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SEAMLESS STEEL PIPES

FOR STEAM GENERATORS AND PIPELINES

Technical Specifications

TU 14-3P-55-2001

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C O N T E N T

Annexes:

These technical specifications are applied to seamless cold-formed, warm-formed, hot-formed, including hot-extruded, and hot-extruded reduced pipes designed for steam generators and piping of plants with high and supercritical steam parameters.

1 TECHNICAL REQUIREMENTS

1.1 Terms and Definitions

1.1.1 Steel is described by means of the following terms: carbon, low-alloyed, high-alloyed.

Steel grades 20 and 20-ПВ (20-PV) are carbon steels, steel grades 15ГС (15MnSi), 15ХМ (15CrMo), 12Х1МФ (15CrMoVa), 12Х1МФ-ПВ (15CrMoVa-PV),, 15Х1М1Ф (15Cr1Mo1Va), 12Х2МФСР (12Cr2MoVaSi) are low-alloyed steels and steel grades 10Х9МФБ-Ш (10Cr9MoVaNb-ESR), 12Х11В2МФ (12Cr11Va2MoVa), 08Х16Н9М2 (08Cr16Ni9Mo2), 12Х18Н12Т (12Cr18Ni10Ti), 10Х13Г2БС2Н2Д2 (10Cr13Mn2NbSi2Ni2Cu2) are referred to high-alloyed steels (10Х9МФБ-Ш and 12Х11В2МФ are martensitic chromium steels, 08Х16Н9М2 и 12Х18Н12Т are austenitic chromium-nickel steels and 10Х13Г12БС2Н2Д2 is austenitic chrome-manganese steel).

1.1.2 For test description the following definitions are used:

- Mandatory tests are those to be performed by manufacturer without additional instructions;
- Complementary tests are those, which are performed by manufacturer at customer's request based on agreement between customer and manufacturer.

1.1.3 Pipes are described using the following terms: cold-formed, warm-formed, hot-formed, hot-extruded and hot-extruded reduced.

1.2 Ordering information and designation

1.2.1 Ordering information to be provided by customer to manufacturer:

- volume of delivery;
- steel grade;
- size (outside or inside diameter, wall thickness);
- length (random length or fixed length (to be specified);
- method of production (hot-formed, cold-formed or warm-formed, hot-extruded reduced, hot-extruded);
- manufacturing precision (customary or extended precision of diameter and wall thickness);

- manufacturing test types;
- bevelling (if necessary);
-complementary tests, test temperature to be indicated (if necessary);
- additional requirements to packing, marking, transportation and storage (protective coating, safety plugs, by-piece loading, if necessary).

Examples of pipe designation:

Cold- or warm-formed pipe OD 25 mm, wall thickness 2mm, customary precision, fixed length of 5000 mm, steel grade 12X1MΦ:

Pipe X25x2x5000 - 12X1MΦ (12Cr1MoVa), TU 14-3P-55-2001

Cold- or warm-formed pipe, ID 42 mm, wall thickness 3 mm, customary precision, in random length, steel grade 12X18H12T:

Pipe X ID 42x3 - 12X18H12T TU 14-3P-55-2001

Hot-formed pipe OD 89 mm, wall thickness 6 mm, extended precision of diameter, customary precision of wall thickness, in random length, steel grade 12X2MΦCP:

Pipe Г 89п x 6 - 12X2MΦCP TU 14-3P-55-2001

Hot-formed pipe OD 426 mm, wall thickness 80 mm, customary precision, limited length of 2800-4600 mm, steel grade 15X1M1Φ:

Pipe Г 426x80x2800-4600 - 15X1M1Φ TU 14-3P-55-2001.

1.3 General requirements

1.3.1 Pipes as delivered shall meet requirements of these technical specifications.

1.3.2 Pipes may be delivered subject to mandatory and complementary tests. Test types are shown in Table 1.

1.4 Round billet

1.4.1 Pipes are produced of rolled, forged, peeled or machined, predrilled or non-drilled round billets of carbon, low-alloyed and high-alloyed steels produced in electrical and open-hearth furnaces, as well as using synthetic slag ladle treatment, electroslag remelting (-ШЛ) and direct recovery (-ПВ).

Table 1 Test types

Test rating	Test type	Item
Mandatory tests	Size control	1.5; 3.6; 3.7; 3.8; 3.9; 3.10
	Straightness control	1.5.9; 3.7
	Chemical analysis	1.6.1; 3.11; 3.12
	Tensile test at room temperature	1.8.1; 3.13
	Impact bending test at room temperature (KCU)	1.8.1; 3.15
	Hardness test	1.8.2; 3.14
	Tensile test at elevated temperature with $\sigma_{0,2}$ determination (occasionally)	1.8.4; 3.13
	Creep rupture strength test (occasionally)	1.8.4; 1.8.6; 3.16
	Visual inspection of surface quality	1.91; 1.9.2; 1.9.4; 3.17; 3.18
	Hydraulic pressure test	1.10.1; 3.19
	Ultrasonic detection of longitudinal defects in all kinds of pipes	1.1 0:2; 3.20
	Ultrasonic detection of "lamination" -type flaws in hot-extruded and hot-extruded reduced pipes produced of continuous-cast billets	1.10.2; 3.20; 3.21
	Macrostructure analysis	1.11.1; 3.23
	Nonmetallic inclusions contamination control	1.11.2; 3.24
	Microstructure analysis	1.11.3; 1.11.4; 1.11.5; 1.11.6; 3.26; 3.27
	Manufacturing tests: flattening test, flare test, bend-over test	1.12; 3.28; 3.29; 3.30
Complementary tests	Chemical analysis of pipe metal	1.6.2; 3.11; 3.12
	Impact bending test at room temperature (KCV) and at reduced temperature (KCU or KCV)	1.8.3; 3.15
	Tensile test at elevated temperature with $\sigma_{0,2}$ determination	1.8.5; 3.13
	Visual inspection of surface quality by more severe standards	1.9.3; 3.17; 3.18
	Ultrasonic detection of "lamination" -type flaws	1.10.3; 3.20; 3.21
	Ultrasonic detection of longitudinal defects	1.10.3; 3.20; 3.21
	Ultrasonic detection of transverse defects by more severe standards	1.10.4; 3.20; 3.21
	Magnetic-flux-leakage (magnetic, eddy-current, etc.) testing for detection of surface and through defects	1.10.5; 3.22
	Intergranular corrosion resistance test	1.13; 3.31
	Pipe wall thickness gauging with ultrasonic thickness gauge	3.8

It is permitted to use basic oxygen steel of grade 20. Round billets are delivered according to TU 14-1-1529, TU 14-1-5185, TU 14-1-2560, TU 14-1-1787, TU 14-1-5271, TU 14-1-1045, TU 14-134-319, TU 14-1-4607, TU 14-1-4616 and TU 14-131-871.

It is permitted to produce hot-extruded and hot-extruded reduced pipes of steel grade 20 and hot-extruded pipes of steel grade 12X1MΦ (12Cr1MoVa), using continuous-cast billets delivered according to TU 14-1-5319.

1.5 Sizes and extreme dimensional deviations

1.5.1 Pipes are delivered on the basis of outside diameter and wall thickness. At customer's request cold-formed and warm-formed pipes may be delivered based on internal diameter and wall thickness.

1.5.2 Sizes of hot-formed pipes, including hot-extruded pipes, produced of carbon and low-alloyed rolled or forged round billets shall correspond to those shown in tables 2 and 3, and pipes of high-alloyed steel to those shown in table 4.

Sizes of hot-extruded and hot-extruded reduced pipes of steel grade 20 and hot-extruded pipes of steel grade 12X1MΦ (12Cr1MoVa), produced of continuous-cast billets shall correspond to those shown in tables 5 and 6.

Sizes of carbon and low-alloyed cold-formed and warm-formed pipes shall correspond to those shown in table 7; and those of high-alloyed steel pipes shall correspond to sizes of table 8.

Upon agreement between manufacturer and customer it is permitted to deliver cold-formed and warm-formed pipes of 114-273 mm OD with wall thickness of 5-25 mm according to hot-formed pipe mix (tables 2 and 4).

Upon agreement between manufacturer and customer it is permitted to deliver hot-, cold- and warm-formed pipes of other sizes but within corresponding mix with permitted variations in outside diameter and wall thickness stipulated in the order.

Table 2 Sizes and maximum fixed length of hot-formed carbon and low-alloyed steel pipes (including hot-extruded pipes of rolled and forged billets)

Outside Diameter, mm	Fixed length, m, not more, at wall thickness, mm																		
	2,5	3,0	3,5	4,0	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0	9,0	10,0	11,0	12,0	13,0	14,0	15,0
25,28,30	11,0	11,0	11,0	11,0	-	-	-	-	-	-	-	-	.	-	-	-	-	-	-
32,36	11,0	11,0	11,0	11,0	11,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38,40	-	11,0	11,0	11,0	11,0	11,0	-	-	-	-	-	-	-	-	-	-	-	-	-
42	-	11,0	11,0	11,0	11,0	11,0	11,0	-	-	-	-	-	-	-	-	-	-	-	-
45, 48, 50	-	-	11,0	11,0	11,0	11,0	11,0	11,0	-	-	-	-	-	-	-	-	-	-	-
51	-	-	11,0	11,0	11,0	11,0	11,0	11,0	-	-	-	-	-	-	-	-	-	-	-
54	-	-	11,0	11,0	11,0	11,0	11,0	11,0	-	-	-	-	-	-	-	-	-	-	-
55	-	-	11,0	11,0	11,0	11,0	11,0	11,0	-	-	-	-	-	-	-	-	-	-	-
57	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	-
60	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	-
76	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
83	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
89	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
102	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	7,5	7,0
108	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	8,0	8,0
114	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	8,0	8,0
121	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
133	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
140	-	-	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
146	-	-	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
152	-	-	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
159	-	-	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
168	-	-	-	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
194	-	-	-	-	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
219	-	-	-	-	-	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
245	-	-	-	-	-	-	-	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0
273	-	-	-	-	-	-	-	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0
299	-	-	-	-	-	-	-	-	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0
325	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,0	9,0	9,0	9,0
351	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,0	9,0	9,0
377	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,5	7,5	7,0
426	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,5	8,5

Table 2 (continued)

Outside Diameter, mm	Fixed length, m, not more, at wall thickness, mm																					
	16,0	17,0	18,0	19,0	22,0	24,0	25,0	26,0	27,0	28,0	30,0	32,0	34,0	36,0	38,0	40,0	42,0	45,0	48,0	50,0	56,0	60,0
76	9,0	9,0	9,0	9,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	9,0	9,0	9,0	9,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
89	9,0	9,0	9,0	9,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
102	7,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
108	7,5	7,0	-	-	4,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
114	7,5	70	7,0	7,0	6,5	6,0	6,0	6,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
121	8,5	8,0	8,0	7,5	6,5	6,5	6,0	6,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
133	9,0	8,5	8,0	7,5	7,0	6,5	6,0	6,0	-	6,0	6,0	6,0	6,0	5,5	-	-	-	-	-	-	-	-
140	8,5	8,0	7,5	7,0	6,5	6,0	5,5	5,5	-	5,5	5,0	6,0	5,5	5,0	-	-	-	-	-	-	-	-
146	9,0	9,0	9,0	9,0	8,0	7,5	7,0	7,0	-	6,5	6,0	6,0	6,0	5,0	-	-	-	-	-	-	-	-
152	9,0	9,0	9,0	9,0	8,0	7,5	7,0	7,0	-	6,5	6,5	6,0	5,5	5,0	-	-	-	-	-	-	-	-
159	9,0	8,5	8,5	8,5	7,5	7,0	7,0	7,0	-	6,5	6,5	6,5	6,0	6,0	-	-	-	-	-	-	-	-
168	9,0	8,5	8,5	8,0	7,0	7,5	6,5	6,5	-	6,5	6,0	6,0	5,5	5,0	5,0	4,5	-	-	-	-	-	-
194	9,0	9,0	9,0	9,0	8,0	7.5	7,0	7,0	-	7,0	7,0	7,0	7,0	6,5	6,5	6,0	5,5	5,0	-	-	-	-
219	9,0	9,0	9,0	9,0	8,0	9,0	8,5	8,5	-	8,0	7,5	7,0	6,5	6,0	6,0	5,75	5,75	5,5	5,0	4,5	-	-
245	9,0	90	9,0	9,0	9,0	9,0	8,0	8,0	-	7,5	7,5	6,5	6,5	6,0	7,75	7,5	7,0	6,5	6,7,5	6,0	-	-
273	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	8,5	8,0	7,5	7,0	7,0	7,0	7,0	6,5	6,5	60	5,5	5,0	4,5
299	9,0	9,0	9,0	9,0	9,0	9,0	8,5	8,5	-	8,0	7,75	7,5	7,25	7,0	6,0	6,0	5,5	5,25	5,0	4,5	4,25	4,0
325	9,0	9,0	9,0	9,0	9,0	8,5	8,0	8,0	-	8,0	7,5	7,0	7,0	7,0	7,0	7,0	7,0	6,0	6,0	6,0	5,5	4,5
351	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	8,5	8,0	7,5	7,25	7,0	6,5	6,25	6,0	5,75	5,5	5,0	4,75	4,5
377	7,0	6,5	9,0	9,0	9,0	9,0	9,0	9,0	-	9,0	9,0	8,5	8.5	8.0	7,5	7,0	7,0	7,0	5,25	5,0	4,5	4,5
426	8,0	7,5	7,0	6,5	6,5	6,0	5,0	5,0	-	5,5	5,5	5,5	5,5	5,5	5,0	5,0	5,0	4,5	4,5	4,5	4,25	4,25
465	6,0	6,0	6,0	6,0	6,0	5,5	5,5	5,5	5,0	5,0	5,0	4,75	4,75	4,75	4,5	4,5	-	-	-	-	-	-

Notes

1 Pipes of steel 15X1M1Ф shall be produced 1 14 mm and over in diameter.

2 Pipes of steel 12X1MФ (12Cr1MoVa), with wall thickness over 45 mm are delivered on agreement between manufacturer and customer.

3 Pipes of 102 mm in diameter with wall thickness from 17 to 22 mm are delivered in fixed length on agreement between manufacturer and customer.

4 Pipes 325x12x9000 mm are produced of steel 20 only.

5 Pipes from 25 to 57 mm OD shall be made upon receipt of additional research results.

Table 3 Sizes and length of hot-formed pipes made of steel 15ГС and 15Х1М1Ф

Steel Grade	Outside diameter, mm	Wall thickness, mm	Limited length, m
15ГС	465	56	3,5-5,1
	465	75	2,8-4,5
	530	28	not less than 4,0
	530	40	not less than 3,5
	530	65	3,5-4,4
15Х1М1Ф	377	70	2,8-4,6
	426	80	2,8-4,6
	426	90	2,8-4,0
	465	56	3,5-5,1
	465	65	3,5-4,6
	465	75	3,5-4,3
	530	25	not less than 4,0

Notes
1 In any lot of pipes OD 465 mm 40% (by weight) of pipes should not be shorter than 4,1 m.
2 It is allowed to deliver one pipe per lot in length not less than 2,5 m.

Table 4 Sizes and maximum fixed length of hot-formed high-alloyed steel pipes

Outside Diameter, mm	Fixed length, m, not more, at wall thickness, mm																												
	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0	8,5	9,0	9,5	10	11	12	13	14	15	16	17	18	19	20	21	24	25	26	28	30	32
76	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	6,0	6,0	6,0	6,0	5,5	5,5	5,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	6,0	6,0	6,0	6,0	6,5	5,5	5,0	5,0	5,0	-	-	-	-	-	-	-	-	-	-	-	-
89	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	6,0	6,0	6,0	6,0	5,0	5,5	4,0	4,0	4,0	-	-	-	-	-	-	-	-	-	-	-	-
102	-	7,0	7,0	7,0	7,0	7,0	7,0	7,0	6,0	6,0	6,0	6,0	5,0	5,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	-	-	-	-	-	-	-
108	-	7,0	7,0	7,0	7,0	7,0	7,0	7,0	6,0	6,0	6,0	6,0	5,0	5,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	-	-	-	-	-	-	-
114	-	7,0	7,0	7,0	7,0	7,0	7,0	7,0	6,0	6,0	6,0	6,0	5,0	5,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	3,5	-	-	-	-	-	-
121	-	7,0	7,0	7,0	7,0	7,0	7,0	7,0	6,0	6,0	6,0	6,0	5,5	5,5	5,5	5,0	4,5	4,5	4,0	4,0	4,0	4,0	3,0	3,0	3,0	3,0	-	-	-
133	-	7,0	7,0	7,0	7,0	7,0	7,0	6,5	6,0	6,0	6,0	6,0	5,5	5,5	5,5	5,0	5,0	5,0	5,0	4,5	4,0	4,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
140	-	-	-	7,0	7,0	7,0	7,0	6,5	6,0	6,0	6,0	6,0	5,5	5,5	5,5	5,0	5,0	5,0	5,0	4,5	4,5	4,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
146	-	-	-	8,5	8,5	8,5	8,0	8,0	8,0	7,5	7,5	7,0	7,0	7,0	6,5	6,5	6,0	6,0	5,5	5,5	5,0	4,5	4,5	4,5	3,0	3,0	3,0	3,0	3,0
152	-	-	-	8,5	8,5	8,5	8,0	8,0	8,0	7,5	7,5	7,0	7,0	7,0	6,5	6,5	6,0	6,0	5,5	5,5	5,0	4,5	4,5	4,5	3,0	3,0	3,0	3,0	3,0
159	-	-	-	8,5	8,5	8,5	8,0	8,0	8,0	7,5	7,5	7,0	7,0	6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,5	4,5	4,5	4,5	3,0	3,0	3,0	3,0	3,0
168	-	-	-	-	-	8,0	8,0	8,0	7,5	7,5	7,5	7,0	7,0	6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,0	4,5	4,5	4,5	3,0	3,0	3,0	3,0	3,0
194	-	-	-	-	-	-	-	-	-	8,0	7,5	7,0	7,0	6,5	6,5	6,5	6,0	6,0	5,5	5,5	5,0	4,5	4,5	4,5	4,0	3,0	3,0	3,0	3,0
219	-	-	-	-	-	-	-	-	-	-	-	8,0	8,0	7,0	7,5	7,0	6,5	6,5	6,0	5,5	5,0	4,5	4,5	4,5	4,0	3,0	3,0	3,0	3,0
245	-	-	-	-	-	-	-	-	-	-	-	-	8,0	8,0	7,5	7,0	7,0	6,5	6,0	5,5	5,0	4,5	4,5	4,5	4,5	3,5	3,5	3,0	3,0
273	-	-	-	-	-	-	-	-	-	-	-	-	8,0	8,0	7,5	7,0	6,5	6,0	5,5	5,5	5,0	4,5	4,5	4,5	4,5	-	-	-	-
325	-	-	-	-	-	-	-	-	-	-	-	-	-	6,5	6,0	5,5	5,0	5,0	5,0	4,5	4,5	4,0	4,0	3,5	3,5	-	-	-	-

Notes

1 Pipes of steel 12Х11В2МФ OD 273 mm are delivered with wall thickness from 26 to 36 mm inclusive.

2 Pipes of steel 08Х16Н9М2 and 10Х13П2БС2Н2Д2are not produced.

Table 5 Sizes and maximum fixed length of hot-extruded pipes made of continuous-cast billets

Outside Diameter, mm	Fixed length, m, not more, at wall thickness, mm																															
	3,5	4,0	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0	9,0	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Steel grade 20																																
57	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	11,0	8,5	8,0	7,5	7,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	12,0	12,0	12,0	12,0	12,0	12,07	12,0	12,0	12,0	12,0	10,0	8,0	7,5	7,0	6,5	7,5	7,0	6,5	6,5	6,0	6,0	6,0	-	-	-	-	-	-	-	-	-	-
76	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	8,5	7,5	7,0	6,0	5,5	5,0	4,5	4,5	4,0	4,0	4,0	-	-	-	-	-	-	-	-	-	-
83	-	-	-	12,0	12,0	12,0	12,0	12,0	11,5	11,0	8,5	8,0	7,0	6,5	-	5,0	5,0	4,5	4,0	4,0	-	-	-	-	-	-	-	-	-	-	-	-
89	-	12,0	12,0	12,0	12,0	11,0	10,0	9,0	9,0	8,5	7,5	7,0	6,5	6,0	5,5	5,5	5,0	4,5	4,5	4,0	4,0	4,0	-	-	-	-	-	-	-	-	-	-
102	-	-	11,0	11,0	9,0	8,50	8,0	7,5	7,0	6,5	6,0	5,5	5,0	5,0	4,5	4,5	4,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
108	-	-	10,0	9,0	8,0	7,5	7,0	6,5	6,5	6,0	5,5	5,0	4,5	4,5	4,0	4,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
114	-	-	-	8,0	7,0	6,5	6,5	6,0	5,5	5,5	4,5	4,5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
121	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	11,5	10,5	10,0	9,5	9,0	8,5	8,0	7,5	7,0	7,0	7,0
133	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	11,0	10,5	9,5	9,0	8,5	8,0	7,5	7,5	7,0	6,5
140	-	-	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	11,5	11,0	10,0	9,5	9,0	8,5	8,0	7,5	7,5	6,5	6,0
146	-	-	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	11,5	11,0	10,0	9,5	9,0	8,5	8,0	7,5	7,0	6,5	6,0
152	-	-	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	11,5	11,0	10,5	9,5	9,0	8,5	8,5	8,0	7,5	7,0	6,5	6,5	6,0	6,0	6,0	5,5	5,5
159	-	-	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	11,0	10,5	10,0	9,5	9,0	8,5	8,5	8,0	7,5	7,0	6,5	6,5	6,0	6,0	6,0	5,5	5,5
168	-	-	-	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	10,5	10,0	9,5	9,0	8,5	7,5	7,0	7,0	7,0	6,5	6,5	6,5	6,0	6,0	6,0	5,5	5,5
194	-	-	-	-	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	9,5	9,0	8,5	8,0	7,5	7,0	6,5	6,5	6,0	6,0	5,5	5,5	5,0	5,0	5,0	-	-
219	-	-	-	-	-	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	8,5	8,0	7,5	7,5	7,0	6,5	5,5	-	-	-	-	-	-	-	-	-	-

Table 5 (continued)

Outside Diameter, mm	Fixed length, m, not more, at wall thickness, mm																																
	3,5	4,0	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0	9,0	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Steel grade 12Х1МФ (12Cr1MoVa),																																	
76	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
121	-	-	-	-	-	-	-	-	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-	-	-
133	-	-	-	-	-	-	-	-	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-	-	-
140	-	-	-	-	-	-	-	-	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-	-	-
146	-	-	-	-	-	-	-	-	-	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-	-	-
152	-	-	-	-	-	-	-	-	-	-	-	12,0	12,0	12,0	12,0	11,5	12,0	10,5	9,5	9,0	8,5	8,5	-	-	-	-	-	-	-	-	-	-	-
159	-	-	-	-	-	-	-	-	-	-	-	12,0	12,0	12,0	12,0	11,0	10,5	10,0	9,5	9,0	8,5	8,5	-	-	-	-	-	-	-	-	-	-	-
168	-	-	-	-	-	-	-	-	-	-	-	12,0	12,0	12,0	12,0	10,5	10,0	9,5	9,0	8,5	7,5	7,0	-	-	-	-	-	-	-	-	-	-	-
194	-	-	-	-	-	-	-	-	-	-	-	12,0	12,0	12,0	12,0	9,5	9,0	8,5	8,0	7,5	7,0	6,5	-	-	-	-	-	-	-	-	-	-	-
219	-	-	-	-	-	-	-	-	-	-	-	12,0	12,0	12,0	12,0	8,5	8,0	7,5	7,5	7,0	6,5	6,5	-	-	-	-	-	-	-	-	-	-	-

Note: Pipes of steel grade 20 of mix to the right from broken line shall be produced upon receipt of additional research results.

