

#### INTERCOMERCE NKR CONSULTORIA E NEGÓCIOS LTDA

#### STAINLESS

The present technical delivery conditions are harmonized with the requirements specified in ASTM A276, ASTM A 479/A479M, ASTM A 182/A 182 M, ASTM A 312/A 312M and cover technical requirements for metal products.

The present technical delivery conditions are an integral part of the contract with customers abroad.

#### 1. Scope

- 1.1 Hot-rolled round bars 0,7874-7,4803 in. (20-190 mm) in diameter with peeled surface.
- 1.2 Hot-rolled round bars 0,3149-5,1181 in. (8-130 mm) in diameter with pickled surface (without peeling).
- 1.3 Forged round bars 2,9527-17,7165 in. (75-450 mm) in diameter with peeled/turned surface.
- 1.4 Round bars 0,1181-1.5748 in. (3,00-40,00 mm) in diameter with ground and polished surface.
- 1.5 Hot-rolled round bars 0,4724-2,7559 in. (12,00-70,00 mm) in diameter with ground and polished surface processed on the *Landgraf* automatic straightening/polishing line.
- 1.6 Hot-rolled billet 1,7716-7,2834 in. (45-185 mm) in square side with pickled or ground surface.
- 1.7 Blooms 7,4803-11,0236 in. (190-280 mm) in square side with ground surface.
- 1.8 Hot-rolled bars 0,3149-3,9370 in. (8-100 mm) in square side with pickled surface.
- 1.9 Forged bars 3,1496-15,7480 in. (80-400 mm) in square side.
- 1.10 Rectangular forgings (forged flats) 1,1811-11,8110x3,1496-31,4960 in. (30-300x80-800 mm) in cross section.

#### 2. Manufacture

Steel shall be EAF melted including AOD refining. Then ingots are processed by hot working on rolling mills, presses, hammers or radial forging machines.

On agreement between sides stated in the specification steel can be produced by ESR-method.

Surface finishing for bars 3,00-40,00 mm in diameter is achieved in any process of rolling skin removing at the manufacturer's option. Hot-rolled bars 12-70 mm in diameter are ground and polished on the *Landgraf* automatic line.

#### 3. Steel grades

Steel grades and chemical composition according to ASTM A 276, ASTM A 479/A 479M, ASTM A 182/A182 M, ASTM A 312/A 312 M shall meet the requirements specified in Tables 1-3.

Steel grades and chemical composition with double designation are indicated in Table 4. Weight percent of residual elements not indicated in Tables 1-4 shall conform to the requirements specified in Table 5.

For finished product, variations in chemical composition not exceeding the values specified in Table 6 shall be accepted.

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	i			I	I	I	I	I	I	I	I	I	I	I	I	5x(C+N) 0,70		I	I	5x(C+N) 0,70	4x(C+N) 0,70
	ïZ		8,00 10,50	8,00 12,00	8,00 10,50	8,00 11,00	8,00 11,00	12,00 15,00	12,00 15,00	12,00 15,00	19,00 22,00	19,00 22,00	10,00 14,00	10,00 14,00	10,00 14,00	10,00 14,00	10,00 14,00	10,00 14,00	11,00 15,00	9,00 12,00	9,00 12,00
	Mo			I	I	I	I	I	I	I	I	I	2,00 3,00	2,00 3,00	2,00 3,00	2,00 3,00	2,00 3,00	2,00 3,00	3,00 4,00	I	I
4/JM	o, % Cr		18,00 20,00	18,00 20,00	18,00 20,00	18,00 20,00	18,00 20,00	22,00 24,00	22,00 24,00	22,00 24,00	24,00 26,00	24,00 26,00	16,00 18,00	16,00 18,00	16,00 18,00	16,00 18,00	16,00 18,00	16,00 18,00	18,00 20,00	17,00 19,00	17,00 19,00
A 4/9/A			max 0,10	max 0,10	.	0,10 0,16	0,10 0,16	I	I	I	I	1	max 0,10	max 0,10	I	max 0,10	0,10 0,16	0,10 0,16	max 0,10	I	I
10, A31W	S		max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030	max 0,030
	P		max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045	max 0,045
oraing to	Mn	e	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00	max 2,00
sition acc	Si	stenite ste	max 1.00	max 1,00	max 1,00	max 1,00	max 1,00	max 1,00	max 1,00	max 1,00	max 1,50	max 1,00	max 1,00	max 1,00	max 1,00	max 1,00	max 1,00	max 1,00	max 1,00	max 1,00	max 1,00
al compo	U	Au	max 0,08	max 0,030	0,04 0,10	max 0,08	max 0,030	max 0,20	max 0,08	0,04 0,10	max 0,08	0,04 0,10	max 0,08	max 0,030	0,04 0,10	max 0,08	max 0,08	max 0,030	max 0,08	max 0,08	0,04 0,10
ades and chemic	Analogue by	- )))))	08X18H10	03X18H10	10X19H10	08X19AH10	03X19AH10	20X23H14	08X23H14	10X23H14	08X25H20	10X25H20	08X17H13M2	03X17H13M2	10X17H13M2	08X17H13M2T	08X17AH13M3	03X17AH13M3	08X19H13M4	08X18H10T	10X18H10T
Ctool and C	Standard		ASTM A 276 ASTM A 479/A 479M	ASTM A 276 ASTM A 479/A 479M	ASTM A 479/A 479M	ASTM A 276 ASTM A 479/A 479M	ASTM A 276 ASTM A 479/A 479M	ASTM A 276	ASTM A 276 ASTM A 479/A 479M	ASTM A 479/A 479M	ASTM A 276 ASTM A 479/A 479M	ASTM A 479/A 479M	ASTM A 276 ASTM A 479/A 479M	ASTM A 276 ASTM A 479/A 479M	ASTM A 479/A 479M	ASTM A 276 ASTM A 479/A 479M	ASTM A 479/A 479M				
	ASTM		304	304L	304H	304N	304LN	309	309S	309H	310S	310H	316	316L	316H	316Ti	316N	316LN	317	321	321H
	UNS designation	10100	S30400	S30403	S30409	S30451	S30453	S30900	S30908	S30909	S31008	S31009	S31600	S31603	S31609	S31635	S31651	S31653	S31700	S32100	S32109

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		TABLE 1 (continued). §	Steel grades and c	chemical c	compositio	on accord	ling to AS	TM A 276,	<b>ASTM A</b>	479/A 479	Σ		-
		Steel grade					Wei	ght percent	by element	s, %			
UNS designation	ASTM	Standard	Analogue by GOST	Э	Si	чW	Ч	S	z	Cr	Mo	Ni	Ξ
				Ma	artensite st	eel							
S41000	410	ASTM A 276 ASTM A 479/A 479M	12X13	max 0,15	max 1,00	max 1,00	max 0,040	max 0,030	Ι	11,50 13,50	I	I	I
S42000	420	ASTM A 276	20X13	over 0,15	max 1,00	max 1,00	max 0,040	max 0,030	Ι	12,00 14,00	I	I	I
S43100	431	ASTM A 276 ASTM A 479/A 479M	20X17H2	max 0,20	max 1,00	max 1,00	max 0,040	max 0,030	Ι	15,00 17,00	I	1,25 2,50	I
S44002	440A	ASTM A 276	65X18	0,60 0,75	max 1,00	max 1,00	max 0,040	max 0,030	Ι	16,00 18,00	max 0,75	Ι	I
S44003	440B	ASTM A 276	85X17	0,95 0,95	max 1,00	max 1,00	max 0,040	max 0,030	Ι	16,00 18,00	max 0,75	Ι	I
S44004	440C	ASTM A 276	110X17	0,95 1,20	max 1,00	max 1,00	max 0,040	max 0,030	I	16,00 18,00	max 0,75	I	I
Notes:													

 Upon agreement between parties stated in the specification, all steel grades can be produced with Sulfur content 0,015-0,030%. In this case grade designation according to GOST contains the letter «Y» added in hyphen.
 Upon agreement between parties stated in the specification, all steel grades can be electro-slag remelted. In this case grade designation according to GOST contains the letter "U" added in hyphen and grade designations according to ASTM contain «ESR» indication. Sulfur content shall not exceed 0,010% in the electro - slag remelted steel grades. 3. For austenite steel residual content of Tin and Boron is to be reported in the certificate.

		Ц													
		Ni		8,00	11,00	8,00	13,00	8,00	11,00	8,00	10,50	8,00	10,50	12,00	15,00
		Mo													
/0	o, /o	Cr		18,00	20,00	18,00	20,00	18,00	20,00	18,00	20,00	18,00	20,00	22,00	24,00
by elements	ny elettert	Z		max	0,10	max	0,10			0,10	0,16	0,10	0,16		
bt percent	JIII helcell	S		max	0,030	max	0,030	max	0,030	max	0,030	max	0,030	max	0,030
	איפור	Р		тах	0,045	max	0,045	max	0,045	max	0,045	max	0,045	тах	0,045
		Mn	eel	max	2,00	max	2,00	max	2,00	max	2,00	max	2,00	max	2,00
		Si	ustenite st	max	1,00	max	1,00	max	1,00	max	1,00	max	1,00	max	1,00
		С	A	тах	0,08	max	0,030	0,04	0,10	max	0,08	max	0,030	0,04	0,10
יכנו או ממכים מוומ		Analogue by GOST									NINALIVON				10/20114
Steel grade	oleel ylaue	Standard		ACTM A 100/A 100M		ACTM A 100/A 100M		ACTM A 100/A 100M		ACTM A 100/A 100M		ACTN A 100/A 100M		ACTM A 102/A 102M	101201 A/201 A MILCA
		ASTM			1 004		L 304L				L 004IN				
		UNS designation		007063	004000		00400	001063	004020	000464	0000	000460	004000		enenco

