

ZAO VNIITneft
R&D Institute for OCTG Design and Operation
Private Stock Company

ENDORSED by:

A.A. Klachkov
Deputy CEO, Chief Engineer, OAO TMK
_____«___», 2010

APPROVED by:

Y.N. Antipov
CEO, ZAO VNIITneft
_____«___», 2010

LINE PIPE

OPERATION MANUAL

DEVELOPED by:

A.A. Donskoy
CTO, ZAO VNIITneft

_____«___», 2010

Samara, 2010

TABLE OF CONTENTS

1 TERMS AND DEFINITIONS.....	3
2 PIPE SPECIFICATIONS.....	4
2.1 Seamless Steel Pipe	4
2.2 Longitudinal electric-welded pipe	4
2.3 Spiral electric-welded pipe, large diameter.....	4
2.4 Pipe with corrosion-resistant coating.....	4
3 MARKING AND PACKING.....	5
4 GOOD PRACTICE FOR PIPE OPERATION – REQUIREMENTS AND RECOMMENDATIONS.....	24
4.1 Scope of Application.....	24
4.2 Pipe Pre-Operation Requirements	27
4.3 Assembly, Welding and Inspection of Welded Pipeline Joints.....	30
4.4 Pipelining in Trenches	33
4.5 Pipeline Testing	34
4.6 Acceptance of Pipelines for Operation	36
4.7 Basic Requirements for Pipeline Operation Supervision and Condition Monitoring	36
4.8 Scope and Frequency of Pipeline Inspections.....	38
4.9 Pipeline Maintenance.....	41
5 PIPE TRANSPORTATION AND STORAGE.....	42
6 SAFETY REQUIREMENTS.....	44
7 SPECIFIED LIFE AND MANUFACTURER’S GUARANTEE.....	44
8 LIST OF REFERENCED DOCUMENTS	45

This Manual covers the range of line pipe manufactured to GOST 8731, GOST 8732, GOST R 53383, GOST 10704, GOST 10705, GOST 10706, GOST 20295, API Spec 5L/ISO 3183, specifications (TU) and other normative documents applied at the mills of Pipe Metallurgical Company (OAO TMK).

All line pipe manufactured according to GOSTs, API Specs, specifications and other referenced documents listed herein may be used for transportation of oil, gas and produced formation water provided the recommendations given below are considered.

The Manual neither supersedes nor disagrees with the existing guidelines, but supplements and gives specific details for proper use of line pipe manufactured at the mills of OAO TMK. This Manual supersedes the document issued by ZAO VNIITneft in 2005.

This line pipe operation Manual will allow the User of the pipe to ease the activities related with pipe choice, procurement decision-making, and to determine advantages of line pipe manufactured at the mills of OAO TMK over the products offered by other Manufacturers.

The Manual covers all the substantial aspects of line-pipe use in the petroleum and natural gas industries.

Data contained herein were taken from pipe specifications and are provided for general reference. For detailed technical data refer to applicable normative pipe specifications.

TMK supplies this Manual with each delivered lot of pipe.

1 TERMS AND DEFINITIONS

Line pipe – pipe lengths joined together for construction of a pipeline (oil-and-gas pipeline).

Oil-and-gas pipeline – pipeline for transportation of oil, gas and oil products.

Seamless steel pipe – steel pipe made without a welded seam or any other joint, manufactured by either of forging, rolling, drawing, or extrusion.

Longitudinal electric-welded pipe – pipe having one longitudinal seam produced of a plate by submerged arc welding or high-frequency electric-welding.

Spiral electric-welded pipe – pipe having one helical seam produced by submerged arc welding.

Pipeline – linear part of a pipeline construction consisting of pipe lengths joined together for use with pump and compressor stations.

Main pipeline – pipeline with a system of above- and underground structures intended for long-distance transportation of oil, gas, and oil products.

Oilfield pipeline – pipeline that connects wells with the field oil and gas gathering station.

Fault – an event that causes malfunction of an object, but the object remains functional.

Failure – an event causing loss of function of an object.

Failure criterion – malfunction symptom or set of symptoms specified in normative and/or design (project) documentation.

Life – total operation time of an object between the start of operation or restart of operation after repairs and its transition to the limit state.

Life-limiting failure – failure of an object resulting in its transition to the limit state.

Residual life – total operation time of an object between the inspection of its technical condition and its transition to the limit state.

Specified life – total operation time of an object which, when achieved, renders the object unsuitable for normal operations irrespective of its technical condition.

Life time – calendar operation period of an object between the start of operation or restart of operation after repairs and its transition to the limit state.

Specified life time – calendar operation period which, when achieved, renders the object unsuitable for normal operations irrespective of its technical condition.

Technical condition of object – condition that is characterized at a specific point of time, under specific environmental conditions, using parametric values set forth in the technical documentation of an object.

Diagnostic engineering – area of knowledge that covers theory, methods and means used to determine technical condition of objects.

Technical diagnosis – determination of the technical condition of an object.

Inspection of technical condition – verification of object parameter values for compliance the technical documentation and determination its technical condition at the specific point of time (functional, serviceable, nonfunctional, unserviceable, etc.)

Limit state – object state beyond which its further operation is prohibited or unpractical, or its functional recovery is impossible or unpractical.

2 PIPE SPECIFICATIONS

2.1 Seamless Steel Pipe

2.1.1 For range of pipe manufactured according to GOST 8732, GOST R 53383 and specification refer to Table 1, for those manufactured according to API Spec 5L/ISO 3183 refer to Table 2.

2.1.2 For the list of referenced specifications for pipe manufacture and delivery refer to Table 3.

2.1.3 For mechanical properties of seamless steel pipe refer to Table 4.

2.1.4 For corrosion-resistance properties of seamless pipe manufactured according to specifications refer to Table 5.

2.2 Longitudinal electric-welded pipe

2.2.1 For range of pipe manufactured according to GOST 10704 refer to Table 6, for those manufactured according to GOST 20295 (type 1) refer to Table 6a.

2.2.2 For the list of referenced specifications for pipe manufacture and delivery refer to Table 7.

2.2.3 For mechanical properties of longitudinal electric-welded pipe manufactured according to GOST 10705 refer to Table 8, for those of pipe manufactured according to GOST 10706 refer to Tables 8a – 8d, for those of pipe manufactured according to specifications refer to Table 8e.

2.3 Spiral electric-welded pipe, large diameter

2.3.1 For range of spiral electric-welded large-diameter pipe refer to Tables 9.

2.3.2 For the list of referenced specifications for pipe manufacture and delivery refer to Table 10.

2.3.3 For mechanical properties of pipe refer to Table 11.

2.4 Pipe with corrosion-resistant coating

2.4.1 To protect the pipe against corrosion, various types of coating are applied to it. Volzhsky Pipe Works applies the following types of internal corrosion-resistant coatings:

- two-layer epoxy coating;

- two- or three-layer extruded polyolefine (polyethylene or polypropylene) based coatings;
- internal flow coatings.

Truboplast Works applies the following internal and external coatings to pipe 57 to 720 mm in diameter:

- external corrosion-resistant epoxy coating;
- two- or three-layer external corrosion-resistant coating based on extruded polyethylene;
- three-layer external corrosion-resistant coating based on extruded polypropylene;
- external thermally insulating and waterproofing coating based on a layer of rigid foamed polyurethane combined with corrosion-resistant coating of steel pipe and external waterproof coating;
- internal coating based on surfaced powder epoxy paints with a system for protection of internal weld joint surface (coating thickness of 350 to 450 μm).

The set of factory-applied coatings and materials for corrosion protection of external weld joint surfaces delivered by Truboplast Works provide for full corrosion protection of steel pipe.

2.4.2 For the list of referenced specifications for manufacture and delivery of pipe with corrosion-resistant coating and pipe application refer to Table 12.

2.4.3 For specifications of epoxy pipe coatings refer to Table 13.

2.4.4 For specifications of coatings based on extruded polyethylene refer to Table 14.

2.4.5 For specifications of internal smooth coatings refer to Table 15.

3 MARKING AND PACKING

3.1 For the general requirements for pipe marking, packing and documentation refer to GOST 10692 and normative pipe specifications.

3.2 The pipe shall be marked in compliance with the requirements of normative documentation. The pipe 159 mm in diameter or less may be marked with tags fastened to pipe bundles.

Table 1- Range of Seamless Line Pipe Manufactured According to GOST and Specifications

Outside Diameter, mm	Wall Thickness, mm																						
	3,0	3,2	3,5	4	4,5	5	6	7	8	9	10	11	12	14	15	16	18	20	22	24	26	28	30
	Mass per 1 running meter, kg																						
28	1.85	1.96	2.11	2.37																			
30	2.00	2.12	2.29	2.57	2.83																		
32	2.15	2.27	2.46	2.76	3.05																		
38	2.59	2.75	2.98	3.35	3.72	4.07																	
42	2.89	3.06	3.32	3.75	4.16	4.56	5.33	6.04	6.71	7.32	7.89	8.41	8.88	9.67									
45	3.11	3.30	3.58	4.04	4.49	4.93	5.77	6.56	7.30	7.99	8.63	9.22	9.77	10.70									
50	3.48	3.69	4.01	4.54	5.05	5.55	6.51	7.42	8.29	9.10	9.86	10.58	11.24	12.43	12.95								
57		4.25	4.62	5.23	5.83	6.41	7.55	8.63	9.67	10.65	11.59	12.48	13.32	14.85	15.54	16.18	17.31						
60		4.48	4.88	5.52	6.16	6.78	7.99	9.15	10.26	11.32	12.33	13.29	14.21	15.88	16.65	17.36	18.64	19.73					
73			6.00	6.81	7.60	8.38	9.91	11.39	12.82	14.21	15.54	16.82	18.05	20.37	21.46	22.49	24.41	26.14					
76		5.75	6.26	7.10	7.93	8.75	10.36	11.91	13.42	14.87	16.28	17.63	18.94	21.41	22.57	23.68	25.75	27.62					
83				7.79	8.71	9.62	11.39	13.12	14.80	16.42	18.00	19.53	21.01	23.82	25.15	26.44	28.85	31.07	33.10				
89				8.39	9.38	10.36	12.28	14.16	15.98	17.76	19.48	21.16	22.79	25.89	27.37	28.80	31.52	34.03	36.35	38.47			
102					11.96	14.21	16.40	18.55	20.64	22.69	24.69	26.63	30.38	32.18	33.93	37.29	40.44	43.40	46.17	48.73	51.10	53.27	
108					12.70	15.09	17.44	19.73	21.97	24.17	26.31	28.41	32.45	34.40	36.30	39.95	43.40	46.66	49.72	52.58	55.24	57.71	
114						13.44	15.98	18.47	20.91	23.31	25.65	27.94	30.19	34.53	36.62	38.67	42.62	46.36	49.91	53.27	56.43	59.38	62.15
121						14.30	17.02	19.68	22.29	24.86	27.37	29.84	32.26	36.94	39.21	41.43	45.72	49.82	53.71	57.41	60.91	64.22	67.33
127						15.04	17.90	20.72	23.48	26.19	28.85	31.47	34.03	39.01	41.43	43.80	48.39	52.78	56.97	60.96	64.76	68.36	71.76
133							18.79	21.75	24.66	27.52	30.33	33.10	35.81	41.09	43.65	46.17	51.05	55.73	60.22	64.51	68.61	72.50	76.20
140							19.83	22.96	26.04	29.08	32.06	34.99	37.88	43.50	46.24	48.93	54.16	59.19	64.02	68.66	73.10	77.34	81.38
146							20.72	24.00	27.23	30.41	33.54	36.62	39.66	45.57	48.46	51.30	56.82	62.15	67.28	72.21	76.94	81.48	85.82
152							21.60	25.03	28.41	31.74	35.02	38.25	41.43	47.65	50.68	53.66	59.48	65.11	70.53	75.76	80.79	85.62	90.26
159							22.64	26.24	29.79	33.29	36.75	40.15	43.50	50.06	53.27	56.43	62.59	68.56	74.33	79.90	85.28	90.46	95.44
168							23.97	27.79	31.57	35.29	38.97	42.59	46.17	53.17	56.60	59.98	66.59	73.00	79.21	85.23	91.05	96.67	102.10
194							27.82	32.28	36.70	41.06	45.38	49.64	53.86	62.15	66.22	70.24	78.13	85.82	93.32	100.62	107.72	114.63	121.33
203							29.15	33.84	38.47	43.06	47.60	52.09	56.52	65.25	69.55	73.79	82.12	90.26	98.20	105.95	113.49	120.84	127.99
219							31.52	36.60	41.63	46.61	51.54	56.43	61.26	70.78	75.46	80.10	89.23	98.15	106.88	115.42	123.75	131.89	139.83
245								41.09	46.76	52.38	57.95	63.48	68.95	79.76	85.08	90.36	100.77	110.98	120.99	130.80	140.42	149.84	159.07
273								45.92	52.28	58.60	64.86	71.07	77.24	89.42	95.44	101.41	113.20	124.79	136.18	147.38	158.38	169.18	179.78
325									62.54	70.14	77.68	85.18	92.63	107.38	114.68	121.93	136.28	150.44	164.39	178.15	191.72	205.09	218.25
351									67.67	75.91	84.10	92.23	100.32	116.35	124.29	132.19	147.82	163.26	178.50	193.54	208.39		
426												102.59	112.58	122.52	142.25	152.04	161.78	181.11	200.25	219.19	237.93	256.48	

Table 2 – Range of Seamless Pipe According to API Spec 5L/ ISO 3183

Nominal Size	Outside Diameter		Wall Thickness		Mass per Unit Length		Mass Class
	mm	inch	mm	inch	kg/m	lb/ft	
1/8	10.3	0.405	1.7	0.068	0.36	0.24	STD
1/8	10.3	0.405	2.4	0.095	0.46	0.31	XS
¼	13.7	0.540	2.2	0.088	0.62	0.42	STD
¼	13.7	0.540	3.0	0.119	0.80	0.54	XS
3/8	17.1	0.675	2.3	0.091	0.84	0.57	STD
3/8	17.1	0.675	3.2	0.126	1.10	0.74	XS
½	21.3	0.840	2.8	0.109	1.27	0.85	STD
½	21.3	0.840	3.7	0.147	1.62	1.09	XS
¾	26.7	1.050	2.9	0.113	1.68	1.13	STD
¾	26.7	1.050	3.9	0.154	2.19	1.47	XS
1	33.4	1.315	3.4	0.133	2.50	1.68	STD
1	33.4	1.315	4.5	0.179	3.24	2.17	XS
1¼	42.2	1.660	3.6	0.140	3.39	2.27	STD
1¼	42.2	1.660	4.9	0.191	4.47	3.00	XS
1½	48.3	1.900	3.7	0.145	4.05	2.72	STD
1½	48.3	1.900	5.1	0.200	5.40	3.63	XS
2 3/8	60.3	2.375	2.1	0.083	3.02	2.03	STD
2 3/8	60.3	2.375	2.8	0.109	3.93	2.64	STD
2 3/8	60.3	2.375	3.2	0.125	4.47	3.00	STD
2 3/8	60.3	2.375	3.6	0.141	5.00	3.36	STD
2 3/8	60.3	2.375	3.9	0.154	5.43	3.65	STD
2 3/8	60.3	2.375	4.4	0.172	6.03	4.05	STD
2 3/8	60.3	2.375	4.8	0.188	6.54	4.39	STD
2 3/8	60.3	2.375	5.5	0.218	7.48	5.02	STD
2 3/8	60.3	2.375	6.4	0.250	8.45	5.76	STD
2 3/8	60.3	2.375	7.1	0.281	9.36	6.28	STD
2 7/8	73.0	2.875	3.6	0.141	6.13	4.12	STD
2 7/8	73.0	2.875	4.0	0.156	6.75	4.53	STD
2 7/8	73.0	2.875	4.4	0.172	7.40	4.97	STD
2 7/8	73.0	2.875	4.8	0.188	8.04	5.40	STD
2 7/8	73.0	2.875	5.2	0.203	8.62	5.79	STD
2 7/8	73.0	2.875	5.5	0.216	9.13	6.13	STD
2 7/8	73.0	2.875	6.4	0.250	10.44	7.01	STD
2 7/8	73.0	2.875	7.0	0.276	11.41	7.66	STD
3 ½	88.9	3.500	4.0	0.156	8.29	5.57	STD
3 ½	88.9	3.500	4.4	0.172	9.10	6.11	STD
3 ½	88.9	3.500	4.8	0.188	9.90	6.65	STD
3 ½	88.9	3.500	5.5	0.216	11.29	7.58	STD
3 ½	88.9	3.500	6.4	0.250	12.93	8.68	STD
3 ½	88.9	3.500	7.1	0.281	14.38	9.66	STD
3 ½	88.9	3.500	7.6	0.300	15.26	10.25	STD
4	101.6	4.000	5.7	0.226	13.57	9.11	STD
4	101.6	4.000	6.4	0.250	14.91	10.01	STD
4	101.6	4.000	7.1	0.281	16.62	11.16	STD
4	101.6	4.000	8.1	0.318	18.61	12.50	STD
4½	114.3	4.500	5.2	0.203	13.88	9.32	STD
4½	114.3	4.500	5.6	0.219	14.91	10.01	STD
4½	114.3	4.500	6.0	0.237	16.07	10.79	STD
4½	114.3	4.500	6.4	0.250	16.90	11.35	STD

Table 2 (continued)

Nominal Size	Outside Diameter		Wall Thickness		Mass per Unit Length		Mass Class
	mm	inch	mm	inch	kg/m	lb/ft	
4½	114.3	4.500	7.1	0.281	18.85	12.66	STD
4½	114.3	4.500	7.9	0.312	20.79	13.96	STD
4½	114.3	4.500	8.6	0.337	22.31	14.98	STD
4½	114.3	4.500	11.1	0.438	28.30	19.00	STD
5 9/16	141.3	5.563	5.6	0.219	18.61	12.50	STD
5 9/16	141.3	5.563	6.6	0.258	21.77	14.62	STD
5 9/16	141.3	5.563	7.1	0.281	23.61	15.85	STD
5 9/16	141.3	5.563	7.9	0.312	26.06	17.50	STD
5 9/16	141.3	5.563	8.7	0.344	28.55	19.17	STD
5 9/16	141.3	5.563	9.5	0.375	30.95	20.78	STD
5 9/16	141.3	5.563	12.7	0.500	40.28	27.04	STD
6 5/8	168.3	6.625	6.4	0.250	25.35	17.02	-
6 5/8	168.3	6.625	7.1	0.280	28.22	18.97	STD
6 5/8	168.3	6.625	7.9	0.312	31.25	21.04	
6 5/8	168.3	6.625	8.7	0.344	34.24	23.08	
6 5/8	168.3	6.625	9.5	0.375	37.20	25.03	
6 5/8	168.3	6.625	11.0	0.432	42.67	28.57	XS
6 5/8	168.3	6.625	12.7	0.500	48.73	32.71	
6 5/8	168.3	6.625	14.3	0.562	54.31	36.39	
6 5/8	168.3	6.625	15.9	0.625	59.76	40.05	
6 5/8	168.3	6.625	18.3	0.750	67.69	45.35	
6 5/8	168.3	6.625	19.1	0.864	70.27	47.06	XXS
6 5/8	168.3	6.625	22.2	0.875	79.98	53.73	
8 5/8	219.1	8.625	7.0	0.277	36.61	24.70	
8 5/8	219.1	8.625	7.9	0.312	41.14	27.70	
8 5/8	219.1	8.625	8.2	0.322	42.65	28.55	STD
8 5/8	219.1	8.625	8.7	0.344	45.14	30.42	
8 5/8	219.1	8.625	9.5	0.375	49.10	33.04	
8 5/8	219.1	8.625	11.1	0.438	56.94	38.30	
8 5/8	219.1	8.625	12.7	0.500	64.64	43.39	XS
8 5/8	219.1	8.625	14.3	0.562	72.02	48.40	
8 5/8	219.1	8.625	15.9	0.625	79.67	53.40	
8 5/8	219.1	8.625	18.3	0.719	90.62	60.71	
8 5/8	219.1	8.625	19.1	0.750	94.20	63.08	
8 5/8	219.1	8.625	20.6	0.812	100.84	67.76	
8 5/8	219.1	8.625	22.2	0.875	107.79	72.42	XXS
8 5/8	219.1	8.625	25.4	1.000	121.32	81.44	
10¾	273.1	10.750	7.8	0.307	51.03	34.24	
10¾	273.1	10.750	8.7	0.344	56.72	38.23	
10¾	273.1	10.750	9.3	0.365	60.50	40.48	STD
10¾	273.1	10.750	11.1	0.438	71.72	48.24	
10¾	273.1	10.750	12.7	0.500	71.87	54.74	XS
10¾	273.1	10.750	14.3	0.562	81.55	61.15	
10¾	273.1	10.750	15.9	0.625	91.26	67.58	
10¾	273.1	10.750	18.3	0.719	100.85	77.03	
10¾	273.1	10.750	20.6	0.812	114.99	86.18	

