

Grade of steel	Strength category	Yield stress, σ_{τ} , MPa	Ultimate strength δ_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	K20	235	413	22	35	373
30ГЛ	K30	334	579	20	25	206
45ГЛ	K30	334	579	14	25	285
70ГЛ	-	-	785	4	-	-
55СЛ	K30	334	687	10	-	-
40Г1.5ФЛ	-	-	-	-	-	-
15ХЛ	K20	196	383	30	30	373
30ХЛ	K25	285	530	15	30	265
25ХГЛ	-	-	-	-	-	-
35ХГЛ	K30	334	628	14	25	137
50ХГЛ	-	-	687	5	-	-
60ХГЛ	-	-	785	4	-	285
70Х2ГЛ	-	-	785	4	-	-
35ХГФЛ	K40	392	638	13	-	285
40ХФЛ	K55	579	770	10	18	245
30ХМЛ	K25	285	530	18	25	304
40ХМЛ	K30	334	628	14	25	206
40ХНЛ	-	-	-	-	-	-
40ХН2Л	K35	373	638	15	25	285
30ХГ1.5МФРЛ	K65	638	981	4	5	49
75ХНМФЛ	-	-	981	3	-	-
40ГТЛ	K30	323	608	14	25	285
20ГНМЮЛ	K35	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_T , MPa	Ultimate strength δ_B , MPa	Elongation, δ , %	Reduction of area, Ψ , %	Impact strength KCU kJ / m ²
Not less than					
Hardening and tempering					
CMEA countries – (CЭB)					
-	-	-	-	-	-
KT45	481	628	16	20	235
KT30	334	628	13	20	285
-	-	-	-	-	-
KT40	392	736	12	-	-
KT50	520	819	8	20	285
-	-	-	-	-	-
KT40	432	677	15	30	402
KT30	304	579	12	20	206
KT35	383	726	10	20	167
-	-	775	13	-	-
KT30	338	628	13	20	285
-	-	-	-	-	-
KT50	491	687	15	-	383
KT90	883	1177	4	8	196
KT30	334	677	14	25	265
KT45	481	677	11	20	206
KT45	481	672	12	25	383
KT55	540	785	12	20	334
KT95	932	1275	2	4	147
-	-	-	-	-	-
KT40	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_s , MPa	Ultimate strength δ_B , MPa	Elongation, δ , %	Reduction of area, Ψ , %	Impact strength KCU k J / m ²
		Not less than				
Alloy steel with special component						
Martensite	20X5MЛ	392	589	16	30	392
	20X8BЛ	392	589	16	30	392
	20X13Л	441	589	16	40	392
	08X14HДЛ	510	648	15	40	590
	09X16H4БЛ ¹	785	932	10	-	392
	09X16H4БЛ ²	883	1128	8	-	245
	09X17H3CЛ ¹	736	981	8	15	196
	09X17H3CЛ ²	736	932	8	20	245
	09X17H3CЛ ³	638	834	6	10	-
	40X9C2Л	Not standard				
	10X12HДЛ	441	638	14	30	294
20X12BHМФЛ	491	589	15	30	294	
Martensite – Ferrite	15X13Л	392	540	16	45	491
Ferrite	15X25ТЛ	275	441	-	-	-
Austenite – Ferrite	08X15H4ДМЛ	589	736	17	45	981
	08X14H7МЛ	687	981	10	25	294
	14X18H4Г4Л	245	441	25	35	981
Austenite – Martensite	12X25H5ТМФЛ	392	540	12	40	294
	35X23H7CЛ	245	540	12	-	-
	40X24H12CЛ	245	491	20	28	-
	20X20H14C2Л	245	491	20	25	-
	16X18H12C4ТЮЛ	245	491	15	30	275
	10X18H3Г3Д2Л	491	687	12	25	294
Austenite	10X18H9Л	177	441	25	35	981
	12X18H9ТЛ	196	441	25	32	590
	10X18H11БЛ	196	441	25	35	590
	07X17H16ТЛ	196	441	40	55	392
	12X18H12M3ТЛ	216	441	25	30	590
	55X18Г14C2ТЛ	-	638	6	-	147
	15X23H18Л	294	540	25	30	981
	20X25H19C2Л	245	491	25	28	-
	18X25H19CЛ	245	491	25	28	-
	45X17Г13H3ЮЛ	-	491	10	18	981
	15X18H22B6M2PЛ	196	491	5	-	-
	08X17H34B5T3Ю2PЛ	687	785	3	3	-
	20X21H46B8PЛ	-	441	6	8	294