# TARI F 2. Steel grades and chemical composition according to ASTM A 182/A 182M

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Image: Not in the standard cost of the standard c		Steel grades					Weig	aht percent	by element	s, %			
F 310         ASTMA 182/A 182M         25X25H20         max         max         max         max         max         max         max         24,00           F 310H         ASTMA 182/A 182M         10X25H20         0,045         1,000         2,000         0,045         0,030         0,100         26,00           F 316H         ASTMA 182/A 182M         08X17H13M2         0,04         1,000         2,000         0,045         0,030         0,10         26,00           F 316L         ASTMA 182/A 182M         08X17H13M2         0,03         1,000         2,000         0,045         0,030         0,10         16,00           F 316L         ASTMA 182/A 182M         08X17H13M2         0,03         1,000         2,000         0,045         0,030         0,10         16,00           F 316L         ASTMA 182/A 182M         08X17AH13M3         0,03         1,000         2,000         0,045         0,030         0,10         16,00           F 316L         ASTMA 182/A 182M         08X17AH13M3         0,03         1,000         2,000         0,045         0,030         0,10         16,00           F 316L         ASTMA 182/A 182M         08X17AH13M3         0,03         0,045         0,030         0,16	ASTM	Standard	Analogue by GOST	C	Si	ЧN	Ч	s	N	Cr	Mo	Ni	Ξ
F 310H         ASTMA 182/A 182M         10X25H20         0,04         max         max         max         max         max         24,00         26,00	F 310	ASTM A 182/A 182M	25X25H20	max 0,25	max 1,00	max 2,00	max 0,045	max 0,030	Ι	24,00 26,00	I	19,00 22,00	I
F 316       ASTMA 182/A 182/M       08X17H13M2       max       max       max       max       max       max       max       16,00         F 316L       ASTMA 182/A 182/M       08X17H13M2       0,030       1,000       2,000       0,045       0,030       0,10       18,00         F 316H       ASTMA 182/A 182/M       10X18H13M2       0,030       1,000       2,000       0,045       0,030        18,00         F 316H       ASTMA 182/A 182/M       10X18H13M2       0,10       1,000       2,000       0,045       0,030        18,00         F 316N       ASTMA 182/A 182/M       08X17AH13M3       0,03       1,000       2,000       0,045       0,030       0,16       18,00         F 316N       ASTMA 182/A 182/M       08X19H13M3       0,03       1,000       2,000       0,045       0,030       0,16       18,00         F 316LN       ASTMA 182/A 182/M       08X19H13M3       max       max       max       max       max       max       0,10       16,00         F 316LN       ASTMA 182/A 182/M       08X19H13M3       0,33       1,000       2,000       0,045       0,030        28,00         F 317L       ASTMA 182/A 1	F 310H	ASTM A 182/A 182M	10X25H20	0,04 0,10	max 1,00	max 2,00	max 0,045	max 0,030	max 0,10	24,00 26,00	I	19,00 22,00	I
F 316L       ASTM A 182/A 182/M       03X17H13M2       max       max       max       max       max       max       max       16,00       18,00       16,00       18,00       16,00       18,00       16,00       18,00       16,00	F 316	ASTM A 182/A 182M	08X17H13M2	max 0,08	max 1,00	max 2,00	max 0,045	max 0,030	max 0,10	16,00 18,00	2,00 3,00	10,00 14,00	Ι
F 316H       ASTM A 182/A 182/M       10X18H13M2       0,010       1,00       2,00       0,045       0,030        16,00       18,00         F 316N       ASTM A 182/A 182/M       10X18H13M3       max       0,10       16,00       18,00       18,00       16,00	F 316L	ASTM A 182/A 182M	03X17H13M2	max 0,030	max 1,00	max 2,00	max 0,045	max 0,030	max 0,10	16,00 18,00	2,00 3,00	10,00 15,00	Ι
F 316N       ASTMA 182/A 182M       08X17AH13M3       max 0,08       max 1,00       max 2,00       max 0,035       max 0,036       max 0,036       max 0,036       max 0,036       max 0,10       16,00	F 316H	ASTM A 182/A 182M	10X18H13M2	0,04 0,10	max 1,00	max 2,00	max 0,045	max 0,030	Ι	16,00 18,00	2,00 3,00	10,00 14,00	Ι
F 316LN       ASTM A 182/A 182M       03X17AH13M3       max       max       max       max       max       max       max       max       0,016       16,00       16,00       16,00       16,00       16,00       0,045       0,030       0,16       18,00       17,00       19,00       17,00       17,00       17,00       17,00       17,00       17,00       17,00       17,00       17,00       17,00       17,00       10,00       2,00       0,045       0,030       -       17,00       10,00       10,00       10,00       10,00       10,00       10,00       1	F 316N	ASTM A 182/A 182M	08X17AH13M3	max 0,08	max 1,00	max 2,00	max 0,045	max 0,030	0,10 0,16	16,00 18,00	2,00 3,00	11,00 14,00	Ι
F 317       ASTM A 182/A 182M       08X19H13M4       max 0,08       max 1,00       max 2,00       max 0,045       max 0,030       max 1,00       max 2,00       max 0,045       max 0,030       max 1,00       max 2,00       max 0,045       max 0,030       max 1,00       max 2,00       max 0,045       max 0,030       max 1,00       max 0,030       max 1,00       max 0,030       max 0,030       max 0,030       max 1,00       max 0,045       max 0,030       max 0,030       max 1,00       max 0,045       max 0,030       max 0,030       max 0,045       max 0,030 <thmax< th="">       max 0</thmax<>	F 316LN	ASTM A 182/A 182M	03X17AH13M3	max 0,030	max 1,00	max 2,00	max 0,045	max 0,030	0,10 0,16	16,00 18,00	2,00 3,00	11,00 14,00	Ι
F 317L       ASTM A 182/A 182M       03X19H13M4       max 0,030       max 1,00       max 2,00       max 0,045       max 0,030       max -       max 20,00         F 321       ASTM A 182/A 182M       08X18H10T       max 0,08       max 1,00       max 2,00       max 0,045       max 0,030       -       13,00         F 321H       ASTM A 182/A 182M       10X18H10T       0,08       1,00       2,00       0,045       0,030       -       17,00         F 321H       ASTM A 182/A 182M       10X18H10T       0,04       max       max       max       max       max       -       17,00         F 321H       ASTM A 182/A 182M       10X18H10T       0,04       max       max       max       max       -       17,00         F 32.0       0,045       0,030       -       19,00       -       19,00       -       19,00         F 62       ASTM A 182/A 182M       10X18H10T       0,10       1,00       2,00       0,045       0,030       -       17,00         F 62       ASTM A 182/A 182M       10X18H10T       0,01       0,01       0,045       0,030       -       19,00         F 62       ASTM A 182/A 182/M       10X18H10T       0,10       1,00	F 317	ASTM A 182/A 182M	08X19H13M4	max 0,08	max 1,00	max 2,00	max 0,045	max 0,030	Ι	18,00 20,00	3,00 4,00	11,00 15,00	I
F 321     ASTM A 182/A 182M     08X18H10T     max     max     max     max     max     max       F 321H     ASTM A 182/A 182M     10X18H10T     0,08     1,00     2,00     0,045     0,030     -     17,00       F 321H     ASTM A 182/A 182M     10X18H10T     0,04     max     max     max     max     17,00       ASTM A 182/A 182M     10X18H10T     0,04     max     max     max     max     17,00       ASTM A 182/A 182M     10X18H10T     0,04     max     max     max     max     -     17,00       ASTM A 182/A 182M     10X18H10T     0,04     0,045     0,030     -     19,00       ASTM A 182/A 182M     10X18H10T     0,10     1,00     2,00     0,045     0,030     -     19,00       ASTM A 182/A 182M     10X18H10T     0,10     1,00     2,00     0,045     0,030     -     19,00	F 317L	ASTM A 182/A 182M	03X19H13M4	max 0,030	max 1,00	max 2,00	max 0,045	max 0,030	Ι	18,00 20,00	3,00 4,00	11,00 15,00	Ι
F 321H ASTM A 182/A 182M 10X18H10T 0,04 max max max max [] [7,00] [] [] [] [] [] [] [] [] [] [] [] [] []	F 321	ASTM A 182/A 182M	08X18H10T	max 0,08	max 1,00	max 2,00	max 0,045	max 0,030	Ι	17,00 19,00	I	9,00 12,00	5xC 0,70
Martensite steel E.e. ACTM A 100/M 10213 Max Max Max Max Max Max 11,50	F 321H	ASTM A 182/A 182M	10X18H10T	0,04 0,10	max 1,00	max 2,00	max 0,045	max 0,030	I	17,00 19,00		9,00 12,00	4xC 0,70
Ees ACTMA 182/A 182M 12Y13 Max Max Max Max Max Max 211,50				Z	artensite si	teel							
T 04 2010 1020 1020 1020 1020 1020 1020 1	F 6a	ASTM A 182/A 182M	12X13	max 0,15	max 1,00	max 1,00	max 0,040	max 0,030		11,50 13,50	-	max 0,50	I

TABLE 2 (continued). Steel grades and chemical composition according to ASTM A 182/A 182M

Notes:

1. Upon agreement between parties stated in the specification, all steel grades can be produced with Sulfur content 0,015-0,030%. In this case grade designation according to GOST contains the letter «V» added in hyphen.

Upon agreement between parties stated in the specification, all steel grades can be electro-slag remelted. In this case grade designation according to GOST contains the letter "UI" added in hyphen and grade designations according to ASTM contain «ESR» indication. Sulfur content shall not exceed 0,010% in the electro - slag remelted steel grades. ດ i ю

For austenite steel residual content of Tin and Boron shall be reported in the certificate.

TABLE 3. Steel grades and chemical composition according to ASTM A 312/A 312M

		Steel grade					Wei	ght percent I	oy elements	5, %			
UNS Designation	ASTM	Standard	Analogue by GOST	С	Si	ЧМ	Ч	S	Ν	Cr	Mo	Ni	Ξ
S30400	TP304	ASTM A 312/A 312M	08X19H10	max 0,08	max 0,75	max 2,00	max 0,040	max 0,030		18,00 20,00		8,00 11,00	Ι

