

1. SCOPE

This section deals with stainless steel and objects made exclusively from stainless steel which as finished products are intended to be in direct contact with food products.

It does not involve materials and objects in stainless steel which are not intended, under normal terms of use or other generally expected conditions, to be in contact with foodstuffs (particular pump axes).

The main examples of use for the different categories of stainless steels are specified in Annex B of standard NF A 36 711.

2. Definitions of performance criteria for food contact

2.1. Texts to be used

2.1.1 Regulatory texts

- Order of 13th January 1976 relating to materials and objects in stainless steel in contact with foodstuffs.
- Order of 15th November 1945 setting the list of materials likely to be used without adverse effect on public health in the manufacturing of measuring instruments.

2.1.2 Other texts

- Standard NF A 36 711 ": Non packaging steel – Stainless steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption.
- Information document BP A 36 720 "Cleaning stainless steels in food and health applications

2.2 Criteria to be used

Composition according to the order of 13th January 1976.

3. ACCEPTABILITY LIMITS

- Minimum chromium content: 13.0 p 100
- Possible added elements: Ta, Nb, Zr, Mo, Ti, Al, Cu with the following maximum contents:
 - 1 p 100 for Ta, Nb, Zr
 - 4 p 100 for Mo, Ti, Al, Cu
- Elements which are not mentioned in the order may be used within the limits of chemical composition defined in the attached tables 1 to 4.

Table 1 – Chemical composition (casting analysis)^a of ferritic stainless steels

Type of steel		% mass											
Name	Number	C Max.	Si max	Mn max.	P max.	S	N max.	Cr	Mo	Nb	Ni	Ti	Others
X1CrNb15	1.4595	0.020	1.00	1.00	0.025	≤ 0.015	0.020	14.00 to 16.00		0.20 to 0.60			
X6Cr13	1.4000	0.08	1.00	1.00	0.040	≤ 0.015 ^b		13.00 to 14.00					
X6CrAl13	1.4002	0.08	1.00	1.00	0.040	≤ 0.015 ^b		13.00 to 14.00					Al : 0.10 to 0.30
X2CrTi17	1.4520	0.025	0.50	0.50	0.040	≤ 0.015	0.015	16.00 to 18.00				0.30 to 0.60	
X6Cr17	1.4016	0.08	1.00	1.00	0.040	≤ 0.015 ^b		16.00 to 18.00					
X3CrTi17	1.4510	0.05	1.00	1.00	0.040	≤ 0.015 ^b		16.00 to 18.00				4(C+N)+0.15<Ti≤0.80 ^c	
X3CrNb17	1.4511	0.05	1.00	1.00	0.040	≤ 0.015		16.00 to 18.00		12 x C to 1.00			
X6CrMo17-1	1.4113	0.08	1.00	1.00	0.040	≤ 0.015 ^b		16.00 to 18.00	0.90 to 1.40				
X2CrMoTi17-1	1.4513	0.025	1.00	1.00	0.040	≤ 0.015	0.015	16.00 to 18.00	1.00 to 1.50			0.30 to 0.60	
X2CrMoTi18-2	1.4521	0.025	1.00	1.00	0.040	≤ 0.015	0.030	17.00 to 20.00	1.80 to 2.50			4(C+N)+0.15<Ti≤0.80 ^c	
X6CrNi17-1 *)	1.4017*)	0.08	1.00	1.00	0.040	≤ 0.015		16.00 to 18.00			1.20 to 1.60		
X6CrMoNb17-1	1.4526	0.08	1.00	1.00	0.040	≤ 0.015	0.040	16.00 to 18.00	0.80 to 1.40	7(C+N)+0.10<Nb≤1.00			
X2CrNbZr17 *)	1.4590*)	0.030	1.00	1.00	0.040	≤ 0.015		16.00 to 17.50		0.35 to 0.55			Zr≥7x(C+N)+0.15
X2CrAlTi18-2	1.4605	0.030	1.00	1.00	0.040	≤ 0.015		17.00 to 18.00				4(C+N)+0.15<Ti≤0.80 ^c	Al : 1.70 to 2.10
X2CrTiNb18	1.4509	0.030	1.00	1.00	0.040	≤ 0.015		17.50 to 18.50		3C+0.3< Nb ≤ 1.00		0.10 to 0.60	
X2CrMoTi29-4	1.4592	0.025	1.00	1.00	0.030	≤ 0.010	0.045	28.00 to 30.00	3.50 to 4.00			4(C+N)+0.15<Ti≤0.80 ^c	

^a The elements which are not included this table cannot be added intentionally into the steel composition without the agreement of the purchaser, excepted those intended to produce the casting. All precautions must be taken to avoid the addition of elements from the scrap metal and raw materials used in production of elements likely to affect the mechanical characteristics as well as the suitability for use of steel.

