



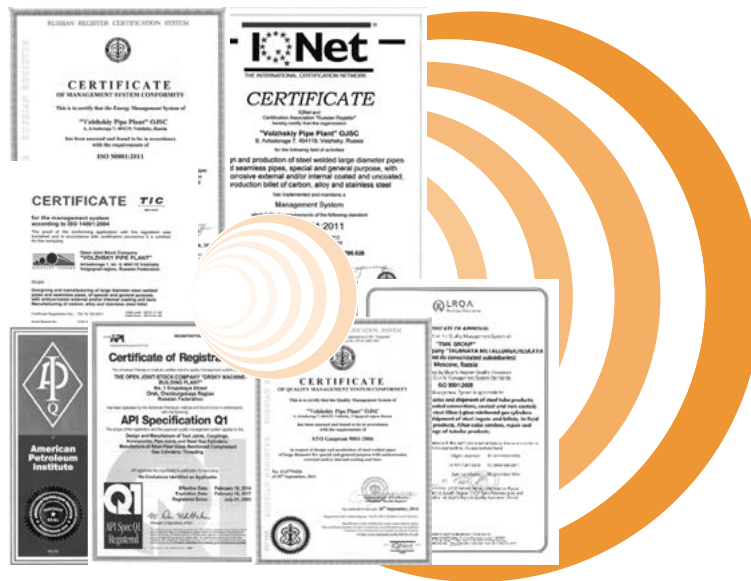
Tube & Pipe  
Technical Catalog





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The information presented herein is intended for use by industry professionals, using their own knowledge, experience and expertise. Although we have endeavored to provide accurate information and calculations, such information may be subject to change or correction, and TMK and its affiliates take no responsibility for the reliance on or use of any information contained herein.



The Company was founded in 2001 and currently operates in Russia, Romania, and Kazakhstan. TMK's core business is the production and sales of seamless and welded pipe, including large diameter pipe, casing pipe with API and Premium connections, combined with an extensive range of heat treatment services, protective coating, Premium connections threading, pipe storage and repair.

TMK consists of four Russian pipe production sites — Volzhsky Pipe Plant, Seversky Pipe Plant, Sinarsky Pipe Plant, and Taganrog Metallurgical Works; TMK ARTROM and TMK-RESITA in Romania. The Company also owns four oilfield service assets in Russia, incorporated into TMK Oilfield Services division, TMK-Kaztrubprom (Kazakhstan).

TMK's research efforts are spearheaded by the Russian Research Institute for the Tube and Pipe Industries (RosNITI) located in Chelyabinsk (Russia). To foster innovation and boost its R&D po-

tential, the Company set up an R&D facility in the Skolkovo Innovation Center (Moscow, Russia). These centres focus on new product design and development, experimental and validation testing, and advanced research.

Consolidation of production assets across the globe, scientific and engineering innovations, and a geographically diversified sales network have allowed the Company to create a modern vertically integrated industrial group, manufacturing and supplying high-tech, competitive pipe products.

TMK's unique production and service capabilities ensure supply to a wide range of customers and offer effective solutions to their operational challenges.

In 2019, TMK's pipe sales totalled 3.8 million tonnes. TMK supplies products to customers in over 80 countries.

For more information on TMK, please visit our web sites at [www.tmk-group.com](http://www.tmk-group.com) and [www.tmk-ipsco.com](http://www.tmk-ipsco.com).



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**TMK's Major Customers**

**RUSSIAN OIL & GAS COMPANIES**

GAZPROM TRANSNEFTPRODUCT  
 ROSNEFT TRANSNEFT  
 SIBNEFT RUSSNEFT  
 TATNEFT SURGUTNEFTEGAZ  
 LUKOIL

**MAJOR CIS Machine Building and Energy Companies**

KRASNY KOTELSHIK  
 KAMAZ  
 GAZ  
 BELENERGOMASH  
 BELAZ  
 VAZ  
 ZIO-PODOLSK  
 UALAZ  
 MAZ  
 PENZAHIMMASH  
 UAZ  
 EPK  
 SIBENERGOMASH

**MAJOR INTERNATIONAL INDEPENDENT OIL & GAS COMPANIES**

SHELL  
 TOTAL  
 EXXONMOBIL  
 AL-FURAT PETROLEUM COMPANY  
 ENCANA  
 PDO  
 ESHPETCO  
 WOODSIDE PETROLEUM  
 REPSOL  
 PETRO-CANADA  
 ANADARKO PETROLEUM  
 MARATHON OIL  
 CHESAPEAKE  
 OMV  
 XTO ENERGY  
 AMERADA HESS  
 STATOIL  
 WINTERSHALL  
 CHEVRON TEXACO  
 AGIP  
 OCCIDENTAL PETROLEUM  
 MAERSK OIL  
 BURLINGTON RESOURCES

**MAJOR EPC & OILFIELD DEVELOPMENT COMPANIES**

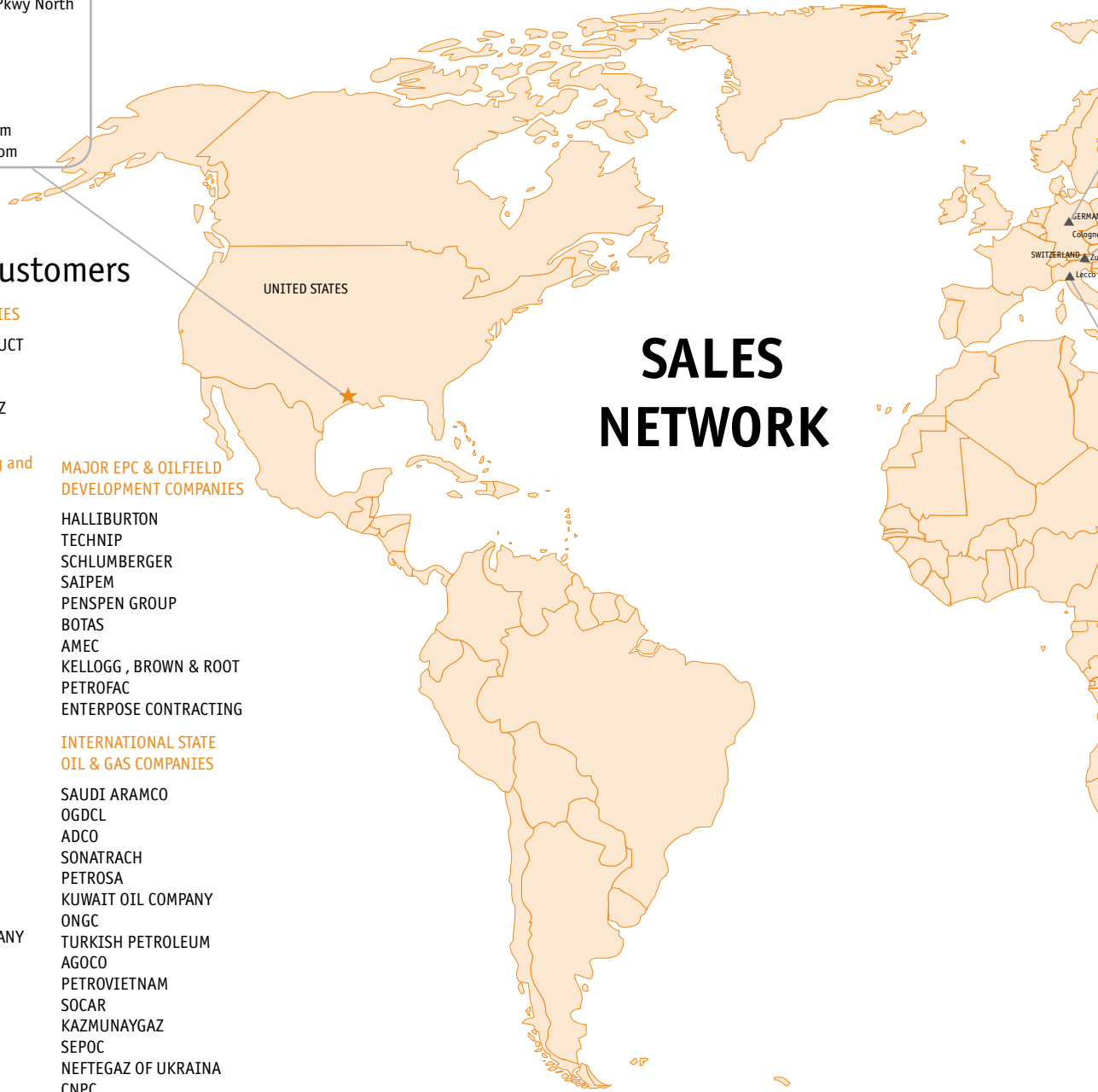
HALLIBURTON  
 TECHNIP  
 SCHLUMBERGER  
 SAIPEM  
 PENSPEN GROUP  
 BOTAS  
 AMEC  
 KELLOGG , BROWN & ROOT  
 PETROFAC  
 ENTERPOSE CONTRACTING

**INTERNATIONAL STATE OIL & GAS COMPANIES**

SAUDI ARAMCO  
 OGDCL  
 ADCO  
 SONATRACH  
 PETROSA  
 KUWAIT OIL COMPANY  
 ONGC  
 TURKISH PETROLEUM  
 AGOCO  
 PETROVIETNAM  
 SOCAR  
 KAZMUNAYGAZ  
 SEPOC  
 NEFTEGAZ OF UKRAINA  
 CNPC  
 GROUPEMENT BERKINE  
 UZBEKNEFTEGAZ  
 EGPC  
 TURKMENNEFTEGAZ  
 SYRIAN PETROLEUM COMPANY  
 ORPIC  
 OMANA GAS CO  
 DALLEL PERTROLEUM  
 OOCEP

★ Headquarters  
 ▲ TMK sales offices

**SALES NETWORK**



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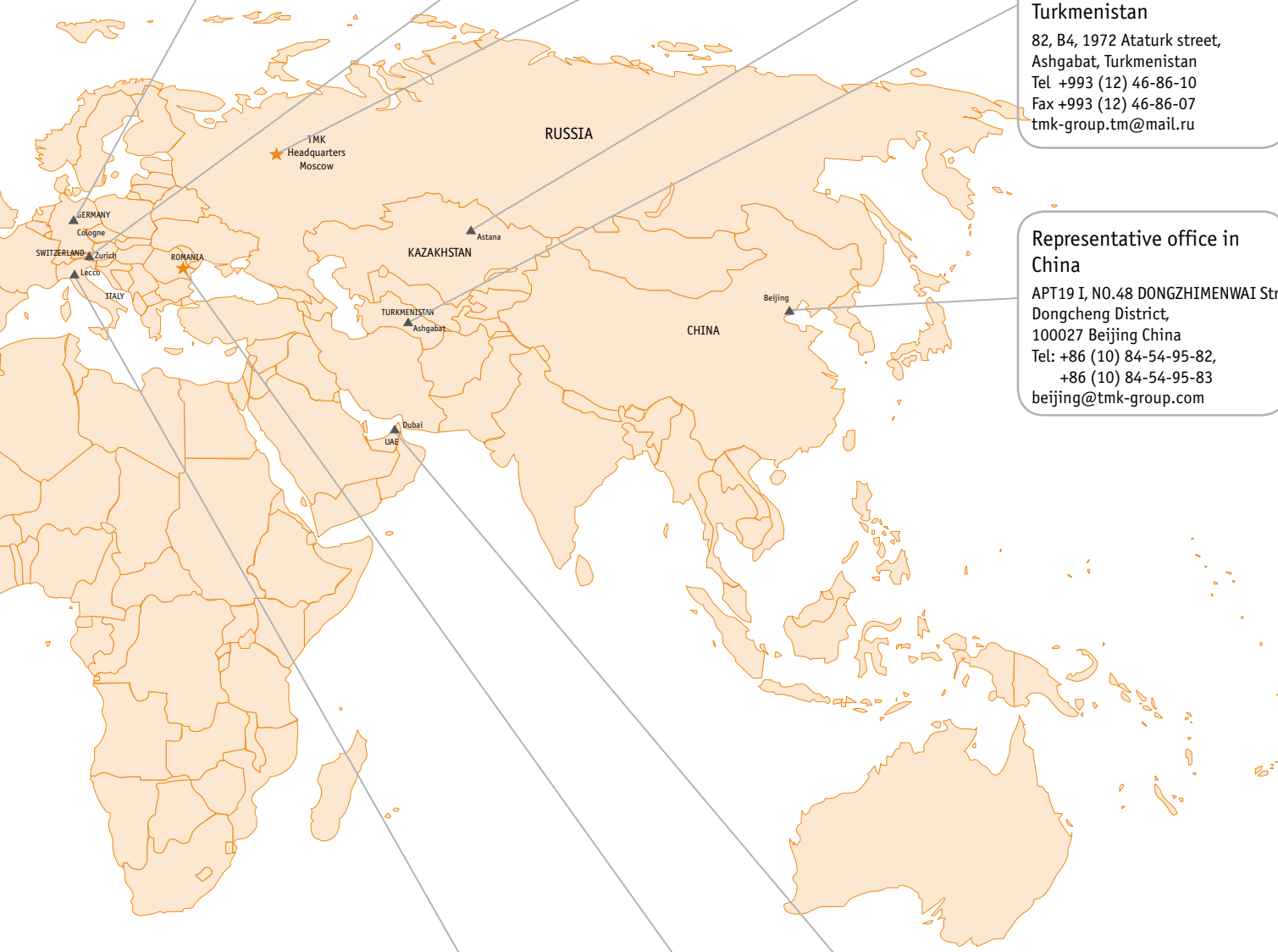
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**TAGMET/Smls, ERW/**  
 Drill Pipe 88.9-139.7 mm  
 Smls OCTG 101.6-219.08 mm  
 Smls Line Pipe 88.9-273.05 mm  
 Welded Pipe 13.5-219 mm  
 Smls Industrial Pipe 89-273 mm  
 Welded profiles 20x20-160x160 mm  
 Premium Connections  
 Round billets 150-400 mm

**Volzhsky Pipe Plant /Smls, SAW/**  
 Smls OCTG 168.28-426 mm  
 Welded LD Pipe 508-1422 mm  
 Smls Line Pipe 57-426 mm  
 Smls Industrial Pipe 38-426 mm  
 Premium Connections  
 Round billets 145-410 mm

**Truboplast**  
 Internal & External Coatings  
 57-720 mm

**TMK NGS-Nizhnevartovsk**  
 Threading 60.3-114.3 mm  
 Coating 76-720 mm  
 Technical support & field service

**Seversky Tube Works /Smls, ERW/**  
 Smls OCTG 168.28-323.9 mm  
 Welded LD Pipe 508-530 mm  
 Smls Line Pipe 168.28-323.9 mm  
 Welded Pipe 21.3-426 mm  
 Welded profiles 15x15-350x250 mm  
 Premium Connections  
 Round billets 150, 156 mm

**Sinarsky Pipe Plant /Smls/**  
 Drill Pipe 60.3-127 mm  
 Smls OCTG 33.4-168.28 mm  
 Smls Line Pipe 57-168.28 mm  
 Smls Industrial Pipe 5-168.28 mm  
 VIT, VIT Light  
 Premium Connections

**Russian Pipe Industry Institute /RosNITI/**  
 Russia, Yekaterinburg

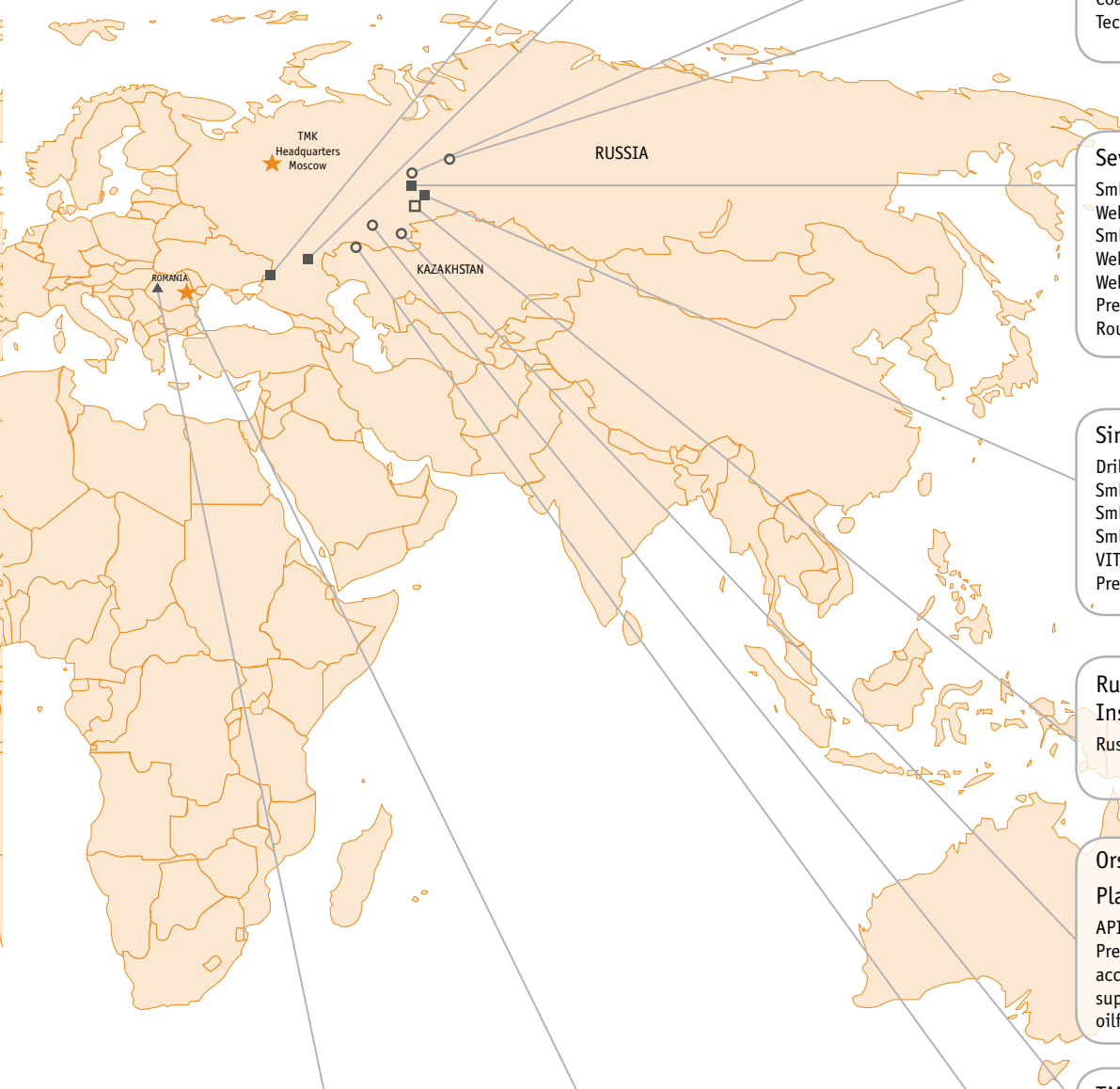
**Orsky Machine Building Plant (OMZ)**  
 API Tool joints  
 Premium Connections  
 accessories, fishing tools, tech. support and general oilfield manufacturing

**TMK NGS Buzuluk**  
 Threading 33.4-346.08 mm  
 Technical support & service  
 Premium Connections

**TMK-Kaztrubprom /Smls/**  
 Smls OCTG 60.3-177.8 mm  
 Premium Connections

**TMK-RESITA**  
 Round billets 177, 220, 280 and 350 mm  
 Blooms 260 x 340 mm

**TMK-ARTROM /Smls/**  
 Smls Line pipe 17.1-219.08 mm  
 Process & PG 15.88 - 219.1mm  
 Mechanicals 15.88 - 250 mm  
 Structural and standard 21.3 - 250 mm









## Drill Pipe

TMK provides high quality drill pipe for the oil and gas industry. Drill pipe is produced at the Sinarsky plant (Russia), TAGMET (Russia). Weld-on tool joints are produced and delivered by OMZ (Russia), which is part of TMK Oilfield Services, certified by API Spec 7-1, API Spec 7-2. Pipe sizes range from 2 3/8 up to 5 1/2 inches and can be produced in grades E75, X95, G105 and S135. Ambridge drill pipe can be produced as green tube for further finishing.

During production, all pipe undergoes required heat treatment and NDT inspection. TMK drill pipe can be produced to lengths both in Range 2 and Range 3. To prevent corrosion, each pipe is covered with a protective coating. Drill pipe connections are coated with an anti-corrosion thread compound and API composite thread protectors are applied. Delivery is carried out in strict accordance to API loading and transportation standards.

### Drill Pipe Producers

Plant Location	Products	OD	WT	Grades
Sinarsky Pipe Plant /Russia/	Drill Pipe	2 3/8 - 4	0.280" - 0.449"	E75, X95, G105, S135
TAGMET /Russia/	Drill Pipe	4 1/2 - 5 1/2	0.337" - 0.500"	E75, X95, G105, S135

## Drill Pipe Dimensional Range and Performance Properties

Pipe Figures										
Plant	Nominal Size	Nominal Weight	Wall thickness	Inside Diameter	Grade	Upset	Tensile Yield	Torsional Yield	Internal Pressure	Collapse
	in	lb/ft	in	in			lb	ft-lb	psi	psi
	mm	kg/m	mm	mm			kN	Nm	bar	bar
3	2 3/8 60,3	6.65 9,34	0.280 7,11	1.815 46,13	E75	EU	138 214 615	6 250 8 474	15 474 1 067	15 599 1 075
		6.65 9,34	0.280 7,11	1.815 46,13	X95	EU	175 072 779	7 917 10 734	19 600 1 351	19 759 1 362
		6.65 9,34	0.280 7,11	1.815 46,13	G105	EU	193 500 861	8 751 11 864	21 663 1 493	21 839 1 505
3	2 7/8 73,0	10.4 15,49	0.362 9,19	2.151 54,64	E75	EU	214 344 953	11 554 15 665	16 526 1 139	16 509 1 138
		10.4 15,49	0.362 9,19	2.151 54,64	X95	EU	271 503 1208	14 635 19 842	20 933 1 443	20 911 1 441
		10.4 15,49	0.362 9,19	2.151 54,64	G105	EU	300 082 1335	16 176 21 932	23 137 1 595	23 112 1 593
		10.4 15,49	0.362 9,19	2.151 54,64	S135	EU	385 820 1716	20 798 28 198	29 747 2 051	29 716 2 048
3	3 1/2 88,9	13.3 19,81	0.368 9,35	2.764 70,20	E75	EU	271 569 1208	18 551 25 152	13 800 951	14 113 973
		13.3 19,81	0.368 9,35	2.764 70,20	X95	EU	343 988 1530	23 498 31860	17 480 1 205	17 877 1 232
		13.3 19,81	0.368 9,35	2.764 70,20	G105	EU	380 197 1691	25 972 35213	19 320 1 332	19 758 1 362
		13.3 19,81	0.368 9,35	2.764 70,20	S135	EU	488 825 2174	33 392 45 273	24 840 1 712	25 404 1 751
		15.5 23,09	0.449 11,4	2.602 66,10	E75	EU	322 775 1436	21 086 28 589	16 838 1 160	16 774 1 156
		15.5 23,09	0.449 11,4	2.602 66,10	X95	EU	408 848 1819	26 708 36 211	21 328 1 470	21 247 1 465
		15.5 23,09	0.449 11,4	2.602 66,10	G105	EU	451 885 2010	29 520 40 023	23 573 1 625	23 484 1 619
		15.5 23,09	0.449 11,4	2.602 66,10	S135	EU	580 995 2585	37 954 51 459	30 308 2 090	30 194 2 081
3	4 101,6	14.0 20,85	0.330 8,38	3.340 84,84	E75	IU	258 359 1269	23 288 31574	10 828 746	11 354 782
		14.0 20,85	0.330 8,38	3.340 84,84	X95	IU	361 454 1608	29 498 39 994	13 716 945	14 382 992
		14.0 20,85	0.330 8,38	3.340 84,84	G105	IU	399 502 1777	32 603 44 204	15 159 1 045	15 896 1 096

Plant designation: 3 – Sinarsky/Rus/; 4 – TAGMET/Rus/



Tool Joint Figures							Assembly		
Connection	Outside Diameter	Inside Diameter	Tong Length Pin	Tong Length Box	Tensile Yield	Torsional Yield	Aprox. Weight	Torsional Ratio, pin to pipe	Make-up torque
	in	in	in	in	lb	ft-lb	lb/ft		ft-lb
	mm	mm	mm	mm	kN	Nm	kg/m		Nm
NC26	3 3/8 85,725	1 3/4 27,15	7 177,8	8 203,2	313 681 1 395	6 875 9 321	6.99 10,41	1.10	4 125 5 593
NC26	3 3/8 85,725	1 3/4 27,15	7 177,8	8 203,2	313 681 1 395	6 875 9 321	7.11 10,59	0.87	4 125 5 593
NC26	3 3/8 85,725	1 3/4 27,15	7 177,8	8 203,2	313 681 1 395	6 875 9 321	7.11 10,59	0.79	4 125 5 593
NC31	4 1/8 104,8	2 1/8 53,98	7 177,8	9 228,6	447 130 1 989	11 790 15 985	10.87 16,19	1.02	7 122 9 656
NC31	4 1/8 104,8	2 50,80	7 177,8	9 228,6	495 726 2 205	13 158 17 839	11.09 16,52	0.90	7 918 10 735
NC31	4 1/8 104,8	2 50,80	7 177,8	9 228,6	495 726 2 205	13 158 17 839	11.09 16,52	0.81	7 918 10 735
NC31	4 3/8 111,1	1 5/8 41,28	7 177,8	9 228,6	623 844 2 775	16 809 22 790	11.55 17,20	0.81	10 167 13 785
NC38	4 3/4 120,7	2 11/16 68,26	8 203,2	10 1/2 266,7	587 308 2 613	18 071 24 500	13.93 20,75	0.97	10 864 14 730
NC38	5 127,0	2 9/16 65,09	8 203,2	10 1/2 266,7	649 158 2 888	20 095 27 245	14.62 21,78	0.86	12 196 16 536
NC38	5 127,0	2 7/16 61,91	8 203,2	10 1/2 266,7	708 063 3 150	22 035 29 875	14.71 21,91	0.85	13 328 18 070
NC38	5 127,0	2 1/8 53,98	8 203,2	10 1/2 266,7	842 440 3 748	26 503 35 933	14.92 22,22	0.79	15 909 21 570
NC38	5 127,0	2 9/16 65,09	8 203,2	10 1/2 266,7	649 158 2 888	20 095 27 245	16.54 24,64	0.95	12 196 16 536
NC38	5 127,0	2 7/16 61,91	8 203,2	10 1/2 266,7	708 063 3 150	22 035 29 875	16.82 25,05	0.86	13 328 18 070
NC38	5 127,0	2 1/8 53,98	8 203,2	10 1/2 266,7	842 440 3 748	26 503 35 933	17.03 25,37	0.90	15 909 21 570
NC40	5 1/2 139,7	2 1/4 57,15	7 177,8	10 254,0	979 996 4 360	32 693 44 325	17.57 26,17	0.86	19 766 26 799
NC40	5 1/4 133,4	2 13/16 71,44	7 177,8	10 254,0	711 611 3 166	23 279 31 562	15.04 22,40	1.00	17 092 19 106
NC40	5 1/4 133,4	2 11/16 68,26	7 177,8	10 254,0	776 406 3 454	25 531 34 615	15.34 22,85	0.87	15 404 20 885
NC40	5 1/2 139,7	2 7/16 61,91	7 177,8	10 254,0	897 161 3 991	29 764 40 354	15.91 23,70	0.91	18 068 24 497