Table 6 Sizes and maximum fixed length of hot-extruded reduced pipes made of steel 20

Outside Diameter, mm	Fixed length, m, not more, at wall thickness, mm													
	2,5	3,0	3,5	4,0	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0	9,0	10,0
	Pipes produced out of rolled and forged billets													
25	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-	-	-
28	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-	-
32	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-	-
38	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-
42	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-
	Pipes produced out of continuous-cast billets													
25	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-		-	-
28	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-
32	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-
38	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-
42	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-
57	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-
60	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-
76	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0
83	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0
89	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0
102	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0
108	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0
114	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0

Table 7 Sizes and maximum fixed length of cold- and warm-formed carbon and low-alloyed steel pipes

Outside Diameter, mm	Fixed length, m, not more, at wall thickness, mm																	
	2,0	2,5	3,0	3,5	4,0	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0	9,0	10,0	11,0	12,0	13,0
10	9,0	9,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	9,0	9,0	9,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	9,0	9,0	9,0	9,0	9,0	-	-	-	-	-	-	-	-	-	-	-	-	-
20	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	-	-	-	-	-	-	-	-	-	-
22	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	-	-	-	-	-	-	-	-	-	-
25	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-
28	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-
30	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-
32	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-
36	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-
38	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-
40	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-
42	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-
45	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-
48	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-
50	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-	-
51	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-
54	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-
55	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-
57	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-
60	-	-_	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-
63	-	-	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	12,0	-
70	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
76	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
83	-	-	-	-	9,0	9,0	9,0	_9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
89	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
102	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
108	-	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0

Notes

1 Pipes of steel 12X1 МФ (12Cr1MoVa), are produced up to 70 mm OD inclusive.

2 Cold-formed pipes of steel 15X1M1Ф are not produced.

Table 8 Sizes and maximum fixed length of cold- and warm-formed high-alloyed steel pipes

Outside Diameter, mm	Fixed length, m, not more, at wall thickness, mm															
	2,0	2,5	3,0	3,5	4,0	4,5	5,0	5,5	6,0	6,5	7,0	8,0	9,0	10,0	11,0	12,0
10	12,0	12,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-	-	-	-	-
16	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-	-	-	-	-
20	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-	-	-
22	-	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-	-	-
25	-	12,0	12,0	12,0	12,0	12,0	12,0	-	-	-	-	-	-	-	-	-
28	-	10,0	10,0	10,0	10,0	10,0	10,0	-	-	-	-	-	-	-	-	-
30	-	-	10,0	10,0	10,0	10,0	10,0	10,0	-	-	-	-	-	.-	-	-
32	-	-	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	-	-	-	-
36	-	-	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	-	-	-	-
38	-	-	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	-	-	-	-
40	-	-	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	-	-	-	-
42	-	-	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	-	-	-	-
45	-	-	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	-	-	-	-
48	-	-	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	-	-	-	-
50	-	-	-	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	-	-	-	-
53	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	-	-	-
56	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	-	-	-
57	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	-	-	-
60	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	-	-	-
76	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	-	-	-
89	-	-	-	-	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	-	-	-	-

Note: Pipes OD over 42 mm of steel 12X11B2MΦ shall be produced on agreement between manufacturer and customer.

1.5.3 Theoretical weight of 1 m of pipe is given in Annex A to technical specifications.

1.5.4 As to length pipes can be delivered as follows:

а) in random length:

- hot-formed carbon and low-alloyed steel pipes - from 4 to 12 m, high-alloyed steel pipes - from 3 to 9 m;
- hot-extruded and hot-extruded reduced pipes - from 4 to 12 m;
- cold- and warm-formed carbon, low-alloyed and high-alloyed steel pipes - from 3 to 12 m.

б) in fixed length:

- hot-formed carbon and low-alloyed steel pipes - from 4 to 9 m, but not longer than specified in tables 2 and 3; high-alloyed steel pipes - from 3 to 8,5 m, but not longer than specified in table 4;
- hot-extruded and hot-extruded reduced pipes - from 4 to 12 m, but not longer than specified in tables 5 and 6;
- cold- and warm-formed pipes - from 3 to 12 m, but not longer than specified in tables 7 and 8.

Delivery of fixed length pipes exceeding specified length is permitted by agreement between manufacturer and customer.

1.5.5 In any lot of random length pipes OD 114 mm and over it is allowed to deliver not more than 10% (by weight) of pipes 1 meter shorter than specified length, but not shorter than 2,5 m.

In any lot of random length pipes OD below 114 mm it is allowed to deliver not more than 5% (by weight) of pipes 1 meter shorter than specified length, but not shorter than 2,5 m.

In any lot of fixed length pipes it is allowed to deliver not more than 5% (by weight) of random length pipes.

1.5.6 Extreme deviations from outside diameter and wall thickness of pipe shall comply with those of tables 9 and 10.

1.5.7 Out-of-roundness of pipe should not bring pipe diameter out of permissible deviations. Pipe eccentricity should not bring wall thickness out of permissible variations.

1.5.8 Length variations of fixed length pipes shall not exceed:

- for pipes up to OD 114 mm:
  - up to 9 m in length - +15 mm;
  - from 9 m and over in length - + 35 mm;
- for pipes OD from 114 mm and above - + 50 mm.

Table 9 Maximum variations in pipe outside diameter

Method of pipe manufacturing and size	Maximum variations, %, at manufacturing precision	
	Customary	Extended
Hot-formed, including hot-extruded, diameter		
Up to 50 mm (table 2)	± 0,4 mm	-
from 50 to 114 mm (tables 2, 4, 5)	±1,0	± 0,75, but not less than 0,5mm
from 114 to 245 mm (tables 2,4, 5)	±1,0	±0,9
from 245 до 325 mm (tables 2,4)	+ 1,25/ - 1,0	±0,9
from 325 mm (tables 2, 3)	+ 1,25/ - 1,0	±1,0
Hot-extruded reduced (table 6), diameter		
Up to 42 mm	± 0,4 mm	-
from 42 до 114 mm	±1,0	-
Cold- and warm-formed, of all steel grades except for steel 12X18H12T (tables 7, 8), diameter		
Up to 30 mm	± 0,3 mm	-
from 30 to 50 mm	± 0,4 mm	-
from 50 mm	± 0,8	-
Cold- and warm-formed, of steel 12X18H12T (table 8), diameter		
from 10 to 42 mm	± 0,25 mm	-
from 42 mm	± 0,70	-

Notes
1 Upon agreement between manufacturer and customer pipes can be supplied based on more strict maximum variations or with a different ratio of plus and minus maximum variations.
2 When delivering pipes on the basis of inside diameter and wall thickness maximum variations in inside diameter should not exceed maximum variations in respective outside diameter.

Table 10 Maximum variations in pipe wall thickness

Method of pipe manufacturing and size	Maximum variations, %, at manufacturing precision	
	Customary	Extended
Hot-formed, including hot-extruded		
- up to 50 mm in diameter (table 2)	+12,5 -10,0	-
- from 50 to 114 mm in diameter ((tables 2, 4, 5) with wall thickness - up to 7 mm	+ 15,0 -10,0	-
- from 7 to 14 mm	+ 15,0 -10,0	+12,5 -10,0
- from 14 mm	+ 15,0 -10,0	±10,0
- from 114 to 325 mm in diameter (tables 2, 4, 5)		
- with wall thickness corresponding to pipe sizes below and left of broken line in tables 2, 4, 5	+ 20,0 -5,0	-
- with wall thickness corresponding to pipe sizes above and right of broken line in tables 2, 4, 5	+ 20,0 -5,0	+ 15,0 -5,0
- from 325 mm in diameter ((table 2)		
- with wall thickness corresponding to pipe sizes below and left of broken line in table 2	+ 20,0 -5,0	-
- wall thickness corresponding to pipe sizes above and right of broken line in table 2	+ 20,0 -5,0	+ 17,5 -5,0
- from 377 to 530 mm in diameter ((table 3) with wall thickness from 25 to 90 mm	+ 20,0 -5,0	-
Hot-extruded reduced (table 6) Up to114 mm in diameter	+ 12,5 -10,0	-
Cold- and warm-formed of all steel grades, except of steel 12X18H12T (table 7, 8), diameter		
- up to 114 mm	±10	-
- от 114мм	+ 15,0 -5,0	-
Cold- and warm-formed of steel 12X18H12T wall thickness, (table 8)		-
- from 2 to 4 mm	±10,0	-
- from 4 mm	± 8,0	

Note. Upon agreement between manufacturer and customer pipes can be supplied based on more strict maximum variations or with a different ratio of plus and minus maximum variations.

1.5.9 Curvature of hot-formed, hot-extruded and hot-extruded reduced pipes in any portion 1 m long shall not exceed:

- for pipes with wall thickness up to 20 mm - 1,5 mm;
- for pipes with wall thickness from 20 to 30 mm - 2,0 mm;
- for pipes with wall thickness from 30 mm - 4,0 mm.

Curvature of cold- and warm-formed pipes in any portion 1 m long shall not exceed 1,5 mm.

Curvature along the full length of pipe shall not exceed 15 mm.

1.5.10 Pipe ends shall be square cut and deburred.

Gas-cutting, plasma-cutting or hot saw cutting of pipe ends followed by bead removal and deburring is permitted for carbon and alloyed steel pipes 114 mm in diameter and larger with wall thickness over 20 mm.

In case of gas and plasma cutting a pipe length allowance shall not be less than 20 mm per cut. Weight of delivered pipes shall be determined without allowances.

1.5.11 On agreement between manufacturer and customer pipe ends to be welded and having wall thickness from 5 to 20 mm shall be beveled at 35-40° to pipe end-face with face ring 1-3 мmm wide.

1.6 Chemical composition

1.6.1 Chemical composition of steel (ladle sample) shall comply with norms in table 11.

Permissible variations in chemical composition of pipe metal are shown in table 12.

At customer's request pipes will be furnished with controlled chemical composition of pipe metal.

1.7 Heat treatment

1.7.1 Pipes will be furnished in heat treated condition. Pipe heat treatment modes are shown in table 13.

Pipe heat treatment mode can be changed upon agreement between pipe-rolling and boiler-building plants approved by NPO TsNIITMASH.

Table 11 Chemical composition of steels

Steel grade	Content of element (by mass), %										
	Carbon	Silicon	Manganese	Chromium	Nickel	Molybdenum	Vanadium	Others	Copper	Sulfur	Phosphorus
									Not more		
1	2	3	4	5	6	7	8	9	10	11	12
20	0,17-0,24	0,17-0,37	0,35-0,65	not more 0,25	not more 0,25	-		-	0,30	0,025	0,030
20-ПВ	0,18-0,24	0,17-0,37	0,35-0,65	not more 0,15	not more 0,15	-	-	-	0,15	0,015	0,015
15ГС	0,12-0,18	0,70-1,00	0,90-1,30	not more 0.30	not more 0,30	-	-	-	0,30	0,025	0,035
15ХМ	0,10-0,15	0,17-0,37	0,40-0,70	0,80-1,10	not more 0,25	0,40-0,55	-	-	0,20	0,025	0,035
12Х1МФ (12Cr1MoVa),	0,10-0,15	0,17-0,37	0,40-0,70	0,9–1,20	not more 0,25	0,25-0,35	0,15-0,30	-	0,20	0,025	0,025
12Х1МФ-ПВ	0,11-0,15	0,17-0,37	0,40-0,70	0,90-1,20	not more 0,15	0,25-0,35	0,15-0.30	-	0,15	0,015	0,015
15Х1М1Ф	0,10-0,15	0,17-0,37	0,40-0,70	1,10-1,40	not more 0,25	0,90-1,10	0,20-0,35	-	0,25	0,025	0,025
12Х2МФСР	0,08-0,15	0,40-0,70	0,40-0,70	1,60-1,90	not more 0,25	0,50-0,70	0,20-0,35	Boron 0,002-0,005	0,25	0,025	0,025
10Х9МФБ-Ш	0,08-0,12	not more 0,50	0,30-0,60	8,60-10,00	not more 0,70	0,60-0,80	0.10-0,20	Niobium 0,1-0,2	0,30	0,015	0,030
12Х11В2МФ	0,09-0,14	not more 0,50	0,50-0,80	10,00-12,00	not more 0,60	0,60-0,90	0,15-0,30	Tungsten 1,7-2,2	0,30	0,025	0,025
08Х16Н9М2	not more 0,08	not more 0,60	1,00-1,50	15,50-17,00	8,50-10,00	1,50-2,00	-	-	-	0,020	0,035
12Х18Н12Т	not more 0,12	not more 0,80	1,00-2,00	17,00-19,00	11.00-13,00			Titanium (C-0,02)x5 but not more 0,7	0,30	0,015	0,030
10Х13Г12БС2Н2Д2	0,06-0,10	1,8-2,2	12,00-13,50	11,50-13,00	1,8-2,5			Niobium 0,60-1,00	2,00-2,50	0,020	0,030

Notes

1 Presence of rare-earth metals added to metal as processing aid is permitted.

2 Steel grades 15ХМ, 12Х1МФ (12Cr1MoVa), 12Х2МФСР and 15Х1М1Ф made by scrap practice or out of cupriferous ores are permitted to contain copper and nickel up to 0,3% each; for steel grades 20 and 15ГС it is allowed to contain nickel and chromium not more than 0,4% each.

3 In steel 15Х1МlФ made in electric furnaces carbon content shall be within 0,11-0,16%, manganese - 0,6-0,9%.

4 Content of residual elements in steel grades 10Х9МФБ-Ш, 12Х11В2МФ, 08Х16Н9М2, 12Х18Н12Т, 10Х13Г12БС2Н2Д2 shall correspond to GOST 5632, and content of residual titanium in steel grades 10Х9МФБ-Ш and 12Х11В2МФ shall not exceed 0,05%.

5 Estimated amounts of zirconium up to 0,10%, cerium up to 0,08%, titanium up to 0,10%, boron up to 0,003% are added to steel 10Х13Г12БС2Н2Д2 and are not determined by chemical analysis. Aluminium up to 0,25% is permitted.

6 Estimated amounts of ferrocerium or misch metal per 0,05% of cerium, SiCa per 0,05% of calcium are added to steel 10Х9МФБ-Ш are not determined by chemical analysis.

Table 12 Permissible variations in chemical composition of pipe metal

Element	Mass content of element in steel, %, steel grade	Permissible variations, %
Carbon	Up to 0,24	±0,01
	15XM	+0,01 -0,02
	08X16H9M2	+0,02
Silicon	Up to 1,0	±0,03
	10X9MФБ-Ш 10X13Г12БС2Н2Д2	±0,10
Manganese	Up to 2,0	±0,02
	10X9MФБ-Ш	+ 0,2
	10X13Г12БС2Н2Д2	±0,5
Chromium	Up to 1,0	±0,05
	from 1,0 to 10,0	±0,10
	Above 10,0 to 15,0	±0,15
	above 15,0	±0,20
	08X16H9M2	+ 0,5
	10X13Г12БС2Н2Д2	+ 0,20
Molybdenum	Up to 1,0	+ 0,02
	above 1,0	±0,05
	08X16H9M2	+ 0,2
Tungsten	Up to 2,2	±0,10
Vanadium	Up to 0,35	±0,02
	10X9MФБ-Ш	+ 0,03
Niobium	10X9MФБ-Ш	+ 0,03
	10X13Г12БС2Н2Д2	±0,10
Nickel	12X18H12T	±0,15
	08X16H9M2	+ 0,5
	10X13Г12БС2Н2Д2	+ 0,20 -0,10
Copper	10X13Г12БС2Н2Д2	-0,20
Titanium	12X18H12T	±0,05

Note – In steel grades 20 and20-ПВ variations are permitted in carbon only, in steel grade 12X18H12T in manganese, chromium, nickel and titanium only.

Table 13 Pipe heat treatment modes

Steel grade	Heat treatment mode
1	2
20 20-ПВ	Normalization at 920-950°C. At normalization rapid fan or spray cooling is permitted. Normalization of hot-formed pipes heated by rolling is permitted. Finishing temperature shall not be lower than normalization temperatures. If rapid heating is used it is allowed to increase temperature of normalization up to 1050°C. High-temperature tempering after normalization is permitted. Normalization of hot-extruded pipes of continuous-cast billets shall be performed after special heating.
15ГС	Normalization at 900-930°C. Normalization of hot-formed pipes heated by rolling is permitted. Finishing temperature shall not be lower than normalization temperatures. It is permitted to perform tempering at 630-670°C after normalization
15ХМ	Normalization at 930-960°C, tempering at 680-730°C, soaking time not less than 30 min., air cooling. Normalization without tempering is permitted. Rapid fan or spray cooling at normalization is permitted. Normalization of hot-formed pipes heated by rolling is permitted followed by tempering at 680-730°C. Finishing temperature shall not be lower than normalization temperatures.
12Х1МФ (12Cr1MoVa), 12Х1МФ-ПВ (12Cr1MoVa-PV),	Normalization at 950-980°C, tempering at 720-750°C, soaking time1-3 hours, air cooling. Rapid fan or spray cooling at normalization is permitted. For electric-furnace steel normalization temperature can be increased up to 1030°C and tempering temperature ca be decreased down to 700°C with soaking time not less than 1hour. For cold-formed pipes of open-hearth steel it is permitted to increase normalization temperature up to 990°C. For pipes with wall thickness over 15 mm normalization requires employment of individual cooling. Normalization of hot-formed pipes 140 mm and less in diameter heated by rolling is permitted when followed by tempering at 720-750°C. Finishing temperature shall not be lower than normalization temperatures. Normalization of hot-extruded pipes made of continuous-cast billets shall be performed after separate heating followed by tempering at 720-750°C.
15Х1М1Ф	Normalization at 970-1000°C, tempering at 730-760°C, soaking time at least 10 hours, air cooling. Rapid fan or spray cooling at normalization is permitted. For pipes with wall thickness up to 15mm soaking time at tempering not less than 5 hours. For electric-furnace steel pipes it is permitted to increase normalization temperature up to 1070°C. For pipes with wall thickness over 15 mm normalization requires employment of individual cooling.
12Х2МФСР	Normalization at 970-1000°C, tempering at 750-780°C, soaking time not less than 2 hours, air cooling.
10Х9МФБ-Ш	Normalization at 1030-1050°C, tempering at 730-750°C, soaking time 3-10 hours, air cooling.
12Х11В2МФ	Normalization at 1020-1050°C, tempering at 750-780°C, soaking time not less than 3 hours, air cooling.
08Х16Н9М2	Austenitizing at 1030-1 100°C, air or water cooling.
12Х18Н12Т	Austenitizing from 1 100-1200°C, air or water cooling.
10Х13Г12БС2Н2	Austenitizing at 1060-1080°C, air cooling.

Notes

1 On agreement between manufacturer and customer normalization of hot-formed pipes over 140 mm in diameter made of steel 12Х1МФ (12Cr1MoVa), and 12Х1МФ-ПВ (12Cr1MoVa-PV), heated by rolling is permitted. Finishing temperature shall not be lower than normalization temperatures.