Contd of table 8

Class of steel	Steel grade	Yield stress, σ_{τ} , MPa	Ultimate strength δ_B , MPa	Elongation, δ , %	Reduction of area, Ψ , %	Impact strength KCU k J / m ²
		Not less than				
Austenite class	35X18H24C2Л	294	549	20	25	-
	31X19H9MBБТЛ	294	540	12	-	294
	12X18H12БЛ	196	392	13	18	196
	110Г13Х2БРЛ	491	-	22	30	1962
	130Г14ХМФЛ	441	883	50	40	2453
Martensite	85X4M5Ф2B6Л (P6M5Л)	Not regulated				
	90X4M4Ф2B6Л (P6M4Ф2Л)	Not regulated				
Alloy steel with special components, used in CMEA countries						
Martensite-Ferrite	15X14HЛ ¹	289	481	15	50	294
	15X14HЛ ²	383	579	15	50	441
	08X12H4ГCMЛ	549	736	15	35	540
Austenite-Ferrite	12X21H5Г2CЛ	343	549	22	20	590
	12X21H5Г2CTЛ	343	549	12	10	196
	12X21H5Г2CM2Л	343	549	22	20	590
	12X19H7Г2CAL	240	481	20	30	590
	12X21H5Г2CAL	334	657	18	20	245
	07X18H10Г2C2M2Л	177	432	30	35	441
	15X18H10Г2C2M2Л	216	432	30	35	785
	15X18H10Г2C2M2TЛ	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 (HTД).

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 (HTД).

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 (HTД).

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 (СТД).

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 СТД). 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 СТД.

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 1st and 2nd 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 1st group, capacity of not more than 500 kg – for casting of 2nd and 3rd groups.

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

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 (СТД).

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 (HTД).

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 HTД 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 HTД.

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 (HTД) 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 HTД.

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

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.

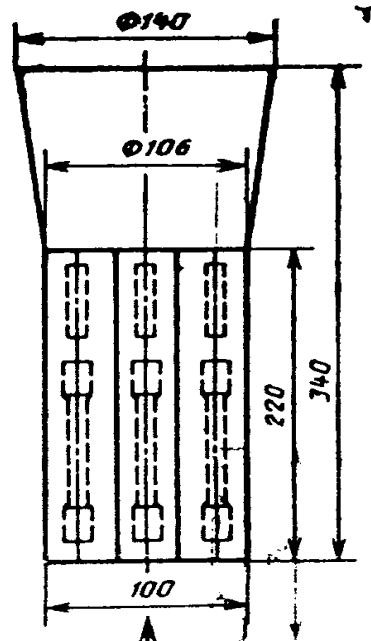
The position of samples for testing stress and determination of impact strength in test pieces are not regulated and in drawings, they are indicated conditionally.

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

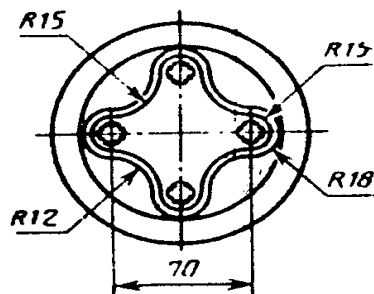
While manufacturing casts, which are required individual checking of mechanical properties, it is permissible to use test pieces, dimensions, it is permissible to use test pieces, dimensions and positions to use test pieces, dimensions and positions place which are indicated in design document and (or) standard technical document (КД and HTД) 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

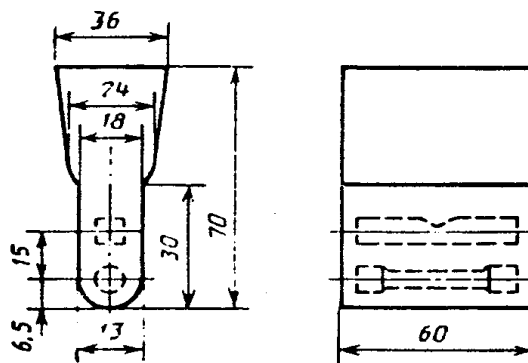
For thick-walled casting, it is permissible to cut out samples at a distance of not more than 30 mm from the inner surface of casting.

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

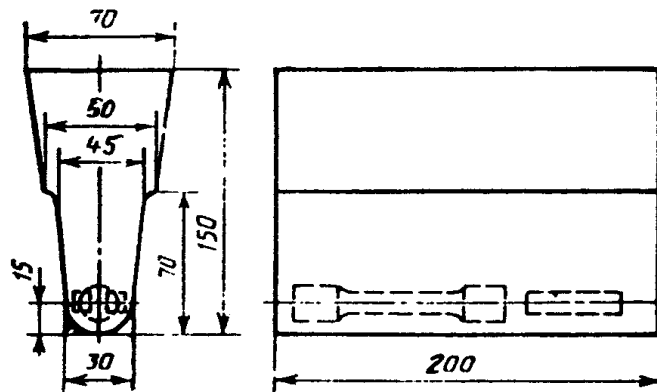
It is permissible to carryout testing on samples of type II – IV No.7.