^b As far as bars, machine wire, profiles and the semi-finished products are concerned, a maximum sulphur content of 0.030% applies.
For all products intended to be machined, a controlled sulphur content between 0.015 and 0.030% is recommended and authorised.

^c The steel can be stabilized by using of Titanium, Niobium or Zirconium. Taking into account the atomic weights of these elements and the Carbon and Nitrogen content, the equivalence shall be :

$$Ti \simeq \frac{Z}{4} Nb \simeq \frac{Z}{4} Zr$$

*) Grade of steel patented

Table 2 – Chemical composition (casting analysis)^a of martensitic stainless steels and under precipitation hardening treatment

Type of steel		C ^b	Si max.	Mn max	P max.	S	Cr	% mass				
Name	Number							Cu	Mo	Nb	Ni	Others
X12Cr13	1.4006	0.08 to 0.15	1.00	≤ 1.50	0.040	≤ 0.015 ^c	13.00 to 13.50				≤ 0.75	
X20Cr13	1.4021	0.16 to 0.25	1.00	1.50	0.040	≤ 0.015 ^c	13.00 to 14.00					
X30Cr13	1.4028	0.26 to 0.35	1.00	1.50	0.040	≤ 0.015 ^c	13.00 to 14.00					
X38CrMo14	1.4419	0.36 to 0.42	1.00	1.00	0.040	≤ 0.015	13.00 to 14.50		0.60 to 1.00			
X39Cr13	1.4031	0.36 to 0.42	1.00	1.00	0.040	≤ 0.015 ^c	13.00 to 14.50					
X46Cr13	1.4034	0.43 to 0.50	1.00	1.00	0.040	≤ 0.015 ^c	13.00 to 14.50					
X50CrMoV15	1.4116	0.45 to 0.55	1.00	1.00	0.040	≤ 0.015 ^c	14.00 to 15.00		0.50 to 0.80			V = 0.10 to 0.20
X70CrMo15	1.4109	0.65 to 0.75	0.70	1.00	0.040	≤ 0.015 ^c	14.00 to 16.00		0.40 to 0.80			
X39CrMo17-1	1.4122	0.33 to 0.45	1.00	1.50	0.040	≤ 0.015 ^c	15.50 to 17.50		0.80 to 1.30		≤ 1.00	
X105CrMo17	1.4125	0.95 to 1.20	1.00	1.00	0.040	≤ 0.015 ^c	16.00 to 18.00		0.40 to 0.80			
X90CrMoV18	1.4112	0.85 to 0.95	1.00	1.00	0.040	≤ 0.015 ^c	17.00 to 19.00		0.90 to 1.30			V = 0.07 to 0.12
X17CrNi16-2	1.4057	0.12 to 0.22	1.00	1.50	0.040	≤ 0.015 ^c	15.00 to 17.00				1.50 to 2.50	
X2CrNiMoV13-5-2	1.4415	≤ 0.03	0.50	≤ 0.50	0.040	≤ 0.015	13.00 to 13.50		1.50 to 2.50		4.50 to 6.50	Ti: ≤ 0.010 V: 0.10 to 0.50
X3CrNiMo13-4	1.4313	≤ 0.05	0.70	1.50	0.040	≤ 0.015	13.00 to 14.00		0.30 to 0.70		3.50 to 4.50	N ≥ 0.020
X4CrNiMo16-5-1	1.4418	≤ 0.06	0.70	1.50	0.040	≤ 0.015 ^c	15.00 to 17.00		0.80 to 1.50		4.00 to 6.00	N ≥ 0.020
X5CrNiCuNb16-4	1.4542	≤ 0.07	0.70	1.50	0.040	≤ 0.015 ^c	15.00 to 17.00	3.00 to 4.00	≤ 0.60	5 x C to 0.45	3.00 to 5.00	
X6NiCrTiMoVB25-15-2	1.4980	0.03-0.08	1.00	1.00 to 2.00	0.025	≤ 0.015	13.50 to 16.00		1.00 to 1.50		24.0 to 27.00	B: 0.0030 to 0.010 Al: ≤ 0.35 Ti: 1.90 to 2.30 V: 0.10 to 0.50
X7CrNiAl17-7	1.4568	≤ 0.09	0.70	1.00	0.040	≤ 0.015	16.00 to 18.00				6.50 to 7.80 ^d	Al = 0.70 to 1.50
X8CrNiMoAl15-7-2	1.4532	≤ 0.10	0.70	1.20	0.040	≤ 0.015	14.00 to 16.00		2.00 to 3.00		6.50 to 7.80	Al = 0.70 to 1.50
X5CrNiMoCuNb14-5	1.4594	≤ 0.07	0.70	1.00	0.040	≤ 0.015	13.00 to 15.00	1.20 to 2.00	1.20 to 2.00	0.15 to 0.60	5.00 to 6.00	

