

Covered electrodes



CHRYSSAFIDIS

Features

- Consumables for welding stainless steels and nickel base alloys
- Electrodes for optimum corrosion properties
- Electrodes for all types of position welding
- Easy and flexible welding methods

Product range

Avesta Welding supplies covered electrodes for welding all of the more common ferritic, martensitic, duplex and austenitic stainless steels as well as nickel base alloys. The product range also encompasses electrodes for dissimilar welds between, for example, stainless steel and mild steel, or stainless steel and nickel base alloys. All electrodes are available manufactured to the requirements set forth by the nuclear power industry in ASME code section III and KTA 1408.

General characteristics

Avesta Welding electrodes are produced in three groups – AC/DC, basic and rutile – and with different coatings in the AC/DC group to ensure the optimum result for each application.

- AC/DC electrodes have a rutile-acid coating, designed for general all-round horizontal welding but can also be used for position welding. All AC/DC electrodes can be welded using direct current, positive polarity or alternating current.
- Basic electrodes offer improved mechanical properties and superior weld penetration. Welding should be performed using direct current, positive polarity.
- The rutile electrode is a predecessor to the rutile-acid (AC/DC) coating, offering a somewhat better weld penetration than the AC/DC type.

Some of the AC/DC electrodes are produced with special coatings for various purposes. The designations indicate their fields of application.

- HX is a rutile-acid, high-recovery electrode for high deposit welding. The metal recovery is up to 150%.
- PW electrodes have a rutile-acid coating specially designed for position welding.
- PWX electrodes have an extra thin rutile-acid coating for pipe welding in all positions.
- VDX is a rutile-acid electrode for vertical down position welding.



Electrode types and designations

Electrode type EN 1600	Avesta Welding designations
Martensitic	248 SV
Austenitic	308L/MVR, 308/308H, 308L-LF, 347/MVNB, 316L/SKR, 318/SKNb, 317L/SNR, SLR
Austenitic-ferritic	2304, 2205, 2507/P100
Fully austenitic	P6, 254 SFER, SKR-NF, SLR-NF, 904L, 383, P12-R, P625, P16, P54
Special types	307, 309L, P5, P7, P10, P690
Heat resisting	309, 310, 253 MA, 253 MA-NF, 353 MA

Avesta Welding can also supply electrodes with a coating or chemical composition specially designed to meet individual customer requirements.



