ALUNOX is a safe choice.

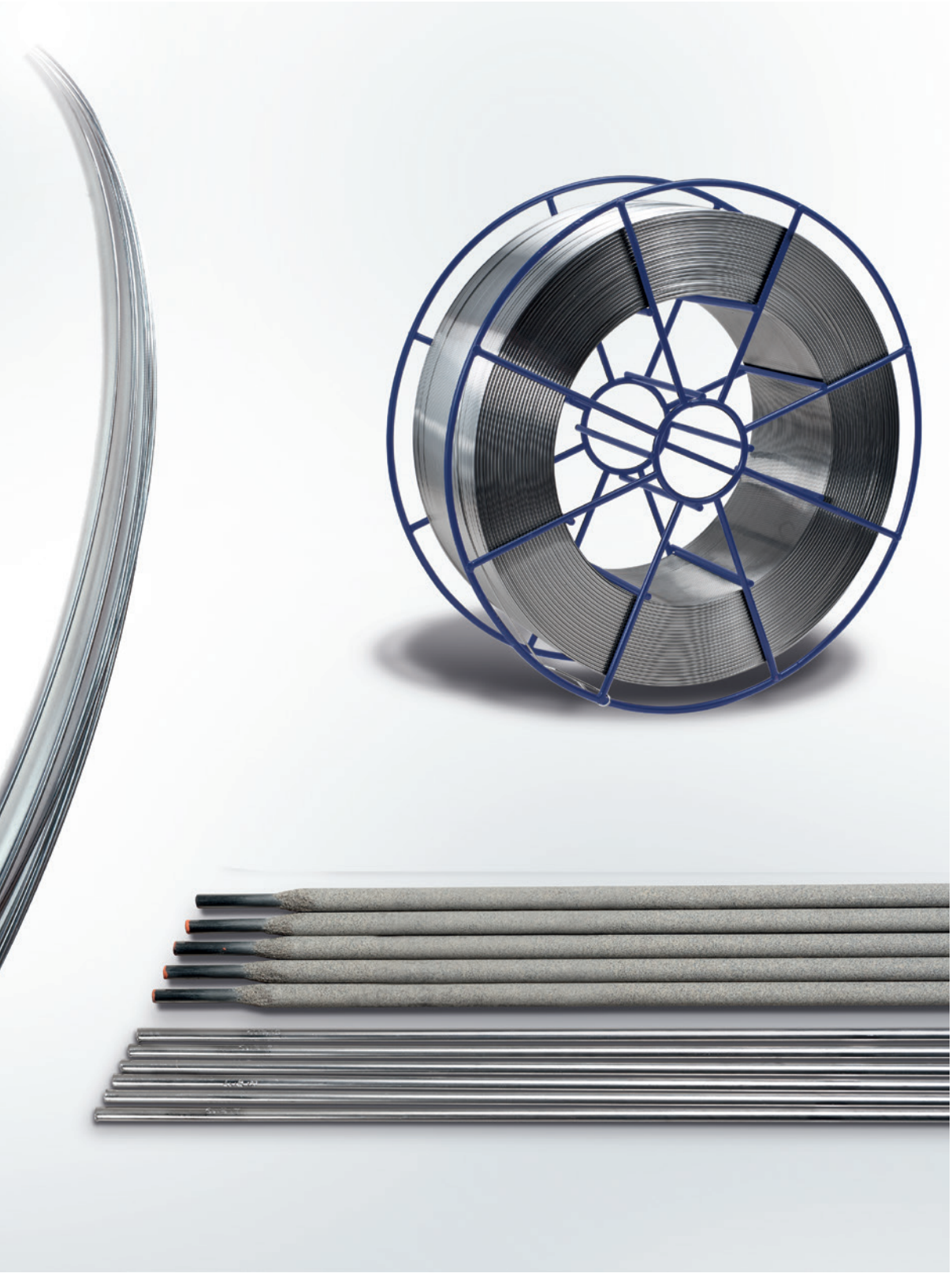
ALUNOX
Schweißtechnik GmbH

Gießerallee 37a
D-47877 Willich

Tel +49 (0) 2154 94 53-0
Fax +49 (0) 2154 9453-30
www.alunox.eu

ALUNOX
welding alloys group

ALUNOX is your programme: high-alloyed.



ALUNOX
welding alloys group

The ALUNOX programme on high-alloyed welding consumables.