## Drill Pipe Dimensional Range and Performance Properties

Pipe Figures										
Plant	Nominal Size	Nominal Weight	Wall thickness	Inside Diameter	Grade	Upset	Tensile Yield	Torsional Yield	Internal Pressure	Collapse
	in	lb/ft	in	in			lb	ft-lb	psi	psi
	mm	kg/m	mm	mm			kN	Nm	bar	bar
4	4 1/2 114,3	16.6 24,73	0.337 8,56	3.826 97,18	E75	IEU	330 558 1 470	30 807 41 774	9 829 678	10 392 717
		16.6 24,73	0.337 8,56	3.826 97,18	X95	IEU	418 707 1 863	39 022 52 914	12 450 859	12 765 880
		16.6 24,73	0.337 8,56	3.826 97,18	G105	IEU	462 781 2 059	43 130 58 484	13 761 949	13 825 953
		16.6 24,73	0.337 8,56	3.826 97,18	S135	IEU	595 004 2 647	55 453 75 194	17 693 1 220	16 773 1157
		20.00 29,79	0.430 10,92	3.64 92,46	E75	IEU	412 358 1 834	36 901 50 038	12 542 865	12 964 894
		20.00 29,79	0.430 10,92	3.64 92,46	X95	IEU	522 320 2 323	46 741 63 381	15 886 1 096	16 421 1132
		20.00 29,79	0.430 10,92	3.64 92,46	G105	IEU	577 301 2 568	51 661 70 052	17 558 1 211	18 149 1252
		20.00 29,79	0.430 10,92	3.64 92,46	S135	IEU	742 244 3 302	66 421 90 067	2 2575 1 557	23 335 1609
4	5 127,0	19.50 29,05	0.362 9,19	4.276 108,62	E75	IEU	395 595 1 760	41 167 55 822	9 503 655	9 962 687
		19.50 29,05	0.362 9,19	4.276 108,62	E75	IEU	395 595 1 760	41 167 55 822	9 503 655	9 962 687
		19.50 29,05	0.362 9,19	4.276 108,62	X95	IEU	501 087 2 229	52 144 70 707	12 037 830	12 026 829
		19.50 29,05	0.362 9,19	4.276 108,62	X95	IEU	501 087 2 229	52 144 70 707	12 037 830	12 026 829
		19.50 29,05	0.362 9,19	4.276 108,62	G105	IEU	553 833 2 464	57 633 78 150	13 304 918	12 999 896
		19.50 29,05	0.362 9,19	4.276 108,62	G105	IEU	553 833 2 464	57 633 78 150	13 304 918	12 999 896
		19.50 29,05	0.362 9,19	4.276 108,62	S135	IEU	712 070 3 168	74 100 100 480	17 105 1180	15 672 1 081
		19.50 29,05	0.362 9,19	4.276 108,62	S135	IEU	712 070 3 168	74 100 100 480	17 105 1180	15 672 1 081
		25.60 38,13	0.50 12,70	4.000 101,60	E75	IEU	530 144 2 358	52 257 70 860	13 125 905	13 500 931
		25.60 38,13	0.50 12,70	4.000 101,60	E75	IEU	530 144 2 358	52 257 70 860	13 125 905	13500 931

Plant designation: 3 – Sinarsky; 4 – TAGMET;

Tool Joint Figures							Assembly		
Connection	Outside Diameter	Inside Diameter	Tong Length Pin	Tong Length Box	Tensile Yield	Torsional Yield	Aprox. Weight	Torsional Ratio, pin to pipe	Make-up torque
	in	in	in	in	lb	ft-lb	lb/ft		ft-lb
	mm	mm	mm	mm	kN	Nm	kg/m		Nm
NC 46	6 1/4 158,8	3 1/4 82,55	7 177,8	10 254,0	901 164 4 009	33 228 45 057	18.37 27,35	1.09	20.396 27 657
NC 46	6 1/4 158,8	3 76,20	7 177,8	10 254,0	1 048 426 4 664	38 998 52 881	18.79 27,98	1.01	20.396 27 657
NC 46	6 1/4 158,8	3 76,20	7 177,8	10 254,0	1 048 426 4 664	38 998 52 881	18.79 27,98	0.91	23.795 32 266
NC 46	6 1/4 158,8	2 3/4 69,85	7 177,8	10 2 54,0	1 183 908 5 266	44 359 60 151	19.00 28,29	0.81	26.923 36 508
NC 46	6 1/4 158,75	3 76,20	7 177,8	10 254,0	1 048 426 4 664	38 998 52 881	22.09 32,89	1.07	23.795 32 266
NC 46	6 1/4 158,75	2 3/4 69,85	7 177,8	10 254,0	1 183 908 5 266	44 359 60 151	22.67 33,76	0.96	26.923 36 508
NC 46	6 1/4 158,75	2 1/2 63,50	7 177,8	10 254,0	1 307 608 5 817	49 297 66 847	22.86 34,03	0.96	29.778 40 379
NC 46	6 1/4 158,75	2 1/4 57,15	7 177,8	10 254,0	1 419 527 6 315	53 800 79 953	23.03 34,29	0.81	
NC 50	6 5/8 168,28	3 3/4 95,25	7 177,8	10 254,0	939 095 4 177	37 269 50 537	20.85 31,05	0.92	22.836 30 966
51/2 FH	7 177,8	3 3/4 95,25	8 203,2	10 254,0	1 448 407 6 443	62 903 85 296	22.28 33,17	1.53	
NC 50	6 5/8 168,28	3 1/2 88,90	7 177,8	10 254,0	1 109 920 4 937	44 456 60 282	21.45 31,94	0.86	27.076 36 715
51/2 FH	7 177,8	3 3/4 95,25	8 203,2	10 254,0	1 448 407 6 443	62 903 85 296	22.62 33,68	1.21	
NC 50	6 5/8 168,28	3 1/4 82,55	7 177,8	10 254,0	1 268 963 5 645	51 217 69 450	21.93 32,65	0.89	31.025 42 070
51/2 FH	7 177,8	3 3/4 95,25	8 203,2	10 254,0	1 448 407 6 443	62 903 85 296	22.62 33,68	1.09	
NC 50	6 5/8 168,28	2 3/4 69,85	7 177,8	10 254,0	1551706 6903	63 393 85 961	22.61 33,67	0.86	38.044 51 588
51/2 FH	7 1/4 184,15	3 1/2 88,90	8 203,2	10 254,0	1 619 231 7 203	72 213 97 921	23.48 34,96	0.98	43.490 58 972
NC 50	6 5/8 168,28	3 1/2 88,90	7 177,8	10 254,0	1 109 920 4 937	44 156 59 876	26.85 39,98	0.86	27.076 36 715
51/2 FH	7 177,8	3 1/2 88,90	8 203,2	10 254,0	1 619 231 7 203	62 903 85 296	28.27 42,09	1.21	37.742 51 178



## Drill Pipe Dimensional Range and Performance Properties

Pipe Figures										
Plant	Nominal Size	Nominal Weight	Wall thickness	Inside Diameter	Grade	Upset	Tensile Yield	Torsional Yield	Internal Pressure	Collapse
	in	lb/ft	in	in			lb	ft-lb	psi	psi
	mm	kg/m	mm	mm			kN	Nm	bar	bar
4	5 127,0	25.60 38,13	0.50 12,70	4.000 101,60	X95	IEU	671 515 2 987	66 192 89 756	16 625 1 147	17 100 1179
		25.60 38,13	0.50 12,70	4.000 101,60	X95	IEU	671 515 2 987	66 192 89 756	16 625 1 147	17 100 1179
		25.60 38,13	0.50 12,70	4.000 101,60	G105	IEU	742 201 3 302	73 159 99 204	18 375 1 267	18 900 1303
		25.60 38,13	0.50 12,70	4.000 101,60	G105	IEU	742 201 3 302	73 159 99 204	18 375 1 267	18 900 1303
		25.60 38,13	0.50 12,70	4.000 101,60	S135	IEU	954 259 4 245	94 062 127 548	23 625 1 629	24 300 1676
4	5 1/2 139,7	21.90 32,62	0.361 9,17	4.778 121,36	E75	IEU	437 116 1 944	50 710 68 763	8 615 594	8 413 580
		21.90 32,62	0.361 9,17	4.778 121,36	X95	IEU	553 681 2 463	64 233 87 100	10 912 753	10 019 691
		21.90 32,62	0.361 9,17	4.778 121,36	G105	IEU	611 963 2 722	70 994 96 258	12 061 832	10 753 742
		21.90 32,62	0.361 9,17	4.778 121,36	S135	IEU	786 809 3 500	91 278 123 773	15 507 1 069	12 679 874
		24.70 36,79	0.415 10,54	4.670 118,62	E75	IEU	497 222 2 212	56 574 76 714	9 903 683	10 464 722
		24.70 36,79	0.415 10,54	4.670 118,62	X95	IEU	629 814 2 802	71 660 97 171	12 544 865	12 933 892
		24.70 36,79	0.415 10,54	4.670 118,62	G105	IEU	696 111 3 097	79 204 107 401	13 865 956	14 013 966
		24.70 36,79	0.415 10,54	4.670 118,62	S135	IEU	894 999 3 981	101 833 138 086	17 826 1229	17 023 1 174

Plant designation: 3 – Sinarsky; 4 – TAGMET;

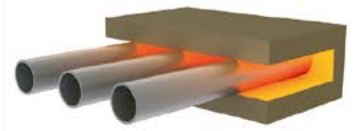
Tool Joint Figures							Assembly		
Connection	Outside Diameter	Inside Diameter	Tong Length Pin	Tong Length Box	Tensile Yield	Torsional Yield	Aprox. Weight	Torsional Ratio, pin to pipe	Make-up torque
	in	in	in	in	lb	ft-lb	lb/ft		ft-lb
	mm	mm	mm	mm	kN	Nm	kg/m		Nm
NC 50	6 5/8 168,28	3 76,20	7 177,8	10 254,0	1 416 225 6 300	57 534 78 016	27.87 41,50	0.86	34.680 47026
51/2 FH	7 177,8	3 1/2 88,90	8 203,2	10 254,0	1 619 231 7 203	62 903 85 296	28.59 42,57	0.95	37.742 51178
NC 50	6 5/8 168,28	2 3/4 69,85	7 177,8	10 254,0	1 619 231 7 203	63 393 85 961	28.32 42,17	0.87	38.044 51588
51/2 FH	7 1/4 184,15	3 1/2 88,90	8 203,2	10 254,0	1 551 706 6 903	72 213 97 921	29.16 43,42	0.99	43.490 58972
51/2 FH	7 1/4 184,15	3 1/4 82,55	8 203,2	10 254,0	1 778 274 7 910	78 716 106 739	29.43 43,82	0.83	47.230 64044
51/2 FH	7 177,8	4 101,60	8 203,2	10 254,0	1 265 802 5 631	55 687 75 512	23.77 35,39	1.11	33.560 45507
51/2 FH	7 177,8	3 3/4 95,25	8 203,2	10 254,0	1 448 407 6 443	62 903 85 296	24.53 36,53	0.98	37.742 51178
51/2 FH	7 1/4 184,15	3 1/2 88,9	8 203,2	10 254,0	1 619 231 7 203	72 213 97 921	25.38 37,79	1.02	43.490 58972
51/2 FH	7 1/2 190,50	3 76,20	8 203,2	10 254,0	1 925 536 8 566	86 765 117 653	26.50 39,46	0.96	52.302 70922
51/2 FH	7 177,8	4 101,60	8 203,2	10 254,0	1 265 802 5 631	55 687 75 512	26.33 39,21	0.99	33.560 45507
51/2 FH	7 1/4 184,15	3 1/2 88,9	8 203,2	10 254,0	1 619 231 7 203	72 213 97 921	27.85 41,47	1.01	43.490 58972
51/2 FH	7 1/4 184,15	3 1/2 88,9	8 203,2	10 254,0	1 619 231 7 203	72 213 97 921	27.85 41,47	0.92	43.490 58972
51/2 FH	7 1/2 190,50	3 76,20	8 203,2	10 254,0	1 925 536 8 566	86 765 117 653	27.77 41,35	0.86	52.302 70922

# Drill Pipe Flowchart

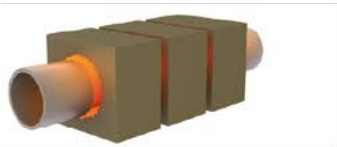
1. Inspection table



2. Heating



5. Heat treatment of pipe



6. Quenching. Water cooling



9. Ultrasonic NDT of pipe and MPI of pipe end



10. Pipe ready for welding



12. Heating and heat treatment of weld area



13. Finish machining of weld area



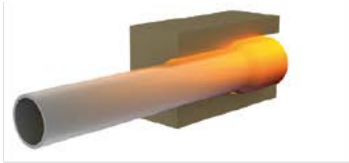
16. Inspection, weighing, marking, stamping



17. Finished drillpipe



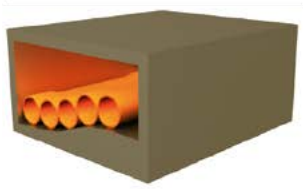
3. Upsetting



4. Magnetic particle inspection (MPI) of pipe end



7. Tempering



8. Straightening



- a. Tool-joint delivery from Manufacturer
- b. Tool-joint depreservation
- c. Incoming inspection of tool-joint



11. Friction welding of tool-joint to drill pipe



14. Seam test for bending



15. Flaw detecting of weld point

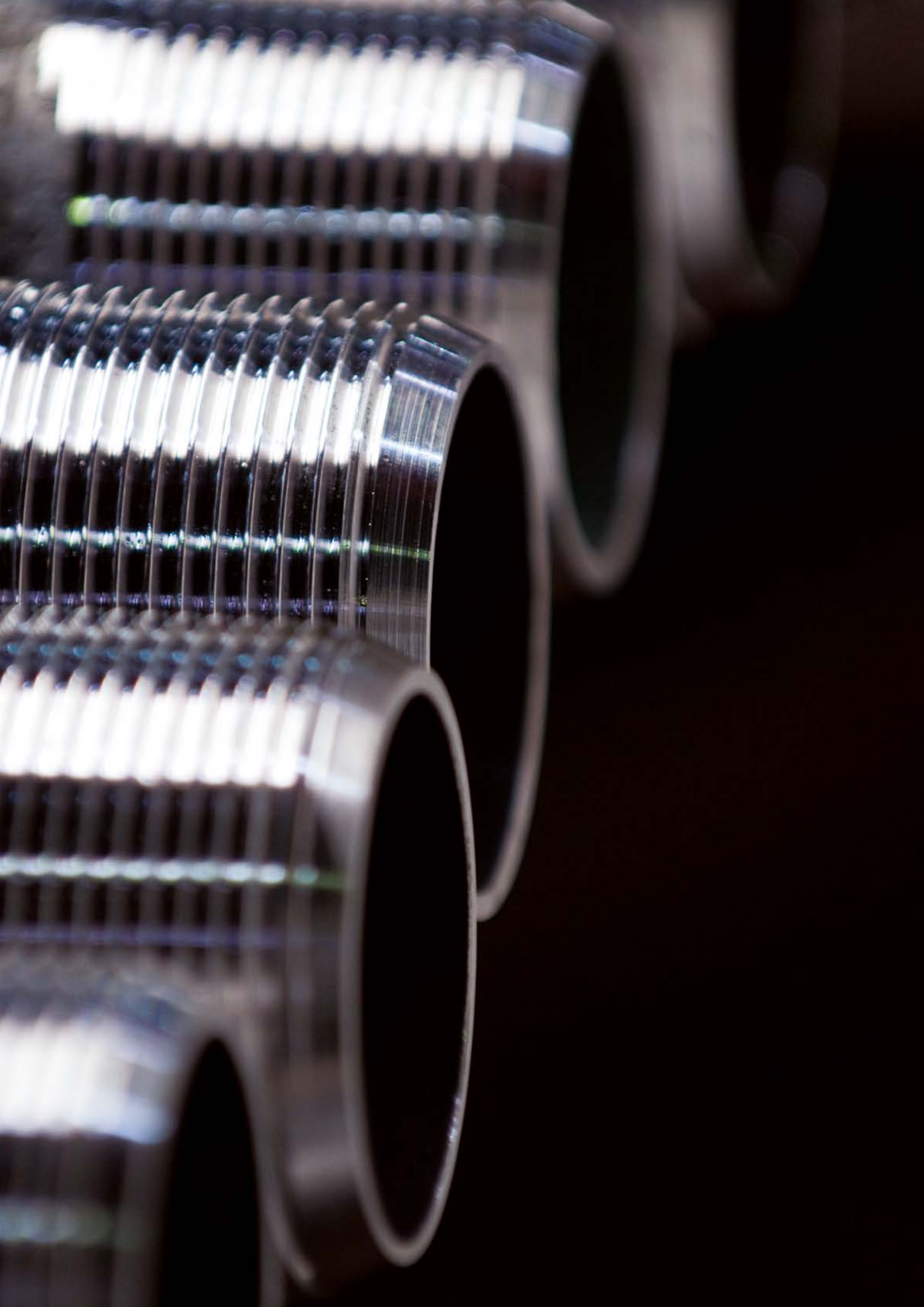


18. Paint pipe body and protection of treading



19. Storage







## OCTG

TMK provides a wide range of high quality casing and tubing as well as related services for the oil and gas industry. Casing and tubing is available in carbon and alloy grades produced by seamless and ERW methods at Russian and US facilities according to API Spec 5CT.

We utilize the latest technologies throughout our steel and pipe production and finishing processes. All OCTG casing and tubing undergoes ultrasonic and electromagnetic NDT inspection per API Spec 5CT. Pipe ends and couplings are tested using luminescent magnetic fluid. Tensile, flattening and hydrostatic tests are carried out according to specifications and/or upon customer request. Outside pipe surfaces are covered with black lacquer. Threads are covered with compound and protectors.

To operate in the most challenging environments and conditions, we offer TMK Premium Connections. For more information and performance properties, please refer to our Premium Connections catalog.

### Tubing Producers

Plant Location	OD	WT	Grades	Method
Sinarsky Tube Works /Russia/	2 3/8 - 4 1/2	0.179" - 0.375"	J55, K55, L80 type1, N80 type 1, N80Q C90, C95, P110	Seamless
Kaztrubprom /Kazakhstan/	2 3/8 - 4 1/2	0.190" - 0.415"	K55, L80, N80, C95, P110	Seamless

### Casing Producers

Plant Location	OD	WT	Grades	Method
Volzhsky Pipe Plant /Russia/	7 - 13 3/8	0.352" - 0.595"	J55, K55, M65, L80, N80 type1, N80Q, C90, C95, T95, P110, Q125	Seamless
Seversky Tube Works /Russia/	8 5/8 - 10 3/4	0.352" - 0.595"	J55, K55, L80, N80Q, C95, P110	Seamless
Seversky Tube Works /Russia/	6 5/8 - 20	0.231" - 0.500"	H40, J55, K55	ERW
Sinarsky Pipe Plant /Russia/	4 1/2 - 6 5/8	0.250" - 0.500"	J55, K55, L80 type 1, N80 type1, N80Q, C90, C95, P110, Q125	Seamless
TAGMET /Russia/	4 1/2 - 8 5/8	0.288" - 0.500"	H40, J55, K55, L80 type 1, N80Q, C95, P110	Seamless
Kaztrubprom/Kazakhstan/	4 1/2 - 6 5/8	0.250" - 0.495"	K55, N80, L80, C95, P110	Seamless

\* Threading process 5-1/2"-13-3/8" BTC, LTC, STC



## Tubing Dimensional Range and Performance Properties 2 3/8 - 2 7/8

Method	Plant	Size O.D.	Weight lb/ft		Grade	Dimensions, in					Performance Properties					
			Threaded & Coupled			Wall Thickness	Inside Diameter	Drift Diameter	Coupling Outside Diameter		Special Clearance	Collapse, psi	Burst, psi			
			Non-Upset	Upset					Non-Upset	Upset Regular			Internal Yield Pressure			
													Plain-end & Non-Upset	Upset Regular	Special Clearance	Integral Joint
S	3	2 3/8	4.00		J55	0.167	2.041	1.947	2.875			7190	6770			
S	3				L80							9980	9840			
S	3				N80							9980	9840			
S	3				C90							10940	11070			
S	3	2 3/8	4.60	4.70	J55	0.19	1.995	1.901	2.875	3.063	2.910	8100	7700	7700	7700	
S	3				L80							11780	11200	11200	11200	
S	3				N80							11780	11200	11200	11200	
S	3				C90							13250	12600	12600	12600	
					T95							13980	13300	13300	13300	
S	3				P110							16130	15400	15400	15400	
S	3	2 3/8	5.80	5.95	L80	0.254	1.867	1.773	2.875	3.063	2.910	15280	14970	14860	11440	
S	3				N80							15280	14970	14860	11440	
S	3				C90							17190	16840	16720	12870	
					T95							18150	17780	17650	13580	
S	3				P110							21010	20590	20430	15730	
S	3	2 7/8	6.40	6.50	J55	0.217	2.441	2.347	3.500	3.668	3.460	7680	7260	7260	7260	
S	3				L80							11170	10570	10570	10570	
S	3				N80							11170	10570	10570	10570	
S	3				C90							12380	11890	11890	11890	
					T95							12940	12550	12550	12550	
S	3				P110							14550	14530	14530	14530	
S	3	2 7/8	7.80	7.90	L80	0.276	2.323	2.229	3.500	3.668	3.460	13890	13440	13440		
S	3				N80							13890	13440	13440		
S	3				C90							15620	15120	15120		
					T95							16490	15960	15960		
S	3				P110							19090	18480	18480		
S	3	2 7/8	8.60	8.70	L80	0.308	2.259	2.165	3.500	3.668	3.460	15300	15000	14940		
S	3				N80							15300	15000	14940		
S	3				C90							17220	16870	16810		
					T95							18170	17810	17740		
S	3				P110							21040	20260	20540		

Method: S - seamless

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties					Recommended Make-up - Thread Tubing					
Tension, lb					Torque, ft x lbs					
Pipe Body Yield Strength	Joint Yield Strength				Non-Upset			Upset		
	Threaded and Coupled				Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Non-Upset	Upset	Special Clearance	Integral Joint						
63700	41400				610	460	760			
92600	60200				830	620	1040			
92600	60200				830	620	1040			
71700	49400	71700	71700		730	550	910	1290	970	1610
104300	71800	104300	104300		990	740	1240	1760	1320	2200
104300	71800	104300	104300		1020	770	1280	1800	1350	2250
117400	80800	117400	117400		1080	810	1350	1920	1440	2400
123900	85300	123900	123900							
143400	98800	143400	143400		1340	1010	1680	2380	1790	2980
135400	102900	135400	135400		1420	1070	1780	2190	1640	2740
135400	102900	135400	135400		1460	1100	1830	2240	1680	2800
15230	115700	152300	152300		1550	1160	1940	2390	1790	2990
160700	122200	160700	160700							
186100	141500	186100	186100		1930	1450	2410	2960	2220	3700
99700	72500	99700	99700		1050	790	1310	1650	1240	2060
145000	105400	145000	145000		1430	1070	1790	2250	1690	2810
145000	105400	145000	145000		1470	1100	1840	2300	1730	2880
163100	118600	163100	163100		1570	1180	1960	2460	1850	3080
172100	125200	172100	172100							
199300	145000	199300	199300		1940	1460	2430	3050	2290	3810
180300	140700	180300	180300		1910	1430	2390	2710	2030	3390
180300	140700	180300	180300		1960	1470	2450	2770	2080	3460
202900	158300	202900	202900		2090	1570	2610	2970	2230	3710
214100	167100	214100	214100							
247900	193500	247900	247900		2590	1940	3240	3670	2750	4590
198700	159200	198700	193100		2160	1620	2700	2950	2210	2690
198700	159200	198700	193100		2210	1660	2760	3020	2271	3780
223600	179100	223600	217300		2370	1780	2960	3230	2420	4040
236000	189100	236000	229400							
273200	218900	273200	265600		2920	2190	3650	3990	2990	4990

## Tubing Dimensional Range and Performance Properties 2 7/8 - 4

Method	Plant	Size O.D.	Weight lb/ft		Grade	Dimensions, in					Performance Properties					
			Threaded & Coupled			Wall Thickness	Inside Diameter	Drift Diameter	Coupling Outside Diameter		Special Clearance	Collapse, psi	Burst, psi			
			Non-Upset	Upset					Non-Upset	Upset Regular			Internal Yield Pressure			
													Plain-end & Non-Upset	Upset Regular	Special Clearance	Integral Joint
		2 7/8	10.50		L80	0.392	2.041	2.091	1.997		18840	19090				
				C90	21200					21470						
				T95	22370					22670						
		2 7/8	11.50		L80	0.440	1995	1901		20740	21430					
				C90	23330				24100							
				T95	24630				25440							
S	3	3 1/2	7.70		J55	0.216	3.068	2.943	4.250		5970	5940				
S	3			L80	7870					8640						
S	3			N80	7870					8640						
S	3			C90	8540					9720						
S	3	3 1/2	9.20	9.30	J55	0.254	2.992	2.867	4.250	4.500	4.180	7400	6990	6990	6990	
S	3				L80							10540	10160	10160	10160	
S	3				N80							10540	10160	10160	10160	
S	3				C90							11570	11430	11430	11430	
					T95							12080	12070	12070	12070	
S	3				P110							13530	13970	13970	13970	
S	3	3 1/2	10.20		J55	0.289	2.922	2.797	4.250		8330	7950				
S	3			L80	12120					11560						
S	3			N80	12120					11560						
S	3			C90	13640					13010						
				T95	14390					13730						
S	3	3 1/2	12.7	12.95	L80	0.375	2.750	2.625	4.250	4.500	4.180	15310	15000	15000		
S	3				N80							15310	15000	15000		
S	3				C90							17220	16880	16880		
					T95							18180	17810	17810		
S	3				P110							21050	20630	20630		
S	3	4	9.50		J55	0.226	3.548	3.423	4.750		5110	5440				
S	3			L80	6590					7910						
S	3			N80	6590					7910						
S	3			C90	7080					8900						