Weld metal composition

Standard designations

Electrode	Type of coating	Chemical composition, typical values, %							Ferrite* typical	EN 1600/14172	AWS A5.4/A5.11
		C	Si	Mn	Cr	Ni	Mo	Other			
248 SV	Rutile	0.03	0.5	3.0	16.0	5.5	1.2	N 0.12	–	–	–
308L/MVR	AC/DC	0.02	0.8	1.0	20.0	10.5			10 FN	E 19 9 L R	E308L-17
308L/MVR-HX	AC/DC	0.03	0.7	0.9	20.0	10.5			10 FN	E 19 9 L R	E308L-17
308L/MVR-PW	AC/DC	0.02	0.8	1.0	19.0	10.0			5 FN	E 19 9 L R	E308L-17
MVR-PWX	AC/DC	0.02	1.1	1.0	19.0	10.5			5 FN	E 19 9 L R	–
308L/MVR-VDX	AC/DC	0.02	0.7	0.8	19.0	10.0			5 FN	E 19 9 L R	E308L-17
308L/MVR	Basic	0.03	0.2	1.7	20.0	10.0			5 FN	E 19 9 L B	E308L-15
308L/MVR	Rutile	0.03	0.3	1.5	20.0	10.0			5 FN	E 19 9 L R	E308L-16
308/308H	AC/DC	0.06	0.7	1.1	20.0	10.0			5 FN	E 19 9 R	E308H-17
308L	AC/DC	0.02	0.8	1.0	20.0	10.5			10 FN	E 19 9 L R	E308L-17
308L-LF	Rutile	0.03	0.3	1.8	18.5	10.5			0 FN	E 19 9 L R	E308L-15
347/MVNB	AC/DC	0.02	0.8	0.8	19.5	10.0		Nb>10xC**	10 FN	E 19 9 Nb R	E347-17
347/MVNB	Basic	0.06	0.2	1.7	19.5	10.0		Nb>10xC**	5 FN	E 19 9 Nb B	E347-15
316L/SKR	AC/DC	0.02	0.8	1.1	18.5	12.0	2.8		10 FN	E 19 12 3 L R	E316L-17
316L/SKR-HX	AC/DC	0.03	0.8	0.8	18.0	12.0	2.8		10 FN	E 19 12 3 L R	E316L-17
316L/SKR-PW	AC/DC	0.02	0.8	1.0	18.0	12.0	2.8		10 FN	E 19 12 3 L R	E316L-17
SKR-PWX	AC/DC	0.02	1.1	0.7	18.0	12.5	2.7		5 FN	E 19 12 3 L R	–
316L/SKR-VDX	AC/DC	0.02	0.7	0.7	18.5	12.5	2.8		5 FN	E 19 12 3 L R	E316L-17
316L/SKR	Basic	0.03	0.2	1.7	18.5	12.0	2.8		5 FN	E 19 12 3 L B	E316L-15
316L/SKR	Rutile	0.02	0.3	1.4	19.0	12.0	2.8		5 FN	E 19 12 3 L R	E316L-16
316/316H	AC/DC	0.06	0.8	1.0	19.0	12.0	2.8		5 FN	E 19 12 2 R	E316H-17
316L	AC/DC	0.02	0.8	1.0	18.5	12.0	2.8		10 FN	E 19 12 3 L R	E316L-17
318/SKNb	AC/DC	0.02	0.8	0.8	18.5	12.0	2.8	Nb>10xC**	10 FN	E 19 12 3 Nb R	E318-17
318/SKNb	Basic	0.04	0.2	2.1	18.5	12.5	2.7	Nb>10xC**	5 FN	E 19 12 3 Nb B	E318-15
317L/SNR	AC/DC	0.02	0.7	0.9	19.0	13.0	3.7		10 FN	–	E317L-17
SLR	AC/DC	0.02	0.8	1.0	18.0	13.5	4.0		10 FN	E 19 13 4 N L R	–
2304	AC/DC	0.02	0.8	0.8	24.5	9.0		N 0.12	30 FN	–	–
2205	AC/DC	0.02	0.8	0.7	23.0	9.5	3.0	N 0.15	30 FN	E 22 9 3 N L R	E2209-17
2205-HX	AC/DC	0.03	0.8	0.7	22.5	9.5	3.0	N 0.15	30 FN	E 22 9 3 N L R	E2209-17
2205-PW	AC/DC	0.02	0.8	0.8	23.0	9.5	3.0	N 0.17	30 FN	E 22 9 3 N L R	E2209-17