^a The elements which are not included in the table cannot be added intentionally into the steel composition without the agreement of the purchaser, excepted of those intended to produce casting. All precautions must be taken to avoid the addition of elements from the scrap metal and raw materials used in the production of elements likely to affect the mechanical characteristics as well as the suitability for use of steel.

^b During calls for tender and order more limited carbon contents can be defined.

^b As far as bars, machine wire, profiles and the semi-finished products are concerned, a maximum sulphur content of 0.030% applies.

For all products intended to be machined, a controlled sulphur content between 0.015 and 0.030% is recommended and authorised.

^d For better cold deformability, the upper limit can be increased to 8.30%.

Table 3 – Chemical composition (casting analysis) ^a of austenitic stainless steels

Type of steel		% mass											
Name	Number	C	Si	Mn	P	S	N	Cr	Cu	Mo	Nb	Ni	Ti
X5CrNi17-7	1.4319	≤ 0.07	≤ 1.00	≤ 2.00	0.045	≤ 0.030	≤ 0.11	16.00 to 18.00				6.00 to 8.00	
X10CrNi18-9	1.4325	0.04 to 0.15	≤ 1.00	≤ 2.00	0.045	≤ 0.030	≤ 0.11	17.00 to 19.00				8.00 to 10.00	
X10CrNi18-8	1.4310	0.05 to 0.15	≤ 2.00	≤ 2.00	0.045	≤ 0.015	≤ 0.11	16.00 to 19.00		≤ 0.80		6.00 to 9.50	
X2CrNi18-7	1.4318	≤ 0.030	≤ 1.00	≤ 2.00	0.045	≤ 0.015	0.10 to 0.20	16.50 to 18.50				6.00 to 8.00	
X2CrNi18-9	1.4307	≤ 0.030	≤ 1.00	≤ 2.00	0.045	≤ 0.015 ^b	≤ 0.11	17.50 to 19.50				8.00 to 10.00	
X2CrNi19-11	1.4306	≤ 0.030	≤ 1.00	≤ 2.00	0.045	≤ 0.015 ^b	≤ 0.11	18.00 to 20.00				10.00 to 12.00 ^c	
X2CrNi18-10	1.4311	≤ 0.030	≤ 1.00	≤ 2.00	0.045	≤ 0.015 ^b	0.12 to 0.22	17.00 to 19.50				8.50 to 11.50	
X5CrNi18-10	1.4301	≤ 0.07	≤ 1.00	≤ 2.00	0.045	≤ 0.015 ^b	≤ 0.11	17.00 to 19.50				8.00 to 10.50	
X6CrNiTi18-10	1.4541	≤ 0.08	≤ 1.00	≤ 2.00	0.045	≤ 0.015 ^b		17.00 to 19.00				9.00 to 12.00 ^c	5xC to 0.70
X6CrNiNb18-10	1.4550	≤ 0.08	≤ 1.00	≤ 2.00	0.045	≤ 0.015		17.00 to 19.00			10xC to 1.00	9.00 to 12.00 ^c	
X4CrNi18-12	1.4303	≤ 0.06	≤ 1.00	≤ 2.00	0.045	≤ 0.015 ^b	≤ 0.11	17.00 to 19.00				11.00 to 13.00	
X1CrNi25-21	1.4335	≤ 0.020	≤ 0.25	≤ 2.00	0.025	≤ 0.010	≤ 0.11	24.00 to 26.00		≤ 0.20		20.00 to 22.00	
X2CrNiMo17-12-2	1.4404	≤ 0.030	≤ 1.00	≤ 2.00	0.045	≤ 0.015 ^b	≤ 0.11	16.50 to 18.50		2.00 to 2.50		10.00 to 13.00 ^c	
X2CrNiMo17-11-2	1.4406	≤ 0.030	≤ 1.00	≤ 2.00	0.045	≤ 0.015 ^b	0.12 to 0.22	16.50 to 18.50		2.00 to 2.50		10.00 to 12.00 ^c	
X5CrNiMo17-12-2	1.4401	≤ 0.07	≤ 1.00	≤ 2.00	0.045	≤ 0.015 ^b	≤ 0.11	16.50 to 18.50		2.00 to 2.50		10.00 to 13.00	
X1CrNiMoN25-22-2	1.4466	≤ 0.020	≤ 0.70	≤ 2.00	0.025	≤ 0.010	0.10 to 0.16	24.00 to 26.00		2.00 to 2.50		21.00 to 23.00	
X6CrNiMoTi17-12-2	1.4571	≤ 0.08	≤ 1.00	≤ 2.00	0.045	≤ 0.015 ^b		16.50 to 18.50		2.00 to 2.50		10.50 to 13.50 ^c	5xC to 0.70
X6CrNiMoNb17-12-2	1.4580	≤ 0.08	≤ 1.00	≤ 2.00	0.045	≤ 0.015		16.50 to 18.50		2.00 to 2.50	10xC to 1.00	10.50 to 13.50	
X2CrNiMo17-12-3	1.4432	≤ 0.030	≤ 1.00	≤ 2.00	0.045	≤ 0.015 ^b	≤ 0.11	16.50 to 18.50		2.50 to 3.00		10.50 to 13.00	
X2CrNiMo17-13-3	1.4429	≤ 0.030	≤ 1.00	≤ 2.00	0.045	≤ 0.015	0.12 to 0.22	16.50 to 18.50		2.50 to 3.00		11.00 to 14.00 ^c	
X8CrMnNi18-9-5	1.4374	0.05 to 0.10	0.30 to 0.60	9.0 to 10.0	0.035	≤ 0.030	0.250 to 0.320	17.50 to 18.50	≤ 0.40	≤ 0.50		5.00 to 6.00	
X8CrMnCuNB17-8-3 ¹⁾	1.4597	≤ 0.10	≤ 2.00	6.50 to 8.50	0.040	≤ 0.030	0.15 to 0.30	16.00 to 18.00	2.00 to 3.50	≤ 1.00		≤ 2.00	
X11CrNiMn19-8-6	1.4369	0.07 to 0.15	0.50 to 1.00	5.0 to 7.5	0.030	≤ 0.015	0.20 to 0.30	17.50 to 19.50				6.50 to 8.50	