		Steel grade	iuea). Steel grade	es and che		mposition	accorain Mei	g to AS I IV	hv element	3 I Z M			
UNS designation	ASTM	Standard	Analogue by GOST	υ	Si	ЧN	<u>с</u>	S	z	Ğ	Mo	ïŻ	Ξ
S30403	TP304L	ASTM A 312/A 312M	035X19H10	max 0,035	max 0,75	max 2,00	max 0,040	max 0,030	Ι	18,00 20,00	I	8,00 13,00	
S30409	TP304H	ASTM A 312/A 312M	10X19H10	0,04 0,10	max 0,75	max 2,00	max 0,040	max 0,030	Ι	18,00 20,00	I	8,00 11,00	
S30451	TP304N	ASTM A 312/A 312M	08X19AH10	max 0,08	max 0,75	max 2,00	max 0,040	max 0,030	0,10 0,16	18,00 20,00	I	8,00 11,00	
S30453	TP304LN	ASTM A 312/A 312M	035X19AH10	max 0,035	max 0,75	max 2,00	max 0,040	max 0,030	0,10 0,16	18,00 20,00	Ι	8,00 11,00	
S30908	TP309S	ASTM A 312/A 312M	08X23H14	max 0,08	max 0,75	max 2,00	max 0,045	max 0,030	I	22,00 24,00	max 0,75	12,00 15,00	
S30909	ТР309Н	ASTM A 312/A 312M	10X23H14	0,04 0,10	max 0,75	max 2,00	max 0,040	max 0,030	Ι	22,00 24,00	I	12,00 15,00	
S31008	TP310S	ASTM A 312/A 312M	08X25H20	max 0,08	max 0,75	max 2,00	max 0,045	max 0,030	Ι	24,00 26,00	max 0,75	19,00 22,00	
S31009	TP310H	ASTM A 312/A 312M	10X25H20	0,04 0,10	max 0,75	max 2,00	max 0,040	max 0,030	I	24,00 26,00	I	19,00 22,00	
S31600	TP316	ASTM A 312/A 312M	08X17H13M3	max 0,08	max 0,75	max 2,00	max 0,040	max 0,030	I	16,00 18,00	2,00 3,00	11,00 14,00	
S31603	TP316L	ASTM A 312/A 312M	035X17H13M3	max 0,035	max 0,75	max 2,00	max 0,040	max 0,030		16,00 18,00	2,00 3,00	10,00 15,00	
S31609	TP316H	ASTM A 312/A 312M	10X17H13M3	0,04 0,10	max 0,75	max 2,00	max 0,040	max 0,030	I	16,00 18,00	2,00 3,00	11,00 14,00	
S31651	TP316N	ASTM A 312/A 312M	08X17AH13M3	max 0,08	max 0,75	max 2,00	max 0,040	max 0,030	0,10 0,16	16,00 18,00	2,00 3,00	11,00 14,00	
S31653	TP316LN	ASTM A 312/A 312M	035X17AH13M3	max 0,035	max 0,75	max 2,00	max 0,040	max 0,030	0,10 0,16	16,00 18,00	2,00 3,00	11,00 14,00	
S31700	TP317	ASTM A 312/A 312M	08X19H13M4	max 0,08	max 0,75	max 2,00	max 0,040	max 0,030		18,00 20,00	3,00 4,00	11,00 14,00	
S31703	TP317L	ASTM A 312/A 312M	035X19H13M4	max 0,035	max 0,75	max 2,00	max 0,040	max 0,030	Ι	18,00 20,00	3,00 4,00	11,00 15,00	
S32100	TP321	ASTM A 312/A 312M	08X19H11T	max 0,08	max 0,75	max 2,00	max 0,040	max 0,030	≤0,10	17,00 20,00		9,00 13,00	5xC 0,70
S32109	TP321H	ASTM A 312/A 312M	10X19H10T	0,04 0,10	max 0,75	max 2,00	max 0,040	max 0,030	I	17,00 20,00	I	9,00 13,00	4xC 0,60

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Notes:

1. Upon agreement between parties stated in the specification, all steel grades can be produced with Sulfur content 0,015-0,030%. In this case grade designation according to GOST contains the letter «У» added in hyphen.

2. Upon agreement between parties stated in the specification, all steel grades can be electro-slag remelted. In this case grade designation according to GOST contains the letter "UI" added in hyphen and grade designations according to ASTM contain «ESR» indication. Sulfur content shall not exceed 0,010% in the electro - slag remelted steel

grades. 3. For all steel grades residual content of Tin and Boron shall be reported in the certificate.

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		TARI F.4. Steel ar	ades and chemic	oranoo lev	cition of a	uetanita .	steel with	ין פועווטע קיפועווסע	acionatio	5		F	U 007-200 Page	0 € 9 6
		Steel grade					Weig	ht percent I	by element	s, %				
UNS designation	ASTM	Standard	Analogue by GOST	С	Si	Mn	Ч	S	z	Cr	oW	Ni	Ϊ	
S30400 / S30403	304 / 304L	ASTM A 276 ASTM A 479/A 479M	03X18H10	max 0,030	max 1,00	max 2,00	max 0,045	max 0,030	max 0,10	18,00 20,00	I	8,00 10,50	I	r
S31600 / S31603	316 / 316L	ASTM A 276 ASTM A 479/A 479M	03X17H13M2	max 0,030	max 1,00	max 2,00	max 0,045	max 0,030	max 0,10	16,00 18,00	2,00 3,00	10,00 14,00	I	r
Notes:			-		-								<u> </u>	- г
<ol> <li>Upon agreeme GOST contains the</li> </ol>	ent between p he letter «V» a	parties stated in the specifi added in hyphen.	cation, all steel g	ades can	be produce	ed with Su	lfur contei	nt 0,015-0	,030%. In	this case	grade des	signation	according	þ
2. Upon agreeme letter "III" added	ent between κ in hvphen an	barties stated in the specified or accertion of the specified of the second of the sec	ication, all steel ( ording to ASTM o	grades car contain «Et	n be electro SB» indica:	ion. Sulfu	ielted. In t ir content	his case ç shall not e	jrade des exceed 0.	ignation a 010% in t	ccording t	o GOST - slad re	contains th melted ste	el e
grades.		l content of Tin and Boron			ificato							2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		<u>s</u>
	TABLE 5. Ma	aximal permissible weigh	it percent of resi	idual elem	incare. ients for st	teel with	chemical	composit	tion conf	orming to	Tables 1	4-		
				Weigh	t percent, %									
ZZ	Mo	Ni	Co	Cu	_	2			qN		Π		AI	-
0,00	0,00		al nermissible d	eviations (	from chem	ical com	nosition i	n finicher			0,10		0, 10	٦
	Elemer	nt nt		/eight perce	int by eleme	nts. %				ermissible	deviations.	%		
					0.030					C+	005			
	U			- 0'0<	i30 ≤0,20					<u>2</u> <u>1</u>	),01 0,01			
					>0,20					Ĥ	0,02			
	N.				≤2,50					)+	),05			
	Мn			7	≤1,00					+ +	0,03			
	٩				0.045					+ +	.005			
	S				0,030					0+	,005			1
	Z			0.0	15-0,030					D T	cnn;			
	Ζ			, 0 , 0	50 < 15 00					FI F	1,UZ			-1
	ö			~15.	00 ≤20.00					ΞŦ	0,20			
					20,00					Ĥ	),25			
					≤0,60					)H	0,03			
	Mo			°, ó	60 ≤2,00					Ξ.	),05 10			
				,×	<u>00 ≤7,00</u>					Ħ	J, I U			-
					≤1,00					Ť	0,03			
	ïZ				00,c≥ 00 01 < 10 ∩0					Η Ψ	10,07			
	2			2,5 -0- -0-	00 ≤20,00					ίŦ	0,15			
				. \	20,00					)H	0,20			
	F				≤0,70					) H	),05			_

#### 4. Product range

Metal products are to be produced as hot-rolled round bars and hot-rolled square bars, round bars with ground and polished surface, round, square and rectangular forgings.

Shape, size and permissible deviations of metal products shall correspond to the requirements of sections 4.1-4.10.

When agreed upon by the parties and stated in the specification, statement "tubular billet" shall be written instead of "hot-rolled round bar" or "forged round bars".

# 4.1 Hot-rolled round bars 0,7874-7,4803 in. (20-190 mm) in diameter with peeled surface

Bar diameter and the utmost deviations from it shall conform to the requirements specified in Table 7.

#### TABLE 7. Diameter and utmost deviations for hot-rolled round bars with turned surface

Diar	neter	Utmost devia	ations, mm
inch	mm	lot 1	lot 2
from 0,7874 to 0,8661	from 20,00 to 22,00	±0,20	+0,40/-0,0
over 0,8661 to 0,9842	over 22,00 to 25,00	±0,23	+0,46/-0,0
over 0,9842 to 1,1023	over 25,00 to 28,00	±0,25	+0,50/-0,0
over 1,1024 to 1,2401	over 28,00 to 31,50	±0,28	+0,56/-0,0
over 1,2401 to 1,8897	over 31,50 to 48,00	±0,30	+0,60/-0,0
over 1,8897 to 1,9685	over 48,00 to 50,00	±0,40	+0,80/-0,0
over 1,9685 to 2,4803	over 50,00 to 63,00	±0,40	+0,80/-0,0
over 2,4803 to 3,5433	over 63,00 to 90,00	±0,60	+1,20/-0,0
over 3,5433 to 4,5275	over 90,00 to 115,00	±0,70	+1,40/-0,0
over 4,5275 to 6,1023	over 115,00 to 155,00	±1,00	+2,00/-0,0
over 6,1023 to 7,4803	over 155,00 to 190,00	±1,25	+2,50/-0,0

#### Notes:

1. Lot number shall be stated in the specification.

2. Hot-rolled peeled bars of steel grade 431 (20X17H2) shall be up to 125 mm (incl.) in diameter and for steel grades 440A (65X18), 440B (85X17), 440C (110X17), F310 (25X25H20), F310H (10H25H20) bar diameter shall be up to 74 mm (incl.).

Out-of-round shall not exceed 50% of the total utmost deviations from diameter.

Straightness deviations of the bars shall be max 2,0 mm/m.

The ends shall be straight cut. Burrs and center holes are not allowed.

Inclination from the cut shall not exceed 0,1 of bar diameter.

Bars shall be 3,0-6,0 m in production length with utmost deviations from the length  $\pm 100$  mm. Actual length is stated in the specification.

# 4.2 Hot-rolled round bars 0,3149-5,1181 in. (8-130 mm) in diameter with pickled surface (without peeling)

Bar diameter and utmost deviations from it shall correspond to the requirements specified in Table 8.