2205-VDX	AC/DC	0.02	0.8	0.9	22.5	9.5	3.1	N 0.15	30 FN	E 22 9 3 N L R	E2209-17
2205	Basic	0.02	0.5	0.8	23.0	9.5	3.0	N 0.16	30 FN	E 22 9 3 N L B	E2209-15
2507/P100	Rutile	0.03	0.5	1.3	25.5	10.0	3.6	N 0.23	30 FN	E 25 9 4 N L R	–
P6	Basic	0.03	0.2	5.5	18.5	17.0	2.7	N 0.17	0 FN	–	–
254 SFER	Rutile	0.03	0.8	4.5	25.5	22.5	2.4	N 0.16	0 FN	E 25 22 2 N L R	–
SKR-NF	Rutile	0.03	0.5	2.0	18.5	15.5	2.8	N 0.18	0 FN	E 18 15 3 L R	–
SLR-NF	Rutile	0.02	0.7	1.4	19.0	18.0	4.8	N 0.13	0 FN	E 18 16 5 N L R	–
904L	AC/DC	0.02	0.7	1.2	20.5	25.0	4.5	Cu 1.5	0 FN	E 20 25 5 Cu N L R	E385-17
904L-PW	AC/DC	0.02	1.0	1.2	20.0	24.5	4.5	Cu 1.5	0 FN	E 20 25 5 Cu N L R	–
383	AC/DC	0.02	0.9	0.9	27.0	32.0	3.7	Cu 1.0	0 FN	E 27 31 4 Cu L R	E383-17
P12-R	Basic	0.02	0.4	0.4	21.5	Bal.	9.5	Nb 2.2 Fe 2	0 FN	ENiCr21MoFeNb	ENiCrMo-12
P625	Basic	0.02	0.5	0.2	21.5	Bal.	9.5	Nb 3.5 Fe 1.5	0 FN	ENiCr22Mo9Nb	ENiCrMo-3
P16	Basic	0.02	0.2	0.3	25.0	Bal.	15.0	Nb <0.1	0 FN	–	–
P54	Basic	0.02	0.2	2.6	25.5	25.5	5.0	N 0.35 Cu 0.8	0 FN	–	–
307	AC/DC	0.07	0.8	4.0	20.0	10.5	0.8		5 FN	E 18 9 Mn Mo R	E307-17
309L	AC/DC	0.02	0.8	1.0	24.0	13.5			15 FN	E 23 12 L R	E309L-17
309L	Basic	0.03	0.2	1.9	24.0	13.0			15 FN	E 23 12 L B	E309L-15
P5	AC/DC	0.02	0.8	1.1	22.5	13.5	2.7		20 FN	E 23 12 2 L R	E309MoL-17
P5-HX	AC/DC	0.03	0.8	1.0	22.0	13.5	2.7		20 FN	E 23 12 2 L R	E309MoL-17
P5-PW	AC/DC	0.02	0.8	1.0	22.5	13.5	2.7		20 FN	E 23 12 2 L R	E309MoL-17
P5-PWX	AC/DC	0.02	1.1	1.0	22.5	13.5	2.9		20 FN	E 23 12 2 L R	–
P5-VDX	AC/DC	0.02	0.9	0.9	22.5	13.5	2.7		20 FN	E 23 12 2 L R	–
P5	Basic	0.03	0.2	2.0	22.5	13.0	2.7		15 FN	E 23 12 2 L B	E309MoL-15
P5	Rutile	0.03	0.3	1.4	22.5	13.5	2.7		15 FN	E 23 12 2 L R	E309MoL-16
P7	AC/DC	0.09	0.8	0.8	29.0	9.5			40 FN	E 29 9 R	(E312-17)
P7-PW	AC/DC	0.10	0.9	1.0	28.5	10.0			40 FN	E 29 9 R	(E312-17)
P10	Basic	0.02	0.4	6.5	16.0	Bal.		Nb 1.8 Fe 5	0 FN	–	ENiCrFe-3
P690	Basic	0.03	0.4	3.0	30.0	Bal.	0.3	Nb 1.5 Fe 9.0	0 FN	ENiCr30Fe9Nb	ENiCrFe-7
309	AC/DC	0.05	0.8	1.0	24.0	13.5			15 FN	–	E309-17
310	AC/DC	0.10	0.5	2.1	26.0	21.0			0 FN	E 25 20 R	E310-17
310	Basic	0.12	0.3	2.4	25.5	21.0			0 FN	E 25 20 B	E310-15
253 MA	AC/DC	0.08	1.5	0.7	22.0	10.5		N 0.18 REM	10 FN	–	–
253 MA-NF	AC/DC	0.08	0.7	1.0	19.0	10.0		N 0.16 REM	0 FN	–	–
353 MA	Basic	0.07	0.7	1.4	27.5	33.0		REM	0 FN	–	–

