



INTERCOMERCE NKR CONSULTORIA E NEGÓCIOS LTDA

**CHEMICAL ANALYSES AND MECHANICAL PROPERTIES OF ROLLED PRODUCTS,
SPECIFIED BY INTERNATIONAL STANDARDS**

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Steel Products Specifications

The present specifications are intended to support the mill's Marketing and Sales Service in its precontract negotiations with customers. The mill's internal quality requirements to the rolled products and production methods are set forth in Process Sheets and Quality Plans.

I. REINFORCING STEEL BARS

Reinforcing steel bars are manufactured both in lengths and in coils. The maximum and the minimum bundle lengths are 12 m and 6m, respectively. Reinforcing steel bars in cut lengths are normally manufactured in nominal diameters from 8 to 40 mm (dia. 28, 32, 36 and 40 mm are less preferable and orders for these sizes shall be limited in number), with the size series depending on the standard for a specific type of product and being limited by the above specified range of sizes. Reinforcing steel bars are manufactured hot rolled - without special cooling, with cooling at final stages (to reduce final rolling temperatures to avoid recrystallization) and with thermal hardening (an intensive water cooling).

Reinforcing steel bars in coils are manufactured in nominal diameters:

- from 5,5 to 14,0 mm – plain round bars;
- from 6 to 14,0 mm – hot rolled ribbed reinforcing steel bars;
- from 8 to 12,0 mm – thermally treated ribbed reinforcing steel bars (depending on the class of strength).

The coil weight is 1350 ± 150 kg. In the course of manufacturing, coils of less than 1000 kg in weight may be formed, therefore, a portion of coils from 500 to 1200 kg in weight, say up to 2% of a lot quantity, is recommended to be agreed upon when negotiating orders.

As of today, the steel products have been approved against the following national standards:

BS 4449-97 (UK), DIN488-84/86 (Germany), LNEC E449-98 (Portugal), LNEC E450-98 (Portugal), STO ASChM 7-93 (Russia).

The list of referenced national standards included in the present part of the specifications:

DIN 488-84/86 part 6. REINFORCING STEEL BARS. GRADES. PROPERTIES.

MARKING.

LNEC E 449-98. STEEL ROLLED PRODUCTS FOR THE REINFORCEMENT OF CONCRETE, A 400NR GRADE

LNEC E 450-98. STEEL ROLLED PRODUCTS FOR THE REINFORCEMENT OF CONCRETE, A 500NR GRADE

SFS 1215-1996. HOT ROLLED WELDABLE RIBBED REINFORCING STEEL BARS OF A500HW GRADE.

Steel Products Specifications

CAN/CSA G30.18-M92. ROLLED PRODUCTS FOR THE REINFORCEMENT OF CONCRETE.

ASTM A615/A615M-96a/95b. PLAIN ROUND AND RIBBED STEEL BARS FOR THE REINFORCEMENT OF CONCRETE.

ASTM A706/A706M-96. LOW ALLOY STEEL RIBBED BARS FOR THE REINFORCEMENT OF CONCRETE.

BS 4449-97. CARBON STEEL BARS FOR THE REINFORCEMENT OF CONCRETE.

EU 80-85/82-79. REINFORCING STEEL BARS FOR THE NON-PRESTRESSED REINFORCEMENT. TECHNICAL CONDITIONS OF DELIVERY.

ISO 6935 part 2. STEEL FOR THE REINFORCEMENT OF CONCRETE. RIBBED REINFORCING STEEL BARS.

GOST 5781-82 HOT ROLLED STEEL BARS FOR THE REINFORCEMENT OF CONCRETE STRUCTURES.

STO ASChM 7-93 DEFORMED REINFORCING STEEL BARS.

DSTU 3760-98 STEEL BARS FOR THE REINFORCEMENT OF CONCRETE STRUCTURES.

TU U 14-4-490-2000. REINFORCING STEEL BARS WITH A SPECIFIED CONTENT OF ALLOYING ELEMENTS, FOR THE REINFORCEMENT OF CONCRETE

GOST 10884-94 MECHANICALLY AND HEAT-TREATED REINFORCING STEEL BARS FOR CONCRETE STRUCTURES.

TU 14-1-5454-2002 MECHANICALLY AND HEAT-TREATED RIBBED REINFORCING STEELS FOR CONCRETE STRUCTURES.

Steel grade	Nominal diameter ²⁾	Mass fraction of chemical elements, %										Mechanical properties					
		C	Mn	Si	P	S	Cr	Ni	Cu	N	Ceq	σ_{B} , N/mm ²	σ_T , N/mm ²	δ_{10} , %	δ_5 , %	Agt, %	σ_B / σ_T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I.I.1. DIN 488-84/86 (ribbed reinforcing bars)																	
BSt500S	8, 10, 12, 14, 16, 20, 25, 28	≤0.22	≤1.40	≤0.35	≤0.050	≤0.050	N/S	≤0.25 ₃₎	≤0.60 ₃₎	≤0.012	≤0.50 ₃₎	≥550	≥500	≥10	N/S	N/S	≥1,05
I.I.2. BS 4449-97 (plain round and ribbed reinforcing bars)																	
460B	8, 10, 12, 16, 20, 25	≤0.25	N/S	N/S	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.51	N/S	≥460	N/S	≥14	N/S	≥1,08
250	8, 10, 12, 16	≤0.25	N/S	N/S	≤0.060	≤0.060	N/S	N/S	N/S	≤0.012	≤0.42	N/S	≥250	N/S	≥22	N/S	≥1,15
I.I.3. EU 80-85/82-79 (ribbed reinforcing bars)																	
FeB500	8, 10, 12, 14, 16, 18, 20,	≤0.22	N/S	N/S	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥550	≥500	N/S	≥12	≥2,5	≥1,05
FeB400	22, 25, 28	≤0.22	N/S	N/S	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥440	≥400	N/S	≥14	≥2,5	≥1,05
I.I.4. ISO 6935-2 (ribbed reinforcing bars)																	
RB400W	8, 10, 12, 16, 20, 25	≤0.22	≤1.60	≤0.60	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥440	≥400	N/S	≥14	≥2,5	≥1,05
RB500W		≤0.22	≤1.60	≤0.60	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥550	≥500	N/S	≥14	≥2,5	≥1,05
I.I.5. E 450-98 (ribbed reinforcing bars)																	
A500NR	8, 10, 12, 16, 20, 25	≤0.22	N/S	N/S	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥550	≥500	N/S	≥14	≥5	≥1,08
I.I.6. E 449-98 (ribbed reinforcing bars)																	
A400NR	8, 10, 12, 16, 20, 25	≤0.22	N/S	N/S	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥460	≥400	N/S	≥14	≥5	≥1,08
I.I.7. SFS 1215-96 (ribbed reinforcing bars)																	
A500HW	8, 10, 12, 14, 16, 20, 25	≤0.20	≤1.60	0.15... 0.55	≤0.060	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥550	≥500	≥12	N/S	N/S	N/S
Ceq = C + Mn/6 + (Cr + Mo + V)/5 + (Cu + Ni)/15																	

Steel grade	Nominal diameter ²⁾	Mass fraction of chemical elements, %										Mechanical properties					
		C	Mn	Si	P	S	Cr	Ni	Cu	N	Ceq	σ_B , N/mm ²	σ_T , H/MM ²	δ_{10} , %	δ_5 , %	Agt, %	σ_B/σ_T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I.I.8. GOST 5781-82 (plain round and ribbed reinforcing bars, chemical composition for St3 sp and St5sp to GOST 380-94)																	
A240 (AI)	8, 10, 12, 14, 16, 18, 20, 22, 25, 28	0.14-0.22	0.40-0.65	0.15-0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	N/S	≥ 373	≥ 235	N/S	≥ 25	N/S	N/S
A300 (AII)	8, 10, 12, 14, 16, 18, 20, 22, 25, 28	0.28-0.37	0.50-0.80	0.15-0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	N/S	≥ 490	≥ 295	N/S	≥ 19	N/S	N/S
A400 (AIII)	8, 10, 12, 14, 16, 18, 20, 22, 25, 28	0.30-0.37	0.80-1.20	0.60-0.90	≤0.040	≤0.045	≤0.30	≤0.30	≤0.30	N/S	≤ 0.62	≥ 590	≥ 390	N/S	≥ 14	N/S	N/S
35GS																	
Ceq = C + Mn/6 + Si/10																	
I.I.9. STO ASChM 7-93 (ribbed reinforcing bars)																	
A400C	8, 10, 12, 14, 16, 18, 20, 22, 25, 28	≤0.22	≤1.60	≤0.90	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤ 0.50	≥ 500	≥ 400	N/S	≥ 16	N/S	≥ 1,05
A500C	8, 10, 12, 14, 16, 18, 20, 22, 25, 28	≤0.22	≤1.60	≤0.90	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤ 0.50	≥ 600	≥ 500	N/S	≥ 14	N/S	≥ 1,05
A600C	8, 10, 12, 14, 16, 18, 20, 22, 25, 28	≤0.28	≤1.60	≤1.00	≤0.045	≤0.045	N/S	N/S	N/S	≤0.010	≤ 0.65	≥ 740	≥ 600	N/S	≥ 12	N/S	≥ 1,05
Ceq = C + Mn/6 + (Cr + Mo + V)/5 + (Cu + Ni)/15																	
I.I.10. DSTU 3760-98 (plain and ribbed reinforcing bars)																	
A240C	8, 10, 12, 14, 16, 18, 20, 22, 25, 28	≤0.22	N/S	N/S	≤0.045	≤0.045	≤0.30	≤0.30	≤0.30	≤0.012	0.30... 0.52	≥ 370	≥ 240	N/S	≥ 25	N/S	≥ 1,05
A300C	8, 10, 12, 14, 16, 18, 20, 22, 25, 28	≤0.22	N/S	N/S	≤0.045	≤0.045	≤0.30	≤0.30	≤0.30	≤0.012	0.30... 0.52	≥ 490	≥ 290	N/S	≥ 19	≥ 2,5	≥ 1,05
A400C	8, 10, 12, 14, 16, 18, 20, 22, 25, 28	≤0.22	N/S	N/S	≤0.045	≤0.045	≤0.30	≤0.30	≤0.30	≤0.012	0.30... 0.52	≥ 500	≥ 400	N/S	≥ 16	≥ 2,5	≥ 1,05
A500C	8, 10, 12, 14, 16, 18, 20, 22, 25, 28	≤0.22	N/S	N/S	≤0.045	≤0.045	≤0.30	≤0.30	≤0.30	≤0.012	0.35... 0.52	≥ 600	≥ 500	N/S	≥ 14	≥ 2,5	≥ 1,05
A600C	8, 10, 12, 14, 16, 18, 20, 22, 25, 28	≤0.28	≤1.60	≤1.00	≤0.045	≤0.045	≤0.30	≤0.30	≤0.30	≤0.012	0.40... 0.65	≥ 800	≥ 600	N/S	≥ 12	≥ 2,5	≥ 1,05
Ceq = C + Mn/6 + (Cr + Mo + V)/5 + (Cu + Ni)/15																	

Steel grade	Nominal diameter ²⁾	Mass fraction of chemical elements, %										Mechanical properties					
		C	Mn	Si	P	S	Cr	Ni	Cu	N	Ceq	σ_B , N/mm ²	σ_T , N/mm ²	δ_{10} , %	δ_5 , %	δp , %	σ_B / σ_T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I.I.11. TU U 14-4-490-2000 (plain round and ribbed reinforcing bars)																	
A240C	8, 10, 12, 14, 16, 18, 20,	0,14- 0,27	0,40- 0,70	0,15- 0,50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.48	≥ 375	≥ 235	≥ 18	N/S	N/S	N/S
At420C	22, 25, 28	0,28- 0,32	0,80- 1,50	0,15- 0,50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.62	≥ 530	≥ 420	≥ 10	N/S	N/S	N/S
At420C		0,14- 0,26	1,00- 1,50	0,60- 0,95	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.62	≥ 530	≥ 420	≥ 10	N/S	N/S	N/S
At420C		0,15- 0,25	0,60- 1,00	0,15- 0,50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.62	≥ 530	≥ 420	≥ 10	N/S	N/S	N/S
A400C		0,32- 0,38	0,80- 1,20	0,15- 0,50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.62	≥ 540	≥ 390	≥ 11	N/S	N/S	N/S
A400C		0,20- 0,29	1,20- 1,60	≤0.15	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.62	≥ 540	≥ 390	≥ 11	N/S	N/S	N/S
At440C		0,25- 0,32	0,50- 0,90	0,15- 0,50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	0.35- 0.57	≥ 530	≥ 440	≥ 10	N/S	N/S	N/S
At440C		0,32- 0,37	0,50- 0,80	0,15- 0,50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	0.35- 0.57	≥ 530	≥ 440	≥ 10	N/S	N/S	N/S
At500C		0,14- 0,26	0,80- 1,50	0,15- 0,50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	0.35- 0.57	≥ 550	≥ 500	≥ 10	N/S	N/S	N/S
At500C		0,32- 0,37	0,50- 0,80	0,15- 0,50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	0.35- 0.57	≥ 550	≥ 500	≥ 10	N/S	N/S	N/S
At600C		0,14- 0,26	0,80- 1,50	0,15- 0,50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	0.35- 0.57	≥ 700	≥ 600	≥ 10	N/S	≥ 4	N/S
At600C		0,32- 0,37	0,50- 0,80	0,15- 0,50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	0.35- 0.57	≥ 700	≥ 600	≥ 10	N/S	≥ 4	N/S