2 Sprayer cooling is permitted for pipes up to 168 mm in diameter inclusive.

1.8 Mechanical properties

1.8.1 Mechanical properties of pipe metal at room temperature shall correspond to those shown in table 14.

1.8.2 Hardness, HB, of pipe metal made of steels 20, 20-ПВ, 15ГС, 15ХМ, 12Х1МФ (12Cr1MoVa), 12Х1МФ-ПВ (12Cr1MoVa-PV), 15Х1М1Ф, 12Х2МФСР, 08Х16Н9М2, 10Х13Г12БС2Н2Д2 is not rated but measured and reported in pipe quality document.

Pipe hardness standards for above steels shall be determined after processing of statistical data obtained from 50 heats of each of steels and from every method of pipe manufacturing. After that they will be entered into this technical specification in accordance with established procedure.

1.8.3 On customer's request pipes will be furnished with determined impact strength at room temperature using V-notch specimens (KCV) and at reduced temperatures from 0 to minus 60°C on V-notch (KCV) or U-notch U (KCU) specimens. Impact strength value are not rated will be reported in pipe quality document.

1.8.4 Yield strengths at elevated temperatures and long-term strength of pipe metal shall comply with those shown in table 15.

Manufacturer ensures compliance of yield strength at elevated temperatures and long-term strength of pipe metal with specified requirements without testing.

1.8.5 On customer's request pipes shall be furnished with determined yield strength at one or more temperatures given in table 15.

1.8.6 Periodically not less than one time in 3 years a control check of pipes fabrication method compliance and check testing of yield strength at elevated temperatures and long-term strength of pipe metal are to be carried out.

Process control check and check tests shall be carried out by one of the following organizations: UralNITI, NPO TsNIITMASH, NPO TsKTI, VTI. In case of positive checkup results UralNITI, NPO TsNIITMASH, NPO TsKTI or VTI confirm of manufacturer's authority of giving warranty for a period not longer than three years.

Table 14 Mechanical properties of pipe metal at room temperature

Steel grade	Longitudinal specimens					Brinell hardness, HB	Transverse specimens				
	Tensile strength $\sigma_в$, N/mm^2 (kgf/mm^2)	Yield strength, $\sigma_{0,2}$, N/mm^2 (kgf/mm^2)	Elongation, δ_5, %	Reduction of area, ψ,%	Impact strength, KCU, J/cmcм^2 (kgcm/cm^2)		Yield strength, $\sigma_{0,2}$, N/mm^2 (kgf/mm^2)	Elongation, δ_5, %	Reduction of area, ψ,%	Impact strength, KCU, J/cmcм^2 (kgcm/cm^2)	Ударная вязкость KCU, J/cmcм^2 (kgcm/cm^2)
		not less				not more		not less			
20 20-ПВ	412-549 (42-56)	216(22)	24	45	49(5)	-	412-549 (42-56)	216 (22)	22	40	39(4)
15ГС	not less 490 (50)	294 (30)	18	45	59(6)	-	не менее 490 (50)	294 (30)	16	40	49(5)
15ХМ	441-637 (45-65)	235 (24)	21	50	59(6)	-	441-637 (45-65)	225 (23)	20	45	49(5)
12Х1МФ (12Cr1MoVa), 12Х1МФ-ПВ	441-637 (45-65)	274 (28)	21	55	59(6)	-	441-637 (45-65)	274 (28)	19	50	49(5)
15Х1М1Ф	490-686 (50-70)	314(32)	18	50	49(5)	-	490-686 (50-70)	314 (32)	16	45	39(4)
12Х2МФСР	not less 70 (48)	274 (28)	21	-	-	-	-	-	-	-	-
10Х9МФБ-Ш	not less 600(61)	400(41)	19	55	78(8)	255	not less 600(61)	400 (41)	17	50	59(6)
12Х11В2МФ	not less 588 (60)	392 (40)	18	-	-	255	not less 588 (60)	392 (40)	17	45	49(5)
08Х16Н9М2	not less 529 (54)	216-294 (22-30)	35	55	-	-	-	-	-	-	-
12Х18Н12Т	539-686 (55-70)	216-392 (22-40)	35	55	-	190	-	-	-	-	-
10Х13Г12БС2Н2Д2	not less 588 (60)	216(22)	40	50	-	-	-	-	-	-	-

Notes

1 Tensile strength, yield strength, elongation shall be determined either on longitudinal branch pipes, sections or tubular specimens, or on transverse tubular specimens.

2 Reduction of area will be determined only on tubular longitudinal specimens for pipes with wall thickness 7 mm and more or on tubular transverse specimens for pipes 120 mm and more in diameter.

3 When mechanical properties are tested on branch pipes, decrease of elongation by 3% is permitted

4 Metal hardness of pipes with wall thickness less than 5 mm shall not be determined.

5 Impact strength of metal shall be determined for pipes with wall thickness over 12 mm on longitudinal or transverse specimens.

6 Decrease of impact strength on one specimen by 9,8 J/cm^2 (1 kgcm/cm^2) from specified shall be permitted, provided that normal value of test results on specimens taken from the same pipe is not lower that specified standard. Decrease of impact strength values on transverse specimens of pipes made of steel 20 and 15Х1М1Ф is not permitted.

Table 15 Yield strength at elevated temperatures and long-term strength of pipe metal

Steel grade	Yield strength, σ_{02}. N/mm^2,(kgf/mm^2), not less, at test temperature, °C			Long-term strength, N/mm^2 (kgf/mm^2), at test temperature, °C, and test length, hrs										
	250	400	450	450		500		550		600		650		700
				10^5	$2\cdot10^5$	10^5	$2\cdot10^5$	10^5	$2\cdot10^5$	10^5	$2\cdot10^5$	10^5	$2\cdot10^5$	10^5
20 20-ПВ	196(20)	137(14)	127(13)	78 (8,0)	56 (5,7)	38 (3,9)	-	-	-	-	-	-	-	-
15ГС	245 (25)	167(17)	127(13)	98(10,0)	56 (5,7)	-	-	-	-	-	-	-	-	-
15ХМ	225 (23)	196 (20)	191 (19,5)	-	-	127(13,0)	118(11,5)	51 (5,2)	38 (3,9}	-	-	-	-	-
12Х1МФ (12Cr1MoVa), 2Х1МФ-ПВ	-	216(22)	206(21)	-	-	167(17,0)	135(13,8)	97 (9,9)	82 (8,4)	55 (5,6)	45 (4,6)	-	-	-
15Х1М1Ф	-	235 (24)	225 (23)	-	-	176(18,0)	147(15,0)	104(10,6)	93 (9,5)	63 (6,4)	56(5,7)	-	-	-
15Х1М1Ф*	-	235 (24)	225 (23)	-	-	147(15,0)	129(13,2)	104 (10,6)	93 (9,5)	63 (6,4)	56 (5,7)	-	-	-
12Х2МФСР	-	206(21)	195 (20)	-	-	152(15,5)	-	92 (9,4)	-	55 (5,6)	-	-	-	-
10Х9МФБ-Ш	380 (39)	340(35)	320 (32,5)		-	[214 (21,9)]	[205 (20,9)]	[140 14,3)]	[132 (13,5)]	[90 (9,2)]	[84 (8,6)]	-	-	-
12Х11В2МФ	-	-	-	-	-	-	-	157(16,0)	-	88 (9,0)	-	29 (3,0)	-	-
08Х16Н9М2 12Х18Н12Т	-	-	-	-	-	-	-	147(15,0)	135 (13,8)	108(11,0)	97 (9,9)	69 (7,0)	61 (6,2)	29 (3,0)
10Х13Г12БС2Н2Д2	176(18)	161 (16,5)	157(16)	-	-	-	-	[190 (19,0)]	[177 (18,0)]	[132 (13,5)]	[108 (11,0)]	[88 (9,0)]	[67(6,8)]	_

Notes

1 Yield strength and long-term strength are mean of total available data, which can be made more precise at periodic testing and corrected if necessary. Variation in actual values of long-term strength is permitted by 20% from shown in the table.

2 Yield strength and long-term strength of pipes for intermediate temperatures shall be determined by means of linear interpolation between the nearest values shown in the table.

3 Long-term strength values in square brackets are checked in not less than 20 heats for every pipe manufacturing process starting from a moment of approval of these technical specifications, whereupon they are entered into technical specification according to established procedure.

* Yield strength and long-term strength are shown for pipes 377-530 mm in diameter with wall thickness 65-90 mm.

1.9 Surface quality

1.9.1 Pipes shall be furnished with external and internal surface free of laps, cracks, folds, fissures, deep marks and ripple markings. Such imperfections have to be completely removed by gentle spot scarfing or entire grinding, polishing, boring and turning, provided that places of removed imperfections do not encroached on minimum wall thickness.

1.9.2 Scale or rolling tools marks, longitudinal marks (without sharp edges), fine ripples and other fine imperfections on external and internal pipe surfaces resulting from manufacturing method are permitted is they are not deeper than 10% of nominal wall thickness, but not more than 2 mm for hot-formed pipes and 0,2 mm for cold-formed and warm-formed pipes at D/S ratio > 5 and 0,6 mm for cold-formed and warm-formed pipes at D/S ratio < 5, provided that they do not encroach on minimum permissible wall thickness.

1.9.3 On customer's request hot-formed pipes up to 245 mm in diameter, as well as hot-extruded and hot-extruded reduced pipes shall be furnished according to more severe requirements to surface quality.

Imperfections listed in 1.9.2. on external and internal pipe surface shall be accepted without grinding if they are not deeper than 5% of nominal wall thickness, but are not more than 1 mm deep..

1.9.4 Loose scale on external and internal pipe surface shall be completely removed. Tight-fitting scale and oxide skin, which do not prevent pipe surface inspection and non-destructive testing, is permitted.

1.10 Continuity of metal

1.10.1 Every pipe has to withstand internal hydrostatic pressure (P) test without showing any leakage. Pressure value in MPa (atm) shall be determined by the following formula:

at $S/D \le 0{,}13$ $\quad P = \dfrac{2 \cdot S_m \cdot R}{D - S_m}$ $\quad \left(P = \dfrac{200 \cdot S_m \cdot R}{D - S_m}\right)$;

at $S/D > 0{,}13$ $\quad P = \dfrac{2{,}65 \cdot S_m}{D}\left(1 - \dfrac{S_m}{D}\right) \cdot R$ $\quad \left(P = \dfrac{265 \cdot S_m}{D}\left(1 - \dfrac{S_m}{D}\right) \cdot R\right)$,

where: S_m – minimum wall thickness subject to maximum negative tolerance, mm;
R - permissible stress, N/mm^2 (kgf/mm^2) equal to 80% of yield strength for given steel grade;
D - nominal outside diameter of pipe, mm.

Manufacture assures that furnished pipes are capable of withstanding the trial hydraulic test at pressure calculated by shown equations, without actual test provided that 100% of pipes are subject to ultrasonic flaw detection.

1.10.2 Each pipe shall be subject to ultrasonic inspection of continuity, i.e. to ultrasonic flaw detection according to requirements of tables 19 and 20 for detection of longitudinal imperfections, and hot-extruded and hot-extruded reduced pipes produced of continuous-cast billets for detection of lamination-type imperfections.

1.10.3 On customer's request every pipe shall be subject to ultrasonic inspection for detection of transverse imperfections and lamination-type imperfections according to requirements of tables 19 and 20.

1.10.4 On customer's request every pipe with D/S ratio > 5 shall be subject to ultrasonic inspection for detection of longitudinal and transverse imperfections based on more severe standards according to requirements of tables 19 and 20.

1.10.5 On customer's request every pipe shall be subject to magnetic or eddy current inspection for detection of surface and through imperfections.

1.11 Macro- and microstructure

1.11.1 Macrostructure of pipe metal has to be free of cracks, lamination and flakes, foreign metallic and nonmetallic slag inclusions visible without aid of magnifying instruments.

Macrostructure shall be checked in pipes with wall thickness of 15 mm and over.

Manufacturer assures compliance of pipe metal macrostructure with specified requirements without checking, provided that 100% of pipes are subject to ultrasonic flaw detection.

1.11.2 Contamination of pipe metal with nonmetallic inclusions by average size number shall not exceed the following values acc. to GOST 1778:

- for carbon and low-alloyed steel:
  - sulfides – size No. 3,5;
  - oxides and silicates – size No. 3,5;
- for high-alloyed steel:
  - sulfides - size No. 3,0;
  - oxides and silicates - size No. 3,5;
- for steel produced by electroslag remelting:
  - sulfides - size No. 2,0;
  - oxides and silicates - size No. 3,0.

Manufacturer assures compliance of pipe metal contamination by nonmetallic inclusions with specified requirements without testing.

1.11.3 In metal microstructure of pipes made of steel grades 20, 20-ПВ, 15ГС, 15ХМ, 12Х1МФ (12Cr1MoVa), 12Х1МФ-ПВ, 15Х1М1Ф and 12Х2МФСР banding shall not exceed No. 3 according to scale No. 1 of Annex B to technical specification.

Manufacturer assures compliance with specified requirements to banding in metal microstructure of pipes made of steel 20, 20-ПВ, 15ГС, 15ХМ, 12Х1МФ (12Cr1MoVa), and 12Х1МФ-ПВ, 15Х1М1Ф и 12Х2МФСР, except of pipes normalized heated by rolling.

1.11.4 In metal microstructure of pipes made of steel grades 20, 20-ПВ and Widmanstatten pattern shall not exceed size No. 3 according to scale No. 2 of Annex B to technical specification.

1.11.5 Metal microstructure of pipes made of steel grades 12Х1МФ (12Cr1MoVa), 12Х1МФ-ПВ (12Cr1MoVa-PV), 15Х1М1Ф, 12Х2МФСР shall not exceed size No. 5 according to scale No 3 of Annex B to technical specification.

1.11.6 Grain size of pipe metal produced of steel grades 12Х18Н12Т shall be within No. 3-7 according to scale of GOST 5639.

Grain size diversity in the microscopic field is allowed to be within 3 to 7 numbers.

1.12 Technological properties

1.12.1 Pipes have to be subject to one or a few of in-process tests:

- up to 60 mm in diameter – bend test over mandrel or flare test;
- from 60 to 108 mm in diameter – flare test or flattening test;
- from 180 to 273mm in diameter - flattening test or strip bend-over test;
- from 273 mm in diameter with wall thickness up to 25 mm - strip bend-over test.

1.12.2 Pipes in diameter of up to 60 mm shall pass bend test over mandrel to an angle of 90°.

Pipes from 180 to 273mm in outside diameter of any wall thickness and from 273 mm and over with wall thickness up to 25 mm shall be subject to a strip bend-over test over mandrel to an angle of 90°.

1.12.3 Pipes up to 108 mm outside diameter with wall thickness not more than 9,0 mm shall be subject to flare test.

Flare test is carried out with the help pf mandrel with cone angle of 30° up to outside diameter expansion by value «*X*» in %, shown in table 16.

Table 16 Expansion value

Steel grade	*X*, expansion, %	Steel grade	*X*, expansion, %
20, 20-ПВ	20	10Х9МФБ-Ш	15
15ГС	20	12Х11В2МФ	15
15ХМ	15	08Х16Н9М2	20
12Х1МФ, 12Х1МФ-ПВ(12Cr1MoVa),	15	12Х18Н12Т	20
15Х1М1Ф	15	10Х13Г12БС2НД2	20
12Х2МФСР	15		

1.12.4 Pipes from 60 to 273 mm in outside diameter with wall thickness of not more than 15% of outside diameter are to be subject to flattening test until distance H in mm is obtained between flattening surfaces calculated from the following equation:

$$H = \frac{(1+a)\cdot S}{a + S/D},$$

where: S – nominal wall thickness, mm;

D – nominal outside diameter of pipe, mm;

a - coefficient of deformation, shown in table 17.

Table 17 Coefficients of deformation

Steel grade	*a,* coefficient of deformation	Steel grade	*a,* coefficient of deformation
20, 20-ПВ	0,08	10Х9МФБ-Ш	0,05
15ГС	0,08	12Х11В2МФ	0,05
15ХМ	0,08	08Х16Н9М2	0,09
12Х1МФ, 12Х1МФ-ПВ (12Cr1MoVa),	0,08	12Х18Н12Т	0,09
15Х1М1Ф	0,08	10Х13Г12БС2Н2Д2	0,08
12Х2МФСР	0,08		

1.13 Intergranular corrosion resistance

1.13.1 On customer's request pipes of steel grades 08Х16Н9М2, 12Х18Н12Т and 10Х13Г12БС2Н2Д2 shall be subject to intergranular corrosion resistance test.

2 SAFETY REQUIREMENTS

2.1 Seamless steel pipes are explosion-proof, nontoxic, electric-safe, radiation-safe.

Special safety measures for transportation, storage and use are not required.

3 ACCEPTANCE RULES AND INSPECTION METHODS

3.1 In order to check quality of pipes a manufacturer carries out a quality inspection and necessary tests, methods and extend whereof are specified in this technical specification.

Customer has a right to perform incoming inspection of pipe quality using acceptance rules inspection and test methods, quality assessment standards specifies in this technical specification.

3.2 Pipes shall be accepted in lots. A lot shall consist of pipes of the same heat, same diameter and wall thickness, same type and mode of heat treatment and accompanied by the same quality document.

A lot shall not contain more than 200 pipes.

Hot-formed pipes normalized as heated by rolling shall be accepted as a whole delivery volume consisting of pipes of the same steel grade, same steel-making process, same heat, same diameter and wall thickness and covered by the same quality document.

Pipes 114 mm and over in diameter shall be accepted by the piece.

3.3 If at least one of sampling tests shows unsatisfactory results a retest shall be carried out with a double number of pipes from the same lot excluding those failed.

Satisfactory results of retests shall be applied to the whole lot.

In case of unsatisfactory retest results of at least one sample all pipes of the lot excluding failed pipes shall be subject to that test or retreated.

Retreated pipes shall be presented for acceptance as a new lot.

For test types providing for 100% inspection, besides determination of grain size it is permitted to conduct retests of pipes, which showed unsatisfactory results, using a double number of samples taken from both pipe ends. Results of grain size determination shall be final.

It is permitted to carry out reheat treatment of pipes (not more than 3) rejected for mechanical properties, grain size and intergranular corrosion resistance, with their subsequent presentation as a new lot. Tempering is not regarded as reheat treatment.

3.4 Pipes and samples for inspection and tests shall be selected according to rates specified in table 18.

3.5 When pipes are furnished in fixed length samples shall be cut from a virgin pipe before cutting to lengths. Test results shall be applied to all lengths.

3.6 Measurement of length is carried out with the help of measuring tape as per GOST 7502.

3.7 Straightness check is carried out according to OST 14-3-123 by means of straightedge according to GOST 8026 and a set of feelers according to TU 2-034-02241.97-011.

3.8 Pipe wall thickness is checked on pipe ends with thickness gauges and wall gauges as per GOST 11358 or micrometers as per GOST 6507. At that manufacturer ensures compliance of wall thickness along the full length of pipe.

Wall thickness in spots of imperfection grinding shall be determined as difference between wall thickness measured at pipe end nearest to ground area and grinding depth measured from pipe generating line or by means of thickness gauge.

It is permitted to measure pipe wall thickness with the help of ultrasonic thickness gauge according to procedure agreed upon with NPO TsNIITMASH.

3.9 Outside diameter of pipe is checked up with micrometers as per GOST 6507, and plain gauges as per GOST 24851 and GOST 24853.

3.10 Inside diameter of pipe is checked up at pipe ends with the help of plug-gages as per GOST 24851 and 24853 and measurement instrumentation agreed upon with NPO TsNIITMASH.

3.11 Chemical composition of steel shall be accepted on the basis of document of round billets quality and transferred to document of pipe quality.

Sampling for chemical analysis shall be carried out according to GOST 7565.

Chemical analysis of pipe metal shall be conducted according to GOST 12344, GOST 12345, GOST 12346, GOST 12347, GOST 12348, GOST 12349, GOST 12350, GOST 12351, GOST 12352, GOST 12353, GOST 12354, GOST 12355, GOST 12356, GOST 12357, GOST 12358, GOST 12359, GOST 12360, GOST 12361, GOST 12365, GOST 22536.0-22536.12, GOST 22536.14, GOST 27809.

It is permitted to determine chemical composition of metals by photoelectric method of spectrum analysis according to GOST 18895.