* Ferrite content measured in all weld metal. FN 0–18 acc. to Schaeffler-DeLong, FN >18 acc. to WRC-92. ** max. 1.0% Nb.



Mechanical properties, all weld metal, typical values

Approvals

Electrode	Type of coating	R _{p0.2} N/mm ²	R _m N/mm ²	Elong. A5 %	Impact strength KV, J			Hardness Brinell	TÜV	DNV	CWB	Others*
					+20°C	-40°C	-196°C					
248 SV	Rutile	510	760	30	115	-		260				
308L/MVR	AC/DC	440	570	37	60	55		200	x	x		x
308L/MVR-HX	AC/DC	395	550	41	65	55		210	x		x	x
308L/MVR-PW	AC/DC	430	580	39	60	50		210			x	x
MVR-PWX	AC/DC	420	520	35	40	-		210				
308L/MVR-VDX	AC/DC	450	600	35	55	40		210			x	x
308L/MVR	Basic	420	560	38	70	55		200	x			x
308L/MVR	Rutile	430	590	40	60	-		200	x			x
308/308H	AC/DC	450	605	37	55	50		210	x		x	x
308L	AC/DC	450	580	37	60	40		200			x	x
308L-LF	Rutile	420	560	39	85	30		200				
347/MVNB	AC/DC	470	620	35	55	45		225	x	x	x	x
347/MVNB	Basic	520	680	30	80	60		255	x			x
316L/SKR	AC/DC	445	590	36	55	55		210	x	x		x
316L/SKR-HX	AC/DC	420	575	37	55	55		210	x	x	x	x
316L/SKR-PW	AC/DC	455	590	36	60	60		210	x	x	x	x
SKR-PWX	AC/DC	480	640	27	70	50		210				x
316L/SKR-VDX	AC/DC	480	630	30	50	35		210	x	x	x	x
316L/SKR	Basic	430	565	34	70	50	25	210	x			x
316L/SKR	Rutile	480	590	32	75	60		210	x			x
316/316H	AC/DC	470	615	35	50	-		210	x		x	x
316L	AC/DC	445	590	36	55	35		210	x		x	x
318/SKNb	AC/DC	470	605	32	50	45		220	x	x		x
318/SKNb	Basic	480	620	31	75	60		220	x			
317L/SNR	AC/DC	485	615	31	40	-		210		x	x	x
SLR	AC/DC	490	635	31	40	30		225	x			x
2304	AC/DC	640	780	23	40	25		260				
2205	AC/DC	620	810	25	45	35		240	x		x	x
2205-HX	AC/DC	640	825	33	55	40		240				
2205-PW	AC/DC	635	830	25	50	40		240	x	x	x	x
2205-VDX	AC/DC	670	860	25	35	25		240				
2205	Basic	635	820	26	80	55		240				
2507/P100	Rutile	695	895	27	80	55		250				
P6	Basic	460	665	31	75	65	25	210	x			x
254 SFER	Rutile	440	660	37	60	-	20	200				
SKR-NF	Rutile	470	660	33	75	-	30	195	x			x
SLR-NF	Rutile	450	640	32	45	-		225				x
904L	AC/DC	400	565	34	60	-		200	x			x
904L-PW	AC/DC	400	600	35	70	-		200				x
383	AC/DC	410	620	33	55	-		200				
P12-R	Basic	465	705	37	80	80	70	220	x		x	x
P625	Basic	460	775	30	50	-		220				
P16	Basic	495	740	35	50	40		220				
P54	Basic	550	650	20	55	45		220				
307	AC/DC	465	605	35	45	-		200				
309L	AC/DC	460	590	33	50	45		210	x	x	x	x
309L	Basic	440	570	30	50	-		210				
P5	AC/DC	490	640	30	30	-		220	x	x	x	x
P5-HX	AC/DC	450	625	30	35	-		220				x
P5-PW	AC/DC	525	660	31	25	-		225				x
P5-PWX	AC/DC	480	635	25	30	-		225				
P5-VDX	AC/DC	545	685	30	40	-		225				x
P5	Basic	465	615	30	50	35		230	x			x
P5	Rutile	510	620	32	50	-		220	x			x
P7	AC/DC	620	810	16	25	-		270				x
P7-PW	AC/DC	710	840	15	20	-		260				
P10	Basic	380	630	39	115	-	80	180				x
P690	Basic	400	640	35	110	-	100	220				
309	AC/DC	435	580	30	45	-		210			x	x
310	AC/DC	430	625	35	80	-	35	190			x	x
310	Basic	415	590	34	100	-		190				
253 MA	AC/DC	535	725	37	60	-		215				
253 MA-NF	AC/DC	460	620	39	60	-		210				
353 MA	Basic	385	565	33	85	-		200				

* Contact Avesta Welding for details.



