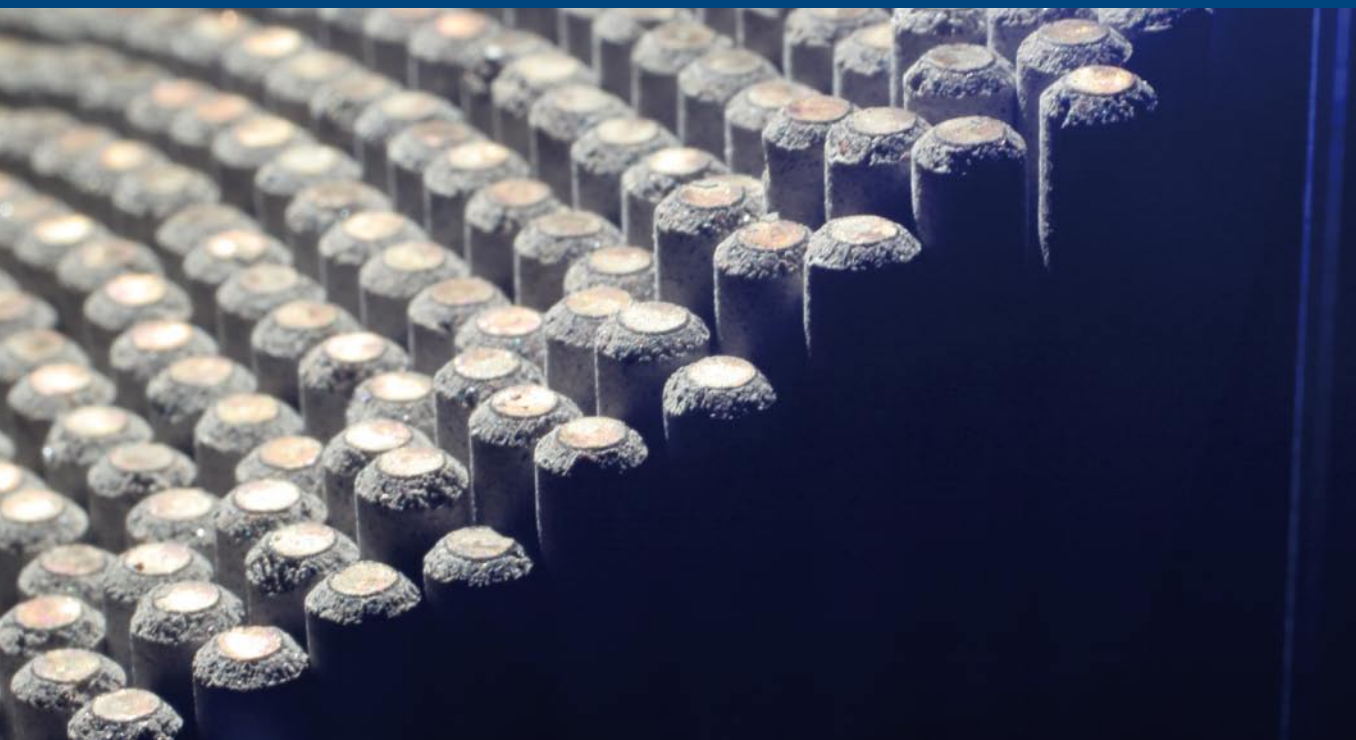


# AVESTA ELECTRODES product programme



## Covered electrodes for stainless steel

Prefabrication welding in workshops, on-site welding, overlay welding and repair welding are just some of the uses of covered electrodes. Avesta Welding's wide programme includes electrodes that, for most steel grades and applications, satisfy the severest requirements in respect of corrosion resistance and mechanical properties.

### Product programme

Avesta Welding produces covered electrodes not only for all the most commonly used ferritic, martensitic, duplex and austenitic stainless steels, but also for nickel base alloys. The programme further includes electrodes for welding dissimilar joints between, for example, stainless steels and unalloyed steels or nickel base alloys.

