BÖHLER EMK 6 — Solid Wire

Classifications		unalloyed
EN ISO 14341-A:	AWS A5.18:	
G 42 4 M21 3Si1/G 42 4 C1 3Si1	ER70S-6	

Characteristics and field of use

Universally applicable copper coated wire electrode with a largely spatter-free material transfer whether using mixed gases or under CO2.The wire electrode is suitable for joint welding in the construction of boilers, containers and building structures. Through its ability to withstand high currents it also offers the ideal properties for thick sheet welding. The version of the solid wire electrode without copper coating is also available as a TOP version, and is designed for minimum tendency to splatter and the ideal feeding characteristics even at high wire feed rates. These versions are particularly used for automated welding.

Base materials

Steels up to a yield strength of 420 MPa (60 ksi)
S235JR-S355JR, S235JO-S355JO, S235J2-S355J2, S275N-S420N, S275M-S420M, P235GH-P355GH, P275NL1-P355NL1, P215NL, P265NL, P355N, P285NH-P420NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L415NB, L245MB-L415MB, GE200-GE240, shipbuilding steels: A, B, D, E, A 32-E 36
ASTM A 106 Gr. A, B, C; A 181 Gr. 60, 70; A 283 Gr. A, C; A 285 Gr. A, B, C; A 350 Gr. LF1; A 414 Gr. A, B, C, D, E, F, G; A 501 Gr. B; A 513 Gr. 1018; A 516 Gr. 55, 60, 65, 70; A 573 Gr. 58, 65, 70; A 588 Gr. A, B; A 633 Gr. C; A 662 Gr. B; A 711 Gr. 1013; A 841 Gr. A; API 5 L Gr. B, X42, X52, X56, X60

Typical composition of solid wire (Wt-%)

C	Si	Mn		
0.08	0.9	1.45		

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-40°C*
untreated	440	560	30	160	80
stress relieved*	380	490	30	160	

* 600°C/2 h – shielding gas 100% Argon + 15-25% CO2

Operating data

Polarity = +

Shielding gas:
Argon + 15-25% CO_2
100% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (3036.), DB (42.014.11), ABS (3SA, 3YSA), CWB (X), DNV (III YMS), GL (3YS), LR (3S, 3YS H15), LTSS, SEPROZ, CE

Union K 52 — Solid Wire

Classifications		unalloyed
EN ISO 14341-A:	AWS A5.18:	
G 42 2 C1 3Si1/G 42 4 M21 3Si1	ER70S-6	

Characteristics and field of use

GMAW solid wire electrode for welding unalloyed and low alloy steels with shielding gas. All-purpose useable with gas mixture or CO2, low-spatter transfer in the short and spray arc range. Used in boiler and pipeline construction, shipbuilding, vehicle manufacturing and structural engineering.

Base materials

S235JRG2 - S355J2; boiler steels P235GH, P265GH, P295GH; fine grained structural steels up to S420N; ASTM A27 u. A36 Gr. all; A106 Gr. A, B; A214; A242 Gr. 1-5; A266 Gr. 1, 2, 4; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A299 Gr. A, B; A328; A366; A515 Gr. 60, 65, 70; A516 Gr. 55; A556 Gr. B2A; A570 Gr. 30, 33, 36, 40, 45; A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A851 Gr. 1, 2; A935 Gr. 45; A936 Gr. 50

Typical composition of solid wire (Wt-%)

C	Si	Mn		
0.08	0.85	1.5		

Mechanical properties of all-weld metal

Shielding Gas	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-20°C:*	*-40°C:*
CO_2	420	540	25	85	47	-
M21	440	560	24	95	60	47

Operating data

Polarity = +

Shielding gas (EN ISO 14175):
M1 - M3 and C1

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (106.), DB (42.132.02), ABS, GL (3YHS), LR, DNV

BÖHLER EMK 8

Solid Wire

Classifications		unalloyed
EN ISO 14341-A:	AWS A5.18:	
G 46 4 M21 4Si1/ G 46 4 C1 4Si1	ER70S-6	

Characteristics and field of use

Copper coated wire electrode applicable universally in the construction of boilers, containers and building structures. It exhibits a largely spatter-free material transfer both under mixed gases and under CO2. Through its ability to withstand high currents it has ideal properties for thick sheet welding. Use low-diameter wire for vertical down welds.
The version of the solid wire electrode without copper coating is also available as a TOP version, and it has been designed for minimum tendency to splatter and the ideal feeding characteristics even at high wire feed rates. These versions are particularly used for automated welding.

Base materials

Steels up to a yield strength of 460 MPa (67 ksi) S235JR-S355JR, S235JO-S355JO, S450JO, S235J2-S355J2, S275N-S460N, S275M-S460M, P235GH-P355GH, P275NL1-P460NL1, P215NL, P265NL, P355N, P285NH-P460NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L415NB, L450QB, L245MB-L450MB, GE200-GE240, shipbuilding steels: A, B, D, E, A 32-E 36 ASTM A 106 Gr. A, B, C; A 181 Gr. 60, 70; A 283 Gr. A, C; A 285 Gr. A, B, C; A 350 Gr. LF1; A 414 Gr. A, B, C, D, E, F, G; A 501 Gr. B; A 513 Gr. 1018; A 516 Gr. 55, 60, 65, 70; A 573 Gr. 58, 65, 70; A 588 Gr. A, B; A 633 Gr. C, E; A 662 Gr. B; A 711 Gr. 1013; A 841 Gr. A; API 5 L Gr. B, X42, X52, X56, X60, X65

Typical composition of solid wire (Wt-%)

C	Si	Mn		
0.1	1.0	1.7		

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-40°C*
untreated *	480	620	26	150	80
untreated 1**	470	580	28	110	50
stress relieved***	410	540	28	130	70

* untreated, as-welded – shielding gas Ar + 15-25% CO_2
** untreated, as-welded – shielding gas 100% CO_2
*** stress relieved, 600°C/2 h – shielding gas Ar + 15-25% CO_2

Operating data

Polarity = +

Shielding gas:
Argon + 15-25% CO_2
100% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*

Approvals and certificates

TÜV (3038.), DB (42.014.05), ABS (3SA, 3YSA), DNV (III YMS), GL (3YS), LR (3S, 3YS H15), SEPROZ, CE, NAKS

Union K 56 — Solid Wire

Classifications		unalloyed
EN ISO 14341-A:	AWS A5.18:	
G 46 2 C1 4Si1/ G 46 4 M21 4Si1	ER70S-6	

Characteristics and field of use

GMAW solid wire electrode for welding unalloyed and low alloy steels with CO2 or gas mixture.Low spatter transfer in short and spray arc range. High arc stability also at high welding current amperage. Large application range; specially suited for steels of higher strength in boiler and pipeline construction, shipbuilding, vehicle manufacturing and structural engineering.

Base materials

S235JRG2 - S355J2; boiler steels P235GH, P265GH, P295GH, P355GH; fine grained structural steels up to S460N; ASTM A27 and A36 Gr. all; A106 Gr. A, B; A214; A242 Gr. 1-5; A266 Gr. 1, 2, 4; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A299 Gr. A, B; A328; A366; A515 Gr. 60, 65, 70; A516 Gr. 55; A556 Gr. B2A;A570 Gr. 30, 33, 36, 40, 45; A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B; A907 Gr. 30.33, 36, 40; A851 Gr. 1, 2; A935 Gr. 45; A936 Gr. 50

Typical composition of solid wire (Wt-%)

C	Si	Mn		
0.08	1.05	1.65		

Mechanical properties of all-weld metal

Shielding Gas	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-20°C:*	*-40°C:*
CO_2	450	550	25	90	47	-
M21	480	580	24	95	65	47

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M2, M3, C1

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (0376.), DB (42.132.01), ABS, BV, GL (3YHS), LR, DNV

BÖHLER NiCu 1-IG — Solid Wire

Classifications		low-alloyed
EN ISO 14341-A:	AWS A5.28:	
G 42 4 M21 Z3Ni1Cu/ G 42 4 C1 Z3Ni1Cu	ER80S-G	

Characteristics and field of use

Ni-Cu alloyed wire electrode, copper coated for gas shielded metal arc welding on weatherproof structural steels and special structural steels. BÖHLER NiCu 1 IG achieves good welding both with short arcs at low voltage as well as with spray arcs at higher voltage. The mechanical properties of the weld metal, the resistance to porosity and the bead formation depend on the kind of shielding gas used and on the other welding parameters. Due to the alloyed copper, the weld metal features increased resistance to atmospheric corrosion.

Base materials

weatherproof structural steels
S235JRG2Cu, S235J2G4Cu, S235J0Cu, S235JRW, S355J0Cu, S355J2G3Cu, S355J0W, 235J2W-S355J2W, S355K2W ASTM A 588 Gr. A, B, C, K; A 618 Gr. II; 709 Gr. C

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cu	Ni
0.1	0.5	1.1	0.4	0.9

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-40°C*
untreated *	500	580	26	130	(≥ 47)
stressed relieved**	460	540	27	130	

*untreated, as-welded – shielding gas Ar + 15-25% CO_2 or 100% CO_2
**stress relieved, 600°C/2 h – shielding gas Ar + 15-25% CO_2 or 100% CO_2

Operating data

Polarity = +

Shielding gas:
Argon + 15-25% CO_2
100% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*

Approvals and certificates

DB (42.014.08), CE

BÖHLER NiMo 1-IG — Solid Wire

Classifications		low-alloyed
EN ISO 16834-A:	AWS A5.28:	
G 55 6 M21 Mn3Ni1Mo/ G 55 4 C1 Mn3Ni1Mo	ER90S-G	

Characteristics and field of use

Copper coated wire electrode for gas shielded arc welding of high-strength, quenched and tempered fine-grained steels. Thanks to the precise addition of micro-alloying elements, BÖHLER NiMo1-IG yields a weld metal that features exceptional ductility and high resistance to cracking. Good low-temperature impact energy down to -60°C, flawless feeding characteristics, good copper adhesion and a low total copper content are further quality features. For joint welding in steel, container, pipeline and apparatus construction. Approved for armour plates. Also suitable for low-temperature applications. The chemical composition, including the Ni content, meets the NORSOK specifications for „water injection systems".