For welding the following steels

EN	ASTM	Outokumpu steel grade	Recommended electrode type
1.4418	–	248 SV	248 SV
1.4307	304L	4307	308/308L/MVR
1.4311	304LN	4311	
1.4301	304	4301	
1.4306	304L	4306	
1.4541	321	4541	347/MVNB
1.4550	347	–	
1.4432	316L	4432	316/316L/SKR
1.4429	S31653	4429	
1.4436	316	4436	
1.4435	316L	4435	
1.4404	316L	4404	
1.4406	316LN	4406	
1.4401	316	4401	
1.4571	316Ti	4571	
1.4438	317L	4438	317L/SNR
1.4439	317LMN	4439	SLR
1.4162	S32101	LDX 2101®	2304, 2205
1.4362	S32304	SAF 2304®	2304
1.4462	S32205	2205	2205
1.4410	S32750	SAF 2507®	2507/P100
1.4429	S31653	4429	P6
1.4466	S31050	4466	254 SFER
1.4435	316L	4435	SKR-NF
1.4439	317LMN	4439	SLR-NF
1.4539	904L	904L	904L
Also for welding similar steels of the 20-25 CrNiMoCu type.			
1.4563 (Alloy 28) and similar steels.			383
1.4547	S31254	254 SMO®	P12-R
Also for welding Ni-based alloys to stainless or unalloyed steel and for surfacing.			
2.4856	N06625	–	P625
Also for welding Ni-based alloys to stainless or unalloyed steel and for surfacing.			
1.4565	S34565	4565	P16
1.4652	S32654	654 SMO®	
1.4547	S31254	254 SMO®	P54
1.4652	S32654	654 SMO®	
For surfacing unalloyed steel, joint welding stainless steel to unalloyed steel and for welding clad materials.			307 309L P5
For difficult-to-weld steels (Mn-steel, tool steel, high temperature steel). Also for welding stainless steel to unalloyed steel.			P7
Inconel 600; 9% Ni-steels. Also for welding Ni-based alloys to stainless or unalloyed steel and for surfacing.			P10
Inconel 690 and for welding unalloyed or low-alloy steels to stainless and Ni-based alloys.			P690
For welding steels for moderately high temperature applications.			309 253 MA-NF
For welding steels for high temperature applications.			310 253 MA 353 MA

For more detailed information, see "Applications" on pages 6 and 7.

SAF 2304 and SAF 2507 are produced under licence from AB Sandvik Steel.

Dimensions and packaging data

Coating	Diameter and length, mm					
	1.60	2.00	2.50	3.25	4.00	5.00
AC/DC	250	250–300	300–350	350	350–450	350–450
HX			350	350–400	450	450
PW	250	250	300	350	350	350
VDX, PWX	250	250–300	300	350		
Basic		250	300	350	350	350
Rutile	250	250	300	350	350	350

Avesta Welding supplies covered electrodes safely packed in moisture-resistant plastic capsules, packed in cardboard boxes. Vacuum-packed capsules are also available.

Most Avesta Welding covered electrodes are available in the full range of diameters given in the table above. The electrodes are produced in different lengths, depending on the grade. Please check with your local distributor for details and availability.

Electrode care

Due to the special composition of their coating, Avesta Welding electrodes are very resistant to moisture absorption. Furthermore, they are delivered in sealed packages, which ensure protection against moisture pick-up.

Nevertheless, electrodes should preferably be stored in a warm storage room with low relative humidity to minimise the risk of moisture pick-up, as this may cause pore formation in the weld metal. For this reason, an opened packet should be resealed when welding is interrupted for a prolonged period.

Electrodes even slightly affected by moisture should be carefully dried for 3 hours at 250–280°C. Both heating and cooling should be carried out slowly.

Quality assurance and marking

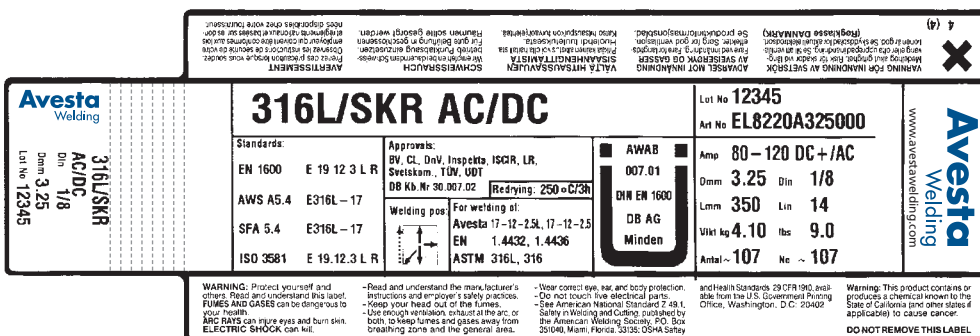
Avesta Welding covered electrodes are supplied with a 3.1.B certificate, showing the actual chemical composition of each lot. Each electrode is stamped with the brand name, lot number and designation, where applicable.