Avesta Welding manufactures three categories of electrodes:

- **Rutile-acid electrodes** are designed for normal flat welding, but can also be used for position welding.
- **Basic electrodes** offer better mechanical properties and superior penetration. Welding with basic electrodes uses direct current and the electrode as the positive terminal (DC+).
- **Rutile electrodes** are the predecessors of today's rutile-acid electrodes. Nowadays, rutile coatings are used almost exclusively for welding more demanding materials such as 2507/P100 and 254 SFER. In these cases, properties are given a higher priority than weldability.

### Electrode types and designations

Electrode types	Avesta Welding's designations
EN 1600	
Martensitic	248 SV
Austenitic	308L/MVR, 308/308H, 308L-LF, 347/MVNB, 316L/SKR, 316/316H, 318/SKNb, 317L/SNR, SLR
Austenitic-ferritic	LDX 2101, 2304, 2205, 2507/P100
Fully austenitic	254 SFER, SKR-NF, 316L/SKR-Cryo, 904L, 383, P12-R, P625, P16, P54
Special types	307, 309L, P5, P7, P10, P690
Heat resistant	309, 310, 253 MA, 253 MA-NF, 353 MA

Avesta Welding can also supply electrodes specially manufactured to meet individual customer requirements as regards, for example, coating or chemical composition.