Ceq = C + Mn/8 + Cr/5 + Cu/23 + Ni/40

Steel grade	Nominal diameter ²⁾	Mass fraction of chemical elements, %										Mechanical properties			
		C	Mn	Si	P	S	Cr	Ni	Cu	N	Ceq	σ_B , kSi (N/mm ²)	σ_T , kSi (N/mm ²)	δ_{200} , %	σ_B/σ_T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
I.I.12. ASTM A615/A615M-96a (ribbed reinforcing bars)															
40/300	№ 3(10), № 4(13), № 5(16), № 6(18)	N/S	N/S	N/S	≤0.060	N/S	N/S	N/S	N/S	N/S	N/S	≥ 70 (500)	≥ 40 (300)	11 (№3) 12 (№4-6)	N/S
60/420	№ 3(10), № 4(13), № 5(16), № 6(18), № 7(22), № 8 (25)	N/S	N/S	N/S	≤0.060	N/S	N/S	N/S	N/S	N/S	N/S	≥ 90 (620)	≥ 60 (420)	9 (№ 3-6) 8 (№7-8) 7 (№ 9-11)	N/S
75/520	№ 6(18), № 7(22), № 8 (25)	N/S	N/S	N/S	≤0.060	N/S	N/S	N/S	N/S	N/S	N/S	≥ 100 (690)	≥ 75 (520)	7 (№ 6-8) 6 (№ 9-11)	N/S
I.I.13. ASTM A706/A706M-96 (ribbed reinforcing bars)															
60/420	№ 3(10), № 4(13), № 5 (16), № 6(19), № 7(22), № 8(25)	≤0.30	≤1.50	≤0.50	≤0.035	≤0.045	N/S	N/S	N/S	N/S	≤0.55	≥ 80 (550)	60-78 (420-540)	12 (№3-6) 14 (№7-11)	≥ 1,15
I.I.14. CAN/CSA – G30.18-M92 (ribbed reinforcing bars)															
Ceq = C + Mn/6 + Cu/40 + Ni/20 + Cr/10 – Mo/50 – V/10															
Mass fraction of chemical elements, %															
Steel grade	Nominal diameter ²⁾	C	Mn	Si	P	S	Cr	Ni	Cu	N	Ceq	σ_B , N/mm ²	σ_T , N/mm ²	δ_{200} , %	σ_B/σ_T
300R	№ 10, № 15	N/S	N/S	N/S	≤0.050	N/S	N/S	N/S	N/S	N/S	N/S	≥ 405	≥ 300	11 (№ 10) 12 (№ 15)	≥ 1,15
400R	№ 10, № 15, № 20, № 25, № 30	N/S	N/S	N/S	≤0.050	N/S	N/S	N/S	N/S	N/S	N/S	≥ 540	≥ 400	10 (№10-20) 9 (№ 25) 8 (№ 30-35)	≥ 1,15
500R		N/S	N/S	N/S	≤0.050	N/S	N/S	N/S	N/S	N/S	N/S	≥ 675	≥ 500	9 (№10-20) 8 (№ 25) 7 (№ 30-35)	≥ 1,15
400W	№ 10, № 15, № 20, № 25, № 30	≤0.30	≤1.60	≤0.50	≤0.035	≤0.045	N/S	N/S	N/S	N/S	≤ 0.55	≥ 540	400-525	13 (№10-25) 12 (№30-35)	≥ 1,15
500W		Ceq = C + Mn/6 + Cu/40 + Ni/20 + Cr/10 – Mo/50 – V/10										≥ 625	500-625	12 (№10-25) 10 (№30-35)	≥ 1,15

Steel grade	Nominal diameter ²⁾	Mass fraction of chemical elements, %										Mechanical properties					
		C	Mn	Si	P	S	Cr	Ni	Cu	N	Ceq	σ_B , N/mm ²	σ_T , N/mm ²	δ_{10} , %	δ_5 , %	δp , %	σ_B / σ_T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I.I.15. GOST 10884-94 (ribbed reinforcing bars)																	
A1400C	8, 10, 12, 14,	≤0.24	0.5-1.5	≤0.65	≤0.045	≤0.045	N/S	N/S	N/S	N/S	≤ 0.32	≥ 373	≥ 235	N/S	≥ 16	N/S	N/S
A1500C	16, 18, 20,	≤0.32	0.5-1.5	≤0.65	≤0.045	≤0.045	N/S	N/S	N/S	N/S	≤ 0.40	≥ 490	≥ 295	N/S	≥ 14	N/S	N/S
A1600C	22, 25, 28																
A1600C	10, 12, 14,	≤0.32	0.6-2.3	0.6-2.4	≤0.045	≤0.045	N/S	N/S	N/S	N/S	≤ 0.44	≥ 441	≥ 295	N/S	≥ 12	≥ 4.0	N/S
	16, 18, 20,																
	22, 25, 28																
A1800	10, 12, 14,	≤0.32	0.6-2.3	0.6-2.4	≤0.045	≤0.045	N/S	N/S	N/S	N/S	N/S	≥	≥ 800	N/S	≥ 8	≥ 2.0	N/S
	16, 18											1000	1000				
Ceq = C + Mn/8 + Si/7																	
I.I.16. TU 14-1-5454-2002 (ribbed reinforcing bars)																	
A1800	10, 12, 14,	≤0.32	0.6-2.3	0.6-2.4	≤0.040	≤0.040	≤0.30	≤0.30	≤0.30	≤0.015	N/S	≥	≥ 800	N/S	≥ 8	≥ 2.0	N/S
	16, 18											1000	1000				

Notes:

1. N/S –not specified in the standard documentation and remains at the producer's discretion.

2. The mill manufactures reinforcing bars belonging to classes of strength 240, 300, 400, 500 and 600 in sizes within the range specified in the standard documentation to the product, though a maximum nominal diameter being 40 mm. Reinforcing bars, Grades 60 and 75, to ASTM A706/A706M-96 and ASTM A615/A615M-96a are manufactured in nominal size of up to No.11/36mm; reinforcing bars of grades 400R/W...500R/W to CAN/CSA – G30.18-M92 – in sizes within the range specified in the standard documentation to the product, though not bigger than 30 mm.

3. Recommended by IfBt Certification Body (Germany).

Steel Products Specifications

I. Reinforcing steel bars/I.I. Reinforcing steel bars in coils

Steel grade	Nominal diameter	Mass fraction of chemical elements, %										Mechanical properties						
		C	Mn	Si	P	S	Cr	Ni	Cu	N	Ceq	σ_B , N/mm ²	σ_T , N/mm ²	δ_{10} , %	δ_5 , %	Agt, %	σ_B / σ_T	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
I.II.1. BS 4449-97 (plain round and ribbed reinforcing bars)																		
460B	8, 10, 12	≤0.25	N/S	N/S	≤0.060	≤0.060	N/S	N/S	N/S	≤0.012	≤0.51	N/S	≥ 460	N/S	≥ 14	N/S	≥ 1,08	
250	5,5...14,0	≤0.25	N/S	N/S	≤0.060	≤0.060	N/S	N/S	N/S	≤0.012	≤0.42	N/S	≥ 250	N/S	≥ 22	N/S	≥ 1,15	
I.II.2. EU 80-85/82-79 (ribbed reinforcing bars)																		
FeB500	8, 10, 12	≤0.22	N/S	N/S	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥ 550	≥ 500	N/S	≥ 12	≥ 2,5	≥ 1,05	
FeB400		≤0.22	N/S	N/S	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥ 440	≥ 400	N/S	≥ 14	≥ 2,5	≥ 1,05	
I.II.3. ISO 6935-2 (ribbed reinforcing bars)																		
RB400W	8, 10, 12	≤0.22	≤1.60	≤0.60	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥ 440	≥ 400	N/S	≥ 14	≥ 2,5	≥ 1,05	
RB500W		≤0.22	≤1.60	≤0.60	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥ 550	≥ 500	N/S	≥ 14	≥ 2,5	≥ 1,05	
I.II.4. E 450-98 (ribbed reinforcing bars)																		
A500NR	8, 10, 12	≤0.22	N/S	N/S	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥ 550	≥ 500	N/S	≥ 14	≥ 5	≥ 1,08	
I.II.5. E 449-98 (ribbed reinforcing bars)																		
A400NR	8, 10, 12	≤0.22	N/S	N/S	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤0.50	≥ 460	≥ 400	N/S	≥ 14	≥ 5	≥ 1,08	
I.II.6. SFS 1215-96 (ribbed reinforcing bars)																		
A500HW	8, 10, 12	≤0.20	≤1.60	0.15... 0.55	≤0.060	≤0.050	N/S	N/S	N/S	≤0.012	≤0.51	≥ 550	≥ 500	≥ 12	N/S	N/S	N/S	
Ceq = C + Mn/6 + (Cr + Mo + V)/5 + (Cu + Ni)/15																		

Notes: N/S –not specified in the standard documentation and remains at the producer's discretion.

Steel Products Specifications

I. Reinforcing steel bars/I.I. Reinforcing steel bars in coils

Steel grade	Nominal diameter	Mass fraction of chemical elements, %										Mechanical properties						
		C	Mn	Si	P	S	Cr	Ni	Cu	N	Ceq	σ_B , N/mm ²	σ_T , N/mm ²	δ_{10} , %	δ_5 , %	Agt, %	σ_B/σ_T	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
I.II.7. GOST 5781-82 (plain round and ribbed reinforcing bars, chemical composition for St3 sp and St5sp to GOST 380-94)																		
A240 (AI)	8, 10, 12, 14	0.14-0.22	0.40-0.65	0.15-0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	N/S	≥ 373	≥ 235	N/S	≥ 25	N/S	N/S	
St3sp																		
A300 (AII)		0.28-0.37	0.50-0.80	0.15-0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	N/S	≥ 490	≥ 295	N/S	≥ 19	N/S	N/S	
St5sp																		
A400 (AIII)		0.30-0.37	0.80-1.20	0.60-0.90	≤0.040	≤0.045	≤0.30	≤0.30	≤0.30	N/S	≤ 0.62	≥ 590	≥ 390	N/S	≥ 14	N/S	N/S	
35GS																		
Ceq = C + Mn/6 + Si/10																		
I.II.8. STO ASChM 7-93 (ribbed reinforcing bars)																		
A400C	8, 10, 12	≤0.22	≤1.60	≤0.90	≤0.050	≤0.050	N/S	N/S	N/S	≤0.012	≤ 0.50	≥ 500	≥ 400	N/S	≥ 16	N/S	≥ 1,05	
A500C		≤0.22	≤1.60	≤0.90	≤0.045	≤0.045	N/S	N/S	N/S	≤0.012	0.35... 0.52	≥ 600	≥ 500	N/S	≥ 14	N/S	≥ 1,05	
Ceq = C + Mn/6 + (Cr + Mo + V)/5 + (Cu + Ni)/15																		
I.II.9. DSTU 3760-98 (plain round and ribbed reinforcing bars)																		
A240C	8, 10, 12, 14	≤0.22	N/S	N/S	≤0.045	≤0.045	≤0.30	≤0.30	≤0.30	≤0.012	0.30... 0.52	≥ 490	≥ 290	N/S	≥ 19	≥ 2,5	N/S	
A300C		≤0.22	N/S	N/S	≤0.045	≤0.045	≤0.30	≤0.30	≤0.30	≤0.012	0.30... 0.52	≥ 490	≥ 290	N/S	≥ 19	≥ 2,5	N/S	
A400C	8, 10, 12	≤0.22	N/S	N/S	≤0.045	≤0.045	≤0.30	≤0.30	≤0.30	≤0.012	0.30... 0.52	≥ 500	≥ 400	N/S	≥ 16	≥ 2,5	N/S	
A500C		≤0.22	N/S	N/S	≤0.045	≤0.045	≤0.30	≤0.30	≤0.30	≤0.012	0.35... 0.52	≥ 600	≥ 500	N/S	≥ 14	≥ 2,5	N/S	
Ceq = C + Mn/6 + (Cr + Mo + V)/5 + (Cu + Ni)/15																		

Notes: N/S –not specified in the standard documentation and remains at the producer's discretion.