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

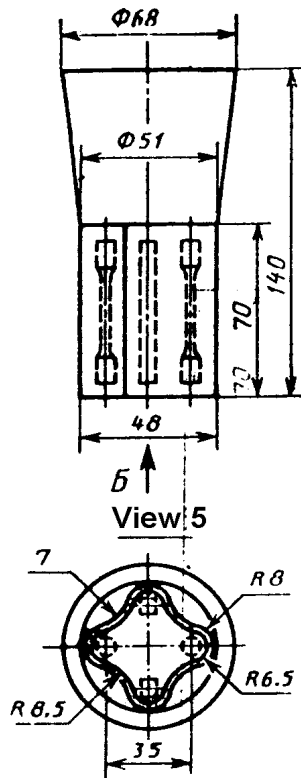
5.7. Test results of samples, having defects, connected with the conditions of their casting (pits, foreign matter (impurity), heated cracks and porosity etc). Mechanical finish condition and testing condition, are not be taken into consideration. The defective samples are to be replaced with new samples,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

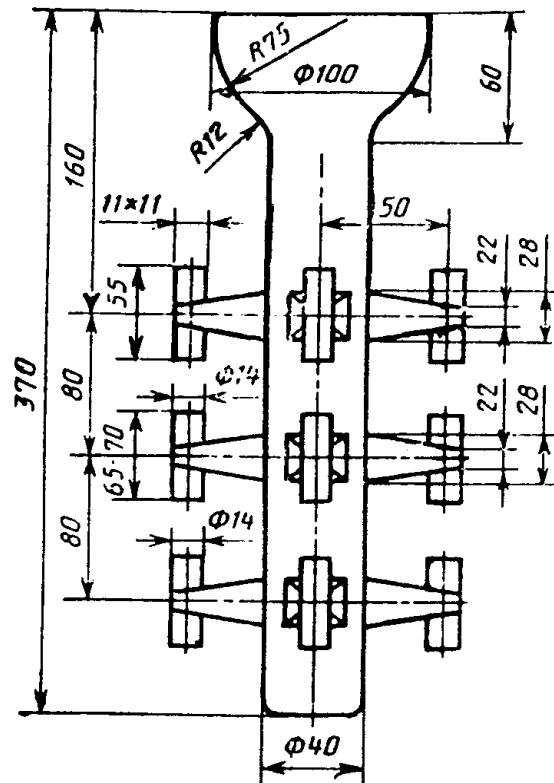
5.9. Checking the inner shape of casting is carried out as per design document and (or) standard technical document.

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 HTД.



Drawing 5

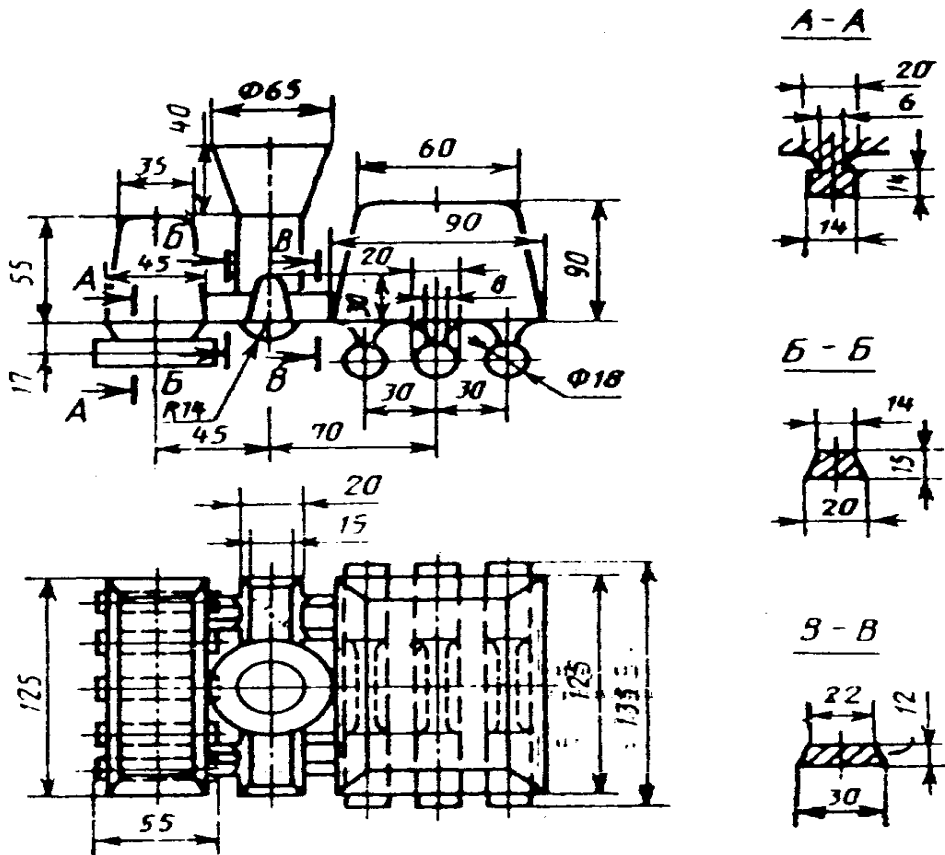
5.13. Testing for stress during increase of temperature is carried out as per GOST 9651, during decrease of temperature – as per GOST 11150.

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 (HTД).

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 (HTД) on casting.



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 ⁰ C.
20ХМФЛ	Mounting parts, body parts, cylinders, working during temperature upto 540 ⁰ C.
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 ⁰ C.
35ХГСЛ	Gearwheel, sprockets, axles, shafts, coupling and other connected parts; from which increase in wear resistance is essential.