**Avesta**  
Welding


## Weld metal composition

## Standard designations

Electrode designations Avesta Welding	Coating type	Chemical composition, typical values, %							Typical ferrite*	EN	AWS
		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-2D	Rutile-acid	0.03	0.7	0.9	20.0	10.5	–	–	10 FN	E 19 9 L R	E308L-17
308L/MVR-3D	Rutile-acid	0.02	0.8	0.6	19.5	10.0	–	–	10 FN	E 19 9 L R	E308L-17
308L/MVR-4D	Rutile-acid	0.02	0.8	0.6	19.5	10.5	–	–	5 FN	E 19 9 L R	E308L-17
308L/MVR basic	Basic	0.03	0.4	1.5	20.0	10.0	–	–	5 FN	E 19 9 L B	E308L-15
308L/MVR-VDX	Rutile-acid	0.02	0.7	0.8	19.0	10.0	–	–	5 FN	E 19 9 L R	E308L-17
308/308H AC/DC	Rutile-acid	0.06	0.7	1.1	20.0	10.0	–	–	5 FN	E 19 9 R	E308H-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-3D	Rutile-acid	0.02	0.8	0.8	19.5	10.0	–	Nb $\geq$ 10xC**	8 FN	E 19 9 Nb R	E347-17
347/MVNB basic	Basic	0.06	0.2	1.7	19.5	10.0	–	Nb $\geq$ 10xC**	5 FN	E 19 9 Nb B	E347-15
316L/SKR-2D	Rutile-acid	0.03	0.8	0.8	18.0	12.0	2.8	–	10 FN	E 19 12 3 L R	E316L-17
316L/SKR-3D	Rutile-acid	0.02	0.8	0.7	18.5	12.0	2.7	–	10 FN	E 19 12 3 L R	E316L-17
316L/SKR-4D	Rutile-acid	0.02	0.8	0.7	18.0	12.0	2.6	–	8 FN	E 19 12 3 L R	E316L-17
316L/SKR basic	Basic	0.03	0.4	1.7	18.5	12.0	2.8	–	5 FN	E 19 12 3 L B	E316L-15
316L/SKR-VDX	Rutile-acid	0.02	0.7	0.7	18.5	12.5	2.8	–	5 FN	E 19 12 3 L R	E316L-17
316/316H AC/DC	Rutile-acid	0.06	0.8	1.0	19.0	12.0	2.8	–	5 FN	E 19 12 2 R	E316H-17
318/SKNb AC/DC	Rutile-acid	0.02	0.8	0.8	18.5	12.0	2.8	Nb $\geq$ 10xC**	10 FN	E 19 12 3 Nb R	E318-17
317L/SNR AC/DC	Rutile-acid	0.02	0.7	0.9	19.0	13.0	3.7	–	10 FN	–	E317L-17
SLR AC/DC	Rutile-acid	0.02	0.8	1.0	18.5	13.5	4.0	–	10 FN	E 19 13 4 N L R	–
LDX 2101-3D	Rutile-acid	0.04	0.8	0.7	23.5	7.0	0.3	N 0.14	45 FN	–	–
2304-3D	Rutile-acid	0.02	0.8	0.8	24.5	9.0	–	N 0.12	30 FN	–	–
2205-2D	Rutile-acid	0.02	0.8	0.7	22.5	9.5	3.0	N 0.15	30 FN	E 22 9 3 N L R	E2209-17
2205-3D	Rutile-acid	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
2205-4D	Rutile-acid	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 basic	Basic	0.03	0.5	1.2	23.5	9.0	3.0	N 0.16	40 FN	E 22 9 3 N L B	E2209-15
2507/P100-4D	Rutile-acid	0.03	0.8	0.8	25.0	9.3	3.6	N 0.22	30 FN	E 25 9 4 N L R	E2594-17
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	E2594-17
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	–
316L/SKR-Cryo	Rutile-acid	0.03	0.4	2.4	17.5	13.8	2.5	–	0 FN	–	E316L-17
904L AC/DC	Rutile-acid	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	Rutile-acid	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	Rutile-acid	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 Fe 3	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	0.01	0.1	0.2	23.5	Bal.	15.5	–	0 FN	ENiCr23Mo16	ENiCrMo-13
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	Rutile-acid	0.07	0.8	4.0	19.5	10.5	0.8	–	5 FN	E 18 9 Mn Mo R	E307-17
309L-3D	Rutile-acid	0.02	0.8	0.8	23.0	13.0	–	–	15 FN	E 23 12 L R	E309L-17
309L-4D	Rutile-acid	0.02	0.8	1.0	23.5	13.0	–	–	15 FN	E 23 12 L R	E309L-17
309L basic	Basic	0.03	0.2	1.9	24.0	13.0	–	–	15 FN	E 23 12 L B	E309L-15
P5-2D	Rutile-acid	0.03	0.8	1.0	22.0	13.5	2.7	–	20 FN	E 23 12 2 L R	E309MoL-17
P5-3D	Rutile-acid	0.02	0.8	0.8	23.0	13.0	2.5	–	15 FN	E 23 12 2 L R	E309MoL-17
P5-4D	Rutile-acid	0.02	0.7	1.0	23.0	13.0	2.5	–	20 FN	E 23 12 2 L R	E309MoL-17
P5 basic	Basic	0.03	0.2	2.0	22.5	13.0	2.7	–	15 FN	E 23 12 2 L B	E309MoL-15
P5-VDX	Rutile-acid	0.02	0.9	0.9	22.5	13.5	2.5	–	20 FN	E 23 12 2 L R	E309MoL-17
P7 AC/DC	Rutile-acid	0.09	0.8	0.8	29.0	9.5	–	–	40 FN	E 29 9 R	(E312-17)
P10	Basic	0.03	0.3	7.0	16.0	Bal.	–	Nb 2.2 Fe 5	0 FN	E Ni Cr 15 Fe 6 Mn	ENiCrFe-3
P690	Basic	0.03	0.4	3.0	30.0	Bal.	0.3	Nb 1.5 Fe 9	0 FN	E Ni Cr 30 Fe 9 Nb	ENiCrFe-7
309 AC/DC	Rutile-acid	0.05	0.8	1.0	24.0	13.5	–	–	15 FN	–	E309-17
310 AC/DC	Rutile-acid	0.10	0.5	2.1	26.0	21.0	–	–	0 FN	E 25 20 R	E310-17
253 MA AC/DC	Rutile-acid	0.08	1.5	0.7	22.0	10.5	–	N 0.18 REM	10 FN	–	–
253 MA-NF	Rutile-acid	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	–	–


\* The ferrite content of pure weld metal. FN 0 – 18 in Schaeffler-DeLong, FN >18 in WRC-92. \*\* Max. 1.0% Nb.