Steel Products Specifications

I. Reinforcing steel bars/I.I. Reinforcing steel bars in coils

Steel grade	Nominal diameter ¹⁾	Mass fraction of chemical elements, %										Mechanical properties						
		C	Mn	Si	P	S	Cr	Ni	Cu	N	Ceq	σ_B , N/mm ²	σ_T , N/mm ²	δ_{10} , %	δ_5 , %	δp , %	σ_B / σ_T	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
I.II.10. TU U 14-4-490-2000 (plain round and ribbed reinforcing bars)																		
A240C	8, 10, 12	0.14-0.27	0.40-0.70	0.15-0.50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.48	≥ 375	≥ 235	≥ 18	N/S	N/S	N/S	
At420C		0.28-0.32	0.80-1.50	0.15-0.50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.62	≥ 530	≥ 420	≥ 10	N/S	N/S	N/S	
At420C		0.14-0.26	1.00-1.50	0.60-0.95	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.62	≥ 530	≥ 420	≥ 10	N/S	N/S	N/S	
At420C		0.15-0.25	0.60-1.00	0.15-0.50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.62	≥ 530	≥ 420	≥ 10	N/S	N/S	N/S	
A400C		0.32-0.38	0.80-1.20	0.15-0.50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.62	≥ 540	≥ 390	≥ 11	N/S	N/S	N/S	
A400C		0.20-0.29	1.20-1.60	≤0.15	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	≤0.62	≥ 540	≥ 390	≥ 11	N/S	N/S	N/S	
At440C		0.25-0.32	0.50-0.90	0.15-0.50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	0.35-0.57	≥ 530	≥ 440	≥ 10	N/S	N/S	N/S	
At440C		0.32-0.37	0.50-0.80	0.15-0.50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	0.35-0.57	≥ 530	≥ 440	≥ 10	N/S	N/S	N/S	
At500C		0.14-0.26	0.80-1.50	0.15-0.50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	0.35-0.57	≥ 550	≥ 500	≥ 10	N/S	N/S	N/S	
At500C		0.32-0.37	0.50-0.80	0.15-0.50	≤0.040	≤0.050	≤0.45	≤0.40	≤0.45	N/S	0.35-0.57	≥ 550	≥ 500	≥ 10	N/S	N/S	N/S	

Notes: N/S –not specified in the standard documentation and remains at the producer’s discretion.

Steel Products Specifications

I. Reinforcing steel bars/I.I. Reinforcing steel bars in coils

Steel grade	Nominal diameter	Mass fraction of chemical elements, %										Mechanical properties				
		C	Mn	Si	P	S	Cr	Ni	Cu	N	Ceq	σ_B , kSi (N/mm ²)	σ_T , kSi (N/mm ²)	δ_{200} , %	σ_B/σ_T	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
I.II.11. ASTM A615/A615M-96a (ribbed reinforcing bars)																
40/300	№ 3(10), № 4(13)	N/S	N/S	N/S	≤0.060	N/S	N/S	N/S	N/S	N/S	N/S	≥ 70 (500)	≥ 40 (300)	11	N/S	
60/420		N/S	N/S	≤0.060	N/S	N/S	N/S	N/S	N/S	N/S	N/S	≥ 90 (620)	≥ 60 (420)	9	N/S	
I.II.12. ASTM A706/A706M-96 (ribbed reinforcing bars)																
60/420	№ 3(10), № 4(13)	≤0.30	≤1.50	≤0.50	≤0.035	≤0.045	N/S	N/S	N/S	N/S	≤0.55	≥ 80 (550)	60-78 (420-540)	12	≥ 1,15	
		Ceq = C + Mn/6 + Cu/40 + Ni/20 + Cr/10 – Mo/50 – V/10														
I.II.13. CAN/CSA – G30.18-M92 (ribbed reinforcing bars)																
Mass fraction of chemical elements, %																
Steel grade	Nominal diameter	C	Mn	Si	P	S	Cr	Ni	Cu	N	Ceq	σ_B , N/mm ²	σ_T , N/mm ²	δ_{200} , %	σ_B/σ_T	
300R	№ 10	N/S	N/S	N/S	≤0.050	N/S	N/S	N/S	N/S	N/S	N/S	≥ 405	≥ 300	11	≥ 1,15	
400R		N/S	N/S	N/S	≤0.050	N/S	N/S	N/S	N/S	N/S	N/S	≥ 540	≥ 400	10	≥ 1,15	
500R		N/S	N/S	N/S	≤0.050	N/S	N/S	N/S	N/S	N/S	N/S	≥ 675	≥ 500	9	≥ 1,15	
400W	№ 10	≤0.30	≤1.60	≤0.50	≤0.035	≤0.045	N/S	N/S	N/S	N/S	≤0.55	≥ 540	400-525	13	≥ 1,15	
500W		Ceq = C + Mn/6 + Cu/40 + Ni/20 + Cr/10 – Mo/50 – V/10														

Notes: N/S –not specified in the standard documentation and remains at the producer's discretion.

Steel Products Specifications

II. Profiled bars

Steel profiled bars are manufactured in lengths from 6 m to 12 m.

The range of profiled bars includes the following products:

- equal side hot rolled steel angle bars to GOST 8509-93; DIN 1028-76 in sizes: 25×25×4; 30×30×4; 32×32×4; 35×35×4; 35×35×5; 40×40×4; 40×40×5; 45×45×4; 45×45×5; 50×50×4; 50×50×5; 50×50×6.

Steel profiled bars are manufactured hot rolled with the use of an accelerated water cooling and without any special cooling methods.

The bundle weight is up to 10.

The list of referenced national standards included in the present part of the specifications:

GOST 535-88. MERCHANT AND PROFILED CARBON STEEL ROLLED BARS

GOST 27772-88. STRUCTURAL STEEL BARS . GENERAL TECHNICAL
CONDITIONS

GOST 19281-89. HIGHER STRENGTH STEEL ROLLED PRODUCTS

DIN 17100-80. STRUCTURAL STEELS OF GENERAL APPLICATION.
QUALITY NORMS.

DIN/BS EN 10025. HOT ROLLED NON-ALLOYED STRUCTURAL STEEL
PRODUCTS

Steel grade	Mass fraction of chemical elements, %											Mechanical properties				Impact strength KCV, J/cm ² , minimum	
	C	Mn	Si	P	S	Cr	Ni	Cu	N	σ_B , N/mm ²	σ_T , N/mm ²	δ_5 , %	temperature, °C		After ageing		
												Not less		+20		-20	
II. 1. GOST 535-88: St0, St3sp, St3ps, St4sp, St4ps, St5sp, St5ps, St6sp, St6ps. Chemical composition to GOST 380-94.																	
St0	≤0.23	-	-	≤0.070	≤0.060	≤0.30	≤0.30	≤0.30	≤0.012	Not less 300	-	18	-	-	-		
St3ps	0.14- 0.22	0.40- 0.65	0.05- 0.15	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	370-480	245	26	108	49	49		
St3sp	0.14- 0.22	0.40- 0.65	0.15- 0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	380-490	255	26	108	49	49		
St4ps	0.18- 0.27	0.40- 0.70	0.05- 0.15	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	410-530	265	24	98	-	-		
St4sp	0.18- 0.27	0.40- 0.70	0.15- 0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	410-530	265	24	98	-	-		
St5ps	0.28- 0.37	0.50- 0.80	0.05- 0.15	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	490-630	285	20	-	-	-		
St5sp	0.28- 0.37	0.50- 0.80	0.15- 0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	490-630	295	20	-	-	-		
St6ps	0.38- 0.49	0.50- 0.80	0.05- 0.15	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	Not less 590	315	15	-	-	-		
St6sp	0.38- 0.49	0.50- 0.80	0.15- 0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	Not less 590	315	15	-	-	-		

Steel Products Specifications

II. Profiled bars

Steel grade	Mass fraction of chemical elements, %										Mechanical properties, minimum			Impact strength KCU, J/cm ² , minimum ²		
	C	Mn	Si	P	S	Cr	Ni	Cu	N	σ_b , N/mm ²	σ_t , N/mm ²	δ_5 , %	temperature, °C		After ageing	
													-20	-40		-70
II.2. GOST 27772-88: C235, C245, C255, C275, C285, C345, C375.																
C235	≤0.22	≤0.60	≤0.05	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	360	235	26	-	-	-	-
C245	≤0.22	≤0.65	0.05-0.15	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	370	245	25	-	-	-	29
C255	≤0.22	≤0.65	0.15-0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	380	255	25	29	-	-	29
C275	≤0.22	≤0.65	0.05-0.15	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	390	275	24	-	-	-	29
C285	≤0.22	≤0.65	0.15-0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	400	285	24	29	-	-	29
C345	≤0.15	1.30-1.70	≤0.80	≤0.035	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	490	345	21	-	39	34	29
C345T¹	≤0.22	≤0.65	0.05-0.15	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	490	345	21	-	39	34	29
C345T¹	≤0.22	0.80-1.10	0.15-0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	490	345	21	-	39	34	29
C375	≤0.15	1.30-1.70	≤0.80	≤0.035	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	518	375	20	-	39	34	29
C375T¹	≤0.22	≤0.65	0.05-0.15	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	518	375	20	-	39	34	29
C375T¹	≤0.20	0.80-1.10	0.15-0.30	≤0.040	≤0.050	≤0.30	≤0.30	≤0.30	≤0.012	518	375	20	-	39	34	29

Notes:

1. T - In-line heat treatment (Termex technology) ; 1 – alternative chemical analysis .
2. The impact strength is specified for rolled products with thickness of 5 mm and over.
For products of 5 mm thick the impact strength to be not less than 49.

Steel grade	Mass fraction of chemical elements, %								
	C	Mn	Si	P	S	Cr	Ni	Cu	N
II. 3. GOST 19281-89: steel grades 09G2, 12GS, 16GS, 14G2, 17GS, 09G2S.									
09G2	≤0.12	1.40-1.80	0.17-0.37	≤0.035	≤0.040	≤0.30	≤0.30	≤0.30	≤0.012
12GS	0.09-0.15	0.80-1.20	0.50-0.80	≤0.035	≤0.040	≤0.30	≤0.30	≤0.30	≤0.012
09G2S	≤0.12	1.30-1.70	0.50-0.80	≤0.035	≤0.040	≤0.30	≤0.30	≤0.30	≤0.012

Class of strength	Mechanical properties, minimum			Impact strength KCU, J/cm ² , minimum ²			Impact strength KCV, J/cm ² , minimum ²	
	σ _B , N/mm ²	σ _T , N/mm ²	δ ₅ , %	temperature, °C		after ageing	temperature, °C	
				-20	-40		-70	0
265	430	265	21	98	-	29	-	-
295	430	295		98	39	29	-	-
325	450	325		64	34	29	34	34
345	480	345		64	39	29	40	40
375	510	375		-	39	-	-	-
390	530	390	18	-	39	34	-	-

GOST 19281-89: class of strength 265, 295, 325, 345, 375, 390.

Mass fraction of chemical elements, %									Mechanical properties			Impact s
C	Mn	Si	P	S	Cr	Ni	Cu	N ¹	σ_B , N/mm ²	σ_T , N/mm ²	δ_5 , %	tempera
										not less		+20
II. 4. DIN 17100												
≤0.17	≤1.60	≤0.55	≤0.050	≤0.050	N/S	N/S	N/S	≤0.009	340-470	235	26	27
≤0.21	≤1.60	≤0.55	≤0.050	≤0.050	N/S	N/S	N/S	≤0.009	410-540	275	22	27
≤0.30	≤1.60	≤0.55	≤0.050	≤0.050	N/S	N/S	N/S	≤0.009	470-610	295	20	-
II. 5. BS EN10025-93												
≤0.17	≤1.40	N/S	≤0.045	≤0.045	N/S	N/S	N/S	≤0.009	340-470	235	26	27
≤0.21	≤1.50	N/S	≤0.045	≤0.045	N/S	N/S	N/S	≤0.009	410-560	275	22	27
≤0.24	≤1.60	≤0.55	≤0.045	≤0.045	N/S	N/S	N/S	≤0.009	490-630	355	22	27

Notes:

1. – Reduction of phosphorous by every 0,005 % allows for the increase of nitrogen by 0,001% but total nitrogen shall not exceeding 0,012%.

2. N/S –not specified in the standard documentation and remains at the producer's discretion.

Steel Products Specifications

III. Wire rod /III.I. Low carbon wire rod

III.I.1. ASTM A510; ASTM A510M

Steel grade	Mass fraction of chemical elements, % ⁵⁾											Mechanical properties ⁵⁾				Processability
	C	Mn	Si	P	S	Cr	Ni	Cu	N ³⁾	Other elements ⁴⁾	$\sigma_{B, 2}$ N/mm ²	$\sigma_{T, 2}$ N/mm ²	δ , %	Ψ , %		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1005	≤0.06	≤0.35	²⁾	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S	N/S	
1005 no B	≤0.06	≤0.35	≤0.10	≤0.030	≤0.015	≤0.15	≤0.20	≤0.30	≤0.012	no B	≤410	-	$\delta_5 \geq 35$	≥72	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.0 mm	
B=0.003 ... 0.008	≤0.06	≤0.35	≤0.10	≤0.030	≤0.015	≤0.15	≤0.20	≤0.30	≤0.012	B=0.003 ... 0.008	≤385	-	$\delta_5 \geq 38$	≥76	Direct drawing from \varnothing 5.5...6.5 to \varnothing 0.7(0.5) mm	
1006	≤0.08	0.25... 0.40	²⁾	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S	N/S	
1006 no B	≤0.08	0.25... 0.40	≤0.15	≤0.030	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	no B	≤440	-	$\delta_5 \geq 35$	≥70	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.2 mm	
B=0.003 ... 0.008	≤0.08	0.25... 0.40	≤0.15	≤0.030	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	B=0.003 ... 0.008	≤420	-	$\delta_5 \geq 36$	≥74	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.0(0.7) mm	
1008	≤0.10	0.30... 0.50	²⁾	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S	N/S	
1008 no B	0.05...0.10	0.30... 0.50	≤0.15	≤0.030	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	no B	≤460	-	$\delta_5 \geq 35$	≥70	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.4 mm	
B=0.003 ... 0.008	0.05...0.10	0.30... 0.50	≤0.15	≤0.030	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	B=0.003 ... 0.008	≤440	-	$\delta_5 \geq 36$	≥72	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.2(1.0) mm	
1010	0.08... 0.13	0.30...0.60 0.60...0.90	²⁾	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S	N/S	
<u>1010</u> 1011	0.08... 0.13	0.30...0.60 0.60...0.90	0.10...0.20 0.15...0.25	≤0.030	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤490 ≤510	-	$\delta_5 \geq 34$ $\delta_5 \geq 33$	≥68 ≥66	-	
1012	0.10...0.15 0.11...0.16	0.30... 0.60	²⁾	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S	N/S	
<u>1012</u> 1013	0.10...0.15 0.11...0.16	0.30...0.60 0.60...0.90	0.10...0.20 0.15...0.25	≤0.030	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤520	-	$\delta_5 \geq 34$	≥64	-	