Base materials

quenched and tempered and cryogenic/creep-resistant fine-grained structural steels
S460N, S460M, S460NL, S460ML, S460Q-S555Q, S460QL-S550QL, S460QL1-S550QL1, 460N,P460NH, P460NL1, P460NL2, L415NB, L415MB-L555MB, L415QB-L555QB, alform 500 M, 550 M, aldur 500 Q, 500 QL, 500 QL1, aldur 550 Q, 550 QL, 550 QL1, 20MnMoNi4-5, 15NiCuMoNb5-6-4 ASTM A 572 Gr. 65; A 633 Gr. E; A 738 Gr. A; A 852; API 5 L X60, X65, X70, X80, X60Q,X65Q, X70Q, X80Q

Typical composition of solid wire (Wt-%)

C	Si	Mn	Mo	Ni
0.08	0.6	1.8	0.3	0.9

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-40°C*	*-60°C*
untreated *	620	700	23	140	110	(≥ 47)
untreated 1**	590	680	22	120	(≥ 47)	

* untreated, as-welded – shielding gas Ar + 15-25% CO_2

** untreated, as-welded – shielding gas 100% CO_2

Operating data

Polarity = +

Shielding gas:
Argon + 15-25% CO_2
100% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*	

Approvals and certificates

TÜV (11763.), DB (42.014.06), GL (4Y55S), SEPROZ, NAKS (1.2 mm), Gazprom (1.2 mm), CE, VG 95132

Union MoNi — Solid Wire

Classifications — low-alloyed

EN ISO 16834-A:	AWS A5.28:	
G 62 5 M21 Mn3Ni1Mo	ER90S-G	

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of quenched and tempered and thermo-mechanically treated fine grained structural steels; creep resistant structural steels with higher yield strength.Outstanding toughness values of the weld metal at low temperatures when deposited with CO_2 and gas mixture.

Base materials

S550QL - S620QL, S550MC, P550M, 15 NiCuMoNb 5, 20 MnMoNi 55 etc; API Spec. 5L: X70, X80; ASTM A517 Gr. A, B, C, E, F, H, J, K, M, P; A255 Gr. C; A633 Gr. E; A572 Gr. 65

Typical composition of solid wire (Wt-%)

C	Si	Mn	Mo	Ni
0.1	0.65	1.55	0.40	1.10

Mechanical properties of all-weld metal

Shielding Gas	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*	*-60°C:*
CO_2	550	640	20	80	47	-
M21	620	700	18	100		47

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M2, M3 and C1

Dimensions (mm)

0.8	*1.0*	*1.2*

Approvals and certificates

TÜV (926.), DB (42.132.09), GL, DNV, WIWEB

Union NiMoCr — Solid Wire

Classifications		low-alloyed
EN ISO 16834-A:	AWS A5.28:	
G 69 6 M21 Mn4Ni1.5CrMo	ER100S-G	

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of quenched and tempered and thermo-mechanically treated fine grained structural steels; for joint welding of wear resistant steels. For use with CO2 and gas mixture. Outstanding toughnesss of the weld metal at low temperatures. For use in crane and vehicle manufacturing.

Base materials

S690QL1 (alform 700 M; aldur 700 QL1; S620QL1, S700MC (alform 700 M)

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni
0.08	0.6	1.70	0.2	0.5	1.50

Mechanical properties of all-weld metal

Shielding Gas	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*	*-60°C:*
CO_2	680	740	18	80	47	
M21	720	780	16	100		47

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M21 and C1

Dimensions (mm)

0.8	*1.0*	*1.2*

Approvals and certificates

TÜV (2760.), DB (42.132.08), ABS, DNV, BV, GL (6Y69S), LR

BÖHLER NiCrMo 2.5-IG — Solid Wire

Classifications	low-alloyed
EN ISO 16834-A:	AWS A5.28:
G 69 6 M21 Mn3Ni2.5CrMo/ G 69 4 C1 Mn3Ni2.5CrMo	ER110S-G

Characteristics and field of use

Copper coated wire electrode for joint welding of quenched and tempered fine-grained structural steels with high requirements for low-temperature toughness (down to -60°C, depending on the shielding gas).

Base materials

quenched and tempered fine-grained structural steels with high requirements for low-temperature toughness. S620Q, S620QL, S690Q, S690QL, S620QL1-S690QL1, alform plate 620 M, 700 M, aldur 620 Q, 620 QL, 620 QL1, aldur 700 Q, 700 QL, 700 QL1
ASTM A 514 Gr. F, H, Q; A 709 Gr. 100 Type B, E, F, H, Q; A 709 Gr. HPS 100W

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.08	0.6	1.4	0.3	2.5	0.4

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-40°C*	*-60°C*
untreated *	810	910	18	120		(≥ 47)
untreated 1**	780	890	17	70	(≥ 47)	

* untreated, as-welded – shielding gas Ar + 15-25% CO2
** untreated, as-welded – shielding gas 100% CO2

Operating data

Polarity = +

Shielding gas:
Argon + 15-25% CO_2
100% CO_2

Dimensions (mm)

1.0	*1.2*	

Approvals and certificates

DB (42.014.07), ABS (XYQ690X-5), BV (UP), DNV (5 Y69), GL (4Y69S), LR (X), SEPROZ, CE

Similar alloy filler metals

SMAW electrode:	*FOX EV 85*	*GTAW rod:*	*NiCrMo 2.5-IG*
SAW combination:	*3 NiCrMo 2.5-UP/BB 24*		

BÖHLER X 70-IG — Solid Wire

Classifications		low-alloyed
EN ISO 16834-A:	AWS A5.28:	
G 69 5 M21 Mn3Ni1CrMo	ER110S-G	

Characteristics and field of use

Copper coated wire electrode for welding high-strength, quenched and tempered fine-grained structural steels with a minimum yield strength of 690 MPa.
Thanks to the precise addition of micro-alloying elements, BÖHLER X 70 IG yields a weld metal that features exceptional ductility and high resistance to cracking in spite of its high strength.
Good low-temperature impact energy down to -50°C.

Base materials

High-strength fine-grained structural steels S620Q, S620QL, S690Q, S690QL, alform plate 620 M, 700 M, aldur 620 Q, 620 QL, aldur 700 Q, 700 QL ASTM A 514 Gr. F, H, Q; A 709 Gr. 100 Type E, F, H, Q; A 709 Gr. HPS 100W

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	V
0.1	0.6	1.6	0.25	1.3	0.25	0.1

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-50°C*	
untreated	800	900	19	190	(≥ 47)	

Operating data

Polarity = +

Shielding gas:
Argon + 15-25% CO_2

Dimensions (mm)

1.0	*1.2*	

Approvals and certificates

TÜV (5547.), DB (42.014.19), ABS (X), BV (UP), DNV (IV Y69), GL (5Y69S), LR (X), RMR (4Y69), SEPROZ, CE

Similar alloy filler metals

SMAW electrode:	*FOX EV 85*	*GTAW rod:*	*NiCrMo 2.5-IG*
SAW combination:	*3 NiCrMo 2.5-UP/BB 24*		

Union X 85 — Solid Wire

Classifications		low-alloyed
EN ISO 16834-A:	AWS A5.28:	
G 79 5 M21 Mn4Ni1.5CrMo	ER110S-G	

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of quenched and tempered fine grained structural steels. Outstandingly tough weld metal at low temperatures when deposited with gas mixture. Good deformability; outstanding mechanical properties even at higher electric heat input per unit length of weld. Good resistance to cold cracking due to high purity of the wire surface. For use in crane and vehicle manufacturing.

Base materials

S690QL (aldur 700 QL; alform 700M;
S700MC (alform 700 M); and higher strength pipe grades (S770QL)

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni
0.09	0.7	1.7	0.3	0.6	1.85

Mechanical properties of all-weld metal

Shielding Gas	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-50°C:*
CO_2	720	770	17	80	
M21	790	880	16	90	47

Operating data

Polarity = +

Shielding gas (EN ISO 14175):
M2, M3, C1

Dimensions (mm)

1.0	*1.2*

Approvals and certificates

DB (42.132.21)

BÖHLER X 90-IG — Solid Wire

Classifications		low-alloyed
EN ISO 16834-A:	AWS A5.28:	
G 89 6 M21 Mn4Ni2CrMo	ER120S-G	

Characteristics and field of use

Copper coated wire electrode for welding high-strength, quenched and tempered fine-grained structural steels with a minimum offset yield strength of 890 MPa.
Thanks to the precise addition of micro-alloying elements, BÖHLER X 90 IG yields a weld metal that features exceptional ductility and high resistance to cracking in spite of its high strength.
Good low-temperature impact energy down to -60°C.

Base materials

high-strength, fine-grained structural steels such as S890Q, S890QL, alform plate 900 M x-treme, alform plate 960 M x-treme ASTM A 709 Gr. 100 Type B, E, F, H, Q, HPS 100W

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.1	0.8	1.8	0.35	2.25	0.60

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-60°C*
untreated	915	960	20	130	(≥ 47)

Operating data

Polarity = +

Shielding gas:
Argon + 15-25% CO_2

Dimensions (mm)

1.0	*1.2*

Approvals and certificates

TÜV (5611.), DB (42.014.23), GL (6Y89S), SEPROZ, CE

Union X 90 — Solid Wire

Classifications		low-alloyed
EN ISO 16834-A:	AWS A5.28:	
G 89 6 M21 Mn4Ni2CrMo	ER120S-G	

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of quenched and tempered fine grained structural steels. Outstandingly tough weld metal at low temperatures when deposited with gas mixture. Good resistance to cold cracking due to high purity of the wire surface. Used in crane and vehicle manufacture.