Table 2 (concluded)

Nominal Size	Outside Diameter		Wall Thickness		Mass per Unit Length		Mass Class
	mm	inch	mm	inch	kg/m	lb/ft	
10 $\frac{3}{4}$	273.1	10.750	22.2	0.875	128.27	92.28	
10 $\frac{3}{4}$	273.1	10.750	23.8	0.938	137.36	98.30	
10 $\frac{3}{4}$	273.1	10.750	25.4	1.000	146.30	104.13	XXS
12 $\frac{3}{4}$	323.9	12.750	8.7	0.344	67.32	45.58	
12 $\frac{3}{4}$	323.9	12.750	9.5	0.375	73.65	49.59	STD
12 $\frac{3}{4}$	323.9	12.750	10.3	0.406	79.65	53.52	
12 $\frac{3}{4}$	323.9	12.750	11.1	0.438	85.62	57.59	
12 $\frac{3}{4}$	323.9	12.750	12.7	0.500	97.46	65.42	XS
12 $\frac{3}{4}$	323.9	12.750	14.3	0.562	109.18	73.15	
12 $\frac{3}{4}$	323.9	12.750	15.9	0.625	120.76	80.93	
12 $\frac{3}{4}$	323.9	12.750	17.5	0.688	132.23	88.63	
12 $\frac{3}{4}$	323.9	12.750	19.1	0.750	143.56	96.12	
12 $\frac{3}{4}$	323.9	12.750	20.6	0.812	154.08	103.53	
12 $\frac{3}{4}$	323.9	12.750	22.2	0.875	165.17	110.97	
12 $\frac{3}{4}$	323.9	12.750	23.8	0.938	176.13	118.33	
12 $\frac{3}{4}$	323.9	12.750	25.4	1.000	186.97	125.49	XXS
12 $\frac{3}{4}$	323.9	12.750	27.0	1.062	197.68	132.57	
14	355.6	14.000	9.5	0.375	81.08	54.57	STD
14	355.6	14.000	10.3	0.406	87.71	58.94	
14	355.6	14.000	11.1	0.438	94.30	63.44	
14	355.6	14.000	11.9	0.469	100.86	67.78	
14	355.6	14.000	12.7	0.500	107.39	72.09	XS
14	355.6	14.000	14.3	0.562	120.36	80.66	
14	355.6	14.000	15.9	0.625	133.19	89.28	
14	355.6	14.000	17.5	0.688	145.91	97.81	
14	355.6	14.000	19.1	0.750	158.49	106.13	
14	355.6	14.000	20.6	0.812	170.18	114.37	
14	355.6	14.000	22.2	0.875	182.52	122.65	
14	355.6	14.000	23.8	0.938	194.74	130.85	
14	355.6	14.000	25.4	1.000	206.83	138.84	
14	355.6	14.000	27.0	1.062	218.79	146.74	
16	406.4	16.000	11.9	0.469	115.77	77.79	
16	406.4	16.000	12.7	0.500	123.30	82.77	XS
16	406.4	16.000	14.3	0.562	138.27	92.66	
16	406.4	16.000	15.9	0.625	153.11	102.63	
16	406.4	16.000	17.5	0.688	167.87	112.51	
16	406.4	16.000	19.1	0.750	182.42	122.51	
16	406.4	16.000	20.6	0.812	195.98	131.71	
16	406.4	16.000	22.2	0.875	210.33	141.34	
16	406.4	16.000	23.8	0.938	224.55	150.89	
16	406.4	16.000	25.4	1.000	238.64	160.20	
16	406.4	16.000	27.0	1.062	252.61	169.43	

Table 3 – Normative Documents Regulating the Manufacture and Delivery of Seamless Pipe

Normative Document	Pipe Size		Steel Grade	Pipe Grade
	Outside Diameter, mm	Wall Thickness, mm		
GOST 8731-74 Seamless hot-wrought steel pipe. Specifications GOST 8732-78 Seamless hot-wrought steel pipe. Range of sizes	28-426	3.0-30.0	10, 20, 40X, 09Г2С, 17Г1С	
GOST R 53383-2009 Seamless hot-wrought steel pipe. Specifications	28-426	3.0-30.0	10, 20, 35, 45, 09Г2С, 30ХГСА, 15ХМ etc.	
API Spec 5L /ISO 3183 Petroleum and natural gas industries – Steel pipe for pipeline transportation systems	10.3-406.4	1.7-28.6	A25; A25P; A; B; X42- X100	L175-L690
GOST 30564-98 Seamless hot-wrought pipe made of carbon or alloy steels with special properties	42-273	4.0-30.0	10, 20, 09Г2С, 10А, 20А, 09Г2СА	
TU 14-3-1128-2000 Seamless hot-wrought steel pipe for gas pipelines of gas-lift systems and gas-field construction TU 14-3P-1128-2007 Seamless cold-resistant steel pipe for gas pipelines of gas-lift oil-production systems and gas-field construction	57-426	4.0-25.0	10, 20, 09Г2С, 10Г2А	
TU 14-3-1618-89 Seamless hot-wrought steel pipe for gas pipelines of gas-lift systems and oil- and gas-field construction in Northern regions	219-426	8.0-26.0	12ГА, 16ГА, 13ГФА, 09Г2С	I, II, III
TU 14-3-1801-92 High-quality seamless hot-wrought steel pipe for gas pipelines, gas-lift systems and oil- and gas-field construction in Northern regions	159	7.0	09Г2С	
TU 14-161-134-93 Seamless hot-wrought steel pipe for gas pipelines of gas-lift systems	57-159	4.0-14.0	10, 20, 35, 10Г2, 09Г2С	
TU 14-3-1971-97 Seamless hot-wrought steel line pipe of higher corrosion resistance and field reliability made of carbon steel (steel 20 and its modifications)	168-426	8.0-26.0	20В	K48
TU 14-3-1972-97 Seamless hot-wrought steel line pipe of higher corrosion resistance and cold resistance	168-426	8.0-26.0	06Х1, 06ХФ	K42, K52
TU 1317-204-00147016-01 Seamless hot-wrought cold-resistant steel line pipe of higher corrosion resistance	219-426	8.0-20.0	09ГФС, 12ГФ	K48, K50, K52
TU 1308-269-00147016-2003 Seamless hot-wrought steel line pipe of higher cold resistance and corrosion resistance for OAO Surgutneftegaz fields	168-426	8.0-26.0	20Ф (В), 06Х1Ф	K42, K48
TU 14-3P-77-2004 H ₂ S-resistant seamless pipe	57-426	4.5-28.0	20, 12ГФ	I, II categories
TU 14-157-60-98 H ₂ S-resistant seamless hot-wrought steel line pipe for OAO GAZ-PROM	108-273	6.0-18.0	20 «С» select	
TU 14-3-1831-92 H ₂ S-resistant seamless pipe made of steel grade 12ГФПВ	89-159	6.0-12.0	12ГФПВ	
TU 14-162-14-96 Seamless hot-wrought steel line pipe of higher cold resistance and corrosion resistance	219-325	8.0-25.0	20А, 20ЮЧА, 08ХМЧА	
TU 14-162-20-97 Seamless hot-wrought steel line pipe of higher cold resistance and corrosion resistance for OAO Surgutneftegaz fields	219-325	8.0-25.0	20А, 20ЮЧА, 08ХМЧА, 09СФА	
TU 14-161-174-97 Seamless hot-wrought steel line pipe of higher cold resistance and corrosion resistance for OAO Surgutneftegaz fields	57-168	6.0-12.0	20Дс	
TU 14-161-147-94 H ₂ S-resistant and cold-resistant seamless hot-wrought line pipe TU 14-161-148-94 Seamless hot-wrought line pipe of higher cold resistance and corrosion resistance	57-168	6.0-16.0	20, 08ХМЧА, 20 «С»	
TU 14-157-37-94 Cold-resistant seamless hot-wrought pipe made of steel grade 20	114-273	6.0-18.0	20 select, 20	

Table 3 (continued)

Normative Document	Pipe Size		Steel Grade	Pipe Grade
	Outside Diameter, mm	Wall Thickness, mm		
TU 14-157-38-94 Cold-resistant seamless hot-wrought pipe made of steel grade 09Г2С	114-273	6.0-18.0	09Г2С	
TU 14-157-54-97 Seamless hot-wrought line pipe of higher cold resistance and corrosion resistance for OAO Surgutneftegaz fields	108-273	6.0-18.0	20 «С» select, 09ГСФА, 09ГСФ	
TU 14-161-184-2000 Seamless hot-wrought steel pipe made of steel grade 09Г2С	5,0-245,0	0.8-50.0	09Г2С	
TU 14-157-80-2006 Seamless hot-wrought steel pipe for construction of sanitation facilities and low-pressure water pipelines	73	6.0-9.0	СТ 2, СТ 4, СТ 5, СТ 6, СТ 10, СТ 20	
	89	6.0-10.0		
	114; 121; 127; 133; 140; 146	6.0-14.0		
	152; 159; 168	6.0-16.0		
	178;180; 194; 203; 219; 245; 273	6.0-20.0		
TU 1308-195-00147016-01 Corrosion-resistant and cold-resistant seamless hot-wrought steel line pipe designed for construction, overhaul and renovation of underwater passages	219-426	12.0-16.0	13ХФ	
TU 14-1-5439-2001 Seamless hot-wrought steel line pipe with higher resistance to local corrosion and cold resistant	57-219	4.0-28.0	20ПКС	К42
TU 14-3P-48-2001 Cold-resistant seamless hot-wrought steel pipe for OAO GAZPROM	89-273	6.0-18.0	20А, 09Г2СА, 20, 09Г2С	
TU 1317-006.1-593377520-2003 Seamless hot-wrought steel line pipe of higher field reliability for construction of OAO TNK fields	57-426	5.0-26.0	20А, 20ФА, 09СФА, 08ХМФА, 13ХФА, 15ХФА, 15ХМФА, 20ХФА	К48, К50, К52, К54, К56
TU 14-156-65-2005 Seamless hot-wrought steel pipe for oil pipelines	114-426	6.0-25.0	20, 09Г2С, 10Г2А	К36, К42, К48
TU 1308-226-00147016-02* Seamless hot-wrought steel line pipe made of micro-alloyed steels with increased field service life	57-426	5.0-25.0	08ХМФА, 20Ф, 20ФА, 12ХМФА, 06Х1Ф	К52, К56
TU 1317-214-00147016-02* Seamless hot-wrought steel line pipe with higher field reliability for fields of TPP Kogalymneftegaz	42-426	5.0-20.0	20Ф, 20ФА	К54, К55
TU 14-157-50-97 Seamless hot-wrought line pipe with higher field reliability	108-273	6.0-18.0	20 «С» select, 09ГСФА	
TU 1308-245-00147016-02 Seamless hot-wrought steel line pipe with increased structural strength designed for corrosive service	245-426	8.0-14.0	20ФА, 13ХФА	
TU 1317-233-00147016-02 Seamless hot-wrought steel line pipe with higher field reliability for fields of OAO Tomskneft	219-426	8.0-26.0	13ХФА	К52
TU 14-1-5392-2000 Corrosion-resistant seamless bimetal pipe	159-219	6.0-28.0	Basic metal: 20; 10Г2; 09Г2С Clad metal: 08Х13; 08Х18Н10; 08Х18Н10Т	К42
TU 1381-159-00147016-01 Seamless hot-wrought steel line pipe with surface improved for application of corrosion-resistant coating	42-245	4.0-28.0	09ГСФ, 06Х1, 06ХФ	К42, К48
TU 14-162-24-97 Seamless hot-wrought pipe for pipelines with TPT thread and couplings for them	219-325	8.0-14.0	10, 20, 20А, 09Г2С	
TU 14-3P- 54-2001 Seamless hot-wrought pipe made of steel grade 20ЮЧ	273-426	8.0-26.0	20ЮЧ, 09ГСФ, 12ГФ	К42
TU 14-3-1798-91 Seamless hot-wrought steel pipe for manufacture of pipeline components	168-325	6.0-30.0	20, 09Г2С	
TU 14-156-93-2010 Seamless steel pipe for subsea pipeline	168-426	8-28		PCT, PCT32, PCT40, PCT420

Table 3 (concluded)

Normative Document	Pipe Size		Steel Grade	Pipe Grade
	Outside Diameter, mm	Wall Thickness, mm		
TU 14-3P-91-2004 Seamless hot-wrought steel line pipe with higher resistance to local corrosion and cold resistant for fields of OAO Surgutneftegaz	57-426	5.0-28.0	20KT	K48, K52
TU 1317-023-48124013-05 Seamless hot-wrought line pipe designed for construction of fields of OAO Yuganskneftegaz	57-426	5.0-28.0	13XΦA, 08XMΦЧA	K42, K52
TU 14-3P-90-2007 H ₂ S-resistant seamless pipe made of steel grade X42SS	21.3-426	2.8-28.0	X42SS	

* For more details refer to Manufacturer's specifications (TU)

Table 4 - Seamless Line Pipe. Mechanical properties

Normative Document	Steel Grade	Pipe Grade	Ultimate Tensile Strength, σ_U , N/mm ²	Yield strength, σ_Y , N/mm ²	σ_Y/σ_U	Elongation, δ_5 , %	Impact Strength, J/cm ²		
			min.	max.		min.	min.		
GOST 8731-74	10		353	216		24			
	20		412	245		21			
	40X		657	-		9			
GOST R 53383	10		353	216		24			
	20		412	245		21			
	35		510	294		17			
	45		588	323		14			
	09Г2С		470	265		21			
	10Г2		421	265		21			
	20X		431	-		16			
	40X		657	-		9			
	30XГСА		686	-		11			
	15XM		431	225		21			
30XMA		588	392		13				
12XH2		539	392		14				
API Spec 5L/ ISO 3183	PSL 1								
	L175	A25	310	175		*			
	L175P	A25P	310	175		*			
	L210	A	335	210		*			
	L245	B	415	245		*			
	L290	X42	415	290		*			
	L320	X46	435	320		*			
	L360	X52	460	360		*			
	L390	X56	490	390		*			
	L415	X60	520	415		*			
	L450	X65	535	450		*			
	L485	X70	570	485		*			
	PSL 2								
	L245	B	415-760	245-450	0.93	*			
	L290	X42	415-760	290-495	0.93	*			
	L320	X46	435-760	320-525	0.93	*			
	L360	X52	460-760	360-530	0.93	*			
	L390	X56	490-760	390-545	0.93	*			
	L415	X60	520-760	415-565	0.93	*			
	L450	X65	535	450		*			
	L485	X70	570-760	485-635	0.93	*			
	L555	X80	625-825	555-705	0.93	*			
	L625	X90	695-915	625-775	0.95	*			
L690	X100	760-990	690-840	0.97	*				
PSL 2 for sour service									
L245S	BS	415-760	245-450	0.93	*				
L290S	X42S	415-760	290-495	0.93	*				
L320S	X46S	435-760	320-525	0.93	*				
L360S	X52S	460-760	360-530	0.93	*				

Table 4 (continued)