"to be continued..."

Table 3 – Chemical composition (casting analysis) ^a of austenitic stainless steels (second part)

Type of steel Name	Number	C	Si	Mn	P max.	S	N	% mass					
								Cr	Cu	Mo	Nb	Ni	Ti
X3CrNiMo17-13-3	1.4436	≤0.05	≤1.00	≤2.00	0.045	≤0.015 ^b	≤ 0.11	16.50 to 18.50		2.50 to 3.00		10.50 to 13.00 ^c	
X2CrNiMo18-14-3	1.4435	≤0.030	≤1.00	≤2.00	0.045	≤0.015 ^b	≤ 0.11	17.00 to 19.00		2.50 to 3.00		12.50 to 15.00	
X2CrNiMoN18-12-4	1.4434	≤0.030	≤1.00	≤2.00	0.045	≤0.015	0.10 to 0.20	16.50 to 19.50		< 4.00		10.50 to 14.00 ^c	
X2CrNiMo18-15-4	1.4438	≤0.030	≤1.00	≤2.00	0.045	≤0.015 ^b	≤ 0.11	17.50 to 19.50		< 4.00		13.00 to 16.00 ^c	
X1CrNiSi18-15-4	1.4361	≤0.015	3.70 to 4.50	≤2.00	0.025	≤0.010	≤ 0.11	16.50 to 18.50		≤ 0.20		14.00 to 16.00	
X12CrMnNiN17-7-5	1.4372	≤0.15	≤1.00	5.50 to 7.50	0.045	≤0.015	0.05 to 0.25	16.00 to 18.00				3.50 to 5.50	
X2CrMnNiN17-7-5	1.4371	≤0.030	≤1.00	6.00 to 8.00	0.045	≤0.015	0.15 to 0.20	16.00 to 17.00				3.50 to 5.50	
X12CrMnNiN18-9-5	1.4373	≤0.15	≤1.00	7.50 to 10.50	0.045	≤0.015	0.05 to 0.25	17.00 to 19.00				4.00 to 6.00	
X3CrNiCu19-9-2	1.4560	≤0.035	≤1.00	1.50 to 2.00	0.045	≤0.015	≤ 0.11	18.00 to 19.00	1.50 to 2.00			8.00 to 9.00	
X3CrNiCu18-9-4	1.4567	≤0.04	≤1.00	≤2.00	0.045	≤0.015 ^b	≤ 0.11	17.00 to 19.00	3.00 to 4.00			8.50 to 10.50	
X3CrNiCuMo17-11-3-2	1.4578	≤0.04	≤1.00	≤1.00	0.045	≤0.015	≤ 0.11	16.50 to 17.50	3.00 to 3.50	2.00 to 2.50		10.00 to 11.00	
X1NiCrMoCu31-27-4	1.4563	≤0.020	≤0.70	≤2.00	0.030	≤0.010	≤ 0.11	26.00 to 28.00	0.70 to 1.50	< 4.00		30.00 to 32.00	