Dian	neter	Utmost dev	iations, mm
inch	mm	lot 1	lot 2
0,3149	8		
0,3543	9		
0,3937	10		
0,4330	11	02/05	
0,4724	12	+0,3/-0,5	+0,0/-0,0
0,5118	13		
0,5511	14		
0,5905	15		

#### TABLE 8. Diameter and utmost deviations from it for hot-rolled round bars without peeling

# TABLE 8 (continued). Diameter and utmost deviations from it for hot-rolled round bars without

Diamo	tor mm	Litmost dov	iations mm
inch	mm		
	10		101 2
0,0299	10		
0,0092	10	+0,3/-0,5	+0,6/-0,0
0,7086	10		
0,7480	19		
0,7874	20		
0,8267	21		
0,8661	22	+0,4/-0,5	+0,8/-0,0
0,9055	23		
0,9448	24		
0,9842	25		
1,0236	26		
1,0629	27		
1,1023	28	+0,3/-0,7	+0,9/-0,0
1,1417	29		
1,1811	30		
1,2204	31		
1,2598	32		
1,2992	33		
1,3385	34	04/07	11/00
1,3779	35	+0,4/-0,7	+1,1/-0,0
1,4173	36		
1,4566	37		
1,4960	38		
1,5354	39	+0,4/-0,7	+1,1/-0,0
1,5748	40	+0,4/-0,7	+1,1/-0,0
1.7322	44	+0.4/-0.7	
1.7716	45	+0.4/-0.7	+1.1/-0.0
1.8110	46	+0.4/-0.7	+1.1/-0.0
1,8897	48	+0.4/-0.7	+1.1/-0.0
1 9685	50	+0.4/-1.0	+1 4/-0 0
2 0472	52	+0.4/-1.0	+1 4/-0 0
2 1653	55	+0,4/-1,0	+1 4/-0 0
2 2047	56	+0,4/-1,0	+1 4/-0 0
2,0866	53		+1 4/-0 0
2 2834	58	+0 4/-1 0	
2,3622	60	+0.5/-1.1	+1.6/-0.0
2 4409	62	+0.5/-1.1	
2 4803	63	+0,5/-1,1	±1.6/_0.0
2 5590	65	+0,5/-1,1	+1,6/-0,0
2,0000	68		
2 7559	70	+0,5/-1,1	+16/-00
2,7555	70	±0,0/=1,1	±1 6/_0 0
2,0740	75	+0,0/=1,1	+1.6/-0.0
3 0708	70	+0,0/-1,1	τι,υ/=υ,υ
2 1406	10	+0,0/-1,1	
3,1430 2,0677	00	+0,0/-1,3	+1,0/-0,0
3,2077	03	+0,5/-1,3	.19/00
0,0404 0,4645	C0 00	+0,0/-1,3	+1,0/-0,0
0,4040	00	+0,0/-1,3	—
0,0014	93	+0,0/-1,3	
3,0433	90	+0,0/-1,3	+1,0/U,U
3,7401	95	+0,5/-1,3	+ I ,ð/—U,U
3,8582	98	+0,5/-1,3	
3,9370	100	+0,6/-1,7	+2,3/-0,0
4,0/48	103,5	+0,6/-1,/	—
4,1338	105	+0,6/-1,7	+2,3/-0,0
4,2716	108,5	+0,6/-1,7	—
4,3307	110	+0,6/-1,7	+2,3/-0,0

, , ,	peeling		
Diam	leter	Utmost dev	iations, mm
inch	mm	lot 1	lot 2
4,4685	113,5	+0,6/-1,7	—
4,5275	115	+0,6/-1,7	+2,3/-0,0
4,6653	118,5	+0,6/-1,7	—
4,7244	120	+0,8/2,0	+2,8/-0,0
4,8622	123,5	+0,8/2,0	_
4,9212	125	+0,8/2,0	+2,8/-0,0
5,0590	128,5	+0,8/2,0	—
5,1181	130	+0,8/-2,0	+2,8/-0,0

# TABLE 8 (continued). Diameter and utmost deviations from it for hot-rolled round bars without

#### Notes:

1. Lot number shall be stated in the specification.

2. For hot-rolled bars with pickled surface (without peeling) of steel grades 440A (65X18), 440B (85X17), 440C (110X17), F310 (25X25H20), F310H (10H25H20) bar diameter shall be up to 75 mm (incl.).

Out-of-round shall not exceed 50% of the total deviations from diameter.

Straightness deviations of the bars shall be max 2,0 mm/m.

The ends shall be straight cut and deburred.

Burrs and squeezed ends not exceeding the utmost plus deviations from diameter are permitted.

For bars 8-19 mm in diameter inclination from the cut shall not exceed 2 mm, and for bars 20-130 mm in diameter it shall be max 0,10f bar diameter.

Bars shall be delivered with the production length 2,0-6,0 m. Utmost deviation from the length shall be  $\pm 100$  mm.

Actual length is stated in the specification.

#### 4.3 Forged round bars 2,9527-17,7165 (75-450 mm) in diameter with peeled/turned surface

Bar diameter and utmost deviations from it shall conform to the requirements specified in Table 9.

Dian	Utmost deviations,	
inch	mm	mm
2,9527-3,8188	75-97	+1,2/-0,0
3,8582-4,5275	98-115	+1,4/-0,0
4,5669-6,1023	116-155	+2,0/-0,0
6,1417-7,0866	156-180	+2,5/-0,0
7,1259-17,7165	181-450	+3,0/-0,0

#### TABLE 9. Diameter and utmost deviations from it for forged round bars with peeled/turned surface

Out-of-round shall not exceed the utmost deviations from diameter.

Straightness deviations shall be max 2,0 mm per 1 m of length.

Bar ends shall be straight cut and deburred. Center holes are not allowed.

Inclination from the cut shall not exceed 0,1 of bar diameter. Steps on the bar ends are permitted if they do not exceed 3,0 mm.

Bars shall be delivered with the production length 2,0-6,0 m. The utmost deviations from the length should be  $\pm 100$  mm.

Actual length is to be stated in the specification.

#### 4.4 Round bars 0,1181-1,5748 in. (3,00-40,00 mm) in diameter with ground and polished surface

Bar diameter and utmost deviations from it shall conform to the requirements specified in Table 10.

Out-of-round (difference between the maximal and the minimal diameters at the same cross section) shall not exceed the half of utmost deviations from diameter.

Straightness deviations shall not exceed 0,5 mm per 1 m of length for bars up to 30,00 mm in diameter and 1,0 mm per 1 m of length for bars over 30,00 mm in diameter.

Dian	neter	Utmost deviation	ns from diameter	
inch mm		(corresponding size tolerance), mm		
0,1181	3,00	-0,040 (h10)	+0,040 (k10)	
over 0,1181to 0,2362	over 3,00 to 6,00	-0,048 (h10)	+0,048 (k10)	
over 0,2362 to 0,3937	over 6,00 to 10,00	-0,058 (h10)	+0,058 (k10)	
over 0,3937 to 0,4724	over 10,00 to 12,00	-0,070 (h10)	+0,070 (k10)	
over 0,4724 to 0,7086	over 12,00 to 18,00	-0,110 (h11)	+0,110 (k11)	
over 0,7086 to 1,1811	over 18,00 to 30,00	-0,130 (h11)	+0,130 (k11)	
over 1,1811 to 1,3385	over 30,00 to 34,00	-0,160 (h11)	+0,160 (k11)	
over 1.3385 to 1.5748	over 34.00 to 40.00	-0.250 (h12)	+0.250 (k12)	

TABLE 10. Diameter and utmost deviations from it for round bars with	ground and	polished surface
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**Note**: required size tolerance is stated in the specification.

Bar ends shall be straight cut and deburred.

Bars up to 13,00 mm in diameter shall be 2,0-3,2 m in length, bars over 13,00 mm shall be 4,0-5,5 m in length with utmost deviations from the length  $\pm 50$  mm.

Other bar lengths and utmost deviations from them can be agreed in the specification.

# 4.5 Hot-rolled round bars with ground and polished surface 0,4724-2,7559 in. (12,00-70,00 mm) in diameter after processing on the *Landgraf* automatic line

Bar diameter and deviations from it shall conform to the requirements specified in Table 11. TABLE 11. Diameter and utmost deviations from it for hot-rolled round bars with ground and

Dian	Utmost deviations from diameter for size tolerances, mm							
inch	mm	h9	k9	h10	k10	h11	k11	
from 0,4724 to 0,7086	from 12,00 to 18,00	-0,043	+0,043	-0,070	+0,070	-0,110	+0,110	
over 0,7086 to 1,1811	over 18,00 to 30,00	-0,052	+0,052	-0,084	+0,084	-0,130	+0,130	
over 1,1811 to 1,9685	over 30,00 to 50,00	-0,062	+0,062	-0,100	+0,100	-0,160	+0,160	
over 1,9685 to 2,7559	over 50,00 to 70,00	-0,074	+0,074	-0,120	+0,120	-0,190	+0,190	

#### polished surface processed on the Landgraf automatic line

#### Notes:

1. Size tolerances shall be stated in the specification.

2.On agreement between sides stated in the specification it is permitted to deliver 10% of bars with size tolerance h9 (k9), h10 (h10) of each item with size tolerance h10, (h10), h11, (h11) correspondingly, separately bundled. Bundle tag with indicated utmost deviations shall be additionally marked with a round 4-5 mm in diameter in the right upper corner.

Out-of-round (the difference between the maximal and minimal diameters measured at the same cross section) shall not exceed 1/2 of the utmost deviations from diameter.

Straightness deviations shall not exceed 0,5 mm per 1 m of length for bars up to 30,00 mm (incl.) in diameter and 1,0 mm per 1 m of length for bars over 30,00 mm in diameter.

Bar ends shall be straight cut, peeled or milled.

Inclination from the cut shall be max 0,1 of bar diameter.

One end of bars shall be chamfered. It is permitted to chamfer both bar ends.

Bars shall be 3,0-6,0 m in length with utmost deviations from the length +50/-0 mm.

Actual bar length can be agreed in the specification.

#### 4.6 Hot-rolled billet 1,7716-7,2834 in. (45-185 mm) in square side

Billet size and deviations from it shall conform to the requirements specified in Table 12.

Convexity, concavity and the difference between the opposite sides of the billet shall not exceed the total utmost deviations from the side.

Difference between the diagonals at the same cross section shall not exceed 0,7 of the total utmost deviations from the square side.

Straightness deviations shall not exceed 5 mm per 1 m of length. Overall bow shall not exceed the permissible straightness deviation value multiplied by total length in meters.

Billet size		Corpor radius, mm	Utmost deviations from bloom	
inch	mm		side, mm	
1,7716	45	7	11.0	
1,9685	50	7	±1,2	
2,3622	60	9	±1,6	
2,4803	63	7,5	±1,6	
2,5590	65	0	11.0	
2,7559	70	9	±1,6	
2,9527	75			
3,1496	80	12	±2,0	
3,5433	90	7		
3,9370	100	15	10.4	
4,1338	105		±∠,4	
4,3307	110		±2,7	
4,7244	120	18		
4,9212	125			
5,1181	130			
5,3149	135	01	10.0	
5,5118	140	21	±3,2	
5,9055	150	7		
6,2992	160			
6,6929	170	25	+2.0	
7,0866	180	2	±3,9	
7,2834	185			

TABLE 12.	Sizes of h	not-rolled s	auare	billets and	lutmost	deviations	from	them
	01203 01 1	iot-roncu a	quarc	billets and	i utinost	acviations	ii oili	uncini

**Note:** corner radius is given for shaping pass setting and is not controlled on a billet

Twisting shall not exceed 3 degree per 1 meter of length multiplied by length value in meters, but this product shall be not more than 15 degrees.

Bar ends shall be straight cut. The inclination from the cut shall not exceed 8 mm.

When shearing, squeezed ends are acceptable.

Bars shall be delivered with the production length 2,0-6,0 m with the utmost deviations from the length  $\pm 100$  mm.

Actual length is to be stated in the specification.

When agreed upon by the parties and stated in the specification it is permissible to supply billets up to 9,0 m in length.