Filler metals

Rod electrodes
- EI 307 B
- EI 307 R
- EI 308 L
- EI 309 L
- EI 309Mo L
- EI 310
- EI 312
- EI 316 L
- EI 318
- EI 347
- EI 2209

Solid wires/WIG-rods
- AX-307
- AX-308L
- AX-309
- AX-309L
- AX-309LMo
- AX-310
- AX-312
- AX-316L
- AX-317L
- AX-318L
- AX-347L
- AX-410
- AX-904L
- AX-2293
- AX-2551
- AX-2594

Flux-cored wire electrodes
- AX-FD-DW307
- AX-FD-DW308L
- AX-FD-DW308LP
- AX-FD-DW309L
- AX-FD-DW309LP
- AX-FD-DW309MoL
- AX-FD-DW309MoLP
- AX-FD-DW310
- AX-FD-DW316L
- AX-FD-DW316LP
- AX-FD-DW329A

Electrode

Rod

Spool

Drum

Stainless steels
Stainless steels are by definition iron alloys containing a minimum of 10.5% chromium and a maximum of 1.2% carbon. The essential property of the stainless steels is their corrosion resistance caused by the formation of a protective passive layer. The effectiveness of the passive layer rises with the chromium content. By increasing the chromium content to approx. 18% the corrosion resistance rises and the passive layer becomes more stable.

By the subsequent addition of molybdenum the resistance to pitting and crevice corrosion is increased, an addition of nickel extends the austenite range and improves ductility and forming capacity as well as weldability. Further alloying constituents that increase corrosion resistance and strength are e.g. copper and nitrogen. Carbon has a negative influence on corrosion resistance through the formation of chromium carbide.

With austenitic CrNi steels the C-content is restricted to 0.08%, often Nb and/or Ti is added to stabilise the chromium. Ferritic and martensitic Cr steels may also show higher C contents.

Depending on alloy content and the resulting structure a distinction is made according to EN 10088 between:

- ferritic steels with mainly 0.03-0.08% C and 10.5-18.5% Cr. In addition up to 1% Nb or 0.7% Ti can be alloyed to it.
- martensitic steels with mainly 0.08-1.20% C and 11.0-19.0% Cr. In addition up to 10.2% Ni, 2.8% Mo and 5.0% Cu can be alloyed to it.
- austenitic-ferritic (duplex) steels with mainly 0.03-0.05% C, 18-30% Cr, 3.5-8.0% Ni, 0.10-4.5% Mo and 0.05-0.40% N. In addition up to 3% Cu can be alloyed to it.
- austenitic steels with mainly ≤0.015-0.15%C, 16-28% Cr, ≤2.0-35% Ni, and ≤2.0-10.5% Mn. In addition up to 8% Mo, 0.55% N, 1.0% Nb and 0.7%Ti can be alloyed to it.

Welding stainless steels
In the heat-affected zone (HAZ) **ferritic steels** tend to grain growth during welding which cannot be removed by subsequent heat treatment.
In addition, depending on C-content, carbides may be precipitated that further reduce toughness.
Similar effects are to be expected in the weld metal of fillers of similar composition. For this reason, whenever possible austenitic welding fillers are used for welding.
Except when identical colouring is required or in the case of attack by sulphureous gases.
To avoid internal welding stresses, preheating to

200-300°C should take place. Subsequent heat treatment at 700-750°C can likewise contribute to the improvement of toughness.

Martensitic steels
are essentially only suitable for welding to a limited extent. With C-contents of >0.15% joint welding is inadvisable. Martensitic steels must always be preheated and heat treated. Because of the risk of hydrogen-induced cracks in the martensitic weld metal basic stick electrodes and flux-cored wires as well as basic SAW powder must be used.

Soft martensitic steels
have a very low C-content of <0.05% and a Ni-content of 1-6%. This enables the formation of a "soft" martensite with good toughness which is even more improved by subsequent heat treatment. They are welded with welding fillers of similar composition that must display a low hydrogen content of ≤ 5 ml/100 g in the weld deposit.

Because of the stresses arising with the martensite conversion the preheating should be max. 100°C, the interpass temperature 100-160°C.

Austenitic steels and duplex steels are welded with materials of similar composition. Preheating is not normally required, because of the susceptibility to hot cracking the interpass temperature should, primarily for fully austenitic steels, be limited to max.120-180°C.

Stick electrodes

	Standard		Typical analysis (Weld metal)								
	EN ISO 3581-A	AWS A 5.4	C	Si	Mn	Cr	Ni	Mo	Nb	N
EI 307 B	E 18 8 Mn B 22	E307-15 mod.	0,13	0,5	5,0	19,0	9,0			
EI 307 R	E 18 8 Mn R 12	E307-16 mod.	0,15	0,8	6,0	19,0	9,0			
EI 308 L	E 19 9 L R 12	E308L-16	≤0,03	0,7	0,8	19,0	10,0			
EIS 309	E Z23 12 L R 53	E309-16	0,10	0,9	0,8	23,0	12,0			
EI 309 L	E 23 12 L R 12	E309L-16	0,03	0,9	1,0	24,0	13,0			
EI 309Mo L	E 23 12 2 L R 12	E309MoL-16	0,03	0,9	0,7	22,5	13,5	2,5		
EI 310	E 25 20 R 12	E310-16	0,10	0,5	1,5	25,0	20,0			
EI 312	E 29 9 L R 12	E312-16	0,10	1,0	1,0	29,0	10,0			
EI 316 L	E 19 12 3 L R 12	E316L-16	0,03	0,8	1,0	19,0	12,0	2,5		
EI 318	E 19 12 3 Nb R 12	E318-16	0,06	0,7	0,8	19,0	12,0	2,5	0,35	
EI 347	E 19 9 Nb R 12	E347-16	0,06	0,8	0,8	19,0	10,0		0,35	
EIS 410	E Z13 B 42	E410-15	0,06	0,5	0,8	13,0	0,7			
EI 2209	E 22 9 3 N L R 12	E2209-16	0,025	0,9	0,9	22,5	9,5	2,8		0,14