III.I.1. ASTM A510; ASTM A510M

Steel grade	Mass fraction of chemical elements, % ⁵⁾											Mechanical properties ⁵⁾			Processability
	C	Mn	Si	P	S	Cr	Ni	Cu	N ³⁾	Other elements ⁴⁾	σ_B , N/mm ²	σ_T , ² N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1015	0.13...0.18	0.30...0.60	²⁾	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed	N/S	N/S	N/S	N/S	N/S
1016		0.60...0.90								B≤0.003					
1015	0.13...0.18	0.30...0.50	0.10...0.20	≤0.030	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤550	-	$\delta_5 \geq 33$	≥64	-
1016		0.60...0.80	0.15...0.25								≤560		$\delta_5 \geq 32$	≥64	
1017	0.15...0.20	0.30...0.60	²⁾	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed	N/S	N/S	N/S	N/S	N/S
1018		0.60...0.90								B≤0.003					
1019		0.70...1.00													
1017	0.15...0.20	0.45...0.60	0.15...0.25	≤0.030	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤570	-	$\delta_5 \geq 30$	≥60	-
1018		0.60...0.80									≤580		$\delta_5 \geq 30$	≥60	
1019		0.80...1.00									≤590		$\delta_5 \geq 30$	≥60	

Notes:

1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer's discretion.
2. If necessary, the content of Si may be either in conformity with the Standard Specification, and particularly less than 0.10 %; 0.07...0.15 %; 0.10...0.20 %; 0.15...0.30 %; 0.20...0.40 %, or as requested by the customer, with Mn/Si ratio being at least 1:3 ; the present Specifications give reference values that may be modified upon agreement with the customer.
3. Nitrogen – as requested by the customer (total nitrogen – up to ≤0.012, free nitrogen – up to ≤0.007 %).
4. ASTM specifies B of up to 0.003 % to be added to improve the hardness of medium carbon steels, offers to add B to improve ductility and deformability of wire rod/wire.
5. The present specifications show the normal quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.

III.I.2. EN 10016, Part 2

Steel grade	Mass fraction of chemical elements ⁴⁾ , %										Mechanical properties ⁴⁾				Processability
	C	Mn	Si ²⁾	P	S	Cr	Ni	Cu	N ³⁾	Other elements	σ_B , N/mm ²	σ_{T_1} , N/mm ²	δ , %	Ψ , %	
I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C4D EN	≤0.06	0.30... 0.60	≤0.30	≤0.035	≤0.035	≤0.20	≤0.25	≤0.30	N/S	Mo≤0.05 AlS 0.01	N/S	N/S	N/S	N/S	N/S
C4D no B	≤0.06	0.30...0.40	≤0.15	≤0.030	≤0.015	≤0.20	≤0.25	≤0.30	≤0.012	no B	≤410	-	$\delta_5 \geq 35$	≥72	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.0 mm
B=0.003 ...0.008	≤0.06	0.30...0.40	≤0.15	≤0.030	≤0.015	≤0.20	≤0.25	≤0.30	≤0.012	B=0.003 ...0.008	≤390	-	$\delta_5 \geq 40$	≥75	Direct drawing from \varnothing 5.5...6.5 to \varnothing 0.7(0.5) mm
C7D EN	0.05... 0.09	0.30... 0.60	≤0.30	≤0.035	≤0.035	≤0.20	≤0.25	≤0.30	N/S	Mo≤0.05 AlS 0.01	N/S	N/S	N/S	N/S	N/S
C7D no B	0.04...0.09	0.35...0.50	≤0.15	≤0.030	≤0.015	≤0.20	≤0.25	≤0.30	≤0.012	-	≤450	-	$\delta_5 \geq 33$	≥70	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.4 mm
B=0.003 ...0.008	0.04...0.09	0.35...0.50	≤0.15	≤0.030	≤0.015	≤0.20	≤0.25	≤0.30	≤0.012	B=0.003 ...0.008	≤430	-	$\delta_5 \geq 37$	≥72	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.2(1.0) mm
C9D EN	≤0.10	≤0.60	≤0.30	≤0.035	≤0.035	≤0.20	≤0.25	≤0.35	N/S	Mo≤0.08	N/S	N/S	N/S	N/S	N/S
C9D no B	0.05...0.10	0.35...0.50	≤0.15	≤0.030	≤0.015	≤0.20	≤0.25	≤0.35	≤0.012	-	≤460	-	$\delta_5 \geq 33$	≥70	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.4 mm
B=0.003 ...0.008	0.05...0.10	0.35...0.50	≤0.15	≤0.030	≤0.015	≤0.20	≤0.25	≤0.35	≤0.012	B=0.003 ...0.008	≤440	-	$\delta_5 \geq 37$	≥72	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.2(1.0) mm
C10D C12D C15D C18D	0.08...0.13 0.10...0.15 0.12...0.17 0.15...0.20	0.30... 0.60	≤0.30	≤0.035	≤0.035	≤0.20	≤0.25	≤0.30	N/S	Mo≤0.05 AlS 0.01	N/S	N/S	N/S	N/S	N/S
C10D	0.08...0.13	0.30...0.50	0.10...0.20	≤0.030	≤0.015	≤0.20	≤0.25	≤0.30	≤0.012	-	≤490	-	$\delta_5 \geq 32$	≥68	-
C12D	0.10...0.15	0.30...0.60							≤0.010		≤510		$\delta_5 \geq 30$	≥64	
C15D	0.12...0.17	0.30...0.60									≤530		$\delta_5 \geq 30$	≥62	
C18D	0.15...0.20	0.30...0.60									≤550		$\delta_5 \geq 28$	-	

III.I.2. EN 10016, Part 2

1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer’s discretion.
2. The content of Si is subjected to the agreement with the customer, and Mn/Si ratio shall be at least 1:3.
3. Nitrogen – as requested by the customer (total nitrogen – up to ≤ 0.012 , free nitrogen – up to ≤ 0.007 %).
4. The present specifications show the normal quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.

III.I.3. EN 10016, part 3

Steel grade	Mass fraction of chemical elements, % ⁵⁾										Mechanical properties ⁵⁾				Processability
	C	Mn	Si	P	S	Cr	Ni	Cu	N ⁴⁾	Other elements	$\sigma_{B, 2}$ N/mm ²	$\sigma_{T, 2}$ N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C3D1 EN	≤0.05	0.20... 0.40	≤0.05	≤0.025	≤0.025	≤0.10 Cr + Ni + Cu ≤ 0.30	≤0.10	≤0.15	≤0.007	Mo ≤ 0.03 Al ≤ 0.05	≤ 390	N/S	N/S	N/S	High deformability at direct drawing, say from Ø 5.5 to Ø 1.0 mm and lower. Depth of defects ≤ 0.17 mm.
C3D1 with B	≤0.05 ²⁾	0.20... 0.40	≤0.05 ²⁾	≤0.025	≤0.015	3)			≤0.012	B/N ≥ 0.8	≤ 380 with B	-	-	≥ 75	Direct drawing from Ø 5.5...6.5 to Ø 0.7(0.5) mm
C4D1 EN	≤0.06	0.20... 0.45	≤0.10	≤0.025	≤0.025	≤0.15 Cr + Ni + Cu ≤ 0.35	≤0.15	≤0.15	≤0.007	Mo ≤ 0.03 Al ≤ 0.05	N/S	N/S	N/S	N/S	As for grade C2D1
C4D1 with B	≤0.06	0.20... 0.45	≤0.10	≤0.025	≤0.015	3)			≤0.012	B = 0.003... 0.008 %	≤ 410 no B	-	-	≥ 72	Direct drawing from Ø 5.5...6.5 to Ø 1.0 mm
											≤ 390 with B	-	-	≥ 75	Direct drawing from Ø 5.5...6.5 to Ø 0.7(0.5) mm

Notes:

1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer's discretion.
2. The given chemical composition can be ensured through the use of a vacuum treatment and the selection of heats.
3. Achievable, though incurs the increase in the costs of production.
4. Nitrogen – as requested by the customer (total nitrogen – up to ≤0.012, free nitrogen – up to ≤0.007 %).
5. The present specifications show the normal quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.

III.I.4. EN 10016, part 4

Steel grade	Mass fraction of chemical elements ³⁾ , %										Mechanical properties ⁵⁾				Processability	
	C	Mn	Si	P	S	Cr	Ni	Cu	N	Other elements	σ_b , N/mm ²	σ_{Tr} , N/mm ²	δ , %	Ψ , %		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
C3D2	≤0.05²⁾	0.30...	≤0.30	≤0.020	≤0.025	≤0.10	≤0.10	≤0.15	≤0.007	Mo ≤ 0.05 Cu+Sn ≤ 0.15 Al ≤ 0.015	Subject to the agreeme nt Δσ_b ≤ 80	N/S	N/S	N/S	For deep drawing quality wire rod: Depth of defects ≤ 0.15 mm; Direct drawing from Ø 5.5...6.5 to Ø 1.0 mm and lower	
C5D2	≤0.07	0.50														
C8D2	0.06...0.10															
EN																
C3D2	≤0.05 ¹⁾	0.30...	≤0.15	≤0.015	≤0.015		3)		4)	Achievable ³⁾	≤ 410	-	δ ₅ ≥35	≥ 72	Achievable	
C5D2	≤ 0.07	0.50									≤ 420		δ ₅ ≥35	≥ 70		
C8D2	0.06...0.10										≤ 460		δ ₅ ≥35	≥ 70		
C10D2	0.08...0.12	0.30...	≤0.30	≤0.020	≤0.025	≤0.10	≤0.10	≤0.15	≤0.007	Mo ≤ 0.05 Cu+Sn ≤ 0.15 Al ≤ 0.015	Subject to the agreeme nt Δσ_b ≤ 80	N/S	N/S	N/S	For deep drawing quality wire rod: Depth of defects ≤ 0.15 mm	
C12D2	0.10...0.14	0.50														
C15D2	0.13...0.17															
C18D2	0.16...0.20															
C10D2	0.08...0.13	0.30...	≤0.15	≤0.015	≤0.015		3)		4)	Achievable ³⁾	≤ 490	-	δ ₅ ≥32	≥ 68	Achievable	
C12D2	0.10...0.15	0.50									≤ 510		δ ₅ ≥30	≥ 64		
C15D2	0.12...0.17										≤ 530		δ ₅ ≥30	≥ 62		
C18D2	0.15...0.20										≤ 550		δ ₅ ≥28	-		

Notes:

1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer's discretion.

2. The given chemical composition can be ensured through the selection of heats.

3. Achievable, though incurs the increased costs of production.

4. Nitrogen shall be agreed upon at the level not exceeding 0.007 %.

5. The present specifications show the normal quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.

6. The evaluation of non-metallic inclusions is performed, if requested by the customer .

Steel Products Specifications

III. Wire rod /III.I. Low carbon wire rod

III.I.5. JIS G 3505

Steel grade ¹⁾	Mass fraction of chemical elements, % ⁵⁾											Mechanical properties ⁵⁾				Processability
	C	Mn	Si ²⁾	P	S	Cr	Ni	Cu	N ³⁾	Other elements	σ_b , N/mm ²	σ_r , N/mm ²	δ , %	Ψ , %		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
SWPM 6K	≤0.08	≤0.60	N/S	≤0.045	≤0.045	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	Wire rod of a general application, including the galvanisation.	
6K with B	≤0.08	0.35...0.40	≤0.15	≤0.030	≤0.020	≤0.30	≤0.30	≤0.35	≤0.012 ≤0.010	-	≤440	-	$\delta_5 \geq 35$	≥70	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.2 mm	
B=0.003 ...0.008	≤0.08	0.35...0.40	≤0.15	≤0.030	≤0.020	≤0.30	≤0.30	≤0.35	≤0.012 ≤0.010	B=0.003 ...0.008	≤420	-	$\delta_5 \geq 37$	≥72	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.0(0.7) mm	
SWPM 8K	≤0.10	≤0.60	N/S	≤0.045	≤0.045	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	Wire rod of a general application, including the galvanisation.	
8K with B	0.05...0.10	0.35...0.50	≤0.15	≤0.030	≤0.020	≤0.30	≤0.30	≤0.35	≤0.012 ≤0.010	-	≤460	-	$\delta_5 \geq 33$	≥70	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.4 mm	
B=0.003 ...0.008	0.05...0.10	0.35...0.50	≤0.15	≤0.030	≤0.020	≤0.30	≤0.30	≤0.35	≤0.012 ≤0.010	B=0.003 ...0.008	≤440	-	$\delta_5 \geq 37$	≥72	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.2(1.0) mm	
SWPM 10K	0.08... 0.13	0.30... 0.60	N/S	≤0.045	≤0.045	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	Wire rod of a general application, including the galvanisation.	
10K	0.08...0.13	0.30...0.60	≤0.15	≤0.030	≤0.020	≤0.30	≤0.30	≤0.40	≤0.012 ≤0.010	-	≤490	-	$\delta_5 \geq 32$	≥68	-	
12K 15K 17K	0.10...0.15 0.13...0.18 0.15...0.20	0.30... 0.60	N/S	≤0.045	≤0.045	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	Wire rod of a general application, including the galvanisation.	
12K	0.10...0.15	0.30...	≤0.15	≤0.030	≤0.020	≤0.30	≤0.30	≤0.35	≤0.012 ≤0.010	-	≤510	-	$\delta_5 \geq 30$	≥64	-	
15K	0.13...0.18	0.60	≤0.15	≤0.030	≤0.020	≤0.30	≤0.30	≤0.35	≤0.012 ≤0.010	-	≤530	-	$\delta_5 \geq 30$	≥62	-	
17K	0.15...0.20	0.60	≤0.15	≤0.030	≤0.020	≤0.30	≤0.30	≤0.35	≤0.012 ≤0.010	-	≤550	-	$\delta_5 \geq 28$	-	-	