Base materials

S890QL, S960QL (alform 960 M), S890MC (alform 900 M), S960MC (alform 960 M), USS-T1

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni
0.1	0.8	1.8	0.35	0.6	2.3

Mechanical properties of all-weld metal

Shielding Gas	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-60°C:*
M21	890	950	15	90	47

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M2, M3

Dimensions (mm)

1.0	*1.2*

Approvals and certificates

TÜV (7675.), DB (42.132.12)

Union X 96 — Solid Wire

Classifications		low-alloyed
EN ISO 16834-A:	AWS A5.28:	
G 89 5 M21 Mn4Ni2.5CrMo	ER120S-G	

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of quenched and tempered fine grained structural steels in crane and vehicle manufacturing. Good deformability in spite of very high strength values. Good resistance to cold cracking due to high purity of the wire surface.

Base materials

S960QL (alform 960), S890QL, S890MC (alform 900 M) S960MC (alform 960 M)
OX 1002

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni
0.12	0.8	1.9	0.45	0.55	2.35

Mechanical properties of all-weld metal

Shielding Gas	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-50°C:*
M21	930	980	14	80	47

Operating data

Polarity = +

Shielding gas (EN ISO 14175):
M2

Dimensions (mm)

1.0	*1.2*

Approvals and certificates

DB (42.132.26)

BÖHLER DMO-IG

Solid Wire

Classifications		low-alloyed
EN ISO 21952-A:	AWS A5.28:	
G MoSi	ER70S-A1 (ER80S-G)	

Characteristics and field of use

Solid wire electrode, copper coated for welding in boiler making, pressure vessel and pipeline construction, crane building and steel construction. High-quality, very tough and crack-resistant weld metal, resistant to ageing. Cryogenic down to -40°C. Approved for long-term use at operating temperatures of up to +550°C.The wire electrode has outstanding sliding and feeding characteristics. Good copper adhesion with a low total copper content. Very good welding and flow behaviour.

Base materials

creep-resistant steels and cast steels of the same type, steels resistant to ageing and to caustic cracking 16Mo3, 20MnMoNi4-5, 15NiCuMoNb5, S235JR-S355JR, S235JO-S355JO, S450JO, S235J2-S355J2, S275N-S460N, S275M-S460M, P235GH-P355GH, P355N, P285NHP460NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L415NB, L450QB, L245MB-L450MB, GE200-GE300 ASTM A 29 Gr. 1013, 1016; A 106 Gr. C; A, B; A 182 Gr. F1; A 234 Gr. WP1; A 283 Gr. B, C, D; A 335 Gr. P1; A 501 Gr. B; A 533 Gr. B, C; A 510 Gr. 1013; A 512 Gr. 1021, 1026; A 513 Gr. 1021, 1026; A 516 Gr. 70; A 633 Gr. C; A 678 Gr. B; A 709 Gr. 36, 50; A 711 Gr. 1013; API 5 L B, X42, X52, X60, X65

Typical composition of solid wire (Wt-%)

C	Si	Mn	Mo
0.1	0.6	1.1	0.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-40°C*
untreated *	500	600	25	150	(≥ 47)
untreated 1**	470	590	23	150	(≥ 47)
annealed ***	450	570	25	150	

* untreated, as-welded - shielding gas Ar + 18% CO_2 ** untreated, as-welded – shielding gas 100% CO_2
*** annealed, 620°C/1 h/furnace down to 300°C/air – shielding gas Ar + 18% CO_2

Operating data

Polarity = +

Shielding gas:
Argon + 15-25% CO_2
100% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*	

Approvals and certificates

TÜV (0021.), DB (42.014.09), CL (0216), SEPROZ, CE, NAKS

Similar alloy filler metals

SMAW electrode:	*GTAW rod:*	*Flux cored wire:*	*SAW wire:*
FOX DMO Kb, FOX DMO Ti	*DMO-IG*	*DMO Ti-FD*	*EMS 2 Mo*

Union I Mo — Solid Wire

Classifications		low-alloyed
EN ISO 21952-A:	AWS A5.28:	
G MoSi	ER80S-G(A1)	

Characteristics and field of use

GMAW solid wire electrode for the welding of low alloy and creep resistant steels. All-purpose, medium-alloyed solid wire electrode, useable both with CO2 and with gas mixture. Applications include the welding of low alloyed and creep resistant steels in boiler, tank, pipeline and reactor construction.

Base materials

P235GH, P265GH, P295GH, 16 Mo 3; fine grained structural steels up to S460N;
pipe steels according to DIN 17 175; ASTM A335 Gr. P1; A161-94 Gr. T1 A; A182M Gr. F1; A204M Gr. A, B, C; A250M Gr. T1; A217 Gr. WC1

Typical composition of solid wire (Wt-%)

C	Si	Mn	Mo
0.1	0.6	1.15	0.5

Mechanical properties of all-weld metal

Shielding Gas	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-50°C:*
CO_2	450	550	24	80	
M21	490	600	23	90	47

Operating data

Polarity = +

Shielding gas (EN ISO 14175):
M1- M3 and C1

Dimensions (mm)

0.8	*1.0*	*1.2*

Approvals and certificates

TÜV (1831.), DB (42.132.14)

BÖHLER DCMS-IG

Solid Wire

Classifications		low-alloyed
EN ISO 21952-A:	AWS A5.28:	
G CrMo1Si	ER80S-G	

Characteristics and field of use

Solid wire electrode, copper coated for welding in boiler, pressure vessel and pipeline construction, also for welding work with quenched and tempered and case-hardening steels. Preferred for 13CrMo4-5. Approved for long-term use at operating temperatures of up to +570°C. The weld metal exhibits high quality, good toughness and crack resistance; it is resistant to caustic cracking, can be nitrided and is suitable for quenching and tempering. The creep strength is in the same range as the 13CrMo4-5 material. The wire electrode has very good sliding and feeding characteristics. Good copper adhesion, low total copper content. Very good welding and flow behaviour.

Base materials

same alloy creep resistant steels and cast steel, case-hardening and nitriding steels with comparable composition, heat treatable steels with comparable composition, steels resistant to caustic cracking 1.7335 13CrMo4-5, 1.7262 15CrMo5, 1.7728 16CrMoV4, 1.7218 25CrMo4, 1.7225 42CrMo4, 1.7258 24CrMo5, 1.7354 G22CrMo5-4, 1.7357 G17CrMo5-5 ASTM A 182 Gr. F12; A 193 Gr. B7; A 213 Gr. T12; A 217 Gr. WC6; A 234 Gr. WP11; A335 Gr. P11, P12; A 336 Gr. F11, F12; A 426 Gr. CP12

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo
0.11	0.6	1.0	1.2	0.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
annealed*	440	570	23	140

* 680°C/2h/furnance down to 300°C/air – shielding gas Ar + 18% CO_2

Operating data

Polarity = +

Shielding Gas:
Argon + 15-25% CO_2
100% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (1091.), DB (42.014.15), SEPROZ, CE

Similar alloy filler metals

SMAW electrode:	*FOX DCMS Kb* *FOX DCMS Ti*	*SAW combination:*	*EMS 2 CrMo/BB 24* *EMS 2 CrMo/BB 418 TT*
GTAW rod:	*DCMS-IG*	*Gas welding rod:*	*DCMS*
Flux cored wire:	*DCMS Ti-FD*		

Union I CrMo — Solid Wire

Classifications		low-alloyed
EN ISO 21952-A:	AWS A5.28:	
G CrMo1Si	ER80S-G	

Characteristics and field of use

Medium alloy solid wire useable both with CO_2 and mixed gas. Applications include the welding of creep resistant steels in boiler, tank, pipeline and reactor construction.

Base materials

1.7335 – 13CrMo4-5; ASTM A193 Gr. B7; A335 Gr. P11 und P12; 1.7357 – G17CrMo5-5 – A217 Gr. WC6

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo
0.09	0.6	1.05	1.1	0.5

Mechanical properties of all-weld metal

Shielding Gas	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
M21	450	560	22	80

Operating data

Polarity = +

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (905.), DB (42.132.19)

Union I CrMo 910 — Solid Wire

Classifications		low-alloyed
EN ISO 21952-A:	AWS A5.28:	
G CrMo2Si	ER90S-G	

Characteristics and field of use

Medium alloy solid wire electrode for gas-shielded arc welding both with gas mixture and CO2. Applications include the welding of creep resistant steels in boiler, tank, pipeline and reactor construction.

Base materials

1.7380 – 10CrMo9-10; ASTM A335 Gr. P22; 1.7379 – G17CrMo9-10 – A217 Gr. WC9

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo
0.09	0.55	0.9	2.55	1.0

Mechanical properties of all-weld metal

	Yield strength 0.2%	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
Shielding Gas	*MPa*	*MPa*	*%*	*+20°C:*
M21*	640	570	20	65

*) Also weldable with CO_2. in this case the mechanical properties will change.

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M1- M3 and C1

Dimensions (mm)

1.0	*1.2*		

Approvals and certificates

TÜV (0907.), DB (42.132.06)

BÖHLER CM 2-IG — Solid Wire

Classifications		low-alloyed
EN ISO 21952-A:	AWS A5.28:	
G CrMo2Si	ER90S-B3 (mod.)	

Characteristics and field of use

Solid wire electrode, copper coated for welding in boiler, pressure vessel and pipeline construction, and for the petrochemical industry, e.g. cracking plants. Preferred for 10CrMo9-10, and also suitable for similar-alloy quenched and tempered and case-hardening steels. Approved for long-term use at operating temperatures of up to +600°C. The weld metal exhibits high quality, good toughness and crack resistance, as well as a creep strength very much in the same range as 10CrMo9-10. The wire electrode has very good sliding and feeding characteristics. Good copper adhesion, low total copper content. Very good welding and flow behaviour.