#### 4.7 Blooms 7,4803-11,0236 in. (190-280 mm) in square side with peeled surface

Bloom sizes and utmost deviations from them shall conform to the requirements specified in Table 13.

		and admost astratistic inc			
Bloom side		Corpor radius, mm	Utmost deviations from the		
inch	mm	Corrier radius, min	side, mm		
7,4803	190	25	±6,0		
7,8740	200	30	±6,0		
8,2677	210	30	±6,0		
8,6614	220	35	±6,0		
9,4488	240	35	±7,0		
9,8425	250	35	±7,0		
10,2362	260	40	±7,0		
10,6299	270	40	±8,0		
11.0236	280	40	+8.0		

TABLE 13. Bloom sizes and utmost deviations from them

Note: corner radius is given for shaping pass setting and is not controlled on a bloom

Bloom sides shall be straight or concave.

Blooms with convexity of two opposite sides not exceeding permissible deviations from the bloom side are acceptable. The middle part of these bloom sides with width min1/3 of bloom side size shall be straight or concave.

Max straightness deviations shall be 10 mm per 1 m of length. Overall bow shall not exceed the permissible straightness deviation value multiplied by total length value in meters. Visible twisting around the longitudinal axle of the bloom is not acceptable.

Bloom ends shall be cut. Inclination from the cut shall not exceed 0,1 of the bloom side. When shearing, squeezed ends are acceptable.

Blooms shall be delivered with the production length 2,0-6,0 m. The utmost deviations from the length should be  $\pm 100$  mm.

Actual length shall be stated in the specification.

#### 4.8 Hot-rolled bars 0,3149-3,9370 in. (8-100 mm) in square side with pickled surface

Bar sides and utmost deviations from them shall conform to the requirements specified in Table 14.

Square side		Utmost deviations from the square side, mm		
inch	mm	lot 1	lot 2	
0,3149	8			
0,3937	10			
0,4724	12	.0.2/ 0.5		
0,5511	14	+0,3/-0,5	—	
0,6299	16			
0,7086	18			
0,8661	22		+0.8/-0.0	
0,9842	25	+0,4/-0,5	+0,0/-0,0	
1,1023	28		+0.9/-0.0	
1,1811	30	+0,3/-0,7	+0,3/ 0,0	
1,2598	32	+0.4/-0.7	+1 1/-0 0	
1,3779	35	+0,+/ 0,/	+1,17=0,0	
1,7716	45	+0.4/-1.0	+1 4/-0 0	
1,9685	50	+0,+/ 1,0	+1,-7 0,0	
2,3622	60			
2,4803	63			
2,5590	65	+0,5/-1,1	+1,6/-0,0	
2,7559	70			
2,9527	75			
3,1496	80	+0.5/-1.3	+1 8/-0 0	
3,5433	90	+0,3/-1,5	+1,3/-0,0	
3,9370	100	+0,6/-1,7	+2,3/-0,0	

TADIE 14 Cideo of bot volled on	www.weakewaa.en.dtwo.en.t.dowlatiewaa.fwawa.thawa
TADLE 14. SILLES OF NOT-FOILED SC	quare pars and utmost deviations from them

Note: lot number is stated in the specification.

The difference between the diagonals measured at the same cross section shall not exceed double sum of utmost deviations from the square side for bars up to 20 mm (incl.); and for bars over 20 mm it shall not exceed the sum of utmost deviations from the square side. Corner blunting shall not exceed 0,15 of square side.

For bars with the square side up to 25 mm (incl.) straightness deviations shall not exceed 0,5% of the length, for bars with the square side over 25 mm it shall be 0,4% of the length. Twisting shall not exceed:

- 4 degrees per meter multiplied by the length value in meters, but not more than 24 degrees when square side is up to 14 mm;
- 3 degrees per meter multiplied by the length value in meters, but not more than 18 degrees when square side is over 14 mm up to 50 mm incl.;
- 3 degree per meter multiplied by the length value in meters, but not more than 15 degrees when the square side is over 50 mm.

Bar ends shall be straight cut. Inclination from the cut shall not exceed 2mm for bars 8-18 mm in square side and 0,1 of square side for bars 22-100mm in square side.

Squeezed ends and burr not exceeding the utmost plus deviations from the square side are permitted.

Square sides, the difference between the diagonals and corner radius shall be measured at a distance not less than 150 mm from the bar end.

Bars shall be produced 3,0 - 6,0 m in length with utmost deviations from the length  $\pm 100$  mm. Actual lengths can be agreed in the specification.

#### 4.9 Forged square bars 3,1496 - 15,7480 in.(80-400 mm) in square side

Square side sizes and utmost deviations from them shall meet the requirements of Table 15.

able 15. Square side size and utiliost deviations norm it						
Square	Utmost deviation, mm					
inch	mm					
3,1496 - 3,3464	80-85	+3,0/ -0,0				
3,5433 - 4,1338	90 -105	+3,5/ -0,0				
4,3307 – 4,5275	110 -115	+4,0 /- 0,0				
4,7244 - 5,7086	120 - 145	+4,5/ -0,0				
5,9055	150	+5,0 / -0,0				
6,1023 – 6,4960	155 - 165	+6,0/ -0,0				
6,6929 - 7,0866	170 - 180	+7,0/-0,0				
7,2834 - 7,8740	185 - 200	+8,0/-0,0(+5,0/-0,0)				
8,0708 - 15,7480	205 - 400	+10,0/-0,0 (+5,0/-0,0)				

Table 15. Square side size and utmost deviations from it

**Note:** for planed or milled forgings utmost deviations are indicated in brackets, for forgings after complete surface conditioning or spot grinding utmost deviations are indicated without brackets.

The difference between the diagonals at the same cross section shall not exceed total utmost deviations from the width for bars 200 mm in square side and 5% of the square side for bars over 200 mm in square side.

Forged bars are delivered with sharp edges. Permissible edge chamfering is to be max 3% of the square side.

For bars with complete surface conditioning or with spot grinding straightness deviation shall not exceed 5 mm per 1 m of the length and for bars with planned/ milled surface -2 mm per 1 m of the length.

When agreed upon by the parties and stated in the specification for forgings up to 200 mm in thickness longitudinal edges may be chamfered up to 8-15 mm in width, for forgings over 200 mm in thickness the chamfering may be 10-20 mm in width.

Bar ends shall be straight cut. Inclination of the cut shall not exceed 0,1 of the square side.

Bars shall be produced 2,0 - 4,0 m in length with utmost deviations from the length  $\pm 100$  mm. Actual lengths can be agreed in the specification.

# 4.10 Rectangular forgings (forged flats) 1,1811-11,8110 x 3,1496-31,4960 in. (30-300x80-800 mm) in cross-section

Sizes of rectangular forgings and deviations from them shall conform to the requirements specified in Table 16.

The difference between the diagonals at the same cross section shall not exceed total utmost deviations from the width.

Convexity or concavity of narrow bar sides is allowed. Convexity shall not exceed the width limits. Concavity shall not reduce under the nominal size.

Forged bars are delivered with sharp edges. Permissible edge chamfering is to be max 0,030 of the thickness.

Thicknes	S	Width		Utmost (plus) deviations, mm		ım
inch	mm	inch	mm	From thickness From width		
a) for forgings de	elivered afte	er spot grinding of sur	iace defect	S		
						Utmost
1 1911 1 0695	20.50	3 1/06 7 87/0	80.200	130/00	Width, mm	deviations,
1,1011-1,9000	50-50	3,1490-7,8740	00-200	+3,0/-0,0		mm
2,0078-2,3622	51-60	3,1496-7,8740	80-200	+3,5/-0,0	80-119	+4,0/-0,0
2,4015-2,5196	61-64	3,1496-7,8740	80-200	+4,0/-0,0 +4,0/-0,0 +4,5/-0,0 +5,0/-0,0	120-179	+5,0/-0,0
2,5590-3,1496	65-80	3,1496-11,8110	80-300		180-214	+7,0/-0,0
3,1889-3,5433	81-90	3,1490-11,8110	80-300		215-249	+8,0/-0,0
3,3826-4,7244	91-120 121-150	3,0333-13,7790	90-350		250-284	+9,0/-0,0
4,7037-3,3033	121-150	0,000-10,7790	30-330	+0;0/-0;0	285-344	+10,0/0,0
					345-350	+12,0/0,0
b) for forgings de	elivered afte	er complete surface co	onditioning	, with milled or planed surf	ace <sup>1)</sup>	
3,9370	100	11,8110	300	+5,0/-0,0 (+5,0/-0,0)	+10,0/0,0	0 (+5,0/-0,0)
3,9763-9,8425	101-250	11,8503-19,6850	301-500	+7,0/-0,0 (+5,0/-0,0)	+15,0/0,0	(+10,0/-0,0)
9,8818-11,8110	251-300	19,7244-23,6220 23,6614-31,4960	501-600 601-800	+10,0/-0,0 (+5,0/-0,0)	+15,0/-0,0 +20,0/-0,0	(+10,0/-0,0) (+15,0/-0,0)

**Notes:** for planed or milled forgings utmost deviations are indicated in brackets, for forgings after complete surface conditioning utmost deviations are indicated without brackets.

When agreed upon by the parties and stated in the specification for forgings up to 200 mm in thickness longitudinal edge chamfering is to be 8-15 mm in width, for forgings over 200 mm in thickness it shall be 10-20 mm in width.

For forgings after spot or complete grinding of surface defects non-flatness and overall bow shall not exceed 0,4% of length; for forgings with planed or milled surface it shall be max 0,2% of length.

Ends of forgings shall be straight cut and deburred.

Inclination from the cut is to be max 0,1 of thickness.

Forgings shall be 2,0-4,0 m in length. The utmost deviations from the length shall be  $\pm 100$  mm. It is permitted to agree other bar length in the specification.

#### 5. Technical requirements

5.1 Round products of austenite steel are supplied after heat treatment (solution annealing) or without heat treatment that shall be stated in the specification. Recommended annealing temperature is 1925-2030°F (1050-1110°C) for steel grades 321H, F321H, TP321H and 1900-2010°F (1040-1100°C) for other steel grades.

For hot-rolled bars 12-130 mm in diameter annealing is permitted to perform on rolling mill as accelerated cooling in the manufacturer's option.

Bars with ground and polished surface over 12,00 mm up to 40,00 mm in diameter shall be produced according to the following procedure: heat treatment of hot-rolled bars (solution annealing on rolling mill), then surface conditioning including cold drawing, grinding and polishing to achieve ordered sizes.

All square and rectangular products are supplied without heat treatment.

5.1a All products of martensite steel are supplied after annealing. Hardness and mechanical properties of martensite steel products in delivery condition shall conform to the requirements of Table 17.