Steel Products Specification

III. Wire rod /III.II. Medium carbon wire rod

III.I.5. JIS G 3505

Notes:

1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer’s discretion.
2. Letter "K" means a killed steel grade, no letter “K” means a rimming or semi-killed steel grade.
3. If required by the customer the content of Si may be modified, with Mn/Si ratio being at least 1:3.
4. Nitrogen – as requested by the customer (total nitrogen – up to ≤0.012, free nitrogen – up to ≤0.007 %).
5. The present specifications show the normal quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.
6. Steel may be microalloyed with B, if agreed upon between the customer and the mill.

III.II.1. ASTM A510; ASTM A510M

Steel grade	Mass fraction of chemical elements, % ⁴⁾											Mechanical properties ⁴⁾				Processability
	C	Mn	Si	P	S	Cr	Ni	Cu	N ³⁾	Other elements	σ_B , N/mm ²	σ_{T_1} , N/mm ²	δ , %	Ψ , %		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1020	0.18...0.23	0.30...0.60	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed	N/S	N/S	N/S	N/S	N/S	
1021		0.60...0.90								B≤0.003						
1020	0.18...0.23	0.30...0.55	0.10...0.20	≤0.030	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤560	-	$\delta_5 \geq 30$	≥60		
1021		0.60...0.80	0.20...0.30								≤580		$\delta_5 \geq 30$	≥60		
1022	0.18...0.23	0.70...1.00	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed	N/S	N/S	N/S	N/S	N/S	
1023	0.20...0.25	0.30...0.60								B≤0.003						
1022	0.18...0.23	0.72...0.90	0.20...0.30	≤0.035	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤600	-	$\delta_5 \geq 28$	≥60	-	
1023	0.20...0.25	0.35...0.55	0.10...0.20								≤620		$\delta_5 \geq 28$	≥60		
1025	0.22...0.28	0.30...0.60	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed	N/S	N/S	N/S	N/S	N/S	
1026		0.60...0.90								B≤0.003						

Steel Products Specification

III. Wire rod /III.II. Medium carbon wire rod

<u>1025</u>	0.22...0.28	0.35...0.55	0.20...0.30	≤0.035	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤ 640	-	δ ₅ ≥26	≥ 58	-
1026		0.60...0.80	0.10...0.20			N/S			N/S	allowed B≤0.003	≤ 660	N/S	δ ₅ ≥26	≥ 58	
1029	0.25...0.31	0.60...	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S		N/S	N/S	N/S	N/S	N/S
1030	0.28...0.34	0.90													
<u>1029</u>	0.25...0.31	0.60...0.80	0.20...0.30	≤0.035	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤ 680	-	δ ₅ ≥24	≥ 54	-
1030	0.28...0.34					N/S			N/S	allowed B≤0.003	≤ 710	N/S	δ ₅ ≥24	≥ 54	
1034	0.32...0.38	0.50...0.80	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S		N/S	N/S	N/S	N/S	N/S
1035		0.60...0.90													
1037		0.70...1.00													
<u>1034</u>	0.32...0.38	0.50...0.70	0.20...0.30	≤0.040	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤ 700	-	δ ₅ ≥20	-	-
<u>1035</u>		0.60...0.70									≤ 720	-	δ ₅ ≥20	-	
1037		0.70...0.90									≤ 740	-	δ ₅ ≥20	-	

Steel Products Specification

III. Wire rod /III.II. Medium carbon wire rod

III.II.1. ASTM A510; ASTM A510M

Steel grade	Mass fraction of chemical elements, % ⁴⁾										Mechanical properties ⁴⁾				Processability
	C	Mn	Si	P	S	Cr	Ni	Cu	N ³⁾	Other elements	σ_B , ² N/mm ²	σ_T , ² N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1038	0.35...0.42	0.60...0.90	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S	N/S
1038	0.35...0.42	0.60...0.70	0.20...0.30	≤0.040	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤ 750	-	$\delta_5 \geq 20$	-	-
1039 1040	0.37...0.44	0.70...1.00 0.60...0.90	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S	N/S
1039 1040	0.37...0.44	0.60...0.90 0.60...0.80	0.20...0.30	≤0.040	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤ 770 ≤ 750	-	$\delta_5 \geq 16$ $\delta_5 \geq 16$	-	-

NOTES:

1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer’s discretion.
2. If necessary, the content of Si may be either in conformity with the Standard Specification, and particularly less than 0.10 %; 0.07...0.15 %; 0.10...0.20 %; 0.15...0.30 %; 0.20...0.40 %, or as requested by the customer, with Mn/Si ratio being at least 1:3.
3. Nitrogen – as requested by the customer (total nitrogen – up to ≤0.012, free nitrogen – up to ≤0.007 %).
4. The present specifications show the normal quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.

III.II.2. EN 10016, part 2

Steel grade	Mass fraction of chemical elements ⁵⁾ , %										Mechanical properties ⁵⁾				Processability
	C	Mn	Si ²⁾	P	S	Cr	Ni	Cu	N ⁴⁾	Other elements ³⁾	σ_b , N/mm ²	σ_T , N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C20D	0.18...0.23	0.30...0.60	≤0.30	≤0.035	≤0.035	≤0.20	≤0.25	≤0.30	N/S	Mo≤0.05 Al≤0.01	N/S	N/S	N/S	N/S	N/S
C20D	0.18...0.23	0.30...0.60	0.10...0.20	≤0.030	≤0.015	≤0.20	≤0.25	≤0.30	≤0.012	-	≤560	-	$\delta_5 \geq 25$	≥60	-
C26D	0.24...0.29	0.50...0.80	0.10...0.30	≤0.035	≤0.035	≤0.20	≤0.25	≤0.30	N/S	Mo≤0.05 Al≤0.01	N/S	N/S	N/S	N/S	N/S
C32D	0.30...0.35	0.80	0.30												
C38D	0.35...0.40														
C26D	0.24...0.29	0.50...0.80	0.20...0.30	≤0.030	≤0.015	≤0.20	≤0.25	≤0.30	≤0.012	-	≤660	-	$\delta_5 \geq 26$	≥58	-
C32D	0.30...0.35	0.80	0.30								≤700		$\delta_5 \geq 24$	≥54	
C38D	0.35...0.40										≤760		$\delta_5 \geq 20$	-	

NOTES:

1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer's discretion.
2. The content of Si by mass shall be agreed with the customer.
3. For grades in the range from C49D to C88D: Cu + Sn ≤0.25 %.
4. Nitrogen – as requested by the customer (total nitrogen – up to ≤0.012, free nitrogen – up to ≤0.007 %).
5. The present specifications show the normal quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.

III.II.3. EN 10016, part 4

Steel grade	Mass fraction of chemical elements, %										Mechanical properties				Processability
	C	Mn	Si	P	S	Cr	Ni	Cu	N	Other elements	σ_b , N/mm ²	σ_T , N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C20D2	0.18...0.23	0.30...0.50	≤0.30	≤0.020	≤0.025	≤0.10	≤0.10	≤0.15	≤0.007	Mo ≤ 0.05 Cu+Sn ≤ 0.15 Al ≤ 0.015	Subject to the agreement $\Delta\sigma_b \leq 80$	N/S	N/S	N/S	For deep drawing quality wire rod: depth of defects ≤ 0.15 mm
C20D2	0.18...0.23	0.30...0.60	0.10...0.20	≤0.020	≤0.015		2)		3)		≤ 560	-	$\delta_5 \geq 25$	≥ 60	Achievable
C26D2	0.24...0.29	0.50...0.70	0.10...0.30	≤0.020	≤0.025	≤0.10	≤0.10	≤0.15	≤0.007	Mo ≤ 0.03 Cu+Sn ≤ 0.15 Al ≤ 0.015	Subject to the agreement $\Delta\sigma_b \leq 80$	N/S	N/S	N/S	For deep drawing quality wire rod: depth of defects ≤ 0.15 mm
C32D2	0.30...0.34	0.60	0.20	≤0.020	≤0.015		2)		3)		≤ 660	-	$\delta_5 \geq 26$	≥ 58	Achievable
C36D2	0.34...0.38										≤ 700		$\delta_5 \geq 24$	≥ 54	
C38D2	0.36...0.40										≤ 750		$\delta_5 \geq 20$	-	
C40D2	0.38...0.42										≤ 760		$\delta_5 \geq 20$	-	
C26D2	0.24...0.29	0.50...0.60	0.10...0.20	≤0.020	≤0.015		2)		3)		≤ 770		$\delta_5 \geq 20$	-	

NOTES:

1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer's discretion.
2. Achievable, though incurs the increase in the costs of production.
3. To agree with the customer free nitrogen of not more than 0.007%.
4. The evaluation of non-metallic inclusions is performed, if requested by the customer. For carbon grades starting from C42D2 and over – evaluation of the decarburisation shall be to Table 4 and EN 10016, part 4, item 3.4.

Steel Products Specification

III. Wire rod /III.II. Medium carbon wire rod

III.II.4. JIS G 3505¹⁾

Steel grade ²⁾	Mass fraction of chemical elements, % ⁶⁾										Mechanical properties ⁶⁾				Processability
	C	Mn	Si ³⁾	P	S	Cr	Ni	Cu	N ⁵⁾	Other elements	$\sigma_{B, 2}$ N/mm ²	$\sigma_{T, 2}$ N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
20K 22K	0.18...0.23 0.20...0.25	0.30... 0.60	N/S	≤0.045	≤0.045	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	
20K	0.18...0.23	0.30...	0.10...	≤0.030	≤0.015	≤0.30	≤0.30	≤0.35	≤0.012	-	≤ 560	-	$\delta_5 \geq 25$	-	
22K	0.20...0.25	0.60	0.20								≤ 580		$\delta_5 \geq 24$	-	

NOTES:

1. Wire rod is not applicable for manufacturing welding wire or electrodes.
2. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer's discretion.
3. Letter "K" means a killed steel grade, no letter "K" means a rimming or semi-killed steel grade.
4. . If required by the customer the content of Si may be modified, with Mn/Si ratio being at least 1:3.
5. Nitrogen – as requested by the customer (total nitrogen – up to ≤0.012, free nitrogen – up to ≤0.007 %).
6. The present specifications show the normal quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.
7. Steel may be microalloyed with B, if agreed upon between the customer and the mill.

Steel Products Specifications

III. Wire rod /III.III. High carbon wire rod

1044	0.43...0.50	0.30...0.60	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S
1045		0.60...0.90												
1046		0.70...1.00												
1044	0.43...0.50	0.35...0.55	0.12...0.20	≤0.025	≤0.020	≤0.15	≤0.15	≤0.012	≤0.012	-	≤ 860	-	δ ₅ ≥14	-
1045		0.60...0.80	0.18...0.25								≤ 880		δ ₅ ≥14	
1046		0.70...0.90									≤ 900		δ ₅ ≥14	
1049	0.46...0.53	0.60...0.90	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S
1049	0.46...0.53	0.60...0.80	0.18... 0.25	≤0.025	≤0.020	≤0.15	≤0.15	≤0.012	≤0.012	-	≤ 910	-	δ ₅ ≥13	-
1050	0.48...0.55	0.60...0.90	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S
1053		0.70...1.00												
1050	0.48...0.55	0.60...0.80	0.18... 0.25	≤0.025	≤0.020	≤0.15	≤0.15	≤0.012	≤0.012	-	≤ 930	-	δ ₅ ≥12	-
1053		0.60...0.90												
1055	0.50...0.60	0.60...0.90	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S
1055	0.35... 0.38	0.60...0.80	0.18... 0.25	≤0.025	≤0.020	≤0.15	≤0.15	≤0.012	≤0.012	-	≤ 980	-	δ ₁₀ ≥12	≥ 35
1059	0.55...0.65	0.50...0.80	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed B≤0.003	N/S	N/S	N/S	N/S
1060		0.60...0.90												
1059 ⁷⁾	0.55...0.65	0.50...0.70	0.18... 0.25	≤0.025	≤0.020	≤0.15	≤0.15	≤0.012	≤0.012	B≤0.003	≤ 1040	-	δ ₁₀ ≥11	≥ 35
1060		0.60...0.80												

Spring, rope, prestressed concrete wire rod, direct drawing from Ø 5.5...6.5 to Ø 1.2...1.8 mm.
From 1 to 2 thermal treatment operations may be eliminated during the drawing process.