Normative Document	Steel Grade	Pipe Grade	Ultimate Tensile Strength, σ_U , N/mm ²	Yield strength, σ_Y , N/mm ²	σ_Y/σ_U	Elongation, δ_5 , %	Impact Strength, J/cm ²			
			min.	max.		min.	min.			
	L390S	X56S	490-760	390-545	0.93	*				
	L415S	X60S	520-760	415-565	0.93	*				
	L450S	X65S	535-760	450-600	0.93	*				
	L485S	X70S	570-760	485-635	0.93	*				
API Spec 5L/ ISO 3183	PSL 2 for offshore service									
	L245O	BO	415-760	245-450	0.93	*				
	L290O	X42O	415-760	290-495	0.93	*				
	L320O	X46O	435-760	320-520	0.93	*				
	L360O	X52O	460-760	360-525	0.93	*				
	L390O	X56O	490-760	390-540	0.93	*				
	L415O	X60O	520-760	415-565	0.93	*				
	L450O	X65O	535-760	450-570	0.93	*				
	L485O	X70O	570-760	485-605	0.93	*				
L555O	X80O	626-825	555-675	0.93	*					
TU 14-3-1128-2000	10		353	216		24	S up to 10 mm incl. S from 10up to 15 mm incl. S over 15 mm	KCU ⁻⁴⁰ 29.4 KCU ⁻⁴⁰ 39.2 KCU ⁻⁴⁰ 49.0	KCV ⁻²⁰ 29.4	
	20		412	245		21	S up to 10 mm incl. S from 10up to 15 mm incl. S over 15 mm	KCU ⁻⁴⁰ 29.4 KCU ⁻⁴⁰ 39.2 KCU ⁻⁴⁰ 49.0	KCV ⁻²⁰ 29.4 - -	
	10Г2А		421	265		21	S up to 10 mm incl. S from 10up to 15 mm incl. S over 15 mm	KCU ⁻⁶⁰ 29.4 KCU ⁻⁶⁰ 39.2 KCV ⁻⁶⁰ 49.5	KCV ⁻⁴⁰ 29.4	
	09Г2С		470-588	265		21	S up to 10 mm incl. S from 10up to 15 mm incl. S over 15 mm	KCU ⁻⁶⁰ 29.4 KCU ⁻⁶⁰ 39.2 KCU ⁻⁶⁰ 49.0	KCV ^{-34,-40,-60} 29.4	
TU 14-3P-1128-2007	10		353	216		24	S up to 10 mm incl. S from 10up to 15 mm incl. S over 15 mm	KCU ⁻⁴⁰ 29.4 KCU ⁻⁴⁰ 39.2 KCU ⁻⁴⁰ 49.0	KCV ⁻²⁰ 29.4	
	20		412	245		21	S up to 10 mm incl. S from 10up to 15 mm incl. S over 15 mm	KCU ⁻⁴⁰ 29.4 KCU ⁻⁴⁰ 39.2 KCU ⁻⁴⁰ 49.0	KCV ⁻²⁰ 29.4 - -	
	10Г2А		421	265		21	S up to 10 mm incl. S from 10up to 15 mm incl. S over 15 mm	KCU ⁻⁶⁰ 29.4 KCU ⁻⁶⁰ 39.2 KCV ⁻⁶⁰ 49.5	KCV ⁻⁴⁰ 29.4	
	09Г2С		470	265		21	S up to 10 mm incl. S from 10up to 15 mm incl. S over 15 mm	KCU ⁻⁶⁰ 29.4 KCU ⁻⁶⁰ 39.2 KCU ⁻⁶⁰ 49.0	KCV ^{-34,-40,-60} 29.4	
TU 14-3-1618-89	13ГФА	I	410	240		23			KCV ⁻³⁰ 245	
		II	471	290		22			KCV ⁻³⁰ 245	
		III	539.5	392.4		20			KCV ⁻³⁰ 245	
TU 14-3P-77-2004	20	I	413-550	241	0.85	22		KCV ⁻²⁰ 294	KCV ⁻³⁰ 294	
	12ГФ	II	413-550	290	0.85	24		KCV ⁻²⁰ 392	KCV ⁻³⁰ 392	
TU 14-3-1971-97	20B	K48	470	338-451	0.8	25			KCV ⁻⁴⁰ 98	
TU 14-3-1972-97	06X1	K42	412	289-412	0.8	25		KCV ⁻³⁰ 147	KCV ⁻⁴⁰ 196	
	06XФ	K52	510	386-510	0.8	25		KCV ⁻³⁰ 98	KCV ⁻⁴⁰ 147	
TU 1308-269-00147016-2003	20Ф(В) 06XФ	K48	470	338-451	0.8	25		KCV ⁺²⁰ 147	KCV ⁻⁴⁰ 98	KCV ⁻⁶⁰ 49
		K42	412	289-412	0.8	25		KCV ⁺²⁰ 196	KCV ⁻⁴⁰ 196	KCV ⁻⁶⁰ 147
		K52	510	385-510	0.8	25		KCV ⁺²⁰ 196	KCV ⁻⁴⁰ 147	KCV ⁻⁶⁰ 98
TU 1381-159-00147016-01	06X1, 06XФ, 09ГСФ	K42	410	245-410	0.75	24				KCV ⁻⁶⁰ 29-49
		K48	470	338-451	0.75	24				KCV ⁻⁶⁰ 29-94
TU 1317 - 006.1 - 593377520 - 2003	20А, 20ФА, 08ХМФЧА, 13ХФА, 15ХФА, 15ХМФА, 20ХФА	K48	470	338-451	0.80	25.0	KCV ⁻⁵⁰ 98	Hardness HRB, max. 98	Shear fracture percent. 50% min. at minus 50°C	
		K50	491	343-470	0.80	25.0				
		K52	510	372-491	0.85	23.0				
		K54	530	383-510	0.85	23.0				
		K56	549	392-539	0.85	23.0				

Table 4 (concluded)

Normative Document	Steel Grade	Pipe Grade	Ultimate Tensile Strength, $\sigma_U, N/mm^2$	Yield strength, $\sigma_Y, N/mm^2$	σ_Y/σ_U	Elongation, $\delta_5, \%$	Impact Strength, J/cm^2		
			min.	max.			max.	min.	min.
TU 1317-214-00147016-02**	20Ф	K54	539	382-590	0.85	25	KCV ⁶⁰ 98		Shear fracture percent, 70% min. at minus 60°C
TU 1381 - 204 - 00147016 - 01	09ГСФ	K48	470-588	314	0.85	25			KCU ⁶⁰ 49
		K50	490-608	343	0.85	25			
	12ГФ	K50	490-608	343	0.85	25			KCV ⁵⁰ 98
TU 1308-226-00147016-02**	12ХМФА 08ХМФА 20Ф4А 20Ф 06Х1Ф		512	386-512	0.85		KCV ⁺²⁰ 205 KCV ⁺²⁰ 196	KCV ⁶⁰ 127	KCV ⁵⁰ 98 KCV ⁵⁰ 67 KCV ⁶⁰ 98
			502	402-510	0.8	23		KCV ⁴⁰ 196	
			502	338-470	0.8	23		-	
			512	386-512	0.85	25			
			512	386-512	0.85	25		KCV ⁶⁰ 127	
TU 14-157-37-94	20А	-	412	245	-	21	-	KCV ⁴⁰ 29	
TU 14-157-38-94	09Г2СА	-	450	325	-	21	-	KCV ⁴⁰ 34	KCU ⁷⁰ 29
TU 14-3P-48-2001	20А	-	412	245	-	21	-	KCV ⁴⁰ 29	-
	09Г2СА	-	470	325	-	21	-	KCV ⁴⁰ 34	-
TU 14-157-50-97 TU 14-157-54-97	20 «S» select, 20ЮЧ		502-598	388-450	0.8	25	KCV ⁺²⁰ 167	KCV ⁴⁰ 147	KCV ⁷⁰ 98
	09ГСФ		461-559	325-441	0.8	26 28	KCV ⁺²⁰ 196	KCV ⁴⁰ 167	KCV ⁷⁰ 147
TU 14-157-60-98	20 «S» select		470-598	314-451		25	KCV ⁺²⁰ 167	KCV ⁴⁰ 147	KCV ⁷⁰ 98
TU 14-3-1801-92	09Г2С	K48	470	314	0.82	22		KCU ⁶⁰ 147	KCV ⁶⁰ 98
		K50	490	343	0.82	22		KCU ⁶⁰ 147	KCV ⁶⁰ 98
TU 14-161-147-94** TU 14-161-148-94**	20 08ХМФА		502-598	338-470	0.80	25	KCV ⁺²⁰ 147	KCV ⁴⁰ 98	KCU ⁷⁰ 69 KCV ⁷⁰ ≥ 69
TU 14-161-174-97	20Дс		502-598	338-470	0.8	25	KCV ⁺²⁰ 196	KCV ⁴⁰ 147	KCV ⁶⁰ 98
TU 14-162-14-96 TU 14-162-20-96	20А 20ЮЧА 08ХМФА 09СФА		502-627	338-470	0.8	25	longitudinal	transverse	
			502-627	338-470			KCV ⁺²⁰ 167	KCV ²⁰ 78	
			502-627	372-509			KCV ⁵⁰ 78	KCV ⁵⁰ 29	
			461-627	338-470			KCV ⁺²⁰ 206 KCV ⁵⁰ 127	KCV ²⁰ 108 KCV ⁵⁰ 49	
			461-627	338-470			KCV ⁺²⁰ 196 KCV ⁵⁰ 147	KCV ²⁰ 98 KCV ⁵⁰ 39	
TU 1308 - 245 - 00147016 - 02	20ФА		502	338-510	0.8	25	KCV ⁺²⁰ 147		KCV ⁵⁰ 98
	13ХФА		502-627	353-470	0.8	25	KCV ⁺²⁰ 196		KCV ⁵⁰ 98
TU 1308 - 195 - 00147016 - 01	13ХФ		510	412-539	0.85	23	KCV ⁺²⁰ 294	KCV ⁴⁰ 196	KCV ⁶⁰ 70
TU 14-1-5439-2001	20ПКС	K42	410	245-410	0.75	24	KCU ⁶⁰ 29-49	KCV ²⁰ 25	
TU 14-1-5392-2000	20	K42	431	255		22	KCU ⁺²⁰ 78		
	10Г2		421	265		21	KCU ⁺²⁰ 118	KCU ⁴⁰ 25	
	09Г2С		460	303		21	KCU ⁺²⁰ 60	KCU ⁴⁰ 34	
TU 1317 - 233 - 00147016 - 02	13ХФА	K52	502-686	353-519	0.85	23	KCV ⁺²⁰ 205		KCV ⁶⁰ 127
TU 1317 - 204 - 00147016 - 01	09ГСФ	K52	510-627	372	0.85	25			
	12ГФ	K52		372	0.85	25		KCV ⁵⁰ 98	
TU 14-3P-91-2004	20КТ							Wall Thickness	
		K48	470	294		22	KCV ²⁰ 39,2	5-10	KCU ⁶⁰ 29,4
		K52	510	353		20		10-15	KCU ⁶⁰ 39,2
K42	412	245	-	21	15-26	KCU ⁶⁰ 49,0			
TU 1317-023-48124013-05	13ХФА 08ХМФА	K52	510	353	0.85	23	KCV ⁶⁰ 98	Hardness HRB, 92 max.	Shear fracture percent, 70% min. at minus 60°C
TU 14-3P-90-2007	X42SS		412	289-402	0.85	Longit. 28.0 Transv. 24.0	Longitudinal KCV ⁴⁰ 98.	Transverse KCV ⁴⁰ 49	Hardness HRB 200 max.
TU 14-156-93-2010		PCT	440-520	235	0.90	22	Group L KCV 29***	Group G KCV 40***	
		PCT32	44-570	315	0.90	22	KCV 31***	KCV 40***	
		PCT36	490-630	355	0.90	21	KCV 36***	KCV 50***	
		PCT40	510-660	390	0.90	20	KCV 39***	KCV 57***	
		PCT420	530-680	420	0.92	19	KCV 42***	KCV 64***	

* Calculations from the equation shown in API specification.

** For more details refer to Manufacturer's specifications (TU)

According to TU 1308-226-00147016-02, the hardness HRB shall not exceed 92-93

According to TU 14-161-147-94 and TU 14-161-148-94 it shall not exceed 92.

*** Test temperature according to the specification.

Table 5 – Seamless Pipe. Corrosion Resistance Criteria

Normative Document	Steel Grade	Properties			
		Corrosion Cracking		Sulfide Stress Cracking Resistance	Corrosion Rate
		Test Method			
		NACE MR 0284		NACE MR 0177	Method of ZAO VNIITneft «STO Ros-NITI 00190420-001-2007» and other ND
		Index			
		Limit Coefficient		Threshold Stress, SSC	Total Corrosion Rate in Simulated Environments
		length, CLR	thickness, CTR		
max.		max.	max.		
TU 14-3-1971-97	20B	3%	6%	75% σ_U	0.5 mm/year
TU 14-3-1972-97	06X1, 06X Φ	3%	6%	80% σ_U	0.5 mm/year
TU 14-1-5439-2001	20ПКС	3%	6%	75% σ_U	0.5 mm/year
TU 1308-195-00147016-01	13X Φ	0%	0%	75% σ_U	0.5 mm/year
TU 1317-214-00147016-02	20 Φ	1,5%	3%	75% σ_U	0.5 mm/year
TU 1317 - 204-00147016-01	09ГС Φ 12Г Φ	3%	6%	65% σ_U 75% σ_U	0.5 mm/year
TU 1308-226-00147016 -02	12XM Φ A	1%	3%	80% σ_U	0.5 mm/year
	08XM Φ ЧA	0 %	0 %	75% σ_U	0.3 mm/year
	20 Φ ЧA	1%	3%	70% σ_U	0.5 mm/year
	20 Φ	1%	3%	75% σ_U	0.5 mm/year
	06X1 Φ	1 %	3 %	80% σ_U	0.3 mm/year
TU 1317-233-00147016-02	13X Φ A	1,5%	3%	75% σ_U	0.5 mm/year
TU 14-162-14-96	20A, 20Ю4A, 15A, 08XM4A	3%	6%	70% σ_U	0.5 mm/year
TU 14-162-20-97	20, 20Ю4, 08XM4A	3%	6%	70% σ_U 75% σ_U	0.5 mm/year
TU 14-161-174-97	20Дс	3%	6%	75% σ_U	0.5 mm/year
TU 14-161-147-94	20	3%	6%	75% σ_U	-
TU 14-161-148-94	20, 08XMЧA	3%	6%	75% σ_U	0.5 mm/year
TU 14-157-60-98	20 «C» select	1%	3%	70% σ_U	-
TU 14-157-50-97	20 «C» select	3%	6%	75% σ_U	0.5 mm/year
TU 14-157-54-97	20 «C» select, 09ГС Φ	3%	6%	75% σ_U	0.5 mm/year
TU 1317-006.1-593377520-2003	20A, 20 Φ A, 09С Φ A, 13X Φ A	3%	6%	75% σ_U	0.5 mm/year
	15X Φ A, 15XM Φ A	1%	2%	75% σ_U	0.3 mm/year
	08XM Φ ЧA, 20X Φ A	0%	0%	80% σ_U	0.3 mm/year
TU 14-3P-90-2007	X42SS	0%	0%	80% σ_U	-
TU 1317-023-48124013-05	13X Φ A	1%	3%	75% σ_U	0.5 mm/year
	08XM Φ ЧA	1%	1%	80% σ_U	0.5 mm/year

3.3 Optionally, at User's request, the pipe shall have temporary corrosion-preventing coating on the outside surface to ensure required corrosion protection of the pipe during transportation.

3.4 The pipe may be supplied with protective polymer coating. The pipe manufacturer shall ensure protection of the coating against abrasion or other damages during transportation.

3.5 Pipe ends shall be protected with special components (plugs, caps). Such protectors shall be disposed of by the user after their utilization.

3.6 Optionally, at User's request, the pipe intended for the Far North regions shall be packed in compliance with GOST 15846.

3.7 A quality document (certificate) shall be attached to each lot of ready pipe to certify pipe compliance with the specification requirements. The document shall contain any information required according to the pipe specification.

3.8 The quality certificate for pipe with polymer coating shall reference the coating specification.

Table 6 – Range of Longitudinal Electric-Welded Pipe According to GOST 10704

Outside Diameter, mm	Wall Thickness, mm																								
	1.0	1.2	1.4	(1.5)	1.6	1.8	2.0	2.2	2.5	2.8	3.0	3.2	3.5	3.8	4.0	4.5	5.0	5.5	6.0	7.0	8.0	9.0	10.0	11.0	12.0
	Mass of 1 running meter, kg																								
10	0.222	0.260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10.2	0.227	0.266	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	0.271	0.320	0.366	0.388	0.410	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	0.370	0.438	0.504	0.536	0.568	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	0.419	0.497	0.573	0.610	0.719	0.789	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	0.444	0.527	0.608	0.647	0.687	0.764	0.838	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	0.469	0.556	0.642	0.684	0.726	0.808	0.888	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21.3	0.501	0.595	0.687	0.732	0.777	0.866	0.952	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	0.518	0.616	0.711	0.758	0.805	0.897	0.986	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	0.567	0.675	0.780	0.832	0.884	0.985	1.09	1.18	1.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	0.592	0.704	0.815	0.869	0.923	1.03	1.13	1.24	1.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	0.617	0.734	0.849	0.906	0.963	1.07	1.18	1.29	1.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	0.641	0.764	0.884	0.943	1.00	1.12	1.23	1.35	1.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	0.666	0.793	0.918	0.980	1.04	1.16	1.28	1.40	1.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	0.715	0.852	0.987	1.05	1.12	1.25	1.38	1.51	1.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	0.765	0.911	1.06	1.13	1.20	1.34	1.48	1.62	1.82	2.02	2.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	0.789	0.941	1.09	1.17	1.24	1.38	1.53	1.67	1.88	2.09	2.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33.7	-	0.962	1.12	1.19	1.27	1.42	1.56	1.71	1.92	2.13	2.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	-	1.00	1.16	1.24	1.32	1.47	1.63	1.78	2.00	2.22	2.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	-	1.03	1.19	1.28	1.36	1.52	1.68	1.83	2.07	2.29	2.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	-	1.09	1.26	1.35	1.44	1.61	1.78	1.94	2.19	2.43	2.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	-	1.15	1.33	1.42	1.52	1.70	1.87	2.05	2.31	2.57	2.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	-	1.21	1.40	1.50	1.59	1.78	1.97	2.16	2.44	2.71	2.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44.5	-	1.28	1.49	1.59	1.69	1.90	2.10	2.29	2.59	2.88	3.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	-	1.3	1.51	1.61	1.71	1.92	2.12	2.32	2.62	2.91	3.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48	-	-	1.61	1.72	1.83	2.05	2.27	2.48	2.81	3.12	3.33	3.54	3.84	-	-	-	-	-	-	-	-	-	-	-	-
48.3	-	-	1.62	1.73	1.84	2.06	2.28	2.50	2.82	3.14	3.35	3.56	3.87	-	-	-	-	-	-	-	-	-	-	-	-
51	-	-	1.71	1.83	1.95	2.18	2.42	2.65	2.99	3.33	3.55	3.77	4.10	-	-	-	-	-	-	-	-	-	-	-	-
53	-	-	1.78	1.91	2.03	2.27	2.52	2.76	3.11	3.47	3.70	3.93	4.27	-	-	-	-	-	-	-	-	-	-	-	-
54	-	-	1.82	1.94	2.07	2.32	2.56	2.81	3.18	3.54	3.77	4.01	4.36	-	-	-	-	-	-	-	-	-	-	-	-
57	-	-	1.92	2.05	2.19	2.45	2.71	2.97	3.36	3.74	4.00	4.25	4.62	-	-	-	-	-	-	-	-	-	-	-	-
60	-	-	2.02	2.16	2.30	2.58	2.86	3.14	3.55	3.95	4.22	4.48	4.88	5.27	-	-	-	-	-	-	-	-	-	-	-
63.5	-	-	2.14	2.29	2.44	2.74	3.03	3.33	3.76	4.19	4.48	4.76	5.18	5.59	-	-	-	-	-	-	-	-	-	-	-
73	-	-	2.47	2.64	2.82	3.16	3.50	3.84	4.35	4.85	5.18	5.51	6.00	6.48	6.81	-	-	-	-	-	-	-	-	-	-
76	-	-	2.58	2.76	2.94	3.29	3.65	4.00	4.53	5.05	5.40	5.75	6.26	6.77	7.10	7.93	8.75	9.56	-	-	-	-	-	-	-
89	-	-	-	-	3.45	3.87	4.29	4.71	5.33	5.95	6.36	6.77	7.38	7.98	8.38	9.38	10.36	11.33	-	-	-	-	-	-	-
95	-	-	-	-	-	-	4.59	-	5.70	-	-	7.24	-	-	-	11.10	-	-	-	-	-	-	-	-	-
102	-	-	-	-	-	4.45	4.93	5.41	6.13	6.85	7.32	7.80	8.50	9.20	9.67	10.82	11.96	13.09	-	-	-	-	-	-	-
108	-	-	-	-	-	4.71	5.23	5.74	6.50	7.26	7.77	8.27	9.02	9.76	10.26	11.49	12.70	13.90	-	-	-	-	-	-	-
114	-	-	-	-	-	7.98	5.52	6.07	6.87	7.68	8.21	8.84	9.54	10.33	10.85	12.15	13.44	14.72	-	-	-	-	-	-	-
127	-	-	-	-	-	5.56	6.17	6.77	7.68	8.58	9.17	9.77	10.66	11.55	12.13	13.59	15.04	16.48	-	-	-	-	-	-	-
133	-	-	-	-	-	5.82	6.46	7.10	8.05	8.99	9.62	10.24	11.18	12.11	12.73	14.26	15.78	17.29	-	-	-	-	-	-	-
140	-	-	-	-	-	6.13	6.81	7.48	8.48	9.47	10.14	10.80	11.78	12.76	13.48	15.04	16.65	18.24	-	-	-	-	-	-	-
152	-	-	-	-	-	6.67	7.40	8.13	9.22	10.30	11.02	11.74	12.82	13.89	14.60	16.37	18.13	19.87	-	-	-	-	-	-	-
159	-	-	-	-	-	7.38	8.19	9.00	10.20	11.41	11.54	12.30	13.42	14.52	15.29	17.15	18.99	20.82	22.64	26.24	26.24	26.24	26.24	26.24	26.24
168	-	-	-	-	-	7.81	8.67	9.53	10.81	12.08	12.21	13.01	14.20	15.39	16.18	18.14	20.10	22.04	23.97	25.97	27.79	27.79	27.79	27.79	27.79
177.8	-	-	-	-	-	-	-	-	-	-	12.93	13.78	15.04	16.31	17.14	19.23	21.31	23.37	25.42	29.49	29.49	29.49	29.49	29.49	29.49
193.7	-	-	-	-	-	-	9.46	10.39	11.79	13.18	14.11	15.03	16.42	17.80	18.71	21.00	23.27	25.53	27.77	32.23	32.23	32.23	32.23	32.23	32.23
219	-	-	-	-	-	-	-	-	13.35	14.93	15.98	17.03	18.60	20.17	21.21	23.80	26.39	28.96	31.52	36.60	36.60	36.60	36.60	36.60	36.60
244.5	-	-	-	-	-	-	-	-	-	-	17.87	19.04	20.80	22.56	23.72	26.63	29.53	32.42	35.42	41.00	41.00	41.00	41.00	41.00	41.00
273	-	-	-	-	-	-	-	-	-	-	-	-	23.26	25.23	26.54	29.80	33.05	36.28	39.51	45.92	45.92	45.92	45.92	45.92	45.92
325	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31.67	35.57	39.46	43.34	47.20	54.90	54.90	54.90	54.90	54.90	54.90