Base materials

same type as creep-resistant steels and cast steels, similar alloy quenched and tempered steels up to 980 MPa strength, similar alloy case-hardening and nitriding steels 1.7380 10CrMo9-10, 1.7276 10CrMo11, 1.7281 16CrMo9-3, 1.7383 11CrMo9-10, 1.7379 G17CrMo9-10, 1.7382 G19CrMo9-10 ASTM A 182 Gr. F22; A 213 Gr. T22; A 234 Gr. WP22; 335 Gr. P22; A 336 Gr. F22; A 426 Gr. CP22

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo
0.08	0.6	0.95	2.6	1.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
annealed*	440	580	23	170

* 720°C/2h/ furnance down to 300°C/ air – shielding gas Ar + 18% CO_2

Operating data

Polarity = +

Shielding gas:
Argon + 15-25% CO_2
100% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*	

Approvals and certificates

TÜV (1085.), DB (42.014.39), SEPROZ, CE

Similar alloy filler metals

SMAW electrode:	*FOX CM 2 Kb* *FOX CM 2 Kb SC*	*SAW combination:*	*CM 2-UP/BB 24* *CM 2 SC-UP/BB 24 SC* *CM 2-UP/BB 418 TT*
GTAW rod:	*CM 2-IG*		
Flux cored wire:	*CM 2 Ti-FD*		

Union K 5 Ni

Solid Wire

Classifications		low-alloyed
EN ISO 14341-A:	AWS A5.28:	
G 50 5 M21 3Ni1/G 46 3 C1 3Ni1	ER80S-G	

Characteristics and field of use

Ni alloyed solid wire electrode for gas-shielded arc welding of cryogenic fine grained structural steels. Shielding gas: Gas mixture and CO_2 .Extremely metallurgically pure weld metal with good low temperature toughness when deposited in combination with gas mixtures.

Base materials

S355NL - S500QL cryogenic special structural steels 15 MnNi 63

Typical composition of solid wire (Wt-%)

C	Si	Mn	Ni
0.1	0.7	1.4	1.4

Mechanical properties of all-weld metal

	Yield strength 0.2%	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
Shielding Gas	*MPa*	*MPa*	*%*	*+20°C:*	*–30°C*	*–50°C*
M21	500	590	24	130		47
CO_2	460	560	24	110	47	

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M1- M3 and C1

Dimensions (mm)

1.0	*1.2*		

Approvals and certificates

TÜV (514.), DB (42.132.13)

BÖHLER SG 8-P

Solid Wire

Classifications		low-alloyed
EN ISO 14341-A:	AWS A5.28:	
G 42 5 M21 3Ni1	ER80S-G	

Characteristics and field of use

BÖHLER SG 8-P is a micro-alloyed wire for automated, gas shielded arc welding of pipelines. The precise addition of micro-alloying elements yields a weld metal that features excellent lowtemperature impact energy down to -50°C, along with exceptional ductility and high resistance to cracking. Further quality features of this wire include exceptional welding and flow properties, along with ideal feeding characteristics. Further applications are found in steel, container and apparatus construction.

Base materials

API5L: X42 – X60 EN 10208-2: L290MB-L415MB

Typical composition of solid wire (Wt-%)

C	Si	Mn	Ni	Ti
0.06	0.7	1.5	0.9	+

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-50°C:*
untreated *	500	590	24	150	80
untreated 1 **	470	560	25	110	45

* untreated, as-welded - shielding gas: Ar +15-25% CO_2
** untreated, as-welded - shielding gas: 100% CO_2

Operating data

	Polarity = +	Shielding gas: Argon + 15-25% CO_2 Argon + 0-5% CO_2 + 3-10% O_2 100% CO_2

Dimensions (mm)

0.9	*1.0*	*1.2*

Approvals and certificates

DNV (IV Y46 MS)

BÖHLER 2.5 Ni-IG — Solid Wire

Classifications		low-alloyed
EN ISO 14341-A:	AWS A5.28:	
G 46 8 M21 2Ni2	ER80S-Ni2	

Characteristics and field of use

2.5% Ni alloy wire electrode, copper coated, for gas shielded arc welding of cryogenic fine-grained construction steels and nickel-alloy steels. For high-quality welding on storage tanks and pipe systems for low-temperature applications. Applicable, depending on the shielding gas used, down to -80°C.

Base materials

cryogenic structural and Ni-alloy steels, special cryogenic shipbuilding steels.
10Ni14, 12Ni14, 13MnNi6-3, 15NiMn6, S275N-S460N, S275NL-S460NL, S275M-S460M, S275ML-S460ML, P275NL1-P460NL1, P275NL2-P460NL2 ASTM A 203 Gr. D, E; A 333 Gr. 3; A334 Gr. 3; A 350 Gr. LF1, LF2, LF3; A 420 Gr. WPL3, WPL6; A 516 Gr. 60, 65; AA 529 Gr. 50; A 572 Gr. 42, 65; A 633 Gr. A, D, E; A 662 Gr. A, B, C; A 707 Gr. L1, L2, L3; A 738 Gr. A; A 841 A, B, C

Typical composition of solid wire (Wt-%)

C	Si	Mn	Ni
0.08	0.6	1.0	2.4

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-60°C:*	*-80°C:*
untreated *	510	600	22	170		(≥ 47)
untreated 1 **	500	590	22	120	(≥ 47)	

* untreated, as-welded - shielding gas: Ar +15-25% CO_2
** untreated, as-welded - shielding gas: 100% CO_2

Operating data

Polarity = +

Shielding gas:
Argon + 15-25% CO_2
100% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*

Approvals and certificates

TÜV (01080.), DB (42.014.16), ABS (XYQ460X-5), BV (SA 3 YM; UP), DNV (5 YMS), GL (6Y38S), LR (5Y40S H15), SEPROZ, CE

Similar alloy filler metals

SMAW electrode:	*FOX 2.5 Ni*	*SAW combination:*	*Ni 2-UP/BB 24, Ni 2-UP/BB 421 TT*
GTAW rod:	*2.5 Ni-IG*		

Union K 52 Ni — Solid Wire

Classifications		low-alloyed
EN ISO 14341-A:	AWS A5.28:	
G 50 6 M21 Z3Ni1/G 46 4 C1 Z3Ni1	ER80S-G [ER80S-Ni1(mod.)]	

Characteristics and field of use

Ni alloyed solid wire for GMAW welding of cryogenic fine grained steels down to -60°C, for fine grained steels up to S500.

Base materials

EN 10028-3 P355NL2 – P460NL2
EN 10025-6 S500QL1
API5L: X 42 – X 70 (X 80)
EN 120208-2: L290MB – L485MB
EN 10149-2 S355MC – S500MC

Typical composition of solid wire (Wt-%)

C	Si	Mn	Ni	Mo
0.06	0.7	1.5	0.9	0.08

Mechanical properties of all-weld metal

	Yield strength 0.2%	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
Shielding Gas	*MPa*	*MPa*	*%*	*+20°C:*	*–40°C*	*–60°C*
M21	500	590	24	150		47
CO_2	460	560	24	140	47	

Operating data

Polarity = +

Shielding gas (EN ISO 14175):
M1- M3 and C1

Dimensions (mm)

1.0	*1.2*		

Approvals and certificates

ABS, DNV

Union K Nova Ni — Solid Wire

Classifications		low-alloyed
EN ISO 14341-A:	AWS A5.28:	
G 42 5 M21 3Ni1	ER80S-G	

Characteristics and field of use

Micro-alloyed wire for automated, gas shielded arc welding. The precise addition of micro-alloying elements yields a weld metal that features excellent lowtemperature impact energy down to -50°C, along with exceptional ductility and high resistance to cracking. Further quality features of this wire include exceptional welding and flow properties, along with ideal feeding characteristics. Applications are found in steel, container and apparatus construction.

Base materials

API5L: X42 – X60 EN 10208-2: L290MB-L415MB

Typical composition of solid wire (Wt-%)

C	Si	Mn	Ni	Ti
0.06	0.7	1.5	0.9	+

Mechanical properties of all-weld metal

	Yield strength 0.2%	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
Shielding Gas	*MPa*	*MPa*	*%*	*+20°C:*	*–50°C*
M21	500	590	24	150	80
CO_2	470	560	25	110	45

Operating data

Polarity = +

Shielding gas (EN ISO 14175):
M1- M3 and C1

Dimensions (mm)

1.0	*1.2*		

Union Ni 2.5 — Solid Wire

Classifications		low-alloyed
EN ISO 14341-A:	AWS A5.28:	
G 50 7 M21 2Ni2	ER80S-Ni2	

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of cryogenic fine grained structural steels. Outstanding toughness values at low temperatures when deposited in combination with gas mixture.