Table 18 Sampling rate for different types of inspection

Types of pipe inspection and tests	Pipe sampling rate	Sampling rate per pipe
Chemical composition analysis	3 pipes per heat	1
External surface inspection	100% of pipes	-
Internal surface inspection	100% of pipes	-
Ultrasonic flaw detection	100% of pipes	-
Magnetic or eddy-current flaw detection	100% of pipes	-
Outside diameter gauging	100% of pipes	-
Inside diameter gauging	100% of pipes	-
Wall thickness checkup	100% of pipes	-
Length measurement	100% of pipes	-
Straightness checkup	100% of pipes	-
Steeloscopy	100% of pipes	-
Metal macrostructure examination of pipes in diameter of: Up to 114 mm from 114 mm	 2% of pipes per lot (delivery volume), but not less than 2 pipes 100% of pipes	 1 1
Metal microstructure examination of pipes in diameter of: Up to 114 mm from 114 mm up to 60 mm inclusive, made of steel 12Х1МФ, 12Х1МФ-ПВ and 12Х2МФСР tempered in box furnaces	 2% of pipes per lot (delivery volume), but not less than 2 pipes 100% of pipes 5% of pipes per lot, but not less than 2 pipes	 1 1 1 from each end
Control of metal contamination with non-metallic inclusions	2 pipes per heat	3
Grain size control in metal of pipes made of steel 12Х18Н12Т	100% of pipes	1
Tensile test at room temperature for pipes in diameter of: Up to 114 mm from 114 mm up to 60 mm inclusive, made of steel 12Х1МФ, 12Х1МФ-ПВ and 12Х2МФСР tempered in box furnaces	 2% of pipes per lot (delivery volume), but not less than 2 pipes 100% of pipes 5% of pipes per lot, but not less than 2 pipes	 1 1 1 from each end

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Table 18 (continued)

Types of pipe inspection and tests	Pipe sampling rate	Sampling rate per pipe
Tensile test at elevated temperatures	2% of pipes per lot (delivery volume), but not less than 2 pipes	1
Hardness test for piped in diameter of : Up to 114 mm from 114 mm	 2% of pipes per lot (delivery volume), but not less than 2 pipes 100% of pipes	 1 1
Metal impact bending test at room temperature for pipes in diameter of : Up to 114 mm from 114 mm from 114 mm of steel 20, 20-ПВ, 12Х1МФ and 12Х1МФ-ПВ	 2% of pipes per lot (delivery volume), but not less than 2 pipes 100% 20% of pipes per lot (delivery volume), but not less than 2 pipes	 2 1 2
Impact bending test at reduced temperatures	2% of pipes per lot (delivery volume), but not less than 2 pipes	2
Intergranular corrosion resistance test	2 pipes per lot	1
Flattening test for pipes in diameter of: Up to 114 mm from 114 mm from 114 mm of steel 20, 20-ПВ, 12Х1МФ and 12Х1МФ-ПВ	 2% of pipes per lot (delivery volume), but not less than 2 pipes 100% of pipes 2% of pipes per lot (delivery volume), but not less than 2 pipes	 1 1 1
Flare test for pipes in diameter of up to 108 mm	2% of pipes per lot (delivery volume), but not less than 2 pipes	1
Bend-over for pipes in diameter of: Up to 114 mm from 114 mm	 2% of pipes per lot (delivery volume), but not less than 2 pipes 100% of pipes	 1 1
Hydrostatic pressure test	100% of pipes	-
Yield strength check test at elevated temperature and long-term strength test	Pipes representative of process types	12

Method of chemical analysis according to referred specifications serve as an arbitration method of chemical composition determination.

3.12 Low-alloyed and high-alloyed steel pipes are subject to sleeloscopy for presence of relative alloying elements.

3.13 Mechanical properties of pipe metal (tensile strength, yield strength, elongation and reduction of area) shall be determined by means of tensile test: at room temperature according to GOST 10006, at elevated temperature according to GOST 19040.

Tests shall be performed either on longitudinal branch pipes, sections or tubular specimens, or on transverse tubular specimens. Transverse specimens are used in all cases when pipe sizes permit to cut out the above mentioned specimens.

It is permitted to test mechanical properties of pipe metal by non-destructive method according to procedure developed by manufacturer and agreed upon with NPO TsNIITMASH and VTI. Test according GOST 10006 serve as an arbitration method of control.

3.14 Hardness test of pipe metal shall be carried out according to GOST 9012 on specimens intended for tensile test and impact bending test.

3.15 Impact strength shall be determined through impact bending test at room and reduced temperatures according to GOST 9454 on specimens of Type 1 (KCU) or on specimens of Type 11 (KCV). Test is performed on longitudinal or transverse specimens. Transverse specimens are use for pipes OD from 114 mm with wall thickness permitting to cut out transverse specimens. Specimens are cut out from two diametrically opposite sections of pipe closer to external pipe surface. Axis of notch of a specimen has to be perpendicular to external pipe surface.

3.16 Long-term strength test shall be performed according to OST 108.901.102 and GOST 10145 on longitudinal specimens.

3.17 External pipe surface is inspected without magnifying instruments.

Internal surface of pipes of 70 mm and over in diameter inspected by means of periscope without magnification and that of smaller pipes without use of magnifying instruments.

For pipes less than 70 mm in inside diameter, which are not subject to periscopy, manufacturer ensures compliance of internal surface condition with requirements of this technical specification, provided that 100% of pipes are subject to ultrasonic flaw detection.

Beginning from 2003 internal surface of pipes in inside diameter of 40 mm and over have been inspected by means of periscope without magnification and pipe in inside diameter of under 40 mm by means of periscope at the length of 0,5 m from each pipe end. In uninspected part of pipe manufacturer ensures compliance of internal surface condition with requirements of this technical specification, provided that 100% of pipes are subject to ultrasonic flaw detection.

Once in three years pipes less than 40 mm in inside diameter (one pipe from every process type) are cut to assess quality of internal surface. Assessment is carried out by assessment committee consisting of representatives of the plant, UralNITI and NPO TsNIITMASH.

3.18 Class of imperfections on external and internal surfaces of pipes is determined according to OST 14-82.

3.19 Hydraulic test of pipes is carried out according to GOST 3845 with holding of pipes at pressure during not less than 10 seconds.

3.20 Ultrasonic flaw detection is carried out based on manufacturing instruction developed according to requirements of GOST 17410, OST 108.885.01 and agreed upon with NPO TsNIITMASH.

Pipe in inspected over the entire cross-section for detention of:

- longitudinal defects at propagation of ultrasonic vibrations in pipe wall on circumference in two directions towards each other;
- lamination type defects at propagation of ultrasonic vibrations in pipe wall perpendicularly to surface;
- transverse defects at propagation of ultrasonic vibrations in pipe wall along axis in two directions towards each other.

3.21 Adjustment of equipment sensitivity according to rejection level shall be carried out by factory reference standards (FRS) with artificial reflectors, which type and dimensions are given in table 19 for hot-formed, hot-extruded and hot-extruded reduced pipes and in table 20 for cold-formed and warm-formed pipes.

Temporary use of factory reference standards with artificial notch 100 mm long for hot-formed pipes and 50 mm long for cold-formed and warm-formed pipes is permitted for ultrasonic flaw detection until 01.01.2003 г.

Table 19 Types and dimensions of artificial reflectors for ultrasonic flaw detection of hot-formed, hot-extruded and hot-extruded reduced pipes

Pipes size	Type and dimensions of artificial reflectors for the following type of defects		
	Longitudinal defects	Transverse defects	Lamination type defects
D/S ≥ 5 D = 25-55 mm S = 2,5-8 mm (tables 2,6) within mix of cold-formed pipes	Mandatory tests Rectangular notch (drw.1 and 2 of GOST 17410) on internal and external surfaces of FRS depth h=(0,3±0,03) mm, length 1 = (25±2,5) mm, width m ≤ 1,5 mm	At customer's request Rectangular notch (drw.7 and 8 of GOST 17410) on internal and external surfaces of FRS depth h=(0,3±0,03) mm, length 1= (25±2,5) mm, width m ≤ 1,5 mm	At customer's request Flat-bottom hole (drw. 14 GOST 17410), area (diameter) for S=8 mm - 10 mm^2 (3,6 mm). Distance h to bottom of flat-bottom hole from internal surface of pipe h = 0,5S mm. Diameter and depth tolerance of flat-bottom hole ± 10% of their nominal values.
D/S≥5 D > 55 mm (tables 2, 3, 4, 5, 6)	Mandatory tests Rectangular notch (drw.1 and 2 of GOST 17410) on internal and external surfaces of FRS depth h=(10±l)%S≤2 mm, length 1 = (25±2,5) mm, width m ≤ 1,5 mm,	At customer's request Rectangular notch (drw.7 and 8 of GOST 17410) on internal and external surfaces of FRS depth h=(10±l)%S≤2 mm, length 1 = (25±2,5) mm, width m ≤ 1,5 mm	Mandatory tests – for hot-extruded and hot-extruded reduced pipes produced of continuous-cast billets. At customer's request – for hot-formed pipes. Flat-bottom hole (drw. 14 GOST 17410), area (diameter) for S from 8 to 22 mm incl. - 10 mm^2 (3,6 mm), over 22 to 40 mm incl. -. 20 mm^2 (5,1 mm), over 40 mm - 30 mm^2 (6,2 mm). Distance h to bottom of flat-bottom hole from internal surface of pipe for S Up to12 mm incl. - h = 0,5S mm; over 12 mm - h = 0,25S; 0,5S and 0,75S mm. Diameter and depth tolerance of flat-bottom hole ± 10% of their nominal values.
D/S < 5 D > 55 mm (tables 2, 3, 4,5)	Mandatory tests Rectangular notch (drw.1 and 2 of GOST 17410) on internal and external surfaces of FRS depth h=(15±l,5)%S3 mm, length 1 = (25±2,5) mm, width *m*≤ 1,5 mm	At customer's request Rectangular notch (drw.7 and 8 of GOST 17410) on internal and external surfaces of FRS depth h=(15±1,5)%S≤3 mm, length 1 = (25±2,5) mm, width *m*≤ 1,5 mm	Mandatory tests – for hot-extruded and hot-extruded reduced pipes produced of continuous-cast billets. At customer's request – for hot-formed pipes. Flat-bottom hole (drw. 14 GOST 17410), area (diameter) for S from 8 to 22 mm incl. - 10 mm^2 (3,6 mm), over 22 to 40 mm incl. - 20 mm^2 (5,1 mm, over 40 mm - 30 mm^2 (6,2 mm). Distance h to bottom of flat-bottom hole from internal surface of pipe for S Up to 12 mm incl. - h = 0,5S mm; over 12 mm - h = 0,25S; 0,5S and 0,75S mm. Diameter and depth tolerance of flat-bottom hole ± 10% of their nominal values.
D/S ≥ 5 D > 55 mm (tables 2, 3, 4, 5, 6)	Mandatory tests Rectangular notch (drw.1 and 2 of GOST 17410) on internal and external surfaces of FRS depth 0,2≤h=(5±0,5)%S≤1,5 mm, length 1 = (25±2,5) mm, width m ≤ 1,5 mm	At customer's request Rectangular notch (drw.7 and 8 of GOST 17410) on internal and external surfaces of FRS depth 0,2≤h=(5±0,5)%S≤1,5 mm, length 1 = (25±2,5) mm, width m ≤ 1,5 mm	Mandatory tests – for hot-extruded and hot-extruded reduced pipes produced of continuous-cast billets. At customer's request – for hot-formed pipes. Flat-bottom hole (drw. 14 GOST 17410), area (diameter) for S Up to 22 mm incl. - 10 mm^2 (3,6 mm), over 22 до 40 mm incl. -. 20 mm^2 (5,1 mm), over 40 mm - 30 mm^2 (6,2 mm); Distance h to bottom of flat-bottom hole from internal surface of pipe for S Up to 12 mm incl. - h = 0,5S mm; over 12 mm - h = 0,25S; 0,5S and 0,75S mm. Diameter and depth tolerance of flat-bottom hole ± 10% of their nominal values.

Table 20 Types and dimensions of artificial reflectors for ultrasonic flaw detection of cold-formed and warm-formed pipes

Pipes size	Type and dimensions of artificial reflectors for the following type of defects		
	Longitudinal defects	Transverse defects	Lamination type defects
D/S≥5 D ≤108 mm, for all S (table 7)	Mandatory tests Rectangular notch (drw.1 and 2 of GOST 17410) on internal and external surfaces of FRS depth h=(0,3±0,03) mm, length 1 = (25±2,5) mm, width m ≤ 1,5 mm	At customer's request Rectangular notch (drw.7 and 8 of GOST 17410) on internal and external surfaces of FRS depth h=(0,3±0,03) mm, length 1= (25±2,5) mm, width m ≤ 1,5 mm	At customer's request Flat-bottom hole (drw. 14 GOST 17410), area (diameter) for S from 8 mm -10 mm ^{2} (3,6 mm). Distance h to bottom of flat-bottom hole from internal surface of pipe for S h = 0,5S mm. Diameter and depth tolerance of flat-bottom hole ± 10% of their nominal values.
D/S≥5 D ≤ 108 mm (table 8 for steel 12X18H12T)	Mandatory tests Rectangular notch (drw.1 and 2 of GOST 17410) on internal and external surfaces of FRS depth h=(0,2±0,02) mm, length 1 = (25±2,5) mm, width m ≤ 1,5 mm	At customer's request Rectangular notch (drw.7 and 8 of GOST 17410) on internal and external surfaces of FRS depth h=(0,2±0,02) mm, length 1 = (25±2,5) mm, width m ≤ 1,5 mm	-
D/S<5 D ≤ 108 mm for all S (tables 7,8)	Mandatory tests Rectangular notch (drw.1 and 2 of GOST 17410) on internal and external surfaces of FRS depth h=(0,6±0,06) mm, length 1 = (25±2,5) mm, width *m*≤ 1,5 mm	At customer's request Rectangular notch (drw.7 and 8 of GOST 17410) on internal and external surfaces of FRS depth h=(0,6±0,06) mm, length 1 = (25±2,5) mm, width *m*≤ 1,5 mm	At customer's request Flat-bottom hole (drw. 14 GOST 17410), area (diameter) for S from 8 mm - 10 mm^2 (3,6 mm) Distance h to bottom of flat-bottom hole from internal surface of pipe for S Up to 12 mm incl. - h = 0,5S mm; Diameter and depth tolerance of flat-bottom hole ± 10% of their nominal values.
D/S<5 D ≤ 108 mm for all S (tables 7,8 except of steel 12X18H12T	Mandatory tests Rectangular notch (drw.1 and 2 of GOST 17410) on internal and external surfaces of FRS depth h=(0,2±0,02) mm, length 1 = (25±2,5) mm, width *m*≤ 1,5 mm	At customer's request Rectangular notch (drw.7 and 8 of GOST 17410) on internal and external surfaces of FRS depth h=(0,2±0,02) mm, length 1 = (25±2,5) mm, width *m*≤ 1,5 mm	At customer's request Flat-bottom hole (drw. 14 GOST 17410), area (diameter) for S from 8 mm - 10 mm^2 (3,6 mm) Distance h to bottom of flat-bottom hole from internal surface of pipe for S Up to 12 mm incl. - h = 0,5S mm; Diameter and depth tolerance of flat-bottom hole ± 10% of their nominal values.
D=114-273 mm S = 5-25 mm (tables 2, 4) within mix of hot-formed pipes	Mandatory tests Rectangular notch (drw.1 and 2 of GOST 17410) on internal and external surfaces of FRS depth h=(7±0,7)%S≤1,5 mm, length 1 = (25±2,5) mm, width m ≤ 1,5 mm	At customer's request Rectangular notch (drw.7 and 8 of GOST 17410) on internal and external surfaces of FRS depth h=(7±0,7)%S≤1,5 mm, length 1 = (25±2,5) mm, width m ≤ 1,5 mm	At customer's request Flat-bottom hole (drw. 14 GOST 17410), area (diameter) for S from 8 to 22 mm incl. - 10 mm^2 (3,6 mm), over 22 mm - 20 mm^2 (5,1 mm). Distance h to bottom of flat-bottom hole from internal surface of pipe for S Up to 12 mm incl. - h = 0,5S mm; over 12 mm - h = 0,25S; 0,5S and 0,75S mm Diameter and depth tolerance of flat-bottom hole ± 10% of their nominal values.
D=114-273 mm S = 5-25 mm (tables 2, 4) within mix of hot-formed pipes	Mandatory tests Rectangular notch (drw.1 and 2 of GOST 17410) on internal and external surfaces of FRS depth 0,3 mm ≤ h=(5±0,5)%S, length 1 = (25±2,5) mm, width m ≤ 1,5 mm	At customer's request Rectangular notch (drw.7 and 8 of GOST 17410) on internal and external surfaces of FRS depth 0,3 mm ≤h=(5±0,5)%S, length 1 = (25±2,5) mm, width m ≤ 1,5 mm	At customer's request Flat-bottom hole (drw. 14 GOST 17410), area (diameter) for S from 8 to 22 mm incl. - 10 mm^2 (3,6 mm), over 22 mm - 20 mm^2 (5,1 mm). Distance h to bottom of flat-bottom hole from internal surface of pipe for S Up to 12 mm incl. - h = 0,5S mm; over 12 mm - h = 0,25S; 0,5S and0,75S mm Diameter and depth tolerance of flat-bottom hole ± 10% of their nominal values.

Upon agreement with a customer it is permitted to use triangular notch (version 2 according to GOST 17410) if magnitude of a signal reflected from triangular notch does not differ from magnitude of signal reflected from rectangular notch by more than 1,5 dB.

At detection of lamination-type defects it is permitted to use artificial defect of "circular rectangular gap" type (drw. 13 GOST 17410) of the following dimensions: width 15 mm (± 10%); depth h = 0,5 S for S up to 12 mm inclusive; h = 0,25 S; 0,5 S and 0,75 S for S from 12 mm.

3.22 Magnetic and eddy-current flaw detection shall be carried out according to manufacturing instruction agreed with NPO TsNIITMASH.

Adjustment of rejection sensitivity of equipment for detection of surface and through defects shall be carried out by factory reference standards (FRS) with artificial reflectors of "circular rectangular gap" type of dimensions shown in tables 21 and 22.

Every FRS with artificial defects of the of "through cylindrical hole" type shall have three holes spaced by 120° over perimeter and along reference standard (along pipe axis) with neighboring holes spaced by at least 150 mm.

Table 21 Dimensions of artificial notch.

Pipe size and manufacturing method	Dimensions of artificial notch, mm
Hot-formed and hot-extruded pipes of all sizes	depth h=(10±l,0)%S≤2 length 1=(25±2,5) width m ≤ 1,5
Cold-formed and warm-formed pipes within the mix of hot-formed (D= 114-273 mm and S= 5-25 mm) pipes	depth h=(7±0,7)% S; length 1=(25±2,5) width m ≤ 1,5
Cold-formed and warm-formed, hot-formed and hot-extruded reduced pipes within the mix of cold-formed and warm-formed (D= 25-57 mm and S= 2,5-8 mm) pipes with D/S ratio > 5	depth h=(0,2±0,02) length 1=(25±2,5) width m ≤1,5
Cold-formed and warm-formed, hot-formed and hot-extruded reduced pipes within the mix of cold-formed and warm-formed (D= 25-57 mm and S = 2,5-8 mm) pipes with D/S ratio < 5	depth h=(0,6±0,06) length 1=(25±2,5) width m ≤ 1,5

Table 22 Diameter of artificial notch

Pipe diameter	Artificial notch diameter, d, mm
Up to 12 mm inclusive	1,0±0,1
Over 12 to 32 mm inclusive	1,4±0,1
Over 32 to 50 mm	1,8±0,1
From 50 to 127 mm inclusive	2,2±0,1
Over 127 mm	2,7±0,1

3.23 Macrostructure examination of pipe metal is carried out on circular transverse specimen as per GOST 10243.

Other method of macrostructure examination is permitted.

Method of examination according to GOST 10243 serves as an arbitration method.

3.24 Contamination of pipe metal with nonmetallic inclusions shall be accepted based on a document of round billet quality.

Control of pipe metal contamination with nonmetallic inclusions shall be carried out according to GOST 1778 by method III, version III1 or III4 over the whole area of metallographic sections with longitudinal grain flow. It is assessed by average number calculated simple mean of maximum estimates of six samples.

3.25. Examination of banding and Widmanstatten pattern in microstructure of pipe metal shall be carried out by scales No. 1 and No. 2 of Annex B by method of comparison.

Examination is performed on specimens prepared according to GOST 5640 over the whole area metallographic sections with longitudinal grain flow at magnification x 90-105.

3.26 Examination of pipe metal microstructure is performed by scale No. 3 of Annex B by method of comparison.

Examination is performed on specimens prepared according to GOST 5640 over the whole area metallographic sections with longitudinal grain flow at magnification x 90-105 and x 500.

It is permitted to examine microstructure by non-destructive method with conversion of instrument readings into microstructure scale numbers according to manufacturing instruction agreed with NPO TsNIITMASH.

Examination by scale No. 3 of Annex B serves as arbitration method.

3.27 Control of pipe metal grain size shall be carried out as per GOST 5639 at magnification x 90-105 on longitudinal specimen through the whole wall.

It is permitted to determine grain size by ultrasonic method according to instruction agreed with NPO TsNIITMASH.

Method of control according to GOST 5639 serves as arbitration method.

3.28 Bend-over (bending) test shall be performed according to GOST 3728 and GOST 14019.

Testing of pipes up to 60 mm in diameter inclusive is carried out on specimens in the form of pipe section in diameter of over 108 mm, and larger pipes are tested with the use of specimens in the form of longitudinal or transverse strip.

3.29 Flare test shall be performed according to GOST 8694.

3.30. Flattening test shall be performed according to GOST 8695.

In case of the smallest fissures and other flaws detected on flattened specimens as a result of opening of acceptable external imperfections arising from manufacturing method, it is permitted to do a retest using specimen taken from the same pipe following preliminary removal of external and internal layer by depth of mot more than 0,2 mm for pipes up to 114 mm in diameter and not more than 1 mm for pipes over 114 mm in diameter.

3.31 Intergranular corrosion resistance test shall be performed by AM or AMУ method according to GOST 6032 on external and internal surface of specimen after inducing heating.

AM method serves as an arbitration method.

4 MARKING, PACKING, DOCUMENTATION, TRANSPORTATION AND STORAGE

4.1 General requirements to marking, packing, documentation, transportation and storage of pipes shall comply with GOST 10692.

4.2 Every pipes 25 mm in diameter and over with wall thickness 3 mm and more shall have legible marking at the distance of 200-300 mm from one of pipe ends containing the following information: manufacturer’s trade mark, technical control stamp, steel grade, lot number.

Every pipe 114 mm in diameter and over shall be additionally marked with pipe number.