Table 6 (concluded)

Outside Diameter, mm	Wall Thickness, mm																															
	4.0	4.5	5.0	5.5	6.0	7.0	8.0	9.0	10	11	12	13	14	16	17.5	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
	Mass of 1 running meter, kg																															
355.6	34.68	38.96	43.23	47.49	51.73	60.18	68.58	76.93	85.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
377	36.79	41.34	45.87	50.39	54.90	63.87	72.80	81.68	90.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
406.4	39.70	44.60	49.50	54.38	59.25	68.95	78.60	88.20	97.76	107.26	116.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
426	41.63	46.78	51.91	57.04	62.15	72.33	82.47	92.55	102.59	112.58	122.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
(478)	-	-	58.32	64.09	69.84	81.31	92.73	104.10	115.42	126.69	137.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
530	-	-	64.74	71.14	77.54	90.29	102.99	115.64	128.24	140.79	153.30	165.75	178.15	202.82	221.18	227.28	239.44	263.61	275.62	278.58	299.49	-	-	-	-	-	-	-	-	-	-	
630	-	-	-	-	-	107.55	122.72	137.83	152.90	167.92	182.89	197.81	212.68	242.27	264.34	271.67	286.30	300.87	-	-	-	-	-	-	-	-	-	-	-	-	-	
720	-	-	-	-	-	123.09	140.47	157.81	175.10	192.33	209.52	226.66	243.75	277.79	303.18	311.62	328.47	345.26	362.01	378.70	395.35	411.95	411.95	428.49	444.99	461.41	477.84	510.49	-	-	-	
820	-	-	-	-	-	140.35	160.20	180.00	199.76	219.46	239.12	258.72	278.28	317.25	346.34	356.01	375.32	394.58	413.79	432.96	452.07	471.13	490.15	509.11	528.03	546.89	565.71	584.48	-	-	-	
920	-	-	-	-	-	157.61	179.93	202.20	224.42	246.59	268.71	290.78	312.81	356.70	389.5	400.40	422.18	443.91	-	-	-	-	-	-	-	-	-	-	-	-	-	
1020	-	-	-	-	-	199.66	224.39	249.08	273.72	298.31	322.84	347.33	396.16	432.65	444.79	469.04	493.23	517.37	541.47	565.51	589.51	613.45	637.35	661.20	685.00	708.75	732.45	756.10	779.70	-	-	
1120	-	-	-	-	-	219.39	246.59	273.74	300.86	327.90	354.90	381.86	435.62	475.81	481.19	515.89	542.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1220	-	-	-	-	-	-	268.7	28.40	327.97	357.49	386.96	416.38	475.08	518.97	533.58	562.75	591.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1420	-	-	-	-	-	-	-	347.73	382.23	416.68	451.08	485.44	554.00	588.20	605.29	622.36	656.46	690.52	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table 6a – Range of Longitudinal Electric-Welded Pipe According to GOST 20295 (type 1)

Outside Pipe Diameter, mm	Design Mass of 1-m pipe length, kg, with Nominal Wall Thickness of, mm																								
	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0
114	8.21	9.54	10.85	12.15	13.44	14.72	15.98	17.23	18.47	19.70	20.91	22.11	23.30	-	-	-	-	-	-	-	-	-	-	-	-
140	10.14	11.78	13.42	15.04	16.65	18.24	19.83	21.40	22.96	24.51	26.04	27.56	29.07	32.06	34.99	-	-	-	-	-	-	-	-	-	-
146	10.58	12.30	14.01	15.70	17.39	19.06	20.71	22.36	23.99	25.62	27.22	28.82	30.41	33.54	36.62	-	-	-	-	-	-	-	-	-	-
159	11.54	13.42	15.29	17.15	18.99	20.82	22.64	24.44	26.24	28.02	29.79	31.55	33.29	36.74	40.15	-	-	-	-	-	-	-	-	-	-
168	12.21	14.20	16.18	18.15	20.10	22.04	23.97	25.89	27.79	29.68	31.57	33.43	35.29	38.96	42.59	-	-	-	-	-	-	-	-	-	-
178	12.95	15.06	17.16	19.25	21.33	23.40	25.45	27.49	29.52	31.53	33.54	35.53	37.51	41.43	45.30	-	-	-	-	-	-	-	-	-	-
219	15.98	18.60	21.21	23.80	26.39	28.96	31.52	34.06	36.60	39.12	41.63	44.12	46.61	51.54	56.42	-	-	-	-	-	-	-	-	-	-
245	-	-	23.77	26.69	29.59	32.49	35.36	38.23	41.09	43.93	46.76	49.57	52.38	57.95	63.47	-	-	-	-	-	-	-	-	-	-
273	-	-	26.54	29.80	33.05	36.28	39.51	42.72	45.92	49.11	52.28	55.44	58.60	64.86	71.07	-	-	-	-	-	-	-	-	-	-
325	-	-	31.67	35.57	39.46	43.34	47.20	51.05	54.90	58.73	62.54	66.35	70.14	77.68	85.18	-	-	-	-	-	-	-	-	-	-
377	-	-	-	41.34	45.87	50.39	54.90	59.39	63.87	68.34	72.80	77.25	81.68	90.51	99.28	-	-	-	-	-	-	-	-	-	-
426	-	-	-	-	51.91	57.04	62.15	67.25	72.33	77.41	82.47	87.52	92.56	102.59	112.58	-	-	-	-	-	-	-	-	-	-
530	-	-	-	-	64.74	71.14	77.54	83.92	90.29	96.64	102.99	109.32	115.64	128.24	140.79	153.30	165.75	178.15	190.50	202.82	215.07	227.28	239.44	251.55	263.61

Table 7 – Normative Documents for Manufacture and Delivery of Longitudinal Electric-Welded Pipe

Normative Document	Pipe Size		Steel Grade
	Outside Diameter, mm	Wall Thickness, mm	
GOST 10705-80 Electric-welded steel pipe. Specification Range of sizes according to GOST 10704. For pipelines and structures for various purposes	10-530	1,0-32,0	08кп, 08пс, 08, 08Ю, 10кп, 10пс, 10, 15кп, 15пс, 15, 20кп, 20пс, 20, Ст2кп, Ст2пс, Ст2сп, Ст3кп, Ст3пс, Ст3сп, Ст4кп, Ст4пс, Ст4сп, 22ГЮ, 20Ф, 20-КСХ, 06ГБ, 09Г2С, 09ГСФ, 13ХФА, 17ГС, 17Г1С, 17Г1С-У, 08ХМФЧА, 22ГФ, 26ХМА
GOST 10706-76 Longitudinal electric-welded steel pipe. Specification Range of sizes according to GOST 10704	530-1420	8,0-32,0	Ст2кп, Ст2пс, Ст2сп, Ст3кп, Ст3пс, Ст3сп. Low-alloy steel ($C_3 \leq 0.48\%$)
GOST 20295-85 Welded steel pipe for main gas-and-oil pipelines. Specification	114 - 1420	8,0 – 25,0	3сп (K34), 20 (K42), low-alloy steels (K50, K52, K55, K60)
GOST 52079-2003 Welded steel pipe for main gas pipelines, oil pipelines and oil product pipelines. Specification	114-1420		K34 – K48
API Spec 5L/ISO 3183 Petroleum and natural gas industries – Steel pipe for pipeline transportation systems	88,9-508,0		A25; A; B; X42; X46; X52; X56; X60; X65
TU 14-162-43-98 Longitudinal electric-welded steel pipe of low-alloy steels. (Range of sizes according to GOST 10704-91)	89 - 530		09Г2С; 16ГС; 17ГС; 17Г1С according to GOST 19281 and steel 22ГЮ according to TU 14-106-502
TU 14-3P-98-2008 Longitudinal electric-welded steel line pipe with higher cold resistance and resistance to local corrosion	168-530		20КСХ
TU 1303-006.3-593377520-2003 Longitudinal electric-welded steel line pipe produced by high-frequency welding, with increased field reliability designed for construction of fields of OAO TNK	168-530		20Ф, 09ГСФ, 09ФСБ, 13ХФА, 15ХМФА, 08ХМФЧА
TU 14-156-77-2008 Longitudinal electric-welded steel pipe 530-1420 mm in diameter for main gas pipelines under a pressure of 9.8 MPa	530-1420	8,0-32,0	K52, K54, K55, K56, K60, X56, X60, X65, X70
TU 14-156-78-2008 Longitudinal electric-welded steel pipe 530-1420 mm in diameter, grade K60, for main gas pipelines under a working pressure of 11.8 MPa	530-1420	11,8-37,9	K60
TU 14-156-80-2008 Longitudinal electric-welded steel pipe of common and cold-resistant design for main oil pipelines	530-1220	8,0-35,0	K42-K60
TU 14-156-82-2008 Longitudinal electric-welded steel pipe 1420 mm in diameter, grade K65, for main gas pipelines under a working pressure of 11.8 MPa	1420	23,0-33,4	K65
TU 14-156-81-2008 Longitudinal electric-welded pipe for main oil pipeline "East Siberia – Pacific Ocean"	1067, 1220	10,0-35,0	K56, K60
API Spec 5L/ISO 3183 Petroleum and natural gas industries – Steel pipe for pipeline transportation systems	508-1422	7,9-31,8	X42-X70
TU 14-156-85-2009 Longitudinal electric-welded steel line pipe 530-1220 mm in diameter with increased corrosion resistance and cold resistance made of steel 20 КСХ for fields of OAO Surgutneftegaz	530-1220	8,0-25,0	K52
TU 1303-006.2-593377520-2003 Longitudinal electric-welded steel line pipe with increased field reliability, corrosion- and cold-resistance, produced by automatic submerged welding and designed for construction of fields of OAO TNK	530-1220		09ГСФ, 20Ф
TU 14-156-87-2010 Longitudinal electric-welded steel line pipe with increased field reliability, corrosion- and cold-resistance, produced by automatic submerged welding and designed for construction of fields of NK Rosneft	530-1220	8-25	X52, X56, X60 K48, K52, K56
TU 14-156-91-2010 Electric-welded steel line pipe	530-820		X52, X56, X60, X65, X70
TU 14-156-92-2010 Longitudinal electric-welded steel pipe for offshore pipelines	508-820	max. 32	K52, K54, K56

Table 8 – Parent Metal of Heat-Treated and Hot-Reduced Longitudinal Electric-Welded Pipe Made of Carbon Steels According to GOST 10705. Mechanical Properties

Steel Grade	Ultimate Tensile Strength, $\sigma_u, N/mm^2$	Yield Strength, $\sigma_y, N/mm^2$	Elongation, $\delta_5, \%$
	minimum		
08Ю	255	174	30
08кп	294	174	27
08, 08пс, 10кп	314	196	25
10, 10пс, 15кп, Ст2пс, Ст2сп, Ст2кп	333	206	24
15, 15пс, 20кп, Ст3сп, Ст3пс, Ст3кп	372	225	22
20, 20пс, Ст4сп, Ст4пс, Ст4кп	412	245	21
20Ф, 20-КСХ, 06ГБ	470	294	20.0
09Г2С, 09ГСФ, 13ХФА, 17ГС, 17Г1С, 17Г1С-У, 22ГФ, 08ХМФЧА, 26ХМА	490	343	20.0

The mechanical properties of heat-treated pipe made of steel grade 22ГЮ shall be agreed by the Parties.

Table 8a – Parent Metal of Longitudinal Electric-Welded Pipe With and Without Weld Heat-Treatment According to GOST 10705. Mechanical Properties

Steel Grade	Ultimate Tensile Strength σ_U , N/mm ² , for Pipe Outside Diameter D, mm			Yield Strength σ_Y , N/mm ²	Elongation δ_5 , %, for Pipe Outside Diameter D, mm		
	10 up to 19	over 19 up to 60	over 60 up to 152		10 up to 60 and Wall Thickness over 0,06D		over 60 up to 152
					0,06D and less	0,06D and less	
08Ю	314	294	264	176	7	16	25
08пс, 08кп	372	314	294	176	6	15	23
08	372	314	294	186	6	15	23
10кп, Ст2кп	372	333	314	176	6	15	23
10пс, Ст2пс	372	333	314	186	6	15	23
10, Ст2сп	372	333	314	196	6	15	23
15кп	441	372	353	186	5	14	21
15пс, 20кп	441	372	353	196	5	14	21
15, 20пс	441	372	353	206	5	14	21
20	441	372	353	216	5	14	21
Ст3кп	441	392	372	196	5	13	20
Ст3пс	441	392	372	206	5	13	20
Ст3сп	441	392	372	216	5	13	20
Ст4кп, Ст4пс	490	431	412	216	4	11	19
Ст4сп	490	431	412	325	4	11	19
22ГЮ	-	-	490	344	-	-	15
20Ф, 20-КСХ, 06ГБ	-	-	470	265	-	-	18
09Г2С, 09ГСФ, 13ХФА, 17ГС, 17Г1С, 17Г1С-У, 22ГФ, 08ХМФ4А, 26ХМА	-	-	490	323	-	-	18

Steel Grade	Wall Thickness, mm	Ultimate Tensile Strength σ_U , N/mm ²	Yield Strength σ_Y , N/mm ²	Elongation δ_5 , %, for Pipe Outside Diameter D, mm		
				over 152 up to 244.5	over 244.5 up to 377	over 377 up to 530
				min.		
08, 08пс, 08кп	6 and less	-	-	18	20	20
10, 10пс, 10кп, Ст2кп	over 6	314	196	15	15	16
Ст2сп, Ст2пс	6 and less	-	-	17	18	20
	over 6	333	206	14	14	15
15, 15пс, 15кп, 20, 20кп	6 and less	353	216	17	18	20
	over 6	-	-	14	14	15
Ст3сп, Ст3пс, Ст3кп	6 and less	353	216	17	17	19
	over 6	-	-	14	14	14
Ст4сп, Ст4пс, Ст4кп	6 and less	402	225	15	17	18
	over 6	-	-	11	12	13
22ГЮ	All Thicknesses	490	344	15	15	15
20Ф, 20-КСХ, 06ГБ	All Thicknesses	470	265	18	18	18
09Г2С, 09ГСФ, 13ХФА, 17ГС, 17Г1С, 17Г1С-У, 22ГФ, 08ХМФ4А, 26ХМА	All Thicknesses	490	323	18	18	18
13Г1С-У	All Thicknesses	540	373	18	18	18

The mechanical properties of low-alloy steel pipe shall be agreed by the Parties.

Table 8b – Impact Strength for Heat-Treated Pipe according to GOST 10705 (at Customer's Request)

Steel Grade	Impact Strength KCU, J/cm ² , at Test Temperature, °C		
	+20	-20	+20 (after mechanical ageing)
	min.		
Ст3сп, Ст3пс, 10, 15, 20	78.4	39.2	39.2
20Ф, 20-КСХ, 06ГБ, 09Г2С, 09ГСФ, 13ХФА, 17ГС, 17Г1С, 17Г1С-У, 08ХМФ4А, 22ГФ, 26ХМА	78.4	39.2	-

Note. The data are given for pipe wall thicknesses of 6 mm at least.

The impact strength for pipe made of steel grade 22ГЮ shall be agreed by the Parties.

Table 8c – Parent Metal of Longitudinal Electric-Welded Pipe According to GOST 10706. Mechanical Properties

Steel Grade	Ultimate Tensile Strength σ_U , kgf/mm ² (MN/m ²)	Yield Strength σ_Y , kgf/mm ² (MN/m ²)	Elongation δ_5 , %
	min.		
	Ст2кп	33(325)	22(215)
Ст2пс, Ст2сп	34(335)	23(225)	22
Ст3кп	37(365)	24(235)	20
Ст3пс, Ст3сп	38(372)	25(245)	20
Low-alloy steel	45(440)	27(265)	18

Table 8d – Impact Strength for Parent Metal of Pipe Group B according to GOST 10706

Steel Grade	Wall Thickness, mm	Impact Strength KCU, kgf·m/cm ² (MJ/m ²), at test temperature, °C		
		+20	-20	-40
Ст3пс3, Ст3пс3	5 up to 9 incl.	6.0 (0.59)	-	-
	Over 9 up to 25	5.0 (0.49)	-	-
	Over 25	3.0 (0.29)	-	-
Ст3пс4, Ст3пс4	5 up to 9 incl.	-	2.0 (0.2)	-
	Over 9 up to 25	-	1.5 (0.15)	-
	Over 25	-	-	-
Low-alloy steel	Any wall thickness	-	-	2.5 (0.24)

Note. If agreed with the customer, the impact strength of low-alloy steel pipe parent metal at minus 60°C shall be 2.5 kgf·m/cm² (0.24 MJ/m²) at least.