Base materials

12Ni14G1, X12Ni5
P-,S275NL2 - P-,S500QL1; 13 MnNi 6-3; ASTM A633 Gr. E;
A572 Gr. 65; A203 Gr. D; A333 and A334 Gr. 3; A350 Gr. LF3

Typical composition of solid wire (Wt-%)

C	Si	Mn	Ni
0.08	0.6	1.0	2.35

Mechanical properties of all-weld metal

	Yield strength 0.2%	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
Shielding Gas	*MPa*	*MPa*	*%*	*+20°C:*	*–70°C*	*–80°C*
M21	510	620	24	120	47	
M21 (SR)*	450	560	24	140		47

*SR (560 °C (1040 °F) – 4 h)

Operating data

Polarity = +

Shielding gas (EN ISO 14175):
M1, M2

Dimensions (mm)

1.0	*1.2*		

Approvals and certificates

TÜV (1627.), ABS, GL (7YS), LR, BV, DNV

Chapter 3.2 - (GMAW) Solid wire (high-alloyed)

Product name	EN ISO		AWS		P
BÖHLER C 9 MV-IG	EN ISO 21952-A	G CrMo91	AWS A5.28	ER90S-B9	263
Thermanit MTS 3	EN ISO 21952-A	G CrMo91	AWS A5.28	ER90S-B9	264
Thermanit MTS 616	EN ISO 21952-A	GZ CrMoWVNb 9 0.5 1.5	AWS A5.28	ER90S-G	265
Thermanit ATS 4	EN ISO 14343-A	G 19 9 H	AWS A5.9	ER19-10H	266
BÖHLER CN 13/4-IG	EN ISO 14343-A	G 13 4	AWS A5.9	ER410NiMo (mod.)	267
Avesta 307-Si	EN ISO 14343-A	G 18 8 Mn	AWS A5.9	ER307 (mod.)	268
BÖHLER A7-IG / A 7 CN-IG	EN ISO 14343-A	G 18 8 Mn	AWS A5.9	ER307 (mod.)	269
Thermanit X	EN ISO 14343-A	G 18 8 Mn	AWS A5.9	ER307(mod.)	270
Avesta 316L-Si/SKR-Si	EN ISO 14343-A	G 19 12 3 L Si	AWS A5.9	ER316LSi	271
BÖHLER EAS 4 M-IG (Si)	EN ISO 14343-A	G 19 12 3 L Si	AWS A5.9	ER316LSi	272
Avesta 318-Si/SKNb-Si	EN ISO 14343-A	G 19 12 3 Nb Si	-	-	273
Thermanit A Si	EN ISO 14343-A	G 19 12 3 Nb Si	AWS A5.9	ER318(mod.)	274
Avesta 308L-Si/MVR-Si	EN ISO 14343-A	G 19 9 L Si	AWS A5.9	ER308LSi	275
BÖHLER EAS 2-IG (Si)	EN ISO 14343-A	G 19 9 L Si	AWS A5.9	ER308LSi	276
BÖHLER SAS 2-IG (Si)	EN ISO 14343-A	G 19 9 Nb Si	AWS A5.9	ER347Si	277
BÖHLER FF-IG	EN ISO 14343-A	G 22 12 H	AWS A5.9	ER309 (mod.)	278
Thermanit D	EN ISO 14343-A	G 22 12 H	AWS A5.9	ER309(mod.)	279
Avesta 2205	EN ISO 14343-A	G 22 9 3 N L	AWS A5.9	ER2209	280
Thermanit 22/09	EN ISO 14343-A	G 22 9 3 N L	AWS A5.9	ER2209	281
BÖHLER CN 22/9 N-IG	EN ISO 14343-A	G 22 9 3 N L	AWS A5.9	ER2209	282
Avesta P5	EN ISO 14343-A	G 23 12 2 L	-	-	283
BÖHLER CN 23/12-IG	EN ISO 14343-A	G 23 12 L	AWS A5.9	ER309L	284
Avesta 309L-Si	EN ISO 14343-A	G 23 12 L Si	AWS A5.9	ER309LSi	285
Avesta LDX 2101	EN ISO 14343-A	G 23 7 N L	-	-	286
BÖHLER FFB-IG	EN ISO 14343-A	G 25 20 Mn	AWS A5.9	ER310 (mod.)	287
BÖHLER FA-IG	EN ISO 14343-A	G 25 4	-	-	288
Thermanit L	EN ISO 14343-A	G 25 4	-	-	289
Avesta 2507/P100	EN ISO 14343-A	G 25 9 4 N L	-	-	290
Thermanit 25/09 CuT	EN ISO 14343-A	G 25 9 4 N L	AWS A5.9	ER2594	291
Thermanit 17/15 TT	EN ISO 14343-A	G Z 17 15 Mn W	-	-	292
Thermanit 439 Ti	EN ISO 14343-A	G Z 18 Ti L	AWS A5.9	ER439(mod.)	293
UTP A 2133 Mn	EN ISO 14343-A	G Z 21 33 Mn Nb	-	-	294
UTP A 2535 Nb	EN ISO 14343-A	G Z 25 35 Zr	-	-	295
BÖHLER SKWAM-IG	EN ISO 14343-A	G Z17 Mo	-	-	296
BÖHLER CAT 430 L Cb-IG	EN ISO 14343-A	G Z18 L Nb	AWS A5.9	ER430 (mod.)	297
BÖHLER CAT 430 L Cb Ti-IG	EN ISO 14343-A	G ZCr 18 NbTi L	AWS A5.9	ER430Nb (mod.)	298
UTP A 80 M	EN ISO 18274	S Ni 4060 (NiCu30Mn3Ti)	AWS A5.14	ERNiCu-7	299
Thermanit Nimo C 24	EN ISO 18274	S Ni 6059 (NiCr23Mo16)	AWS A5.14	ERNiCrMo-13	300
UTP A 759	EN ISO 18274	S Ni 6059 (NiCr23Mo16)	AWS A5.14	ERNiCrMo-13	301
BÖHLER NIBAS 70/20-IG/NiCR 70 NB-IG A	EN ISO 18274	S Ni 6082 (NiCr20Mn3Nb)	AWS A5.14	ERNiCr-3	302
Thermanit Nicro 82	EN ISO 18274	S Ni 6082 (NiCr20Mn3Nb)	AWS A5.14	ERNiCr-3	303
UTP A 068 HH	EN ISO 18274	S Ni 6082 (NiCr20Mn3Nb)	AWS A5.14	ERNiCr-3	304
UTP A 776	EN ISO 18274	S Ni 6276 (NiCr15Mo16Fe6W4)	AWS A5.14	ERNiCrMo-4	305
Thermanit 617	EN ISO 18274	S Ni 6617 (NiCr22Co12Mo9)	AWS A5.14	ERNiCrCoMo-1	306
UTP A 6170 Co	EN ISO 18274	S Ni 6617 (NiCr22Co12Mo9)	AWS A5.14	ERNiCrCoMo-1	307
Avesta P12	EN ISO 18274	S Ni 6625 (NiCr22Mo9Nb)	AWS A5.14	ERNiCrMo-3	308
BÖHLER NIBAS 625-IG/NiCr 625-IG A	EN ISO 18274	S Ni 6625 (NiCr22Mo9Nb)	AWS A5.14	ERNiCrMo-3	309
Thermanit 625	EN ISO 18274	S Ni 6625 (NiCr22Mo9Nb)	AWS A5.14	ERNiCrMo-3	310
UTP A 6222 Mo	EN ISO 18274	S Ni 6625 (NiCr22Mo9Nb)	AWS A5.14	ERNiCrMo-3	311
Thermanit 35/45 Nb	EN ISO 18274	S Ni Z (NiCr36Fe15Nb0.8)	-	-	312
UTP A 3545 Nb	EN ISO 14343-A	GZ 35 45 Nb	-	-	313
Thermanit JE-308L Si	EN ISO 14343-A	G 19 9 L Si	AWS A5.9	ER308LSi	314
Thermanit 25/14 E-309L Si	EN ISO 14343-A	G 23 12 L Si	AWS A5.9	ER309LSi	315
Thermanit GE-316L Si	EN ISO 14343-A	G 19 12 3 L Si	AWS A5.9	ER316LSi	316
Thermanit H Si	EN ISO 14343-A	G 19 9 Nb Si	AWS A5.9	ER347Si	317

BÖHLER C 9 MV-IG — Solid Wire

Classifications		high-alloyed
EN ISO 21952-A:	AWS A5.28:	
G CrMo91	ER90S-B9	

Characteristics and field of use

Solid wire electrode for highly creep resistant, quenched and tempered 9-12% chrome steels, particularly for T91/P91 steels in turbine and boiler construction and in the chemical industry. BÖHLER C 9 MV-IG can be employed for long-term operating temperatures of up to +650°C.

Base materials

same type as highly creep resistant steels 1.4903 X10CrMoVNb9-1, GX12CrMoVNbN9-1
ASTM A 335 Gr. P91, A 336 Gr. F91, A 369 Gr. FP91, A 387 Gr. 91, A 213 Gr. T91

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	V	Nb
0.12	0.3	0.5	9.0	0.5	0.9	0.2	0.06

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
annealed*	620	760	18	80

* 760°C/2 h/furnance down to 300°C/air – shielding gas Argon + 2.5% CO_2

Operating data

Polarity = +

Shielding gas:
Argon + 2.5% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Similar alloy filler metals

SMAW electrode:	*FOX C 9 MV*	*SAW combination:*	*C 9 MV-UP/BB 910*
GTAW rod:	*C 9 MV-IG*		

Thermanit MTS 3 — Solid Wire

Classifications		high-alloyed
EN ISO 21952-A:	AWS A5.28:	
G CrMo91	ER90S-B9	

Characteristics and field of use

High temperature resistant, resistant to scaling up to 600 °C (1112 °F). Suited for joining and surfacing applications with quenched and tempered 9% Cr steels, particularly for matching high temperature resistant parent metal T91 / P91 according to ASTM.

Base materials

1.4903 – X10CrMoVNb9-1; ASTM A 199 Gr. T91, A213/213M Gr. T91, A355 Gr. P91 (T91)

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	Nb	others
0.1	0.3	0.5	9.0	1.0	0.7	0.06	0.2

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
760 °C / 2 h	520	620	16	50

Operating data

Polarity =+

Shielding gas (EN ISO 14175): M12, (M13)

Dimensions (mm)

1.0	*1.2*		

Thermanit MTS 616 — Solid Wire

Classifications		high-alloyed
EN ISO 21952-A:	AWS A5.28:	
GZ CrMoWVNb 9 0.5 1.5	ER90S-G	

Characteristics and field of use

High temperature resistant. Suited for joining and surfacing applications with matching high temperature resistant parent metal P92 according to ASTM A 335.

Base materials

ASTM A 355 Gr. P92, NF 616, ASTM A 355 Gr. P92 (T92); A213 Gr. 92, 1.4901 – X10CrWMoVNb9-2

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	W	V	Nb	N
0.1	0.25	0.5	8.5	0.4	0.5	1.6	0.2	0.06	0.04

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
760°C/≥2 h	560	720	15	41

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M12, (M13)

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (9290.)