When pipe ends cutting is performed at the customer’s premises it is permitted to transfer marking to remaining part of pipe with corresponding documentation of transfer by Quality Department of the customer.

4.3. Method of marking is at manufacturer’s option.

In case of impact stamping care should be to avoid unacceptable cold-hardening of marking area and depth of stamp should not encroach on minimum permissible wall thickness.

Method of marking has to ensure quality of execution and preservation of marking during shipment and storage of pipes during 6 months, provided that requirements to transportation and storage are followed.

4.4. Every pipe, except of pipes made of steel 12Х18Н12Т, 08Х16Н9М2 and 10Х13Г2БС2Н2Д2, shall have colour marking applied with indelible paint in one longitudinal band at full pipe length for pipes 25 mm in diameter and over and in circular bands applied every 2 m at pipe length for pipes less than 25 mm in diameter.

On agreement between manufacturer and customer it is permitted to apply colour marking in circular bands on pipe ends only or furnish pipes without colour marking.

Depending on steel grade colour marking will be as follows:

20	- green;
20 (hot-extruded and hot-extruded reduced pipes produced of continuous-cast billets)	- two green bands;
20-ПВ	-light blue;
15ГС	- brown;
15ХМ	- yellow;
12Х1МФ (12Cr1MoVa),	- red;
12Х1МФ (12Cr1MoVa), (hot-extruded pipes produced of continuous-cast billets)	- two red bands;
12Х1МФ-ПВ (12Cr1MoVa-PV),	-orange;
15Х1М1Ф	- white;
12Х2МФСР	- blue;
10Х9МФБ-Ш	- violet;
12Х11В2МФ	- black.

4.5 Ends of every pipe 108 mm and under in diameter shall be tightly closed with special protective plugs (caps).

On customer's request pipes can be furnished without plugs.

Pipes up to 89 mm in diameter shall be furnished packed in paper, cloths or crate.

4.6 On customer's request pipes shall have temporary protective coating providing required anti-rust protection of pipe surface. Method of corrosion-proofing and depreservation shall correspond to GOST 9.014.

4.7 Pipes up to 159 mm in diameter inclusive shall be furnished in bundles securely tied in two or three places along the bundle.

Pipes from 159 mm to 245 mm in diameter shall be supplied by the piece or in bundles, pipes in diameter of 245 mm and over are supplied by the piece.

Weight of bundle shall not exceed 5 tons and at customer's request 3 tons.

4.8 Cold-formed and warm-warmed pipes of steel grades 08Х16Н9М2, 12Х18Н12Т and 10Х13Г12БС2Д2Н2 shall be wrapped in paper and packed in boxes or crates in a way ensuring their safety while in transportation. In that case pipe ends are not covered with plugs.

4.9 Every bundle and every box is provided with a tag securely attached thereto and indicating the following:

- manufacturer's trade mark;
- steel grade and steelmaking process (for steel process - Ш and - ПВ);
- pipe size, manufacturing precision, fixed length, mm;
- lot number, except of pipes normalized as heated by rolling;
- heat number;
- weight, kg;
- number of pipes, pieces;
- meterage for cold-formed and warm-formed pipes;
- P.O. number;
- technical specification number.

4.10 Every lot of pipes and every delivery volume shall be accompanied with pipe quality documents confirming their quality and compliance with requirements of this technical specification.

Document of pipe quality ahs to contain the following:

-customer's name;
- P.O. number;
- name and location of manufacturer;
- pipe manufacturing method;
- pipe size, manufacturing precision, fixed length, mm;
- steel grade and steelmaking process (for steel process - Ш and - ПВ);
- number of this technical specification;
- chemical composition including elements derived by calculation;
- number of this technical specification for round billets and name of billet producer;
- lot number, except of pipes normalized as heated by rolling;
- heat number;
- actual appearance and heat treatment mode or a note of pipe normalization as heated by rolling with indication of finishing temperature;

- pipe number for pipes 114 mm and over in diameter;
- results of all tests including complementary tests;
- data of pipe metal contamination with non-metallic inclusions;
- note of ultrasonic flaw detection process with indication of type and dimensions of artificial reflector;
- note of magnetic or eddy-current test process with indication of type and dimensions of artificial reflector;
- notes of hydrostatic pressure, microstructure, yield strength at elevated temperatures and long-term strength ensuring with indication of permit number;
- seal and signature of quality control section manager, date of quality document.

5 MANUFACTURER'S WARRANTY

5.1 Manufacturer warrants compliance of pipes with requirements of this technical specification provided a customer meets all requirements to transportation and storage.

Table A1 Theoretical weight of 1 m of hot-formed carbon, low-alloy and martencitic chromium steel pipes with ρ= 7,85

Outside diameter, mm	Theoretical weight of 1 m of pipe, kg, at wall thickness, mm																
	2,5	3,0	3,5	4,0	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0	9,0	10,0	11,0	12,0	
25	1,26	1,68	1,86	2,07	2,28	2,46	-	-	-	-	-	-	-	-	-	-	
28	1,57	1,85	2,11	2,37	2,61	2,84	-	-	-	-	-	-	-	-	-	-	
32	1,82	2,15	2,46	2,76	3,05	3,33	-	-	-	-	-	-	-	-	-	-	
36	2,07	2,44	2,81	3,16	3,50	-	-	-	-	-	-	-	-	-	-	-	
38	2,19	2,59	2,98	3,35	3,72	4,07	4,41	4,74	-	-	-	-	-	-	-	-	
40	-	2,74	3,15	3,55	3,94	4,32	-	-	-	-	-	-	-	-	-	-	
42	2,44	2,89	3,32	3,75	4,16	4,56	4,95	5,33	-	-	-	-	-	-	-	-	
45	-	-	3,58	4,04	4,49	4,93	5,36	5,77	-	-	-	-	-	-	-	-	
48	-	-	3,84	4,34	4,82	5,30	5,76	6,21	-	-	-	-	-	-	-	-	
50	-	-	4,10	4,54	5,05	5,55	6,04	6,51	-	-	-	-	-	-	-	-	
51	-	-	4,19	4,64	5,16	5,67	6,17	6,66	-	-	-	-	-	-	-	-	
54	-	-	4,36	4,93	5,49	6,04	6,57	7,10	-	-	-	-	-	-	-	-	
55	-	-	4,45	5,03	5,60	6,17	6,71	7,25	-	-	-	-	-	-	-	-	
57	-	-	4,72	5,35	5,96	6,56	7,14	7,71	8,27	8,81	9,35	9,87	10,87	11,82	12,71	13,56	
60	-	.	4,99	5,65	6,30	6,94	7,56	8,17	8,76	9,35	9,92	10,47	11,55	12,58	13,55	14,47	
76	-	-	6,41	7,27	8,12	8,96	9,78	10,59	11,39	12,18	12,95	13,71	15,19	16,62	18,00	19,32	
83	-	-	6,95	7,98	8,92	9,84	10,75	11,65	12,54	13,42	14,28	15,12	16,78	18,39	19,94	21,44	
89	-	-	7,47	8,58	9,60	10,60	11,59	12,56	13,53	14,48	15,41	16,34	18,15	19,90	21,61	23,26	
102	-	-	-	-	11,08	12,24	13,40	14,54	15,66	16,78	17,88	18,97	21,10	23,19	25,22	27,21	
108	-	-	-	-	11,76	13,00	14,23	15,45	16,65	17,84	19,02	20,18	22,47	24,71	26,89	29,03	
114	-	-	-	-	-	14,40	15,76	17,11	18,44	19,76	21,06	22,35	24,89	27,37	29,79	32,16	
121	-	-	-	-	-	15,32	16,78	18,22	19,64	21,06	22,45	23,84	25,56	29,23	31,84	34,39	
133	-	-	-	-	-	16,92	18,53	20,13	21,71	23,28	24,84	26,38	29,42	32,41	35,34	38,20	
140	-	-	-	-	-	-	-	21,24	22,92	24,58	26,23	27,87	31,09	34,26	37,38	40,43	
146	-	-	-	-	-	-	-	22,20	23,95	25,70	27,42	29,14	32,52	35,85	39,13	42,34	
152	-	-	-	-	-	-	-	23,15	24,99	26,81	28,62	30,41	33,96	37,44	40,88	44,25	
159	-	-	-	-	-	-	-	24,26	26,19	28,11	30,01	31,90	35,63	39,30	42,92	46,48	
168	-	-	-	-	-	-	-	-	27,74	29,78	31,80	33,80	37,77	41,69	45,54	49,34	
194	-	-	-	-	-	-	-	-	-	34,60	36,97	39,32	43,98	48,58	53,12	57,61	
219	-	-	-	-	-	-	-	-	-	-	41,94	44,62	49,94	55,21	60,41	65,56	
245	-	-	-	-	-	-	-	-	-	-	-	-	56,14	62,10	67,99	73,83	
273	-	-	-	-	-	-	-	-	-	-	-	-	58,60	68,52	76,16	82,74	
299	-	-	-	-	-	-	-	-	-	-	-	-	-	76,41	83,74	91,01	
325	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	92,63	
351	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
377	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table A1 (continued)

Outside diameter, mm	Theoretical weight of 1 m of pipe, kg, at wall thickness, mm															
	13,0	14,0	15,0	16,0	17,0	18,0	19,0	20,0	22,0	24,0	25,0	26,0	27,0	28,0	30,0	32,0
57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
76	20,59	21,82	22,99	24,10	25,17	26,18	27,15	28,06	-	-	-	-	-	-	-	-
83	22,89	24,29	25,64	26,93	28,18	29,37	30,51	31,59	-	-	-	-	-	-	-	-.
89	24,87	26,42	27,91	29,36	30,76	32,10	33,39	34,64	-	-	-	-	-	-	-	-
102	29,14	31,02	32,84	34,62	36,34	38,01	39,68	41,20	44,18	-	-	-	-	-	-	-
108	31,11	33,14	35,12	37,04	38,92	40,74	42,51	44,23	47,52	50,59	52,05	53,46	-	-	-	-
114	34,47	36,72	38,92	41,06	43,14	45,16	47,13	49,04	52,69	56,12	57,74	59,31	-	-	-	-
121	36,88	39,32	41,70	44,08	46,29	48,50	50,66	52,75	56,78	60,57	62,38	64,13	-	-	-	-
133	41,02	43,77	46,47	49,12	51,70	54,23	56,70	59,12	63,77	68,20	70,33	72,40	-	76,38	80,12	83,64
140	43,43	46,37	49,26	52,08	54,86	57,57	60,23	62,83	67,86	72,66	74,97	77,23	-	81,58	85,69	89,58
146	45,50	48,60	51,64	54,63	57,56	60,48	63,25	66,01	71,36	76,47	78,95	81,36	-	86,03	90,46	94,67
152	47,57	50,83	54,08	57,18	60,26	63,30	66,27	69,19	74,85	80,29	82,92	85,50	-	90,48	95,24	99,76
159	49,98	53,42	56,81	60,14	63,42	66,64	69,80	72,90	78,94	84,74	87,56	90,32	-	95,68	100,80	105,70
168	53,08	56,76	60,39	63,96	67,48	70,98	74,33	77,67	84,19	90,47	93,53	96,53	-	102,36	107,96	113,33
194	62,04	66,41	70,73	74,99	79,19	83,34	87,43	91,46	99,35	107,01	110,76	114,45	-	121,66	128,64	135,39
219	70,66	75,69	80,67	85,59	90,46	95,27	100,02	104,71	113,93	122,92	127,33	131,68	-	140,21	148,52	156,60
245	79,62	85,34	91,01	96,62	102,18	107,67	113,11	118,50	129,09	139,46	144,56	149,60	-	159,51	169,20	178,65
273	89,27	95,73	102,14	108,50	114,79	121,03	127,32	133,34	145,42	157,28	163,28	168,90	-	180,30	191,46	202,40
299	98,23	105,38	112,48	119,53	126,51	133,44	140,31	147,13	160,59	173,82	180,35	186,82	-	199,60	212,14	224,46
325	107,19	115,03	122,82	130,88	138,28	145,85	153,41	160,91	175,75	190,36	197,58	204,74	-	218,89	232,82	246,52
351	117,44	126,07	134,63	143,14	151,59	159,98	168,32	174,70	190,91	206,90	214,81	222,61	-	238,19	253,49	268,57
377	126,50	135,83	145,09	154,30	168,45	172,54	181,57	188,48	206,08	223,44	232,13	240,58	-	257,49	274,17	290,63
426	-	154,22	164,80	175,82	185,78	196,19	206,53	214,46	234,65	254,62	264,52	274,35	-	293,86	313,14	332,20
465	-	-	-	192,06	203,56	215,02	226,41	235,14	257,40	279,43	290,36	301,24	312,10	322,81	344,15	365,28
530	-	-	-	-	-	-	-	-	-	-	-	-	-	344,26	-	-

Table A1 (continued)

Outside diameter, mm	Theoretical weight of 1 m of pipe, kg, at wall thickness, mm														
	34,0	36,0	38,0	40,0	42,0	45,0	48,0	50,0	56,0	60	65	70	75	80	90
57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
102	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
114	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
121	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
133	86,93	89,99	-	-	-	-	-	-	-	-	-	-	-	-	-
140	93,24	96,67	-	-	-	-	-	-	-	-	-	-	-	-	-
146	98,65	102,40	-	-	-	-	-	-	-	-	-	-	-	-	-
152	104,06	108,13	-	-	-	-	-	-	-	-	-	-	-	-	-
159	110,37	314,81	-	-	-	-	-	-	-	-	-	-	-	-	-
168	118,49	123,40	128,08	132,55	-	-	-	-	-	-	-	-	-	-	-
194	141,91	148,21	154,28	160,12	165,73	173,72	-	-	-	-	-	-	-	-	-
219	164,45	172,07	179,46	186,63	193,56	203,54	213,01	219,03	-	-	-	-	-	-	-
245	187,88	196,88	205,65	215,26	222,51	234,56	246,09	253,50	-	-	-	-	-	-	-
273	213,12	223,60	233,86	243,89	253,69	267,96	281,72	290,61	315,91	331,60	-	-	-	-	-
299	236,55	248,42	260,05	271,46	289,64	298,98	314,80	325,07	354,51	372,99	-	-	-	-	-
325	259,99	273,23	286,24	299,03	311,58	329,99	347,89	359,54	393,10	414,34	-	-	-	-	-
351	283,42	298,04	312,43	326,60	340,53	361,01	380,97	395,99	431,70	455,70	-	-	-	-	-
377	306,86	322,85	388,62	354,17	369,18	392,08	414,06	428,46	470,30	497,05	-	526,33	-	-	-
426	351,02	369,62	387,98	406,12	424,04	450,48	476,41	498,41	543,04	574,99	-	-	-	677,94	770,04
465	366,17	406,84	427,27	447,48	-	-	-	-	560,96	-	636,79	-	716,39	-	-
530	-	-	-	480,04	-	-	-	-	-	-	740,27	-	-	-	-

Note – Calculation of theoretical weight of pipe is produced from arithmetical mean values of diameter and wall thickness subject to unsymmetry of maximum variations.

Annex A (informative)

Table A2 Theoretical weight of 1 m of hot-formed high-alloy pipes with ρ = 7,90

Outside diameter, mm	Theoretical weight of 1 m of pipe, kg, at wall thickness, mm													
	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0	8,5	9,0	9,5	10,0	11,0	12,0
76	8,22	9,07	9,90	10,73	11,54	12,33	13,11	13,88	14,64	15,38	16,11	16,83	18,22	19,56
83	9,03	9,96	10,89	11,80	12,70	13,58	14,46	15,32	16,16	16,99	17,81	18,62	20,19	21,71
89	9,72	10,73	11,73	10,73	11,54	12,33	13,11	13,88	14,64	15,38	16,11	16,83	18,22	19,56
102	-	12,40	13,56	14,72	15,86	16,99	18,10	19,21	20,29	21,37	22,43	23,48	25,54	27,55
108	-	13,17	14,41	15,64	16,86	18,06	19,26	20,43	21,60	22,75	22,89	25,02	27,23	29,39
114	-	13,93	15,25	16,56	17,86	19,14	20,41	21,66	22,91	24,13	25,35	26,55	28,92	31,24
121	-	14,83	16,24	17,64	19,02	20,39	21,75	23,10	24,43	25,75	27,05	28,35	30,89	33,39
133	-	16,36	17,93	19,48	21,02	22,54	24,05	25,55	27,03	28,51	29,97	31,42	34,27	37,07
140	-	-	-	20,55	22,18	23,80	25,40	26,99	28,56	30,12	31,67	33,21	36,24	39,22
146	-	-	-	22,48	24,25	26,02	27,77	29,51	31,23	32,93	34,63	36,30	39,62	42,87
152	-	-	-	23,44	25,30	27,15	28,98	30,79	32,60	34,38	36,16	37,92	41,39	44,81
159	-	-	-	24,57	26,52	28,46	30,39	32,30	34,19	36,07	37,94	39,79	43,46	47,06
168	-	-	-	-	-	30,15	32,20	34,23	36,25	38,25	40,24	42,21	46,11	49,96
194	-	-	-	-	-	-	-	-	-	44,53	46,87	49,19	53,79	58,33
219	-	-	-	-	-	-	-	-	-	-	-	55,90	61,17	66,39
245	-	-	-	-	-	-	-	-	-	-	-	-	68,85	74,76
273	-	-	-	-	-	-	-	-	-	-	-	-	77,12	83,78
325	-	-	-	-	-	-	-	-	-	-	-	-	-	100,53

Table A2 (continued)

Outside diameter, mm	Theoretical weight of 1 m of pipe, kg, at wall thickness, mm													
	14,0	15,0	16,0	17,0	18,0	19,0	20,0	22,0	24,0	25,0	26,0	28,0	30,0	32,0
76	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	24,6	25,96	-	-	-	-	-	-	-	-	-	-	-	-
89	26,75	28,26	-	-	-	-	-	-	-	-	-	-	-	-
102	31,41	33,26	35,05	36,80	38,49	40,13	40,72	-	-	-	-	-	-	-
108	33,56	35,56	37,51	39.41	41,26	43,05	44,79	-	-	-	-	-	-	-
114	35,71	37,89	39,97	42,02	44,02	45,97	47,86	51,49	-	-	-	-	-	-
121	39,21	40,55	42,83	45,06	47,24	49,37	51,44	55,43	59,21	61,03	62,78	-	-	-
133	42,51	45,16	47,75	50,29	52,77	55,21	57,59	62,19	66,59	68,70	70,77	74,74	78,51	82,06
140	45,02	47,84	50,62	53,33	56,00	58,61	61,17	66,13	70,88	73,18	75,43	79,76	73,88	87,80
146	49,21	52,29	55,32	58,28	61,19	64,04	66,84	72,25	77,44	79,94	82,39	87,11	91,60	95,86
152	51,47	54,71	57,89	61,02	64,09	67,10	70,06	75,80	81,30	83,97	86,58	91,62	96,43	101,01
159	54,10	57,53	60,90	64,22	52,77	55,21	73,82	79,93	85,81	88,66	91,46	96,88	102,07	107,03
168	57,48	61,15	64,77	68,32	71,82	75,26	78,65	85,24	91,61	94,70	97,74	103,64	109,32	114,76
194	67,25	71,62	75,93	80,19	84,39	88,52	92,61	100,60	108,36	112,15	115,89	123,19	130,25	137,09
219	76,64	81,69	86,67	91,60	96,46	101,28	106,03	115,36	124,46	128,93	133,34	141,98	150,39	158,56
245	86,41	92,15	97,84	103,46	109,03	114,54	119,99	130,72	141,21	146,38	151,48	161,52	171,32	180,90
273	96,94	103,43	109,86	116,26	122,56	128,82	132,02	147,25	159,25	165,17	-	-	-	-
325	116,48	124,36	132,20	139,97	147,68	155,34	162,94	177,96	192,75	200,06	-	-	-	-

Note – Calculation of theoretical weight of pipe is produced from arithmetical mean values of diameter and wall thickness subject to unsymmetry of maximum variations.