### Avesta 2D electrodes

 high productivity in the flat position

Avesta 2D high-recovery electrodes give a metal recovery of up to 150%. The deposition rate can be as much as 30% better than that of corresponding standard products. Because weld beads are generally considerably longer when using 2D electrodes, there is minimum starting and stopping. This improves both cost efficiency and quality. 2D electrodes can be used for: horizontal-vertical and flat fillet welds; flat butt welds; and, various types of overlay welding. Suitable metal thicknesses are 5 mm upwards.

### Avesta 3D electrodes

 the perfect "all-round" electrodes

Avesta 3D electrodes have been specially developed for flexible welding in all common welding positions. Because 3D electrodes have a very wide parameter box, they have a large working range and can be used for all types of joints. 3D electrodes have extremely good weldability and give a stable arc. Both the slag and the weld pool are easy to control. Suitable metal thicknesses are 3 mm upwards. For thinner materials, Avesta 4D electrodes are recommended.

## Mechanical properties, typical values

## Approvals\*

Electrode	R <sub>p0.2</sub> N/mm <sup>2</sup>	R <sub>m</sub> N/mm <sup>2</sup>	A <sub>5</sub> %	Impact strength, KV, J		Brinell hardness	TÜV	DNV	CWB	CE	Other
				+20°C	Lågtemp						
248 SV	510	760	30	115	–	260	–	–	–	–	–
308L/MVR-2D	395	550	41	65	55 (–40°C)	210	X	–	X	X	–
308L/MVR-3D	470	570	37	60	55 (–40°C)	200	X	X	–	X	DB
308L/MVR-4D	420	520	35	54	38 (–40°C)	210	X	–	–	X	–
308L/MVR basic	420	560	38	70	55 (–40°C)	200	X	–	–	X	–
308L/MVR-VDX	450	600	35	55	40 (–40°C)	210	–	–	X	–	–
308/308H	450	605	37	55	50 (–40°C)	210	X	–	X	X	–
308L-LF	420	570	39	85	35 (–196°C)	200	–	–	–	–	–
347/MVNb-3D	470	620	35	55	45 (–40°C)	225	X	X	X	X	DB
347/MVNb basic	520	680	30	80	60 (–40°C)	255	X	–	–	X	–
316L/SKR-2D	420	575	37	55	55 (–40°C)	210	X	X	X	X	–
316L/SKR-3D	445	590	36	55	55 (–40°C)	210	X	X	–	X	DB
316L/SKR-4D	480	590	34	60	55 (–20°C)	210	X	–	–	X	–
316L/SKR basic	430	565	34	70	50 (–40°C)	210	X	–	–	X	–
316L/SKR-VDX	480	630	30	50	35 (–40°C)	210	X	X	X	X	–
316/316H	470	615	35	50	–	210	X	–	X	X	DB
318/SKNb	470	605	34	60	50 (–40°C)	220	X	X	–	X	DB
317L/SNR	485	615	32	45	–	210	–	X	X	–	–
SLR	490	635	31	45	30 (–40°C)	225	X	–	–	X	–
LDX 2101-3D	640	800	25	45	28 (–40°C)	260	X	–	–	X	–
2304-3D	640	780	23	40	25 (–40°C)	260	X	–	–	X	–
2205-2D	640	825	33	55	40 (–40°C)	240	–	–	–	–	–
2205-3D	620	810	25	45	35 (–40°C)	240	X	–	X	X	DB, LR, GL, RINA
2205-4D	630	820	25	45	35 (–40°C)	240	X	–	–	X	–
2205 basic	645	840	26	100	75 (–40°C)	240	–	–	–	–	–
2507/P100-4D	700	880	24	40	30 (–46°C)	250	–	–	–	–	–
2507/P100	700	900	26	80	55 (–40°C)	250	–	–	–	–	–
254 SFER	440	660	32	55	–	200	–	–	–	–	–
316L/SKR-Cryo	440	550	37	75	35 (–196°C)	200	–	–	–	–	–
904L	400	565	34	70	–	200	X	–	–	X	DB
904L-PW	400	600	35	70	–	200	–	–	–	–	–
383	410	620	33	55	–	200	–	–	–	–	–
P12-R	480	730	37	90	70 (–196°C)	220	X	–	X	X	–
P625	480	770	30	60	50 (–40°C)	220	–	–	–	–	–
P16	550	780	35	60	40 (–40°C)	220	–	–	–	–	–
P54	500	700	20	50	30 (–70°C)	220	–	–	–	–	–
307	465	605	35	45	–	200	–	–	–	–	–
309L-3D	450	550	35	50	45 (–40°C)	210	X	X	X	X	DB, LR, GL, RINA
309L-4D	460	590	29	50	–	210	X	–	–	X	–
309L basic	440	570	30	50	–	210	–	–	–	–	–
P5-2D	450	625	30	35	–	220	–	–	–	–	–
P5-3D	490	640	30	30	–	220	X	X	X	X	DB
P5-4D	530	660	28	40	–	220	X	–	–	X	–
P5 basic	465	615	30	50	35 (–40°C)	230	X	–	–	–	–
P5-VDX	545	685	30	40	–	225	–	–	–	–	–
P7	620	810	18	25	–	270	–	–	–	–	–
P10	380	630	39	115	80 (–196°C)	180	–	–	–	–	–
P690	400	640	35	110	100 (–196°C)	220	–	–	–	–	–
309	435	580	30	45	–	210	–	–	X	–	–
310	430	625	35	80	35 (–196°C)	190	–	–	X	–	–
253 MA	535	725	37	60	–	215	–	–	–	–	–
253 MA-NF	470	630	35	70	–	210	–	–	–	–	–
353 MA	385	565	33	85	–	200	–	–	–	–	–