Method: S - seamless

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties					Recommended Make-up - Thread Tubing					
Tension, lb					Torque, ft x lbs					
Pipe Body Yield Strength	Joint Yield Strength				Non-Upset			Upset		
	Threaded and Coupled				Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Non-Upset	Upset	Special Clearance	Integral Joint						
244600										
275200										
290500										
269300										
302900										
319800										
122500	89400				1210	910	1510			
178200	130000				1660	1250	2080			
178200	130000				1700	1280	2130			
	146400				1820	1360	2270			
142500	109200	142500	142500		1480	1110	1850	2280	1710	2850
207200	158900	207200	207200		2030	1520	2540	3030	2270	3790
207200	158900	207200	207200		2070	1550	2590	3200	2400	4000
233100	178700	233100	233100		2220	1970	2780	3430	2570	4290
246000	188700	246000	246000							
284900	218500	284900	284900		2740	2060	3430	4240	3180	5300
160300	127200				1720	1290	2150			
233200	185000				2360	1770	2950			
232000	185000				2410	1810	3010			
242400	208100				2590	1940	3240			
276900	219600									
294600	246200	294600			3140	2360	3930	4200	3150	5250
294600	246200	294600			3210	2410	4010	4290	3220	5360
331400	277000	331400			3440	2580	4300	4610	3460	5760
249800	292400	249800								
405000	338600	405000			4250	3190	5310	5690	4270	7110
147400	99000				1220	920	1530			
214400	144000				1680	1260	2100			
214400	144000				1720	1290	2150			
	162000				1870	1410	2340			

## Tubing Dimensional Range and Performance Properties 4 - 4 1/2

Method	Plant	Size O.D.	Weight lb/ft		Grade	Dimensions, in					Performance Properties					
			Threaded & Coupled			Wall Thickness	Inside Diameter	Drift Diameter	Coupling Outside Diameter		Special Clearance	Collapse, psi	Burst, psi			
			Non-Upset	Upset					Non-Upset	Upset Regular			Internal Yield Pressure			
													Plain-end & Non-Upset	Upset Regular	Special Clearance	Integral Joint
S	3	4		11.00	J55	0.262	3.476	3.351		5.000		6590	6300	6300		
S	3				L80							8800	9170	9170		
S	3				N80							8800	9170	9170		
S	3				C90							9590	10320	10320		
					T95							9980	10890	10890		
S	3	4	13.20		L80	0.330	3.340	3.215			12110	11550				
S	3				C90						13620	12990				
					T95						14380	13720				
		4	16.10		L80	0.415	3.170	3.045			14880	14530				
					C90						16740	16340				
					T95						17670	17250				
		4	18.90		L80	0.500	3.000	2.875			17500	17500				
					C90						19690	19690				
					T95						20780	20780				
		4	22.20		L80	0.610	2.780	2.655			20680	21350				
					C90						23260	24020				
					T95						24560	25350				
S	3	4 1/2	12.60	12.75	J55	0.271	3.958	3.833	5.200	5.563		5730	5800	5800		
S	3				L80							7500	8430	8430		
S	3				N80							7500	8430	8430		
S	3				C90							8120	9490	9490		
					T95							8410	10010	10010		
S	3	4 1/2	15.20		L80	0.337	3.826	3.701			11080	10480				
S	3				C90						12220	11800				
					T95						12760	12450				
		4 1/2	17.00		L80	0.380	3.740	.615			12370	11820				
					C90						13920	13300				
					T95						14690	14040				

Method: S - seamless

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties					Recommended Make-up - Thread Tubing					
Tension, lb					Torque, ft x lbs					
Pipe Body Yield Strength	Joint Yield Strength				Non-Upset			Upset		
	Threaded and Coupled									
	Non-Upset	Upset	Special Clearance	Integral Joint	Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
169200		169200						2560	1920	3200
246200		246200						3530	2650	4410
246200		246200						3600	2700	4500
276900		276900						3870	2900	4840
292300		292300								
304400										
342500										
361500										
373900										
420700										
444000										
439800										
494800										
522300										
519800										
584700										
617200										
198000	143500	198000			1740	1310	2180	2860	2150	3580
288000	208700	288000			2400	1800	3000	3940	2960	4930
288000	208700	288000			2440	1830	3050	4020	3020	5030
324000	234800	324000			2630	1970	3290	4330	3250	5410
342000	247900	342000								
352600										
396600										
418700										
393400										
442600										
467200										



## Casing Dimensional Range and Performance Properties 4 1/2

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties			
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi			
			in	lb/ft						in	in	in	psi
									Plain End, psi	Round Thread		Buttress Thread, psi	
						Short, psi	Long, psi						
S, ERW	3	4 1/2	0.250	11.60 11.36	J55	4.000	3.875	5.000	4960	5350	5350	5350	5350
S	3				K55				4960	5350	5350	5350	5350
					M65				5560	6320		6320	6320
S	3				L80				6350	7780		7780	7780
S	3				N80				6350	7780		7780	7780
S	3				C90				6820	8750		8750	8750
S	3				C95				7030	9240		9240	9240
					T95				7030	9240		9240	9240
S	3				P110				7580	10690		10690	10690
S	3,4										L80		
S	3,4				N80			8540	9020		9020	9020	
S	3,4				C95			9660	10710		10710	10710	
S, ERW	3,4				P110			10690	12410		12410	12410	
S	3,4	4 1/2	0.337	15.10	P110	3.826	3.701	5.000	14340	14420		14420	13460
S	3			15.00	Q125				15830	16380		16380	15300

Method: S - seamless

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
	Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum
Short		Long							
184	154	162	225	1540	1160	1930	1620	1220	2030
184	170	180	277	1700	1280	2130	1800	1350	2250
217		188	256				1880	1410	2350
167		212	291				2230	1670	2790
267		223	304				2280	1710	2850
300		223	309				2450	1840	3060
317		234	325				2580	1940	3230
317		234	325				2580	1940	3230
367		279	385				3020	2270	3780
307		257	334				2710	2030	3390
307		270	349				2760	2070	3450
364		284	374				3130	2350	3910
422		338	443				3660	2750	4580
485		406	509				4400	3300	5500
551		438	554				4910	3680	6140

## Casing Dimensional Range and Performance Properties 5

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties									
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi									
			in	lb/ft		in	in	in	psi	Minimum Internal Yield Pressure									
										Plain End, psi	Round Thread		Buttress Thread, psi						
									Short, psi	Long, psi									
S	3	5	0.253	13.00 12.84	J55	4.494	4.369	5.563	4140	4870	4870	4870	4870						
S	3				K55				4140	4870	4870	4870	4870						
					M65				4590	5760	5760	5760	5760						
S	3,4	5	0.296	15.00 14.88	J55	4.408	4.283	5.563	5560	5700	5700	5700	5700						
S	3,4				K55				5560	5700	5700	5700	5700						
					M65				6280	6730		6730	6730						
					L80				7250	8290		8290	8290						
S	3,4				N80				7250	8290		8290	8290						
S	3				C90				7830	9320		9320	9320						
S	3,4				C95				8110	9840		9840	9840						
					T95				8110	9840		9840	9840						
S	3,4				P110				8850	11400		11400	11400						
					M65				8730	8240		8240	8240						
S	3,4	5	0.362	18.00 17.95	L80	4.276	4.151	5.563	10500	10140		10140	9910						
S	3,4				N80				10500	10140		10140	9910						
S	3				C90				11520	11400		11400	11150						
S	3,4				C95				12030	12040		12040	11770						
					T95				12030	12040		12040	11770						
S	3,4				P110				13470	13940		13940	13620						
S	3,4				Q125				14820	15840		15840	15840						
					M65				10370	9940		9940	9910						
S	4	5	0.437	21.40 21.32	L80	4.126	4.001	5.563	12760	12240		10810	9910						
S	4				N80				12760	12240		10810	9910						
					C90				14360	13770		12170	11150						
					C95				15150	14530		12840	11770						
					T95				15150	14530		12840	11770						
S	4				P110				17550	16820		14870	13620						
S	4				Q125				19940	19120		16900	15480						
S	4				5				0.478	23.20 23.11	L80	4.044	3.919	5.563	13830	13380		10810	9910
S	4										N80				13830	13380		10810	9910
											C90				15560	15060		12170	11150
S	4	C95	16430	15890			12840	11770											
		T95	16430	15890			12840	11770											
S	4	P110	19020	18400			14870	13620											
S	4	5	0.500	24.10 24.05	L80	4	3.875	5.563	14400	14000		10810	9910						
S	4				N80				14400	14000		10810	9910						
					C90				16200	15750		12170	11150						
S	4				C95				17100	16630		12840	11770						
					T95				17100	16630		12840	11770						
S	4				P110				19800	19250		14870	13620						

Method: S - seamless

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Short	Long							
208	169	182	252	1690	1270	2110	1820	1370	2280
208	186	201	309	1860	1400	2330	2010	1510	2510
245	196	212	288	1960	1470	2450	2120	1590	2650
241	207	223	293	2070	1550	2590	2230	1670	2790
241	228	246	359	2280	1710	2850	2460	1850	3080
284		259	334				2590	1940	3240
350		295	379				3080	2310	3850
350		311	396				3140	2360	3930
394		311	404				3380	2540	4230
416		326	424				3560	2670	4450
416		326	424				3560	2670	4450
481		388	503				4170	3130	5210
343		331	402				3310	2480	4140
422		376	457				3930	2950	4910
422		396	477				4000	3000	5000
475		395	487				4310	3230	5390
501		416	512				4550	3410	5690
501		416	512				4550	3410	5690
580		495	606				5310	3980	6640
659		535	661				5930	4450	7410
407		409	478				4090	3070	5110
501		466	510				4860	3650	6080
501		490	536				4950	3710	6190
564		490	536				5340	4010	6680
595		515	563				5620	4220	7030
595		515	563				5620	4220	7030
689		613	671				6580	4940	8230
783		662	724				7340	5510	9180
543		513	510				5350	4010	6690
543		540	536				5450	4090	6810
611		540	536				5880	4410	7350
645		567	563				6200	4650	7750
645		567	563				6200	4650	7750
747		675	671				7250	5440	9060
565		538	510				5610	4210	7010
565		567	536				5720	4290	7150
636		567	536				6170	4630	7710
672		595	563				6500	4880	8130
672		595	563				6500	4880	8130
778		708	671				7600	5700	9500

## Casing Dimensional Range and Performance Properties 5 1/2

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties			
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi			
			in	lb/ft		in	in	in	psi	Minimum Internal Yield Pressure			
										Plain End, psi	Round Thread		Buttress Thread, psi
								Short, psi	Long, psi				
S	3	5 1/2	0.275	15.50 15.36	J55	4.950	4.825	6.050	3120	4270	4270		
S	3				K55				3120	4270	4270		
S	3				M65				3360	5050	5050		
S	3				J55				4040	4810	4810	4810	4810
S	3				K55				4040	4810	4810	4810	4810
					M65				4470	5690	5690	5690	5690
S	3,4	5 1/2	0.304	17.00 16.89	J55	4.892	4.767	6.050	4910	5320	5320	5320	5320
S	3,4				K55				4910	5320	5320	5320	5320
					M65				5510	6290		6290	6290
S, ERW	3,4				L80				6290	7740		7740	7740
S, ERW	3,4				N80				6290	7740		7740	7740
S	3				C90				6740	8710		8710	8710
S	3,4				C95				6940	9190		9190	9190
					T95				6940	9190		9190	9190
S	3,4				P110				7480	10640		10640	10640
					M65				7540	7470		7470	7470
S	3,4				L80				8830	9190		9190	8990
S	3,4				N80				8830	9190		9190	8990
S	3	C90	9630	10340		10340	10120						
S	3,4	C95	10020	10910		10910	10680						
		T95	10020	10910		10910	10680						
S	3,4	P110*	11100	12640		12640	12360						
		M65	9070	8580		8580	8580						
S	3,4	L80	11160	10560		9880	8990						
S	3,4	N80	11160	10560		9880	8990						
S	3	C90	12380	11880		11100	10120						
S	3,4	C95	12930	12540		11730	10680						
		T95	12930	12540		11730	10680						
S	3,4	P110	14540	14530		13580	12360						
S	3	Q125	16060	16510		15430	14050						
		C90	14880	14320									
		T95	15700	15100									
		C90	16510	16090									
		T95	17430	16990									
		C90	18130	17900									
		T95	19140	18890									

Method: S - seamless

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Short	Long							
222	172			1720	1290	2150			
222	189			1890	1420	2360			
262	200			2000	1500	2500			
248	202	217	300	2020	1520	2530	2170	1630	2410
248	222	239	366	2220	1670	2780	2390	1790	2880
293	235	253	342	2350	1760	2940	2530	1900	3160
273	229	247	329	2290	1720	2860	2470	1850	3090
273	252	272	402	2520	1890	3150	2720	2040	3400
323		287	376				2870	2150	3590
397		338	428				3410	2560	4260
397		348	446				3480	2610	4350
447		356	456				3750	2810	4690
471		374	480				3960	2970	4950
471		374	480				3960	2970	4950
546		445	568				4620	3470	5780
379		353	442				3530	2650	4410
466		416	503				4200	3150	5250
446		428	524				4280	3210	5350
525		438	536				4620	3470	5780
554		460	563				4870	3650	6090
554		460	563				4870	3650	6090
641		548	667				5690	4270	7110
431		415	503				4150	3110	5190
530		489	551				4930	3700	6160
530		502	580				5020	3770	6280
597		514	580				5430	4070	6790
630		540	609				5720	4290	7150
630		540	609				5720	4290	7150
729		643	725				6680	5010	8350
829		694	783				7470	5600	9340
707									
746									
785									
828									
861									
909									

## Casing Dimensional Range and Performance Properties 5 1/2 - 7

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties			
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi			
			in	lb/ft		in	in	in	psi	Minimum Internal Yield Pressure			
										Plain End, psi	Round Thread		Buttress Thread, psi
								Short, psi	Long, psi				
		5 1/2	0.687	35.30 35.35	C90 T95	4.126	4.001		19680 20770	19670 20770			
		5 1/2	0.750	38.00 38.08	C90 T95	4.000	3.875		21200 22380	21480 22670			
		5 1/2	0.812	40.50 40.69	C90 T95	3.876	3.751		22650 23910	23250 24540			
		5 1/2	0.875	43.10 43.26	C90 T95	3.750	3.625		24080 25420	25060 26450			
S, ERW	4,2w	6 5/8	0.288	20.00 19.51	H40	6.049	5.924	7.390	2520	3040	3040		
S, ERW	3,4,1,2w				J55				2970	4180	4180	4180	4180
S, ERW	3,4,1,2w				K55				2970	4180	4180	4180	4180
S	1				M65				3190	4940	4940	4940	4940
S	3,4,1	6 5/8	0.352	24.00 23.60	J55	5.921	5.796	7.390	4560	5110	5110	5110	5110
S	3,4,1				K55				4560	5110	5110	5110	5110
S	1				M65				5080	6040		6040	6040
S	3,4,1				L80				5760	7440		7440	7440
S	3,4,1				N80				5760	7440		7440	7440
S	3,1				C90				6140	8370		8370	8370
S	3,4,1				C95				6310	8830		8830	8830
S	1				T95				6310	8830		8830	8830
S	3,4,1				P110				6730	10230		10230	10230
S	1				M65				7010	7160		7160	7160
S	3,4,1				L80				8170	8810		8810	8810
S	3,4,1	N80	8170	8810		8810	8810						
S	3,1	C90	8880	9910		9910	9910						
S	3,4,1	C95	9220	10460		10460	10460						
S	1	T95	9220	10460		10460	10460						
S	3,4,1	P110	10160	12120		12120	12120						
S	3,4,1	L80	10320	10040		10040	9820						
S	3,4,1	N80	10320	10040		10040	9820						
S	3,1	C90	11330	11290		11290	11050						
S	3,4,1	C95	11820	11920		11920	11660						
S	1	T95	11820	11920		11920	11660						
S	3,4,1	P110	13220	13800		13800	13500						
S	3,1	Q125	14540	15680		15680	15340						
S, ERW	2w	7	0.231	17.00	H40	6.538	6.413	7.656	1420	2310	2310		
S, ERW	2w	7	0.272	20.00 19.56	H40	6.456	6.331	7.656	1970	2720	2720		
S, ERW	2w				J55				2270	3740	3740		
S, ERW	2w				K55				2270	3740	3740		
S, ERW	2w				I65*				2480	4420	4420	4420	4420
S, ERW	C,W				M65				2480	4420	4420		

Method: S - seamless; ERW - electric resistance welded

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Short	Long							
935									
987									
1007									
1063									
1076									
1136									
1144									
1208									
229	184			1840	1380	2300			
315	245	266	374	2450	1840	3060	2660	2000	3330
315	267	290	453	2670	2000	3340	2900	2180	3630
373	285	309	428	2850	2140	3560	3090	2320	3860
382	314	340	453	3140	2360	3930	3400	2550	4250
382	342	372	548	3420	2570	4280	3720	2790	4650
451		396	518				3960	2970	4950
555		473	592				4730	3550	5910
555		481	615				4810	3610	6010
624		520	633				5210	3910	6510
659		546	665				5490	4120	6860
659		546	665				5490	4120	6860
763		641	786				6410	4810	8010
529		483	607				4830	3620	6040
651		576	693				5760	4320	7200
651		586	721				5860	4400	7330
732		633	742				6350	4760	7940
773		665	780				6690	5020	8360
773		665	780				6690	5020	8360
895		781	922				7810	5860	9760
734		666	783				6660	5000	8330
734		678	814				6780	5090	8480
826		732	837				7340	5510	9180
872		769	880				7740	5810	9680
872		769	880				7740	5810	9680
1010		904	1040				9040	6780	11300
1147		989	1138				10110	7580	12640
196	122			1220	920	1530			
230	176			1760	1320	2200			
316	234			2340	1760	2930			
316	254			2540	1910	3180			
374	262			2620	1970	3280	2880	2160	3600
374	273			2730	2050	3410			



## Casing Dimensional Range and Performance Properties 7

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties			
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi			
			in	lb/ft		in	in	in	psi	Minimum Internal Yield Pressure			
										Plain End, psi	Round Thread		Buttress Thread, psi
								Short, psi	Long, psi				
S, ERW	4,1,2w	7	0.317	23.00 22.65	J55	6.366	6.241	7.656	3720	4360	4360	4360	4360
S, ERW	4,1,2w				K55				3270	4360	4360	4360	4360
					I65*				3540	5150		5150	5150
S	1				M65				3540	5150		5150	5150
S	4,1				L80				3830	6340		6340	6340
S	4,1				N80				3830	6340		6340	6340
S	1				C90				4030	7130		7130	7130
S	4,1				C95				4140	7530		7530	7530
S	1				T95				4140	7530		7530	7530
S	4,1				7				0.362	26.00 25.69	J55	6.276	6.151
S	4,1	K55	4330	4980		4980	4980	4980					
		I65*	4810	5880			5880	5880					
S	1	M65	4810	5880			5880	5880					
S	4,1	L80	5410	7240			7240	7240					
S	4,1	N80	5410	7240			7240	7240					
		HC-L80*	7000	7240			7240	7240					
S	1	C90	5740	8150			8150	8150					
S	4,1	C95	5890	8600			8600	8600					
S	1	T95	5890	8600			8600	8600					
S	4,1	P110	6230	9960			9960	9960					
		I65*	6100	6630			6630	6630					
S	1	M65	6100	6630			6630	6630					
S	4,1	L80	7030	8160			8160	8160					
S	4,1	N80	7030	8160		8160	8160						
		HC-L80*	7720	8160		8160	8160						
S	1	C90	7580	9180		9180	9180						
S	4,1	C95	7840	9690		9690	9690						
S	1	T95	7840	9690		9690	9690						
S	4,1	P110	8530	11220		11220	11220						
S	1	7	0.453	32.00 31.7	M65	6.094	5.969 6.000	7.656	7360	7360		7360	7360
S	4,1				L80				8600	9060		9060	8460
S	4,1				N80				8600	9060		9060	8460
S	1				C90				9380	10190		10190	9520
S	4,1				C95				9740	10760		10760	10050
S	1				T95				9740	10760		10760	10050
S	4,1				P110				10780	12460		12460	11640

Method: S - seamless; ERW - electric resistance welded

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Short	Long							
366	284	313	432	2840	2130	3550	3130	2350	3910
366	309	341	522	3090	2320	3860	3410	2560	4260
433		350	450				3500	2630	4380
433		364	494				3640	2730	4550
532		435	565				4350	3260	5440
532		442	588				4420	3320	5530
599		479	605				4790	3590	5990
632		505	636				5050	3790	6310
632		505	636				5050	3790	6310
415	334	367	490	3340	2510	4180	3670	2750	4590
415	364	401	592	3640	2730	4550	4010	3010	5010
491		411	510				4110	3080	5140
491		428	561				4280	3210	5350
604		511	641				5110	3830	6390
604		519	667				5190	3890	6490
604		511	641				5110	3830	6390
679		563	687				5630	4220	7040
717		593	722				5930	4550	7410
717		593	722				5930	4550	7410
830		693	853				6930	5200	8660
549		473	571				4730	3550	5910
549		492	628				4920	3690	6150
676		587	718				5870	4480	7460
676		597	746				5970	4400	7340
676		587	718				5870	4400	7340
760		648	768				6480	4860	8100
803		683	808				6830	5120	8540
803		683	808				6830	5120	8540
929		797	955				7970	5980	9960
606		554	692				5540	4160	9630
745		661	791				6610	4960	8260
745		672	823				6720	5040	8400
839		729	847				7290	5470	9110
885		768	891				7680	5760	9600
885		768	891				7680	5760	9600
1025		897	1053				8970	6730	11210

## Casing Dimensional Range and Performance Properties 7 - 7 5/8

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties			
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi			
			in	lb/ft		in	in	in	psi	Minimum Internal Yield Pressure			
										Plain End, psi	Round Thread, psi		Buttress Thread, psi
										Short, psi	Long, psi		
S	4,1	7	0.498	35.00 34.60	L80	6.004	5.879	7.656	10180	9960		9240	8460
S	4,1				N80				10180	9960		9240	8460
S	1				C90				11170	11210		10390	9620
S	4,1				C95				11650	11830		10970	10050
S	1				T95				11650	11830		10970	10050
S	4,1				P110				13030	13700		12700	11640
S	1				Q125				14310	15560		14430	13220
S	1	7	0.540	38.00 34.61	L80	5.920	5.795	7.656	11390	10800		9240	8460
S	1				N80				11390	10800		9240	8460
S	1				C90				12810	12150		10390	9520
S	1				C95				13430	12830		10970	10050
S	1				T95				13430	12830		10970	10050
S	1				P110				15130	14850		12700	11640
S	1				Q125				16740	16880		14430	13220
S	1	7	0.625	42.70 42.59	C90	5.750	5.625	15450	14640	14060			
S	1				T95				15450	14840			
S	1	7	0.687	46.40 46.36	C90	5.626	5.501		15930	15460			
S	1				T95			16820	16320				
S	1	7	0.750	50.10 50.11	C90	5.500	5.375		17220	16880			
S	4,1				T95			18180	17810				
		7	0.812	53.60 53.71	C90	5.376	5.251		18460	18270			
					T95			19480	19290				
		7	0.875	57.1 57.29	C90	5.250	5.125		19690	19690			
					T95			20780	20780				
ERW	2w	7 5/8	0.300	24	H40	7.025	6.900	8.500	2030	2750	2750		
S, ERW	4,2w	7 5/8	0.328	26.40 25.59	J55	6.969	6.844	8.500	2900	4140	4140	4140	4140
S, ERW	4,2w				K55				2900	4140	4140	4140	4140
					M65				3100	4890	4890	4890	4890
S	4				L80				3400	6020		6020	6020
S	4				N80				3400	6020		6020	6020
					C90				3610	6780		6780	6780
					C95				3710	7150		7150	7150
		T95	3710	7150		7150	7150						
		7 5/8	0.375	29.70 29.06	M65	6.875	6.750	8.500	4310	5590		5590	5590
S	4				L80				4790	6890		6890	6890
S	4				N80				4790	6890		6890	6890
					C90				5030	7750		7750	7750
S	4				C95				5130	8180		8180	8180
					T95				5130	8180		8180	8180
S	4				P110				5350	9470		9470	9470

Method: S - seamless; ERW - electric resistance welded

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Short	Long							
814		734	832						
814		746	876						
916		809	876						
966		853	920						
966		853	920						
1119		996	1095						
1272		1106	1183						
877		801	832						
877		814	876						
986		883	876						
1041		931	920						
1041		931	920						
1206		1087	1095						
1370		1207	1183						
1127									
1189									
1226									
1294									
1325									
1399									
1421									
1500									
1515									
1600									
276	212			2120	1590	2650			
414	315	346	483	3150	2360	3940	3460	2600	4330
414	342	377	581	3420	2570	4280	3770	2830	4710
489	368	404	554	3680	2760	4600	4040	3030	5050
602		482	635				4820	3620	6030
602		490	659				4900	3680	6130
677		532	681				5320	3990	6650
714		560	716				5600	4200	7000
714		560	716				5600	4200	7000
555		474	629				4740	3560	5930
683		567	721				5670	4250	7090
683		575	749				5750	4310	7190
769		625	773				6250	4690	7810
811		659	813				6590	4940	8240
811		659	813				6590	4940	8240
940		769	960				7690	5770	9610

## Casing Dimensional Range and Performance Properties 7 5/8 - 7 3/4

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties			
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi			
			in	lb/ft		in	in	in	psi	Minimum Internal Yield Pressure			
										Plain End, psi	Round Thread Short, psi	Round Thread Long, psi	Buttress Thread, psi
S	4	7 5/8	0.430	33.70 33.07	M65	6.765	6.640	8.500	5730	6410		6410	6410
					L80				6560	7900		7900	7900
					N80				6560	7900		7900	7900
					C90				7050	8880		8880	8880
					C95				7280	9380		9380	9380
					T95				7280	9380		9380	9380
S	4				P110			7870	10860		10860	10860	
S	4	7 5/8	0.500	39.00 38.08	L80	6.625	6.500	8.500	8820	9180		9180	9180
					N80				8820	9180		9180	9180
					C90				9620	10330		10330	10330
					C95				10000	10900		10900	10900
					T95				10000	10900		10900	10900
					P110				11080	12620		12620	12620
S	4				Q125			12060	14340		14340	14340	
S	1,4	7 5/8	0.562	42.80 42.43	L80	6.501	6.376	8.500	10810	10320		10320	9790
					N80				10810	10320		10320	9790
					C90				11890	11610		11610	11610
					C95				12410	12250		12250	11620
					T95				12410	12250		12250	11620
					P110				13930	14190		14190	13460
S	1,4				Q125			15350	16120		16120	15290	
S	1,4	7 5/8	0.595	45.30 44.71	L80	6.435	6.310	8.500	11510	10920		10490	9790
					N80				11510	10920		10490	9790
					C90				12950	12290		11810	11010
					C95				13670	12970		12460	11620
					T95				13670	12970		12460	11620
					P110				15430	15020		14430	13460
S	1,4				Q125			17090	17070		16400	15290	
S	1,4	7 5/8	0.625	47.10 46.77	L80	6.375	6.250	8.500	12040	11480		10490	9790
					N80				12040	11480		10490	9790
					C90				13540	12910		11810	11010
					C95				14300	13630		12460	11620
					T95				14300	13630		12460	11620
					P110				16550	15780		14430	13460
S	1,4				Q125			18700	17930		16400	15290	
S	1,4	7 5/8	0.687	51.20	6.251	6.126			14760	14190			
				50.95					T95	15580	14980		
S	1,4	7 5/8	0.750	55.30	6.125	6.000			15960	15490			
				55.12					T95	16850	16350		
S	1,4	7 3/4	0.595	46.10 45.51	L80	6.560	6.435 6.500		11340	10750			
					N80				11340	10750			
					C90				12750	12090			
					C95				13320	12760			
					T95				13320	12760			
					P110				15000	14780			
S	1,4				Q125			16590	16790				