Table 8e – Parent Metal of Longitudinal Electric-Welded Pipe Made According to Specifications (TU). Mechanical Properties

Normative Document	Steel Grade	Pipe Grade	Ultimate Tensile Strength ₁ , σ _u , N/mm ²	Yield Strength ₂ , σ _y , N/mm ²	σ _y /σ _u	Elongation, δ ₅ , %	Hardness, HRB	Shear Fracture Percentage, %	Impact Strength, J/cm ²		
					max.	min.			max.	min.	min.
TU 14-3P-98-2008	20KCX										
TU 1303-006.3-593377520-2003		K48	470	338-451	0.87	20	92	50 (at -50°C)	KCV ⁵⁰ 59		
		K50	502	343-470	0.87	20	92	50 (at -50°C)	KCV ⁵⁰ 59		
		K52	510	353-510	0.87	20	92	50 (at -50°C)	KCV ⁵⁰ 59		
		K54	529	383-529	0.87	20	92	50 (at -50°C)	KCV ⁵⁰ 59		
		K56	549	392-539	0.87	20	92	50 (at -50°C)	KCV ⁵⁰ 59		
TU 14-156-77-2008		K52, K54, K55, K56, K60, X56, X60, X65, X70	510-590 490-565	360-480 386-483		20		50-85 (at -20°C)	KCV ²⁰ 39.2-107.8	KCU ⁶⁰ 34.3-58.8	
TU 14-156-78-2008		K60	590	485	0.90	20	-	85(at -20°C)	KCV ⁴⁰ 100-170		
TU 14-156-80-2008		K42	410	245	0.9	21	-	-	KCV 58.8-78.5*	KCU 34.3-58.8*	
		K48	470	265		21	-	-			
		K50	490	345		20	-	-			
		K52	510	355		20	-	-			
		K54	530	380		20	-	-			
		K55	540	390		20	-	-			
		K56	550	410		20	-	-			
		K60	590	460		20	-	-			
TU 14-156-81-2008		K56	550	410	0.90	20	-	60*	KCV 58.8-78.5*	KCU 49.0-58.8*	
		K60	590	460	0.90	20	-				
TU 14-156-82-2008		K65	640	555		18		85(at -20°C)	KCV ³⁰ 250		
TU 14-156-85-2009	20KCX	K52	510-628	355	0.89	20		50(at -20°C)	KCV ²⁰ 39.2	KCU ⁶⁰ 39.2	
TU 1303-006.2-593377520-2003		K48	470	338-451	0.87	20	92	50(at -50°C)	KCV ⁵⁰ 59.0		
		K50	491	343-470	0.87	20	92				
		K52	510	353-539	0.87	20	92				
		K54	529	383-529	0.87	20	92				
		K56	549	392-539	0.87	20	92				
TU 14-156-87-2010		X52	460-760	360-530	0.89	Table 7 API 5L/ ISO 3183		55 (at -20°C)	KCV ²⁰ 59.0	KCU ⁶⁰ S up to 12.0 mm incl. - 34.3 over 12.0 up to 25.0 mm incl. - 39.2	
		X56	490-760	390-545	0.89						
		X60	520-760	415-565	0.90						
		K48	470-590	315-435	0.89						20.0
		K62	510-630	350-470	0.89						20.0
		K56	550-670	410-530	0.90						20.0
TU 14-156-91-2010		X52	460-760	360-530	0.90	Note f to Table 7 API 5L/ ISO 3183			KCV 29.4-49.0*	KCU ⁴⁰ S from 6 up to 12 mm incl. - 34.3 over 12 up to 25 mm -39.2 over 25 mm - 44.1	
		X56	490-760	390-545	0.90						
		X60	520-760	415-565	0.90						
		X65	535-760	450-600	0.9						
		X70	570-760	485-635	0.92						
TU 14-156-92-2010		PCT36W	490-630	355	0.90	21		**	**		
		PCT420W	530-680	420	0.92	19					

* The test temperature was taken from the specification.
** The impact strength values, shear fracture percentage are in compliance with the Manufacturer's specifications (TU).

Table 9 – Range of Spiral Electric-Welded Pipe of Large Diameter

Outside Diameter, mm	Wall Thickness, mm																									
	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	16.0	18.0	20.0	22.0	24.0	25.0	
	Mass of 1 running meter, kg																									
530	78.7	85.2	91.6	98.1	104.5	111.0	117.4	123.8	130.2	136.5	142.2	149.2	155.6													
630	93.7	101.4	109.2	116.9	124.5	132.2	139.9	147.5	155.2	162.8	170.4	178.0	185.6													
720	107.2	116.1	124.9	133.8	142.6	151.4	160.2	168.9	177.7	186.5	195.2	203.9	212.7	221.3	230.1											
820					162.6	172.6	182.7	192.7	202.7	212.7	222.7	232.7	242.7	252.6	262.6											
920					182.6	193.9	205.2	216.5	227.8	239.0	250.3	261.5	272.7													
1020							227.7	240.3	252.8	265.3	277.8	290.3	302.8	315.2	327.7	340.1	352.5	367.4	377.3	402.1						
1220								287.8	302.9	317.9	332.9	347.9	362.8	377.8	392.7	407.7	422.6	440.5	452.4	482.2						
1420													422.9	440.4	457.8	475.3	492.7	510.2	527.5	562.3	631.7	700.8	758.5			
1620																	562.8	582.7	602.6	642.4	721.8	801.0	867.0	944.6	998.1	
1720																		597.8	619.0	640.1	682.4	766.8	851.0	935.0	1018.8	1060.7
1820																		632.9	655.3	677.7	722.5	811.9	901.1	990.1	1078.9	1123.3
2020																		702.9	727.9	752.8	802.6	902.0	1001.2	1100.2	1199.0	1248.4
2220																					882.7	992.1	1101.3	1210.3	1319.2	1373.5
2520																					1002.8	1127.2	1251.5	1375.5	1499.4	1561.2

Table 10 – Normative Documents for Manufacture and Delivery of Large-Diameter Spiral Electric-Welded Pipe

Normative Document	Pipe Size		Steel Grade, Pipe Grade
	Outside Diameter, mm	Wall Thickness, mm	
GOST 20295-85 Welded steel pipe for main gas-and-oil pipelines. Specification	530-1020	6-12	K34, K42, K50, K52, K55, K60
API Spec 5L./ISO3183	610-2032	6,4-21,6	A, B, X42-X70
TU 1104-138100-357-02-96 Spiral electric-welded steel pipe 720, 820, 1020, 1220 mm in diameter, with external corrosion-resistant coating for use at a pressure up to 7.4 MPa (75 kgf/cm ²)	720-1220	7-14	17Г1С, 17Г1С-У; K52, K55, K60
TU 14-3-1976-99 Spiral electric-welded steel pipe with external corrosion-resistant coating for use at a pressure up to 7.4 MPa (75 kgf/cm ²)	530-1220	7-16	17Г1С, 17Г1С-У, 13ГС, 13Г1С-У, 10Г2ФБ and other low-alloy steels. K56, K60
TU 14-3-1977-2000 Spiral electric-welded steel pipe 1420 mm in diameter, with external corrosion-resistant coating for use at a pressure up to 7.4 MPa (75 kgf/cm ²)	1420	15,7	Low-alloy K60
TU 1381-144-00147016-01 Spiral electric-welded line pipe subjected to bulk heat treatment and designed for construction of field pipelines intended for service in highly-corrosive environments at OAO Surgut-neftegaz fields	530-1220	7-12	20, K48 09ГСФ, K52
TU 1381-158-00147016-01 Spiral electric-welded pipe subjected to bulk heat treatment and designed for construction of field pipelines intended for service in highly-corrosive environments	530-1220	7-12	20, K48, 09ГСФ K52
TU 14-3-1970-97 Spiral electric-welded steel pipe with increased corrosion and cold resistance made of quality carbon steel grade 20	530-1220	8-16	20, 20Ф K48, K52
TU 14-3-1973-98 Spiral electric-welded steel pipe made of low-alloy steel, with external corrosion-resistant coating for construction of main oil pipelines	530-1220	7-15	20, 17Г1С, 17Г1С-У, 13ГС, 13Г1С-У, 10Г2ФБ K52, K56, K60, X70
TU 14-3P-60-2002 Spiral electric-welded steel pipe 1420 mm in diameter for service at a pressure up to 8.3 MPa (84 kgf/cm ²)	1420	15,7-21,8	10Г2ФБ, X70
TU 1381-213-00147016-02 Spiral electric-welded steel line pipe subjected to bulk heat treatment with increased field reliability	530-720	7-12	20 K48, K52
TU 14-3P-52-2001 Spiral electric-welded steel pipe made of low-alloy steel grade 06ГФБАА for construction of main pipelines	530-1220	7-15	06ГФБАА K52, K54, K56
TU 1303-006.4-593377520-2003 Spiral electric-welded steel line pipe with increased field reliability for construction of OAO TNK fields	530-820	7-12	20Ф, 09Г2СФ, K48, K50, K52
TU 14-156-55-2005 Spiral electric-welded steel pipe of common and cold-resistant design designed for construction of main oil pipelines	530-1220	7-16	K42-K60

Table 10 (concluded)

Normative Document	Pipe Size		Steel Grade, Pipe Grade
	Outside Diameter, mm	Wall Thickness, mm	
GOST R 52079-2003 Electric-welded steel line pipe for main gas-and-oil pipelines, oil pipelines and oil product pipelines. Specifications.	530-1420	7-22	K34, K38, K42, K48, K50, K52, K54, K56, K60
TU 14-156-76-2007 Spiral electric-welded steel pipe 1420 mm in diameter for service at a pressure up to 9.8 MPa (100 kgf/cm ²). Specification.	1420	21.6	K60, X70
TU 14-156-67-2006 Spiral electric-welded steel pipe 1420, 1720, 1820 mm in diameter for manufacture of protective cases.	1420-1820	15.7; 18.7; 20.0	K60
TU 14-156-70-2006 Spiral electric-welded steel pipe for manufacture of protective cases with "pipe-in-pipe" design.	1420; 1620	22.0; 24.0	K60
TU 14-156-56-2005 Spiral electric-welded steel pipe with increased field reliability for main oil pipelines.	530-1220	6.0-16.0	K52-K60
TU 14-3-1363-97 Spiral electric-welded steel pipe 1420 in diameter for service at a pressure up to 7.4 MPa (75 kgf/cm ²)	1420	15.7; 16.8; 18.7	10Г2ФБ, X70

4 GOOD PRACTICE FOR PIPE OPERATION – REQUIREMENTS AND RECOMMENDATIONS

4.1 Scope of Application

The pipelines may be operated in various areas after their design check and experimental verification for resistance to the following impacts:

- loads (internal pressure, weight of pipeline and fluid, environmental attack);
- deformation loads (temperature variations, elastic bending, earthquake);
- corrosion attack of the fluid transported affecting the internal pipe surface (overall or local metal dissolution; metal stress-cracking);
- low ambient temperatures (decrease of metal resistance to shock loads).

The main pipelines shall be designed in compliance with Code of Practice 2.05.06-85. The field pipelines shall be designed in compliance with SP 34-116-97 taking into consideration the corrosive attack of transported fluids. Recommendations for the selection of materials and standards/specifications according to the corrosive properties of transported fluid and the service conditions are specified in the Field Fluid Classifier (*Supplement to the Operating Manual for Line Pipe, Tubing and Casing*).

For the scope of pipe application refer to the specifications for pipe manufacture and delivery.

Table 11 – Large-Diameter Spiral Electric-Welded Pipe. Mechanical Properties

Normative Document	Grade, Ultimate Tensile Strength, σ_u , MPa (kgf/mm ²), min.	Yield strength σ_y , MPa (kgf/mm ²), Min.	Elongation δ_s , %, min.	Impact Strength KCU at test temperature °C, J/cm ² (kgf x m/cm ²), min.	Impact Strength KCV at test temperature °C, J/cm ² (kgf x m/cm ²), min.	Shear Fracture Percentage on Drop-Weight Test Specimens at test temperature °C, %, min.	Welded Joint Bend Angle, degrees, min.
GOST 20295-85	K34 333 (34)	206 (21)	24	-40 29.4 (3)–39.2 (4)	-10 29.4 (3)	-	100
	K38 372 (38)	235 (24)	22	-40 29.4 (3)–39.2 (4)	-10 29.4 (3)	-	100
	K42 412 (42)	245 (25)	21	-40 29.4 (3)–39.2 (4)	-10 29.4 (3)	-	100
	K50 485 (50)	343 (35)	20	-60 39.2 (4)	-10 29.4 (3)	-	100
	K52 510 (52)	353 (36)	20	-40 29.4 (3)–39.2 (4)	-10 29.4 (3)	-	100
	K56 539 (55)	372 (38)	20	-40 29.4 (3)–39.2 (4)	-10 29.4 (3)	-	100
	K60 588 (60)	412 (42)	16	-40 29.4 (3)–39.2 (4)	-10 29.4 (3)	-	100
TU 1303-011-00212179-2003	K42 412 (42)	245 (25)	23	-20 29.4 (3)	-	-	100
TU 1004-138100-357-02-96	K52 510 (52)	363 (37)	21	-40 29.4 (3)–39.4 (4)	-5 29.4 (3)–39.2 (4)	-5 50	180
	K56 549 (56)	441 (45)	20	-60 39.4 (4)	-15 39.2 (4)	-15 50	180
	K60 588 (60)	441 (45)	20	-60 39.2 (4)–49.0 (5)	-15 39.2 (3)–58.8 (6)	-15 50-70	180
TU 14-3-1970-97	K48 470 (48)	294 (30)	25	-40 39.4 (4)	+20 78.0 (8)	-	180
	K52 510 (52)	353 (36)	20	-40 39.4 (4)	+20 78.0 (8)	-	180
TU 14-3-1973-97	K52 510 (52)	353 (36)	20	-60 39.0 (4)	-15 39.0 (4)	-15 80	180
	K56 549 (56)	441 (45)	20-24	-60 98(10) – 147 (15)	-15 98.0 (10)	-20 95	180
	K60 588 (60)	441 (45) – 482 (49)	20-23	-60 98(10) – 147 (15)	-15 98.0 (10)	-20 95	180
	X70 588 (60)	482 (49)	23	-60 147 (15)	-15 98.0 (10)	-20 95	180
TU 14-3-1976-99	K60 550 (56)	441 (45)	20	-	-60 29.4 (3)–58.8 (6)	-60 50-70	180
	K60 588 (60)	441 (45)	20	-	-60 29.4 (3)–58.8 (6)	-60 50-70	180
TU 14-3-1977-2000	K60 590-690 (60-70)	460-560 (47-57)	20	-60 49.0 (5)	-20 78.4 (8)	-20 80	180
TU 14-3-954-2001	L 40 392 (40)	265 (27)	23	-20 49.0 (5)	-	-	100
	K42 412 (42)	245 (25)	23	-	-	-	100
	K52 510 (52)	353 (36)	20	-40 39.2 (4)	-	-	100
	K60 588 (60)	412 (42)	20	-40 39.2 (4)	-	-	100
TU 14-3-1975-99	K60 590 (60)	460 (47)	20	-60 64.0 (6.5)	-20 88 (9)	-20 85	100
TU 14-3-52-2001	K52 510 (52)	370 (38)	20	-60 118.0 (12)	-60 59.0 (6)	-20 60	180
	K54 530 (54)	390 (40)	20	-60 118.0 (12)	-60 59.0 (6)	-20 60	180
	K56 550 (56)	410 (42)	20	-60 118.0 (12)	-20 98.0 (10)	-20 60	180
TU 14-3P-60-2002	K60 588 (60)	461 (47)	20	-60 49.0 (5)	-20 78.4 (8) – 88.3 (9)	-20 80-85	180
TU 1381-144-00147016-01	K48 470-588 (48-60)	314 (32)	23	-60 49.0 (5)	-20 49.0 (5)	-15 80	180
	K52 510-630 (52-64)	350 (36)	20	-60 59.0 (6)	-40 59.0 (6)	-15 80	180
TU 1381-158-00147016-01	K48 470-588 (48-60)	314 (32)	23	-60 49.0 (5)	-20 49.0 (5)	-15 80	180
	K52 510-630 (52-64)	350 (36)	20	-60 59.0 (6)	-40 59.0 (6)	-15 80	180
TU 1381-213-00147016-2002	K48 470 (48)	314 (32)	23	-	-50 78.4 (8)	-50 50	180
	K52 510 (52)	350 (36)	20	-	-50 78.4 (8)	-50 50	180
TU 14-156-55-2005	K42-K60 410-590 (42-56)	245-460 (25-47)	21-20	-60 34.3 (3.5)-49.0(5.0)	-20 39.2 (4.0)-78.5(8.0)	-	180
TU 14-156-76-2007	K60, X70 590(60)	480 (49)	20	-60 79 (8.0)	-20 108 (11.0)	85	180
TU 14-156-67-2006	K52 510 (52)	355 (36)	20	-60 29.4 (3.0)	-	-	-
TU 14-156-70-2006	K60 590 (60)	460 (47)	20	-60 49 (5.0)	-20 88.3 (9.0) Ø1420	-	180
					-20 93.1 (9.5) Ø1620		
TU 14-156-56-2005	K52 510 (52)	355 (36)	20	-	-20 98 (10)	-	180
	K54 530 (54)	380 (39)	20		-40 78 (8)		
	K55 540 (55)	390 (40)	20		-60 59 (6)		
	K56 550 (56)	410 (42)	20		-		
	K60 590 (60)	460 (47)	20		-		

Table 12 – Normative Documents for Manufacture and Delivery of Coated Pipe and Pipe Application

Normative Document	Application of Coated Pipe
GOST 51164-98 Main steel pipelines. General Requirements for corrosion protection	Protection of main pipelines against underground and atmospheric corrosion
TU 14-3P-33-2000 Electric-welded steel pipe 530 to 1420 mm in diameter with three-layer corrosion-resistant polyethylene coating for main gas pipelines	For subsurface laying of main gas pipelines
TU 14-3P-49-2003 Seamless and electric-welded steel pipe 102 to 1420 mm in diameter with external protective coating based on extruded polyethylene	For construction of main oil pipelines, subsurface, offshore and onshore (dumped) pipelining
TU 14-156-57-2005 Seamless steel pipe with three-layer polypropylene coating for construction of main oil pipelines	For construction of main oil pipelines, for pipeline cases, passages made by directional drilling and microtunneling methods
TU 14-156-69-2006 Seamless and electric-welded steel pipe with external two-layer epoxy coating for construction of main pipelines	For construction of oil-and-gas pipelines of 114 to 1420 mm in diameter laid underground, offshore and onshore (dumped)
TU 1381-00900154341-02 Steel pipe 57 to 530 mm in diameter with external corrosion-resistant coating based on powder epoxy compounds	For construction of main pipelines (transportation of oil, gas, oil products) and their branches, urban gas and water supply networks
TU 1381-012-00154341-02 Steel pipe 102 to 530 mm in diameter with internal and external protective coating based on powder epoxy compounds	For oil and oil product transportation pipelines, and water supply pipelines
TU 1468-014-32256008-07 Fittings 57 to 530 mm in diameter with internal and external protective coating based on surfaced powder compounds	For construction of underground pipelines, oil gathering systems and reservoir pressure maintenance systems, hot and cold water supply systems
TU 14-156-74-2008 Electric-welded steel pipe 406 to 1420 mm in diameter with external three-layer polyethylene coating	For underground laying of main pipelines
OTT-04.00-27.22.00-KTH-005-1-03 Factory-applied polyethylene coating of pipe. Specification	For construction of offshore pipelines and construction by trenchless pipelining methods
TU 14-156-79-2008 Seamless and electric-welded steel pipe 530 to 1420 mm in diameter with internal flow coating	For main pipelines intended for a working pressure of 11.8 MPa