Table A3 Theoretical weight of 1 m of cold- and warm-formed carbon, low-alloy and martensitic chromium steel pipes with p = 7,85

Outside diameter, mm	Theoretical weight of 1 m of pipe, kg, at wall thickness, mm																	
	2,0	2,5	3,0	3,5	4,0	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0	9,0	10,0	11,0	12,0	13,0
10	0,395	0,462	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	0,493	0,586	0,666	-	-	-	-	.	-	-	-	-	-	-	-	-	-	-
16	0,691	0,832	0,962	1,08	1,18	-	-	-	-	-	-	-	-	-	-	-	-	-
20	0,888	1,08	1,26	1,42	1,58	1,72	1,85	-	-	-	-	-	-	-	-	-	-	-
22	0,986	1,20	1,41	1,60	1,77	1,94	2,10	-	-	-	-	-	-	-	-	-	-	-
25	1,13	1,39	1,63	1,86	2,07	2,28	2,47	2,64	2,81	-	-	-	-	-	-	-	-	-
28	1,28	1,57	1,85	2,11	2,37	2,61	2,84	3,05	3,26	3,45	3,63	3,79	3,94	-	-	-	-	-
30	1,38	1,70	2,00	2,29	2,56	2,83	3,03	3,32	3,55	3,77	3,97	4,16	4,34	.	_	.	-	.
32	1,48	1,76	2,15	2,46	2,76	3,05	3,33	3,59	3,85	4,09	4,32	4,53	4,74	.	-	-	-	-
36	1,68	2,07	2,44	2,81	3,16	3,50	3,82	4,14	4,44	4,73	5,01	5,27	5,52	-	-	-	-	-
38	1,78	2,19	2,59	2,98	3,35	3,72	4,07	4,41	4,74	5,05	5,35	5,64	5,92	6,44	-	-	-	-
40	-	2,31	2,74	3,15	3,55	3,94	4,32	4,68	5,03	5,37	5,70	6,01	6,31	6,88	7,40	7,87	-	-
42	-	2,44	2,89	3,32	3,75	4,16	4,56	4,95	5,33	5,69	6,04	6,38	6,71	7,32	7,89	8,41	-	-
45	-	2,62	3,11	3,58	4,04	4,49	4,93	5,36	5,77	6,17	6,56	6,94	7,30	7,99	8,63	9,22	-	-
48	-	2,81	3,33	3,84	4,34	4,83	5,30	5,76	6,21	6,65	7,08	7,49	7,89	8,66	9,37	10,00	-	-
50	-	2,93	3,48	4,01	4,54	5,05	5,55	6,04	6,51	6,97	7,42	7,86	8,29	9,10	9,86	10,59	-	-
51	-	2,99	3,55	4,10	4,64	5,16	5,67	6,17	6,66	7,13	7,60	8,05	8,48	9,32	10,11	10,85	11,54	-
54	-	3,18	3,77	4,36	4,93	5,49	6,04	6,58	7,10	7,61	8,11	8,60	9,08	9,99	10,85	11,67	12,43	-
55	-	3,24	3,85	4,44	5,03	5,60	6,16	6,71	7,25	7,77	8,28	8,78	9,27	10,21	11,10	11,93	12,72	-
57	-	3,36	4,00	4,62	5,23	5,83	6,41	6,99	7,55	8,10	8,63	9,16	9,67	10,65	11,59	12,48	13,32	-
60	-	-	4,22	4,88	5,52	6,16	6,78	7,39	7,99	8,58	9,15	9,71	10,26	11,32	12,33	13,29	14,21	-
63	-	-	4,44	5,13	5,81	6,49	7,14	7,77	8,41	9,04	9,57	10,23	10,81	11,96	13,05	14,07	15,09	-
70	-	-	4,96	5,74	6,51	7,27	8,01	8,75	9,47	10,18	10,88	11,56	12,23	13,54	14,80	16,01	17,16	18,27
76	-	-	-	-	7,10	7,93	8,75	9,56	10,36	11,14	11,91	12,67	13,42	14,87	16,28	17,63	18,94	20,20
83	-	-	-	-	7,79	8,71	9,62	10,51	11,39	12,26	13,12	13,96	14,80	16,42	18,00	19,53	21,01	22,44
89	-	-	-	-	8,38	9,38	10,36	11,33	12,28	13,22	14,16	15,07	15,98	17,76	19,48	21,16	22,79	24,36
102	-	-	-	-	-	10,82	11,96	12,09	14,21	15,31	16,40	17,48	18,55	20,64	22,69	24,69	26,63	28,53
108	-	-	-	-	-	11,49	12,70	13,90	15,09	16,27	17,44	18,59	19,73	21,97	24,17	26,31	28,41	30,45

Note – Calculation of theoretical weight of pipe is produced from arithmetical mean values of diameter and wall thickness subject to unsymmetry of maximum variations.

Annex A (informative)

Table A4 Theoretical weight of 1 m of cold- and warm-formed high-alloy steel grades with p = 7,90

Outside diameter, mm	Theoretical weight of 1 m of pipe, kg, at wall thickness, mm															
	2,0	2,5	3,0	3,5	4,0	4,5	5,0	5,5	6,0	6,5	7,0	8,0	9,0	10,0	11,0	12,0
10	0,40	0,47	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	0,50	0,59	0,67	-	-	-	-	-	-	-	-	-	-	-	-	-
16	0,70	0,84	0,97	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	1,09	1,27	1,44	1,60	-	-	-	-	-	-	-	-	-	-	-
22	-	1,22	1,42	1,62	1,80	-	-	-	-	-	-	-	-	-	-	-
25	-	1,40	1,65	1,88	2,10	2,30	2,50	-	-	-	-	-	-	-	-	-
28	-	1,59	1,87	2,14	2,40	2,64	2,87	-	-	-	-	-	-	-	-	-
30	-	-	2,02	2,32	2,60	2,87	3,12	3,36	-	-	-	-	-	-	-	-
32	-	-	2,17	2,49	2,80	3,09	3,37	3,64	3,90	4,14	4,37	4,79	-	-	-	-
36	-	-	4,47	2,84	3,20	3,54	3,87	4,19	4,49	4,79	5,07	5,59	-	-	-	.
38	-	-	2,62	3,02	3,40	3,76	4,12	4,46	4,79	5,11	5,42	5,99	-	-	-	-
40	-	-	-	3,19	3,60	3,99	4,37	4,74	5,09	5,44	5,77	6,39	-	-	-	-
42	-	-	-	3,36	3,80	4,21	4,62	5,01	5,39	5,76	6,12	6,79	-	-	-	-
45	-	-	3,15	3,63	4,10	4,55	4,99	-	-	-	-	-	-	-	-	-
48	-	-	3,37	3,89	4,39	4,89	5,37	-	-	-	-	-	-	-	-	-
50	-	-	3,52	4,06	4,59	5,11	5,62	-	-	-	-	-	-	-	-	-
53	-	-	3,74	4,33	4,89	5,45	5,99	-	-	-	-	-	-	-	-	-
56	-	-	3,97	4,59	5,19	5,79	6,37	-	-	-	-	-	-	-	-	-
57	-	-	4,04	4,68	5,29	5,90	6,49	-	-	-	-	-	-	-	-	-
60	-	-	4,27	4,94	5,59	6,24	6,87	-	-	-	-	-	-	-	-	-
76	-	-	-	-	7,10	7,93	8,75	9,56	10,35	11,14	11,91	13,41	-	-	-	-
89	-	-	-	-	8,38	9,38	10,35	11,32	12,28	13,22	14,15	15,98	-	-	-	-

Note – Calculation of theoretical weight of pipe is produced from arithmetical mean values of diameter and wall thickness subject to unsymmetry of maximum variations.

ANNEX B (mandatory)

Scale No. 1 Ferrite-pearlite structure banding for steels with increased carbon content up to 0,25%.

Шкала № 2 Widmanstatten pattern (acicularity of ferrite) for steel with carbon content up to 0,10%.

Шкала № 3 Metal microstructures of pipes produced of steel grades 12Х1МФ, 12ХШФ-ПВ, 15Х1М1Ф, 12Х2МФСР.

1 Metal microstructures of pipes produced of steel 12Х1МФ, 12Х1МФ-ПВ

Acceptable microstructures:

No.1 – ммicrostructure contains from 100 to 30% of tempered bainite and pearlite plus ferrite;

No.3 - ммicrostructure contains from 30 to 20% of tempered bainite and pearlite plus ferrite;

Nos. 4-5 - ммicrostructure contains from 20 to 15% of tempered bainite and pearlite plus ferrite.

Rejection microstructures:

No. 6 - microstructure contains from 15 to 5% of tempered bainite and pearlite plus ferrite;
No. 7 – microstructure contains from 5 to 0% of tempered bainite and pearlite plus ferrite;
Nos. 8-9 - microstructure of overheating at tempering above Ac_1.

2 Metal microstructures of pipes produced of steel 5Х1М1Ф Acceptable microstructures:

No. 1 - microstructure contains not less than 100% of tempered bainite;
No. 2 - microstructure contains not less than 80% of tempered bainite;
No. 3 - microstructure contains not less than 60% of tempered bainite;
No. 4 - microstructure contains not less than 40% of tempered bainite;
No. 5 - microstructure contains not less than 20% of tempered bainite.

Rejection microstructures:

No. 6 - ferrite-pearlite microstructure;
Nos. 7-9 - microstructure of overheating at tempering above Ac_1;
No. 10 - microstructure contains 100% of tempered martensite with bainite.

3 Metal microstructures of pipes produced of steel 12Х2МФСР

Acceptable microstructures:

No. 1 - microstructure contains from 100 to 90% of tempered bainite plus ferrite;
No. 2 - microstructure contains from 90 to 70% of tempered bainite plus ferrite;
No. 3 - microstructure contains from 70 to 50% of tempered bainite plus ferrite;
No. 4 - microstructure contains from 50 to 30% of tempered bainite plus ferrite;
No. 5 - microstructure contains from 30 to 15% of tempered bainite plus ferrite.

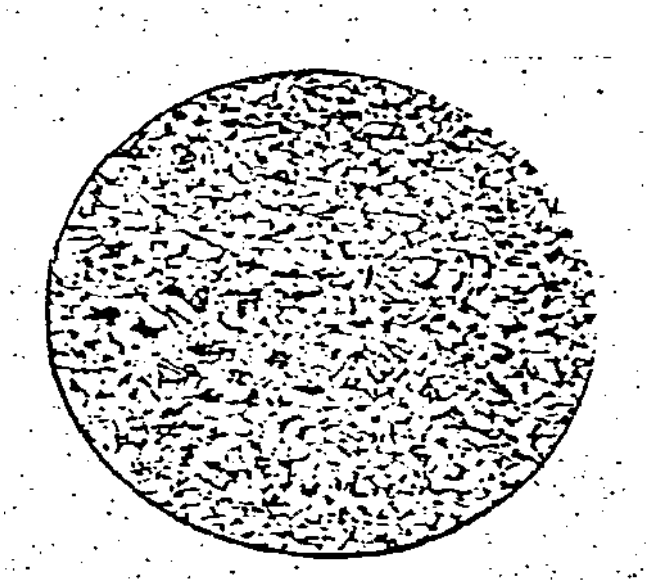
Rejection microstructures:

No. 6 - microstructure contains from 15 до 5% of tempered bainite plus ferrite;
No. 7 - microstructure contains from 5 до 0% of tempered bainite plus ferrite;
No. 8 - microstructure of overheating at tempering above Ac_1.

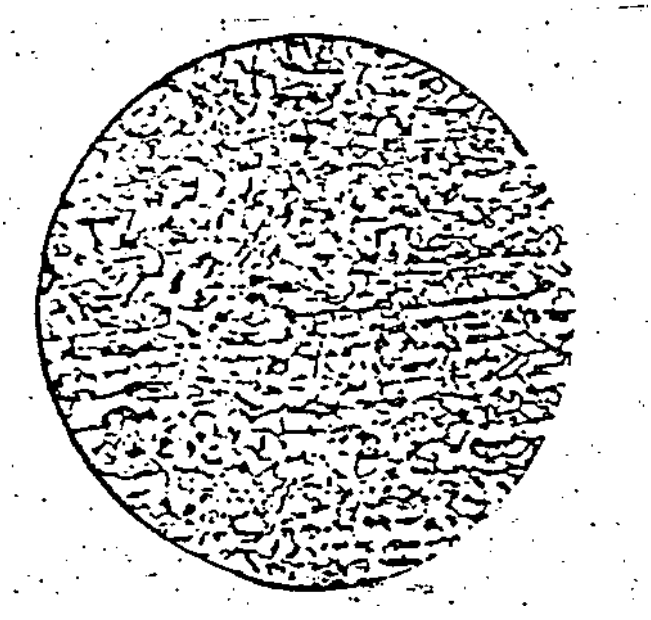
Annex B
(mandatory)

Scale No. 1

Ferrite-pearlite structure banding for steel with carbon content up to 0,25% x 100



Grain Size No. 0

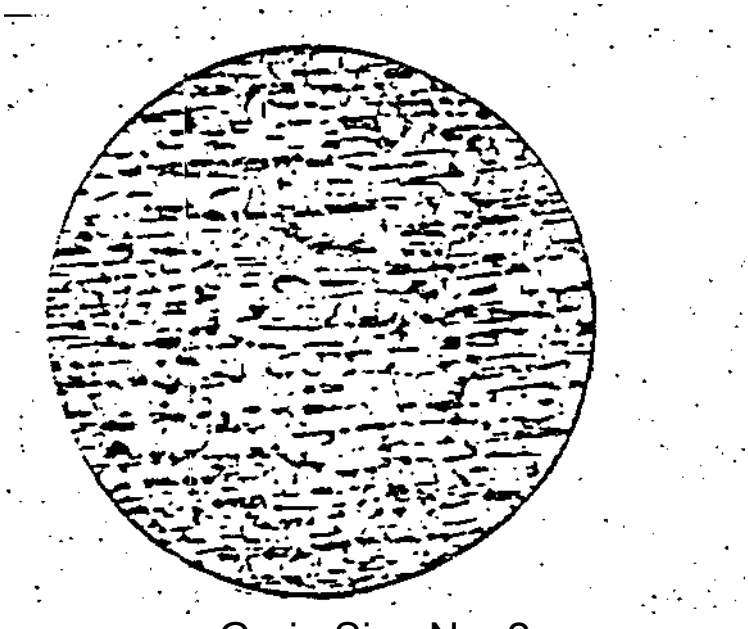


Grain Size No. 1

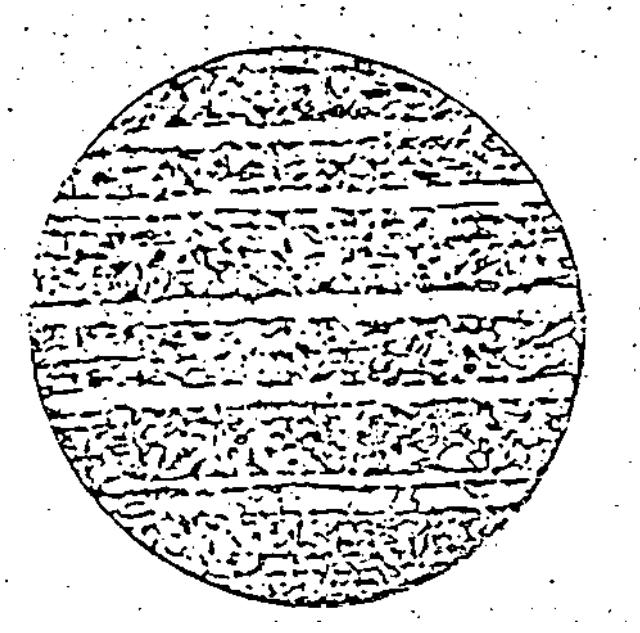
Annex B
(mandatory)

Scale No.1
(continued)

Ferrite-pearlite structure banding for steel with carbon content up to 0,25% x 100



Grain Size No. 2

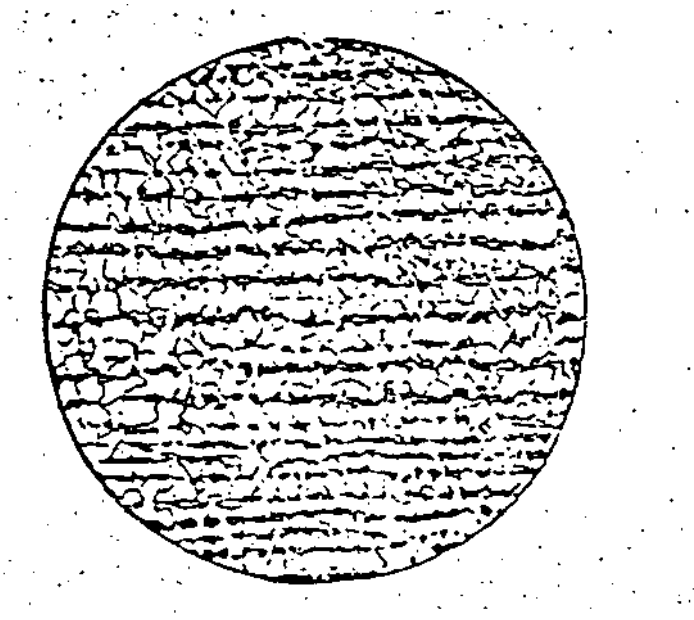


Grain Size No. 3

Annex B
(mandatory)

Scale No.1
(continued)

Ferrite-pearlite structure banding for steel with carbon content up to 0,25% x 100

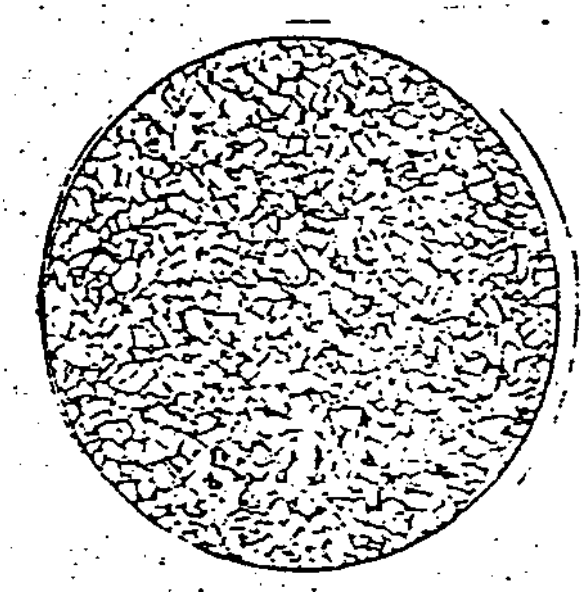


Grain Size No. 4

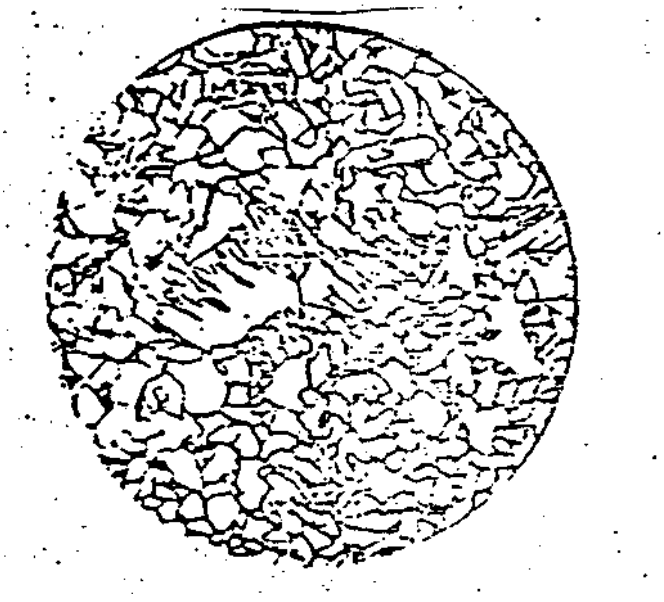
Annex B
(mandatory)

Scale No. 2

Widmanstatten pattern (ferrite acicularity) for steel with carbon content up to 0,15% x 100



Grain Size No. 0

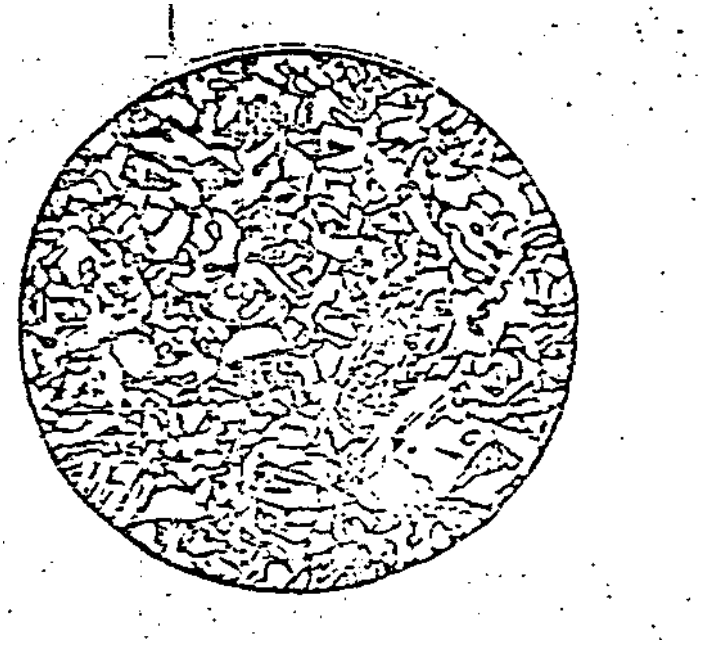


Grain Size No. 1

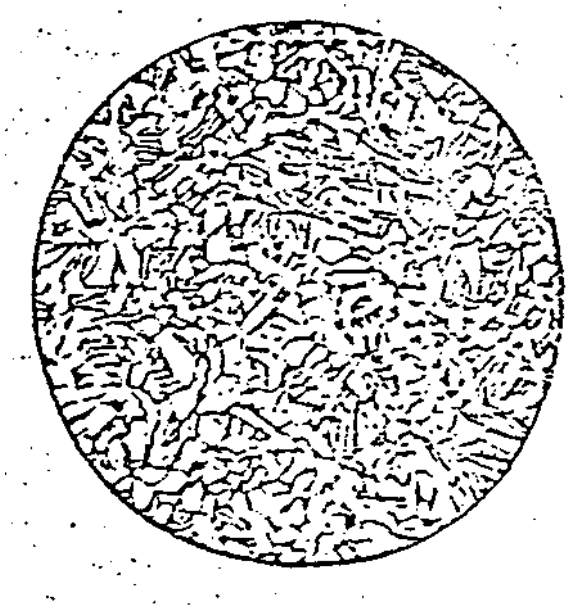
Annex B
(mandatory)

Scale No.2
(continued)

Widmanstatten pattern (ferrite acicularity) for steel with carbon content up to 0,15% x 100



