ40	432	677	15	30	402
КТ30	304	579	12	20	206
КТ35	383	726	10	20	167
-	-	775	13	-	-
КТ30	338	628	13	20	285
-	-	-	-	-	-
КТ50	491	687	15	-	383
КТ90	883	1177	4	8	196
КТ30	334	677	14	25	265
КТ45	481	677	11	20	206
КТ45	481	672	12	25	383
КТ55	540	785	12	20	334
КТ95	932	1275	2	4	147
-	-	-	-	-	-
КТ40	422	726	10	20	334
-	-	-	-	-	-

table 11.

3.8 . On the non-machining surfaces of casting, the blowholes, which cannot be rectified, and other defects, except cracks, appearance, dimensions, quantity and position of which is indicated in the design document КД.

3.9 It is permissible to rectify the defects on casting, deterioration the strength and working capacity of casting, if they are specified in the design document КД.

3.10. During rectification of defects by welding, they should be conducted before final heat treatment if there are no other instruction in the design document КД and standard technical document НТД.

It is permissible to rectify the welding defects, which are detected after completion of heat treatment or mechanical finish, as well as the necessity and type of heat treatment of casting as indicated in the design document КД and standard technical document НТД.

Table 8

Class of steel	Steel grade	Yield stress, σ_τ, MPa	Ultimate strength $^{\delta}_{B}$, MPa	Elongation, δ, %	Reduction of area, Ψ, %	Impact strength KCU k J / m^2
		Not less than				
Alloy steel with special component						
Martensite	20Х5МЛ	392	589	16	30	392
	20Х8ВЛ	392	589	16	30	392
	20Х13Л	441	589	16	40	392
	08Х14НДЛ	510	648	15	40	590
	09Х16Н4БЛ[1]	785	932	10	-	392
	09Х16Н4БЛ[2]	883	1128	8	-	245
	09Х17Н3СЛ[1]	736	981	8	15	196
	09Х17Н3СЛ[2]	736	932	8	20	245
	09Х17Н3СЛ[3]	638	834	6	10	-
	40Х9С2Л	Not standard				
	10Х12НДЛ	441	638	14	30	294
	20Х12ВНМФЛ	491	589	15	30	294
Martensite – Ferrite	15Х13Л	392	540	16	45	491
Ferrite	15Х25ТЛ	275	441	-	-	-
Austenite – Ferrite	08Х15Н4ДМЛ	589	736	17	45	981
	08Х14Н7МЛ	687	981	10	25	294
	14Х18Н4Г4Л	245	441	25	35	981
Austenite - Martensite	12Х25Н5ТМФЛ	392	540	12	40	294
	35Х23Н7СЛ	245	540	12	-	-
	40Х24Н12СЛ	245	491	20	28	-
	20Х20Н14С2Л	245	491	20	25	-
	16Х18Н12С4ТЮЛ	245	491	15	30	275
	10Х18Н3Г3Д2Л	491	687	12	25	294
Austenite	10Х18Н9Л	177	441	25	35	981
	12Х18Н9ТЛ	196	441	25	32	590
	10Х18Н11БЛ	196	441	25	35	590
	07Х17Н16ТЛ	196	441	40	55	392
	12Х18Н12М3ТЛ	216	441	25	30	590
	55Х18Г14С2ТЛ	-	638	6	-	147
	15Х23Н18Л	294	540	25	30	981
	20Х25Н19С2Л	245	491	25	28	-
	18Х25Н19СЛ	245	491	25	28	-
	45Х17Г13Н3ЮЛ	-	491	10	18	981
	15Х18Н22В6М2РЛ	196	491	5	-	-
	08Х17Н34В5Т3Ю2РЛ	687	785	3	3	-
	20Х21Н46В8РЛ	-	441	6	8	294

Contd of table 8

Class of steel	Steel grade	Yield stress, $\sigma_т$, MPa	Ultimate strength $\delta_в$, MPa	Elongation, δ, %	Reduction of area, Ψ, %	Impact strength KCU k J / m^2
		Not less than				
Austenite class	35Х18Н24С2Л	294	549	20	25	-
	31Х19Н9МВБТЛ	294	540	12	-	294
	12Х18Н12БЛ	196	392	13	18	196
	110Г13Х2БРЛ	491	-	22	30	1962
	130Г14ХМФАЛ	441	883	50	40	2453
Marten-site	85Х4М5Ф2В6Л (Р6М5Л)	Not regulated				
	90Х4М4Ф2В6Л (Р6М4Ф2Л)	Not regulated				
Alloy steel with special components, used in CMEA countries						
Martensite-Ferrite	15Х14НЛ[1]	289	481	15	50	294
	15Х14НЛ[2]	383	579	15	50	441
	08Х12Н4ГСМЛ	549	736	15	35	540
Austenite – Ferrite	12Х21Н5Г2СЛ	343	549	22	20	590
	12Х21Н5Г2СТЛ	343	549	12	10	196
	12Х21Н5Г2СМ2Л	343	549	22	20	590
	12Х19Н7Г2САЛ	240	481	20	30	590
	12Х21Н5Г2САЛ	334	657	18	20	245
	07Х18Н10Г2С2М2Л	177	432	30	35	441
	15Х18Н10Г2С2М2Л	216	432	30	35	785
	15Х18Н10Г2С2М2ТЛ	196	432	20	-	-

[1, 2, 3] Characteristics of mechanical properties obtained during heat treatment condition are indicated in table 12.