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^b As far as bars, machine wire, profiles and the semi-finished products are concerned, a maximum sulphur content of 0.030% applies. For all products intended to be machined, a controlled sulphur content between 0.015 and 0.030% is recommended and authorised.

^c When it is necessary to minimise the ferrite delta content for special reasons, for example forgeability of unsoldered tubes or low magnetic permeability, the maximum Ni content can be increased to the following values:

0.50 % (m/m) : 1.4571
 1.00 % (m/m) : 1.4306, 1.4406, 1.4429, 1.4434, 1.4436, 1.4438, 1.4541, 1.4550
 1.50 % (m/m) : 1.4404

*) Grade of steel patented. The Boron content is: B: 0.0005 to 0.0050

Table 4 – Chemical composition (casting analysis) ^a of austeno-ferritic stainless steels

Description		% mass										
Name	Number	C max	Si max	Mn max	P max	S max	N	Cr	Cu	Mo	Ni	W
X2CrNiN23-4 *)	1.4362*)	0.030	1.00	2.00	0.035	0.015	0.05 to 0.20	22.00 to 24.0	0.10 to 0.60	0.10 to 0.60	3.50 to 5.50	
X2CrNiCuN23-4*	1.4655	0.030	1.00	2.00	0.035	0.015	0.05 to 0.20	22.00 to 24.00	1.00 to 3.00	0.10 to 0.60	3.50 to 5.50	
X2CrNiMoN29-7-2	1.4477	0.030	0.50	0.80 to 1.50	0.030	0.015	0.30 to 0.40	28.00 to 30.00	≤ 0.80	1.50 to 2.60	5.8 to 7.50	
X2CrNiMoSi18-5-3	1.4424	0.030	1.40 to 2.00	1.20 to 2.00	0.035	0.015	0.05 to 0.10	18.00 to 19.00		2.50 to 3.00	4.50 to 5.20	
X3CrNiMoN27-5-2	1.4460	0.05	1.00	2.00	0.035	0.015 ^b	0.05 to 0.20	25.00 to 28.00		1.30 to 2.00	4.50 to 6.50	
X2CrNiMoN22-5-3	1.4462	0.030	1.00	2.00	0.035	0.015	0.10 to 0.22	21.00 to 23.00		2.50 to 3.50	4.50 to 6.50	
X2CrNiMoCuN25-6-3	1.4507	0.030	0.70	2.00	0.035	0.015	0.15 to 0.30	24.00 to 26.00	1.00 to 2.50	2.70 to 4.00	5.50 to 7.50	
X2CrNiMoN25-7-4 *)	1.4410 *)	0.030	1.00	2.00	0.035	0.015	0.20 to 0.35	24.00 to 26.00		3.00 to 4.00	6.00 to 8.00	
X2CrNiMoCuWN25-7-4	1.4501	0.030	1.00	1.00	0.035	0.015	0.20 to 0.30	24.00 to 26.00	0.50 to 1.00	3.00 to 4.00	6.00 to 8.00	0.50 to 1.00

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^b As far as bars, machine wire, profiles and the semi-finished products are concerned, a maximum sulphur content of 0.030% applies.

For all products intended to be machined, a controlled sulphur content between 0.015 and 0.030% is recommended and authorised.

*) Grade of steel patented.