Method: S - seamless

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Short	Long							
632		556	716				5560	4170	6950
778		664	820				6640	4980	8300
778		674	852				6740	5060	8430
875		733	880				7330	5500	9160
923		772	925				7720	5790	9650
923		772	925				7720	5790	9650
1069		901	1093				9010	6760	11260
895		786	945				7860	5900	9830
895		798	981				7980	5990	9980
1007		867	1013				8670	6500	10840
1063		914	1065				9140	6860	11430
1063		914	1065				9140	6860	11430
1231		1066	1258				10660	8000	13330
1399		1194	1379				11940	8960	14930
998		891	1053				8910	6680	11140
998		906	1093				9060	6800	11330
1122		984	1129				9840	7380	12300
1185		1037	1187				10370	7780	12960
1185		1037	1187				10370	7780	12960
1372		1210	1402				12100	9080	15130
1559		1355	1536				13550	10160	16940
1051		947	1109				9470	7100	11840
1051		962	1152				9620	7220	12030
1183		1045	1189				10450	7840	13060
1248		1101	1251				11010	8260	13760
1248		1101	1251				11010	8260	13760
1445		1285	1477				12850	9640	16060
1643		1439	1619				14390	10790	17990
1100		997	1160				9970	7480	12460
1100		1013	1205				10130	7600	12660
1237		1100	1239				11000	8250	13750
1306		1159	1301				11590	8690	14490
1306		1159	1301				11590	8690	14490
1512		1353	1545				13530	10150	16910
1718		1515	1673				15150	11360	18940
1348									
1423									
1458									
1539									
1070									
1070									
1204									
1271									
1271									
1471									
1672									



## Casing Dimensional Range and Performance Properties 8 5/8

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties					
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi					
			in	lb/ft		in	in	in	psi	Minimum Internal Yield Pressure					
										Plain End, psi	Round Thread Short, psi	Round Thread Long, psi	Buttress Thread, psi		
ERW	2w	8 5/8	0.264	24.00	J55	8.097	7.972	9.625	1370	2950	2950				
ERW	2w			23.6						K55	1370	2950	2950		
										M65	1420	3480	3480		
ERW	2w	8 5/8	0.304	27.00	H40	8.017	7.892	9.625	1610	2470	2470				
ERW	2w			27.04						M65	2020	4010	4010		
S, ERW	4,2w	8 5/8	0.352	32.00	H40	7.921	7.796	9.625	2200	2860	2860				
S, ERW	4,1,2,2w				31.13					J55	2530	3930	3930	3930	3930
S, ERW	4,1,2,2w									K55	2530	3930	3930	3930	3930
										M65	2740	4640	4640	4640	4640
S	4,2	8 5/8	0.400	36.00	J55	7.825	7.700	9.625	3450	4460	4460	4460	4460		
S	4,2				K55					3450	4460	4460	4460	4460	
					M65					3760	5280	5280	5280	5280	
S	4,2				L80					4100	6490		6490	6490	
S	4,2				N80					4100	6490		6490	6490	
					C90					4250	7300		7300	7300	
S	4,2				C95					4350	7710		7710	7710	
					T95					4350	7710		7710	7710	
					M65					4900	5930		5930	5930	
S	4,2				L80					5520	7300		7300	7300	
S	4,2	N80	5520	7300		7300	7300								
		C90	5870	8220		8220	8220								
S	4,2	C95	6020	8670		8670	8670								
		T95	6020	8670		8670	8670								
S	4,2	P110	6390	10040		10040	10040								
S	4,2	L80	6950	8120		8120	8120								
S	4,2	N80	6950	8120		8120	8120								
		C90	7490	9130		9130	9130								
S	4,2	C95	7740	9460		9460	9460								
		T95	7740	9460		9460	9460								
S	4,2	P110	8420	11160		11160	11160								
S	2	8 5/8	0.557	49.00	L80	7.511	7.386	9.625	8570	9040	9040	9040	9040		
S	2				N80					8570	9040	9040	9040		
					C90					9340	10170	10170	10170		
S	2				C95					9700	10740	10740	10740		
					T95					9700	10740	10740	10740		
	2				P110					10740	12430	12430	12430		
					Q125					11660	14130	14130	14130		

Method: S - seamless; ERW - electric resistance welded

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Short	Long							
381	244			2440	1830	3050			
381	263			2630	1970	3290			
451	285			2850	2140	3560			
318	233			2330	1750	2910			
437	311			3110	2330	3890			
366	279			2790	2090	3490			
503	372	417	579	3720	2790	4650	4170	3130	5210
503	402	452	690	4020	3020	5030	4520	3390	5650
595	435	487	664	4350	3260	5440	4870	3650	6090
568	434	486	654	4340	3260	5430	4860	3650	6080
568	468	526	780	4680	3510	5850	5260	3950	6580
672	506	567	751	5060	3800	6330	5670	4250	7090
827		678	864				6780	5090	8480
827		688	895				6880	5160	8600
930		749	928				7490	5620	9360
982		789	976				7890	5920	9860
982		789	976				7890	5920	9860
751		649	839				6490	4870	8110
925		776	966				7760	5820	9700
925		788	1001				7880	5910	9850
1040		858	1038				8580	6440	10730
1098		904	1092				9040	6780	11300
1098		904	1092				9040	6780	11300
1271		1055	1288				10550	7910	13190
1021		874	1066				8740	6560	10930
1021		887	1105				8870	6650	11090
1149		965	1146				9650	7240	12060
1212		1017	1206				10170	7630	12710
1212		1017	1206				10170	7630	12710
1404		1186	1423				11860	8900	14830
1129		983	1180				9830	7370	12290
1129		997	1222				9970	7480	12460
1271		1085	1268				10850	8140	13560
1341		1144	1334				11440	8580	14300
1341		1144	1334				11440	8580	14300
1553		1335	1574				13350	10010	16690
1765		1496	1728				14960	11220	18700

## Casing Dimensional Range and Performance Properties 9 5/8

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties									
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi									
			in	lb/ft		in	in	in	psi	Minimum Internal Yield Pressure									
										Plain End, psi	Round Thread Short, psi	Round Thread Long, psi	Buttress Thread, psi						
ERW	2w	9 5/8	0.312	32.3	H40	9.001	8.845	10.625	1370	2270	2270								
ERW	2w	9 5/8	0.352	36.00 34.89	H40	8.921	8.765	10.625	1720	2560	2560								
S, ERW	1,2,2w				J55				2020	3520	3520	3520	3520						
S, ERW	1,2,2w				K55				2020	3520	3520	3520	3520						
S	1				M65				2190	4160	4160	4160	4160						
S, ERW	1,2,2w				J55				2570	3950	3950	3950	3950						
S, ERW	1,2,2w	9 5/8	0.395	40.00 38.97	K55	8.835	8.679 8.750	10.625	2570	3950	3950	3950	3950						
S	1				M65				2770	4670	4670	4670	4670						
S	1,2				L80				3090	5750		5750	5750						
S	1,2				N80				3090	5750		5750	5750						
S	1				C90				3260	6460		6460	6460						
S	1,2				C95				3330	6820		6820	6820						
S	1				T95				3330	6820		6820	6820						
S	1				9 5/8				0.435	43.50 42.73	M65	8.755	8.599	10.625	3530	5140		5140	5140
S	1,2										L80				3810	6330		6330	6330
S	1,2										N80				3810	6330		6330	6330
S	1	C90	4010	7120			7120	7120											
S	1,2	C95	4130	7510			7510	7510											
S	1	T95	4130	7510			7510	7510											
S	1,2	P110	4420	8700			8700	8700											
S	1	9 5/8	0.472	47.00 46.18		M65	8.681	8.525			10.625				4280	5580		5580	5580
S	1,2				L80	4760			6870			6870	6870						
S	1,2				N80	4760			6870			6870	6870						
S	1				C90	4990			7720			7720	7720						
S	1,2				C95	5090			8150			8150	8150						
S	1				T95	5090			8150			8150	8150						
S	1,2				P110	5300			9440			9440	9440						
S	1				Q125	5640			10730			10730	10730						
S	1,2				9 5/8	0.545			53.50 52.90	L80		8.535	8.379 8.500	10.625	6620	7930		7930	7930
S	1,2	N80	6620	7930				7930		7930									
S	1	C90	7110	8920				8920		8920									
S	1,2	C95	7340	9410				9410		9410									
S	1	T95	7340	9410				9410		9410									
S	1,2	P110	7950	10900				10900		10900									
S	1	Q125	8440	12390				12390		12390									

Method: S - seamless; ERW - electric resistance welded

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Short	Long							
365	254			2540	1910	3180			
410	294			2940	2210	3680			
564	394	453	639	3940	2960	4930	4530	3400	5660
564	423	489	755	4230	3170	5290	4890	3670	6110
667	460	529	734	4600	3450	5750	5290	3970	6610
630	452	520	714	4520	3390	5650	5200	3900	6500
630	486	561	843	4860	3650	6080	5610	4210	7010
744	528	607	820	5280	3960	6600	6070	4550	7590
916		727	947				7270	5450	9090
916		737	979				7370	5530	9210
1031		804	1021				8040	6030	10050
1088		847	1074				8470	6350	10590
1088		847	1074				8470	6350	10590
816		679	899				6790	5090	8490
1005		813	1038				8130	6100	10160
1005		825	1074				8250	6190	10310
1130		899	1119				8990	6740	11240
1193		948	1178				9480	7110	11850
1193		948	1178				9480	7110	11850
1381		1105	1388				11050	8290	13810
882		745	972				7450	5590	9310
1086		893	1122				8930	6700	11160
1086		905	1161				9050	6790	11310
1222		987	1210				9870	7400	12340
1289		1040	1273				10400	7800	13000
1289		1040	1273				10400	7800	13000
1493		1213	1500				12130	9100	15160
1697		1361	1650				13600	10200	17000
1244		1047	1285				10470	7850	13090
1244		1062	1329				10620	7970	13280
1399		1157	1386				11570	8680	14460
1477		1220	1458				12200	9150	15250
1477		1220	1458				12200	9150	15250
1710		1422	1718				14220	10670	17770
1943		1595	1890				15950	11960	19940

## Casing Dimensional Range and Performance Properties 9 5/8 - 10 3/4

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties			
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi			
			lb/ft	in		in	in	psi	Minimum Internal Yield Pressure				
									Plain End, psi	Round Thread Short, psi	Round Thread Long, psi	Buttress Thread, psi	
S	1,2	9 5/8	0.595	58.40 57.44	L80	8.435	8.279 8.375	10.625	7890	8650		8650	8650
S	1,2				N80				7890	8650		8650	8650
S	1				C90				8560	9740		9740	9740
S	1,2				C95				8880	10280		10280	10280
S	1				T95				8880	10280		10280	10280
S	1,2				P110				9770	11900		11900	11900
S	1				Q125				10540	13520		13520	13520
		9 5/8	0.609	59.40 58.70	C90	8.407	8.251	10.625	8970	9970			
					T95				9320	10520			
		9 5/8	0.672	64.90 64.32	C90	8.281	8.125	10.625	10800	11000			
					T95				11260	11610			
		9 5/8	0.734	70.30 69.76	C90	8.157	8.001	10.625	12600	12010			
					T95				13170	12680			
		9 5/8	0.797	75.60 75.21	C90	8.031	7.875	10.625	13670	13040			
					T95				14430	13700			
ERW	2w	10 3/4	0.279	32.75	H40	10.192	10.036	11.750	840	1820	1820		
ERW	2w				H40				1390	2280	2280		2280
S, ERW	2,2w				J55				1580	3130	3130		3130
S, ERW	2,2w				K55				1580	3130	3130		3130
					M65				1670	3700	3700		3700
S, ERW	2,2w	10 3/4	0.400	45.50 44.26	J55	9.950	9.794 9.875	11.750	2090	3580	3580		3580
S, ERW	2,2w				K55				2090	3580	3580		3580
					M65				2270	4230	4230		4230
S, ERW	2,2w	10 3/4	0.450	51.00 49.55	J55	9.850	9.694	11.750	2700	4030	4030		4030
S, ERW	2,2w				K55				2700	4030	4030		4030
					M65				2870	4760	4760		4760
S	2				L80				3220	5860	5860		5860
S	2				N80				3220	5860	5860		5860
S	2				C90				3400	6590	6590		6590
					C95				3480	6960	6960		6960
					T95				3480	6960	6960		6960
S	2				P110				3660	8060	8060		8060
					10 3/4				0.495	55.50 54.26	M65	9.760	9.604 9.625
S	2	L80	4020	6450		6450		6450					
S	2	N80	4020	6450		6450		6450					
		C90	4160	7250		7250		7250					
S	2	C95	4290	7660		7660		7660					
		T95	4290	7660		7660		7660					
S	2	P110	4610	8860		8860		8860					

Method: S - seamless; ERW - electric resistance welded

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Short	Long							
1350		1151	1396				11510	8630	14390
1350		1167	1443				11670	8750	14590
1519		1272	1505				12720	9540	15900
1604		1341	1583				13410	10060	16760
1604		1341	1583				13410	10060	16760
1857		1564	1865				15640	11730	19550
2110		1754	2052				17540	13160	21930
1552									
1639									
1701									
1796									
1845									
1948									
1989									
2100									
367	205			2050	1540	2560			
457	314			3140	2360	3930			
629	420		700	4200	3150	5250			
629	450		819	4500	3380	5630			
743	491		806	4910	3680	6140			
715	493		796	4930	3700	6160			
715	528		931	5280	3960	6600			
845	576		916	5760	4320	7200			
801	565		891	5650	4240	7060			
801	606		1043	6060	4550	7580			
946	661		1026	6610	4960	8260			
1165	794		1190	7940	5960	9930			
1165	804		1228	8040	6030	10050			
1311	879		1287	8790	6590	10990			
1383	927		1354	9270	6950	11590			
1383	927		1354	9270	6950	11590			
1602	1080		1594	10790	8090	13490			
1037	736		1124	7360	5520	9200			
1276	884		1303	8840	6630	11050			
1276	895		1345	8950	6710	11190			
1435	979		1409	9790	7340	12240			
1515	1032		1483	10320	7740	12900			
1515	1032		1483	10320	7740	12900			
1754	1203		1745	12020	9020	15030			



## Casing Dimensional Range and Performance Properties 10 3/4 - 11 3/4

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties			
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi			
			in	lb/ft		in	in	in	psi	Minimum Internal Yield Pressure			
									Plain End, psi	Round Thread Short, psi	Round Thread Long, psi	Buttress Thread, psi	
S	2	10 3/4	0.545	60.70	C90	9.660	9.504	11.750	5460	7980	7980	7980	
				59.45					T95	5580	8430	8430	8430
									P110	5880	9760	9760	9760
									Q125	6070	11090	11090	11090
S	2	10 3/4	0.595	65.70	C90	9.560	9.404	11.750	6760	8720	8720	8720	
				64.59					T95	6960	9200	9200	9200
									P110	7500	10650	10650	10650
									Q125	7920	12110	12110	12110
		10 3/4	0.672	73.20	C90	9.406	9.250	11.750	8760	9850			
	T95			9090					10390				
		10 3/4	0.734	79.20	C90	9.282	9.126	11.750	10370	10750			
	T95			10800					11350				
		10 3/4	0.797	85.30	C90	9.156	9.000	11.750	12010	11680			
	T95			12540					12330				
		11 3/4	0.333	42.00	H40	11.084	10.928	12.750	1040	1980	1980		
		11 3/4	0.375	47.00	J55	11.000	10.844	12.750	1510	3070	3070	3070	
	45.60			K55	1510				3070	3070	3070		
				M65	1590				3630	3630	3630		
		11 3/4	0.435	54.00	J55	10.880	10.724	12.750	2070	3560	3560	3560	
	52.62			K55	2070				3560	3560	3560		
				M65	2250				4210	4210	4210		
		11 3/4	0.489	60.00	J55	10.772	10.616	12.750	2660	4010	4010	4010	
	58.87				K55				2660	4010	4010	4010	
					M65				2840	4730	4730	4730	
					L80				3180	5830	5830	5830	
					N80				3180	5830	5830	5830	
					C90				3360	6550	6550	6550	
					C95				3440	6920	6920	6920	
					T95				3440	6920	6920	6920	
					P110				3610	8010	8010	8010	
		Q125	3680	9100	9100	9100							
		11 3/4	0.534	65.00	L80	10.682	10.526	12.750	3870	6360			
	64.03				N80				3870	6360			
					C90				4060	7160			
					C95				4170	7560			
					T95				4170	7560			
					P110				4480	8750			
					Q125				4690	9940			
			11 3/4	0.582	71.00	L80	10.586	10.430	12.750	4880	6930		
	69.48	N80				4880				6930			
		C90				5130				7800			
		C95				5240				8230			
		T95				5240				8230			
		P110				5470				9530			
		Q125	5760	10840									

Method: S - seamless; ERW - electric resistance welded

Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum	Maximum
	Short	Long							
1573	1089		1544	10890	8170	13610			
1660	1148		1625	11480	8610	14350			
1922	1338		1912	13370	10030	16710			
2184	1503		2109	15020	11270	18790			
1708	1198		1677	11980	8990	14980			
1803	1263		1765	12630	9470	15790			
2088	1472		2077	14710	11030	18390			
2373	1653		2291	16520	12390	20650			
1915									
2021									
2079									
2194									
2243									
2367									
478	307			3070	2300	3840			
737	477		807	4770	3580	5960			
737	509		935	5090	3820	6360			
871	557		931	5570	4180	6960			
850	568		931	5680	4260	7100			
850	606		1079	6060	4550	7580			
1005	664		1074	6640	4980	8300			
951	649		1042	6490	4870	8110			
951	693		1208	6930	5200	8660			
1124	759		1201	7590	5690	9490			
1384	913		1399	9130	6850	11410			
1384	924		1440	9240	6930	11550			
1557	1011		1517	10110	7580	12640			
1643	1066		1596	10660	8000	13330			
1643	1066		1596	10660	8000	13330			
1903	1242		1877	12420	9320	15530			
2162	1396		2074	13960	10470	17450			
1505									
1505									
1693									
1788									
1788									
2070									
2352									
1634									
1634									
1838									
1940									
1940									
2246									
2552									

## Casing Dimensional Range and Performance Properties 10 3/4 - 11 3/4

Method	Plant	Size O.D.	Wall Thickness	Weight-T&C	Grade	Dimensions, in				Performance Properties			
				Weight Plain End		Inside Diameter	Drift diameter	Outside Diameter of Coupling	Collapse Pressure	Burst Pressure, psi			
			in	lb/ft		in	in	in	psi	Minimum Internal Yield Pressure			
										Plain End, psi	Round Thread		Buttress Thread, psi
								Short, psi	Long, psi				
S,ERW	1,2w	13 3/8	0.380	54.50	J55	12.615	12.459	14.375	1130	2730	2730		2730
S,ERW	1,2w			52.79	K55				1130	2730	2730		2730
S	1				M65				1140	3230	3230		3230
S,ERW	1,2w	13 3/8	0.430	61.00	J55	12.515	12.359	14.375	1540	3090	3090		3090
S,ERW	1,2w			59.50	K55				1540	3090	3090		3090
S	1				M65				1620	3660	3660		3660
S	1	13 3/8	0.480	68.00 66.17	J55	12.415	12.259	14.375	1950	3450	3450		3450
S	1				K55				1950	3450	3450		3450
S	1				M65				2100	4080	4080		4080
S	1				L80				2260	5020	5020		5020
S	1				N80				2260	5020	5020		5020
S	1				C90				2320	5650	5650		5650
S	1				C95				2330	5970	5970		5970
S	1				T95				2330	5970	5970		5970
S	1				P110				2340	6910	6910		6910
S	1				L80				2670	5380	5380		5380
S	1				N80				2670	5380	5380		5380
S	1	C90	2780	6050	6050		6050						
S	1	C95	2820	6390	6390		6390						
S	1	T95	2820	6390	6390		6390						
S	1	P110	2880	7400	7400		7400						
S	1	Q125	2880	8410	8410		8410						
ERW	2w	16	0.375	65.00	H40	15.250	15.062	17.000	630	1640	1640		1640
ERW	2w	16	0.438	75.00	J55	15.124	14.936	17.000	1020	2630	2630		2630
ERW	2w			72.86	K55				1020	2630	2630		2630
					M65				1020	3110	3110		3110
ERW	2w	20	0.500	106.50	J55	19.000	18.812	21.000	770	2410	2410	2410	2410
ERW	2w			104.23	K55				770	2410	2410	2410	2410

Method: S - seamless; ERW - electric resistance welded

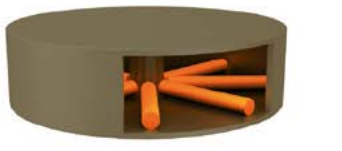
Plant designation:

Russia: 1 – Volzhsky/Smls/; 2 – Seversky/Smls/; 2w – Seversky /ERW/; 3 – Sinarsky/Smls/; 4 – TAGMET/Smls/;

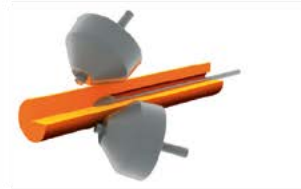
Performance Properties				Recommended Make-up Torque 8-Round - Thread Casing					
Tension, 1000 lbs				Torque, ft-lbs					
Pipe Body	Joint Strength			Short Thread			Long Thread		
	Yield Strength	Round Thread		Buttress Thread	Optimum	Minimum	Maximum	Optimum	Minimum
Short		Long							
853	514		909	5140	3860	6430			
853	547		1038	5470	4100	6840			
1008	602		1052	6020	4520	7530			
962	595		1025	5950	4460	7440			
962	633		1170	6330	4750	7910			
1137	697		1185	6970	5230	8710			
1069	675		1140	6750	5060	8440			
1069	718		1300	7180	5390	8980			
1264	791		1318	7910	5930	9890			
1556	952		1545	9520	7140	11900			
1556	963		1585	9630	7220	12040			
1750	1057		1683	10570	7930	13210			
1847	1114		1772	11140	8360	13930			
1847	1114		1772	11140	8360	13930			
2139	1297		2079	12970	9730	16210			
1661	1029		1650	10290	7720	12860			
1661	1040		1693	10400	7800	13000			
1869	1142		1797	11420	8570	14280			
1973	1204		1893	12040	9030	15050			
1973	1204		1893	12040	9030	15050			
2284	1402		2221	14020	10520	17530			
2596	1576		2463	15760	11820	19700			
736	439			4390	3290	5490			
1178	710		1200	7100	5330	8880			
1178	752		1331	7520	5640	9400			
1392	832		1394	8320	6240	10400			
1685	913	1056	1595	9130	6850	11410	10560	7920	13200
1685	959	1113	1683	9590	7190	11990	11130	8350	13910

## Seamless Process Flowchart (PQF)

1. Billet heating in circular furnace



2. Cross-rolling piercing



3. Hydrodescaling



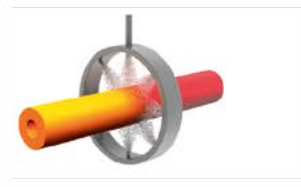
4. Elongating



5. Reheating



6. Hydrodescaling



7. Stretch reducing mill



8. Cutting



9. Cooling



10. Batch sawing



## Casing Pipe Finishing Process

1. Control of pipe geometry



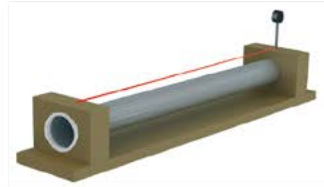
2. Heat treatment



3. Flaw-detecting



4. Geometrics inspection



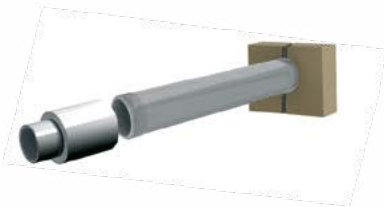
5. Magnetic-fluoroscopic flaw inspection of pipe ends



6. Threading, thread inspection



7. Coupling screw-on and drifting



8. Hydrostatic testing



9. Protectors screw-on



10. Coating application



11. Marking, packing, storage



## CRA OCTG

TMK-C-110 Tubing and Casing (UNS N08028-110, UNS N08535-110 according to API Specification 5CRA / ISO 13680)

Corrosion-resistant chrome-nickel TMK-C alloy is designed for the production of tubing and casing used for wells construction in oil and gas fields with high content and partial pressure of H<sub>2</sub>S and CO<sub>2</sub> in the extracted product.