\* For detailed information, contact Avesta Welding.

## Avesta 4D electrodes



for extreme position welding of sheet and pipes

The weldability of 4D electrodes is extremely good and the arc and weld pool are both stable. The thin coating gives a small weld pool. However, the slag is very compliant and easy to control. A short arc is to be used for welding. The slag is self-releasing and leaves an even, beautiful weld finish.

Several of the rutile-acid electrodes are manufactured with the coating specially adapted for specific purposes:

- PW electrodes, predecessors to our 3D and 4D electrodes, have a rutile-acid coating specially developed for position welding.
- VDX electrodes, predecessors to 4D electrodes, have a rutile-acid coating and are to be used for the vertical-down welding of joints that have no gaps, e.g. lap welds.

## Welding recommendations, typical values

Coating type	Diameter mm	Voltage V	Flat (PA) Current, A	Vertical-up (PF) Current, A	Overhead (PE) Current, A
Rutile-acid	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	–	–

\* A slightly lower current is recommended for nickel base electrodes such as P10, P12 and P16.

### Quality assurance and marking

Avesta Welding's covered electrodes are supplied with 3.1 certificates. These give the chemical analyses of the supplied items. Each electrode is marked with the product name, lot number and, where there is one, standard designation.

Each capsule has the following markings:

- Avesta Welding's product name
- Lot number
- Weight
- Standard designation
- Approvals
- Recommended welding parameters
- Warning text

All Avesta electrodes can be supplied manufactured in accordance with the relevant parts of the requirements set out by the nuclear power industry in ASME code section III and KTA 1408.

### Further information

Further information about Avesta Welding's products is available at [www.avestawelding.com](http://www.avestawelding.com) and in various publications, e.g.:

- The "Avesta Welding manual"
- Product brochures
- Product data sheets
- "How to weld..." – a series of brochures with welding recommendations for special steels.

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