Ste	eel grade		Yield				
UNS designation	ASTM	GOST analogue	strength, Re (R <sub>0,2%</sub> ), ksi (N/mm <sup>2</sup> ), min	Tensile strength, Rm, ksi (N/mm <sup>2</sup> ), min	Elongation, A <sub>5</sub> ,%, min	Reduction of area, Z, %, min	Hardness, HB
			ASTM A 276, .	ASTM A 479/ A 479	9 M		
S41000	410	12X13	40 (275)	70 (485)	20	45	≤223
S42000	420	20X13	—	—	—	—	≤241
S43100	431	20X17H2	—	—	—	—	≤277
S44002	440A	65X18	—	—	—	—	≤269
S44003	440B	85X17	—	—	—	—	≤269
S44004	440C	110X17	—	—	—	—	≤269
			ASTM	A 182/ A 182 M			
S41000	F 6a	12X13	40 (275)	70 (480)	20	45	≤223

 TABLE 17. Hardness and mechanical properties of martensite steel products after annealing

#### Note:

Mechanical properties of the steel grade 410 according to ASTM A 276, ASTM A 479/A479M and the steel grade F6a according to ASTM A 182/A182M are tested on the longitudinal specimens taken from the section of finished product. For bars 3,00-11,00 mm in diameter yield strength is not controlled.

5.2 Surface quality of round, square bars and rectangular forgings shall meet the requirements stated in 5.2.1 - 5.2.4:

#### 5.2.1 Hot-rolled and forged round bars

Round bars 20-40 mm in diameter shall be delivered in peeled or ground condition; bars over 40 up to 450 mm in diameter shall be in turned condition with surface roughness as follows:

-for bars up to 180 mm (incl.) in diameter– $Rz \le 60$  mkm;

-for bars over 180 mm in diameter –  $Rz \le 80$  mkm.

When agreed upon by the parties and stated in the specification round bars 8-130 mm in diameter can be delivered with pickled surface (without peeling) and after spot grinding of surface defects.

Cracks, laps (forging folds), scabs, forged/rolled blisters are not allowed on the surface of bars with or without machining.

Local surface imperfections shall be removed by flat grinding. The width of grind-outs shall be min 5 times the depth. For peeled bars the depth of grind-outs shall not reduce the nominal size under the minimally permissible one.

The depth of spot grinding of bars without peeling shall not exceed the total utmost deviations from diameter for bars up to 40 mm in (incl.) diameter and for bars over 40 to 130 mm in diameter it shall be 5% counting from the actual diameter.

On the surface of bars at the same cross section max 2 grind-outs are acceptable. Single marks, scratches, indentations and other surface defects of mechanical origin are allowed without flat grinding, if their depth does not exceed 1/2 of the total utmost deviations from diameter counting from the actual size.

Welding or weld repair of surface defects is not permitted.

5.2.2 Hot-rolled square bars, hot-rolled square billets, blooms, square and rectangular forged bars.

Hot-rolled square billets and bars with square side up to 100 mm are delivered with pickled surface and after spot grinding of surface defects.

Rectangular forgings 30-150x80-350 mm in section shall be furnished after spot grinding of surface defects.

Hot-rolled square billets, forged square and rectangular bars 100 mm and over in square side or thickness are supplied after complete surface conditioning. When agreed upon by the parties and stated in the specification rectangular forged bars with thickness 100 mm and over, as well as forged square bars 185 mm and over in square side, shall be furnished with milled (planed) surface.

Surface roughness  $R_z$  of metal products after complete surface conditioning and with planed or milled surface shall not exceed 100 mkm.

On agreement between sides stated in the specification forged square bars over 100 to 200 mm in square side can be with pickled surface and after spot grinding of surface defects.

Blooms shall be delivered after complete grinding of surface defects. Surface roughness R<sub>z</sub> shall not exceed 100 mkm.

Type of surface conditioning shall be stated in the specification.

Local defects shall be removed by flat grinding. The width of flat grinding shall be min 5 times the depth.

For forgings 30-150x80-350 mm in section supplied after spot grinding of surface defects and for forgings 100-300x300-800 mm in section, as well as for forged bars 185 mm and over in square side supplied with milled or planed surface, the depth of grinding shall not reduce product size under the nominal one. For other types of square or rectangular products supplied after spot grinding of surface defects or after complete surface conditioning the depth of grid-outs (if counting from actual size) shall not exceed the following values:

- the total utmost deviation from the square side for bars up to 40 mm incl. in square side;
- 5% of square side or thickness for hot-rolled billets, forged bars, rectangular forgings, blooms, as well as bars over 40 mm in square side.

Single marks, scratches and other defects of mechanical origin max 1,0 mm in depth are permitted without grinding for metal products with square side or thickness up to 100 mm, for metal products with square side or thickness over 100 mm to 180 mm the acceptable depth of defects should be max 2,0 mm, for metal products with square side or thickness over 180 mm maximal defect depth is to be 2,5 mm.

Welding or weld repair of surface defects is not permitted.

5.2.3 Round bars with ground and polished surface 0,1181-1,5748 in. (3,00-40,00 mm) in diameter

Surface defects of mechanical origin max 1/2 of utmost deviation from diameter in depth are permitted on bar surface.

Roughness R<sub>a</sub> shall not exceed 2,5 mkm.

5.2.4 Hot-rolled round bars 0,4724-2,7559 in. (12,00-70,00 mm) in diameter with ground and polished surface processed on the Landgraf automatic straightening/polishing line

Defects of mechanical origin are allowed if their depth does not exceed the following:

- 0.040 mm for bars with size tolerance h9 (k9) and for bars 12,00 18,00 mm in diameter with size tolerance h10(k10);
- 1/2 of utmost deviation from diameter for bars over 18,00 mm in diameter with size tolerance h10 (k10) and for bars of all diameters with size tolerance h11(k11).

Surface roughness Ra shall not exceed 1,4 mkm.

5.3 Steel macrostructure shall be free of visible pipe cavity, porosity, blisters, cracks, slag inclusions, crusts, laminations and flakes.

5.4 Mechanical properties tested on the longitudinal specimens at room temperature shall conform to the requirements of Tables 18-22.

# TABLE 18. Mechanical properties of austenite steel grades with chemical composition conforming to ASTM A 276, ASTM A 479/A 479M

UNS designation	Steel grad	e GOST analogue	Yield strength, Re (R <sub>0,2%</sub> ), ksi (N/mm <sup>2</sup> ), min	Tensile strength Rm, ksi (N/mm²), min	Elongation A <sub>5</sub> , %, min	Reduction of area Z, %, min	
		AS	TM A 276. AST	M A 479/A 479 M			
S30400	304	08X18H10	30 (205)	75 (515)	40	50	
S30403	304L	03X18H10	25 (170)	70 (485)	40	50	
S30451	304N	08X19AH10	35 (240)	80 (550)	30	40	
S30453	304LN	03X19AH10	30 (205)	75 (515)	40	50	
S30908	309S	08X23H14	30 (205)	75 (515)	40	50	
S31008	310S	08X25H20	30 (205)	75 (515)	40	50	
S31600	316	08X17H13M2	30 (205)	75 (515)	40	50	
S31603	316L	03X17H13M2	25 (170)	70 (485)	40	50	
S31635	316Ti	08X17H13M2T	30 (205)	75 (515)	40	50	
S31651	316N	08X17AH13M3	35 (240)	80 (550)	30	40	
S31653	316LN	03X17AH13M3	30 (205)	75 (515)	40	50	
S31700	317	08X19H13M4	30 (205)	75 (515)	40	50	
S32100	321	08X18H10T	30 (205)	75 (515)	40	50	
			ASTM	A 276			
S30900	309	20X23H14	30 (205)	75 (515)	40	50	
			ASTM A 47	9/ A479 M			
S30409	304H	10X19H10	30 (205)	75 (515)	30	40	
S30909	309H	10X23H14	30 (205)	75 (515)	30	40	
S31009	310H	10X25H20	30 (205)	75 (515)	30	40	
S31609	316H	10X17H13M2	30 (205)	75 (515)	30	40	
S32109	321H	10X18H10T	30 (205)	75 (515)	30	40	

#### Notes:

1. For bars 3,00-11,00 mm in diameter yield strength is not tested.

2. For round heat-treated bars (after solution annealing) mechanical properties are tested on specimens taken from material in delivery condition.

3. For metal products of any section delivered without heat treatment mechanical properties are tested on specimens heat-treated according to the requirements of the item 5.1. For metal products over 100 mm in diameter, square side or thickness mechanical properties can be tested on specimens taken from samples reforged into round/ square 90-100 mm in size.

# TABLE 19. Mechanical properties of austenite steel grades with chemical composition conforming to ASTM A 182/A 182M

	Steel grade	Э	Yield			
UNS designation	ASTM	GOST analogue	strength, Re (R <sub>0,2%</sub> ), ksi (N/mm <sup>2</sup> ), min	Tensile strength, Rm, ksi (N/mm <sup>2</sup> ), min	Elongation A <sub>5</sub> , %, min	Reduction of area Z, %, min
S30400	F 304	08X19H10	30 (205)	75 (515)	30	50
S30403	F 304L	03X18H11	25 (170)	70 (485)	30	50
S30409	F 304H	10X20H10	30 (205)	75 (515)	30	50
S30451	F 304N	08X19AH10	35 (240)	80 (550)	30	50
S30453	F 304LN	03X19AH10	30 (205)	75 (515)	30	50
S30909	F 309H	10X23H14	30 (205)	75 (515)	30	50
S31000	F 310	25X25H20	30 (205)	75 (515)	30	50
S31009	F 310H	10X25H20	30 (205)	75 (515)	30	50
S31600	F 316	08X17H13M2	30 (205)	75 (515)	30	50
S31603	F 316L	03X17H13M2	25 (170)	70 (485)	30	50
S31609	F 316H	10X18H13M2	30 (205)	75 (515)	30	50
S31651	F 316N	08X17AH13M3	35 (240)	80 (550)	30	50
S31653	F 316LN	03X17AH13M3	30 (205)	75 (515)	30	50
S31700	F 317	08X19H13M4	30 (205)	75 (515)	30	50
S31703	F 317L	03X19H13M4	25 (170)	70 (485)	30	50
S32100	F 321	08X18H10T	30 (205)	75 (515)	30	50
S32109	F 321H	10X18H10T	30 (205)	75 (515)	30	50

#### Notes:

1. For bars 3,00-11,00 mm in diameter yield strength is not tested.

2. For round heat-treated bars (after solution annealing) mechanical properties are tested on specimens taken from material in delivery condition.

3. For metal products of any section delivered without heat treatment mechanical properties are tested on specimens heat-treated according to the requirements of the item 5.1. For metal products over 100 mm in diameter, square side or thickness mechanical properties can be tested on specimens taken from samples reforged into round/ square 90-100 mm in size.