TMK-C alloy pipes application area:

- Ambient temperature up to 455° F
- CO<sub>2</sub> pressure > 2 psi
- H<sub>2</sub>S pressure > 500 psi
- High chlorides content

### Short chemical composition of TMK-C alloy

C, %	Cr, %	Ni, %	Mo, %	S, %	P, %
≤ 0.02	24.0 – 27.0	29.5 – 36.5	2.5 – 4.0	≤ 0.01	≤ 0.03

### Mechanical properties of TMK-C-110 Tubing and Casing

Yield strength $\sigma_{0.2}$ , ksi	Tensile strength $\sigma_b$ , ksi	Elongation $\delta$ , %	Hardness HRC
110 - 140	≥ 115	≥ 12	≤ 32

### TMK-C-110 Tubing Dimensional Range and Performance Properties

Method	Plant	Size O.D.	Weight T&C, lb/ft	Grade	Dimension, in			
					Wall Thickness	Inside Diameter	Drift Diameter	Coupling Outside Diameter
Seamless	Sinarsky Pipe Plant / Russia/	3 1/2	9.2	TMK-C-110	0.254	2.992	2.867	4.250
		4 1/2	12.6		0.271	3.958	3.833	5.200

Performance Properties			Performance Properties			
Collapse Pressure, psi	Burst, psi		Tension, lb		Compression, lb	
	Internal Yield Pressure		Pipe Body Yield Strength	Joint Yield Strength	Pipe Body Yield Strength	Joint Yield Strength
	Plain-end	T&C "TMK UP PF" Premium Connection		T&C "TMK UP PF" Premium Connection		T&C "TMK UP PF" Premium Connection
13530	13970	13970	284900	284900	284900	227920
9210	11590	11590	396000	396000	396000	237600



Recommended Make-up - Thread Tubing		
Torque, ft-lbs		
T&C "TMK UP PF" Premium Connection		
Optimum	Minimum	Maximum
3700	3300	4100
4000	3600	4400

### TMK-C-110 Casing Dimensional Range and Performance Properties

Method	Plant	Size O.D.	Weight T&C, lb/ft	Grade	Dimension, in			
					Wall Thickness	Inside Diameter	Drift Diameter	Coupling Outside Diameter
Seamless	Orsky Machine Building Plant / Russia/	4 1/2	13.5	TMK-C-110	0.290	3.920	3.795	5
		5	15		0.296	4.408	4.283	5.563
		7	26		0.362	6.276	6.151	7.875
		7	29		0.408	6.184	6.059	7.875

Performance Properties			Performance Properties			
Collapse Pressure, psi	Burst, psi		Tension, lb		Compression, lb	
	Internal Yield Pressure		Pipe Body Yield Strength	Joint Yield Strength	Pipe Body Yield Strength	Joint Yield Strength
	Plain End	T&C "TMK UP PF" Premium Connection		T&C "TMK UP PF" Premium Connection		T&C "TMK UP PF" Premium Connection
10690	12410	12410	422000	422000	422000	253200
8850	11400	11400	481000	481000	481000	288600
6230	9960	9960	830000	830000	830000	498000
8530	11220	11220	929000	929000	929000	557400

Recommended Make-up - Thread Casing		
Torque, ft-lbs		
T&C "TMK UP PF" Premium Connection		
Optimum	Minimum	Maximum
4300	3800	4700
5900	5300	6500
12800	11500	14000
14400	13000	15900

## TMK-C-110 Tubing and Casing Process Flowchart

1. Billets cutting



2. Billets drilling



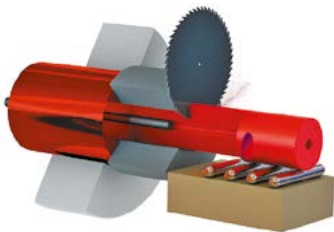
5. Glass lubricant apply



6. Piercing



9. Hot pressing



10. Cooling



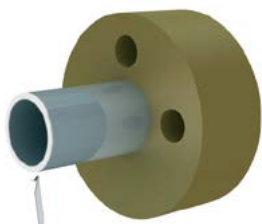
13. Pipe ends cutting



14. NDT



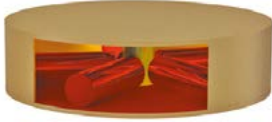
17. Threading and make-up



18. Drifting



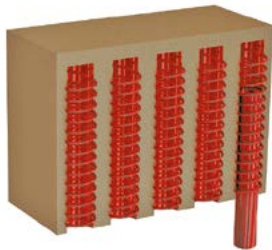
3. Billets heating



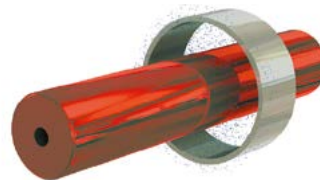
4. Hydrodescaling



7. Intermediate heating



8. Hydrodescaling



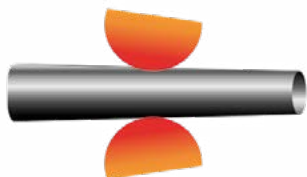
11. Glass lubricant removal



12. Pipe sizing



15. Pipe cold rolling



16. NDT



19. Hydrotesting



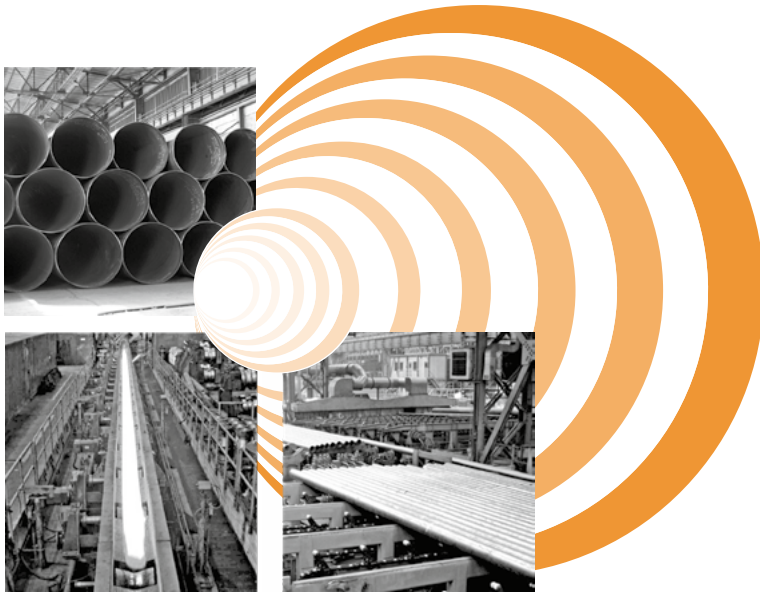
20. Marking, packing, storage











## Line Pipe

TMK manufactures a wide range of line pipe for onshore and offshore applications. Line pipe is available in sizes ranging from 0.500 to 100 inches and can be produced by seamless, ERW, SAWL and SAWH methods according to API Spec 5L, CSA, DIN EN, BS EN and DNV standards.


In 2008, TMK launched a 650,000 tpa Haeusler RB(E) SAWL pipe mill at our Volzhsky plant (Russia) that is certified according to DNV-OSS-313. Operating its own coating facilities, pipes can be supplied with 3-layer FBE or PE external and internal coating. The pipe is inspected for internal and external defects using automated electromagnetic and ultrasonic inspection equipment. Pipe ends undergo magnetic-fluoroscopic detection after beveling. For wall thicknesses exceeding 16 mm, ends can be double beveled. The pipe also undergoes tensile, flattening and hydrostatic testing. The pipe is automatically packed in bundles and tied with steel banding or wires in compliance with API loading and transportation standards.


### Line Pipe Producers

Plant Location	Method	OD	WT	Standards/Grades
Volzhsky Pipe Plant /Russia/	SAWL	20" - 56"	0.312" - 1.250"	API Spec 5L, X42-X100, DNV 485 FD
	SAWH	22" - 100"	0.250" - 1.000"	API Spec 5L DIN EN ISO 3183
	Seamless	6.625" - 16"	0.280" - 1.062"	API Spec 5L, DNV 250-450 S/F/P/D
Seversky Tube Works /Russia/	Seamless	8.625" - 12.752"	0.315" - 0.984"	API Spec 5L, PSL 1,2 AB, X42-X60
	ERW	0.839" - 20"	0.114" - 0.500"	API Spec 5L PSL 1, AB, X42-X60
Sinarsky Pipe Plant /Russia/	Seamless	1.315" - 6.625"	0.133" - 0.562"	API Spec 5L, PSL1,2 AB, X42-X65
TAGMET /Russia/	Seamless	0.260" - 0.720"	4,500" - 8,625"	API Spec 5L, PSL1,2 AB, X42-X65
Artrom /Romania/	Seamless	0.840" - 8.625"	0.109" - 1.000"	API 5L, A,B, X42-X60, DIN EN ISO 3183 , L210GA-L360GA DIN EN ISO 3183, L245NB

## Seamless Line Pipe Dimensional Range

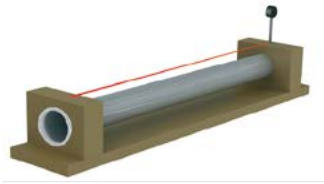
OD,		Wall Thickness																												
		0,065	0,079	0,118	0,131	0,137	0,157	0,196	0,216	0,255	0,275	0,295	0,314	0,354	0,374	0,393	0,433	0,472	0,511	0,551	0,590	0,629	0,669	0,748	0,787	0,866	0,944	0,984	1,063	
in	mm	1,65	2,0	3,0	3,35	3,5	4,0	5,0	5,5	6,5	7,0	7,5	8,0	9,0	9,5	10,0	11,0	12,0	13,0	14,0	15,0	16,0	17,0	19,0	20,0	22,0	24,0	25,0	27,0	
0,673	17,1																													
0,838	21,3																													
1,051	26,7																													
1,314	33,4																													
1,661	42,2																													
1,902	48,3																													
2,374	60,3																													
2,874	73																													
3,500	88,9																													
4,000	101,6																													
4,500	114,3																													
5,562	141,3																													
6,625	168,3																													
8,625	219,1																													
9,625	244,5																													
10,748	273,0																													
12,748	323,8																													
14,000	355,6																													
16,000	406,4																													

 - Cold drawn

 - Hot rolled

## Seamless Line Pipe Finishing Process

1. Geometrics inspection



2. Beveling



3. Hydrostatic testing



4. Magnetic-fluoroscopic flaw inspection of pipe ends



5. Ultrasonic inspection



6. Coating application (on Customer's request)



7. Marking, packing, storage



## Longitudinally Welded Line Pipe Dimensional Range SAWL acc. to API Spec 5L

OD		Wall Thickness																			
		Weight, kg/m																			
in	mm	0,311	0,342	0,374	0,406	0,437	0,468	0,500	0,562	0,625	0,688	0,751	0,811	0,874	0,937	1,000	1,063	1,125	1,188	1,251	
20	508	97,43	107,12	116,78	126,41	136,01	145,58	155,12	174,10	192,95	211,68	230,27	247,60								
22	559	107,36	118,06	128,73	139,37	149,97	160,55	171,09	192,08	212,95	233,68	254,30	273,51	293,87	314,11						
24	610	117,30	129,00	140,68	152,32	163,93	175,51	187,06	210,07	232,94	255,69	278,32	299,41	321,79	344,05	366,17					
26	660	127,04	139,73	152,39	165,02	177,62	190,19	202,72	227,70	252,55	277,27	301,87	324,81	349,16	373,39	397,49					
28	711	136,97	150,67	164,34	177,98	191,58	205,15	218,70	245,68	272,54	299,28	325,89	350,72	377,09	403,32	429,44					
30	762	146,91	161,61	176,29	190,93	205,54	220,12	234,67	263,67	292,54	321,29	349,91	376,63	405,01	433,26	461,38					
32	813	156,84	172,56	188,24	203,88	219,50	235,09	250,64	281,65	312,54	343,30	373,93	402,54	432,93	463,19	493,32					
34	864	166,78	183,50	200,18	216,84	233,46	250,05	266,61	299,64	332,54	365,31	397,95	428,44	460,85	493,12	525,27					
36	914	176,52	194,22	211,90	229,54	247,15	264,72	282,27	317,27	352,14	386,88	421,50	453,84	488,22	522,47	556,59					
38	965	186,46	205,17	223,85	242,49	261,11	279,69	298,24	335,25	372,14	408,89	445,52	479,75	516,14	552,40	588,53	624,54	660,42	696,18	731,80	
40	1016	196,39	216,11	235,79	255,45	275,07	294,66	314,22	353,24	392,13	430,90	469,55	505,66	544,06	582,33	620,48	658,50	696,39	734,16	771,80	
42	1067		227,05	247,74	268,40	289,03	309,62	330,19	371,22	412,13	452,91	493,57	531,57	571,98	612,26	652,42	692,45	732,36	772,14	811,79	
44	1118		237,99	259,69	281,35	302,99	324,59	346,16	389,21	432,13	474,92	517,59	557,47	599,90	642,19	684,37	726,41	768,33	810,12	851,79	
46	1168		248,72	271,40	294,05	316,67	339,26	361,82	406,84	451,73	496,50	541,14	582,87	627,27	671,54	715,68	759,70	803,59	847,36	890,99	
48	1219		259,66	283,35	307,01	330,63	354,23	377,79	424,82	471,73	518,51	565,16	608,78	655,19	701,47	747,63	793,66	839,56	885,34	930,99	
52	1321			307,25	332,92	358,55	384,16	409,74	460,79	511,72	562,53	613,20	660,60	711,03	761,34	811,52	861,57	911,50	961,30	1010,98	
56	1422			330,91	358,57	386,20	413,80	441,37	496,41	551,32	606,11	660,77	711,91	766,32	820,61	874,78	928,82	982,73	1036,52	1090,18	



## Helically Welded Line Pipe Dimensional Range SAWH acc. to DIN EN ISO 3183

Outside Diameter, mm	Wall Thickness, mm														
	Weight, kg/m														
	5,6	6,3	7,1	8	8,8	10	11	12,5	14,2	16	17,5	20	22,2	25	
559	76,4	85,9	96,6	109	119	135	149								
610	83,5	93,8	106	119	130	148	162								
660	90,4	102	114	129	141	160	176								
711	97,4	109	123	139	152	173	190	215							
762	104	117	132	149	163	185	204	231							
813	112	125	141	159	175	198	218	247							
864			150	169	186	211	231	262	298						
914			159	179	196	223	245	278	315						
1016			177	199	219	248	273	309	351						
1220			212	239	263	298	328	372	422						
1420			247	279	306	348	382	434	492	554	605	691	765		
1620									562	633	692	789	875		
1820									632	712	778	888	984		
2020									702	791	864	986	1094	1230	
2220										870	951	1085	1203	1353	
2520										988	1080	1233	1367	1538	

# Longitudinal Process Flowchart 20" - 56" /508 - 1422 mm/

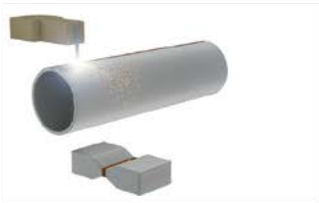
1. Infeed of plates Identity check



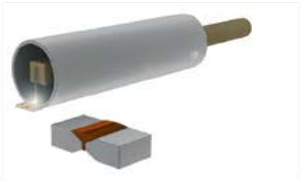
2. Milling of longitudinal plate edges



5. Tack welding



6. Inside welding



9. UT of weld



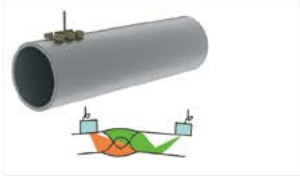
10. X-ray testing of weld seam



13. Hydrostatic testing



14. UT of weld seam



17. Inspection, weighing, marking, stamping



18. Storage



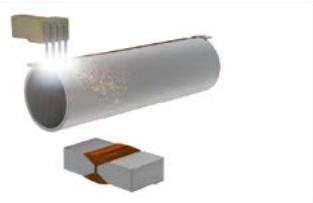
3. Forming by the 3-roll bending process



4. Post-bending of the longitudinal plate edges



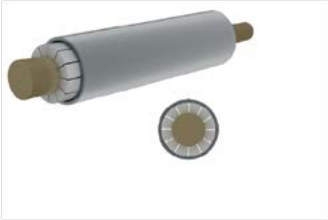
7. Outside welding



8. Visual control



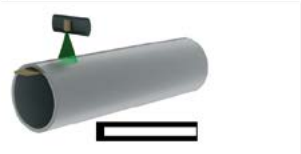
11. Mechanical expanding



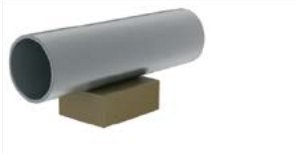
12. Grinding of weld at pipe ends and beveling



15. X-ray testing of weld seam and pipe ends



16. Magnetic particle and ultrasonic inspection of both pipe ends



## ERW Line Pipe Dimensional Range

Outside Diameter		Wall Thickness																																			
in	mm	0,102	0,114	0,126	0,142	0,156	0,177	0,188	0,220	0,224	0,248	0,250	0,280	0,300	0,311	0,315	0,322	0,327	0,328	0,337	0,343	0,365	0,375	0,406	0,432	0,438	0,450	0,500	0,562	0,625	0,689	0,750	0,866	0,944	1,000		
in	mm	2,6	2,9	3,2	3,6	4,0	4,5	4,78	5,6	5,7	6,30	6,4	7,1	7,62	7,9	8,0	8,2	8,3	8,33	8,56	8,7	9,3	9,5	10,3	10,97	11,10	11,43	12,7	14,3	15,9	17,5	19,1	22,0	24,0	25,0		
0,839	21,3																																				
1,059	26,9																																				
1,327	33,7																																				
1,669	42,4																																				
1,902	48,3																																				
2,244	57																																				
2,375	60,3																																				
2,996	76,1																																				
3,500	88,9																																				
4,000	101,6																																				
4,252	108																																				
4,500	114,3																																				
5,000	127																																				
5,236	133																																				
6,000	152,4																																				
6,260	159																																				
6,625	168,3																																				
7,000	177,8																																				
7,625	193,68																																				
8,625	219,1																																				
8,825	224,16																																				
9,625	244,48																																				
9 5/8	244,5																																				
10,748	273																																				
10 3/4	273,1																																				
12,752	323,9																																				
13 3/8	339,7																																				
14,000	355,6																																				
16,000	406,4																																				
17,992	457																																				
18,000	457,2																																				
18 5/8	473,1																																				
20,000	508																																				
22,000	559																																				
24,000	610																																				

## Mechanical Properties PSL 2, API Spec 5L

Steel Grade	Pipe body (seamless and welded)				Weld Seam
	Yield Strength $R_{10,5}$ , MPa (psi)		Tensile Strength $R_m$ , MPa (psi)		Tensile Strength $R_m$ , MPa (psi), min.
	min	max	min	max	
X42/L290	290 (42 100)	495 (71 800)	415 (60 200)	760 (110 200)	415 (60 200)
X46/L320	320 (46 400)	525 (76 100)	435 (63 100)	760 (110 200)	435 (63 100)
X52/L360	360 (52 200)	530 (76 900)	460 (66 700)	760 (110 200)	460 (66 700)
X56/L390	390 (56 600)	545 (79 000)	490 (71 100)	760 (110 200)	490 (71 100)
X60/L415	415 (60 200)	565 (81 900)	520 (75 400)	760 (110 200)	520 (75 400)
X65/L450	450 (65 300)	600 (87 000)	535 (77 600)	760 (110 200)	535 (77 600)
X70/L485	485 (70 300)	635 (92 100)	570 (82 700)	760 (110 200)	570 (82 700)
X80/L555	555 (80 500)	705 (102 300)	625 (90 600)	825 (119 700)	625 (90 600)
X90/L625	625 (90 600)	775 (112 400)	695 (100 800)	915 (132 700)	695 (100 800)
X100/L690	690 (100 100)	840 (121 800)	760 (110 200)	990 (143 600)	760 (110 200)
X120/L830	830 (120 400)	1050 (152 300)	915 (132 700)	1 145 (166 100)	915 (132 700)

## Chemical Composition for PSL 2, API Spec 5L

Steel Grade (Steel Name)	Mass fraction, based upon heat and product analyses % maximum									Carbon equivalent %, max	
	C <sup>b</sup>	Si	Mn <sup>b</sup>	P	S	V	Nb	Ti	other	CE <sub>IW</sub>	CE <sub>cm</sub>

### Seamless and welded pipes

L245R or BR	0,24	0,4	1,2	0,025	0,015	*	*	0,04	*		
L290R or X42R	0,24	0,4	1,2	0,025	0,015	0,06	0,05	0,04	*		
L245N or BN	0,24	0,4	1,2	0,025	0,015	*	*	0,04	*		
L290N or X42N	0,24	0,4	1,2	0,025	0,015	0,06	0,05	0,04	*		
L320N or X46N	0,24	0,4	1,4	0,025	0,015	0,07	0,05	0,04	*		
L360N or X52N	0,24	0,45	1,4	0,025	0,015	0,1	0,05	0,04	*		
L390N or X56N	0,24	0,45	1,4	0,025	0,015	0,1	0,05	0,04	*		
L415N or X60N	0,24	0,45	1,4	0,025	0,015	0,1	0,05	0,04	*		
L245Q or BQ	0,18	0,45	1,4	0,025	0,015	0,05	0,05	0,04	*		
L290Q or X42Q	0,18	0,45	1,4	0,025	0,015	0,05	0,05	0,04	*		
L320Q or X46Q	0,18	0,45	1,4	0,025	0,015	0,05	0,05	0,04	*		
L360Q or X52Q	0,18	0,45	1,5	0,025	0,05	0,05	0,05	0,04	*		
L390Q or X56Q	0,18	0,45	1,5	0,025	0,015	0,07	0,05	0,04	*		
L415Q or X60Q	0,18	0,45	1,70	0,025	0,015	*	*	*	*		
L450Q or X65Q	0,18	0,45	1,70	0,025	0,015	*	*	*	*		
L485Q or X70Q	0,18	0,45	1,80	0,025	0,015	*	*	*	*		
L555Q or X80Q	0,18	0,45	1,90	0,025	0,015	*	*	*	*		

### Welded pipes

L245M or BM	0,22	0,45	1,2	0,025	0,015	0,05	0,05	0,04	*	0,43	0,25
L290M or X42M	0,22	0,45	1,3	0,025	0,015	0,05	0,05	0,04	*	0,43	0,25
L320M or X46M	0,22	0,45	1,3	0,025	0,015	0,05	0,05	0,04	*	0,43	0,25
L360M or X52M	0,22	0,45	1,4	0,025	0,015	*	*	*	*	0,43	0,25
L390M or X56M	0,22	0,45	1,4	0,025	0,015	*	*	*	*	0,43	0,25
L415M or X60M	0,12	0,45	1,6	0,025	0,015	*	*	*	*	0,43	0,25
L450M or X65M	0,12	0,45	1,60	0,025	0,015	*	*	*	*	0,43	0,25
L485M or X70M	0,12	0,45	1,7	0,025	0,015	*	*	*	*	0,43	0,25
L555M or X80M	0,12	0,45	1,85	0,025	0,015	*	*	*	*	0,43	0,25
L625M or X90M	0,1	0,55	2,1	0,02	0,01	*	*	*	*		0,25
L690M or X100M	0,1	0,55	2,1	0,02	0,01	*	*	*	*	–	0,25
L830M or X120M	0,1	0,55	2,1	0,02	0,01	*	*	*	*		0,25

\* Calculated according to API Spec 5L/ISO 3183

# ERW Process Flowchart

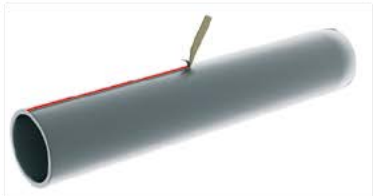
1. Strip Storage



2. Uncoiling



5. Fin removing



6. Straightening



9. Induction heat treatment



10. Pipe reducing and sizing



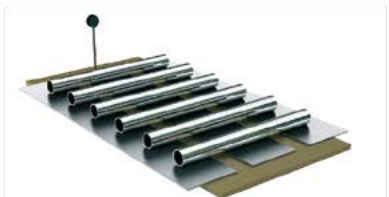
13. Pipe straightening



14. Cutting



17. Inspection and weighing



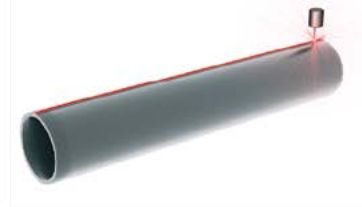
18. Bundling



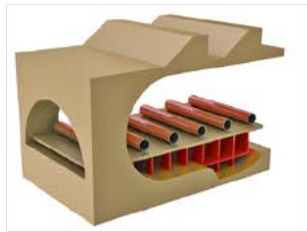
3. Strip forming



4. High Frequency Induction Welding



7. Heating in continuous furnace



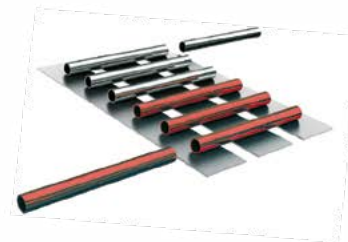
8. Preliminary reduction



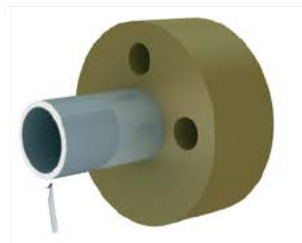
11. Specified lengths sawing



12. Pipe handling, cooling and passing to the finishing lines



15. End machining (beveling)



16. Hydrostatic testing



## Seamless Line Pipe Dimensional Range acc. to DNV-OS-F101

NS	Wall Thickness																					
	OD		Weight, kg/m																			
6 5/8	in	0,280	0,312	0,322	0,344	0,365	0,375	0,406	0,432	0,438	0,469	0,500	0,562	0,625	0,688	0,719	0,750	0,812	0,875	0,938	1,000	1,062
8 5/8	mm	7,1	7,9	8,2	8,7	9,3	9,5	10,3	11,0	11,1	11,9	12,7	14,3	15,9	17,5	18,3	19,1	20,6	22,2	23,8	25,4	27,0
10 3/4	168,3	28,22	31,25	34,24	37,20	42,67	49,10			56,94		64,64	72,02	79,67	90,62	94,20	100,84	107,79				
12 3/4	219,1		41,14	42,65	45,14	60,50				71,87		71,72	81,55	91,26	100,85							
14	273,0						73,65	79,65		85,62		97,46	109,18	120,76	132,23		143,56	154,08	165,17	176,13	186,97	197,68
16	323,8							87,71		94,30	100,86	107,39	120,36	133,19	145,91		158,49	170,18	182,52	194,74	206,83	218,79
30	355,6										115,77	123,30	138,27	153,11	167,87		182,42	195,98	210,33	224,55	238,64	252,61
	406,4																					

## Mechanical Properties

SMYS (MPa) (T+L)	SMYS (MPa) (T)	YS/TS ratio	Hardness (HV 10) BM, WM, HAZ	Elongation		Charpy V-notch energy (KVT), J	
				A <sub>5</sub> min % (T+L)	average	average	min
245	370	0,9	270	22	27	27	22
290	415	0,9	270	21	30	30	24
360	460	0,9	270	20	36	36	30
415	520	0,92	270	18	42	42	35
450	535	0,92	270	18	45	45	38
485	570	0,92	300	18	50	50	40
555	625	0,92	300	18	56	56	45

## Chemical Composition

SMYS	maximum %											Pern	CE					
	C	Mn	Si	P	S	Cu	Ni	Mo	Cr	Al	Nb			V	Ti	N	B	
245	0,14	1,35	0,4	0,02	0,01	0,35	0,3	0,1	0,3	0,06	-	-	-	0,01	0,000	t ≤ 15 15<t≤26	0,20 0,21	0,34 0,35
290	0,14	1,65	0,4	0,02	0,01	0,35	0,3	0,1	0,3	0,06	0,04	0,04	0,04	0,01	0,000	0,20 0,21	0,20 0,21	0,34 0,35
360	0,14	1,65	0,45	0,02	0,01	0,5	0,5	0,5	0,5	0,06	0,05	0,07	0,04	0,01	0,000	0,21 0,22	0,21 0,22	0,37 0,38
415	0,14	1,65	0,45	0,02	0,01	0,5	0,5	0,5	0,5	0,06	0,05	0,08	0,04	0,01	0,000	0,22 0,23	0,22 0,23	0,39 0,4
450	0,15	1,65	0,45	0,02	0,01	0,5	0,5	0,5	0,5	0,06	0,05	0,09	0,06	0,01	0,000	0,23 0,24	0,23 0,24	0,4 0,41



## Anti-Corrosion Coating

Types of coatings used: one- and two-layer FBE coating; two- and three-layer PE coating; two- and three-layer polypropylene coating; internal flow coating. Working temperature range from – 40°C up to + 80°C. Life time min 30 years.