Thermanit ATS 4 — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 19 9 H	ER19-10H	

Characteristics and field of use

High temperature resistant up to 700 °C (1292 °F); resistant to scaling up to 800 °C (1472 °F). For surfacing and joining applications on matching/similar high temperature resistant steels/cast steel grades.

Base materials

1.4550 – X6CrNiNb18-10 1.4948 – X6CrNi18-1 1.4878 – X12CrNiTi18-9 AISI 304H; 321H; 347H

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
0.05	0.3	1.8	18.8	9.3

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
AW	350	550	35	70

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M12

Dimensions (mm)			
1.0	*1.2*		

Approvals and certificates

TÜV (6522.)

BÖHLER CN 13/4-IG

Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 13 4	ER410NiMo (mod.)	

Characteristics and field of use

Solid wire electrode for same-type corrosion-resistant, martensitic and martensitic-ferritic rolled, forged and cast steels. Used in the construction of water turbines and compressors, and in the construction of steam power stations. Resistant to water and steam. Very good welding and flow behaviour.

Base materials

1.4317 GX4CrNi13-4, 1.4313 X3CrNiMo13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4
ACI Gr. CA6NM

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.01	0.65	0.7	12.2	4.8	0.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-20°C:*
untreated	950	1210	12	36	
annealed*	760	890	17	80	≥ 47

*annealed, 580°C/8h furnace down to 300°C/air - shielding gas Ar + 8-10% CO_2

Operating data

Polarity = +

Shielding gas:
Argon + 8-10% CO_2
Preheating and interpass temperature of thick-walled parts 100-160°C. Heat input max. 15 kJ/cm. Tempering at 580-620°C.

Dimensions (mm)

1.2				

Approvals and certificates

TÜV (04110.), SEPROZ, CE

Similar Alloy Filler Metals

SMAW electrode:	*FOX CN 13/4* *FOX CN 13/4 SUPRA*	*Flux cored wire:*	*CN 13/4-MC* *CN 13/4-MC (F)*
GTAW solid wire:	*CN 13/4-IG*	*SAW combination:*	*CN 13/4-UP/BB 203*

Avesta 307-Si — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 18 8 Mn	ER307 (mod.)	

Characteristics and field of use

Avesta 307-Si is a high-alloy, fully austenitic wire designed for welding dissimilar joints between stainless and mild or low-alloy steels, as well as Mn-steels. It can also be used for welding steels like alform®. Avesta 307-Si offers a crack resistant weld with good mechanical properties.
Corrosion resistance:
Primarily intended for stainless to mild steel connections but with the same corrosion resistance as 1.4301/ASTM 304.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
Avesta 307-Si is primarily used in dissimilar welding between stainless and mild steel or low-alloy steels.					

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.08	0.8	6.8	19.0	8.0	0.1

Ferrite 0 FN

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*
untreated	410	630	38	120	110

Operating data

Polarity = +

Shielding gas:
Ar + 2 % O_2 or 2–3 % CO_2.
Gas flow rate 12 – 16 l/min.

Dimensions (mm)			
0.8	*1.0*	*1.2*	*1.6*

BÖHLER A7-IG / A 7 CN-IG* — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 18 8 Mn	ER307 (mod.)	

Characteristics and field of use

Solid wire electrode for joints between dissimilar steels, steels that are hard to weld and 14% Mn steels. Well suited for tough intermediate layers in case of hardfacing. Wear-resistant and corrosion-resistant surfacings on rail and points components, valve seats and cavitation protection armour in hydroelectric machines. Properties of the weld metal: suitable for strain-hardening, very good cavitation resistance, crack resistant, resistant to thermal shock, resistant to scaling up to +850°C, little tendency to sigma-phase embrittlement above +500°C. Cryogenic down to -110°C. Heat treatment is possible. Consultation with the manufacturer is recommended for operating temperatures above +650°C. Outstanding sliding and feeding characteristics. Very good welding and flow behaviour. It is approved for welding armour plates.

Base materials

High-strength, unalloyed and alloyed structural and quenched and tempered steels among themselves or among each other; unalloyed and alloyed steels with high-alloy Cr and CrNi steels; heat-resistant steels up to +850°C; austenitic manganese steels together and with other steels; cryogenic plate and pipe steels together with cryogenic austenitic materials

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
0.08	0.9	7.0	19.2	9.0

Typical composition of solid wire (Wt-%)

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	430	640	36	110

Operating data

Polarity = +

Shielding gas:
Argon + max. 2.5% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (06632.), DB (43.014.13), DB (43.014.07), SEPROZ, VG 95132, CE, NAKS (Ø 0.8; 1.0 mm), DNV (X), GL (4370S), (A 7 CN-IG: TÜV (00024.))

Similar Alloy Filler Metals

SMAW electrode:	*FOX A 7 / FOX A 7 CN* FOX A 7-A*	*Flux cored wire:*	*A 7-MC, A 7-FD, A 7 PW-FD*
GTAW solid wire:	*A 7-IG / A 7 CN-IG**	*SAW combination:*	*A 7 CN-UP/BB 203*

*Product name in Germany

Thermanit X — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 18 8 Mn	ER307 (mod.)	

Characteristics and field of use

Stainless. Resistant to scaling up to 850 °C (1562 °F). No adequate resistance against sulphureous combustion gases at temperatures above 500 °C (932 °F). For joining and surfacing applications with heat resistant Cr-steels/cast steel grades and heat resistant austenitic steels/cast steel grades. Well suited for fabricating austenitic-ferritic joints – max. application temperature 300 °C (572 °F). For joining unalloyed/low-alloy or Cr-steels/ cast steel grades to austenitic steels. Low heat input required in order to avoid brittle martensitic transition zones.

Base materials

TÜV-certified parent metal 1.4583 – X10CrNiMoNb18-12 and included parent metals combined with ferritic steels up to boiler plate P295GH. High tensile, unalloyed and alloyed structural, quenched and tempered, and armour steels, same parent metal or in combination; unalloyed and alloyed boiler or structural steels with high alloyed Cr and CrNi steels; heat resistant steels up to 850 °C (1562 °F); austenitic high manganese steel with matching and other steels. Cryogenic sheet metals and pipe steels in combination with austenitic parent metals.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
0.08	0.8	7.0	19.0	9.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	370	600	35	100

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M12,M13, M21

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (5651.), GL (4370 S), DB (43.132.01), DNV

Avesta 316L-Si/SKR-Si — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 19 12 3 L Si	ER316LSi	

Characteristics and field of use

Avesta 316L-Si/SKR-Si is designed for welding 1.4436/ASTM 316 type stainless steels. It is also suitable for welding steels that are stabilized with titanium or niobium, such as 1.4571/ASTM 316Ti, for service temperatures not exceeding 400°C. For higher temperatures, a niobium stabilised consumable such as Avesta 318-Si/SKNb-Si should be used.

Corrosion resistance

Excellent resistance to general, pitting and intergranular corrosion in chloride containing environments. Intended for severe service conditions, e.g. in dilute hot acids.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
4436	1.4436	316	316S33	Z7 CND 18-12-03	2343
4432	1.4432	316L	316S13	Z3 CND 17-12-03	2353
4429	1.4429	S31653	316S63	Z3 CND 17-12 Az	2375
4571	1.4571	316Ti	320S31	Z6 CNDT 17-12	2350

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.02	0.85	1.7	18.5	12.2	2.6

Ferrite 6 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	410	590	35	110	55

Operating data

Polarity = +

Shielding gas:
Ar + 2 % O_2 or 2–3 % CO_2.
Gas flow rate 12–16 l/min.

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

BÖHLER EAS 4 M-IG (Si)

Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 19 12 3 L Si	ER316LSi	

Characteristics and field of use

Solid wire electrode for application in all branches of industry in which same-type steels and ferritic 13% chrome steels are welded, e.g. the construction of chemical apparatus and containers, the textile and cellulose industry, dye works, beverage production, synthetic resin plants and many more. Also suitable for media containing chlorides due to the inclusion of Mo. Outstanding sliding and feeding characteristics. Very good welding and flow behaviour. Resists intergranular corrosion up to an operating temperature of +400°C. Cryogenic down to -196°C.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-13-3, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12, 1.4409 GX2CrNiMo19-11-2 UNS S31603, S31653; AISI 316L, 316Ti, 316Cb

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo
≤0.02	0.8	1.7	18.4	12.4	2.8

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	430	580	38	120	

Operating data

Polarity = +

Shielding gas:
Argon + max. 2.5% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*		

Approvals and certificates

TÜV (03233.), DB (43.014.11), DNV (316L), GL (4429S), Statoil, SEPROZ, CE

Similar Alloy Filler Metals

SMAW electrode:	*FOX EAS 4 M* *FOX EAS 4 M (LF)* *FOX EAS 4 M-A* *FOX EAS 4 M-VD*	*Flux cored wire:*	*EAS 4 M-MC* *EAS 4 M-FD* *EAS 4 PW-FD* *EAS 4 PW-FD (LF)*
GTAW rod:	*EAS 4 M-IG*	*SAW combination:*	*EAS 4 M-UP/BB 202*

Avesta 318-Si/SKNb-Si — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:		
G 19 12 3 Nb Si		

Characteristics and field of use

Avesta 318-Si/SKNb-Si is designed for welding steels that are stabilised with titanium or niobium such as 1.4571/ASTM 316Ti and similar, providing improved high temperature properties, e.g. creep resistance, compared to low-carbon non-stabilised materials. 318-Si/SKNb-Si shows better properties than 316L-Si/SKR-Si at elevated temperatures and is therefore recommended for applications with service temperatures above 400°C. A stabilised weldment has improved high temperature properties, e.g. creep resistance, compared to low-carbon non-stabilised grades.

Corrosion resistance

Corresponding to 1.4571/ASTM 316Ti, i.e. good resistance to general, pitting and intergranular corrosion.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
4571	1.4571	316Ti	320S31	Z6 CNDT 17-12	2350

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	Nb
0.04	0.85	1.3	19.0	12.0	2.6	>12xC

Ferrite 10 FN; WRC-92 7 FN; WRC- 92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*
untreated	440	625	35	110	90

Operating data

Polarity = +

Shielding gas:
Ar + 2 % O_2 or 2–3% CO_2.
Gas flow rate 12–16 l/min.