Steel Products Specifications

III. Wire rod /III.III. High carbon wire rod

III.III.1. ASTM A510; ASTM A510M

Steel grade	Mass fraction of chemical elements, % ⁴⁾											Mechanical properties ⁴⁾				Processability
	C	Mn	Si	P	S	Cr	Ni	Cu	N ³⁾	Other elements	σ_B , N/mm ²	σ_{Ts} , N/mm ²	δ , %	Ψ , %		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1064	0.60...0.70	0.50...0.80	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed	N/S	N/S	N/S	N/S		
1065		0.60...0.90								B≤0.003						
1064	0.60...0.70	0.50...0.70	0.15...	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	≤0.012	B≤0.003	≤1090	-	$\delta_{10} \geq 10$	≥32		
1065		0.60...0.80	0.30						≤0.010							
1069	0.65...0.75	0.40...0.70	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed	N/S	N/S	N/S	N/S		
1070		0.60...0.90								B≤0.003						
1069	0.65...0.75	0.40...0.60	0.12...0.20	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	≤0.012	B≤0.003	≤1140	-	$\delta_{10} \geq 9$	≥30		
1070		0.60...0.80	0.18...0.25													
1074	0.70...0.80	0.50...0.80	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed	N/S	N/S	N/S	N/S		
1075		0.40...0.70								B≤0.003						
1074	0.70...0.80	0.50...0.70	0.18...0.25	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	≤0.012	B≤0.003	≤1190	-	$\delta_{10} \geq 9$	≥30		
1075		0.40...0.60	0.12...0.20													
1078	0.72...0.85	0.30...0.60	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed	N/S	N/S	N/S	N/S		
1080	0.75...0.88	0.60...0.90								B≤0.003						
1078	0.72...0.85	0.35...0.55	0.12...0.20	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	≤0.012	B≤0.003	≤1240	-	$\delta_{10} \geq 8$	≥27		
1080	0.75...0.88	0.60...0.80	0.18...0.25													
1084	0.80...0.93	0.60...0.90	2)	≤0.040	≤0.050	N/S	N/S	N/S	N/S	allowed	N/S	N/S	N/S	N/S		
1085		0.70...1.00								B≤0.003						
1086		0.30...0.50														
1084	0.80...0.93	0.60...0.80	0.18...	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	≤0.012	B≤0.003	≤1280	-	$\delta_{10} \geq 7$	≥24		
1085		0.70...0.90	0.25													
1086		0.35...0.45														

NOTES: 1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. N/S –not specified in the standard documentation and remains at the producer's discretion.

2. If necessary, the content of Si may be either in conformity with the Standard Specification or as requested by the customer, with Mn/Si ratio being at least 1:3.

3. Nitrogen – as requested by the customer (total nitrogen – up to ≤0.012, free nitrogen – up to ≤0.007 %).

4. The present specifications show the normal (basic) quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.

III.III.2. EN 10016, part 2

Steel grade	Mass fraction of chemical elements ⁴⁾ , %										Mechanical properties ⁴⁾				Processability
	C	Mn	Si ²⁾	P	S	Cr	Ni	Cu	N ³⁾	Other elements ²⁾	σ_B , N/mm ²	σ_T , N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C42D	0.40...0.45	0.50...	0.10...	≤0.035	≤0.035	≤0.20	≤0.25	≤0.30	N/S	Mo≤0.05	N/S	N/S	N/S	N/S	N/S
C48D	0.45...0.50	0.80	0.30					≤0.25							
C50D	0.48...0.53							≤0.20							
C52D	0.50...0.55														
C56D	0.53...0.58														
C58D	0.55...0.60														
C60D	0.58...0.63														
C62D	0.60...0.65														
C66D	0.63...0.68														
C68D	0.65...0.70														
C70D	0.68...0.73														
C72D	0.70...0.75														
C76D	0.73...0.78														
C42D	0.40...0.45	0.50...	0.10...	≤0.025	≤0.020	≤0.20	≤0.25	≤0.30	≤0.012	B≤0.003	≤ 820	-	$\delta_5 \geq 15$	-	Spring, rope and PC quality wire rod, direct drawing from $\varnothing 5.5...6.5$ mm to $\varnothing 1.2...1.8$ mm
C48D	0.45...0.50	0.80	0.30					≤0.25			≤ 880		$\delta_5 \geq 14$	-	
C50D	0.48...0.53							≤0.20			≤ 910		$\delta_5 \geq 13$	-	
C52D	0.50...0.55										≤ 930		$\delta_5 \geq 12$	≥ 35	
C56D	0.53...0.58										≤ 980		$\delta_5 \geq 12$	≥ 35	
C58D	0.55...0.60										≤ 980		$\delta_5 \geq 12$	≥ 35	
C60D	0.58...0.63										≤ 1040		$\delta_{10} \geq 11$	≥ 33	
C62D	0.60...0.65										≤ 1060		$\delta_{10} \geq 10$	≥ 32	
C66D	0.63...0.68										≤ 1090		$\delta_{10} \geq 10$	≥ 32	
C68D	0.65...0.70										≤ 1090		$\delta_{10} \geq 10$	≥ 30	
C70D	0.68...0.73										≤ 1140		$\delta_{10} \geq 9$	≥ 30	
C72D	0.70...0.75										≤ 1160		$\delta_{10} \geq 9$	≥ 30	
C76D	0.73...0.78										≤ 1190		$\delta_{10} \geq 9$	≥ 28	

III.III.2. EN 10016, part 2

Steel grade	Mass fraction of chemical elements ⁴⁾ , %										Mechanical properties ⁴⁾				Processability ⁵⁾
	C	Mn	Si ²⁾	P	S	Cr	Ni	Cu	N ³⁾	Other elements ²⁾	σ_b , N/mm ²	σ_{T_1} , N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C78D	0.75...0.80	0.50...	0.10...	≤0.035	≤0.035	≤0.15	≤0.20	≤0.25	N/S	Mo≤0.05	N/S	N/S	N/S	N/S	
C80D	0.78...0.83	0.80	0.30							Al≤ 0.01					
C82D	0.80...0.85									Cu + Sn ≤ 0.25 %					
C86D	0.83...0.88														
C88D	0.85...0.90														
C78D	0.75...0.80	0.50...	0.10...	≤0.025	≤0.020	≤0.15	≤0.20	≤0.25	≤0.012	B≤0.003	≤ 1210	-	$\delta_{10} \geq 9$	≥28	Spring, rope and PC
C80D	0.78...0.83	0.80	0.30								≤ 1240		$\delta_{10} \geq 8$	≥27	quality wire rod, direct
C82D	0.80...0.85										≤ 1260		$\delta_{10} \geq 8$	≥27	drawing from Ø
C86D	0.83...0.88										≤ 1280		$\delta_{10} \geq 7$	≥24	5.5...6.5 to Ø 1.2...1.8
C88D	0.85...0.90										≤ 1280		$\delta_{10} \geq 7$	≥24	mm

NOTES:

1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer's discretion.
2. Microalloying shall be agreed upon with the customer.
3. Nitrogen – as requested by the customer (total nitrogen – up to ≤0.012, free nitrogen – up to ≤0.007 %).
4. The present specifications show the normal (basic) quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.
5. From 1 to 2 thermal treatment operations may be eliminated during the drawing process.

III.III.3. EN 10016, part 4

Steel grade	Mass fraction of chemical elements ⁵⁾ , %										Mechanical properties ⁵⁾				Processability
	C	Mn	Si	P	S	Cr	Ni	Cu	N	Other elements	σ_b , N/mm ²	σ_{T1} , N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C42D2	0.40...0.44	0.50...	0.10...	≤0.020	≤0.025	≤0.10	≤0.10	≤0.15	≤0.007	Mo≤0.03	Upon agreement	N/S	N/S	N/S	For wire rod of deep drawing quality the depth of defects to be ≤0.15 mm, for diameters over 12 mm the depth of defects to be ≤0.20 mm
C46D2	0.44...0.48	0.70	0.30			Cr + Ni + Cu ≤ 0.30				0.15	Δσ_b ≤ 100				
C48D2	0.46...0.50									Al ≤ 0.015					
C50D2	0.48...0.52														
C52D2	0.50...0.54														
C56D2	0.54...0.58														
C58D2	0.56...0.60														
C42D2	0.40...0.44	0.50...	0.10...	≤0.020	≤0.020		2)		3)	2)	≤ 820	-	δ ₅ ≥15	-	
C46D2	0.44...0.48	0.70	0.30								≤ 850		δ ₅ ≥15	-	
C48D2	0.46...0.50										≤ 880		δ ₅ ≥14	-	
C50D2	0.48...0.52										≤ 910		δ ₅ ≥13	-	
C52D2	0.50...0.54										≤ 930		δ ₅ ≥12	≥ 35	
C56D2	0.54...0.58										≤ 980		δ ₅ ≥12	≥ 35	
C58D2	0.56...0.60										≤ 980		δ ₅ ≥12	≥35	
C60D2	0.58...0.62	0.50...	0.10...	≤0.020	≤0.025	≤0.10	≤0.10	≤0.15	≤0.007	Mo≤0.03	Upon agreement	N/S	N/S	N/S	For wire rod of deep drawing quality the depth of defects to be ≤0.15 mm, for diameters over 12 mm the depth of defects to be ≤0.20 mm
C62D2	0.60...0.64	0.70	0.30							0.15	Δσ_b ≤ 100				
C66D2	0.64...0.68									Al ≤ 0.015	From grade C72D2				
C68D2	0.66...0.70									From grade C70D2	Δσ_b ≤ 120				
C70D2	0.68...0.72									Mo≤0.02					
C72D2	0.70...0.74														
C76D2	0.74...0.78														
C60D2	0.58...0.62	0.50...	0.10...	≤0.020	≤0.020		2)		3)	2)	≤ 1040	-	δ ₁₀ ≥11	≥35	
C62D2	0.60...0.64	0.70	0.30								≤ 1060		δ ₁₀ ≥10	≥32	
C66D2	0.64...0.68										≤ 1090		δ ₁₀ ≥10	≥32	
C68D2	0.66...0.70										≤ 1090		δ ₁₀ ≥10	≥30	
C70D2	0.68...0.72										≤ 1140		δ ₁₀ ≥9	≥30	
C72D2	0.70...0.74										≤ 1160		δ ₁₀ ≥9	≥30	
C76D2	0.74...0.78										≤ 1190		δ ₁₀ ≥9	≥30	

III.III.3. EN 10016, part 4

Steel grade	Mass fraction of chemical elements ⁵⁾ , %										Mechanical properties ⁵⁾				Processability
	C	Mn	Si	P	S	Cr	Ni	Cu	N	Other elements	σ_B , N/mm ²	σ_T , N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C78D2	0.76...0.80	0.50...	0.10...	≤0.020	≤0.025	≤0.10	≤0.10	≤0.15	≤0.007	Mo≤0.03	Upon	N/S	N/S	N/S	For wire rod of deep drawing quality the depth of defects to be ≤0.15 MM, for diameters over 12 mm the depth of defects to be ≤0.20 mm
C80D2	0.78...0.82	0.70	0.30			Cr + Ni + Cu ≤ 0.30				Cu+Sn ≤ 0.15	agreement				
C82D2	0.80...0.84									Al ≤ 0.015	Δσ_B ≤ 120				
C86D2	0.84...0.88									Mo≤0.02					
C88D2	0.86...0.90														
C78D2	0.76...0.80	0.50...	0.10...	≤0.020	≤0.020		2)		3)	Achievable	≤ 1210	-	δ ₁₀ ≥9	≥28	
C80D2	0.78...0.82	0.70	0.30							B≤0.003	≤ 1240		δ ₁₀ ≥8	≥27	
C82D2	0.80...0.84										≤ 1260		δ ₁₀ ≥8	≥27	
C86D2	0.84...0.88										≤ 1280		δ ₁₀ ≥7	≥24	
C88D2	0.86...0.90										≤ 1280		δ ₁₀ ≥7	≥24	

NOTES:

1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer's discretion.
2. Ensured through the use of a clean scrap charge, though it incurs the increase in the production costs.
3. Free nitrogen shall be agreed upon at the level not exceeding 0.007 %.
4. The evaluation of non-metallic inclusions is performed, if requested by the customer. For carbon grades starting from C42D2 and over – evaluation of the decarburisation shall be to Table 4 and EN 10016, part 4, item 3.4 .
5. The present specifications show the normal (basic) quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.