Grain Size No. 2

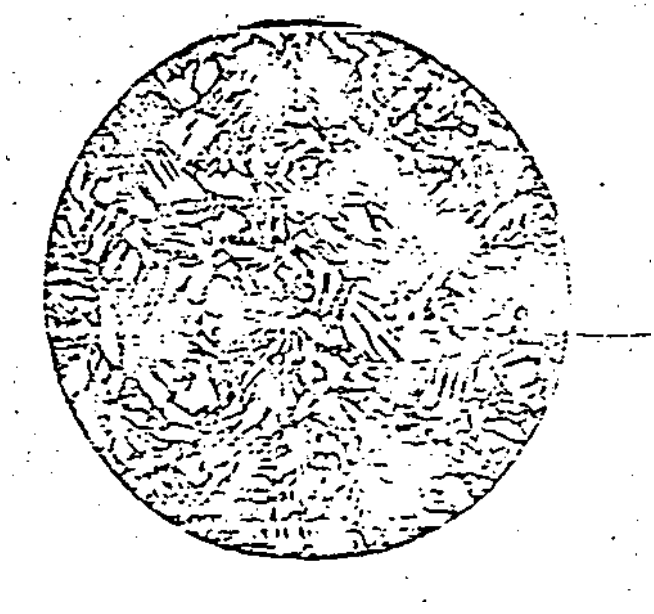


Grain Size No. 3

Annex B
(mandatory)

Scale No.2
(continued)

Widmanstatten pattern (ferrite acicularity) for steel with carbon content up to 0,15% x 100

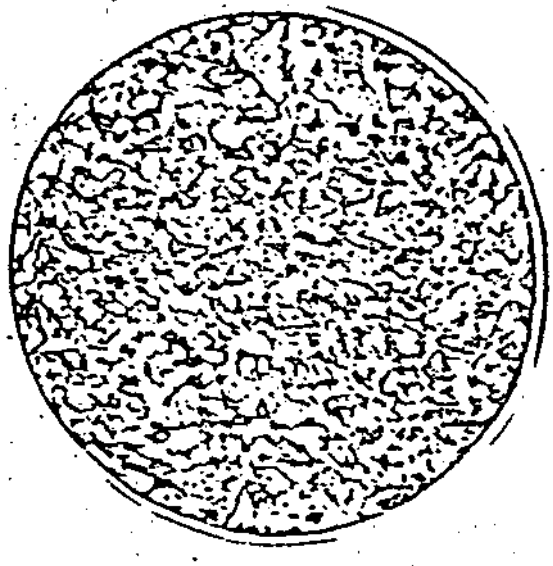


Grain Size No. 4

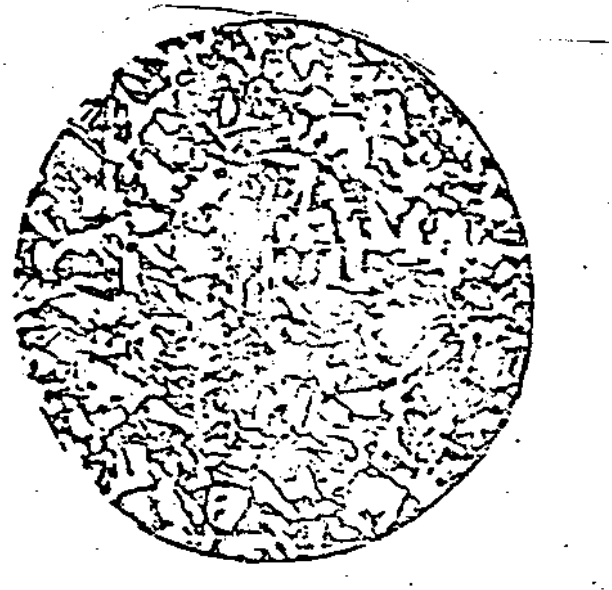
Annex B
(mandatory)

Scale No.2
(continued)

Widmanstatten pattern (ferrite acicularity) for steel with carbon content 0,16 – 0,30% x 100



Grain Size No. 0



Grain Size No. 1

Annex B
(mandatory)

Scale No.2
(continued)

Widmanstatten pattern (ferrite acicularity) for steel with carbon content 0,16 – 0,30% x 100

Grain Size No. 2

Grain Size No. 3

Annex B
(mandatory)

Scale No.2
(continued)

Widmanstatten pattern (ferrite acicularity) for steel with carbon content 0,16 – 0,30% x 100

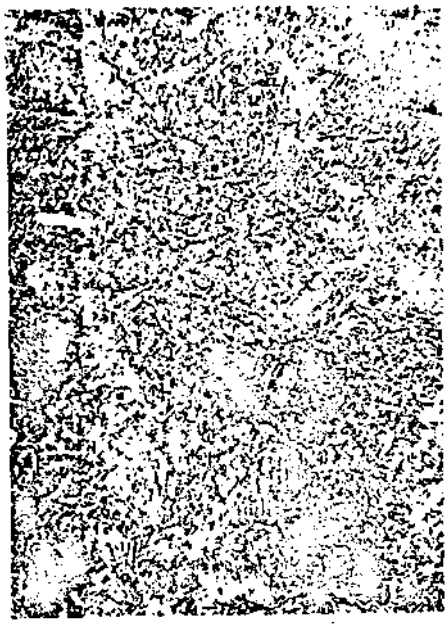
Grain Size No. 4

SCALE No. 3

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ПВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grades 12Х1МФ and 12Х1МФ-ПВ

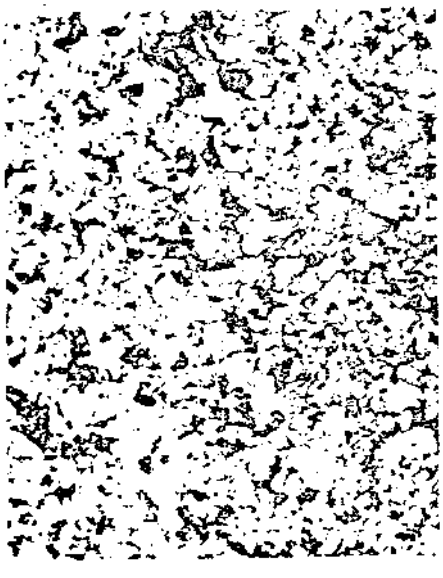
Grain Size No. 1



x 100

x 500

Grain Size No. 2



x 100

x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ІІВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grades 12Х1МФ and 12Х1МФ-ІІВ

Grain Size No. 3

x 100

x 500

Grain Size No. 4

x 100

x 500

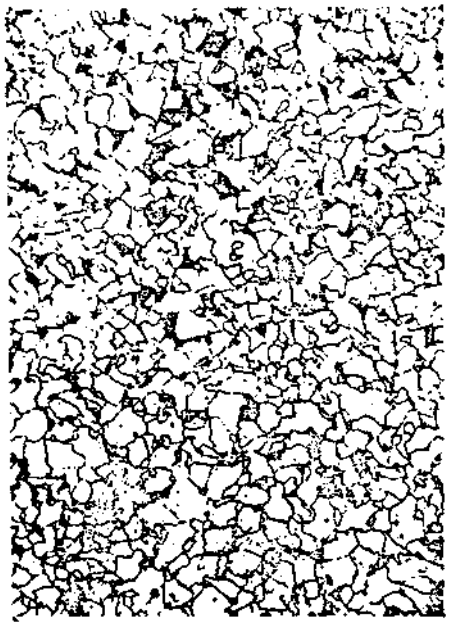
Annex B
(mandatory)

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ІІВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grades 12Х1МФ and 12Х1МФ-ІІВ

Grain Size No. 5



x 100

x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12X1MФ, 12X1MФ-IIB, 15X1M1Ф, 12X2MФCP

Rejected pipe metal structures of steel grades 12X1MФ and 12X1MФ-IIB

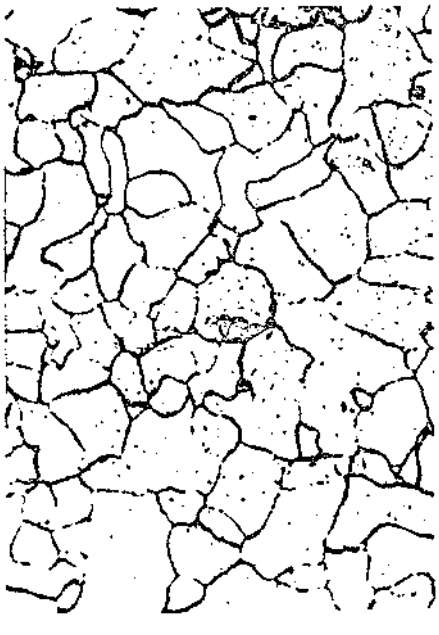
Grain Size No. 6

x 100

x 500

Grain Size No. 7

x 100



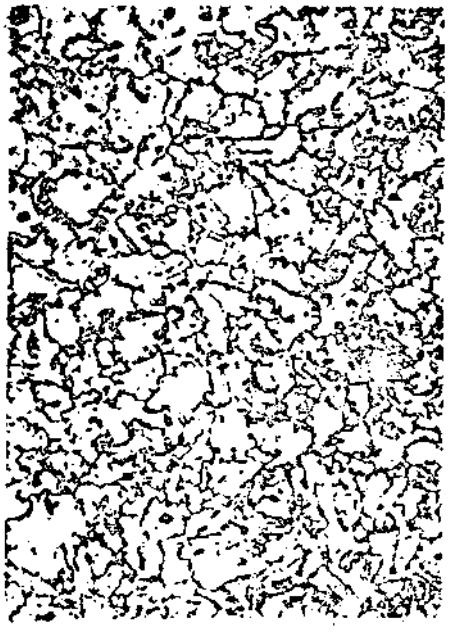
x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ПВ, 15Х1М1Ф, 12Х2МФСР

Rejected pipe metal structures of steel grades 12Х1МФ and 12Х1МФ-ПВ

Grain Size No. 8

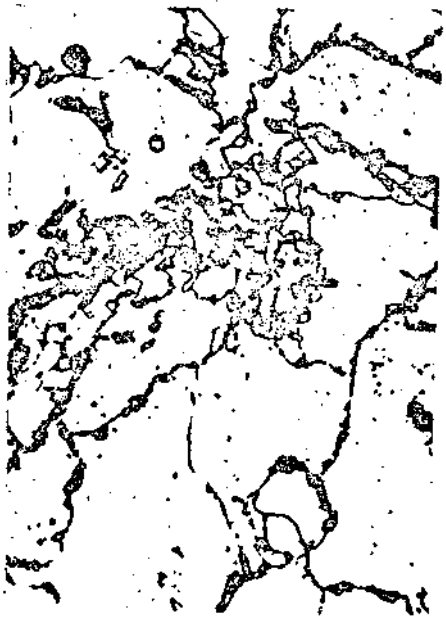


x 100

x 500

Grain Size No. 9

x 100



x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12X1MФ, 12X1MФ-ПВ, 15X1M1Ф, 12X2MФCP

Acceptable pipe metal structures of steel grade 15X1M1Ф

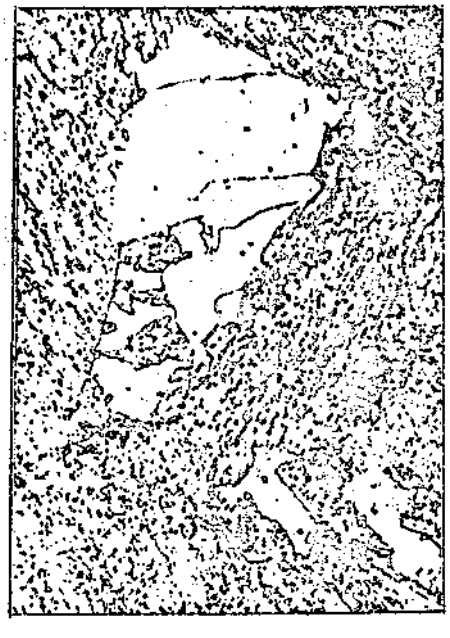
Grain Size No. 1

x 100

x 500

Grain Size No. 2

x 100



x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12X1MФ, 12X1MФ-IIB, 15X1M1Ф, 12X2MФCP

Acceptable pipe metal structures of steel grade 15X1M1Ф

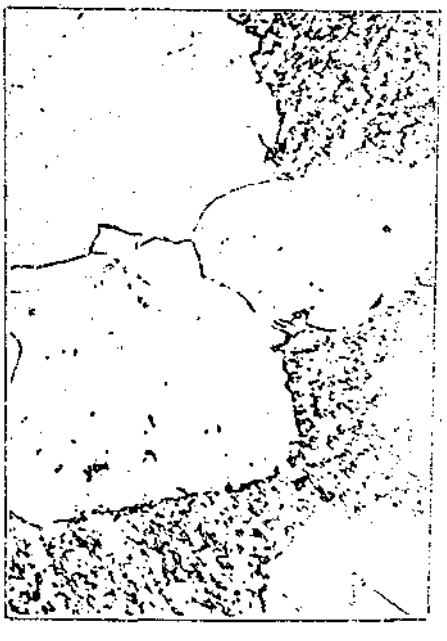
Grain Size No. 3

x 100

x 500

Grain Size No. 4

x 100



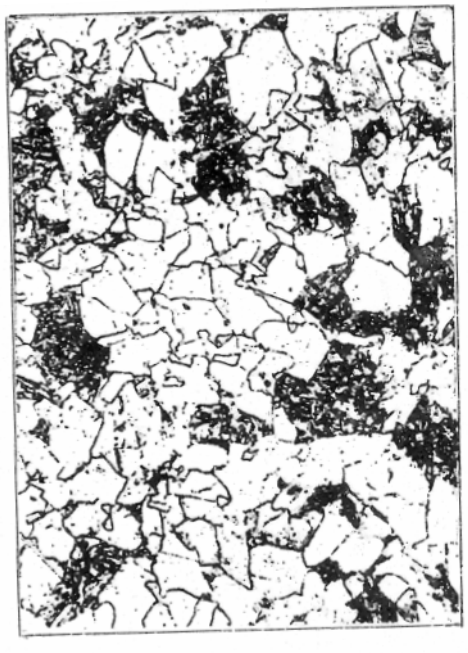
x 500

SCALE No. 3
(continued)

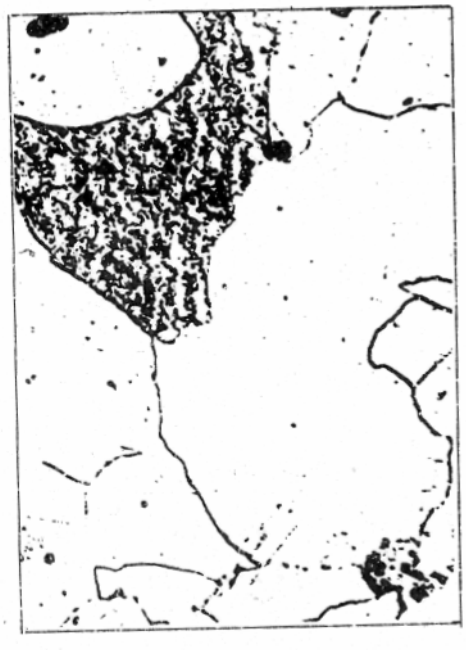
Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ПВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grade 15Х1М1Ф

Grain Size No. 5



x 100



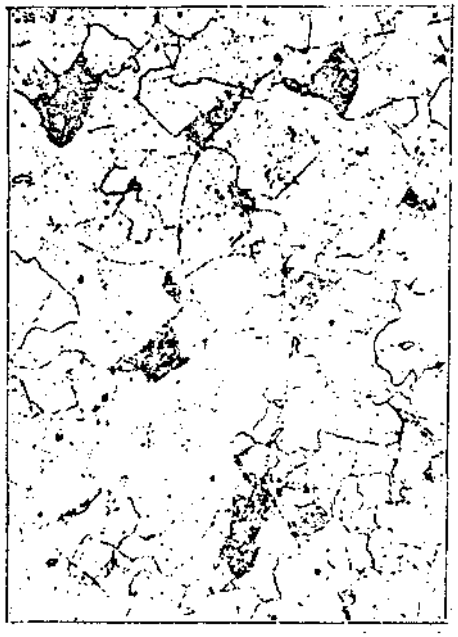
x 500

SCALE No. 3
(continued)

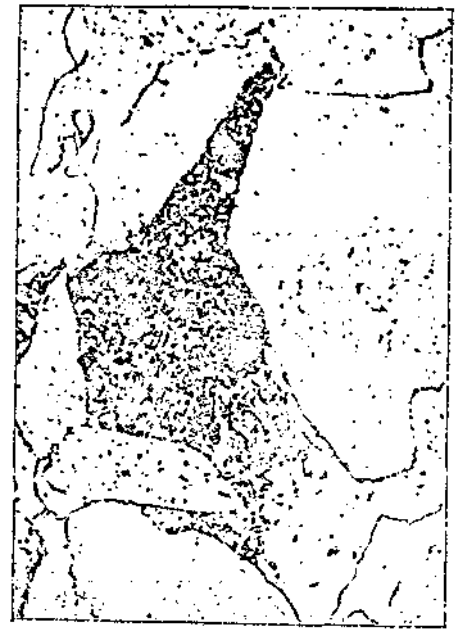
Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ПВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grade 15Х1М1Ф

Grain Size No. 6



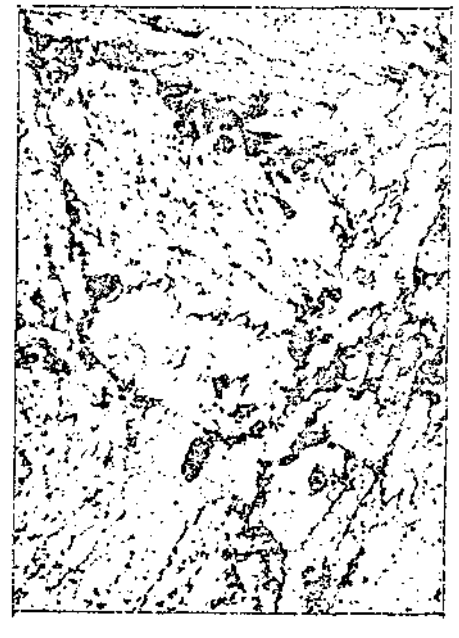
x 100



x 500

Grain Size No. 7

x 100



x 500

Annex B
(mandatory)

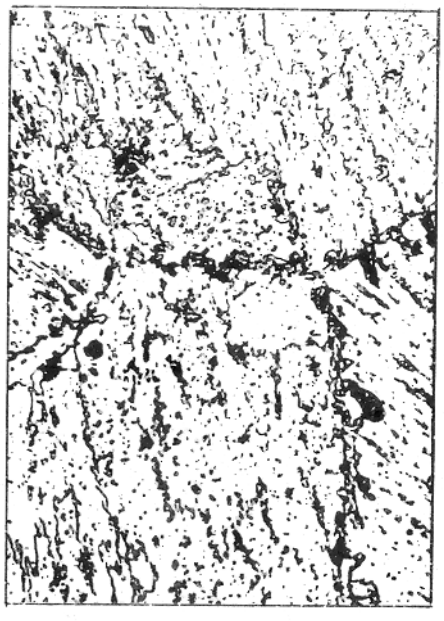
SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ПВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grade 15Х1М1Ф

Grain Size No. 8

x 100



x 500

Grain Size No. 9

x 100

x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12X1MФ, 12X1MФ-ПВ, 15X1M1Ф, 12X2MФCP

Rejected pipe metal structures of steel grade 15X1MlФ

Grain Size No. 10

x 100

x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ІІВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grade 12Х2МФСР

GRANE SIZE No. 1
CHEMICAL ETCHING

x 100

x 500

ELECTROLYTIC ETCHING

x 100

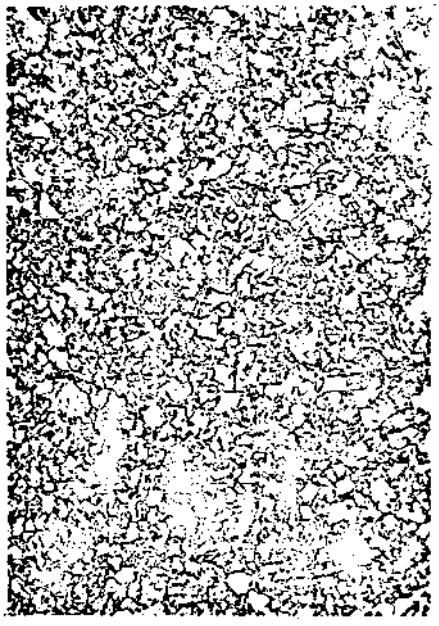
x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ІІВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grade 12Х2МФСР