Note: Mechanical properties of steel grade 110Г13Л, 110Г13ФТЛ and 120Г10ФЛ is set as per the agreement of manufacturer and customer.

3.11. Permissibility of unevenness as blowhole, porosity etc and also their dimension, quantity and position is indicated in the design document (КД) and standard technical documentation (НТД).

3.12. It is permissible to straighten (rectification of warpage) the casting in cold and hot condition, dimensions of straightening, necessary for tempering for releasing of stress after straightening is indicated in design document (КД) and standard technical documentation (НТД).

3.13. It is necessary to check the de-carbonized metallic layer of casting and its depth as indicated in design document (КД) and technical documentation and (НТД).

Complete removal of de-carbonized layer should be ensured on the machining of friction surfaces of casting and in places of checking hardness for machining allowances.

3.12. Norms of additional parameters to be checked are given in design document (КД) and (or) standard technical document НТД.

3.13. Casting should have stamp of QAD of manufacturer on the unfinished surface and marking in accordance with the requirements of design document and technical standard document (КД and НТД). Marking signs may be with moulding, printed or stamped with indelible paint.

If it is not possible to mark and stamp due to configuration and dimensions, batches of casting should have a tag with marking and QAD stamp indicating the quantity of casting in a batch. During continuous mass production of castings, the markings and stamp should be in accordance with the instructions of the design document and КД (or) technical standard document НТД.

4. ACCEPTENCE

4.1. Casting is accepted in batches. The batch consists of one heat of casting. As per the agreement of manufacturer, with customer, it is permissible to mix castings steel of similar grade with same or heat of different smelt, having passed heat treatment in same or several changes in similar conditions with necessary recording of conditions with automatic devices.

The batch of castings, which are not heat treated in manufacturing plant, make up as a set of castings of same heat.

For the casting, designed for the unit, which is subject to the acceptance of the customer, the batch of castings should pass the heat – treatment.

During mass production as per the agreement of the manufacturer and customer, it is permissible to comprise batches of casting steel of similar grade with different heat, manufactured as per same drawing, melted in one stock and having pass heat treatment at one stage. During this it is permissible to indicate the batch number in document regarding the quality together with heat number.

During small batch of production, as per the agreement of manufacturer and customer, it is permissible to comprise batches from castings of steel of similar grade with several heats; it is permissible to comprise batches from steel casting of similar grade with different heats of smelting as per the agreement between the manufacturer and user.

It is permissible to comprise batch of casting of 1^{st} and 2^{nd} groups near to configuration and dimension, manufactured from different drawings from steel of

similar heat, having passed heat – treatment in similar charge (heat).

4.2. Acceptance of remaining castings from batches and also castings rectified by welding with heat treatment, should be done as per the test results of main batch, if the condition of heat treatment in both the cases are similar and be approved by statement of automatic devices or as per the results of tests of other batches of same grade, heat treated simultaneously with the remaining castings.

4.3. Batches of casting should be accompanied by document on quality certifying, and indicating the following details:

Trademark of manufacturing plant;
Drawing No. or casting No.
conventional designation of casting;
Quantity and casting weight;
Batch no.;
Heat No.;
Steel grade;
Chemical analysis results;
Class of heat treatment;
Mechanical testing results;
Additional test results;
Present standard No.

4.4. Selection of sample is carried out as per GOST 7565 (section 2) for checking according to chemical composition of steel casting with requirements indicated in table 1 and 2.

Checking of chemical composition of steel casting is carried out on each heat is permissible.

It is permissible to check for chemical composition of structural non-alloy and alloy steel from same heat with set technological process, continue charge and melting of steel of similar grade in furnace having capacity of not more than 3 tonnes for casting of 1^{st} group, capacity of not more than 500 kg – for casting of 2^{nd} and 3^{rd} groups.

During mass production, the extent of checking of chemical composition is set as per design document (КД) and (or) technical standard document (НТД).

4.5. For checking the casting in accordance with the present GOST, acceptance, periodical and type tests are to be carried out. Type and scope of testing is indicated in design document (КД) and (or) technical standard document.

For checking the parameters in accordance with the mechanical composition of casting, the requirements of present standard for each batch of casting, specimen in number, as indicated in design document (КД) and (or) technical standard document are to be cast.

Sample from similar or different castings are permissible to cast as per instructions in design document (КД) and (or) technical standard document (НТД).

As per the agreement between manufacturer and customer, it is permissible to carryout the checking of mechanical properties of steel in casting, which are selected from each batch in accordance with design document (КД) and (or) standard technical document (НТД).