III.III.4. JIS G 3506¹⁾

Steel grade	Mass fraction of chemical elements ⁴⁾ , %										Mechanical properties ⁴⁾				Processability ⁵⁾
	C	Mn	Si	P	S	Cr	Ni	Cu	N ³⁾	Other elements	σ_B , N/mm ²	σ_{Tr} , N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
42A/42B	0.39...0.46	0.30...0.60/	0.15...	≤ 0.040	≤ 0.040	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
47A/47B	0.44...0.51	0.60...0.90	0.35	для марок с 67A/67B	для марок с 67A/67B										
52A/52B	0.49...0.56			≤ 0.030	≤ 0.030										
57A/57B	0.54...0.61														
62A/62B	0.59...0.60														
67A/67B	0.64...0.71														
72A/72B	0.69...0.76														
77A/77B	0.74...0.81														
82A/82B	0.79...0.86														
42A/42B	0.39...0.46	0.30...0.60/	0.15...	≤ 0.050	≤ 0.020	≤ 0.15	≤ 0.15	≤ 0.25	≤ 0.012	B ≤ 0.003	≤ 820	-	$\delta_5 \geq 15$	-	
47A/47B	0.44...0.51	0.60...0.90	0.35								≤ 880		$\delta_5 \geq 14$	-	
52A/52B	0.49...0.56										≤ 930		$\delta_5 \geq 12$	-	
57A/57B	0.54...0.61										≤ 980		$\delta_5 \geq 12$	≥ 35	
62A/62B	0.59...0.60										≤ 1040		$\delta_{10} \geq 11$	≥ 35	
67A/67B	0.64...0.71										≤ 1040		$\delta_{10} \geq 11$	≥ 35	
72A/72B	0.69...0.76										≤ 1090		$\delta_{10} \geq 10$	≥ 32	
77A/77B	0.74...0.81										≤ 1140		$\delta_{10} \geq 9$	≥ 30	
82A/82B	0.79...0.86										≤ 1240		$\delta_{10} \geq 8$	≥ 27	

NOTES: 1. Wire rod applicable for manufacturing steel wire, oil quenched wire, prestressed concrete wire, ropes, including coated ropes.

2. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. N/S – not specified in the standard documentation and remains at the producer's discretion.

3. Nitrogen – as requested by the customer (total nitrogen – up to ≤ 0.012, free nitrogen – up to ≤ 0.007 %).

4. The present specifications show the normal (basic) quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.

5. Spring, rope, prestressed concrete wire rod, direct drawing from Ø 5.5...6.5 to Ø 1.2...1.8 mm.

From 1 to 2 thermal treatment operations may be eliminated during the drawing process.

III.III.5. TY Y 27.1-4-519-2002¹⁾

Steel grade	Mass fraction of chemical elements, %										Mechanical properties				Processability ³⁾
	C	Mn	Si	P	S	Cr	Ni	Cu	N ²⁾	Other elements	σ_B , N/mm ²	σ_T , N/mm ²	δ_{10} , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
50	0.48...	0.30...	0.15...	≤0.017	≤0.012	≤0.10	≤0.15	≤0.20	0,007	S+P ≤ 0.025 Cr+Ni+Cu ≤ 0.35	≤ 940	N/S	≥ 13	≥ 40	Spring, rope, prestressed concrete wire rod, direct drawing from Ø 5.5...6.5 to Ø 1.2...1.8 mm. From 1 to 2 thermal treatment operations may be eliminated during the drawing process.
	0.52	0.60	0.25								≤ 990	N/S	≥ 12	≥ 35	
55	0.53...	0.30...	0.15...	≤0.017	≤0.012	≤0.10	≤0.15	≤0.20	0,007		≤ 1040	N/S	≥ 11	≥ 35	
	0.57	0.60	0.25							≤ 1090	N/S	≥ 10	≥ 32		
60	0.58...	0.30...	0.15...	≤0.017	≤0.012	≤0.10	≤0.15	≤0.20	0,007		≤ 1140	N/S	≥ 9	≥ 30	
	0.62	0.60	0.25							≤ 1190	N/S	≥ 9	≥ 30		
65	0.63...	0.30...	0.15...	≤0.017	≤0.012	≤0.10	≤0.15	≤0.20	0,007		≤ 1240	N/S	≥ 8	≥ 27	
	0.67	0.60	0.25							≤ 1280	N/S	≥ 7	≥ 24		
70	0.68...	0.30...	0.15...	≤0.017	≤0.012	≤0.10	≤0.15	≤0.20	0,007		≤ 1300	N/S	≥ 6	≥ 22	
	0.72	0.60	0.25												
75	0.73...	0.30...	0.15...	≤0.017	≤0.012	≤0.10	≤0.15	≤0.20	0,007						
	0.77	0.60	0.25												
80	0.78...	0.30...	0.15...	≤0.017	≤0.012	≤0.10	≤0.15	≤0.20	0,007						
	0.82	0.60	0.25												
85	0.83...	0.30...	0.15...	≤0.017	≤0.012	≤0.10	≤0.15	≤0.20	0,007						
	0.87	0.60	0.25												
90	0.88...	0.30...	0.15...	≤0.017	≤0.012	≤0.10	≤0.15	≤0.20	0,007						
	0.92	0.60	0.25												

NOTES: 1. Wire rod applicable for manufacturing steel wire of rope and spring quality, prestressed concrete wire, and other types of wire.

2. Free nitrogen.

III.III.6. TY Y 27.1-4-521-2002¹⁾

Steel grade	Mass fraction of chemical elements, %										Mechanical properties				Processability ³⁾
	C	Mn	Si	P	S	Cr	Ni	Cu	N ²⁾	Other elements	σ_B , N/mm ²	σ_T , N/mm ²	δ_{10} , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
50	0.48...	0.30...	0.15...	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	0,008	-	≤940	N/S	≥13	≥40	Spring, rope, prestressed concrete wire rod, direct drawing from Ø 5.5...6.5 to Ø 1.2...1.8 mm. From 1 to 2 thermal treatment operations may be eliminated during the drawing process.
	0.52	0.60	0.25	≤0.025	≤0.020	≤0.15	≤0.25	≤0.25			≤990	N/S	≥12	≥35	
55	0.53...	0.30...	0.15...	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	0,008	-	≤1040	N/S	≥11	≥35	
	0.57	0.60	0.25	≤0.025	≤0.020	≤0.15	≤0.25	≤0.25			≤1090	N/S	≥10	≥32	
60	0.58...	0.30...	0.15...	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	0,008	-	≤1140	N/S	≥9	≥30	
	0.62	0.60	0.25	≤0.025	≤0.020	≤0.15	≤0.25	≤0.25			≤1190	N/S	≥9	≥30	
65	0.63...	0.30...	0.15...	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	0,008	-	≤1240	N/S	≥8	≥27	
	0.67	0.60	0.25	≤0.025	≤0.020	≤0.15	≤0.25	≤0.25			≤1280	N/S	≥7	≥24	
70	0.68...	0.30...	0.15...	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	0,008	-	≤1300	N/S	≥6	≥22	
	0.72	0.60	0.25	≤0.025	≤0.020	≤0.15	≤0.25	≤0.25							
75	0.73...	0.30...	0.15...	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	0,008	-					
	0.77	0.60	0.25	≤0.025	≤0.020	≤0.15	≤0.25	≤0.25							
80	0.78...	0.30...	0.15...	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	0,008	-					
	0.82	0.60	0.25	≤0.025	≤0.020	≤0.15	≤0.25	≤0.25							
85	0.83...	0.30...	0.15...	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	0,008	-					
	0.87	0.60	0.25	≤0.025	≤0.020	≤0.15	≤0.25	≤0.25							
90	0.88...	0.30...	0.15...	≤0.025	≤0.020	≤0.15	≤0.15	≤0.25	0,008	-					
	0.92	0.60	0.25	≤0.025	≤0.020	≤0.15	≤0.25	≤0.25							

NOTES: 1. Wire rod applicable for manufacturing steel wire of rope and spring quality, prestressed concrete wire, and other types of wire.

2. Free nitrogen.

III.IV.1. TY Y 14-4-470-2000¹⁾

Steel grade	Mass fraction of chemical elements, %										Mechanical properties				Processability ⁴⁾
	C	Mn	Si	P	S	Cr	Ni	Cu	N ²⁾	Other elements	σ_B , N/mm ²	σ_T , N/mm ²	δ_{10} , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
70 KRD	0.70...	0.40...	0.15...	≤0.015	≤0.010	≤0.10	≤0.13	≤0.20	0,007	Al ≤ 0.005	≤ 1160	N/S	≥ 9	≥ 30	Direct drawing from Ø 5.5...6.5 to Ø 1.2...1.8 mm
	0.74	0.60	0.25							Mo ≤ 0.12					
75 KRD	0.75...	0.40...	0.15...	≤0.015	≤0.010	≤0.10	≤0.13	≤0.20	0,007	S+P ≤ 0.022	≤ 1200	N/S	≥ 9	≥ 30	From 1 to 2 thermal treatment operations may be eliminated during the drawing process.
	0.79	0.60	0.25							Cr+Ni+Cu					
80 KRD	0.80...	0.40...	0.15...	≤0.015	≤0.010	≤0.10	≤0.13	≤0.20	0,007	≤ 0.30	≤ 1250	N/S	≥ 8	≥ 27	From 1 to 2 thermal treatment operations may be eliminated during the drawing process.
	0.84	0.60	0.25							Upon agreement					
85 KRD	0.85...	0.40...	0.15...	≤0.015	≤0.010	≤0.10	≤0.13	≤0.20	0,007	Cr+Ni+Cu	≤ 1300	N/S	≥ 7	≥ 25	From 1 to 2 thermal treatment operations may be eliminated during the drawing process.
	0.89	0.60	0.25							≤ 0.35					

NOTES: 1. Wire rod for manufacturing cord and wire applicable for high pressure hose reinforcement.

2. Free nitrogen.

3. Manufactured in diameters 5,5 and 6,5 mm, tolerance ± 0,2, ovality- 0,30 mm max. When agreed upon with the customer, wire rod may be manufactured in other diameters and with other tolerance values.

III.V.1. TY Y 14-4-495-2001¹⁾

Steel grade	Mass fraction of chemical elements, %										Mechanical properties				Processability ³⁾
	C	Mn	Si	P	S	Cr	Ni	Cu	N	Other elements ²⁾	σ_B , N/mm ²	σ_T , N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SB08GSA	0.05... 0.10	1.4... 1.7	0.60... 0.85	≤0.020	≤0.020	≤0.20	≤0.30	≤0.25	²⁾	N/S	≤530	N/S	N/S	≥70	Direct drawing from Ø 5.5...6.5 to Ø 1.2(1.0) mm
SB08GS	≤0.10	1.4... 1.7	0.60... 0.85	≤0.025	≤0.030	≤0.20	≤0.25	≤0.25	0.010	N/S	≤640	N/S	N/S	≥50	
SB08G1SA	0.06... 0.11	1.4... 1.7	0.80... 1.10	≤0.020	≤0.020	≤0.20	≤0.30	≤0.25	²⁾	N/S	≤560	N/S	N/S	≥65	
SV08G1S	0.06... 0.11	1.4... 1.7	0.80... 1.10	≤0.025	≤0.030	≤0.20	≤0.30	≤0.25	²⁾	N/S	≤650	N/S	N/S	≥48	
SV08G2SA	0.06... 0.11	1.8... 2.1	0.70... 0.95	≤0.020	≤0.020	≤0.20	≤0.30	≤0.25	²⁾	N/S	≤600	N/S	N/S	≥60	
SV08G2S	0.05... 0.11	1.8... 2.1	0.70... 0.95	≤0.025	≤0.030	≤0.20	≤0.30	≤0.25	0.010	N/S	≤690	N/S	N/S	≥48	
SV12GS	≤0.14	0.8... 1.1	0.60... 0.90	≤0.025	≤0.030	≤0.20	≤0.30	≤0.25	0.010	N/S	≤640	N/S	N/S	≥48	

NOTES: 1. Wire rod for manufacturing welding wire and coated welding electrodes.

2. Microalloying of steel with B ensures free nitrogen of ≤ 0.007 % in steel.

3. Drawing with a total reduction ratio of not less than 90% is achievable only when modification of non-metallic inclusions is applied and the complete protection/shrouding of the entire steel strand is arranged during the casting process.

4. Manufactured in diameters 5,5...9,0 mm, tolerances ± 0,2, ovality - 0,35 mm maximum. When agreed upon with the customer, wire rod may be manufactured in other diameters and with other diameter tolerance values.