### Standards

Coatings	Standards	Application
External	DIN 30670: 2012 /EN 10288, Polyethylene insulation of pipes and shape articles	Insulation of pipes in the ground and water
External	DIN 30678: 2013, Polypropylene coating for steel pipes	Insulation of pipes in the ground and water
External PE	DIN 30670, ISO 21809-1(2,3,4,5), CSA Z245.20 SERIES, Shell DEP 31.40.30.31	Underground/above ground
External PP	DIN 30678: 2013, ISO 21809-1(2,3,4,5)	Underground/above ground
Internal	API RP 5L2, ISO 15724, Shell DEP 31.40.30.35	Gas, oil, water transmission
Internal	EN 10301:2003 Steel tubes and fittings for on and offshore pipelines. Internal coating for the reduction of friction for conveyance of non corrosive gas	Gas, oil, water transmission

### Coated Pipes Range

Coatings	OD, mm	Wall Thickness, mm	Length, m
External	114-426	6-35	9-12.5
External	530-1420	7-22	8-11.6
External	168,3-1219,2	4-38	8-18
Internal	508-1420	12-48	9-12.5
Internal	219,1-1219,2	4-38	8-13

### Internal Flow Coating Properties

Parameter	Limit
1. Cured coating thickness	60-150 μm
2. Coating adhesion by lattice cut method	1
3. Coating adhesion after 240 hours ageing in water at (20±5)°C by lattice cut method, not more than	2
4. Bend resistace	10 mm
5. Buchholz Hardness, not less than	94
6. Pinchholes, not more than a) in uncured coating b) in cured coating	0 pcs/cm <sup>2</sup> 1 pcs/cm <sup>2</sup>
7. Gas pressure fluctuation resistance	After the 10 <sup>th</sup> cycle: No blistering, fractures
8. Hydraulic pressure fluctuation resistance	After 1 cycle: No blistering, fractures
9. Salt spray resistance at (20±5)°C, 240 hours	No blistering, flaking
10. Coating roughness(Rz), not more than	15 μm

### External Three-Layer PE Coating Properties

1. Thickness, min, mkm (mil)	
1st layer	100-175(4-7)
2d layer	150-400 (6-16)
3d layer for pipe body	3000
for weld zone	2500
2. Space between coating and pipe ends, mm	130-180
3. Adhesion strength *, N/cm length	
under temperature: + 20 ± 5°C	150
under temperature: + 50 ± 5°C	40
4. Pressure resistance *, max, mm	
under temperature: + 25 ± 2°C	0.2
under temperature: + 50 ± 2°C	0.3
5. Impact resistance, min, J	
under temperature: + 23 ± 2°C	18
6. Elongation, min, % under temperature: -40°C	100

# External Coating Process Flowchart

1. The entrance control of pipes.  
Visual inspection



2. Preliminary heating in the gas furnace



3. Abrasive cleaning of external pipes surface in a shotblast unit by steel chipped fraction



4. Removal of dust from pipes internal cavity by a purge



5. Visual inspection of pipe



6. Having heated pipes



7. Having heated pipes



8. One- and two-layer FBE coating

- a) Epoxy powder paint coating
- b) Epoxy impact-resistant coating (only in case of a two-layer coating)



9. Three-layer PE and polypropylene coating

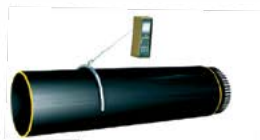
- a) Epoxy primer coating
- b) Adhesive coating
- c) Polyethylene (or polypropylene) coating



10. Water cooling of coated pipes



11. Uniformity coating inspection with high-voltage flaw detector



12. Coating removal from pipe ends



13. Final quality inspection of coated pipes (visual)



14. Pipe marking and Pipe storage



# Internal Coating Process Flowchart

1. Pipe storage before pipe delivery



2. Pipe incoming control



3. Pipe heating



4. Internal pipe surface degreasing



5. Second heating of pipes



6. Internal pipe surface blast creating in Shot Blaster 1



7. Blaster internal surface quality examination



8. Internal pipe surface blast cleaning in Shot Blaster 2



9. Internal surface blowout



10. Internal surface preparation quality inspection



11. Coating application on pipes (in coating chamber)



12. Internal coating pre-curing



13. Pipe induction heating



14. Pipe coating curing in the full-polymerization chamber



15. Internal flow coating quality inspection



15. Marking of coated pipes. Stocking of pipes provided tarpaulin protective caps









## Process & Power Generation

TMK provides tube and pipe serving the power generation industry where critically high temperatures and pressures necessitate rigorous quality standards. Made of carbon, alloy and stainless steel and in accordance with DIN EN, BS EN and ASTM standards, TMK produces a broad range of high quality cold-drawn and hot-rolled tube and pipe for process and power generation applications. Cold-drawn pipe is manufactured at our Sinarsky plant (from purchased tubular billets or from semi finished hot extruded pipes made at our Volzhsky plant). Hot-rolled pipe is produced at our Russian plants. Pipe is made in random lengths from 3 to 12m and fixed lengths upon customer request.

### Producers

Plant Location	Standards	OD, mm	WT, mm	Method
Volzhsky Pipe Plant /Russia/	DIN EN 10216-1,2, ASTM A106-13, A210-02 (2012), A333-13	42 - 406,4	4 - 34,8	Seamless, hot-rolled
	ASTM A 213-14, A312-14, A335-11	42,2 - 406,4	on request	Stainless, hot-rolled
Seversky Tube Works /Russia/	DIN EN 10217-1, ASTM A 106-13	88,9 - 323,8	4 - 23,58	Seamless, hot-rolled
	DIN EN 10217-1	21,3 - 508	2,9 - 12,5	ERW
Sinarsky Pipe Plant /Russia/	DIN EN 10216-1,2,3, ASTM A106-13	33,4 - 168,3	2,9 - 18,26	Seamless, hot-rolled
	EN 10216-1,2,3, ASTM A106-13, A179-90a (2012), A192-02 (2012)	10,3 - 76,2	1,73 - 9,53	Seamless, cold-drawn
	DIN EN 10216-5, ASTM A213-14, A312-14	10,29 - 60,30	1,24 - 5,54	Stainless, cold-drawn
TAGMET /Russia/	EN 10216-1, ASTM A106	114,3 - 273,8	7,1 - 28,58	Seamless, hot-rolled
Artrom /Romania/	EN 10216-2, ASTM A106, A210	21,3-219,1	2,3 - 60	Seamless, hot-rolled
	DIN EN 10216-2, ASTM A179-90a (2012), A210-02 (2012)	15,88 - 210	1,5 - 20	Seamless, cold-drawn

## List of Standards and Ranges for Process and Power Generation

Standarts	OD mm	WT mm	Steel Grade
<b>Carbon and alloyed steel</b>			
<b>DIN EN 10216-1</b> Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 1: Non-alloy steel tubes with specified room temperature properties.	16 - 273	1,8 - 60	P195TR1, P235TR1, P265TR1, P195TR2, P235TR2, P265TR2.
<b>DIN EN 10216-2</b> Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties.	16 - 245	1,8 - 60	St.45.8,St.35.8,17Mn5, 19Mn5, 15Mo3,16Mo3,13CrMo4-5, P235GH, P265GH
<b>DIN EN 10216-3</b> Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 3: Alloy fine grain steel tubes	16 - 219,1	1,8 -60	P355N, P355NH, P275NL1, P355NL1
<b>DIN EN 10217-1</b> Welded steel tubes for pressure purposes - Technical delivery conditions - Part 1: Non-alloy steel tubes with specified room temperature properties;	21,3 - 508	4,0 - 12,5	P195TR1, P195TR2, P235 TR1, P235 TR2, P265 TR1, P265TR2
<b>ASTM A106-13</b> Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service	17,1 - 406,4	1,65 - 28,58	Grade A, Grade B, Grade C
<b>ASTM A210-02(2012)</b> Standard Specification for Seamless Medium-Carbon Steel Boiler and Superheater Tubes	19,05 - 127	2,11-12,7	Grade A-1, Grade C
<b>ASTM A179/A179M-90a(2012)</b> Standard Specification for Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes	15,88 - 88,9	1,65- 7,62	Low carbon steel
<b>ASTM A192-02(2012)</b> Standard Specification for Seamless Carbon Steel Boiler Tubes for High-Pressure Service	19,05 - 114,3	2,11 - 11,53	Low carbon steel
<b>DIN 17175</b> Seamless Tubes of Heat-resistant Steels/ SUPERSEDE BY DIN EN 10216-2	10 - 219,1	1,8 - 60	St 35.8, St 45.8, 15Mo3, 13CrMo4-4
<b>Stainless steel</b>			
<b>DIN EN 10216-5</b> Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 5: Stainless steel tubes	21,34 - 60,32	3,73 - 3,91	X5CrNiMo17-12-2, X2CrNiMo17-12-2 X6CrNiTi18-10, X5CrNi18-10, X2CrNi19-11
<b>ASTM A335-11</b> Standard Specification for Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service	42,2 - 406,4	on request	P5, P9, P11, P12, P22, P91 and others
<b>ASTM A213-14</b> Standard Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes	20,6 - 127	2,87 - 12,7	T5, T9, T91, T22, TP304, TP316, TP304L, TP316L, TP 321
<b>ASTM A312-14</b> Standard Specification for Seamless, Welded, and Heav'ly Cold Worked Austenitic Stainless Steel Pipes	42,16 - 219,1	on request	TP304/TP304L, TP321/JR321L, TP347/TP347H TP316/TR316L, TR316Ti
<b>Low temperature service</b>			
<b>DIN EN 10216-4</b> Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 4: Non-alloy and alloy steel tubes with specified low temperature properties	16 - 219,1	1,8 - 60	P215NL; P265NL
<b>ASTM A333-13</b> Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service and Other Applications with Required Notch Toughness	17,1 - 406,4	1,65 - 25,4	Grade 1; Grade 6
<b>ASTM A 334 ASTM A334-04a(2010)</b> Standard Specification for Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service	17,1 - 219,1	1,65 - 25,4	Grade 1; Grade 6

## Mechanical Properties acc. to DIN EN 10216-2

Steel Grades		Tensile testing at room temperature						Impact Strength						
Grade designation	Material Number	Upper Yield strength ReH Mpa minimum For T ≤ 16 mm			ReH Mpa minimum		Tensile Strength	Elongation at fracture A% minimum		Minimum average value KV J at temperature in °C				
		T < 16	16 < T < 40	40 < T < 60	60 < T < 100	longitud.		transverse	20	0	-10	20	27c	
		Mpa	Mpa	Not less		Mpa								
P195GH	1,034	195	-	-	-	320...440	27	25	40e	28d	-	27c	-	27c
P235GH	1,034	235	225	215	-	360...500	25	23	40e	28d	-	27c	-	27c
P265GH	1,042	265	255	245	-	410...570	23	21	40e	28d	-	27c	-	27c
20MnNb6	1,047	355	345	335	-	500...650	22	20	40e	-	-	27c	-	27c
16Mo3	1,541	280	270	260	-	450...600	22	20	40e	-	-	27c	-	-
8MoB5-4	1,545	400	-	-	-	540...690	19	17	40e	-	-	27c	-	-
14MoV6-3	1,771	320	320	310	-	460...610	20	18	40e,f	-	-	27c	-	-
10CrMo5-5	1,733	275	275	265	-	410...560	22	20	40e	-	-	27c	-	-
13CrMo4-5	1,733	290	290	280	-	440...590	22	20	40e	-	-	27c	-	-
10CrMo9-10	1,738	280	280	270	-	480...630	22	20	40e	-	-	27c	-	-
HCrMo9-10	1,738	355	355	355	-	540...680	20	18	40e	-	-	27c	-	-
25CrMo4	1,721	345	345	345	-	540...690	18	15	40e,f	-	-	27c	-	-
20CrMoV13-5-5	1,777	590	590	590	-	740...880	16	14	40e,f	-	-	27c	-	-
15NiCuMoNb5-6-4	1,636	440	440	440	440e	610...780	19	17	40e,f	-	-	27c	-	-
7CrWVMoNb9-6	1,820	400	400	400	-	510...740	20	18	40e,f	-	-	27c	-	-
7CrMoVTiB10-10	1,737	450	430	430h	-	565...840	17	15	40e,f	-	-	27c	-	-
X11CrMo5+l	1.7362+1	175	175	175	175	430...580	22	20	40e	-	-	27c	-	-
X11CrMo5+NT1	1.7362+NT1	280	280	280	280	480...640	20	18	40e	-	-	27c	-	-
X11CrMo5+NT2	1.7362+NT2	390	390	390	390	570...740	18	16	40e	-	-	27c	-	-
X11CrMo9-l+l	1.7386+1	210	210	210	-	460...640	20	18	40e	-	-	27c	-	-
X11CrMo9-l+NT	1.7386+NT	390	390	390	-	590...740	18	16	40e	-	-	27c	-	-
X10CrMoVNb9-l	1,490	450	450	450	450	630...830	19	17	40e,f	-	-	27c	-	-
X10CrWMoVNb9-2	1,490	440	440	440	440	620...850	19	17	40e,f	-	-	27c	-	-
X11CrMoWVNb9-l-l	1,490	450	450	450	450	620...850	19	17	40e,f	-	-	27c	-	-
X20CrMoVl-l	1,492	490	490	490	490	690...840	17	14	40e,f	-	-	27c	-	-

# Dimensional Range according to DIN EN 10216-2

OD mm	Wall Thickness, mm														OD mm								
	1,6	1,8	2,0	2,3	2,6	2,9	3,2	3,6	4,0	4,5	5,0	5,6	6,3	7,1		8,0	8,8	10,0	11,0	12,5	14,2		
10,2																						10,2	
12,0																							12,0
12,7																							12,7
13,5																							13,5
14,0																							14,0
16,0																							16,0
17,2																							17,2
18,0																							18,0
19,0																							19,0
20,0																							20,0
21,3																							21,3
22,0																							22,0
25,0																							25,0
25,4																							25,4
26,9																							26,9
30,0																							30,0
31,8																							31,8
32,0																							32,0
33,7																							33,7
35,0																							35,0
38,0																							38,0
40,0																							40,0
42,4																							42,4
44,5																							44,5
48,3																							48,3
51,0																							51,0
54,0																							54,0
57,0																							57,0
60,3																							60,3
63,5																							63,5
70,0																							70,0
73,0																							73,0
76,1																							76,1
82,5																							82,5
88,9																							88,9
101,6																							101,6
108,0																							108,0
114,3																							114,3
127,0																							127,0
133,0																							133,0
139,7																							139,7
141,3																							141,3
152,4																							152,4
159,0																							159,0
168,3																							168,3
177,8																							177,8
193,7																							193,7
219,1																							219,1
244,5																							244,5
273,0																							273,0
323,9																							323,9
355,6																							355,6
406,4																							406,4
457,0																							457,0
508,0																							508,0
559,0																							559,0
610,0																							610,0
660,0																							660,0
711,0																							711,0
OD mm	1,6	1,8	2,0	2,3	2,6	2,9	3,2	3,6	4,0	4,5	5,0	5,6	6,3	7,1	8,0	8,8	10,0	11,0	12,5	14,2	OD mm		

- EN 10216-2 Standard Range   
 TMK Scheduled:  - Hot Rolled   
 - Cold Drawn



OD mm	Wall Thickness, mm																			OD mm		
	16,0	17,5	20,0	22,2	25,0	28,0	30,0	32,0	36,0	40,0	45,0	50,0	55,0	60,0	65,0	70,0	80,0	90,0	100,0			
10,2																					10,2	
12,0																						12,0
12,7																						12,7
13,5																						13,5
14,0																						14,0
16,0																						16,0
17,2																						17,2
18,0																						18,0
19,0																						19,0
20,0																						20,0
21,3																						21,3
22,0																						22,0
25,0																						25,0
25,4																						25,4
26,9																						26,9
30,0																						30,0
31,8																						31,8
32,0																						32,0
33,7																						33,7
35,0																						35,0
38,0																						38,0
40,0																						40,0
42,4																						42,4
44,5																						44,5
48,3																						48,3
51,0																						51,0
54,0																						54,0
57,0																						57,0
60,3																						60,3
63,5																						63,5
70,0																						70,0
73,0																						73,0
76,1																						76,1
82,5																						82,5
88,9																						88,9
101,6																						101,6
108,0																						108,0
114,3																						114,3
127,0																						127,0
133,0																						133,0
139,7																						139,7
141,3																						141,3
152,4																						152,4
159,0																						159,0
168,3																						168,3
177,8																						177,8
193,7																						193,7
219,1																						219,1
244,5																						244,5
273,0																						273,0
323,9																						323,9
355,6																						355,6
406,4																						406,4
457,0																						457,0
508,0																						508,0
559,0																						559,0
610,0																						610,0
660,0																						660,0
711,0																						711,0
OD mm	16,0	17,5	20,0	22,2	25,0	28,0	30,0	32,0	36,0	40,0	45,0	50,0	55,0	60,0	65,0	70,0	80,0	90,0	100,0	OD mm		
	Wall Thickness, mm																					

## Chemical Composition % acc. to DIN EN 10216-2

Steel Grade	Material Number	C	Si	Mn	P max.	S max.	Cr	Mo
P195GH	1,034	≤0,13	≤0,35	≤0,70	0,025	0,02	≤0,30	≤0,08
P235GH	1,034	≤0,16	≤0,35	≤1,20	0,025	0,02	≤0,30	≤0,08
P265GH	1,042	≤0,20	≤0,40	<1,40	0,025	0,02	≤0,30	≤0,08
20MnNb6	1,047	≤0,22	0,15 to 0,35	1.00 to 1,50	0,025	0,02	—	—
16Mo3	1,541	0,12 to 0,20	≤0,35	0,40 to 0,90	0,025	0,02	≤0,30	0,25 to 0,35
8MoB5-4	1,545	0,06 to 0,10	0,10 to 0,35	0,60 to 0,80	0,025	0,02	≤0,20	0,40 to 0,50
14MoV6-3	1,771	0,10 to 0,15	0,15 to 0,35	0,40 to 0,70	0,025	0,02	0,30 to 0,60	0,50 to 0,70
10CrMo5-5	1,733	≤ 0,15	0,50 to 1,00	0,30 to 0,60	0,025	0,02	1,00 to 1,50	0,45 to 0,65
13CrMo4-5	1,733	0,10 to 0,17e	≤0,35	0,40 to 0,70	0,025	0,02	0,70 to 1.15	0,40 to 0.60
10CrMo9-10	1,738	0,08 to 0,14	S 0,50	0,30 to 0,70	0,025	0,02	2,00 to 2,50	0,90 to 1,10
11CrMo9-10	1,738	0,08 to 0,15	≤0,50	0,40 to 0,80	0,025	0,02	2,00 to 2,50	0,90 to 1,10
25CrMo4	1 7218	0,22 to 0,29	≤ 0,40	0,60 to 0,90	0,025	0,02	0,90 to 1.20	0,1 5 to 0,30
20CrMoV1 3-5-5	1,777	0,17 to 0,23	0,15 to 0,35	0,30 to 0,50	0,025	0,02	3,00 to 3.30	0,50 to 0,60
15NiCuMoNb5-6-4	1,636	≤0,17	0,25 to 0,50	0,80 to 1,20	0,025	0,02	50,3	0,25 to 0,50
7CrWVMoNb9-6	1,820	0,04 to 0,10	≤0,50	0,10 to 0,60	0,03	0,01	1,90 to 2.60	0,05 to 0,30
7CrMoVTiB10-10	1,737	0,05 to 0,10	0,15 to 0,45	0,30 to 0,70	0,02	0,01	2,20 to 2,60	0,90 to 1,10
X11CrMo5+l X11CrMo-5+NT1 X11CrMo5+NT2	1.7362+1 1.7362+NT1 17362+NT2	0,08 to 0,15	0,15 to 0,50	0,30 to 0,60	0,025	0,02	4,00 to 6,00	0,45 to 0,65
X11CrMo9-1+l X11CrMo9-1+NT	1.7386+1 1.7386+NT	0,08 to 0,15	0,25 to 1,00	0,30 to 0,60	0,025	0,02	8,00 to 10,00	0,90 to 1,10
X10CrMoVNB9-1	1,490	0,08 to 0,12	0,20 to 0,50	0,30 to 0,60	0,02	0,01	8,00 to 9,50	0,85 to 1,05
X10CrWMoVNB9-2	1,490	0,07 to 0,13	≤0,50	0,30 to 0,60	0,02	0,01	8,50 to 9,50	0,30 to 0,60
X11CrMoVWNB9-1-1	1,490	0,09 to 0,13	0,10 to 0,50	0,30 to 0,60	0,02	0,01	8,50 to 9,50	0,90 to 1,10
X20CrMoV11-1	1,492	0,17 to 0,23	0,15 to 0,50	s 1,00	0,025	0,02	10,00 to 12,50	0,80 to 1,20

## Chemical Composition % acc. to DIN EN 10216-2

Outside Diameter D mm	Tolerance on D	Tolerances on T for a T/D ratio			
		≤ 0.025	> 0.025 < 0.050	> 0.050 < 0.10	> 0.10
D ≤ 219.1	± 1% or ± 0.5 mm whichever is the greater	±12.5 % or ± 0.4 mm whichever is the greater			
D > 219.1		±20%	±15%	±12.5%	± 10 % <sup>a</sup>

<sup>a</sup> For outside diameters D > 355.6 mm it is permitted to exceed the upper wall thickness locally by a further 5 % of the wall thickness T

Ni	Al	Cu	Nb	Ti max.	V	Cr+Cu+ Mo+N max.	others
≤0,30	> 0,020"	≤ 0,30c	≤0,010d	0,040d	≤ 0,02d	0,7	—
≤0,30	> 0,020"	≤ 0,30c	≤0,010d	0,040d	≤ 0,02d	0,7	—
≤0,30	> 0,020"	≤ 0,30c	≤ 0,010d	0,040d	≤ 0,02d	0,7	—
—	≤ 0,060	≤ 0,30c	0,015 to 0,10	—	—	—	—
≤0,30	≤ 0,040	≤ 0,30c	—	—	—	—	—
—	≤ 0,060	≤ 0,30c	—	0,06	—	—	B: 0,002 to 0,006
≤0,30	≤ 0,040	≤ 0,30c	—	—	0,22 to 0,28	—	—
≤0,30	≤ 0,040	≤ 0,30c	—	—	—	—	—
≤0,30	≤ 0,040	≤ 0,30c	—	—	—	—	—
≤0,30	≤ 0,040	≤ 0,30c	—	—	—	—	—
≤0,30	≤ 0,040	≤ 0,30c	—	—	—	—	—
≤0,30	≤ 0,040	≤ 0,30c	—	—	—	—	—
≤0,30	≤ 0,040	≤ 0,30c	—	—	—	—	—
≤0,30	≤ 0,040	≤ 0,30c	—	—	0,45 to 0,55	—	—
1,00 to 1,30	≤ 0,050	0,50 to 0,80	0,015 to 0,045	—	—	—	—
—	≤ 0,030	—	0,02 to 0,08	—	0,20 to 0,30	—	N<0,03 B:0,0005 to 0.006 W:1,45to 1,75
—	≤ 0,020	—	—	0,05 to 0,10	0,20 to 0,30	—	N< 0,010 B: 0,0015 to 0,0070
—	50,04	≤ 0,30c	—	—	—	—	—
—	≤ 0,040	≤ 0,30c	—	—	—	—	—
≤0,40	50,04	≤ 0,30c	0,06 to 0,10	—	0,18 to 0,25	—	N: 0,030 to 0,070
≤0,40	≤ 0,040	—	0,04 to 0,09	—	0,15 to 0,25	—	N: 0,030 to 0,070 B: 0,001 to 0.006 W: 1,50 to 2,00
0,10 to 0,40	≤ 0,040	—	0,06 to 0,10	—	0,18 to 0,25	—	N: 0,050 to 0,090 B: 0,000 5 to 0,005 W: 0,90 to 1,10
0,30 to 0,80	≤ 0,040	≤ 0,30c	—	—	0,25 to 0,35	—	—

## Dimensional Range acc. to ASTM A106-13

OD mm	Wall Thickness, mm																								
	1,65	2,0	3,0	3,5	4,0	4,5	5,0	5,6	6,3	7,1	8,0	8,8	10,0	11,0	12,5	14,2	16,0	17,5	20,0	22,2	25,0	28,0	30,0		
10,3																									
13,7																									
17,1																									
21,3																									
26,7																									
33,4																									
42,4																									
44,5																									
48,3																									
51,0																									
54,3																									
57,0																									
60,3																									
63,5																									
70,0																									
73,0																									
76,1																									
82,5																									
88,9																									
101,6																									
108,0																									
114,3																									
127,0																									
133,0																									
139,7																									
141,3																									
152,4																									
159,0																									
168,3																									
177,8																									
193,7																									
219,1																									
244,5																									
273,0																									
323,9																									
355,6																									
406,4																									

TMK Scheduled

- Cold drawn
- Hot Rolled

## Correlation Between DIN EN and ASTM Grades

EN	ASTM					
DIN EN 10216-2	A 106	A 179	A 192	A 210	A 213	A 335
P195GH	Grade A	low carbon	low carbon			
P235GH						
P265GH	Grade B			Grade A1		
	Grade C			Grade C		
20MnNb6						
16Mo3						P1
8MoB5-4						
14MoV6-3						
10CrMo5-5					T11	P11
13CrMo4-5					T12	P12
10CrMo9-10					T22	P22
11CrMo9-10						
25CrMo4						
20CrMoV 13-5-5						
15NiCuMoNb5-6-4					T36	P36
7CrWVMoNb9-6						
7CrMoVTiB10-10						
X11CrMo5+I					T5	P5
XUCrMo5+NT1						
XHCrMo5+NT2						
X11CrMo9-1+I					T9	P9
X11CrMo9-1+NT						
X10CrMoVNb9-1					T91	P91
X10CrWMoVNb9-2					T92	P92
X11CrMoWVNb9-1-1					T911	P911
X20CrMoVLL-L						

## Mechanical Properties of Stainless Steel Tubes according to ASTM A213-14

Grade	UNS Designation	Tensile strength ksi (MPa) minimum	Yield strength ksi (MPa) minimum	Elongation in 2 in (50 mm) % minimum	Hardness, maximum	
					Brinell/Vickers	Rockwell
TP 304	S30400	75 (515)	30(205)	35	192HBW / 200HV	90 HRB
TP 304L	S30403	70(485)	25 (170)	35	192HBW / 200HV	90 HRB
TP 316	S31600	75 (515)	30(205)	35	192HBW / 200HV	90 HRB
TP 316L	S31603	70(485)	25 (170)	35	192HBW / 200HV	90 HRB

Marking is according to the standards and customers' requests.