Checking the mechanical properties of steel of casting in accordance with the requirements of present standard category of strength is to be carried out by the manufacturer for each batch of casting 2nd and 3rd group.

It is permissible to carryout analysis of mechanical component, characteristics of non-alloy structural steel with mathematical statistics methods in accordance with design document КД and standard technical document НТД on casting and in accordance with the agreement of customer representative, who uses this product.

During mass production checking of mechanical properties of steel is carried out periodically as per design document КД and standard technical document НТД.

4.6. Mechanical properties of cast steel are checked on one sample during tensile strength test and on two samples during impact bend testing.

4.7. When unsatisfactory results are obtained during testing even for a sample for one of the characteristics of mechanical properties, carryout repeat testing in double quantity with samples, taken from specimens or castings of the same batch and heat or casting and specimens are subjected to repeat heat treatment and conduct test for all mechanical properties.

4.8. Conformity of inner shape of casting with drawing and requirements as per para 3.5, 3.7 - 3.9 is checked for each batch of castings.

4.9. The dimensions of casting, which are subjected to check, and also type of check and volume of selection is laid down in design document and КД (or) technical standard document (НТД) on casting.

4.10. Volume, period and checking methods of cast metal in accordance with para 3.11 (magnetic and capillary flow detector, illuminated with X – ray or gamma – rays and others) is laid down in design document КД and technical standard document НТД.

4.11. Volume and periodical testing of additional control characteristics are indicated in design document КД and (or) technical standard document НТД.

5. TESTING METHODS

5.1. Chemical composition check is carried out as per GOST 12344, GOST 12345, GOST 12346, GOST 12347, GOST 12348, GOST 12349, GOST 12350, GOST 12351, GOST 12352, GOST 12354, GOST 12355, GOST 12356, GOST 12357, GOST 12359, GOST 12360, GOST 12361, GOST 20560, GOST 22536.0…

GOST 22536.5, GOST 22536.7…GOST 22536.14 or by other methods, ensuring accuracy as per the given standards.

5.2. Samples for determining chemical composition of cast steel is selected in accordance with GOST 7565.

While melting the steel in furnaces having capacity of not more than 500 kg, it is permissible to select samples for determining chemical composition in the middle of heat and to use samples with weight of 200 g and more.

While pouring one casting, selection of samples from heat is done after casting the mould/die.

It is permissible to use metal, taken from the test piece for mechanical testing or from the casting for determining mechanical composition.

The samples are marked with cast number.

5.3. Determination of mechanical properties of cast metal is carried out on samples, which are taken from the test pieces, or during absence of test pieces, from the castings.

Test piece is recommended to cast in the middle of pouring of each smelting.

NOTE:The samples are manufactured as per the requirement of customer.

5.4. Recommended configurations, dimensions of test pieces and diagram of cut samples are indicated in drawings 1 to 6.

For the casting, designed for units, which are subject to the acceptance by customer, test pieces as per drawings 2, 4, 5 is not manufactured.

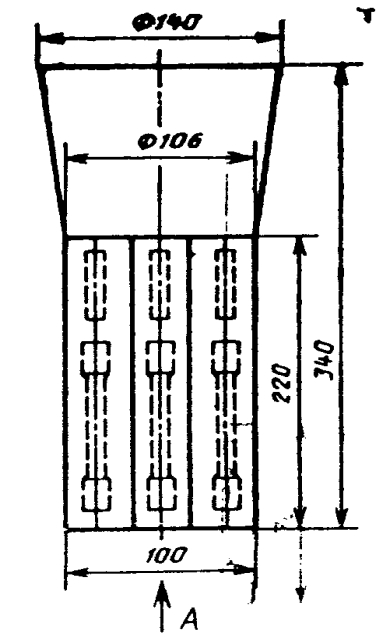
The position of samples for testing stress and determination of impact strength in test pieces are not regulated and in drawings, they are indicated conditionally.

The type of test piece is determined by the manufacturing plant.

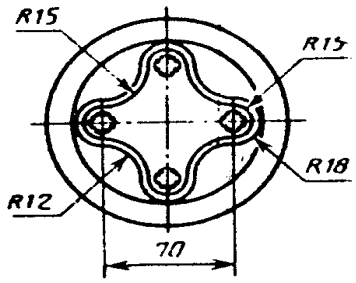
While manufacturing casts, which are required individual checking of mechanical properties, it is permissible to use test pieces, dimensions, it is permissible to use test pieces, dimensions and positions to use test pieces, dimensions and positions place which are indicated in design document and (or) standard technical document (КД and НТД) the place of positioning test pieces on casting, designed for the item, is subjected to acceptance by user, is set by the manufacturing plant. Separation of test pieces from castings may be carried out after completion of heat treatment.

The specifications for manufacturing test pieces and casting should be similar. Test pieces or cut out from their manufacturing for determines: mechanical properties should undergo heat treatment, together with casting of the given batch.

It is permissible to cast test pieces in sand die casting (dry or raw) irrespective of the method of casting.