Dimensions (mm)

0.8	*1.0*	*1.2*	

Thermanit A Si — Solid Wire

Classifications — high-alloyed

EN ISO 14343-A:	AWS A5.9:	
G 19 12 3 Nb Si	ER318(mod.)	

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistant similar to matching stabilized CrNiMo steels. For joining and surfacing application on matching and similar – stabilized and non-stabilized – austenitic CrNi(N) and CrNiMo(N) steels and cast steel grades.

Base materials

TÜV-certified parent metal 1.4583 – X10CrNiMoNb18-12; AISI 316L, 316Ti, 316Cb

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	Nb
0.05	0.8	1.5	19.0	2.8	12.0	≥12xC

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	390	600	30	70	

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M12, M13

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (0601.), DB (43.132.02)

Avesta 308L-Si/MVR-Si — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 19 9 L Si	ER308LSi	

Characteristics and field of use

Avesta 308L-Si/MVR-Si is designed for welding 1.4301/ASTM 304 type stainless steels. It can also be used for welding steels that are stabilised with titanium or niobium, such as 1.4541/ASTM 321 and 1.4550/ASTM 347 in cases where the construction will be operating at temperatures below 400°C. For higher temperatures a niobium stabilized consumable such as Avesta 347-Si/MVNb-Si is required.

Corrosion resistance

Very good under fairly severe conditions, e.g. in oxidising acids and cold or dilute reducing acids.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
4301	1.4301	304	304S31	Z7 CN 18-09	2333
4307	1.4307	304L	304S11	Z3 CN 18-10	2352
4311	1.4311	304LN	304S61	Z3 CN 18-10 Az	2371
4541	1.4541	321	321S31	Z6 CNT 18-10	2337

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
0.02	0.85	1.8	20.0	10.5

Ferrite 8 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	410	590	36	110	60

Operating data

Polarity = +

Shielding gas:
Ar + 2 % O_2 or 2–3 % CO_2.
Gas flow rate 12–16 l/min.

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

BÖHLER EAS 2-IG (Si) — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 19 9 L Si	ER308LSi	

Characteristics and field of use

Solid wire electrode for application in all branches of industry in which same-type steels and ferritic 13% chrome steels are welded, e.g. the construction of chemical apparatus and containers, the textile and cellulose industry, dye works and many more. Outstanding sliding and feeding characteristics. Very good welding and flow behaviour. Resists intergranular corrosion up to an operating temperature of +350°C. Cryogenic down to -196°C.

Base materials

1.4306 X2CrNi19-11, 1.4301 X5CrNi18-10, 1.4311 X2CrNiN18-10, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10 AISI 304, 304L, 304LN, 302, 321, 347, ASTM A157 Gr. C9, A320 Gr. B8C or D

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
≤0.02	0.8	1.7	20.0	10.2

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	390	540	38	110

Operating data

Polarity = +

Shielding gas:
Argon + max. 2.5% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*		

Approvals and certificates

TÜV (03159.), DB (43.014.09), DNV (308L), GL (4550S), SEPROZ, CE

Similar Alloy Filler Metals

SMAW electrode:	*FOX EAS 2* *FOX EAS 2-A*	*Flux cored wire:*	*EAS 2-FD* *EAS 2 PW-FD (LF)*
SAW combination:	*EAS 2-UP/BB 202*		

BÖHLER SAS 2-IG (Si) — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 19 9 Nb Si	ER347Si	

Characteristics and field of use

Solid wire electrode for application in all branches of industry in which same-type steels, including higher-carbon steels, and ferritic 13% chrome steels are welded, e.g. the construction of chemical apparatus and containers, the chemical, pharmaceutical and cellulose industries, and many more. Outstanding sliding and feeding characteristics. Very good welding and flow behaviour. Resists intergranular corrosion up to an operating temperature of +400°C. Cryogenic down to -196°C.

Base materials

1.4550 X6CrNiNb18-10, 1.4541 X6CrNiTi18-10, 1.4552 GX5CrNiNb19-11, 1.4301 X5CrNi18-10, 1.4312 GX10CrNi18-8, 1.4546 X5CrNiNb18-10, 1.4311 X2CrNiN18-10, 1.4306 X2CrNi19-11
AISI 347, 321, 302, 304, 304L, 304LN, ASTM A296 Gr. CF 8 C, A157 Gr. C9, A320 Gr. B8C or D

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Nb
≤0.035	0.8	1.3	19.4	9.7	+

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	460	630	33	110	

Operating data

Polarity = +

Shielding gas:
Argon + max. 2.5% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*		

Approvals and certificates

TÜV (00025.), GL (4550S), LTSS, SEPROZ, NAKS, CE

Similar Alloy Filler Metals

SMAW electrode:	*FOX SAS 2* *FOX SAS 2-A*	*Flux cored wire:*	*SAS 2-FD* *SAS 2 PW-FD*
GTAW rod:	*SAS 2-IG*	*SAW combination:*	*SAS 2-UP/BB 202*

BÖHLER FF-IG

Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 22 12 H	ER309 (mod.)	

Characteristics and field of use

Solid wire electrode for same-type, heat resistant rolled, forged and cast steels, as well as for heat resistant ferritic Cr-Si-Al steels, such as in annealing shops, hardening shops, steam boiler construction, the petrochemical industry and the ceramic industry. Austenitic weld metal containing about 8% ferrite. Preferred for exposure to oxidising gases. Joints on Cr-Si-Al steels that are exposed to gases containing sulphur must be carried out using BÖHLER FOX FA or BÖHLER FA-IG as a final layer. Resistant to scaling up to +1000°C.

Base materials

austenitic 1.4828 X15CrNiSi20-12, 1.4826 GX40CrNiSi22-10, 1.4833 X12CrNi23-13 ferritic-pearlitic 1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4710 GX30CrSi7, 1.4740 GX40CrSi17 AISI 305, ASTM A297HF

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
0.1	1.1	1.6	22.5	11.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	480	620	34	110	

Operating data

Polarity = +

Shielding gas:
Argon + max. 2.5% CO_2
Preheating and interpass temperature according to the base material and its thickness.

Dimensions (mm)

1.0	*1.2*			

Approvals and certificates

SEPROZ

Similar Alloy Filler Metals

SMAW electrode:	*FOX FF* *FOX FF-A*	*GTAW rod:*	*FF-IG*

Thermanit D — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 22 12 H	ER309(mod.)	

Characteristics and field of use

Resistant to scaling up to 950 °C (1742 °F). For joining and surfacing applications with matching/similar heat resistant steels/cast steel grades.

Base materials

1.4828 – X15CrNiSi20-12 AISI 305; ASTM A297HF

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
0.11	1.2	1.2	22.0	11.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	350	550	30	70	

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M13

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Avesta 2205

Solid Wire

Classifications **h**igh-alloyed

EN ISO 14343-A:	AWS A5.9:	
G 22 9 3 N L	ER2209	

Characteristics and field of use

Avesta 2205 is primarily designed for welding the duplex grade Outokumpu 2205 and similar but it can also be used for 2304 type of steels. Avesta 2205 provides a ferritic-austenitic weldment that combines many of the good properties of both ferritic and austenitic stainless steels. The welding can be performed using short, spray or pulsed arc. Welding using pulsed arc provides good results in both horizontal and vertical-up positions. The best flexibility is achieved by using pulsed arc and Ø 1.20 mm wire. The weldability of duplex steels is excellent, but the welding should be adapted to the base material, considering fluidity, joint design, heat input etc.
Corrosion resistance
Very good resistance to pitting and stress corrosion cracking in chloride containing environments. PREN>35. Meets the corrosion test requirements per ASTM G48 Methods A, B and E (22°C).

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
2205	1.4462	S32205	318S13	Z3 CND 22-05 Az	2377

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N
0.02	0.5	1.6	22.8	8.5	3.1	0.17

Ferrite 50 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-50°C:*
untreated	560	780	30	150	100

Operating data

Polarity = +

Shielding gas:
1. Ar + 30% He + 2.5% CO_2
2. Ar + 2% O2 or Ar + 2–3% CO_2.

Welding is best performed using argon with an addition of approx. 30% He and 2 – 3% CO_2. The addition of helium (He), will increase the energy of the arc.
Gas flow rate 12 – 16 l/min.

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Thermanit 22/09 — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 22 9 3 N L	ER2209	

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion (Application temp.: –40 °C (–40 °F) up to 250 °C (482 °F). Good resistance to stress corrosion cracking in chlorine- and hydrogen sulphide-bearing environment. High Cr and Mo contents provide resistance to pitting corrosion. For joining and surfacing work on matching and similar austenitc steels/cast steel grades. Attention must be paid to embrittlement susceptibility of the parent metal.

Base materials

TÜV-certified duplex stainless steels 1.4462 – X2CrNiMoN22-5-3 and others, also combinations of aforementioned steels and ferritic steels up to S355J, 16Mo3 and 1.4583 – X10CrNiMoNb18-12 – UNS S31803, S32205

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	N
0.025	0.5	1.6	23.0	3.0	9.0	0.14

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	510	700	25	70	

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M12, M13

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (3342.), GL (4462S), DNV (W 11132)

BÖHLER CN 22/9 N-IG

Solid Wire

Classifications high-alloyed

EN ISO 14343-A:	AWS A5.9:	
G 22 9 3 N L	ER2209	

Characteristics and field of use

Solid wire electrode ideally suited to welding ferritic-austenitic duplex steels. As a result of the carefully adjusted alloy, the weld metal not only features high strength and toughness, but is also exceptionally resistant to stress corrosion cracking and to pitting (ASTM G48 / Method A). The welding consumable can be used in a temperature range from -60°C up to +250°C. To achieve the special properties of the weld metal, it is necessary to ensure controlled dilution and thorough back purging. Ferrite content 30-60 FN (WRC). The solid wire electrode has outstanding sliding and feeding characteristics, along with very goog welding and flow behaviour.