Table 13 – Epoxy Coating Specifications

Parameter	Value
	Make type – normal «N»
1 Thickness, min., mm	0.40
2 Dielectric continuity, kV, min.	No breakdown under a voltage of 3.5 kV
3 Shock resistance, min., J	
at a temperature of - 20±10°C	10.0
at a temperature of - 40±5°C	7.0
at a temperature of - 60±5°C	10.0
4 Penetration, max., mm	
at a temperature of +20±10°C	0.10
at a temperature of +80±5°C	0.15
5 Strain of flexure, min., %	
at a temperature of +20±10°C	5
at a temperature of -40±5°C	3
6 Transient electrical resistance, min, Ω/m ²	
initial	110 ⁹
after 30 days in 3% solution of NaCl at a temperature of + 80±5°C	110 ⁷
7 Cathodic lift-off, max., cm ²	
after 30 days in 3% solution of NaCl at a temperature of + 20±5°C	8.0
after 30 days in 3% solution of NaCl at a temperature of + 80±5°C	15.0

Table 14 – Three-layer Based on Extruded Polyethylene

Parameter	Value
1 Thickness, min., μm (mm) 1 st layer 2 nd layer 3 rd layer for pipe body for weld	100-175 (4-7) 150-400 (6-18) 3000 2500
2 Distance from pipe ends to, mm coating chamfer, deg.	130-180 20-45
3 Adhesion strength, N, cm of width at a temperature of $+20 \pm 5^\circ\text{C}$ at a temperature of $+20 \pm 5^\circ\text{C}$	150 40
4 Indentation resistance, max., mm at a temperature of $+25 \pm 2^\circ\text{C}$ at a temperature of $+50 \pm 2^\circ\text{C}$	0.2 0.3
5 Impact strength, min., J at a temperature of $+23 \pm 2^\circ\text{C}$	18
6 Elongation at rupture, % min., at a temperature of $-45 \pm 5^\circ\text{C}$	100
7 Cathodic debonding, max., cm^2	4
8 Degree of epoxy primer cure	$-2 < \Delta T_g < +3$

Table 15 – Internal Flow Coating

Parameter	Unit	Standard Value
1 Thickness of cured coating	μm	60-150
2 Coating adhesion determined by cross-cut adhesion test method	number	1
3 Coating adhesion after 240-hour exposure to water at a temperature of $(20 \pm 5)^\circ\text{C}$ determined by cross-cut adhesion test, max	number	2
4 Coating bending strength	mm	10
5 Buchholz hardness, min	conventional unit	94
6 Pores in coating, max. a) uncured b) cured	number per cm^2	0
7 Coating resistance to gas pressure variation	-	1 After 10 th cycle: No blowholes, ruptures
8 Coating resistance to hydraulic pressure variation	-	After 1 st cycle: No blowholes, ruptures
9 Resistance to salt-mist exposure at a temperature of $(20 \pm 5)^\circ\text{C}$ during 240 hours	-	No blowholes, delaminations
10 Coating roughness (R_z), max.	μm	15

4.2 Pipe Pre-Operation Requirements

4.2.1 The pipe may only be accepted for operation when any required Manufacturer's certificates or other accompanying documents confirming pipe quality are available. In case of incomplete certificate data or lack of certificates, the pipe may only be accepted after test and inspections required to confirm its compliance with the requirements of standards or specifications.

4.2.2 The pipe supplied for pipelining shall be subjected to incoming acceptance inspection in the scope specified in the respective standard/specification. The parameters to be tested and their limit deviations are specified in the respective standards/specifications governing the supply. The incoming inspection shall include the following main stages:

4.2.3 Visual inspection

4.2.3.1 Verification of marking and its content.

4.2.3.2 Thorough visual inspection of the entire pipe surface rolled over on the inspection table guides without any magnifiers.

4.2.3.3 Thorough visual inspection of the internal pipe surface as far as it is seen when illuminated at both pipe ends simultaneously.

4.2.3.4 According to the requirements of standards/specifications, the depth of defect location may be determined by applicable measuring instruments as the difference between the actual pipe diameter in a point near the defect and that in the defect location after its full removal by grinding.

The depth of defects on the internal pipe surface shall not be determined.

For the defect acceptability criteria refer to the product standards/specifications.

If necessary, a random pipe length may be cut to pieces used for more thorough visual inspection or defect analysis.

4.2.4 Pipe geometry verification

4.2.4.1 The pipe geometry and curvature shall be verified by measuring instruments specified in current standards and specifications.

Other measuring instruments may be used for verification provided that their metrological performance ensures the required precision.

The personnel engaged in inspection activities shall make sure that the measuring instruments are functional, verify their markings and documents (calibration certificate, verification certificate, any other certificates or records) that evidence calibration and verification of the instruments.

4.2.4.2 The wall thickness shall be measured in at least two perpendicular planes of pipe cross section, in two diametrically opposite points. The initial measurement point shall be chosen visually where wall thickness is apparently at its maximum or minimum.

If necessary, the measurements may be taken at any distance from the pipe end after cutting it in the respective place.

4.2.4.3 The outside diameter shall be measured at pipe ends at least twice to determine the maximum and minimum diameter at a distance of 5...20 mm from the pipe end. To determine the actual diameter over the entire pipe length, the measurement shall be made each 500 mm.

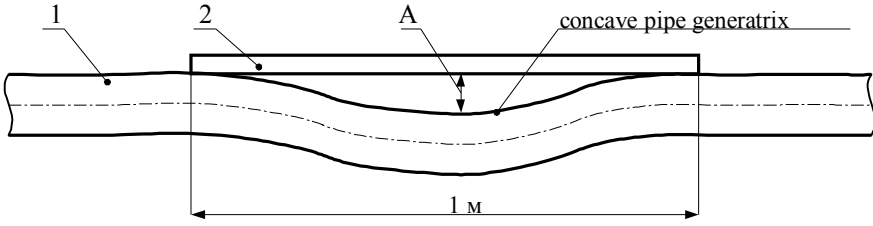
4.2.4.4 To measure the length, the measuring instrument (measuring tape, straight edge) shall be placed on the pipe body along its axis, its zero mark shall coincide with one pipe end and the reading shall be taken at the other pipe end.

4.2.4.5 The chamfer angle shall be measured with a vernier protractor: one measuring surface shall be placed against the pipe end and the other one against the chamfer surface, the angle value shall be read from the scale.

4.2.4.6 The width of end ring shall be measured with a straight edge or vernier caliper placed on the surface to be measured so that it is perpendicular to the pipe axis and its zero mark coincides with the edge of one end, the reading is taken at the edge of the other end.

4.2.4.7 The local deviation from a straight line in any 1.0 m portion of pipe length where concave pipe generatrix is visually observed shall be measured with 1-m long

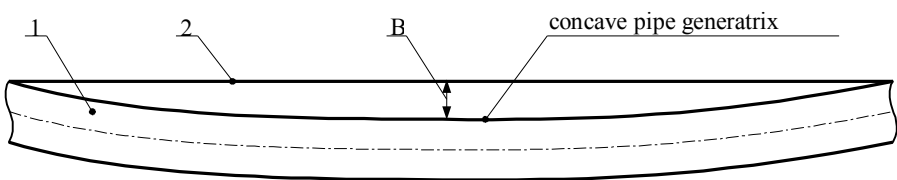
straight edge placed on this pipe portion. The value of the maximum deviation A shall be measured with a feeler gage over this generatrix at this pipe length portion (see Figure 1).



1 – pipe; 2 – straight edge

Figure 1 – Measuring Local Straightness Deviation over any 1-m Portion of Pipe Length

4.2.4.8 The total deviation from a straight line over the entire pipe length shall be measured with a string (wire, line) stretched tight between two pipe ends. The maximum deviation B of the pipe surface from the taut string shall be measured with a scale bar (see Figure 2).

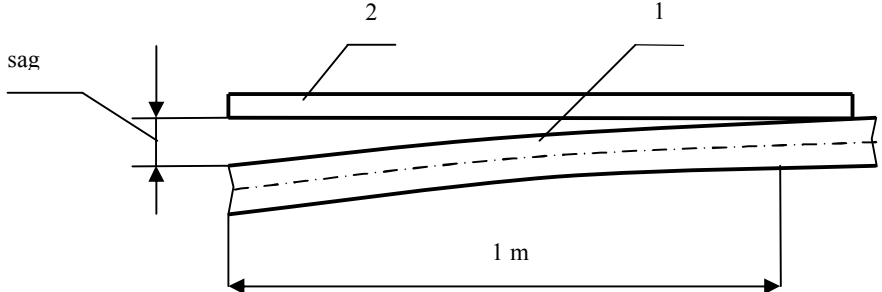


1 – pipe; 2 – taut string, line

Figure 2 – Measuring Full-Length Straightness Deviation

4.2.4.9 To measure the out-of-straightness at end areas equal to one-third of the length, a visible concave pipe generatrix shall be found in a 1,0 m portion and measured with 1-m long straight edge. Then, the maximum deviation (sag) shall be measured with a feeler gage.

The out-of-straightness at the pipe ends shall be determined based on the sag, it shall be calculated as the quotient resulting from division of the sag value in millimeters by the distance from the place of sag measurement to the nearest pipe end in meters (see Figure 3).



1 – pipe; 2 – straight edge

Figure 3 – Measuring Sag at Pipe Ends

4.2.5 The pipe length inspected shall be marked.

The marking shall be applied at a distance of 100-150 mm from the end with indelible paint in the follows order:

- serial number of the pipe length;
- designation of the category assigned to the pipe length after the inspection:
 - П – fit for use in oil-and-gas pipeline construction;
 - P – requiring repair for subsequent use in oil-and-gas pipeline construction;
 - У – fit for use in other industries;
 - Б – unfit for use.

4.2.6 Based on the incoming inspection results, the committee appointed by an internal order shall draw up a report wherein the number of pipe lengths inspected and the number of pipe lengths with different categories shall be recorded.

The causes of assigning “require repair” and “unfit for use” categories shall be also reported.

4.3 Assembly, Welding and Inspection of Welded Pipeline Joints

4.3.1 The assembly, welding and inspection of welded pipeline joints shall be carried out in compliance with the Code of Practice III-42-80* and RD 39-132-94*.

4.3.2 The following shall be performed prior to assembly and welding:

- visual inspection of pipe surface (no unacceptable defects described in pipe supply specification are allowed);
- inner pipe space cleaning to remove earth, dirt, snow that penetrated inside;
- straightening or cutting to remove deformed pipe ends and pipe surface damages;
- cleaning of edges and adjacent inside and outside pipe surface to bright metal over a width of 10 mm min.

Additionally, grind pipe end and a ring zone for welding machine boots when flash-butt welding will be used.

4.3.3 Smooth dents on pipe ends up to 3.5% of pipe diameter in depth and deformed pipe ends may be straightened with nonimpact expanding device. The dents and deformed ends on pipe made of steels with specified ultimate tensile strength up to 539 MPa (55 kgf/mm²) may be straightened at positive temperatures without heating. At negative ambient temperatures, the pipe shall be heated by 100-150°C. The pipe made of steels with specified ultimate tensile strength of 539 MPa (55 kgf/mm²) and over shall be straightened with local heating by 150-200°C at any ambient temperatures.

The pipe portions and ends with dents exceeding 3.5% of pipe diameter in depth or with ruptures shall be cut out.

The chamfer dints and tears up to 5 mm in depth may be repaired by welding.

Pipe ends with chamfer dints and tears over 5 mm in depth shall be cut.

4.3.4 The pipe lengths up to 500 mm in diameter shall be assembled using internal centralizer. The pipe length of smaller diameter may be assembled using both external and internal centralizers. Irrespective of pipe diameter, the overlaps and other joint types, where internal centralizer cannot be used, shall be assembled using external centralizers.

4.3.5 The misalignment of edges during assembly of pipe lengths with equal wall thickness shall not exceed 20% of pipe wall thickness, however this value shall not exceed 3 mm in case of arc welding methods and 2 mm in case of flash butt welding.

4.3.6 The direct field assembly of pipe lengths or pipe with components (tees, reducers, bottoms, branches) when they have the same diameter but different thickness may be carried out provided that:

- the difference in wall thickness of pipe lengths or pipe length and component (with the maximum thickness of 12 mm) does not exceed 2.5 mm;
- the difference in wall thickness of pipe lengths or pipe length and component (with the maximum thickness over 12 mm) does not exceed 3 mm.

The pipe lengths or pipe length and components with larger wall thickness difference shall be joined by welding between them reducers or inserts of intermediate thickness and at least 250 mm long.

When the difference does not exceed 1.5 of wall thickness, the pipe lengths may be directly assembled and welded provided that the pipe or component with larger wall thickness has special edge preparation. The dimensions of edge preparation and welds shall comply with those shown in Figure 4.

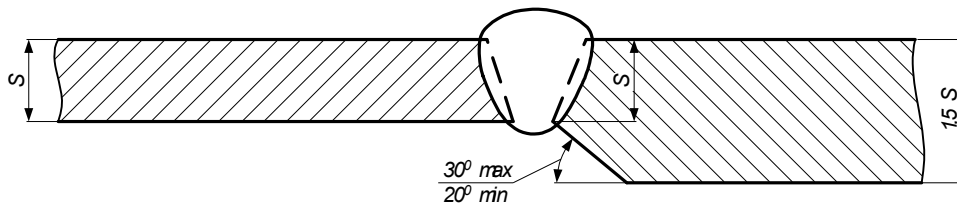


Figure 4 – Dimensions of Edge Preparation and Welds for Pipe of Different Thickness (up to 1.5 of Wall Thickness)

The misalignment of edges when welding pipe lengths of different thickness as measured over the outer surface shall not exceed the tolerances set forth in 3.2.6 of this Section.

The root pass inside the pipe with different wall thickness and diameter greater than or equal to 1000 mm over the entire joint perimeter is mandatory, the backing weld shall be cleaned to remove slag from the weld surface and electrode stubs and slag from the pipe.

4.3.7 Each joint shall be identified with the stamp of the welder or welding gang that carried out the welding. The joints of pipe made of steels with specified ultimate tensile strength up to 539 MPa (55 kgf/mm²) shall be marked mechanically or deposit welding. The joints of pipe made of steels with specified ultimate tensile strength 539 MPa (55 kgf/mm²) and over shall be identified with indelible paint on the outside pipe surface.

The identification marks shall be located at a distance of 100-150 mm from the joint in the top pipe semicircle.

4.3.8 Any elements except cathode terminals shall not be welded in the locations of transverse girth, spiral and longitudinal shop welds. If the project provides for welding any

elements to the pipe body, the distance between the pipeline welds and the weld of the element shall be 100 mm at least.

4.3.9 The shutoff and distribution fittings may be directly welded to the pipe provided that the thickness of the fitting edge to be welded does not exceed 1.5 of pipe wall thickness and the fitting has special shop-made edge preparation shown in Figure 5.

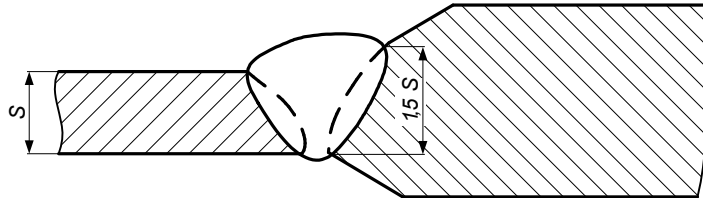


Figure 5 – Fitting Edge Preparation for Direct Joining to Pipe

When special fitting edge preparation is not shop-made or the thickness of the fitting edge to be welded exceeds 1.5 pipe wall thickness, a special adapter or adapter ring shall be welded between the pipe and fitting.

4.3.10 When welding pipe sections up, the welded joints shall be referenced to pipeline route stakes and recorded in the job report.

4.3.11 If the welding is interrupted for more than 2 hours, the pipeline ends shall be protected with reusable plugs to prevent penetration of snow, dirt, etc. inside the pipe.

4.3.12 The girth welds of main steel pipelines may be made by arc welding methods or flash butt welding.

4.3.13 The welding may be carried out at ambient air temperatures as low as minus 50°C.

If wind speed exceed 10 m/s or in case of atmospheric precipitations, the welding shall be only performed under reusable shelters.

4.3.14 The pipelines may be only mounted on the erection supports. No earth or snow supports for pipeline mounting are allowed.

4.3.15 The tack welding and welding of main pipelines may only be performed by the welders, which passed examinations in compliance with the Rules for Qualification of Welders laid down by the Gosgortekhnadzor of Russia.

4.3.16 Inspection and testing of pipeline girth welds

4.3.16.1 The inspection of pipeline welds shall include the following:

- systematic operational inspection carried out in the course of pipeline assembly and welding;
- visual inspection and measurement of welds;
- nondestructive testing of weld;
- mechanical testing of welds.

The nondestructive testing shall be performed by the personnel specially trained and qualified in compliance with the Rules for Qualification of Nondestructive Inspection Personnel PB 03-440-02 (approved by the resolution No. 3 of the Gosgortekhnadzor of Russia, dated 23.01.02).

4.3.16.2 The operational inspection shall be performed by welding supervisors and foremen, and the self-inspection shall be performed by the welders.

The operational inspection shall include verification for compliance of the welding with the design drawings, requirements of this Section, state standards and job instructions approved in accordance with the established procedure.

4.3.16.3 The joints made by arc welding shall be cleaned to remove slag and visually inspected. The welds shall have no cracks, undercuts exceeding 0.5 mm in depth, inadmissible edge misalignments, craters or open surface pores.

The weld reinforcement shall be within 1 to 3 mm in height and blend in smoothly with the adjacent parent metal.

4.3.16.4 The joints made by flash butt welding shall have a reinforcement not exceeding 3 mm in height after removal of the internal and external flash. The removal of internal and external flash shall not reduce the pipe wall thickness.

The edge misalignment after the welding shall not exceed 25% of the wall thickness or 3 mm. Local misalignments over 20% of the joint perimeter are allowed provided that they do not exceed 30% of wall thickness or 4 mm of incomplete penetration over edges and between weld passes in fixed pipe joints made by automatic arc welding and their length does not exceed 50 mm on 350 mm long weld portion.

4.3.16.5 The defects in joints made by arc welding methods may be repaired, if:

- the total length of defective areas does not exceed 1/6 of the joint perimeter;
- the length of cracks detected in the joints does not exceed 50 mm.

If the total length of detected cracks exceeds 50 mm, the joints shall be removed.

4.3.16.6 The defects in joints made by arc welding processes shall be repaired by the following methods:

- root pass inside the pipe over the defective portions in the weld root;
- thin weld beads of 3 mm in height maximum for repair of external and internal undercuts;
- grinding out and subsequent repair welding of weld areas with slag inclusions and pores;
- joints with cracks up to 50 mm in length shall be repaired by drilling two holes at each side of the crack at a distance of 30 mm minimum from the crack edges, full grinding out of the defective portions and multiple-pass welding;
- the inadmissible defects detected during the visual inspection shall be removed before nondestructive testing.

4.3.16.7 All repaired joint areas shall be visually inspected and subjected to radiographic test. No repeated repair of joints is allowed.