Each capsule is marked with the Avesta Welding brand name, lot number, standard designation, welding parameter recommendations and warning text.

Additional information

Further information on Avesta Welding products can be found in printed matter, such as

- Avesta Welding Manual
- Data sheets
- "How to weld..." (series of brochures covering Outokumpu Stainless special grades) and on www.avestawelding.com



Avesta Welding

316L/SKR AC/DC

Lot No **12345**
Art No **EL8220A3Z5000**

AWAB 007.01
DIN EN 1600
DB AG
Minden

Amp **80 – 120 DC + / AC**
Dmm **3.25** Dln **1/8**
Lmm **350** Lin **14**
Ukt kg **4.10** lbs **9.0**
Antal - **107** No ~ **107**

Standards: EN 1600 E 19 12 3 L R
AWS A5.4 E316L – 17
SFA 5.4 E316L – 17
ISO 3581 E 19.12.3 L R

Approvals: BV, CL, DnV, Inspecta, ISCR, LR, Sveisekom, TÜV, UDT
DB Kb. Nr. 30.007.02 Redrying: 250 oC/3h

Welding pos: For welding of: Avesta 17 – 12 – 25L, 17 – 12 – 25 EN 1.4432, 1.4436 ASTM 316L, 316

Warnings: Protect yourself and others. Read and understand the manufacturer's instructions and employer's safety practices. FUMES AND GASES can be dangerous to your health. Fumes can irritate eyes and burn skin. ELECTRIC SHOCK can kill. -Read and understand the manufacturer's instructions and employer's safety practices. -Keep your head out of the fumes. -Use enough ventilation, contact at the arc, or both, to keep fumes and gases away from breathing zone and the general area. -Wear correct eye, ear and body protection. -Do not touch live electrical parts. -See American National Standard Z 49.1, Safety in Welding and Cutting, published by the American Welding Society, P.O. Box 351046, Miami, Florida 33136, OSHA Safety and Health Standards, 29 CFR 1910, available from the U.S. Government Printing Office, Washington, D.C. 20540

www.avestawelding.com



Avesta Welding has been ISO 9002 approved since 1991. In 2003 the approval was upgraded to ISO 9001:2000. Certificate No. FM 20031



Applications

248 SV

For welding austenitic-ferritic-martensitic components in applications demanding high wear resistance and high strength.

308L/MVR

Low carbon 19/9 type electrode with excellent general corrosion resistance, for welding ASTM 304/304L. The MVR-PWX electrode has been specially developed for pipe welding.

308/308H

High carbon 19/9 type electrode with enhanced creep resistance for welding ASTM 304.

308L-LF

Fully austenitic 19/9 electrode designed for low temperature applications.

347/MVNB

Nb-stabilised 19/9 type electrode for welding Nb and Ti-stabilised steels of the ASTM 321 type. This electrode offers better creep resistance than other 19/9 type electrodes in environments where service temperatures exceed 400°C.

316L/SKR

Low carbon 18/13/3 type electrode alloyed with Mo for higher corrosion resistance than 308L/MVR. This electrode is used for welding ASTM 316/316L. The SKR-PWX electrode has been specially developed for pipe welding.

316/316H

High carbon type 18/13/3 electrode with enhanced creep resistance for welding ASTM 316.

318/SKNb

Nb-stabilised 18/13/3 type electrode for welding Nb and Ti-stabilised steel of the 316Ti type. It offers slightly better creep resistance than other 18/13/3L type electrodes where service temperatures exceed 400°C.

317L/SNR

This electrode produces a 19/14/4L weld metal with high corrosion resistance in acid and chlorine containing environments.

SLR

Electrode with similar characteristics to 317L/SNR but with a 1% higher Mo content for enhanced corrosion resistance properties.

2304

Specially designed electrode for welding SAF 2304, e.g. in nitric acid environments. Can also be used for welding Outokumpu LDX 2101.

2205

Ferritic-austenitic (duplex) electrode with very high proof and tensile strength as well as excellent resistance to pitting corrosion and stress corrosion cracking. Can also be used for welding Outokumpu LDX 2101.