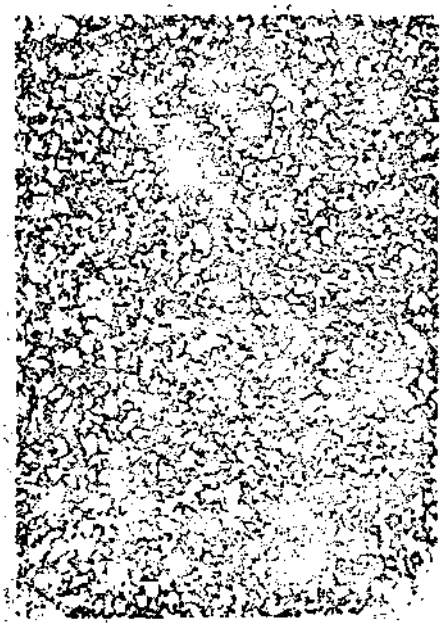
GRANE SIZE No. 2
CHEMICAL ETCHING



x 100

x 500

ELECTROLYTIC ETCHING



x 100

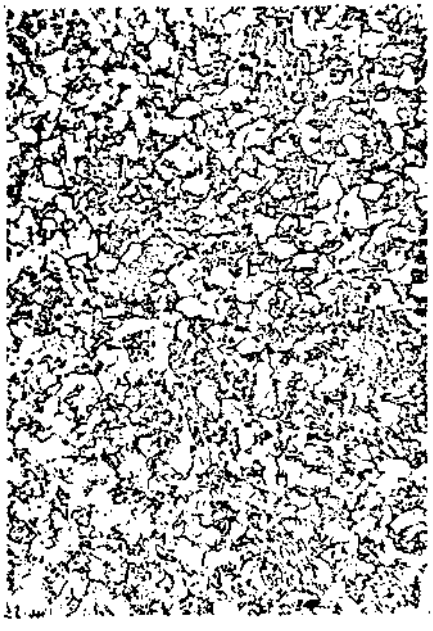
x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ІІВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grade 12Х2МФСР

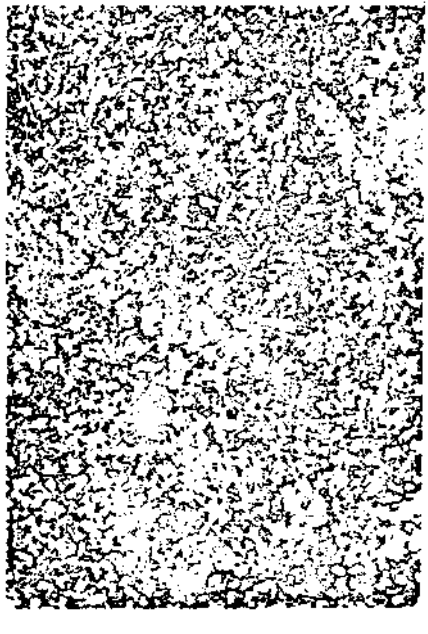
GRANE SIZE No. 3
CHEMICAL ETCHING



x 100

x 500

ELECTROLYTIC ETCHING



x 100

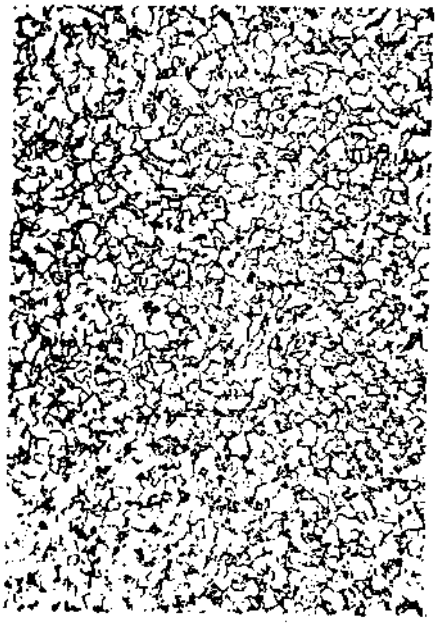
x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ІІВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grade 12Х2МФСР

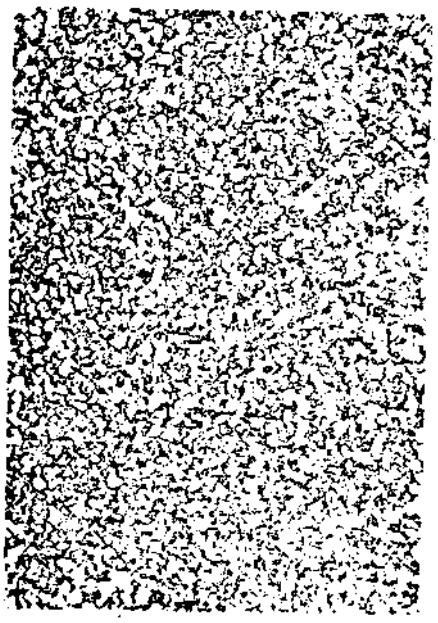
GRANE SIZE No. 4
CHEMICAL ETCHING



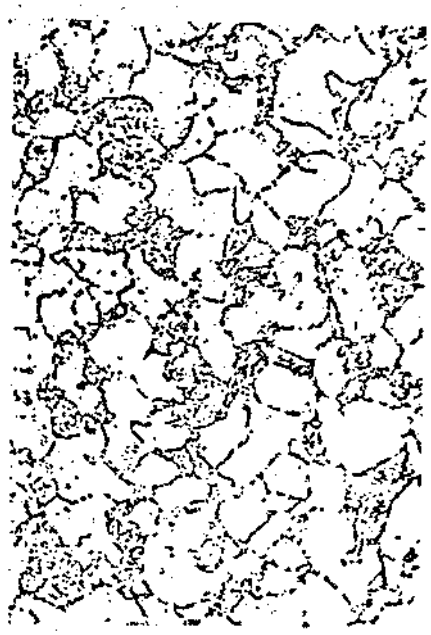
x 100

x 500

ELECTROLYTIC ETCHING



x 100



x 500

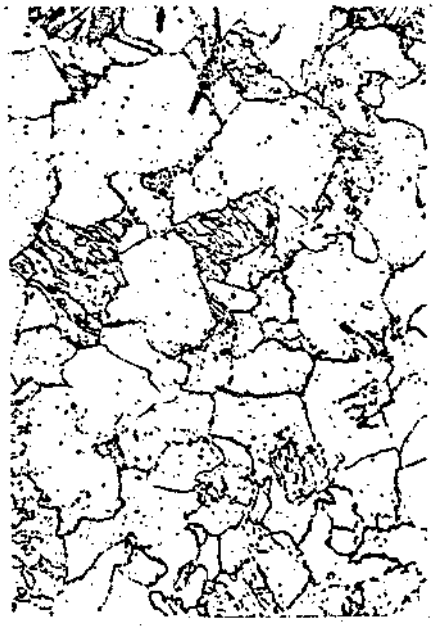
SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ІІВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grade 12Х2МФСР

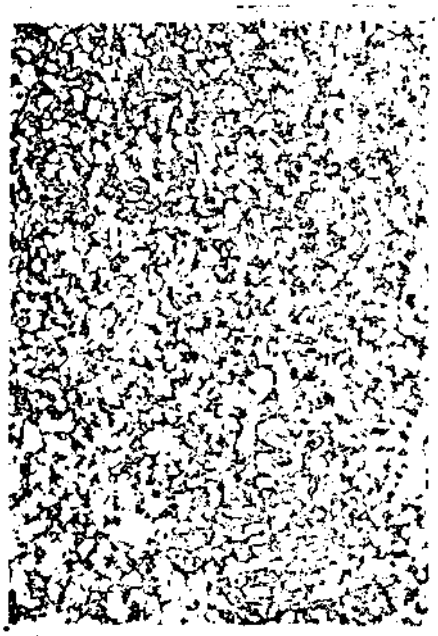
GRANE SIZE No. 5
CHEMICAL ETCHING

x 100

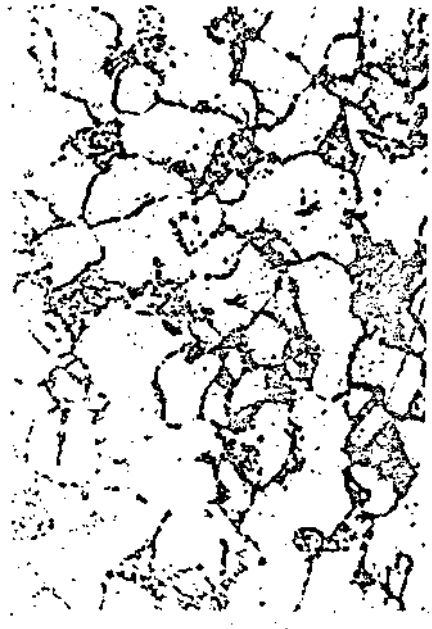


x 500

ELECTROLYTIC ETCHING



x 100



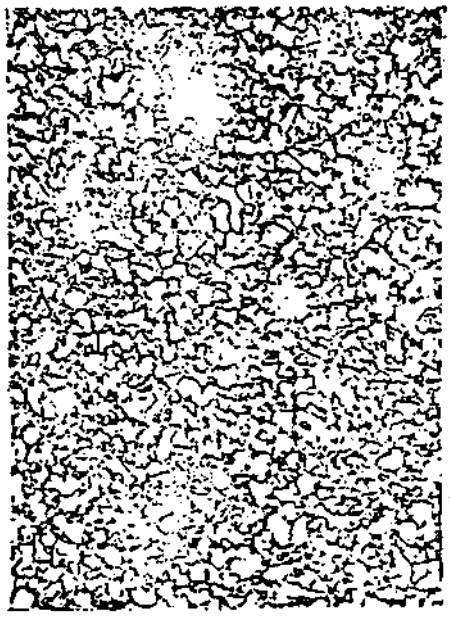
x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ІІВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grade 12Х2МФСР

GRANE SIZE No. 6
CHEMICAL ETCHING



x 100

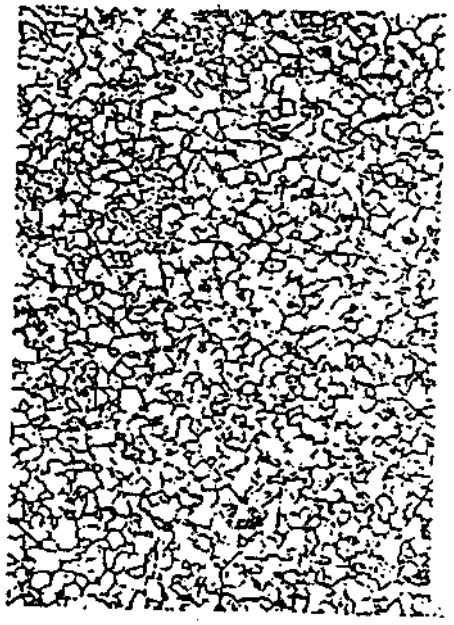
x 500

SCALE No. 3
(continued)

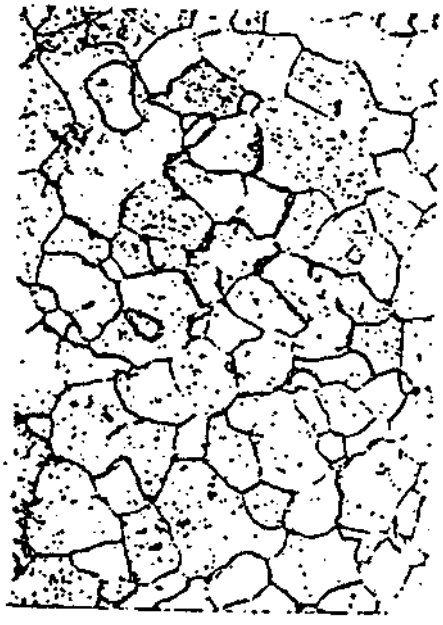
Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ІІВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grade 12Х2МФСР

GRANE SIZE No. 7
CHEMICAL ETCHING



x 100



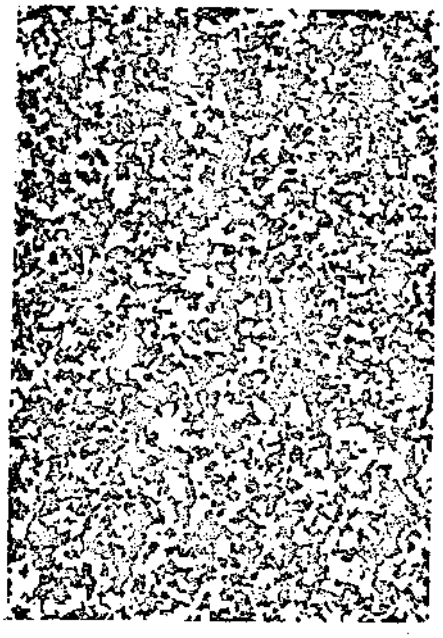
x 500

SCALE No. 3
(continued)

Pipe metal microstructure of steel grades 12Х1МФ, 12Х1МФ-ІІВ, 15Х1М1Ф, 12Х2МФСР

Acceptable pipe metal structures of steel grade 12Х2МФСР

GRANE SIZE No. 8
CHEMICAL ETCHING



x 100

x 500

ELECTROLYTIC ETCHING

x 100

x 500

ANNEX C

Reference Documents

Designation of reference document	Ref. Section, sub-section number
1	2
GOST 9.014-78 Temporary anticorrosive protection of product. General requirements.	4.6
GOST 1778-70 Steel. Metallographic methods of nonmetallic inclusions determination.	1.11; 3.24
GOST 3728-78 Pipes. Bend-over test method.	3.28
GOST 3845-75 Metal pipes. Hydrostatic pressure test method.	3.19
GOST 5632-72 High-alloy steels and corrosion-resistant, heat-resistant and refractory alloys. Grades.	1.7
GOST 5639-82 Steels and alloys. Methods of grain size determination and assessment.	1.11; 3.27
GOST 5640-68 Steel. Metallographic estimation method of sheet and strip microstructure.	3.25; 3.26
GOST 6032-89 Corrosion-resistant steels and alloys. Intergranular resistance test methods.	3.31
GOST 6507-90 Micrometers. Technical specifications.	3.8; 3.9
GOST 7502-98 Metal measuring tapes. Technical specifications.	3.6
GOST 7565-81 Cast iron, steel and alloys. Sampling method for chemical analysis.	3.11
GOST 8026-92 Straight edges. Technical specifications.	3.7
GOST 8694-75 Pipes. Flare test methods.	3.29
GOST 8695-75 Pipes. Flattening test methods.	3.30
GOST 9012-59 Metals. Brinell hardness test methods.	3.14
GOST 9454-78 Metals. Impact bend test methods at elevated, room and reduced temperatures.	3.15
GOST 10006-80 Metal pipes. Tensile test method.	3.13
GOST 10145-81 Metals. Long-term strength test methods.	3.16
GOST 10243-75 Steel. Macrostructure examination and assessment test methods.	3.23
GOST 10692-80 Steel and cast-iron pipes and fittings. Acceptance, marking, packing, transportation and storage.	4.1
GOST 11358-89 Indicator thickness gauges and wall gauges with scale-division values 0,01 and 0,1 mm. Technical specifications.	3.8
GOST 12344-88 Alloyed and high-alloyed steels. Carbon test methods.	3.11

1	2
GOST 12345- Alloyed and high-alloyed steels. Sulfur test methods.	3.11
GOST 12346-78 Alloyed and high-alloyed steels. Silicon test methods.	3.11
GOST 12347-77 Alloyed and high-alloyed steels. Phosphorus test methods.	3.11
GOST 12348-78 Alloyed and high-alloyed steels. Manganese test methods.	3.11
GOST 12349-83 Alloyed and high-alloyed steels. Tungsten test methods.	3.11
GOST 12350-78 Alloyed and high-alloyed steels. Chromium test methods.	3.11
GOST 12351-81 Alloyed and high-alloyed steels. Vanadium test methods.	3.11
GOST 12352-81 Alloyed and high-alloyed steels. Nickel test methods.	3.11
GOST 12354-81 Alloyed and high-alloyed steels. Molybdenum test methods.	3.11
GOST 12355-78 Alloyed and high-alloyed steels. Copper test methods.	3.11
GOST 12356-81 Alloyed and high-alloyed steels. Titanium test methods.	3.11
GOST 12357-84 Alloyed and high-alloyed steels. Aluminium test methods.	3.11
GOST 12360-82 Alloyed and high-alloyed steels. Boron test methods.	3.11
GOST 12361-81 Alloyed and high-alloyed steels. Niobium test methods.	3.11
GOST 12365-84 Alloyed and high-alloyed steels. Zirconium test methods.	3.11
GOST 14019-80 Metals. Bend test methods.	3.28
GOST 17410-78 Non-destructive testing. Seamless, tubular metal pipes. Ultrasonic flaw detection methods.	3.20; 3.21
GOST 18895-81 Steel. Method of photoelectric spectrum analysis.	3.11
GOST 19040-81 Metal pipes. Tensile test method at elevated temperatures.	
GOST 22536.0-87 Carbon steel and unalloyed cast-iron. General requirements to methods of analysis.	3.11
GOST 22536.1-88 Carbon steel and unalloyed cast-iron. Total carbon and graphite test methods.	3.11

1	2
GOST 22536.2-87 Carbon steel and unalloyed cast-iron. Sulfur test methods.	3.11
GOST 22536.3-88 Carbon steel and unalloyed cast-iron. Phosphorus test methods.	3.11
GOST 22536.4-88 Carbon steel and unalloyed cast-iron. Silicon test methods.	3.11
GOST 22536.5-87 Carbon steel and unalloyed cast-iron. Manganese test methods.	3.11
GOST 22536.7-88 Carbon steel and unalloyed cast-iron. Chromium test methods.	3.11
GOST 22536.8-87 Carbon steel and unalloyed cast-iron. Copper test methods.	3.11
GOST 22536.9-88 Carbon steel and unalloyed cast-iron. Nickel test methods.	3.11
GOST 22536.10-88 Carbon steel and unalloyed cast-iron. Aluminium test methods.	3.11
GOST 22536.11-87 Carbon steel and unalloyed cast-iron. Titanium test methods.	3.11
GOST 22536.12-88 Carbon steel and unalloyed cast-iron. Vanadium test methods.	3.11
GOST 24851-81 Plain gauges for cylindrical openings and shafts. Types.	3.9; 3.10
GOST 24853-81 Plain gauges for sizes up to 500 mm. Tolerances.	3.9; 3.10
GOST 27809-95 Cast-iron and steel. Spectrographic analysis methods.	3.11
OST 108.885.01-96 Tubes for power equipment. Ultrasonic inspection methods.	3.20
OST 108.901.102-78 Long-term strength check. Boilers, turbines and piping. High-temperature resistance test.	3.16
OST 14-82-82 Sectoral ferrous metallurgy product quality management system and departmental product quality control. Seamless rolled steel pipes. Surface defects. Terms and definitions.	3.18
OST 14-3-123-83 Product-quality index system. Steel, cast-iron pressure pipes and alloy pipes.	3.7
TU 14-1-1045-74 Round billets of high-alloyed thermostable corrosion-resistant steel grade 08X16H9M2	1.4
TU 14-1-1529-93 Rolled and forged round billets for boiler tubes.	1.4
TU 14-1-1787-76 High-quality rolled and forged round billets for boiler tubes.	1.4
TU 14-1-2560-78 Forged round billets for boiler tubes.	1.4
TU 14-1-4607-89 Round billets of corrosion-resistant steel grade 10X9МФБ-Ш (ДИ 82-Ш) over 180 mm in diameter	1.4

1	2
TU 14-1-4616-89 Round billets of corrosion-resistant steel grade 10Х9МФБ-Ш (ДИ 82-Ш) 80-180 mm in diameter	1.4
TU 14-1-5185-93 Round billets of steel 20-ПВ melted from direct reduction iron, for boiler tubes.	1.4
TU 14-1-5271-94 Round billets of steel grade 12Х1МФ-ПВ, melted from direct reduction iron, for boiler tubes.	1.4
TU 14-1-5319-96 Continuous-cast billets for boiler tubes.	1.4
TU 14-131-871-92 Round billets of corrosion-resistant steel grade 10Х13Г12БС2Н2Д2 (ДИ59) и 10Х13Г12БС2Н2Д2-Ш (ДИ59-Ш).	1.4
TU 14-134-319-93 Round billets of corrosion-resistant steel grade 10Х9МФБ-Ш (ДИ 82-Ш).	1.4
TU 2-034-02241.97-011.97 Feelers. Models 82003, 82103, 82203, 83203	3.7

CHANGES REGISTRATION SHEET

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Explanatory Note

To technical Specification TU 14-3P-55-2001
«Seamless steel pipes for steam generators and pipe-lines»

1. Presently seamless steel pipes for steam generators and pipelines are produced by domestic pipe plants according to numerous technical specifications, based on conditions of centralized pipes supply subject to restricted technical potentialities of pipe mills of the former USSR. Standard-technical base currently in use on territory of RF for that kind of have been developed more than 20 years ago and reflects both level of technical state of processes and product quality meeting demand of consumers of that time. Besides, technical specifications currently in force do not reflect the latest achievements of scientific-and-technological advance and legislative instruments of RF as to generating of up-to-date requirements to guaranteed reliability control and safety.

2. This technical specification is drawn up for the purpose of introduction of enhanced requirements to pipe surface quality, metal continuity, ultrasonic non-destructive inspection of pipes, diversification of steel grades with enhanced service parameters of reliability and service life. Long-term experience of pipe production and their operation in different enterprises is summarized. Results of theoretical and experimental studies carried out over the last years by various scientific organizations of the country are taken into account. A system of characteristics of this Technical specification exceeds quality and reliability of pipes produced according to existing TU 14-3-460, TU 14-3-796, TU 14-3-917, etc.

3. TU «Seamless steel pipes for steam generators and pipe-lines» are agreed with manufacturers and users of this product.

4. Sources of information:

TU 14-3-460-75 «Seamless steel pipes for steam generators and pipe-lines»,

TU 14- 3-796-79 «Seamless cold-formed corrosion-resistant steel pipes for steam generators and pipe-lines»;

TU 14-3-917-80 «Cold-formed corrosion-resistant pipes of steel grades 12Х13И2АС2М2 СДИ 5СГ) and 10Х13П2БС2Н2Д2(ДИ59); «Rules of arrangement and safe operation of steam and hot-water boilers";

«Rules of arrangement and safe operation of steam and hot-water pipe-lines».

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