View A



Drawing 1

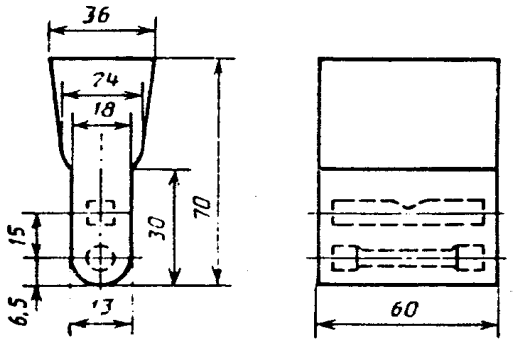
For thick-walled casting, it is permissible to cut out samples at a distance of not more than 30 mm from the inner surface of casting.

5.5. Testing for stress is carried out as per GOST 1497 on samples type I – IV No.4.

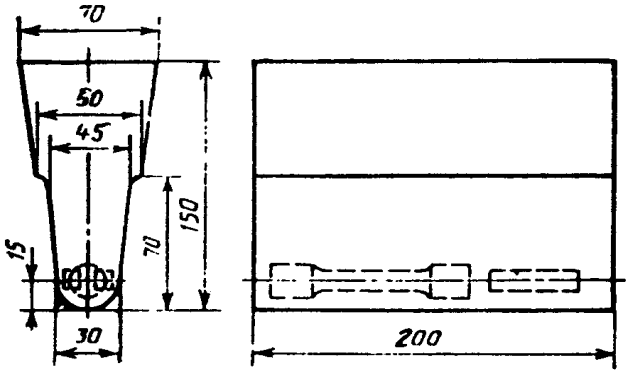
It is permissible to carryout testing on samples of type II – IV No.7.

5.6. Determination of impact strength is carried out as per GOST 9454 or samples type 1.

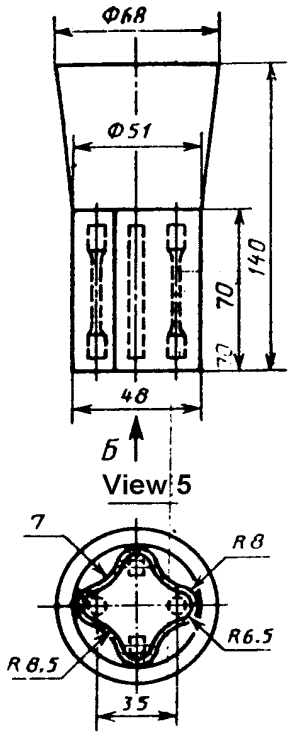
5.7. Test results of samples, having defects, connected with the conditions of their casting (pits, foreign matter (impurity), heated cracks and porosity etc). Mechanical finish condition and testing condition, are not be taken into consideration. The defective samples are to be replaced with new samples, taken out from the pieces or casting.



Drawing 2



Drawing 3



Drawing 4

5.8. Determination of hardness – Brinell test as per GOST 9012, determination of Rock well hardness GOST 9013.

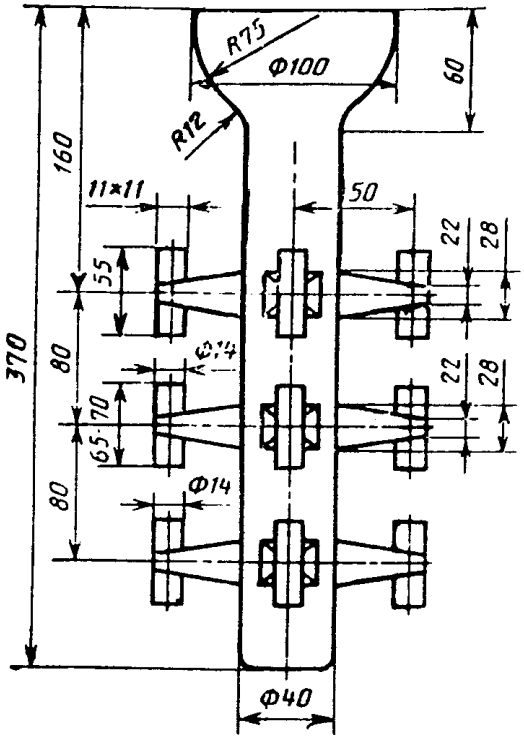
5.9. Checking the inner shape of casting is carried out as per design document and (or) standard technical document.

5.10. Determination of depth of de-carbonized layer as per GOST 1763.

5.11. Determination of heat tolerance as per GOST 6130.

5.12. Testing for resistance against inter-crystalline corrosion – as per GOST 6032.

NOTE:Methods of testing of steel, not included in GOST 6032, is indicated in design document (КД) and (or) standard technical document НТД.