2507/P100

Specially designed electrode for welding SAF 2507 and similar super duplex grades.

P6

High alloyed fully austenitic electrode with high resistance to hot cracking. Approved by Snamprogetti.

254 SFER

Highly alloyed fully austenitic electrode with good austenite stability and excellent corrosion resistance, e.g. in urea plants.

SKR-NF

Fully austenitic 18/13/3L electrode designed for low temperature (cryogenic) applications and with excellent resistance to selective corrosion, e.g. in urea services.

SLR-NF

Fully austenitic electrode with properties similar to SLR.

904L

Fully austenitic electrode with excellent corrosion resistance in non-oxidising solutions such as sulphuric and phosphoric acids.

383

Fully austenitic electrode for welding steels such as ASTM N08028. This electrode provides excellent corrosion resistance in sulphuric and phosphoric acid.

P12-R

Nickel base electrode for welding nickel alloys, surfacing mild steel and welding 6Mo-steels such as Outokumpu 254 SMO. Extremely good resistance to pitting and crevice corrosion.

P625

Nickel base electrode corresponding to Alloy 625. Suitable for high temperature applications.



P16

Nickel base electrode specially designed for welding 7Mo-steels such as Outokumpu 654 SMO for use in extremely demanding corrosive environments.

P54

Iron base electrode for welding Outokumpu 254 SMO and Outokumpu 654 SMO exposed to highly oxidising environments.



307

Fully austenitic Mn-alloyed 18-8 electrode for welding dissimilar steels, such as stainless steels to carbon, low alloyed or Mn-steels.

309L

Highly alloyed 23/13L electrode suitable for reliable, crack-resistant welds between mild steel and stainless steels of the ASTM 304/304L type. Also for surfacing, producing a 304 type deposit from the very first layer.

P5

Highly alloyed 23/13/3L electrode suitable for reliable, crack-resistant welds between mild steel and stainless steels of the ASTM 316/316L type. Also for surfacing, producing a 316 type deposit from the very first layer.

P7

312 type electrode producing a high strength austenitic-ferritic weld metal with high resistance to cracking. Suitable for welding dissimilar steels, such as stainless steels to carbon, low alloyed or Mn-steels. Also offers good resistance to sulphur-containing gases.

P10

Specially designed electrode producing a highly crack-resistant weld metal for welding heat-resistant nickel base alloys or dissimilar steels, such as mild steel to stainless or nickel base to stainless steels.

P690

Nickel base alloy for welding Inconel 690 as well as for joining unalloyed or low-alloy steels to stainless steels and nickel base alloys. Also well suited for

depositing overlays on carbon steel, especially when there are stringent requirements regarding service at high temperatures, or in the construction of nuclear reactors.

309

High carbon 23/13 electrode for welding steels of the 309S type for use in moderately high temperature applications.

310

Fully austenitic electrode of the 26/20 type for welding steels of the ASTM 310S type for use in high temperature applications.

253 MA

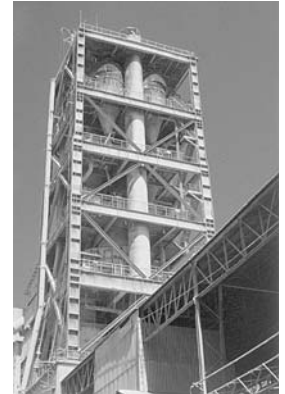
Specially designed electrode for welding high temperature steels such as Outokumpu 253 MA. Possesses even better high-temperature properties than ASTM 310S.

253 MA-NF

Non-ferritic 253 MA electrode with extremely good impact strength values even when exposed to temperatures between 750°C and 950°C.

353 MA

Fully austenitic electrode, specially designed for welding high temperature steels such as Outokumpu 353 MA.