## Mechanical Properties of Stainless Steel Tubes according to ASTM A312-14

Grade	UNS Designation	Tensile strength ksi (MPa) minimum	Yield strength ksi (MPa) minimum	Elongation in 2 in (50 mm) %, minimum	
				longitudinal	transverse
TP 304	S30400	75(515)	30(205)	35	25
TP 304L	S30403	70 (485)	25 (170)	35	25
TP 316L	S31603	70 (485)	25 (170)	35	25
TP 321	S32100				
≤ 3/8 in.		75(515)	30(205)	35	25
> 3/8 in.		70 (485)	25 (170)	35	25

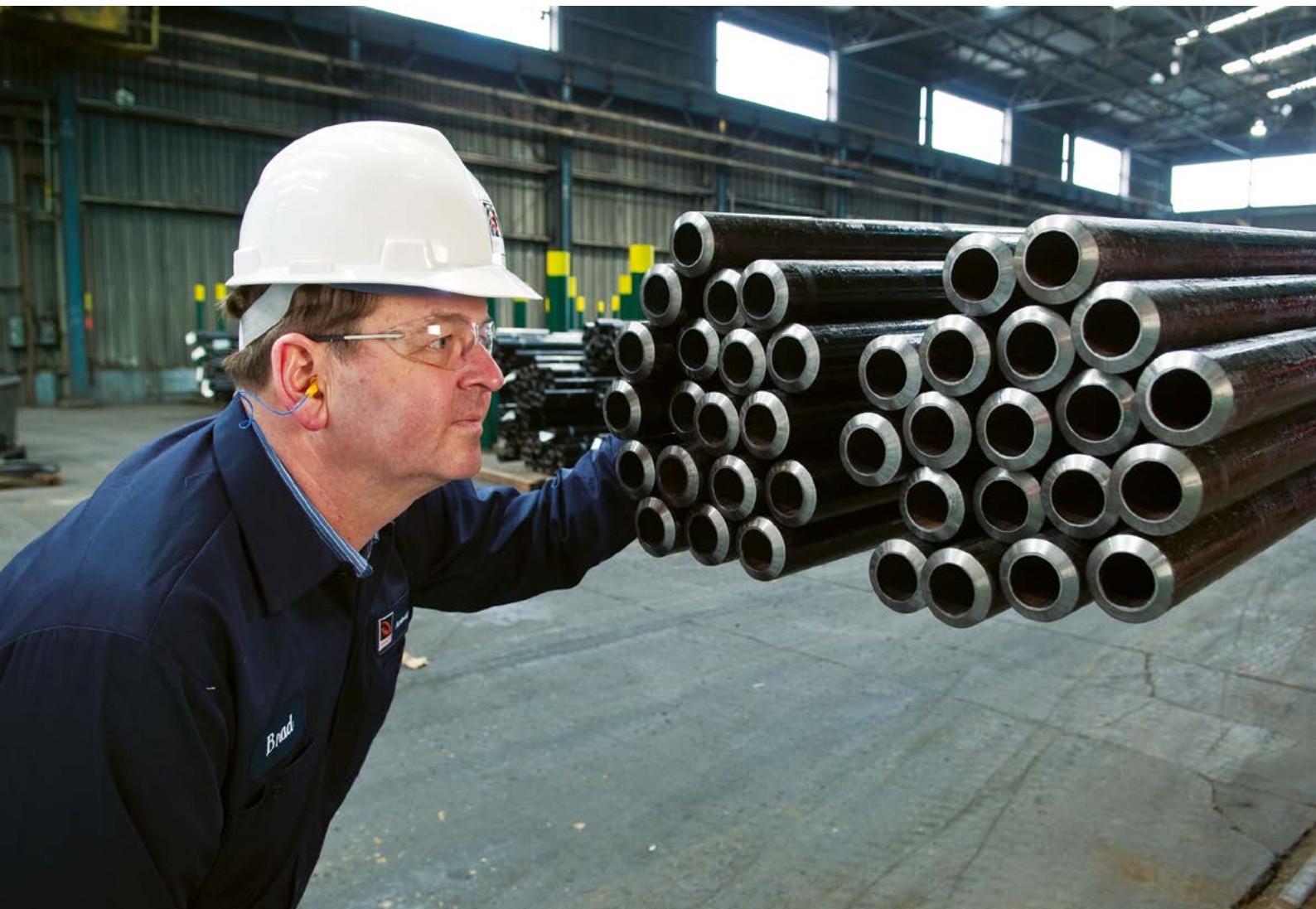
Marking is according to the standards and customers' requests.

## Mechanical Properties of Stainless Steel Tubes according to DIN EN 10216-5

Steel grade		Tensile testing at room temperature					Impact strength KV J, minimum			Heat treatment		Intergranular corrosion resistance
Grade designation	Material number	Yield strength		Tensile strength MPa	Elongation A% minimum		At room temperature °C		at -196 °C	Temperature for solid solution	Cooling media	
		Rp 0,2 MPa minimum	Rp 0,2 MPa minimum		longitud.	transverse	longitud.	transverse				
X2CrNi19-11	1,430	180	215	460-680	40	35	100	60	60	1000-1100	w,a	
X5CrNi18-10	1,4301	195	230	500-700	40	35	100	60	60	1000-1100	w,a	
X6CrNiTi1810	1,4541	180	215	460-680	35	30	100	60	60	1020-1120	w,a	
X2CrNiMo17-12-2	1,4404	190	225	490-690	40	30	100	60	60	1020-1120	w,a	
X5CrNiMo17-12-2	1,4401	205	240	510-710	40	30	100	60	60	1020-1120	w,a	

w - water, a – air for sufficiently rapid cooling

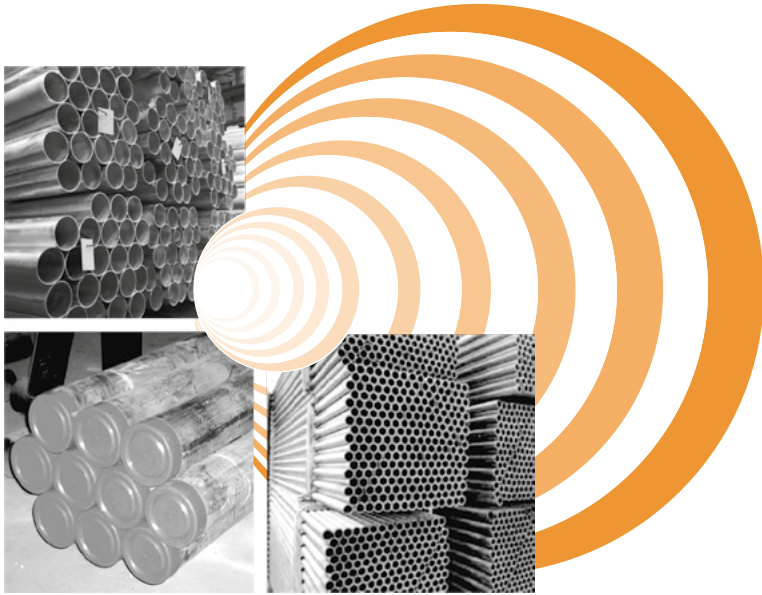
Marking is according to the standards and customers' requests.











## Mechanical Tube

TMK produces hot-rolled and cold-drawn mechanical tubes made of non-alloy, alloy and stainless steel that meet or exceed various international standards including, ASTM A519 and ASTM A511. Mechanical pipe can be produced according to customer specifications for dimensions and tolerances, including precise tolerances for wall thickness (+/- 6%) and for outside diameter (+/- 0.5%), as well as heavy weight pipes with WT up to 67 mm. Isothermal annealing and outside surface peeling and grinding services are available.

### Producers

Plant Location	Standards	OD, mm	WT, mm	Method
Volzhsky Pipe Plant /Russia/	DIN EN 10297-1, ASTM A519	57 - 245	6 - 50,0	Seamless, hot rolled
	DIN EN 10297-2	57 - 245	6 - 50,0	Seamless stainless
Seversky Tube Works /Russia/	EN 10296-1	21.3 - 76.1	2.9 - 8.0	ERW
Sinarsky Pipe Plant /Russia/	DIN EN 10305-1	12.0 - 46.0	1.5 - 5.0	Seamless, cold drawn
	ASTM A511	21.3 - 33.4	2.77 - 3.38	Seamless stainless
Artrom /Romania/	EN 10297-1, ASTM A519	21.3 - 229	2.3 - 60	Seamless hot rolled
Artrom /Romania/	DIN EN 10305-1	15 - 210	1.5 - 20	Seamless cold drawn

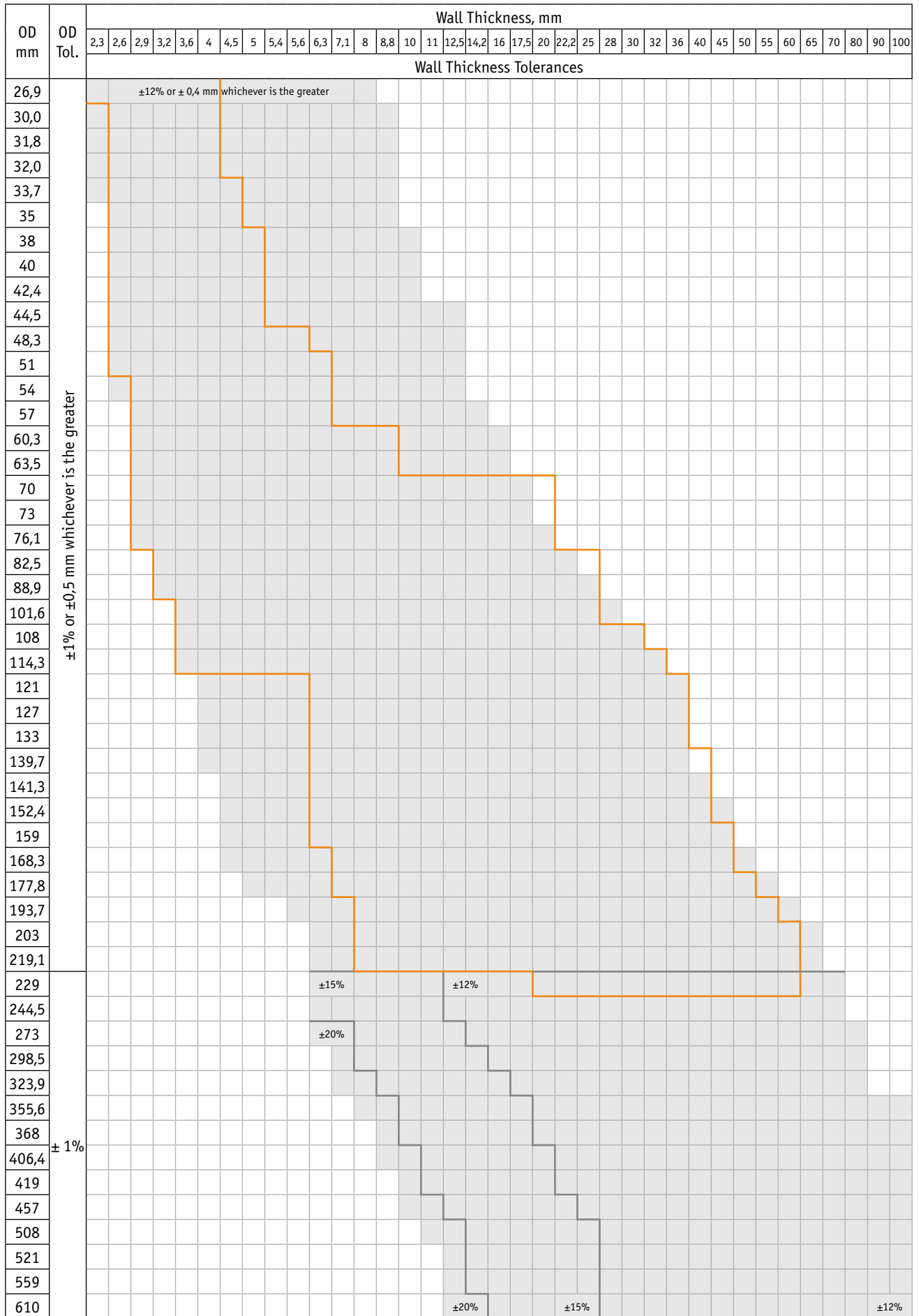
## List of Standards and Ranges for Mechanical Application

Specification	OD, mm	WT, mm	Steel Grade
<b>DIN EN 10296-1</b> Welded circular steel tubes for mechanical and general engineering purposes; Non-alloy and alloy steel tubes	21,3 - 219,1	2,9 - 8,0	E155, E190, E195, E220, E235, E260, E275, E320, E355, E370
<b>DIN EN 10297-1</b> Seamless circular steel tubes for mechanical and general engineering purposes; Non-alloy and alloy steel tubes	26,9-245	2,3-60	E235, E355, E470 and others according to standards
<b>DIN EN 10297-2</b> Seamless steel tubes for mechanical and general engineering purposes; Stainless steel	57-245	4-28	X6CRNiTi1810 and others according to standards
<b>DIN EN 10305-1</b> Steel tubes for precision applications; Seamless cold drawn tubes	12-210	1,0-20	E235, E355
<b>ASTM A 511</b> Seamless Stainless Steel Mechanical Tubes	21,3 - 33,4	2,77 - 3,38	MT316, MT 321

## Mechanical Properties DIN EN 10297-1

Steel Grade	Delivery Condition	Minimum Yield Strength $R_{eHr}$ , MPa		Minimum Tensile Strength $R_m$ , Mpa		Minimum Elongation $A_v$ , %								
		<16	>6...40	>40...80	≤16	>16...40	>40...80	≤16		>16...40		>40...80		
							l	t	l	t	l	t	l	t
C22E	N	240	210	210	430	410	24	22	25	23	25	23	25	23
C35E	N	300	270	270	550	520	18	16	19	17	19	17	19	17
C45E	N	340	305	305	620	580	14	12	16	14	16	14	16	14
C60E	N	390	350	340	710	670	10	8	11	9	11	9	11	9
38Mn6	N	400	380	360	670	620	14	12	15	13	15	13	16	14

# Dimensional Range acc. to EN 10297-1



— TMK Scheduled

## Mechanical Properties DIN EN 10297-1

Steel Grade	Delivery Condition	Minimum Yield Strength R <sub>eyf</sub> MPa			Minimum Tensile Strength R <sub>m</sub> Mpa			Minimum Elongation A, %									
		≤8	>8...20	>20...50	>50...80	≤8	>8...20	>20...50	>50...80	≤8		>8...20		>20...50		>50...80	
										l	t	l	t	l	t	l	t
C22E	QT	340	290	270	260	500	470	440	420	20	18	22	20	22	20	22	20
C35E	QT	430	380	320	290	630	600	550	500	17	15	19	17	20	18	20	18
C45E	QT	490	430	370	340	700	650	600	600	14	12	16	14	17	15	17	15
C60E	QT	580	520	450	420	850	800	750	710	11	9	13	11	14	12	14	12
38Mn6	QT	620	570	470	400	850	750	650	550	13	11	14	12	15	13	16	14
41Cr4	QT	800	660	560	-	1000	900	800	-	11	9	12	10	14	12	-	-
25CrMo4	QT	700	600	450	400	900	800	700	650	12	10	14	12	15	13	16	14
30CrMo4	QT	750	630	520	480	950	850	750	700	12	10	13	11	14	12	15	13
34CrMo4	QT	800	650	550	500	1000	900	800	750	11	9	12	10	14	12	15	13
42CrMo4	QT	900	750	650	550	1100	1000	900	800	10	8	11	9	12	10	13	11
36CrNiMo4	QT	900	800	700	600	1100	1000	900	800	10	8	11	9	12	10	13	11
30CrNiMo8	QT	1050	1050	900	800	1250	1250	1100	1000	9	7	9	7	10	8	11	9
41 NiCrMo7-3-2	QT	950	870	800	750	1150	1050	1000	900	9	7	10	8	11	9	12	10

Steel Grade	Delivery Condition	Minimum Yield Strength R <sub>eyf</sub> MPa						Minimum Tensile Strength R <sub>m</sub> Mpa						Minimum Elongation A, %			Minimum Impact Strength KV, t -20 °C		
		≤16	>16...40	>40...65	>65...80	>80...100	≤16	>16...40	>40...65	>65...80	≤16	>16...40	>40...65	>65...80	Minimum Elongation A, %		Minimum Impact Strength KV, t -20 °C		
															l	t	l	t	
E235	ARorN	235	225	215	205	195	360	360	360	360	360	360	340	25	23				
E275	ARorN	275	265	255	245	235	410	410	410	410	410	410	380	22	20				
E315	ARorN	315	305	295	280	270	450	450	450	450	450	420	21	19					
E355	ARorN	355	345	335	315	295	490	490	490	490	490	470	20	18					
E470	AR	470	430	-	-	-	650	600	600	600	-	-	-	17	15				
E275K2	N	275	265	255	245	235	410	410	410	410	410	380	22	20	40	27			
E355K2	N	355	345	335	315	295	490	490	490	490	470	470	20	18	40	27			
E420J2	N	420	400	390	370	360	600	560	530	530	500	500	19	17	27	20			
E460K2	N	460	440	430	410	390	550	550	550	550	520	520	19	17	40	27			
E590K2	QT	590	540	480	455	420	700	650	570	570	520	520	16	14	40	27			
E730K2	QT	730	670	620	580	540	790	750	700	700	680	680	15	13	40	27			

Orientation: l - longitudinal; t - transversal

## Chemical Composition DIN EN 10297-1

Steel Grade	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	N	Nb	Ti	V
E235	≤0,17	≤0,35	≤1,2	≤0,03	≤0,035									
E275	≤0,21	≤0,35	≤1,4	≤0,03	≤0,035									
E315	≤0,21	≤0,3	≤1,5	≤0,03	≤0,035									
E355	≤0,22	≤0,55	≤1,6	≤0,03	≤0,035									
E470	0,16 - 0,22	0,1 - 0,5	1,3 - 1,7	≤0,03	≤0,035				> 0,010		≤0,020	≤0,07		0,08 - 0,15
E275K2	≤0,2	≤0,4	0,5 - 1,4	≤0,03	≤0,03	≤0,3	≤0,1	≤0,3	>0,02	≤0,35	≤0,015	≤0,05	≤0,03	≤0,05
E355K2	≤0,2	≤0,5	0,9 - 1,65	≤0,03	≤0,03	≤0,3	≤0,1	≤0,5	>0,02	≤0,35	≤0,015	≤0,05	≤0,05	≤0,12
E420J2	0,16 - 0,22	0,1 - 0,5	1,3 - 1,7	≤0,03	≤0,035	≤0,3	≤0,08	≤0,4	>0,01	≤0,3	≤0,02	≤0,07	≤0,05	0,08 - 0,15
E460K2	≤0,2	≤0,6	1 - 1,7	≤0,03	≤0,03	≤0,3	≤0,1	≤0,8	>0,02	≤0,7	≤0,025	≤0,05	≤0,05	≤0,2
E590K2	0,16 - 0,22	0,1 - 0,5	1,3 - 1,7	≤0,03	≤0,035	≤0,3	≤0,08	≤0,4	>0,01	≤0,3	≤0,02	≤0,07	≤0,05	0,08
E730K2	≤0,2	≤0,5	1,4 - 1,7	≤0,025	≤0,025	≤0,3	0,3 - 0,45	0,3 - 0,7	>0,02	≤0,2	≤0,02	≤0,05	≤0,05	≤0,12
C22E	0,17 - 0,24	≤0,4	0,4 - 0,7	≤0,035	≤0,035									
C35E	0,32 - 0,39	≤0,4	0,5 - 0,8	≤0,035	≤0,035									
C45E	0,42 - 0,5	≤0,4	0,5 - 0,8	≤0,035	≤0,035									
C60E	0,57 - 0,65	≤0,4	0,6 - 0,9	≤0,035	≤0,035									
38Mn6	0,34 - 0,42	0,15 - 0,35	1,4 - 1,65	≤0,035	≤0,035									
41Cr4	0,38 - 0,45	≤0,4	0,6 - 0,9	≤0,035	≤0,035	0,9 - 1,2	-							
25CrMo4	0,22 - 0,29	≤0,4	0,6 - 0,9	≤0,035	≤0,035	0,9 - 1,2	0,15 - 0,3							
30CrMo4	0,27 - 0,34	≤0,35	0,35 - 0,6	≤0,035	≤0,035	0,8 - 1,15	0,15 - 0,3							
34CrMo4	0,3 - 0,37	≤0,4	0,6 - 0,9	≤0,035	≤0,035	0,9 - 1,2	0,15 - 0,3							
42CrMo4	0,38 - 0,45	≤0,4	0,6 - 0,9	≤0,035	≤0,035	0,9 - 1,2	0,15 - 0,3							
36CrNiMo4	0,32 - 0,4	≤0,4	0,5 - 0,8	≤0,035	≤0,035	0,9 - 1,2	0,15 - 0,3	0,9 - 1,2						
30CrNiMo8	0,26 - 0,34	≤0,4	0,3 - 0,6	≤0,035	≤0,035	1,8 - 2,2	0,3 - 0,5	1,8 - 2,2						
41NiCrMo7-3-2	0,38 - 0,44	≤0,3	0,6 - 0,9	0,025	0,025	0,7 - 0,9	0,15 - 0,3	1,65 - 2						

# Dimensional Range and Tolerances acc. to DIN EN 10305-1

OD mm	OD Tol.	Wall Thickness, mm																									
		0,5	0,8	1	1,2	1,5	1,8	2	2,2	2,5	2,8	3	3,5	4	4,5	5	5,5	6	7	8	9	10	12	14	16	18	20
		Inside Diameter tolerances																									
4	±0,15	±0,15																									
5																											
6																											
7																											
8		±0,25																									
9																											
10																											
12																											
14	±0,08	±0,08																									
15																											
16																											
18																											
20																											
22																											
25																											
26																											
28																											
30		±0,08																									
32	±0,15	±0,15																									
35		±0,25																									
38																											
40		±0,15																									
42																											
45	±0,20	±0,20																									
48																											
50		±0,20																									
55	±0,25	±0,25																									
60		±0,25																									
65	±0,30	±0,30																									
70		±0,30																									
75	±0,35	±0,35																									
80		±0,35																									
85	±0,40	±0,40																									
90		±0,40																									
95		±0,45																									
100	±0,45	±0,45																									
110		±0,50																									
120	±0,50	±0,50																									
130		±0,70																									
140	±0,70	±0,70																									
150		±0,90																									
160	±0,90	±0,90																									
170		±0,90																									
180		±0,90																									
190	±1,00	±1,00																									
200		±1,00																									
220	±1,20	±1,20																									
240		±1,20																									
260	±1,30	±1,30																									

— TMK Scheduled

## Mechanical Properties DIN EN 10305-1

Steel Grade	Material Number	C		LC		SR			A		N		
		R <sub>m</sub> MPa, not less	A %, not less	R <sub>m</sub> MPa, not less	A %, not less	R <sub>m</sub> MPa, not less	R <sub>eH</sub> MPa, not less	A %, not less	R <sub>m</sub> MPa, not less	A %, not less	R <sub>m</sub> MPa	R <sub>eH</sub> MPa, not less	A %, not less
E215	1,021	430	8	380	12	380	280	16	280	30	290-430	215	30
E235	1,030	480	6	420	10	420	350	16	315	25	340-480	235	25
E255	1,040	580	5	520	8	520	375	12	390	21	440 - 570	255	21
E355	1,058	640	4	580	7	580	450	10	450	22	490-630	355	22
E410	1,050	750	4	620	8	690	590	12	520	22	550 - 700	410	22
26Mn5	1,116	700	4	650	7	—	—	—	—	—	—	—	—
C35E	1,118	590	5	540	7	—	—	—	440	22	>460	280	21
C45E	1,119	720	4	670	6	—	—	—	510	20	>540	340	18
26Mo2	1,541	720	4	670	6	—	—	—	—	—	—	—	—
25CrMo4	1,721	720	4	670	6	—	—	—	—	—	—	—	—
42CrMo4	1,722	720	4	670	6	—	—	—	—	—	—	—	—
10S10	1,071	510	8	—	—	440	370	16	—	—	360 - 500	240	25
15S10	1,071	550	7	—	—	490	415	14	—	—	380 - 540	260	22
18S10	1,071	650	6	—	—	600	520	12	—	—	520 - 650	360	22
37S10	1,071	720	4	—	—	700	630	12	—	—	650 - 720	420	16

## Chemical Composition DIN EN 10305-1

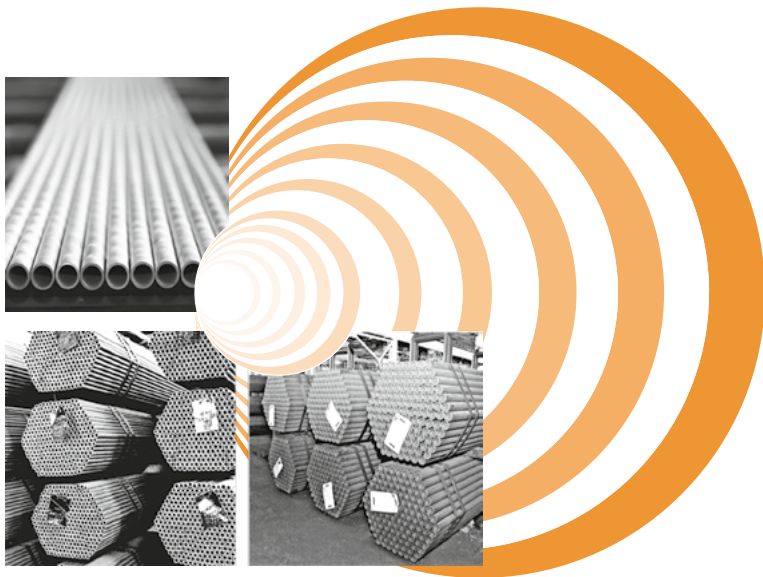
Steel Grade	Material Number	%										
		C	Si	Mn	P, not less	S	Cr	Mo	V	Others	Cr+Mo+Ni	
E215	1,021	≤0,1	≤0,05	≤0,7	0,025	≤ 0,025					≤ 0,025 Al	
E235	1,030	≤0,17	≤0,35	≤1,2	0,025	≤ 0,025					≤ 0,025 Al	
E255	1,040	≤0,21	≤0,35	40 -1,10	0,025	≤ 0,025	—	—	—	—	—	—
E355	1,058	≤0,22	≤0,55	≤1,6	0,025	≤ 0,025					≤ 0,025 Al	
E410	1,050	0,16-0,22	0,10-0,50	1,30-1,70	0,03	≤ 0,035			0,08-0,15	0,010-0,060 Al ≤0,07Nb ≤0,05 Ti		
26Mn5	1,116	0,20-0,30	≤0,40	1,20-1,50	0,035	≤ 0,035	—	—	—	—	—	—
C35E	1,118	0,32-0,39	≤0,40	0,50-0,80	0,035	≤ 0,035	≤0,40	≤0,10	—	—	—	≤ 0,63
C45E	1,119	0,42-0,55	≤0,40	0,50-0,80	0,035	≤ 0,035	≤0,40	≤0,10	—	—	—	≤ 0,63
26Mo2	1,541	0,22-0,29	≤0,40	≤1,50	0,035	≤ 0,035	—	0,15-0,25	—	—	≤ 0,40 Ni	—
25CrMo4	1,721	0,22-0,29	≤0,40	0,60-0,90	0,035	≤ 0,035	0,90-1,20	0,15-0,30	—	—	—	—
42CrMo4	1,722	0,38-0,45	≤0,40	0,60-0,90	0,035	≤ 0,035	0,90-1,20	0,15-0,30	—	—	—	—
10S10	1,071	≤ 0,12	0,10-0,35	0,75-1,10	0,03	0,08-0,13	—	—	—	—	—	—
15S10	1,071	0,12-0,18	0,10-0,35	0,70-1,10	0,03	0,07-0,13	—	—	—	—	—	—
18S10	1,071	0,14-0,20	0,10-0,35	1,30-1,60	0,03	0,08-0,13	—	—	—	—	—	—
37S10	1,071	0,32-0,39	0,10-0,35	1,35-1,65	0,03	0,07-0,13	—	—	—	—	—	—

Nb + V: ≤ 0,20%

Nb, Ti and V upon request







## Structurals and Standard Pipe

TMK produces hot finished structural hollow sections of non-alloy and fine grain steel according to the standard DIN EN 10210-1,2 and cold-formed seamless and welded carbon steel structural tubing in rounds in accordance with ASTM A500.