Drawing 5

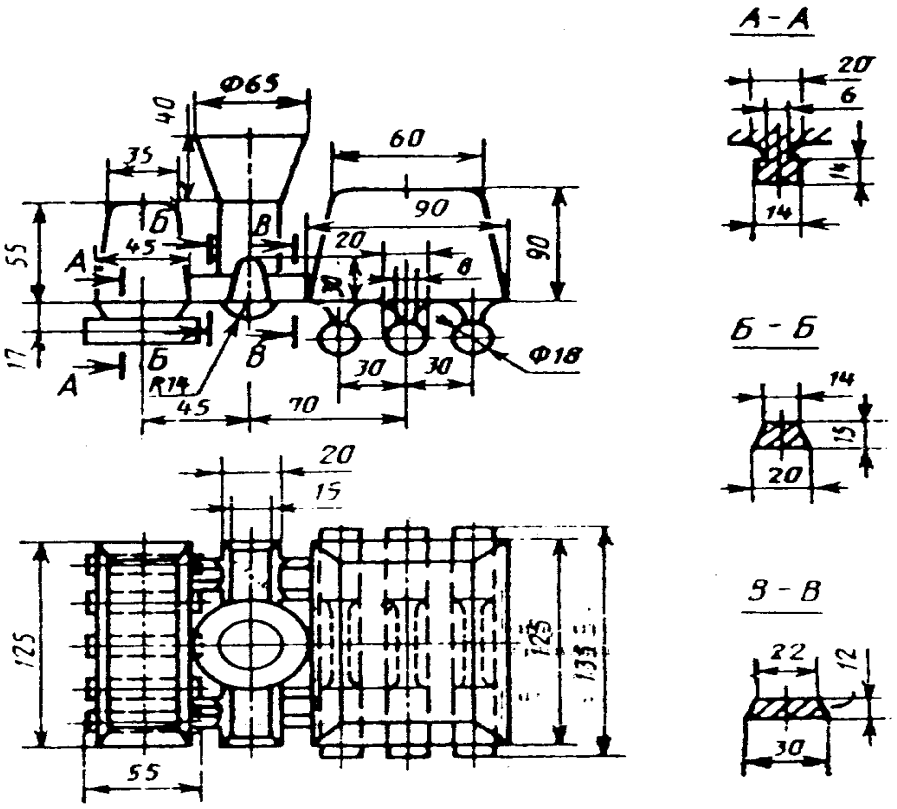
5.13. Testing for stress during increase of temperature is carried out as per GOST 9651, during decrease of temperature – as per GOST 11150.

5.14. Testing of (stress) rupture test – as per GOST 10145.

5.15. Methods of special properties test, which is not mentioned in this standard, should be indicated in the design document (КД) and (or) standard technical document (НТД).

6. PACKING, TRANSPORTATION AND STORAGE

6.1. The rules for packing, transportation and storage of castings are given in design document (КД) and (or) standard technical document (НТД) on casting.


А - А
Б - Б
В - В
Ф65
Ф18
R14
40
35
60
90
55
45
20
8
17
30
70
15
125
135
22
12
6
14

Drawing 6

APPENDIX I
Reference

AREA FOR USE OF STRUCTURAL ALLOY STEEL

Table 9

Steel grade	Area for use
20ГЛ	Discs, sprockets, crown gear, drums and other parts, to which requirements for strength and viscosity is present, working under the influence of static and dynamic loads.
35ГЛ	Discs, sprockets, crown gear, drums, pulley and other. Heavily loaded parts of excavators, bearing covers, and pins.
20ГСЛ	Hydro-turbine body parts, working during temperature upto 450^0 C.
30ГСЛ	Gear wheel, rollers, bands, crown gears, levers, flanges, pulley, segments, columns, running wheel and other parts.
20Г1ФЛ	Frames, arms, body and other parts of wagons.
20ФЛ	Casting parts of wagons, metallurgical and mining equipment
30ХГСФЛ	Casting parts of excavators
45ФЛ	Wear resistance casting parts for tractors and metallurgical equipment
32Х06Л	Brackets, balances, rollers, other important parts with wall of thickness upto 50 mm and general weight of parts upto 80 kg.
40ХЛ	Parts, which require increased strength, and also working in wear and tear.
20ХМЛ	Pinions, cross pieces, bushes, gear wheels, cylinder, bands, and other body parts, which are required to work during temperature upto 500^0C.
20ХМФЛ	Mounting parts, body parts, cylinders, working during temperature upto 540^0C.
20ГНМФЛ	Welded structure of high size, belt of cement furnaces.
35ХМЛ	Pinions cross pieces, bushes, gearwheels, furnace parts, and other important parts to which requirement of high strength and viscosity is present, working under the influence of static and dynamic loads.
30ХНМЛ	Important loading parts, to which the requirement of high strength and viscosity is present under the influence of static and dynamic load. During temperature 400^0C.
35ХГСЛ	Gearwheel, sprockets, axles, shafts, coupling and other connected parts; from which increase in wear resistance is essential.