Welding recommendations

Electrode type	Diameter mm	Voltage V	Horizontal (PA) Current, A	Vertical up (PF) Current, A	Overhead (PE) Current, A
AC/DC	1.6	26 – 30	30 – 50	30 – 40	35 – 45
	2.0	26 – 30	35 – 60	35 – 50	40 – 50
	2.5	26 – 30	50 – 80	50 – 60	60 – 70
	3.25	26 – 30	80 – 120	80 – 95	95 – 105
	4.0	26 – 30	100 – 160		
	5.0	26 – 30	160 – 220		
Basic *	2.0	24 – 27	35 – 55	35 – 40	35 – 45
	2.5	24 – 27	50 – 75	50 – 60	55 – 65
	3.25	24 – 27	70 – 100	70 – 80	90 – 100
	4.0	24 – 27	100 – 140	100 – 115	125 – 135
	5.0	24 – 27	140 – 190		
Rutile	1.6	22 – 24	30 – 40	30 – 35	30 – 40
	2.0	22 – 24	35 – 55	35 – 40	40 – 50
	2.5	22 – 24	50 – 75	50 – 60	60 – 70
	3.25	22 – 24	70 – 110	70 – 80	95 – 105
	4.0	22 – 24	100 – 150	100 – 120	120 – 135
	5.0	22 – 24	140 – 190		

* For nickel base electrodes type Avesta P10, P12 and P16, a slightly lower current should be used.

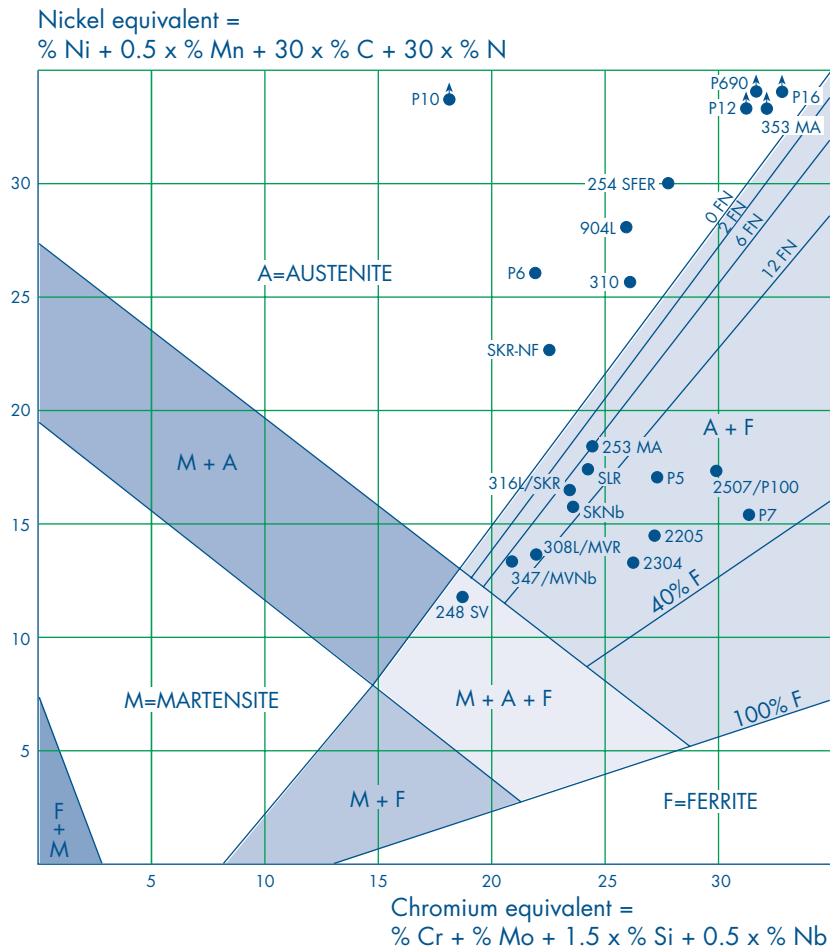
Values shown are typical values. Contact Avesta Welding for details.



Models for ferrite prediction

The ferrite content of a weldment can be described in several different ways. It can be measured according to ASTM E562, but this method is time consuming and expensive. The ferrite value is therefore normally measured by a magnetic method, e.g. Magne-Gage or ferritescope or calculated in terms of the weld metal composition. Nowadays, this latter approach is often

preferred, using either the Schaeffler-DeLong method (below) or WRC-92 diagrams. The ferrite content is given as a ferrite number, FN. The relationship between percentage and ferrite number according to Schaeffler-DeLong correlate well up to 18 FN. Above this level, values should be given according to the WRC-92.



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