III.V.2. JIS G 3503¹⁾

Steel grade	Mass fraction of chemical elements ⁵⁾ , %										Mechanical properties ⁵⁾				Processability ⁶⁾
	C	Mn	Si ³⁾	P	S	Cr	Ni	Cu	N ⁴⁾	Other elements	σ_B , N/mm ²	σ_T , N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SWRY 11	≤ 0.09	0.35... 0.65	≤ 0.03	≤ 0.020	≤ 0.023	N/S	N/S	≤ 0.20	N/S	N/S	N/S	N/S	N/S	N/S	N/S
SWRY 11 no B	0.04... 0.09	0.40... 0.55	≤ 0.03	achievable	≤ 0.15	≤ 0.20	≤ 0.19	≤ 0.012	no B	-	-	$\delta_5 \geq 33$	≥ 70	Direct drawing from \emptyset 5.5...6.5 to \emptyset 1.4 mm	
B=0.003... 0.008									B=0.003... 0.008	≤ 430	≤ 430	$\delta_5 \geq 37$	≥ 72	Direct drawing from \emptyset 5.5...6.5 to \emptyset 1.0 mm	
SWRY 21	0.06... 0.10	0.35... 0.65	≤ 0.03	≤ 0.020	≤ 0.023	N/S	N/S	≤ 0.20	N/S	N/S	N/S	N/S	N/S	N/S	N/S
SWRY 21 no B	0.06... 0.10	0.40... 0.55	≤ 0.03	achievable	≤ 0.15	≤ 0.20	≤ 0.19	≤ 0.012	no B	-	-	$\delta_5 \geq 33$	≥ 70	Direct drawing from \emptyset 5.5...6.5 to \emptyset 1.4 mm	
B=0.003... 0.008									B=0.003... 0.008	≤ 440	≤ 440	$\delta_5 \geq 37$	≥ 72	Direct drawing from \emptyset 5.5...6.5 to \emptyset 1.0 mm	

NOTES:

1. Wire rod for manufacturing welding wire and coated welding electrodes.
2. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer's discretion.
3. It can be ensured through the selection of heats upon the availability of other concurrent orders. It results in the increased costs of production due to the use of special ferroalloys and a vacuum treatment of steel.
4. Nitrogen – as requested by the customer (total nitrogen – up to ≤ 0.012, free nitrogen – up to ≤ 0.007 %).
5. The present specifications show the normal (basic) quality characteristics of wire rod, though chemical composition and mechanical properties may be modified if agreed upon between the customer and the mill.

III.V.4. DIN 17145 – welding quality wire rod

Steel grade ⁴⁾	Mass fraction of chemical elements, %										Mechanical properties				Processability ⁶⁾
	C	Mn	Si	P	S	Cr	Ni	Cu	N ⁵⁾	Other elements	σ_B , N/mm ²	σ_T , N/mm ²	δ , %	Ψ , %	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
USD7 code:1.03 23	0.06... 0.10	0.45... 0.65	traces	≤0.025	≤0.025	≤0.12 0.12	≤0.12 0.12	≤0.17 0.17	N/S	N/S	N/S	N/S	N/S	N/S	N/S
USD7 no B	0.06... 0.10	0.45... 0.55	≤0.03 2)	≤0.025	≤0.015	4)	4)		≤0.012 ≤0.010	no B	≤450	-	$\delta_5 \geq 33$	≥70	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.4 mm
B=0.003... 0.008										B=0.003... 0.008	≤430	-	$\delta_5 \geq 37$	≥72	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.0 mm
USD6 code:1.11 16	0.06... 0.10	0.45... 0.65	traces	≤0.020	≤0.020	≤0.12 0.12	≤0.12 0.12	≤0.17 0.17	N/S	N/S	N/S	N/S	N/S	N/S	N/S
USD6 no B	0.06... 0.10	0.45... 0.55	≤0.03 2)	≤0.020	≤0.015	4)	4)		≤0.012 ≤0.010	no B	≤450	-	$\delta_5 \geq 33$	≥70	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.4 mm
B=0.003... 0.008										B=0.003... 0.008	≤430	-	$\delta_5 \geq 37$	≥72	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.0 mm
USD5 code:1.11 12	0.06... 0.10	0.45... 0.65	traces	≤0.010	≤0.010	≤0.12 0.12	≤0.12 0.12	≤0.17 0.17	N/S	N/S	N/S	N/S	N/S	N/S	N/S
USD5 no B	0.06... 0.10	0.45... 0.55	≤0.03 2)	≤0.010	≤0.010	4)	4)		≤0.012 ≤0.010	no B	≤450	-	$\delta_5 \geq 33$	≥70	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.4 mm
B=0.003... 0.008										B=0.003... 0.008	≤430	-	$\delta_5 \geq 37$	≥72	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.0 mm
RSD7 code:1.03 24	0.05... 0.09	0.38... 0.62	0.05... 0.17	≤0.025	≤0.020	≤0.12 0.12	≤0.12 0.12	≤0.17 0.17	N/S	AI ≤ 0.010	N/S	N/S	N/S	N/S	N/S
RSD7 no B	0.05... 0.09	0.38... 0.47	0.05... 0.17	≤0.025	≤0.015	4)	4)		≤0.012 ≤0.010	no B	≤435	-	$\delta_5 \geq 33$	≥70	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.4 mm
B=0.003... 0.008										B=0.003... 0.008	≤410	-	$\delta_5 \geq 37$	≥72	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.0 mm

III.V.4. DIN 17145 – welding quality wire rod

Steel grade ³⁾	Mass fraction of chemical elements, %										Mechanical properties					Processability ⁶⁾
	C	Mn	Si	P	S	Cr	Ni	Cu	N ⁵⁾	Other elements	σ_B , N/mm ²	σ_T , N/mm ²	δ , %	Ψ , %		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
RSD10Si code:1.0339 RRSD10 code:1.0351	0.07... 0.11	0.38... 0.57	0.18... 0.45	≤0.025 ≤0.025	≤0.022 ≤0.025	≤ 0.12	≤ 0.12	≤ 0.17	N/S	Al ≤ 0.010	N/S	N/S	N/S	N/S	N/S	
	0.07... 0.11	0.38... 0.57	0.18... 0.45	≤0.025 ≤0.015	≤0.015	4)	4)		≤0.012	-	≤ 470	-	$\delta_5 \geq 32$	≥ 68	-	
11Mn4Si code:1.0492	0.08... 0.14	0.83... 1.15	0.18... 0.37	≤0.025 ≤0.025	≤0.025 ≤0.025	≤0.12 ≤0.12	≤0.12 ≤0.12	≤0.17 ≤0.17	N/S	Al ≤ 0.030	N/S	N/S	N/S	N/S	N/S	
11Mn4Si no B B=0.003... 0.008	0.08... 0.14	0.83... 1.15	0.18... 0.37	≤0.025 ≤0.015	≤0.015	4)	4)		≤0.012	no B	≤ 550	-	$\delta_5 \geq 22$	≥ 55	-	
11Mn4Al code:1.0494	0.08... 0.14	0.83... 1.15	≤ 0.12 ≤ 0.12	≤0.025 ≤0.025	≤0.025 ≤0.025	≤0.12 ≤0.12	≤0.12 ≤0.12	≤0.17 ≤0.17	N/S	Al ≤ 0.040	N/S	N/S	N/S	N/S	N/S	
11Mn4Al no B B=0.003... 0.008	0.08... 0.14	0.83... 1.15	≤ 0.12 ≤ 0.12	≤0.025 ≤0.015	≤0.015	4)	4)		≤0.012	no B	≤ 550	-	$\delta_5 \geq 22$	≥ 55	-	
12Mn6 code:1.0496	0.08... 0.14	1.35... 1.65	0.08... 0.22	≤0.025 ≤0.025	≤0.025 ≤0.025	≤0.12 ≤0.12	≤0.12 ≤0.12	≤0.17 ≤0.17	N/S	Al ≤ 0.030	N/S	N/S	N/S	N/S	N/S	
12Mn6 no B B=0.003... 0.008	0.08... 0.14	1.35... 1.65	0.08... 0.22	≤0.025 ≤0.015	≤0.015	4)	4)		≤0.012 ≤0.010	no B	≤ 570	-	$\delta_5 \geq 24$	≥ 56	-	
13Mn6 code:1.0479	0.08... 0.14	1.35... 1.65	0.30... 0.45	≤0.025 ≤0.025	≤0.025 ≤0.025	≤0.12 ≤0.12	≤0.12 ≤0.12	≤0.17 ≤0.17	N/S	N/S	N/S	N/S	N/S	N/S	N/S	
13Mn6 no B B=0.003... 0.008	0.08... 0.14	1.35... 1.65	0.30... 0.45	≤0.025 ≤0.015	≤0.015	4)	4)		≤0.012 ≤0.010	no B	≤ 570	-	$\delta_5 \geq 24$	≥ 56	-	
	0.08... 0.14	1.35... 1.65	0.30... 0.45	≤0.025 ≤0.015	≤0.015				≤0.012 ≤0.010	B=0.003... 0.008	≤ 540	-	$\delta_5 \geq 27$	≥ 60	-	

III.V.4. DIN 17145 – welding quality wire rod

Steel grade ³⁾	Mass fraction of chemical elements, %										Mechanical properties				Processability ⁶⁾
	C	Mn	Si	P	S	Cr	Ni	Cu	N ⁵⁾	Other elements	σ_B , N/mm ²	σ_T , N/mm ²	δ , %	Ψ , %	
1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
10MnSi5 code:1.5112 -SG1 DIN	0.07... 0.11	1.03... 1.27	0.55... 0.75	≤0.020 ≤0.020	≤0.020 ≤0.020	≤0.12 ≤0.12	≤0.12 ≤0.12	≤0.17 ≤0.17	N/S N/S	Al ≤ 0.020 Mo ≤ 0.12 Ti + Zr ≤ 0.13	N/S N/S	N/S N/S	N/S N/S	N/S N/S	N/S N/S
10MnSi5 no B	0.07...	1.03...	0.55...	≤0.020	≤0.015		4)		≤0.012	no B	≤ 550	-	$\delta_5 \geq 26$	≥ 60	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.5 mm.
B = 0.003 ...0.008	0.11	1.27	0.75							B = 0.003 ...0.008	≤ 520	-	$\delta_5 \geq 28$	≥ 63	Direct drawing from \varnothing 5.5...6.5 to \varnothing 0.6 mm
11MnSi6 code:1.5125 -SG2 DIN	0.08... 0.13	1.33... 1.57	0.75... 0.95	≤0.020 ≤0.020	≤0.020 ≤0.020	≤0.12 ≤0.12	≤0.12 ≤0.12	≤0.17 ≤0.17	N/S N/S	Al ≤ 0.020 Mo ≤ 0.12 Ti + Zr ≤ 0.13	N/S N/S	N/S N/S	N/S N/S	N/S N/S	N/S N/S
11MnSi6 no B	0.08...	1.33...	0.75...	≤0.020	≤0.015		4)		≤0.012	no B	≤ 570	-	$\delta_5 \geq 24$	≥ 53	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.5 mm.
B = 0.003 ...0.008	0.13	1.57	0.95							B = 0.003 ...0.008	≤ 550	-	$\delta_5 \geq 28$	≥ 58	Direct drawing from \varnothing 5.5...6.5 to \varnothing 0.6 mm
10MnSi7 code:1.5130 -SG3 DIN	0.08... 0.13	1.63... 1.87	0.85... 1.13	≤0.020 ≤0.020	≤0.020 ≤0.020	≤0.12 ≤0.12	≤0.12 ≤0.12	≤0.17 ≤0.17	N/S N/S	Al ≤ 0.020 Mo ≤ 0.12 Ti + Zr ≤ 0.13	N/S N/S	N/S N/S	N/S N/S	N/S N/S	N/S N/S
10MnSi7 no B	0.08...	1.63...	0.85...	≤0.020	≤0.015		4)		≤0.012	no B	≤ 590	-	$\delta_5 \geq 23$	≥ 52	Direct drawing from \varnothing 5.5...6.5 to \varnothing 2.0 mm
B = 0.003 ...0.008	0.13	1.87	1.13							B = 0.003 ...0.008	≤ 570	-	$\delta_5 \geq 26$	≥ 57	Direct drawing from \varnothing 5.5...6.5 to \varnothing 1.2 mm

III.V.4. DIN 17145 – welding quality wire rod**NOTES:**

1. Requirements of the Standard Specification to the product are shown in bold letters, the values achievable by the mill for a respective grade are given below. **N/S** –not specified in the standard documentation and remains at the producer’s discretion.
2. It can be ensured through the selection of heats upon the availability of other concurrent orders. It results in the increased costs of production due to the use of special ferroalloys and a vacuum treatment of steel.
3. Additional costs on desulphurization and dephosphorization.
4. It is achievable though incurs the increase in the production costs.
5. Nitrogen – as requested by the customer (total nitrogen – up to ≤ 0.012 , free nitrogen – up to ≤ 0.007 %).
6. All grades belong to the ordinary steel grades : grade USD7 to EU 133 defined as grade 1CE8; USD6: to EU 133 - 2CE8; USD5: to EU 133 - 2CE8; RSD7: to DIN 8554 - G1; RSD10Si: to DIN 8557 - S1Si;RSD10: to DIN 8557 - S1; to EU 133 – CE9; 11Mn4Si: to DIN 8557 – S2Si; to DIN 8575 – RES2Si; to EU 133 – CE11Si; 11Mn4Al: to DIN 8557 – S2; to DIN 8575 – RES2; to EU 133 – CE11; 12 Mn6: to DIN 8557 – S3; to DIN 8575 – RES3; to EU 133 – CE11Mn; 13 Mn6: DIN 8575 – RES3Si; 10MnSi5: to DIN 8559 – SG1; to EU 133 – 9MnSi53KE; 11MnSi6: to DIN 8559 – SG2; to EU 133 – 10MnSi63KE; - 10MnSi7: to DIN 8559 – SG3; to EU 133 – 10MnSi74KE.
7. does not produce alloyed, multi-alloyed or stainless steels of the following grades 11CrMo45; 11CrMo55; 10MnMo45; 11MnMo45; 13MnMo65; 11MnMo85; 9MnNi4; 17MnNi4; 11NiMn54; 11NiMn94; 12CrMo1110; 7CrMo1110; 6CrMo910; X11CrMo61; X7CrMo61; X24CrMoV121... X10CrNi309.

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