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
03Н12Х5М3ТЮЛ	-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	20Х13Л	To some extent less corrosion in atmospheric conditions as compared with steel grade 15Х13Л	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.
	08Х14НДЛ	Corrosion resistance in sea water and atmospheric conditions corrosion resistance is higher than steel grades 15Х13Л and 20Х13Л	Parts operating in sea water (propeller and others)
	09Х16Н4БЛ	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	09Х17Н3СЛ	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)
	20Х5МЛ	Heat tolerance in hot petroleum fluids, containing sulphur compound. Heat tolerance up to 600^0 С.	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 С.
	20Х8ВЛ	Heat tolerance in more aggressive sulphur compound as compound with steel grade 20Х5МЛ. Heat tolerance up to 600^0 С.	Those parts, operating in conditions of powerful sulfur petroleum fluids under pressure during temperature up to 575^0 С.
	40Х9С2Л	Heat tolerance during temperature up to 800^0 С. Heat resistance up to 700^0 С.	Parts, which are working for a long period under load during temperature upto 700^0 С (motor valves, grate bar, and fastening parts)
	10Х12НДЛ	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.
	20Х12ВНМФЛ	Corrosion – resistance steel heat tolerance up to 650^0 С.	Casting parts of turbine (cylinders, nozzles, diaphragms and fitting) with working temperature upto 600^0 С.

Contd.of Table 10

Grade of steel	Steel grade	Main characteristics	Branches of application
Martensite – Ferrite	15Х13Л	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	15Х25ТЛ	Rust proof, heat tolerance during temperature up to 1100^0C. possess satisfactory resistance for inter crystalline corrosion	Parts, are not subject to the influence of direct and indirect load (equipment for fussing 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	08Х15Н4ДМЛ	Rust proof in seawater and atmospheric conditions. As compared with steel 08Х14НДЛ, it is less sensitive to stress concentrates.	Parts, working in sea water (heavy load propeller ice breaker and others)
	08Х14Н7МЛ	Rust proof.	Parts, which are working at room and low temperature (upto minus 196^0 C).
	14Х18Н4Г4Л	Rust proof. Possess inclination to inter crystalline corrosion more than steel grade 10Х18Н9Л.	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	12Х25Н5ТМФЛ	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)
	16Х18Н12С4ТЮЛ	Rust – proof.	Welded unit, working in aggressive atmosphere, in particular for concentration of nitric acid during temperature of 105^0C.
	35Х23Н7СЛ	Rust - proof in sulphurous atmosphere, heat resistance during temperature up to 1000^0C.	Parts of tube steel of oil plants and other parts, working during temperature up to 1000^0C. Recommended to replace steel grade 40Х24Н12СЛ.
	40Х24Н12СЛ	Rust - proof heat tolerance during temperature upto 1000^0C, heat resistance.	Parts, working in high, temperature and presence (compressing blades and guide vane, furnace conveyor, screw conveyor, fastening parts and other)
	20Х20Н14С2Л	Steel, heat tolerance upto 1000 - 1050°C, having resistance in carbonized atmosphere	Furnace conveyor, screw conveyor for segmentation and other parts, working at high temperatures in load condition.
	10Х18Н3Г3Д2Л	Cavitation resistant, having high erosion resistance compared with steel grade 10Х12НДЛ	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	10Х18Н9Л	Rust proof, heat tolerance up to 750°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°C.

Contd., Table 10

Grade of steel	Steel grade	Main characteristics	Branches of application
Austenite	12Х18Н9ТЛ	Rust – proof. Heat tolerance upto 750°C, heat resistance during temperature upto 600^0C. 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.
	10Х18Н11БЛ	Rust proof. Heat resistance upto 800^0C. 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.
	07Х17Н16ТЛ	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.
	12Х18Н12М3ТЛ	Rust proof, heat resistant, not subjected to inter crystalline corrosion during temperature upto 800^0 C.	Parts resistant, to phosphorous, formic, acetic and other acids, and also part, working for long periods under load during temperature upto 800^0 C.
	55Х18Г14С2ТЛ	Rust proof steel, heat tolerance up to temperature of 950^0C, it is not resistant in sulfurous atmosphere.	Those parts, which are manufactured from steel grade 40Х24Н12СЛ
	15Х23Н18Л	Heat resistance upto 900^0C. During temperature of 600 – 800 ^{0}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	20Х25Н19С2Л	Rust proof, heat resistant upto temperature 1100^0 C.	Converts for annealing, furnace, parts and boxes for case hardening.
	18Х25Н19СЛ	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.
	45Х17Г13Н3ЮЛ	Rust – proof, corrosion proof in sulphurous atmosphere. Heat tolerance during temperature upto 900^0C, 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 40Х24Н12СЛ
	35Х18Н24С2Л	Rust – proof. Heat resistance upto 1100 – 1200^0C temperature, heat tolerance. Heat resistance steel	Parts working during high temperature in highly load condition (furnace conveyors, worm conveyors, fastening parts)
	31Х19Н9МВБТЛ	Heat resistance steel	Working wheel of turbines, turbo compressors, turbine and adjusting apparatus
	12Х18Н12БЛ	Rust – proof, heat resistance up to 650^0 C	Cast parts of power plant with prolonged jobs during 600 – 650^0C and restricted up to 700^0C.
	08Х17Н34В5Т3Ю2РЛ	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.
	15Х18Н22В6М2РЛ	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)
	20Х21Н46В8РЛ	Heat resistance during temperature up to 1000^0C. 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	85Х4М5Ф2В6Л (Р6М5Л)	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 1st group).
	90Х4М4Ф2В6Л (Р6М4Ф2Л)	High wear resistant, heat proof.	- do –
Alloy with special characteristics, used in contract Between CMEA countries			
Martensite – Ferrite	15Х14НЛ	Rust proof in water, moisture, diluted nitric acid and poor organic acids; high resistance against cavitation.	Used under contract obligations
	08Х12Н4ГСМЛ	Rust proof in water, moisture diluted nitric acid and organic acids	Used under contract obligations
Austenite – Ferrite	12Х21Н5Г2СЛ	Rust – proof in water, in nitric acid, diluted sulphuric acid and mild or diluted organic acids	Used under contract obligations
	12Х21Н5Г2СТЛ	Rust proof in air, in nitric acid, diluted sulphuric acid and mild or diluted organic acids, highly resistant against inter crystalline corrosion than steel 10Х18Н9Л	Used under contract obligations