For standard uses such as steam, gas and water supply, TMK manufactures seamless and welded tube and pipe according to ASTM A53, EN 10208-1,2, DIN EN 10224 and EN 10255 specifications.

### Producers

Plant Location	Standards	OD	Wall Thickness	Method
<b>Structurals</b>				
Volzhsky Pipe Plant /Russia/	EN 10210 1,2	57 - 245 mm	6,0 - 50 mm	Seamless, hot rolled
Sinarsky Pipe Plant /Russia/	EN 10210 1,2	33,7 - 168,3 mm	2,9 - 16 mm	Seamless, hot rolled
	ASTM A500	23 - 76 mm	2,0 - 10 mm	Seamless, cold drawn
TAGMET /Russia/	EN 10210 1	114,3 - 273 mm	8,0 - 20 mm	Seamless hot rolled
Artrom /Romania/	EN 10210-1,2	21,3 - 219,1 mm	2,3 - 60 mm	Seamless hot rolled
<b>Standard pipe</b>				
Volzhsky Pipe Plant /Russia/	ASTM A53	219,1 - 406,4 mm	7,92 - 34,8 mm	Seamless
Seversky Tube Works /Russia/	ASTM A53	219,1-323,8 mm	7,92 - 23,32 mm	Seamless
	EN 10208-1, 10255, 10224, ASTM A53	21,3 - 530 mm	2,9 - 13 mm	ERW
Sinarsky Pipe Plant /Russia/	EN 10255	33,7 - 88,9 mm	4,05 - 4,85 mm	Seamless, hot rolled
	EN 10255, ASTM A53	10,2 - 76,1 mm	1,73 - 9,53 mm	Seamless, cold drawn
TAGMET /Russia/	EN 10255	21,3 - 60,3 mm	2,65 - 3,65 mm	ERW
Artrom /Romania/	ASTM A53	21,3 - 219,1 mm	2,3 - 25,4 mm	Seamless hot rolled
	EN 10255	21,3 - 114,3 mm	2,3 - 5,4 mm	Seamless hot rolled
	EN 10208-1,2	21,3 - 219,1 mm	2,3 - 60 mm	Seamless hot rolled

## List of Standards and Ranges for Structural and Standard Application

Standarts	OD	WT	Steel Grade
Structurals			
<b>DIN EN 10210-1</b> Hot finished structural hollow sections of nonalloy and fine grain steels - Part 1: Technical delivery conditions <b>DIN EN 10210-2</b> Hot finished structural hollow sections of non-alloy and fine grain steels - Part 2: Tolerances, dimensions and sectional properties	21,3 - 273	2,3 - 60	S235JRH; S275J0H; S275J2H; S355J0H; S355J2H; S355K2H
<b>ASTM A500-13</b> Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes	23 - 76	2-10	Grade A, Grade B, Grade C, Grade D
<b>DIN EN 10210-1</b> Hot finished structural hollow sections of nonalloy and fine grain steels - Part 1: Technical delivery conditions	10,2 - 193,7	0 C\J CD rH	St 37.2, St 44.2, St 52.3, St 37.3, St 44.3
<b>DIN EN 10210-1</b> Hot finished structural hollow sections of nonalloy and fine grain steels - Part 1: Technical delivery conditions	21,3 - 229	2,3 - 60	St 52.3
Standard pipe			
<b>ASTM A53-12</b> Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless	21,3 - 530	2,3 - 34,8	Grade A, Grade B
<b>DIN EN 10224</b> Non-alloy steel tubes and fittings for the conveyance of water and other aqueous liquids - Technical delivery conditions	21,3-219,1	2,9 - 8,0	L235, L275, L355
<b>DIN EN 10208</b> P1 STEEL PIPES FOR PIPE LINES FOR COMBUSTIBLE FLUIDS; TECHNICAL DELIVERY CONDITIONS; PART 1: PIPES OF REQUIREMENT CLASS A	21,3 - 508	2,76 - 25,4	L210GA, L235GA, L245GA, L290GA, L360GA
<b>DIN EN 10255</b> NON-ALLOY STEEL TUBES SUITABLE FOR WELDING AND THREADING - TECHNICAL DELIVERY CONDITIONS	10,2 - 114,3	2,0 - 5,4	S195T

## Chemical Compositon DIN EN 10210

Steel Grade	Material Number	Contents %, not less						
		C WT, mm		Si	Mn	P	S	N
		≤40	>40 ≤120					
S235JRH	1,003	0,17	0,2	-	1,4	0,04	0,04	0,009
S275J0H	1,014	0,2	0,22	-	1,5	0,035	0,035	0,009
S275J2H	1,013	0,2	0,22	-	1,5	0,03	0,03	-
S355J0H	1,054	0,22	0,22	0,55	1,6	0,035	0,035	0,009
S355J2H	1,057	0,22	0,22	0,55	1,6	0,03	0,03	-
S355K2H	1,051	0,22	0,22	0,55	1,6	0,03	0,03	-

Steel Grade	Material Number	Carbon Equivalent, CEV, %, not less			
		WT, mm			
		≤16	>16 ≤40	>40 ≤65	>65 ≤ 120
S235JRH	1,003	0,37	0,39	0,41	0,44
S275J0H	1,014	0,41	0,43	0,45	0,48
S275J2H	1,013	0,41	0,43	0,45	0,48
S355J0H	1,054	0,45	0,47	0,5	0,53
S355J2H	1,057	0,45	0,47	0,5	0,53
S35K2H	1,051	0,45	0,47	0,5	0,53

## Mechanical Properties DIN EN 10210

Steel Grade	Material Number	Yield Strength ReH Mpa, not less						Tensile Strength Rm, Mpa			Elongation %, not less			Impact Strength, not less			
		Wall thickness, mm						Wall thickness, mm			Wall thickness, mm			T, °C			
		<16	>16 <40	>40 <63	>63 <80	>80 <100	>100 <120	<3	>3 <65	>100 <120	<40	>40 <63	>63 <80	>100 <120	-20	0	20
S235JRH	1,003	235	225	215	215	215	195	360-510	360-510	350-500	26	25	24	22	-	-	27
S275J0H	1,014	275	265	255	245	235	225	430-580	410-560	400-540	23	22	21	19	-	27	-
S275J2H	1,013																
S355J0H	1,054	355	345	335	325	315	295	510-680	470-630	450-600	22	21	20	18	-	27	-
S355J2H	1,057																
S355K2H	1,051													40	-	-	-

**Dimensional Range acc. to DIN EN 10210-1,2**

OD	Wall Thickness, mm																											
	2,3	2,6	3,2	3,6	4,0	4,5	5,0	5,6	6,3	7,1	8,0	8,8	10,0	11,0	12,5	14,2	16,0	20,0	25,0	30,0	32,0	40,0	45,5	50,0	55,0	60,0		
mm																												
21,3																												
26,9																												
33,7-38,0																												
42,4-44,5																												
48,3-51,0																												
57,0																												
60,3																												
63,5-76,1																												
82,5																												
88,9																												
101,6-108,0																												
114,3																												
121,0																												
127-141,3																												
152,4-159,0																												
168,3																												
177,8																												
193,7																												
219,1																												
244,5																												
273,0																												



## Vacuum Insulated Tubing

### MANUFACTURER

SinTZ

### APPLICATION OF VIT

Vacuum insulated tubing (VIT) is designed for production of oil and gas in the permafrost – it prevents thawing, and, therefore, destruction of the infrastructure of the well. It also prevents formation of paraffin and gas hydrate plugs caused by the temperature drop of the produced fluid in the upper part of the well. VIT is also used in thermal recovery of hydrocarbons, in particular, in steam treatment of heavy (high-viscosity) oil in order to enhance the flow rate of the well.

### DISTINCTIVE FEATURES

Vacuum insulated tubing consists of two pipes with one pipe (the internal pipe) placed into the other (the external supporting pipe). The pipes are welded together, a multilayer shield insulation is placed into the vacuum-tight annular space and high vacuum is created to reduce heat loss. Design and production engineering was carried out in cooperation with RosNITI, Gazprom VNIIGAZ and TMK-Premium Service. Threaded connections with a coupling, including premium connections, and coupling inserts made of heat-insulating material are used in the VIT string assembly.

TMK has developed and manufactured cold-resistant VIT and VIT made of martensitic steel, type 13CrS, which is resistant to media with high CO<sub>2</sub> content (TU 14-161-239-2012 and TU 14-161-240-2018). The field trials of these products were successful and the pipes were approved for commercial operation.

Design and production engineering of the following types of vacuum insulated tubing is underway:

- 1) VIT for development of oil and gas fields located in the most challenging oil and gas production conditions of the permafrost that are characterized by high viscosity or paraffin deposition of the extracted hydrocarbons. This type of VIT is used to prevent thawing in the annular space of the well and to prevent destruction of the infrastructure of the well. It also prevents formation of paraffin and gas hydrate plugs in the upper part of the well.



2) VIT for thermal recovery of hydrocarbons, in particular, for steam treatment of heavy (high-viscosity) oil in order to enhance the flow rate of the well. These production methods require injection of a heat carrier with a high temperature of up to 350°C into the well.

3) VIT Light – a non-vacuum design with shield thermal insulation in the annular space. This product is used in the field to transport the fluid with temperature of up to 180°C.

4) VIT with internal supporting pipe and a threaded connection with a coupling, or with integral joints on both the external and the internal pipe.

## STANDARDS

Title of the technical guidance document	Pipe size		Grade	Thread
	Diameter of the external pipe (wall thickness), mm	Diameter of the internal pipe (wall thickness), mm		
<b>TU 14-161-239-2012</b> Vacuum insulated tubing and couplings of martensitic steels, 13Cr and super 13Cr types, with TMK GF, TMK CS, TMK FMT and TMK PF (tubing) gas-tight threaded connections for the fields of PAO Gazprom*	6 5/8 (0.352)	4 1/2 (0.290)	L80 type 13Cr L80 type 13CrS P110 type 13CrS P110 type 13CrSL	TMK CS TMK UP GF TMK UP FMT TMK UP PF (Tubing)
	4 1/2 (0.271)	2 7/8 (0.217)		
<b>TU 14-161-240-2018</b> Cold-resistant vacuum insulated tubing and couplings with gas-tight threaded connections for the fields of PAO Gazprom*	6 5/8 (0.352)	4 1/2 (0.271)	L80 type 1 external / J55LT internal	TMK CS TMK UP GF TMK UP FMT
	4 1/2 (0.271)	2 7/8 (0.217)	N80LT	
	3 1/2 (0.254)	2 3/8 (0.190)		
<b>TU 14-161-249-2015</b> Field vacuum insulated tubing designed to prevent thawing of the permafrost during production and heat carrier injection**	3 1/2 (0.256)	2 3/8 (0.197)	Д, К, Е, Л, М, Р (D, K, E, L, M, P)	Plain-end tubing thread as per GOST 633
<b>TU 14-161-250-2015</b> Downhole vacuum insulated tubing for oilfields developed by thermal recovery methods***	6 5/8 (0.352/0.350)	4 1/2 (0.271/0.276)	J55 K55 K72 L80 type 1 N80 type Q R95 P110 as per GOST R 53366	Tubing as per GOST 31446 Buttress as per GOST R 51906 Tubing as per GOST 633 Tubing with long thread as per TU 14-161-232 TMK UP CWB TMK UP PF
	5 (0.296/0.295)	3 1/2 (0.254/0.256)		
	4 1/2 (0.271/0.276)	3 1/2 (0.254/0.256)		
	4 1/2 (0.250/0.252)	3 1/2 (0.254/0.256)		
	4 1/2 (0.271/0.276)	2 7/8 (0.217)		
	4 1/2 (0.250/0.252)	2 7/8 (0.217)		
	4 (0.262/0.256)	2 7/8 (0.217)		
	3 1/2 (0.254/0.256)	2 3/8 (0.190/0.197)		
3 1/2 (0.254/0.256)	1.900 (0.157)			

\* Pipe length from 10.0 to 11.7 m

\*\* Pipe length from 8.5 to 10.5 m

\*\*\* Pipe length from 6.0 to 11.7 m



**Semi-finished Steel Products**



# Continuous Cast Billets

## Geometric Parameters

Mill	Nom. size	Max. tolerances	Difference between diagonals/Ovality	Length	Length tolerance	Streightness deviation %	Streightcut deviation
1	240 x 240 mm	±7.0 mm	±9.8 mm	4,1 - 8.1 m	±50.0 mm	0.3	8.0
1	300 x 300 mm	±8.0 mm	±11.2 mm				15.0
1	360 x 360 mm	±10.0 mm	±14.0 mm				15.0
R	260 x 340 mm	±5.2 x ±6.8mm	±5.0 mm	4 - 10.5 m	+0/-100 mm*	0.5	7.0
2 4	∅ 150 mm	+3.0/-5.0 mm ±3/-5 mm	ε 8.0 mm ε 8.0 mm	5.6 - 12 m 4.5 - 12 m	+70/-0 mm +70/-10.0 mm	0.3	7.0 7.0
1 2	∅ 156 mm	+4.0/-5.0 mm +3.0/-5.0 mm	ε 9.0mm ε 8.0 mm	9 - 11.3 m 5.6 - 12 m	±50.0 or +100.0/-0* +70/-0.0	0.3	7.0 7.0
R	∅ 177 mm	+2.0/-4.0 mm	ε 2/3 of the ultimate O.D. deviation	4-10.5 m	+0/-100 mm*	0.4	7.0
1	∅ 196 mm	+4.0/-5.0 mm	ε 9.0 mm	8 - 11.3 m	±50.0 or +100.0/-0*	0.3	7.0
4	∅ 210 mm	±3.0 mm	ε 3.0 mm	4.5 - 12 m	+55 mm	0.3	6.0
R	∅ 220mm	+3.0/-4.0 mm	ε 2/3 of the ultimate O.D. deviation	4-10.5 m	+0/-100 mm*	0.4	7.0
1	∅ 228 mm	+4.0/-5.0 mm	ε 9.0mm	6 - 11.5 m	±50.0 or +100.0/-0*	0.3	7.0
1	∅ 260 mm	+4.0/-5.0 mm	**	6 - 11.5 m	±50.0 or ±100.0/-0*	0.3	7.0
R	∅ 280 mm	+3.0/-5.0 mm	ε 2/3 of the ultimate O.D. deviation	4-10.5 m	+0/-100 mm*	0.4	7.0
4	∅ 300 mm	±3.0 mm	ε 3.0 mm	3.5 - 12 m	+55 mm	0.3	7.0
1 4	∅ 340 mm	±5.0 mm ±4.0 mm	ε 3/4 of the ultimate O.D. deviation ε 7.0 mm	4 - 11 m 3.5 -12 m	±50.0 or +100.0/-0* +50.0/-10.0 mm	0.3	15.0 7.0
R	∅ 350 mm	+2.0/-7.0 mm	ε 2/3 of the ultimate O.D. deviation	6-7 m (4-10.5)***	+0.0/-100.0 mm*	0.4	15.0
1	∅ 360 mm	±5.0 mm	ε 3/4 of the ultimate O.D. deviation	4 - 11 m	±50.0 or +100.0/-0*	-	15.0
4	∅ 400 mm	±4.0 mm	ε 7.0	3.5 - 12 m	+50.0/-10.0 mm	0.3	7.0
1	∅ 410 mm	+4.0/-6.0 mm	ε 3/4 of the ultimate O.D. deviation	4 - 8.5 m	±50.0 or+100.0/-0*	0.3	15.0
K	∅ 5.5"	±0.250"	±0.125"	30 - 40 ft	±4"	0.250" in 5 ft	±0.250"
K	∅ 6.5"	±0.250"	±0.125"	30 - 40 ft	±4"	0.250" in 5 ft	±0.250"

Mill Designation: 1 – Volzhsky/Rus/; 2 – Seversky/Rus/; 4 – TAGMET/Rus/; R – Resita /Rom/

\* up to 10 % in random length \*\* shall not exceed of the ultimate O.D. deviation \*\*\* special cases

## Steel Grades according to the following standards:

**Volzhsky:** ASTM A106-13, ASTM A210-02(2012), ASTM A213-14, ASTM A333-13, ASTM A335-11, ASTM A519-06(2012), DIN EN 10083-3, 10208-2-заменен на DIN EN ISO 3183, DIN EN 10210-1, DIN EN 10216-2, DIN EN 10297-1, ISO 3183-3;

**Seversky:** API Spec 5CT, API Spec 5L, ASTM A53-12, ASTM A106-13;

**TAGMET:** API 5DP, API Spec 5CT, ASTM A53-12, ASTM A106-13, ASTM A333-13, ASME SA 106, DIN EN 10210-1, DIN EN 10216-1, DIN EN 10255;

**Resita:** API Spec 5CT, API Spec 5L, ASTM A106-13, A519-06(2012), 10216-1/2/3/4, DIN EN 10216-2, ISO 2938.

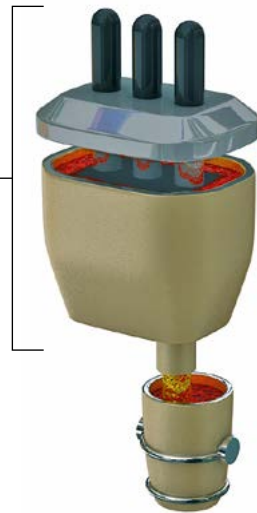


# Steel Melting and Casting Flowchart

- Preparation of scrap
- Preparation of deoxidizers, materials and ferroalloys.
- Charging of steel making furnace

Electric arc furnace

1. Melting



2. Treatment of steel in ladle furnace

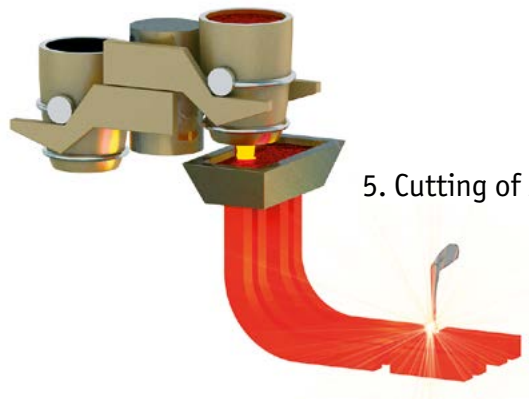
Ladle furnace



3. Vacuum degassing  
(applicable for high grades of steel)



4. Continuous steel casting.  
Production of square and round billets



5. Cutting of billets

6. Cooling and marking of billets\*



7. Acceptance of billets, heats.  
Delivery to storage or shipment



\*Turning of round billets is performed if required.

**Controlled parameters:** scrap weight, chemical composition and sizes; materials gravimetric and chemical composition, humidity, weight; metal temperature; vacuum degree, cooling regimens, casting rate; cut length and quality; billetwise traceability, outside surface, geometric sizes, billet quality, macrostructure.

# Calculations, Formulas, Conversions, and Constants

## US CUSTOMARY UNITS

### Capacity of Pipe

Barrels per Linear ft	Linear Ft/Barrel	Cubic Ft/Linearft	Linear Ft/Cubic ft
Equation	Equation	Equation	Equation
$= 0.0009714 \times D^3$	$= 1029.4 / D^3$	$= 0.005454 \times D^3$	$= 183.35 / D^3$
$= 1029.4 / D^3$			
$= 0.005454 \times D^3$			
$= 183.35 / D^3$			
D inches	Pipe inside diameter inches		
d inches	$OD - 2 \times w.t.$		
w.t. inches	wall thickness		

### Volume and Height between tubing and casing, or between casing and hole (annular volume)

Barrels per linear ft	Linear Ft/Barrel	Cubic Ft/linearft	Linear Ft/Cubic ft
Equation	Equation	Equation	Equation
$= 0.0009714 \times (D^3 - nd^3)$	$= 1029.4 / (D^3 - nd^3)$	$= 0.005454 \times (D^3 - nd^3)$	$= 183.35 / (D^3 - nd^3)$
$= 1029.4 / (D^3 - nd^3)$			
$= 0.005454 \times (D^3 - nd^3)$			
$= 183.35 / (D^3 - nd^3)$			
D inches	Pipe inside diameter inches of the casing		
D inches	$OD - 2 \times w.t.$		
w.t. inches	wall thickness		
d inches	Outside diameter of tubing or casing, inches		
n	number of strings of tubing		

### Hydrostatic Pressure

psi	psi	s.g.	tvd	ppg	#/gal	inches
Equation	Equation	Equation	Equation	Equation	Equation	Equation
$= tvd \times s.g. \times 0.4330$	$= tvd \times ppg \times 0.051981$	$= \text{specific gravity, water is 1.0}$	$= \text{true vertical depth in ft}$	$= \text{fluid density, \#/gal (pounds per gallon)}$	$= \text{fluid density, \#/gal (pounds per gallon)}$	$= \Delta T \times \text{Length} \times 0.0000828$
$= tvd \times ppg \times 0.051981$						
$= \text{specific gravity, water is 1.0}$						
$= \text{true vertical depth in ft}$						
$= \text{fluid density, \#/gal (pounds per gallon)}$						
$= \text{fluid density, \#/gal (pounds per gallon)}$						
$= \Delta T \times \text{Length} \times 0.0000828$						

### Effect of Temperature on Steel (Steel expands or contracts 0.0000828"/ft/°F)

Pipe Expansion	Uniformly heated	Pipe Expansion	Downhole
Equation	Equation	Equation	Equation
$= [(BHST - ambT) / 2 - PT] \times \text{Length} \times 0.0000828$	$= [(BHST - ambT) / 2 - PT] \times \text{Length} \times 0.0000828$	$= [(BHST - ambT) / 2 - PT] \times \text{Length} \times 0.0000828$	$= [(BHST - ambT) / 2 - PT] \times \text{Length} \times 0.0000828$
$= [(BHST - ambT) / 2 - PT] \times \text{Length} \times 0.0000828$			
$= [(BHST - ambT) / 2 - PT] \times \text{Length} \times 0.0000828$			
BHST °F	Bottom Hole Static Temp		
$\Delta T$ °F	Change in Temperature		
ambT °F	year-around ambient temperature (70 °F)		
PT °F	Pipe Temperature, or outside temp		
Length ft	Total length of pipe		
Weight Lb/ft	$= 10.69 \times (D-t) \times t$		
D inches	Pipe OD		
t inches	wall thickness		

### Plain end pipe weight #/ft

## CONVERSION FACTORS

1 inch	= 25.4 mm exact, all linear conversions are derived from this factor	1 N/cm <sup>2</sup>
1 Pound (lb)	= .45359 kilograms (kg)	1 N/cm <sup>2</sup>
1 Pound/ft	= 1.4882 kilograms per meter (kg/m)	1 oilfield barrel
1 foot-pound	= 1.3558 newton-meters (N-m) for torque	

## METRIC CALCULATIONS

### Capacity of Pipe

Cubic meters per linear meter	Linear Meters per cubic meter	Liter per linear Meter	Meter per linear Liter
Equation	Equation	Equation	Equation
$= D^2 / 1,273,000$	$= 1,273,000 / D^2$	$= D^2 / 1,273$	$= 1273 / D^2$
$= D^2 / 1,273,000$			
$= D^2 / 1,273$			
$= 1273 / D^2$			
D mm	Pipe inside diameter millimeters		
d mm	$OD - 2 \times w.t.$		
w.t. mm	wall thickness		

### Volume and Height between tubing and casing, or between casing and hole (annular volume)

Cubic meters/meter	Meters/cubic meter	Liters/meter	Meters/liter
Equation	Equation	Equation	Equation
$= (D^2 - nd^2) / 1,273,000$	$= 1,273,000 / (D^2 - nd^2)$	$= (D^2 - nd^2) / 1273$	$= 1273 / (D^2 - nd^2)$
$= (D^2 - nd^2) / 1,273,000$			
$= 1,273,000 / (D^2 - nd^2)$			
$= (D^2 - nd^2) / 1273$			
$= 1273 / (D^2 - nd^2)$			
D mm	Pipe inside diameter inches of the casing		
D mm	$OD - 2 \times w.t.$		
w.t. mm	wall thickness		
d mm	Outside diameter of tubing or casing, mm		
n	number of strings of tubing		

### Hydrostatic Pressure

P	P	s.g.	tvd	meters
Equation	Equation	Equation	Equation	Equation
$= tvd \times s.g. \times 9.807$	$= tvd \times kg/L \times 9.807$	$= \text{specific gravity, water is 1.0}$	$= \text{true vertical depth in meters}$	$= \text{true vertical depth in meters}$
$= tvd \times s.g. \times 9.807$				
$= tvd \times kg/L \times 9.807$				
$= \text{specific gravity, water is 1.0}$				
$= \text{true vertical depth in meters}$				
$= \text{true vertical depth in meters}$				
$= \Delta T \times \text{Length} \times 0.0000828$				

### Effect of Temperature on Steel (Steel expands or contracts 0.01242 mm/m/°C)

Pipe Expansion	Uniformly heated	Pipe Expansion	Downhole
Equation	Equation	Equation	Equation
$= \Delta T \times \text{Length} \times 0.0000828$	$= \Delta T \times \text{Length} \times 0.0000828$	$= \Delta T \times \text{Length} \times 0.0000828$	$= \Delta T \times \text{Length} \times 0.0000828$
$= \Delta T \times \text{Length} \times 0.0000828$			
$= \Delta T \times \text{Length} \times 0.0000828$			
BHST °C	Bottom Hole Static Temp		
$\Delta T$ °C	Change in Temperature		
ambT °C	year-around ambient temperature (21 °C)		
PT °C	Pipe Temperature, or outside temp		
Length m	Total length of pipe		
Mass kg/m	$= 0.0246615 \times (D-t) \times t_m$		
D mm	Pipe OD		
t <sub>m</sub> mm	wall thickness		

### Plain end pipe mass/meter (kg/m)

= 10 kPa
= 1.450377 psi (for compressive strength comparison)
= 42 US Gallons, = 5.6146 ft <sup>3</sup>

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