4.3.16.8 The results of the inspection by physical methods shall be recorded as findings. The findings, radiographs, recorded ultrasonic test results, and ferromagnetic tapes of the joints subjected to inspection shall be retained in the field test laboratory till the pipeline commissioning.

4.4 Pipelining in Trenches

4.4.1 The pipelines shall be laid in trenches in compliance with the project requirements; depending on the approved pipelining process and method the following methods shall be used:

- pipeline lowering and simultaneously insulating it using mechanical means (simultaneous pipe laying and insulating approach);
- lowering previously insulated pipeline sections from the trench bank (separate operations approach);
- longitudinal towing of previously made pipe strings along the trench afloat and their subsequent immersion to the trench floor.

4.4.2 In the course of trench pipelining, the following shall be ensured:

- proper selection of the number and arrangement of pipe-laying cranes and the minimum pipeline height above the ground required to prevent pipeline overstress, fracture and dents;
- integrity of pipeline insulating coating;
- full bearing of the pipeline to the trench floor over its entire length;
- designed pipeline position.

4.4.3 The simultaneous pipe laying and insulating shall be made using pipe-laying cranes equipped with trolley suspensions. When insulated pipeline sections are to be lifted (suspended) by pipe-laying cranes located after the insulating and coating machine, soft towels shall be used.

4.4.4 In case of separate insulating and pipe-laying, the insulated pipeline shall be lowered by pipe-laying cranes fitted with soft towels.

4.4.5 The tolerances for pipeline position in the trench shall be as follows: the minimum distance (clearance) between the pipeline and trench walls shall be 100 mm, and in the areas where weights or anchors shall be installed the clearance shall be $0.45D + 100$ mm, where D is pipeline diameter.

4.5 Pipeline Testing

4.5.1 The pipeline strength and leak tests should be carried out after full completion of a section or of the entire pipeline (full dumping, banking or fastening on supports, cleaning of inner space, installation of fittings and devices, cathode terminals and presentation of as-built documentation for the object to be tested).

4.5.2 The strength and leak tests of gas pipelines may be performed both hydraulically (water, nonfreezing liquids) and pneumatically (air, natural gas), the oil and oil product pipelines shall be tested hydraulically.

The pipelines located in highlands and cross-country may tested by a combined method (air and water or gas and water).

The hydraulic testing of pipelines with water at negative temperatures may be only performed provided that the pipeline, its fittings and devices are protected against freezing.

4.5.3 Test methods, area limits, test pressure values, test flow chart showing water intake and drain locations agreed with the interested parties, as well as gas-supply stations and temporary communications shall be determined in the project.

4.5.4 The pipeline tested for strength and leak shall be subdivided into separate sections limited with plugs or fittings.

The fittings may be used as limiting elements during the tests provided that the pressure difference does not exceed the maximum value admissible for this type of fittings.

4.5.5 The leak tests of the sections of all pipelines shall be carried out after the strength test and decrease of the test pressure down to the maximum operating pressure specified in the project.

4.5.6 During the pneumatic test, the filling of the pipeline and pressure buildup up to the test one (P_{TEST}) shall be performed through the fully open bypass-line valves and closed line valves.

4.5.7 An odorant shall be added to the air or natural gas to detect their leaks in the course of supply to the pipeline.

4.5.8 During the pneumatic test, the pressure in the pipeline shall be raised gradually [0.3 MPa (3 kgf/cm²) per hour], the route shall be inspected under a pressure of 0.3 P_{TEST} , but less than 2 MPa (20 kgf/cm²). The pressure buildup shall be stopped for the inspection period. The subsequent pressure buildup up to the test value shall be made without stops. The pipeline shall be held under the test pressure for 12 h with the bypass line valves closed and line valves open for temperature and pressure stabilization. Then, the pressure shall be reduced down to the operating one, the bypass line valves shall be closed, after that the pipeline route inspection, observations and pressure measurements shall be made during 12 h at least.

4.5.9 The route shall not be inspected during the pressure buildup from 0.3 P_{TEST} to P_{TEST} , during 12 h for temperature and pressure stabilization and during strength tests.

The route should be only inspected after pressure reduction from the test value to the operating value to check the pipeline for tightness.

4.5.10 When filling the pipelines for the hydraulic tests, the air shall be fully removed from it. The air shall be removed by piston separators or through air-venting valves installed in the places of possible air accumulation.

4.5.11 The pipeline shall be considered as tested for strength and tightness, if the pressure during the pipeline strength test does not change and no leaks are detected during the leak test.

In the course of the pneumatic pipeline strength test, the pressure may drop by 2% within 12 h.

4.5.12 If visual inspection, sound, odor or monitoring instruments reveal any leaks, the pipeline section shall be repaired and re-tested for strength and tightness.

4.5.13 After the hydraulic pipeline strength and leak test, the water shall be fully drained from it.

4.5.14 The full water removal from gas pipelines shall be performed by two subsequent piston separators (principal and check one) under the pressure of compressed air or, in exceptional cases, natural gas.

The speed of the piston separators during water removal from gas pipelines shall be within the range of 3 to 10 km/h.

4.5.15 The removal of water from the gas pipeline shall be considered satisfactory, if no water is detected in front of the piston separator and it exits the gas pipeline not destructed. Otherwise, check piston-separator passes through the gas pipeline shall be repeated.

4.5.16 The full water removal from oil and oil-product pipelines shall be performed by one piston separator moving under the pressure of the transported product.

If no product is available at the test end, water shall be removed by two pistons separators moving under the pressure of compressed air.

4.5.17 The method used to remove water from oil and oil-product pipelines shall be determined by the customer who ensures prompt supply of oil and oil products.

The filling of the pipeline with oil and oil products on the water-barrier crossing sections shall be carried out so that to fully avoid air ingress into the internal pipeline space.

4.5.18 Only calibrated, sealed and certified remote instruments or pressure gages of the 1st precision class at least and a scale for a pressure of about 4/3 of the test one installed outside the protected zone shall be used for any strength and leak test methods.

4.5.19 To evidence the cleaning of the internal pipeline space, its results, strength and leak tests, reports of an appropriate form shall be drawn up.

For the methods, processes, duties and parameters of pipeline space cleaning, tests and water removal refer to the In-house Code of Practice VSN-011.

4.5.20 The acceptance of the pipeline for operation shall be done by the State Acceptance Committee assigned by the customer after pipeline acceptance by the internal committee.

4.6 Acceptance of Pipelines for Operation

4.6.1 The pipelines shall be commissioned after their acceptance in compliance with the requirements of the Code of Practice 3.01.04, VSN 012 and other Russian national or in-house normative documents.

4.6.2 The pipelines intended for transportation of H₂S-containing gas and oil shall not be accepted for operation until full completion (in compliance with the project) of the objects that ensure safety of the public and environmental protection.

4.6.3 The pipelines shall be accepted for operation together with the inhibitor pipelines and other installations designed for fittings and pipe metal protection against corrosion or sulphide stress cracking.

4.6.4 The pipeline shall not be operated until accepted by the State Acceptance Committee.

The pipeline shall be considered commissioned at the date when the Acceptance Certificate is signed by the State Acceptance Committee.

4.7 Basic Requirements for Pipeline Operation Supervision and Condition Monitoring

4.7.1 The scope, extent and frequency of inspections and diagnostics shall be determined depending on the categories of pipeline sections. The elevation point of reference of the linear pipeline section shall be used as the base for the route condition observations, this point shall be used to fix inspection points. The most dangerous sections shall be equipped with permanent preventive diagnostic facilities functioning in continuous scanning mode, e.g. acoustic emission systems designed to detect incipient and progressive cracks.

4.7.2 The linear pipeline section and its most critical components (underwater passages, bypasses, etc.) shall be equipped with permanent sensors of the diagnostic facilities.

ties, whose data shall be read by the mobile laboratories during the periodic inspections. The periodic diagnostics shall include instrumented examination of pipeline sections in the course of its operation. The frequency and extent of such examination depends on the section category.

4.7.3 First of all, the following shall be done for diagnostics and inspection of active pipelines:

1) Determination of pipeline sections that are most susceptible to initiation and development of defects and corrosive damages.

2) Determination of actual location and profile of the pipeline route, assessment of insulation quality, evaluation of stress on the critical sections.

3) Selection of diagnostic and inspection facilities to be used for practical diagnostics.

The first stage shall include identification of the project and as-built documentation holders, analysis of project data, as-built service documentation, emergency information. The preliminary data on physical and chemical properties of the liquid transported shall be obtained to determine route sections that are most susceptible to initiation and development of defects and corrosive damages.

The second stage shall include the following practical operations:

- determination of pipeline steel grade;
- assessment of insulation quality;
- topographical and geodesic survey;
- determination of actual stresses on the pipeline sections;
- determination of physical and chemical properties of the liquid transported.

4.7.4 The above activities shall result in plan and elevation views of the sections subject to inspections with inspection points shown on them, and a table of physical and chemical properties of the liquid transported.

The diagnostic and inspection facilities shall be selected according to the data obtained during the first and second stages.

4.7.5 Types of defects and damages

4.7.5.1 Defects and damages of parent metal:

- corrosive damages classified according to their types:
 - uniform corrosion (corrosion that affects the entire metal surface);
 - local corrosion (corrosion that affects individual surface areas);
 - pitting, crater and pointed corrosion in the form of separate point and crater damages, including perforation corrosion;
 - groove-type corrosion (corrosive damage in the form of specific grooves);
 - corrosion cracking;
- tears, cracks, burns, fusions, delaminations, nonmetallic inclusions, folds;
- material ageing, change of physical and mechanical properties;
- overall and local deformations, dents, bulges.

4.7.5.2 Defects and damages of welds:

- nonconformity of weld dimensions to the requirements of the project, Codes of Practice and standards;
- cracks of any types and directions;

- overlaps, cuds, burns, non-welded craters, lacks of fusion, porosity and other technological defects;
- lack of smooth transitions from one section to another;
- nonconformity of general weld geometry to the project requirements. Nonconformity of pipeline laying line to the project requirements.

4.7.6 Main loads and factors affecting pipeline condition in the course of operation

4.7.6.1 Service loads.

The service loads include:

- service fluid pressure inside the pipeline;
- temperature load;
- weight load at the places of passages.

4.7.6.2 The service factors that affect pipeline condition and loads include:

- metal corrosion;
- erosion of walls under the action of the working fluid;
- change of physical and mechanical properties of metals.

4.8 Scope and Frequency of Pipeline Inspections

4.8.1 Visual inspection.

4.8.1.1 Visual inspection (scheduled).

This inspection includes monitoring of pipeline route condition, state of pipeline components and parts located above the ground to detect illicit crossings, water erosions, deformations; visual inspection of leaks.

4.8.1.2 Visual inspection (unscheduled).

This inspection is carried out after natural disasters, visual detection of oil, gas and water leaks, detection of pipeline pressure drops shown by pressure gages, lack of transported product balance.

4.8.1.3 The frequency of visual inspections shall be fixed by the Enterprise management depending on the local conditions, terrain and route form, season and operation life. The inspection results shall be recorded in the operator's log.

4.8.2 Verification inspection

4.8.2.1 During the verification inspections, specific attention shall be paid to:

- condition of the areas where pipelines come out of the ground;
- condition of welds;
- condition of the areas where formation water, condensate, solid precipitations can accumulate;
- condition of flanged joints;
- correct pipeline-support functioning;
- condition and operation of bucking out devices;
- condition of fittings seals;
- pipeline vibration;
- condition of the insulation and corrosion-resistant coatings;
- condition of bends, welded tees, transitions and other shaped pieces.

4.8.2.2 The verification inspections shall be carried out by specially appointed personnel at least once a year. The inspections should be timed to one of the scheduled repairs.

The pipelines subject to vibrations shall be inspected at least quarterly.

4.8.2.3 Additional inspection (prescribed according to the results of the verification inspections).

4.8.2.4 The additional pre-schedule inspection of the pipelines shall be performed if reference specimens or corrosion-meter probe show high corrosion rate.

4.8.2.5 The results of verification inspections and wall-thickness measurements for all the pipelines shall be reported in the documents of the appropriate services and recorded in the pipeline certificate.

4.8.3 Random inspection

The section to be subjected to random inspection shall be selected by the operator and approved by the operator's chief engineer.

Sections of minimum length operating under the most heavy load conditions, dead-end sections and section that are temporarily out of service shall be selected.

The first inspection of the newly commissioned pipelines shall be performed in 1 year at the latest.

4.8.3.1 During the inspection of the selected pipeline section, do the following:

- evacuate the working fluid from the pipeline, wash it with water and, if necessary, clean to remove deposits and dirt;
- perform thorough visual inspection;
- perform (if possible) internal pipeline inspection (in case of flanged or other detachable joints, the pipe shall be dismantled for internal inspection using such joints; in case of all-welded pipeline a pipeline section shall be cut out, the length of such a section shall be equal to two-three its diameters and, if practical, the section shall contain the weld designed for service under extra heavy-load conditions);
- rap the wall with a hammer (if pipe has no insulation) and measure the wall thickness with ultrasonic thickness gauge in several places that are most subjected to wear;
- in case of any doubts about weld quality, cut out specimens for metallographic examination or inspect them using magnetic-tape or gamma-ray testing methods;
- inspect the condition of flanged joints, their collars, contact surfaces, gaskets, fasteners, as well as shaped parts and fittings, if there are any on the section under inspection;
- unscrew (randomly, according to engineering supervision representative's instructions) threaded pipeline joints, inspect them and measure with thread gages;
- check the condition and proper functioning of supports, fasteners and, at random, gaskets;
- test the pipeline in case of any repairs on it.

4.8.3.2 The mechanical properties of pipe metal shall be tested, if they can be affected by the corrosive fluid attack.

4.8.3.3 The inspection results shall be recorded in the pipeline certificate and compared with the initial data (post-erection acceptance data or previous inspection results), after that an inspection certificate shall be drawn up. The works specified in the inspection certificates shall be performed within the prescribed periods.

4.8.3.4 If the inspection reveals unsatisfactory condition of a pipeline section, another pipeline section shall be additionally inspected, and the number of similar pipelines subjected to the inspection shall be doubled.

4.8.3.5 If the inspection of the pipeline detects that the initial wall thickness of the pipe or any other part decreased under the corrosive attack or erosion, the fitness of the pipeline for further service shall be verified with calculations.

4.8.3.6 If the inspection of additional sections gives unsatisfactory results, a general inspection of such a pipeline shall be carried out and it shall cover five sections equally spaced over the entire length of the pipeline.

4.8.3.7 All the defects detected during the inspection shall be eliminated, and the pipeline sections and parts that became unfit for service shall be replaced with new ones. If the general inspection gives unsatisfactory results, the pipelines shall be rejected.

4.8.3.8 All the pipelines and their sections that were dismantled, cut or welded in the course of the inspection shall be subjected to strength and leak tests.

Testing of active pipelines

1) The strength tests serve to confirm the reliability and serviceability of the active pipeline and its sections, they shall be performed:

- after an overhaul with replacement of pipe length;
- after a renovation;
- if they cannot be inspected with internal diagnostics means;
- in case of oil-and-gas pipeline certification.

The tests shall be performed in compliance with the requirements specified in the current normative documents.

2) The operator shall take decision on testing based on the accident rate analysis results taking into consideration the planned measures for reliability improvement, environmental protection requirements, need to increase the maximum permissible operating pressure or to carry out pipeline renovation.

3) The test parameters (section length, test pressure, holding time at test pressure and test pressure change cycling) shall be specified by the operator (together with a specialized organization, if necessary) taking into consideration the pipeline condition, pipelining conditions, route profile, physical and chemical properties of pipe material and other data that describe pipeline operation conditions.

The length of the sections to be tested in the linear pipeline part shall not exceed 30-40 km.

4) The pipeline damages detected during the tests shall be immediately eliminated.

After the elimination of the damages, the pipeline testing shall be continued in compliance with the approved Program or Project. The nature of each pipeline defect or damage detected during the tests shall be recorded in a special report.

5) The pipeline shall be considered as tested for strength and tightness, if the pipe did not fail during the pipeline strength test, and if the pressure remained within the acceptable limits and no leaks were detected during the leak test.

After the tests are completed, a test report of an appropriate form shall be drawn up.

4.8.3.9 The inspection results shall be recorded in the pipeline certificate and compared with the initial data (post-erection acceptance data or previous inspection results),

after that an inspection certificate shall be drawn up; all the reports and conclusions made with respect to the tests performed shall be attached to this inspection certificate.

The inspection certificate and all the other applicable documents shall be attached to the pipeline certificate.

4.8.3.10 The frequency of inspections for the oil-and-gas gathering pipelines shall be determined by the enterprise administration depending on the corrosion and erosion rate taking into consideration the field experience with similar pipelines, visual inspection results, previous inspection results. The frequency of inspections shall ensure safe and accident-free pipeline operation in the periods between inspections.

4.9 Pipeline Maintenance

4.9.1 Assessment of the state of the pipeline equipment and constructions.

4.9.1.1 The assessment of the linear pipeline part state and selection of the maintenance type and method shall be based on the results of comprehensive examinations.

4.9.1.2 The comprehensive examinations include:

- diagnostic examination of the linear pipeline part;
- acoustic-emission or ultrasonic examination of the pipeline wall or welded joints;
- analysis of the pipeline protection potential changes over the period of its operation;
- determination of the insulation condition;
- analysis of the historical data about the accident rate;
- assessment of the utilized pipeline capacity.

4.9.1.3 Based on the analysis of the comprehensive examination and data-processing results, the following shall be done:

- localization of the defect area on the oil pipeline;
- planning of measures to prevent eventual pipeline rupture;
- selection of the maintenance type and method, determination of the work scope and dates depending on the defect nature and taking into consideration the workload of the main oil pipeline during the period of interest and long-run period.

4.9.2 Determination of the maintenance type.

4.9.2.1 Based on the condition assessment results, the following pipeline maintenance types or renewals shall be planned:

- a) repair of short sections that involves cutting defective areas or pipe lengths out and installation of pipe reels or sections;
- b) selective repair of short pipeline sections that includes repair of the pipe wall and welded joints (installation of repair constructions), recovery of the pipeline transportation capacity (repair without cutting out) and replacement of the insulation;
- c) repair of long pipeline sections that includes repair of the pipe wall and welded joints and replacement of the insulation (full insulation replacement based on the existing technologies);
- d) pipeline repair that involves replacement of individual sections or the entire pipeline.

Each maintenance type shall be based on the respective repair method (procedure) specified in a normative document.

4.9.2.2 The priority of maintenance activities and actions aimed at prevention of eventual pipeline ruptures shall be planned depending on the defect nature and severity and taking into consideration the oil-pipeline condition.

5 PIPE TRANSPORTATION AND STORAGE

5.1 The pipe shall be transported and stored in compliance with GOST 10692 by railway transport (open rolling stock), motor or water transport according to the Rules of goods transportation, loading and fastening currently in force for the respective transport type.

5.2 When pipe is transported in stacks or bundles, separator strips shall be used. Bearing strips shall be laid on the railcar or truck body floor, otherwise the pipe bundles shall have transportation clamps.

When pipe is transported on flat-cars, wooden posts shall be installed on the car sides, the posts shall be tied with wire over the pipe bundles.