Contd.,

Grade of steel	Steel grade	Main characteristics	Branches of application
Austenite – Ferrite	12Х21Н5Г2СМ2ЛI	Rust proof in series of non-organic and organic acids	Used under contract obligations
	12Х19Н7Г2САЛI	Rust proof in air, in nitric acid, diluted sulfuric acid and mild or diluted organic acids	-do –
	12Х21Н5Г2САЛI	Rust proof in air, in nitric acid, very diluted sulfuric acid and mild or diluted organic acids	-do –
	07Х18Н10Г2С 2М2ЛI	Rust proof in series of non-organic and organic acids, more resistant against inter crystalline corrosion than steel grade 15Х18Н10Г2С2М2ЛI	-do –
	15Х18Н10Г2С 2М2ЛI	Rust proof in series of non-organic and organic acids	- do-
	15Х18Н10Г2С 2М2ТЛI	Rust proof in series of non-organic and organic acids, more resistant against inter crystalline corrosion than steel grade 15Х18Н10Г2С2М2ЛI	-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
23ХГС2МФЛ	Preliminary treatment		Final treatment	
	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			
12Х7Г3СЛ	Preliminary treatment		Final treatment	
	940 - 960	650 - 720	880 - 900	200 - 250
25Х2ГНМФЛ[1]	Preliminary treatment		Final treatment	
	900 - 950	650 - 700	880 - 920	630 - 700
25Х2ГНМФЛ[2]	Preliminary treatment		Final treatment	
	900 - 950	660 - 680	900 - 950	260 - 300
27Х5ГСМЛ	Preliminary treatment		Final treatment	
	970 - 990	700 - 720	980 - 1000	200 - 220
30Х3С3ГМЛ	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:

1. For steel grade 40ХФЛ it is permitted to temper after normalizing.
2. For steel grade 23ХГС2МФЛ the indicated conditions of preliminary heat treatment may be replaced by hardening with tempering, annealing or tempering.
3. For steel grades 03Н12Х5М3ТЛ and 03Н12Х5М3ТЮЛ, it is recommended to apply heat treatment as per conditions: Homogenization at temperature of 1180 – 1200^0 C; hardening with 1000 ^{0}C; age hardening at temperature 500 ^{0}C.

APPENDIX 4
Recommended

HEAT TREATMENT CONDITIONS OF ALLOY STEEL WITH SPECIAL CHARACTERISTICS

Table 12

Grade of steel	Grade	Recommended heat treatment mode
Martensite	20Х5МЛ	Annealing at temperature 940 – 960°C, normalizing 940 – 960°C, cooling in air; tempering at 680 – 720°C, cooling in air.
	20Х8ВЛ	- do –
	20Х13Л	Annealing at 940 – 960 ^{0}C; hardening at 1040 – 1060°C, cooling in oil or in air; tempering 740 – 760°C, cooling in air.
	08Х14НДЛ	Hardening 1000 – 1200°C, cooling in air; tempering 660 – 700°C, cooling in air.
	09Х16Н4БЛ[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.
	09Х16Н4БЛ[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.
	09Х17Н3СЛ[1]	Annealing at 660 – 670°C; hardening 1040 – 1060°C cooling in oil; Tempering 300 – 350°C, cooling in air.
	09Х17Н3СЛ[2]	Hardening at 1040 – 1060°C, cooling in oil; tempering at 540 – 560°C cooling in air.
	09Х17Н3СЛ[3]	Tempering at 670 – 690°C, cooling in air.
	40Х9С2Л	Without heat treatment
	10Х12НДЛ	Normalizing 940 – 960°C, cooling in air or hardening at 950 – 1050°C temperature, cooling at the rate of 30 ^{0}C / per hour; tempering 650 – 680°C.
	20Х12ВНМФЛ	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	20Х12ВНМФЛ	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	15Х13Л	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	15Х25ТЛ	Without heat treatment
Austenite – martensite	08Х15Н4Д4Л	Hardening at 1030 – 1050°C, cooling in air. Tempering at 600 – 620°C , with cooling in air.
	08Х14Н17МЛ	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.
	14Х18Н4Г4Л	Hardening at 1020 – 1070°C, cooling in water
Austenite – Ferrite	12Х25Н5ТМФЛ	Hardening at 1140 – 1160°C with cooling in furnace up to 970 – 990°C and further in oil.
	35Х23Н7СЛ	Without heat treatment
	40Х21Н12СЛ	Hardening at 1040 – 1060°C, cooling in water, oil or air.
	20Х20Н14С2Л	Normalizing at 1100 – 1150°C cooling in air.
	16Х18Н12С4ТЮЛ	Hardening at 1150 – 1200°C cooling in air
	10Х18Н3Г3Д2Л	Normalizing 1070 – 1100°C, cooling in air, tempering (1^{st} time) 790 – 810°C, cooling upto 20^0C, tempering (2^{nd} time) during 590 – 610°C
Austenite	10Х18Н9Л	Hardening at 1050 – 1100°C, cooling in water, oil or in air.
	07Х17Н16ТЛ	Hardening at 1050 – 1100°C, cooling in water
	12Х18Н9ТЛ	Hardening at 1050 – 1100°C, cooling in water, oil or air.