	Steel grad	е	Yield			
UNS designation	ASTM	GOST analogue	strength, Re (R <sub>0,2%</sub> ), ksi (N/mm <sup>2</sup> ), min	Tensile strength Rm, ksi (N/mm <sup>2</sup> ), min	Elongation A <sub>5</sub> , %, min	Reduction of area Z, %, min
S30400	TP304	08X19H10	30 (205)	75 (515)	35	_
S30403	TP304L	035X19H10	25 (170)	70 (485)	35	—
S30409	TP304H	10X19H10	30 (205)	75 (515)	35	—
S30451	TP304N	08X19AH10	35 (240)	80 (550)	35	—
S30453	TP304LN	035X19AH10	30 (205)	75 (515)	35	_
S30908	TP309S	08X23H14	30 (205)	75 (515)	35	_
S30909	TP309H	10X23H14	30 (205)	75 (515)	35	—
S31008	TP310S	08X25H20	30 (205)	75 (515)	35	—
S31009	TP310H	10X25H20	30 (205)	75 (515)	35	_
S31600	TP316	08X17H13M3	30 (205)	75 (515)	35	—
S31603	TP316L	035X17H13M3	25 (170)	70 (485)	35	_
S31609	TP316H	10X17H13M3	30 (205)	75 (515)	35	—
S31651	TP316N	08X17AH13M3	35 (240)	80 (550)	35	—
S31653	TP316LN	035X17AH13M3	30 (205)	75 (515)	35	—
S31700	TP317	08X19H13M4	30 (205)	75 (515)	35	—
S31703	TP317L	035X19H13M4	30 (205)	75 (515)	35	
S32100	TP321	08X19H11T	30 (205)	75 (515)	35	_
S32109	TP321H	10X19H10T	30 (205)	75 (515)	35	

TABLE 20. Mechanical properties of austenite steel grades with chemical composition conforming to ASTM A 312/A 312M

#### Notes:

1. For bars 3,00-11,00 mm in diameter yield strength is not tested.

2. For round heat-treated bars (after solution annealing) mechanical properties are tested on specimens taken from material in delivery condition.

3. For metal products of any section delivered without heat treatment mechanical properties are tested on specimens heat-treated according to the requirements of the item 5.1. For metal products over 100 mm in diameter, square side or thickness mechanical properties can be tested on specimens taken from samples reforged into round/ square 90-100 mm in size.

Steel grade			Yield	Tonsilo				
UNS designation	ASTM	GOST analogue	strength, Re (R <sub>0,2%</sub> ), ksi (N/mm <sup>2</sup> ), min	strength Rm, ksi (N/mm²), min	Elongation A₅, %, min	Reduction of area Z, %, min	Impact energy KV, J, min	Hardness, HB
S30400 / S30403	304 / 304L	03X18H10	30 (205)	75 (515)	45	50	100	140-223
S31600 / S31603	316 / 316L	03X17H13M2	30 (205)	75 (515)	45	50	100	140-223

TABLE 21. Mechanical properties of austenite steel grades with double designation

#### Notes:

1. For bars 3,00-11,00 mm in diameter yield strength is not tested.

2. For round heat-treated bars (after solution annealing) mechanical properties are tested on specimens taken from material in delivery condition.

3. For metal products of any section delivered without heat treatment mechanical properties are tested on specimens heat-treated according to the requirements of the item 5.1. For metal products over 100 mm in diameter, square side or thickness mechanical properties can be tested on specimens taken from samples reforged into round/ square 90-100 mm in size. 4. Impact energy is tested for metal products over 16 mm (incl.) in diameter or thickness. 5. Hardness values are given for information only and are not considered as a subject for rejection.

6. For bars up to 12 mm in diameter Brinell hardness is determined according to the conversion charts on the basis of actual values for tensile strength.

	Steel grade	Э		Mistal	•			
UNS designa tion	ASTM	GOST analog ue	Heat treatment type	strength, Re (R <sub>0,2%</sub> ), ksi (N/mm <sup>2</sup> ), min	Tensile strength Rm, ksi (N/mm <sup>2</sup> ), min	Elongation A₅, %, min	Reductio n of area Z, %, min	Hardness, HB
			ASTM	A 276, ASTM	A 479/A 479M			
			1	40 (275)	70 (485)	20	45	≤223
S41000	410	12X13	2	85(585)	110(760)	15	45	≤269
			3	100(690)	130(895)	12	35	≤331
S43100	431	20X17H2	1	90 (620)	115 (795)	15	45	≤321
				ASTM A 182/A	A 182M			
			class 1	40 (275)	70 (485)	18	35	143-207
S41000	F 6a	12X13	class 2	55 (380)	80 (585)	18	35	167-229
			class 3	85 (585)	110 (760)	15	35	235-302
			class 4	110 (760)	130 (895)	12	35	263-321

#### TABLE 22. Mechanical properties of martensite steel

#### Notes:

1. Mechanical properties and hardness are tested on the specimens obtained from heattreated samples 20-30 mm in section. Recommended heat-treatment schedules for samples conforming to ASTM A 276, ASTM A 479/A 479M, ASTM A 182/A 182M are given in Table 23.

2. Heat treatment type is stated in the specification. If a given type is not stated in the specification, tests are carried out for the steel grade 410 type 1; for steel grade F6a it shall be according to the type for class 1.

3. For metal products over 100 mm in diameter, square side or thickness mechanical properties can be tested on specimens taken from samples reforged into round/ square 90-100 mm in size.

TABLE 23. Recomm	ended heat	treatment schedul	es for samples of	martensite steel gr	ades conforming to
	ASTM	A 276, ASTM A 47	9/A 479M, ASTM	A 182/A 182M	-

UNS	ASTM	Heat treatment type	Temperature, °F (°C)			
designation	ASTM	neat treatment type	Quenching or normalizing	Tempering		
		ASTM A 276, /	ASTM A 479/A 479M			
		1		1250-1400 (675-760)		
S41000	410	2	1700-1805 (925-985)	1100-1400 (595-760)		
		3		1050-1400 (565-760)		
S43100	431	1	At the manufacturer's option	1100-1400 (595-760)		
		ASTM A	A 182/A 182M			
		class 1		≥1325 (725)		
S41000	F 6a	class 2	At the manufacturer's option	≥1250 (675)		
		class 3	At the manufacturer's option	≥1100 (595)		
		class 4		≥1000 (540)		

5.5 Hardness of steel grades 410, 420, 431, 440A, 440B, 440C after quenching tested on specimens max 3/8 " (9,5 mm) in thickness shall conform to the requirements of Table 24.

Steel grade			Quenching		Hardnoog HPC
UNS	ASTM	GOST	Temperature,	modium	
designation	ASTM	analogue	°F ( °C)	medium	11111
		ASTM A 27	'6, ASTM A 479/A 479N		
S41000	410	12X13	1750 (955)	air	35
S42000	420	20X13	1825 (995)	air	50
S43100	431	20X17H2	1875 (1020)	oil	40
S44002	440A	65X18	1875 (1020)	air	55
S44003	440B	85X17	1875 (1020)	oil	56

TABLE 24. Hardness for quenched specimens of martensite steel

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S44004	440C	110X17	1875 (1020)	air	58

#### Notes:

1. Utmost deviations from the quenching temperature are  $\pm 25^{\circ}F$  ( $\pm 15^{\circ}C$ ).

5.6 For austenite steel products a susceptibility to inter-crystalline corrosion is controlled according to ASTM A 262, Method E.

5.7 Metal products are delivered after non-metallic inclusion control.

Average severity rating for non-metallic inclusions is tested according to ASTM E 45 (Method A) and shall not exceed values shown in Table 25.

Melting practice	Inclusion series	Average severity ratio for different types of inclusions <sup>1)</sup>				
		A <sup>2)</sup>	В	С	D	
In clastric are furnação	thin	3,0	3,0	3,0	3,0	
In electric arc furnaces	heavy	2,5	2,5	2,5	2,5	
EQD	thin	1,5	1,5	1,5	1,5	
EGN	heavy	1,0	1,0	1,0	1,0	

#### Notes:

 Test results on inclusion content evaluating in accordance with ASTM E 45 (method A) for martensite steel are not subject to rejection. Testing is performed only for data accumulation.
 For austenite steel grades with sulfur content 0,015-0,030% non-metallic inclusions of type «A» are not subject to rejection.

5.8 Metal products 20 mm and over in diameter, square side or thickness shall be US-tested according to SEP 1921 and shall meet the requirements of Table 26.

Diameter, square side or thickness, mmGroupClass20-703Ee71-1803Dd181-4503Cc

TABLE 26. Standard US-test values according to SEP 1921

For bars 20-70 mm in diameter with ground and polished surface the conformity with requirements to US-test results (Group 3, class Ee) is provided by the manufacturer's technology when semiproduct is US-tested. Other US-test results can be negotiated in the specification.

5.9 Austenite and martensite steel is delivered after grain size testing according to ASTM E 112. Austenite grain size for all steel grades except stated in Table 27 shall be not coarser than 5 for products up to 200 mm in diameter or thickness and not coarser than 3 for products over 200 mm in diameter or thickness.

 TABLE 27. Austenite grain size

Steel grade				
UNS designation	ASTM	GOST analogue	Austenite grain size	
ASTM A 479/A 479M				
S30409	304H	10X19H10	6 or coarser	
S30909	309H	10X23H14		
S31009	310H	10X25H20		
S31609	316H	10X17H13M2		
S32109	321H	10X18H10T	7 or coarser	
ASTM A 182/A 182M				
S30909	F 309H	10X23H14	6 or coarser	
S31009	F 310H	10X25H20		
S31609	F 316H	10X18H13M2		
S32109	F 321H	10X18H10T	7 or coarser	
ASTM A 312/A 312M				
S30909	TP309H	10X23H14	6 or coarser	

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S31009	TP310H	10X25H20	
S32109	TP321H	10X19H10T	7 or coarser

5.10 Mixing tests shall be provided by the spark method or by other acceptable non-destructive method.

5.11 Forging reduction ratio shall be min 4 that is provided by the manufacturer's technology.

5.12 When agreed upon by the parties and stated in the specification bars from 80 up to 270 mm in diameter or square side shall be tested for ferrite phase content.

Average amount of ferrite phase at the section of metal products shall not exceed the following:

5% for steel grade 304/304L;

3% for steel grade 316/316L;

3% for other austenite steel grades.

Specific requirements to the ferrite phase content can be agreed in the specification.

Ferrite phase content is tested at the transversal cross section in two mutually perpendicular directions at each 10 mm counting from the surface.