Cross beams, soft ropes and towels shall be used for pipe handling with cranes and pipe layers; special accessories shall be used for handling longer pipe.

Pipe lengths and sections may only be rolled over ground joists.

5.3 Pipe unloading from railcars

The pipe shall be unloaded from every second railcar or the work may be performed on both track sides in staggered order. The unloading shall be only carried out by specially trained teams under the direction of a responsible person. The moment when gondola car hatches, flat-car side walls are opened or posts are removed is the most dangerous both for pipe quality and for personnel.

The unloaded pipe lengths shall be placed on the racks located near the track at a height of 300 mm minimum from the ground with horizontal supporting surface to prevent spontaneous pipe rolling. The stack height shall not exceed 2.8 m, its length shall exceed five heights. Strong wooden separators at least 35-40 mm thick shall be laid after each layer, the separators shall be fitted with strips at the ends to prevent pipe from rolling and falling.

5.4 Pipe unloading from pipe trucks

The pipe unloading to the racks and their loading from the racks shall be performed using existing handling mechanisms or special loading skids. The handling procedure and limits of stacking on racks do not differ from those specified above. When pipe lengths are rolled up to the racks manually, the stack height shall not exceed 1.5 m.

5.5 The types of transport and transport means for pipe lengths and sections shall be selected taking into consideration the results of technical and economic calculations and depending on the volume of loads, length of haul, season and local conditions.

The transport means shall be equipped with facilities that ensure integrity of both pipe (sections, fittings) and coatings applied to them.

5.6 The pipe lengths or sections shall be never dragged or towed.

5.7 The maximum number of pipe lengths and sections to be transported on motor cars and tractors shall be determined from Table 15 based on the transport load-carrying capacity and pipe dimensions.

5.8 The required road width in the road turn zones shall be determined from Table 2 based on the transport negotiation in a rectangular turn.

5.9 The pipe sections and lengths shall be conveyed on such transport means (flat-cars) that preclude application of bending loads to the pipe body.

5.10 When in mountains on the roads with a grade of 10-15°, pipe sections up to 24 m in length shall be transported by wheel-mounted pipe layers. In case of grades exceeding 15°, caterpillar-mounted transport shall be used.

5.11 An accompanying tractor (hauler or self-propelled tractor-attached hoist) shall be foreseen for especially difficult road sections and cross-country areas.

Table 16 – Limit number of pipe lengths and sections to be transported on motor cars and tractors

Load-Carrying capacity, t	Pipe Diameter, mm														
	1420 × 17			1220 × 13			1020 × 13			820 × 9			720 × 10		
	Length of pipe or pipe section, m														
	12	24	36	12	24	36	12	24	36	12	24	36	12	24	36
9	1	-	-	2	1	-	2	1	-	3	2	1	5	3	1
18	2	-	1	3	2	1	5	2	2	5	3	2	7	5	4
30	-	2	1	3	3	2	5	3	2	5	5	3	9	9	5
50	-	2	2	3	3	3	5	5	5	6	6	6	9	9	9

Table 17 – Required Road Width in Turn Areas

Entry Passage Width, m	Length of Road Train, m				
	12	16	20	24	28
	Road Width in Turn Area, m				
5	15	18	22	26	28
10	11.5	14	17.5	20	23
15	8	12	14	17	19
20	7.5	9	12	14	17
25	7	8	11	13	15

5.12 When pipe lengths or sections cannot be delivered by wheel-mounted transport directly to the erection site on the route, intermediate stations shall be established for transloading of pipe sections onto caterpillar-mounted transport. The locations for such stations shall be selected so as to provide for construction of U-turns and two-way road.

5.13 The transloading stations shall be equipped with handling means.

5.14 Pipe storage

5.14.1 The pipe lengths placed for storage shall be sorted out into batches of various sizes and grades so that not to mix them up.

The pipe shall be placed on storage and stored on racks of outdoor warehouses sorted into sizes and grades.

The lower and subsequent layers of pipe shall be laid on separators. Wooden strips, long rubber or reinforced items shall be used as separators.

The pipe may be stored without separators on special racks that preclude their rolling and contact.

5.14.2 The pipe lengths shall be stored on racks or outdoors, they shall be subjected to preservation treatment for transportation and storage condition categories C (cold

storage), Ж (under shed), ОЖ (outdoor storage yard) according to GOST 9.014. The limit preservation treatment duration is 6 months.

5.14.3 Thin-wall seamless, electric-welded and other special-purpose pipe shall be stored indoors. Pipe lengths may be stored under shelters provided that they are protected against atmospheric precipitations.

6 SAFETY REQUIREMENTS

6.1 The pipelines are classified as dangerous industrial facilities.

6.2 The industrial safety in the course of main oil-pipeline operation shall be based on the Federal Law *On industrial safety in the course of main oil-pipeline operation*, Russian Federation government regulations No. 263 dated 10.03.99 and other effective legal acts and normative documents.

6.3 The safety management system for industrial pipeline facilities shall provide for:

- identification of dangerous industrial facilities;
- licensing of operation activities;
- pipeline operation management that ensures compliance with the requirements of normative documents;
- continuous monitoring of facilities safety condition;
- assessment of facilities safety condition and forecast of its change;
- development of methods and plans to maintain facilities safety within standard limits and admissible risks and implementation of these plans;
- maintenance of the emergency control and warning systems, personnel and resources for elimination of accidents on pipelines and their consequences, interaction with the units of the Russian Ministry for Emergency Situations;
- interaction with state supervisory bodies and control authorities;
- compulsory risk insurance covering damage liabilities during operation of dangerous industrial facilities;
- development of safety declarations for pipeline facilities.

6.4 The pipeline route shall be patrolled to check the state of the protected zone and adjacent territories, detect factors that can endanger pipeline safety and its reliable operation.

7 SPECIFIED LIFE AND MANUFACTURER'S GUARANTEE

The manufacturer guarantees compliance of the pipe with the requirements of GOSTs, TUs within 1 year from the date of manufacture provided that the requirements of this Manual are observed.

The Customer may carry out any examinations and tests both at the Manufacturer's premises and on the Customer's own site to verify pipe compliance with the requirements of GOSTs, TUs.

8 LIST OF REFERENCED DOCUMENTS

- 1 GOST 9.014-78 Unified system of corrosion and ageing protection. Temporary corrosion protection of products. General requirements
- 2 GOST 8731-74 Seamless hot-deformed steel pipe. Specification.
- 3 GOST 8732-78 Seamless hot-wrought steel pipe. Range of sizes.
- 4 GOST 10704-91 Electric-welded straight-seam steel pipe. Range of sizes.
- 5 GOST 10705-80* Electric-welded steel pipe. Specification.
- 6 GOST 10692-80 Steel and cast iron pipe and fittings. Acceptance, marking, packing, transportation and storage.
- 7 GOST 15846-2002 Products for transportation to Far-North areas and other remote regions. Packing, marking, transportation and storage.
- 8 GOST 20295-85 Welded steel pipe for main gas-and-oil pipelines. Specification.
- 9 GOST R 53383-2009 Seamless hot-wrought steel pipe. Specification.
- 10 ANSI/API Specification 5L (44th edition) Specification for Line Pipe / ISO 3183:2007, Petroleum and natural gas industries – Steel pipe for pipeline transportation systems.
- 11 RD 39-132-94 Rules for operation, inspection, repair and rejection of oilfield pipelines.
- 12 Code of Practice 2.05.06-85* Main pipelines.
- 13 Code of Practice 3.01.04-87 Acceptance of completed construction projects for operation.
- 14 Code of Practice III-42-80* Main pipelines. Rules for project construction and acceptance.
- 15 SP 34-116-97 Instruction for design, construction and renovation of field pipelines.
- 16 In-house Code of Practice VSN-011-88 Construction of main and field pipelines. Cleaning of inner space and testing.
- 17 In-house Code of Practice VSN-012-88 Construction of main and field pipelines. Quality inspection and acceptance of work. Part II. Forms of documents and rules for their issue during acceptance period.
- 18 TU 14-3-1128-2000 Seamless hot-wrought steel pipe for gas pipelines of gas-lift systems and gas-field construction.

- 19 TU 14-3P-1128-2007 Seamless cold-resistant steel pipe for gas pipelines of gas-lift oil-production systems and gas-field construction
- 20 TU 14-3-1618-89 Seamless hot-wrought steel pipe for gas pipelines of gas-lift systems and oil- and gas-field construction in Northern regions.
- 21 TU 14-3-1801-92 High-quality seamless hot-wrought steel pipe for gas pipelines, gas-lift systems and oil- and gas-field construction in Northern regions.
- 22 TU 14-161-134-93 Seamless hot-wrought steel pipe for gas pipelines of gas-lift systems.
- 23 TU 14-3-1971-97 Seamless hot-wrought steel line pipe of higher corrosion resistance and field reliability made of carbon steel (steel 20 and its modifications).
- 24 TU 14-3-1972-97 Seamless hot-wrought steel line pipe of higher corrosion resistance and cold resistance.
- 25 TU 1317-204-00147016-01 Seamless hot-wrought cold-resistant steel line pipe of higher corrosion resistance.
- 26 TU 1308-269-00147016-2003 Seamless hot-wrought steel line pipe of higher cold resistance and corrosion resistance for OAO Surgutneftegaz fields.
- 27 TU 14-3P-77-2004 H₂S-resistant seamless pipe.
- 28 TU 14-157-60-98 H₂S-resistant seamless hot-wrought steel line pipe for OAO GAZPROM.
- 29 TU 14-3-1831-92 H₂S-resistant seamless pipe made of steel grade 12ГФПВ.
- 30 TU 14-162-14-96 Seamless hot-wrought steel line pipe of higher cold resistance and corrosion resistance.
- 31 TU 14-162-20-97 Seamless hot-wrought steel line pipe of higher cold resistance and corrosion resistance for OAO Surgutneftegaz fields.
- 32 TU 14-161-174-97 Seamless hot-wrought steel line pipe of higher cold resistance and corrosion resistance for OAO Surgutneftegaz fields.
- 33 TU 14-161-147-94 H₂S-resistant and cold-resistant seamless hot-wrought line pipe.
- 34 TU 14-161-148-94 Seamless hot-wrought line pipe of higher cold resistance and corrosion resistance.
- 35 TU 14-157-37-94 Cold-resistant seamless hot-wrought pipe made of steel grade 20.
- 36 TU 14-157-38-94 Cold-resistant seamless hot-wrought pipe made of steel grade 09Г2С.
- 37 TU 14-157-54-97 Seamless hot-wrought line pipe of higher cold resistance and corrosion resistance for OAO Surgutneftegaz fields.
- 38 TU 14-161-184-2000 Seamless hot-wrought steel pipe made of steel grade 09Г2С.
- 39 TU 14-157-80-2006 Seamless hot-wrought steel pipe for construction of sanitation facilities and low-pressure water pipelines.
- 40 TU 1308-195-00147016-01 Corrosion-resistant and cold-resistant seamless hot-wrought steel line pipe designed for construction, overhaul and renovation of underwater passages.

- 41 TU 14-1-5439-2001 Seamless hot-wrought steel line pipe with higher resistance to local corrosion and cold resistant.
- 42 TU 14-3P-48-2001 Cold-resistant seamless hot-wrought steel pipe for OAO GAZPROM.
- 43 TU 1317-006.1-593377520-2003 Seamless hot-wrought steel line pipe of higher field reliability for construction of OAO TNK fields.
- 44 TU 14-156-65-2005 Seamless hot-wrought steel pipe for oil pipelines.
- 45 TU 1308-226-00147016-02 Seamless hot-wrought steel line pipe made of micro-alloyed steels with increased field service life.
- 46 TU 1317-214-00147016-02 Seamless hot-wrought steel line pipe with higher field reliability for fields of TPP Kogalymneftegaz.
- 47 TU 14-157-50-97 Seamless hot-wrought line pipe with higher field reliability.
- 48 TU 1308-245-00147016-02 Seamless hot-wrought steel line pipe with increased structural strength designed for corrosive service.
- 49 TU 1317-233-00147016-02 Seamless hot-wrought steel line pipe with higher field reliability for fields of OAO Tomskneft.
- 50 TU 14-1-5392-2000 Corrosion-resistant seamless bimetal pipe.
- 51 TU 1381-159-00147016-01 Seamless hot-wrought steel line pipe with surface improved for application of corrosion-resistant coating.
- 52 TU 14-162-24-97 Seamless hot-wrought pipe for pipelines with TPT thread and couplings for them.
- 53 TU 14-3P- 54-2001 Seamless hot-wrought pipe made of steel grade 20Ю4.
- 54 TU 14-3-1798-91 Seamless hot-wrought steel pipe for manufacture of pipeline components.
- 55 TU 14-3P-91-2004 Seamless hot-wrought steel line pipe with higher resistance to local corrosion and cold resistant for fields of OAO Surgutneftegaz.
- 56 TU 1317-023-48124013-05 Seamless hot-wrought line pipe designed for construction of fields of OAO Yuganskneftegaz.
- 57 TU 14-3P-90-2007 H₂S-resistant seamless pipe made of steel grade X42SS.
- 58 TU 14-162-43-98 Longitudinal electric-welded steel pipe of low-alloy steels.
- 59 TU 14-3P-98-2008 Longitudinal electric-welded steel line pipe with higher cold resistance and resistance to local corrosion.
- 60 TU 1303-006.3-593377520-2003 Longitudinal electric-welded steel line pipe produced by high-frequency welding, with increased field reliability designed for construction of fields of OAO TNK.
- 61 TU 14-156-77-2008 Longitudinal electric-welded steel pipe 530-1420 mm in diameter for main gas pipelines under a pressure of 9.8 MPa.
- 62 TU 14-156-78-2008 Longitudinal electric-welded steel pipe 530-1420 mm in diameter, grade K60, for main gas pipelines under a working pressure of 11.8 MPa.
- 63 TU 14-156-80-2008 Longitudinal electric-welded steel pipe of common and cold-resistant design for main oil pipelines.
- 64 TU 14-156-82-2008 Longitudinal electric-welded steel pipe 1420 mm in diameter, grade K65, for main gas pipelines under a working pressure of 11.8 MPa.

- 65 TU 14-156-81-2008 Longitudinal electric-welded pipe for main oil pipeline "East Siberia – Pacific Ocean"
- 66 TU 14-156-85-2009 Longitudinal electric-welded steel line pipe 530-1220 mm in diameter with increased corrosion resistance and cold resistance made of steel 20 KCX for fields of OAO Surgutneftegaz.
- 67 TU 1303-006.2-593377520-2003 Longitudinal electric-welded steel line pipe with increased field reliability, corrosion- and cold-resistance, produced by automatic submerged welding and designed for construction of fields of OAO TNK.
- 68 TU 14-156-87-2010 Longitudinal electric-welded steel line pipe with increased field reliability, corrosion- and cold-resistance, produced by automatic submerged welding and designed for construction of fields of NK Rosneft.
- 69 TU 14-156-91-2010 Electric-welded steel line pipe.
- 70 TU 14-156-92-2010 Longitudinal electric-welded steel pipe for offshore pipelines.
- 71 TU 14-156-93-2010 Seamless steel pipe for offshore pipelines.
- 72 TU 1104-138100-357-02-96 Spiral Electric-Welded Steel Pipe of 720, 820, 1020, 1220 mm in diameter, with external corrosion-resistant coating for use at a pressure up to 7.4 MPa (75 kgf/cm²).
- 73 TU 14-3-1976-99 Spiral Electric-Welded Steel Pipe with external corrosion-resistant coating for use at a pressure up to 7.4 MPa (75 kgf/cm²)
- 74 TU 14-3-1977-2000 Spiral Electric-Welded Steel Pipe of 1420 mm in diameter, with external corrosion-resistant coating for use at a pressure up to 7.4 MPa (75 kgf/cm²)
- 75 TU 1381-144-00147016-01 Spiral electric-welded line pipe subjected to bulk heat treatment and designed for construction of field pipelines intended for service in highly-corrosive environments at OAO Surgutneftegaz fields.
- 76 TU 1381-158-00147016-01 Spiral electric-welded pipe subjected to bulk heat treatment and designed for construction of field pipelines intended for service in highly-corrosive environments.
- 77 TU 14-3-1970-97 Spiral electric-welded steel pipe with increased corrosion and cold resistance made of quality carbon steel grade 20.
- 78 TU 14-3-1973-98 Spiral electric-welded steel pipe made of low-alloy steel, with external corrosion-resistant coating for construction of main oil pipelines.
- 79 TU 14-3P-60-2002 Spiral electric-welded steel pipe 1420 mm in diameter for service at a pressure up to 8.3 MPa (84 kgf/cm²)
- 80 TU 1381-213-00147016-02 Spiral electric-welded steel line pipe subjected to bulk heat treatment with increased field reliability.
- 81 TU 14-3P-52-2001 Spiral electric-welded steel pipe made of low-alloy steel grade 06ГФБАА for construction of main pipelines.
- 82 TU 1303-006.4-593377520-2003 Spiral electric-welded steel line pipe with increased field reliability for construction of OAO TNK fields.
- 83 TU 14-156-55-2005 Spiral electric-welded steel pipe of common and cold-resistant design designed for construction of main oil pipelines.
- 84 TU 14-156-76-2007 Spiral electric-welded steel pipe 1420 in diameter for service at a pressure up to 9.8 MPa (100 kgf/cm²). Specification.

- 85 TU 14-156-67-2006 Spiral electric-welded steel pipe 1420, 1720, 1820 mm in diameter for manufacture of protective cases.
- 86 TU 14-156-70-2006 Spiral electric-welded steel pipe for manufacture of protective cases with "pipe-in-pipe" design.
- 87 TU 14-156-56-2005 Spiral electric-welded steel pipe with increased field reliability for main oil pipelines.
- 88 TU 14-3-1363-97 Spiral electric-welded steel pipe 1420 in diameter for service at a pressure up to 7.4 MPa.
- 89 TU 14-3P-49-2003 Seamless and electric-welded pipe 102 to 1420 mm in diameter with external protective coating based on extruded polyethylene.
- 90 TU 14-156-57-2005 Seamless steel pipe with three-layer polypropylene coating for construction of main oil pipelines.
- 91 TU 14-156-69-2006 Seamless and electric-welded steel pipe with external two-layer epoxy coating for construction of main pipelines.
- 92 TU 1381-00900154341-02 Steel pipe 57 to 530 mm in diameter with external corrosion-resistant coating based on powder epoxy compounds.
- 93 TU 1381-012-00154341-02 Steel pipe 102 to 530 mm in diameter with internal and external protective coating based on based on powder epoxy compounds.
- 94 TU 1468-014-32256008-07 Fittings of 57 to 530 mm in diameter with internal and external protective coating based on surfaced powder compounds.
- 95 TU 14-156-74-2008 Electric-welded steel pipe 406 to 1420 mm in diameter with external three-layer polyethylene coating.
- 96 OTT-04.00-27.22.00-KTH-005-1-03 Factory-applied polyethylene coating of pipe. Specification.
- 97 TU 14-156-79-2008 Seamless and electric-welded steel pipe 530 to 1420 mm in diameter with internal flow coating.

Certified the foregoing Document to be a true, complete, and accurate English translation of the original document translated from Russian by the INTERSERVICE translation agency.


A. Itskovich
Director