Appendix to table 12

Grade of steel	Grade	Recommended heat treatment mode
Austenite	10Х18Н11БЛ	Hardening at 1100 – 1150°С, cooling in water
	12Х18Н12М3ТЛ	Hardening at 1100 – 1150°С, cooling in water
	55Х18Г14С2ТЛ	Without heat treatment
	15Х23Н18Л	Hardening at 1050 – 1100°С, cooling in water
	20Х25Н19С2Л	Hardening at 1090 – 1110°С, cooling in water
	18Х25Н19СЛ	Hardening at 1090 – 1110°С, cooling in water oil or in air
	45Х17Г13Н3ЮЛ	Without heat treatment
	15Х18Н22В6М2РЛ	Ageing at 790 – 810°С, for 12 – 16 hours cooling in air.
	08Х17Н34В5Т3Ю2РЛ	Hardening at 1140 – 1160°С, cooling in water age hardening 740 – 760°С, 32 hours
	20Х21Н46В8РЛ	Ageing at 890 – 910°С, for 5 hours cooling in air.
	35Х18Н24С2Л	Hardening at 1140 – 1160°С, cooling in water
	31Х19Н9МВБТЛ	Hardening at 1150 – 1180°С, cooling in water, age hardening 700 – 800°С
	12Х18Н12БЛ	Hardening at 1170 – 1190°С, cooling in air; double age hardening 790 – 810°С, 10 hours and 740 – 760°С, 16 hours
	110Г13Х2БРЛ	Hardening at 1050 – 1100°С, cooling in water
	110Г13ФТЛ	Hardening at 1050 – 1100°С, cooling in water
	130Г14ХМФАЛ	Hardening at 1120 – 1150°С, cooling in water
	120Г10ФЛ	Hardening at 1050 – 1100°С, cooling in water
	110Г13Л	Hardening at 1050 – 1100°С, cooling in water
Martensite	85Х4М5Ф2b6Л (Р6М5Л)	Annealing at 860 – 880°С, hold it at same mode then cooling at furnace upto 740 – 760°С, hold it at same mode, cooling in furnace upto 500°С, cooling in air.
	90Х4М4Ф2В6Л (Р6М4Ф2Л)	Annealing at temperature 860 – 880°С, hold it at same mode, cooling at furnace up to 740 – 760°С, hold it at same mode, cooling at furnace upto 500°С, 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	15Х14НЛ[1]	Normalizing temperature 930 – 950°C, cooling in air, tempering 680 – 740°C, cooling in furnace or in air.
	15Х14НЛ[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
	08Х12Н4ГСМЛ	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	12Х21Н5Г2СЛ	Hardening at 1050 – 1100°C, cooling in water or in air
	12Х21Н5Г2СТЛ	Hardening at 1050 – 1100°C, cooling in water or in air
	12Х21Н5Г2СМ2Л	Hardening at 1050 – 1100°C, cooling in water or in air
	12Х19Н7Г2САЛ	Hardening at 1050 – 1100°C, cooling in water or in air
	12Х21Н5Г2САЛ	Hardening at 1050 – 1100°C, cooling in water or in air
	07Х18Н10Г2С2М2Л	Hardening at 1050 – 1100°C, cooling in water or in air
	15Х18Н10Г2С2М2Л	Hardening at 1050 – 1100°C, cooling in water or in air
	15Х18Н10Г2С2М2ТЛ	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
GOST12346 – 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 СЭВ 4559-84	Introductory part
GOST 12350 – 78	5.1			
GOST 12351 – 81	5.1		CT СЭВ 4561-84	Introductory part
GOST 12352 – 81	5.1			
GOST 12354 – 81	5.1		CT СЭВ 4563-84	Introductory part
GOST 12355 – 78	5.1			
GOST 12356 – 81	5.1			