Product forms per EN ISO 544 Ø/Length [mm] I other diameters upon request

Stabelektroden:	2,0/300	2,5/300	3,2/350	4,0/350

Solid wires/TIG-rods

	Standard		Typical analysis (Wire/Rod)							
	EN ISO 14343-A	AWS A 5.9	C	Si	Mn	Cr	Ni	Mo	Nb	N
AX-307	W/G 18 8 Mn	ER307 mod.	0,08	0,8	6,5	18,0	8,0			
AX-308L	W/G 19 9 L Si	ER308LSi	0,02	0,8	1,7	20,0	10,0			
AX-309	W/G 22 12 H	ER309 mod.	0,10	1,1	1,6	23,0	12,5			
AX-309L	W/G 23 12 L Si	ER309LSi	0,025	0,8	1,7	24,5	12,5			
AX-309LMo	W/G 23 12 2 L	ER309LMo	0,025	0,35	1,5	22,0	14,0	2,7		
AX-310	W/G 25 20	ER310 mod.	0,12	0,8	2,5	25,0	20,0			
AX-312	W/G 29 9	ER312	0,12	0,4	1,8	30,0	9,0			
AX-316L	W/G 19 12 3 L Si	ER316LSi	0,02	0,8	1,7	18,0	12,0	2,7		
AX-317L	W/G 18 16 5 N L	ER317L mod.	0,03	0,4	1,8	18,0	17,5	3,5		
AX-318L	W/G 19 12 3 Nb Si	ER318 mod.	0,04	0,8	1,6	19,0	11,5	2,7	<1,1	
AX-347L	W/G 19 9 Nb Si	ER347Si	0,04	0,8	1,4	19,0	10,0		<1,1	
AX-410	G Z13	ER410	0,08	1,1	0,6	14,5				
AX-904L	W/G 20 25 5 Cu L	ER904L	0,02	0,4	1,8	20,0	25,0	4,5	Cu 1,5	
AX-2293	W/G 22 9 3 N L	ER2209	0,02	0,4	1,5	23,0	8,5	3,0		0,15
AX-2551	G 25 4		0,10	0,6	1,0	25,0	5,0			
AX-2594	W/G 25 9 4 N L	ER2594 mod.	0,02	0,5	0,8	25,5	9,0	3,7		0,15

Product forms per EN ISO 544 Ø/Length [mm] I other diameters upon request

Spool:	0,8	1,0	1,2	1,6
Rod (1.000 mm length)	1,6	2,0	2,4	3,2

Flux-cored wire

	Standard		Typical analysis (Weld metal)							
	EN ISO 17633-A	AWS A 5.22	C	Si	Mn	Cr	Ni	Mo	Nb	N
AX-FD-DW307	T 18 8 Mn R M21 3	E307T0-G	0,07	0,6	6,4	19,2	8,1			
AX-FD-DW308L	T 19 9 L R M21 3	E308LT0-4/-1	0,03	0,8	1,8	20,5	9,5			
AX-FD-DW308LP	T 19 9 L P M21 1	E308LT1-4/-1	0,03	0,8	1,8	20,5	9,5			
AX-FD-DW309L	T 23 12 L R M21 3	E309LT0-4/-1	0,02	0,7	1,4	24,0	13,0			
AX-FD-DW309LP	T 23 12 L P M21 1	E309LT1-4/-1	0,03	0,7	1,3	23,3	12,6			
AX-FD-DW309MoL	T 23 12 2 L R M21 3	E309LMoT0-4/-1	<0,04	1,0	2,0	24,0	13,0	2,5		
AX-FD-DW309MoLP	T 23 12 2 L P M21 1	E309LMoT1-4/-1	0,025	1,0	2,0	24,0	13,0	2,5		
AX-FD-DW310	T 25 20 R M21 3	E310T0-4/-1	<0,2	1,0	2,1	27,0	21,0			
AX-FD-DW316L	T 19 12 3 L R M21 3	E316LT0-4/-1	0,03	0,6	1,5	19,0	12,0	2,6		
AX-FD-DW316LP	T 19 12 3 L P M21 1	E316LT1-4/-1	0,03	0,6	1,5	19,0	12,0	2,6		
AX-FD-DW329A	T 22 9 3 N L R M21 3	E2209T0-4/-1	0,03	0,8	1,5	23,0	9,0	3,5		0,2

Product forms per EN ISO 544 Ø/Length [mm] I other diameters upon request

Spool:	0,9	1,2	1,6