5.13 Metal products shall be radiation and mercury free that is provided by the manufacturer's technology.

#### 6. Acceptance rules and testing methods

Acceptance rules and testing methods shall be in accordance with GOST 5949-75 with the following details:

- non-metallic inclusions are evaluated according to ASTM E 45 (Method A);
- US-testing is performed according to SEP 1921 as follows:

For bars up to 100 mm in diameter, square side or thickness 10% of shipping lot is US-tested For bars over 100 mm in diameter, square side or thickness 100% of shipping lot is US-tested;

- grain size is evaluated in accordance with ASTM E 112;
- susceptibility to inter-crystalline corrosion is evaluated in accordance with ASTM A 262, Method E;
- ferrite phase content is tested by magnetic method using ferritoscope;
- for round bars of austenite steel grades supplied as heat-treated (after solution annealing) macrostructure, grain size, non-metallic inclusions, susceptibility to inter-crystalline corrosion, mechanical properties are tested on specimens taken from the finished product section;
- for bars of austenite steel grades over 100 mm in diameter, square side or thickness supplied without heat treatment macrostructure, grain size, non-metallic inclusions, susceptibility to inter-crystalline corrosion, mechanical properties can be tested on specimens reforged into round or square 90-100 mm in size;
- for hot-rolled products of different sizes delivered without heat treatment and produced of one heat of austenite steel macrostructure, grain size, non-metallic inclusions, susceptibility to inter-crystalline corrosion and mechanical properties can be controlled on the product of maximal section and the results are extended on all smaller sizes;
- for metal products of martensite steel grades macrostructure, grain size, non-metallic inclusions and mechanical properties conforming to 5.1a are controlled on the specimens taken from the finished product;
- for martensite steel products over 100 mm in diameter, square side or thickness conforming to 5.4 mechanical properties can be tested on specimens reforged into round or square 90-100 mm in size;
- for bars with ground and polished surface produced on the *Landgraf* automatic line diameter, out-of-round and surface roughness are checked at a distance min 25 mm and min 50 mm from the bar end for bars up to 50,00 mm and over 50,00 mm in diameter correspondingly;
- for forgings 2500-3200 kg in weight each forging is considered as a lot during quality parameters testing according to section 5 of these technical delivery conditions; forgings

over 3200 kg in weight are considered as two lots and two samples are taken from each forging (one from each side).

#### 7. Marking and packing

7.1 Marking and packing of hot-rolled and forged bars, billets, blooms and rectangular forgings

One end of each forged bar, billet, bloom or hot-rolled bar over 42 mm in diameter or square side, as well as one end of each rectangular forging, shall be stamped with indication of heat number, grade designation according to ASTM, manufacturer's logo, and the sign (digital code) of a quality control inspector.

For hot-rolled bars up to 42 mm (incl.) in diameter or square side 5-7 product pieces of the bundle shall be stamped indicating heat number, grade designation according to ASTM, manufacturer's logo, sign (digital code) of a quality control inspector. Stamped bar ends shall be coloured.

Ends of hot-rolled or forged bars, billets, blooms and rectangular forgings that are opposite to the stamped ones shall be painted with the colour stated in the specification.

When agreed upon by the parties and stated in the specification it is permitted to deliver bars without painting of the ends opposite to the stamped ones.

Bundle weight shall not exceed 5000 kg. Other bundle weight can be agreed in the specification.

Each bundle shall be secured with 2-3 ties (3-4 turns each one) with wire 5-7 mm in diameter or with flat steel band 0,8-1,5 mm in thickness and 19-35 mm in width. Places under ties shall be wrapped in polyethylene film or waterproof paper 150-200 mm in width with 2 or more coats after that each bundle shall be wrapped in waterproof paper, polymer film and then in burlap. When corrosion-preventing band is used, places under ties shall not be wrapped in polyethylene film or waterproof paper. To save packing while handling, wooden lagging under strapping up to the manufacturer's design protects the ties.

Square bars and billets, blooms and flat forgings after spot grinding of surface defects shall not be wrapped in waterproof paper, film and burlap.

When agreed upon by the parties and stated in the specification,qqqqq the following is permitted:

- a) hot-rolled and forged metal products with turned/peeled, milled or planed surface or with complete grinding of surface can be packed without waterproof paper, film and burlap wrapping;
- b) other types of packing materials.

#### 7.2 Marking and packing of bars with ground and polished surface

Ground and polished bars up to 10,00 mm in diameter shall be rigidly tied at 3 places and wrapped in waterproof paper and after that in polyethylene film. Bundle weight shall not exceed 80 kg. Each bundle shall have 2 tags. Bundles of bars should be placed in wooden boxes. Box gross weight shall be max 2000 kg. Faces of each box shall be labeled.

Each bundle of bars over 10,00 mm in diameter shall be secured with 2-3 ties (2-3 turns each one) of wire 5-7 mm in diameter or flat steel band 0,8-1,5 mm in thickness and 19-35 mm in width. Bundles shall be tightly packed and rigidly tied. Bars with ground and polished surface shall be packed in waterproof paper and then in polyethylene film. Wooden lagging under strapping up to the manufacturer's design should be used. Each bundle shall contain min 2-5 bars stamped with heat number and ASTM grade designation. Ends of stamped bars shall be painted with bright colour stated in the specification. Bundle weight shall not exceed 2500 kg. Other weight can be agreed in the specification.

For bars machined on the *Landgraf* automatic line it is permitted to identify bars with heat number and grade designation according to ASTM using indelible ink instead of stamp marking.

Stamped (marked) bar ends shall be painted with bright colour stated in the specification. Ground and polished bars shall be coated with corrosion preventatives before packing. When agreed upon by the parties and stated in the specification ground and polished bars can be delivered without corrosion preventive coating or other types of packing materials can be used.

7.3 Each bundle shall have two tags (one on each side) containing the following information in English:

- contract number
- specification number
- manufacturer
- customer
- steel grade (according to ASTM)
- heat number
- section size, mm and inches
- lot number for hot-rolled bars and size tolerance for ground and polished bars
- length, mm
- net/gross weight, kg
- package number and number of packages

#### 8. Inspection certificate

Products shall be accompanied with the Inspection certificate conforming to EN 10204, form 3.1B in English including the following:

- chemical composition and melting process (melting practice and heat treatment type): for austenite and martensite steel products delivered after heat treatment "A(solution annealed)" and "A(annealed)" shall be stated correspondingly;
- steel grade (according to ASTM and UNS);
- heat number;
- lot number for hot-rolled bars and size tolerance for bars with ground and polished surface;
- section size, mm and inches;
- length, mm;
- net weight, kg;
- specification number and contract number;
- test results: macrostructure, mechanical properties, hardness, grain size, non-metallic inclusions, ferrite phase content, US-testing, susceptibility to inter-crystalline corrosion, mixing.

The following also should be stated in the certificate:

- "made in Ukraine"
- "radiation free"
- "mercury free"
- "no weld or weld repair"
- in the section "acceptance rules" for all steel grades "ASTM A 484/A 484M" shall be stated; and also designation of the corresponding ASTM standard(s) mentioned in tables 1-4 shall be given;
- in the section "susceptibility to inter-crystalline corrosion" the designation "ASTM A262, Method E" shall be stated.

#### Notes:

1. For martensite steel grades 410, 431 and F 6a, in the section "Mechanical properties" test results according to 5.1a are given in the numerator and test results according to 5.4 are given in the denominator;

2. The Certificate shall contain the following statement "after dimension/surface defect test" 3. If it is required by a customer and stated in the specification for steel grades 304/304L and 316/316L in the section "acceptance rules" data given in the Appendix 1 shall be stated. In this case in the specification shall be stated: "acceptance rules according to the Appendix 1".

#### 9. Supplementary and special requirements

Customer's supplementary and special requirements including augment of product range, changes in technical requirements are to be executed in a technical protocol that is an integral part of the contract.

#### 10. Reference standards

ASME SA 182 /	Specification for forged or rolled alloy-steel pipe flanges, forged fittings, and valves and parts for
SA 182M	high-temperature service
ASTM A 182 /	Standard specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves
A 182M	and Parts for High-Temperature Service
ASME SA 193 /	Specification for alloy-steel and stainless steel bolting materials for high-temperature service
SA 193M	
ASTM A 193 /	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature
A 193M	Service
ASTM A 262	Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM A 276	Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A 312 /	Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes
A 312M	
ASME SA 320	Specification for alloy steel bolting materials for low-temperature service
ASTM A 320	Standard Specification for Alloy/Steel Bolting Materials for Low-Temperature Service
ASTM A 370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASME SA 479 /	Specification for stainless steel bars and shapes for use in boilers and other pressure vessels
SA 479M	
ASTM A 479 /	Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure
A 479M	Vessels
ASME SA 484 /	Specification for general requirements for stainless steel bars, billets, and forgings
SA 484M	
ASTM A 484 /	Standard Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings
A 484M	
ASTM E 45	Standard Test Methods for Determining the Inclusion Content of Steel
ASTM E 112	Standard Test Methods for Determining Average Grain Size
AMS 5639	Steel, corrosion resistant, bars, wire, forgings, tubing, and rings 19Cr-10Ni solution heat treated
AMS 5647	Steel bars, forgings, tubing, and rings, corrosion resistant 19Cr-9.5Ni (SAE 304L) solution heat
	treated
AMS 5648	Steel bars, forgings, tubing, and rings, corrosion and heat resistant 17Cr-12Ni-2.5Mo (SAE 30316)
	solution heat treated
AMS 5653	Steel bars, forgings, tubing, and rings, corrosion and heat resisitant 17Cr-12Ni-2.5Mo (SAE
	30316L) solution heat treated
NACE MR 0175	Standard material requirements sulfide stress cracking resistant metallic material for oilfield
	equipment
QQS-763	Steel bars, wire, torgings, corrosion resistant
SEP 1921	Prüfung von Schmiedestücken und geschmiedetem Stabstahl ab ≈ 100mm Durchmesser oder
	Kantenlänge
FOCT 5949	Сталь сортовая и калиброванная коррозионностойкая, жаростойкая и жаропрочная. Технические условия

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# APPENDIX 1. Standard specifications on acceptance rules for metal products of steel grades 304 / 304L, 316 / 316L

Designations of standard specifications				
304 / 304L	316 / 316L			
ASTM A 276	(latest edition)			
QQS-763	(latest edition)			
ASTM A 479	(latest edition)			
ASME SA 479	(latest edition)			
ASTM A 182	(latest edition)			
ASME SA 182	(latest edition)			
ASTM A 193, GRB 8	(latest edition)			
ASME SA 193, GRB 8	(latest edition)			
ASTM A 320, GRB 8	(latest edition)			
ASME SA 320, GRB 8	(latest edition)			
ASTM A 484	(latest edition)			
ASME SA 484	(latest edition)			
NACE MR 0175	(latest edition)			
AMS 5639 (latest edition)	AMS 5648 (latest edition)			
AMS 5647 (latest edition)	AMS 5653 (latest edition)			