Base materials

same-type duplex steels as well as similar-alloy, ferritic-austenitic materials of increased strength 1.4462 X2CrNiMoN22-5-3, 1.4362 X2CrNiN23-4, 1.4462 X2CrNiMoN22-5-3 with 1.4583 X10CrNiMoNb18-12, 1.4462 X2CrNiMoN22-5-3 with P235GH/ P265GH, S255N, P295GH, S355N, 16Mo3 UNS S31803, S32205

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N	PRE_N
≤0.015	0.4	1.7	22.5	8.8	3.2	0.15	≥35

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*
untreated	660	830	28	85	≥ 32

Operating data

Polarity = +

Shielding gas:
Argon + 20-30% He + max. 2% CO_2
Argon + 20-30% He + max. 1% O_2
Preheating and subsequent heat treatment are not necessary for the weld metal. The interpass temperature should not be allowed to exceed a maximum of +150°C.

Dimensions (mm)

1.0	*1.2*			

Approvals and certificates

TÜV (04483.), DB (43.014.26), DNV (X), GL (4462S), Statoil, SEPROZ, CE

Similar Alloy Filler Metals

SMAW electrode:	*FOX CN 22/9 N-B* *FOX CN 22/9 N*	*Flux cored wire:*	*CN 22/9 N-FD* *CN 22/9 PW-FD*
GTAW solid wire:	*CN 22/9 N-IG*	*SAW combination:*	*CN 22/9 N-UP/BB 202*

Avesta P5 — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:		
G 23 12 2 L		

Characteristics and field of use

Avesta P5 is a high-alloy low carbon wire of the 309LMo type, primarily designed for surfacing low-alloy steels and for welding dissimilar joints between stainless and mild or low-alloy steels. It is also suitable for welding steels like alform®. When used for surfacing, a composition equivalent to that of 1.4401/ASTM 316 is obtained already in the first layer.

Corrosion resistance

Superior to type 316L. When used for overlay welding on mild steel a corrosion resistance equivalent to that of 1.4401/ASTM 316 is obtained already in the first layer.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
Avesta P5 is primarily used when surfacing unalloyed or low-alloy steels and when joining molybdenum-alloyed stainless and carbon steels.					

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.015	0.35	1.4	21.5	15.0	2.6

Ferrite 8 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*
untreated	390	610	31	75	60

Operating data

Polarity = +

Shielding gas:
Ar + 2 % O_2 or 2–3 % CO_2.
Gas flow rate 12–16 l/min.

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

BÖHLER CN 23/12-IG

Solid Wire

Classifications high-alloyed

EN ISO 14343-A:	AWS A5.9:	
G 23 12 L	ER309L	

Characteristics and field of use

Solid wire electrode with increased ferrite content (FN ~16) in the weld metal. High crack resistance with hard-to-weld materials, austenite-ferrite joints and weld claddings. Dilution is to be kept as low as possible. Outstanding sliding and feeding characteristics. Very good welding and flow behaviour. Usable for operating temperatures between -80°C and +300°C.

Base materials

Joints of and between high-strength, unalloyed and alloyed quenched and tempered steels, stainless, ferritic Cr and austenitic Cr-Ni steels, austenitic manganese steels and weld claddings: for the first layer of chemically resistant weld claddings on the ferritic-pearlitic steels used for boiler and pressure vessel construction up to fine-grained structural steel S500N, and for the creep resistant fine-grained structural steels 22NiMoCr4-7, 20MnMoNi5-5 and GS-18NiMoCr3 7.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
≤0.02	0.5	1.7	23.5	13.2

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-80°C:*
untreated	420	570	32	90	≥ 32

Operating data

Polarity = +

Shielding gas:
Argon + max. 2.5% CO_2
Argon + max. 1.0% O_2
Preheating and subsequent heat treatment depend on the base material being used.

Dimensions (mm)

0.8	*1.0*	*1.2*		

Approvals and certificates

TÜV (4698.), DB (43.014.18), DNV (309L), GL (4332S), SEPROZ, CE

Similar Alloy Filler Metals

SMAW electrode:	*FOX CN 23/12-A* *FOX CN 23/12 Mo-A*	*Flux cored wire:*	*CN 23/12-MC* *CN 23/12-FD* *CN 23/12 PW-FD* *CN 23/12 Mo-FD* *CN 23/12 Mo PW-FD*
GTAW rod:	*CN 23/12-UP/BB 202*		
SAW combination:	*CN 23/12-UP/BB 202*		

Avesta 309L-Si — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 23 12 L Si	ER309LSi	

Characteristics and field of use

Avesta 309L-Si is a high-alloy 23 Cr 13 Ni wire primarily intended for surfacing of lowalloy steels and dissimilar weldd between mild steel and stainless steels, offering a ductile and crack resistant weldment. The chemical composition, when surfacing, is equivalent to that of 1.4301/ASTM 304 from the first run. One or two layers of 309L are usually combined with a final layer of 308L, 316L or 347.

Corrosion resistance

Superior to type 308L. When used for overlay welding on mild steel a corrosion resistance equivalent to that of 1.4301/ASTM 304 is obtained already in the first layer.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
Avesta 309L-Si is primarily used when surfacing unalloyed or low-alloy steels and when joining non-molybdenum-alloyed stainless and carbon steels.					

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
0.02	0.8	1.8	23.2	13.8

Ferrite 9 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*
untreated	400	600	32	110	100

Operating data

Polarity = +

Shielding gas:
Ar + 2 % O_2 or 2–3 % CO_2.
Gas flow rate 12 – 16 l/min.

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Avesta LDX 2101 — Solid Wire

Classifications — high-alloyed

EN ISO 14343-A:		
G 23 7 N L		

Characteristics and field of use

Avesta LDX 2101 is designed for welding the duplex stainless steel Outokumpu LDX 2101, a "lean duplex" steel with excellent strength and medium corrosion resistance. The steel is mainly intended for applications such as civil engineering, storage tanks, containers etc. Avesta LDX 2101 is over alloyed with respect to nickel to ensure the right ferrite balance in the weld metal. Welding can be performed using short, spray or pulsed arc. Welding using pulsed arc provides good results in both horizontal and vertical-up positions. The best flexibility is achieved by using pulsed arc and Ø 1.20 mm wire. The weldability of duplex steels is excellent but the welding should be adapted to the base material, considering fluidity, joint design, heat input etc.

Corrosion resistance

Good resistance to general corrosion. Better resistance to pitting, crevice corrosion and stress corrosion cracking than 1.4301/AISI 304

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
LDX 2101®	1.4162	S32101	-	-	-

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N
0.02	0.5	0.8	23.2	7.3	<0.5	0.14

Ferrite 45 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*
untreated	520	710	32	150	110

Operating data

Polarity = +

Shielding gas:
1. Ar + 30% He + 2.5% CO_2.
2. Ar + 2% O2 or 2–3% CO_2.
Welding is best performed using argon with an addition of approx. 30% He and 2 – 3% CO_2. The addition of helium (He), will increase the energy of the arc.
Gas flow rate 12 – 16 l/min.

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

BÖHLER FFB-IG

Solid Wire

Classifications high-alloyed

EN ISO 14343-A:	AWS A5.9:	
G 25 20 Mn	ER310 (mod.)	

Characteristics and field of use

Solid wire electrode for same-type, heat resistant rolled, forged and cast steels such as in annealing shops, hardening shops, steam boiler construction, the petrochemical industry and the ceramic industry. Fully austenitic weld metal. Preferred for exposure to gases that are oxidising, contain nitrogen or are low in oxygen. Joint welding on heat resistant Cr-Si-Al steels that are exposed to gases containing sulphur must be carried out using BÖHLER FOX FA or BÖHLER FA-IG as a final layer. Resistant to scaling up to +1200°C. Cryogenic down to -196°C. Due to the risk of embrittlement, the temperature range between +650-900°C should be avoided.

Base materials

austenitic
1.4841 X15CrNiSi25-21, 1.4845 X8CrNi25-21, 1.4828 X15CrNiSi20-12,
1.4840 GX15CrNi25-20, 1.4846 X40CrNi25-21, 1.4826 GX40CrNiSi22-10
ferritic-pearlitic
1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4762 X10CrAlSi25,
1.4710 GX30CrSi7, 1.4740 GX40CrSi17
AISI 305, 310, 314, ASTM A297 HF, A297 HJ

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni		
0.13	0.9	3.2	24.6	20.5		

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	400	620	38	95	≥ 32

Operating data

Polarity = +

Shielding gas:
Argon + max. 2.5% CO_2

Dimensions (mm)

0.8	*1.0*	*1.2*

Approvals

SEPROZ

Similar alloy filler metals

SMAW electrode:	*FOX FFB* *FOX FFB-A*	*GTAW rod:*	*FFB-IG*

BÖHLER FA-IG — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:		
G 25 4		

Characteristics and field of use

Solid wire electrode for gas shielded arc welding of heat resistant same type or similar type steels. Ferritic-austenitic weld metal. Due to the low Ni content it is particularly recommended when there will be exposure to oxidising or reducing combustion gases containing sulphur. Resistant to scaling up to +1100°C.

Base materials

ferritic-austenitic
1.4821 X15CrNiSi25-4, 1.4823 GX40CrNiSi27-4
ferritic-pearlitic
1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4762 X10CrAlSi25, 1.4710 GX30CrSi7, 1.4740 GX40CrSi17
AISI 327, ASTM A297HC

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
0.07	0.8	1.2	25.7	4.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	520	690	20	50

Operating data

Polarity = +

Shielding gas:
Argon + max. 2.5% CO_2

Dimensions (mm)

1.0	*1.2*		

Similar alloy filler metals

SMAW electrode:	*FOX FA*	*GTAW rod:*	*FA-IG*

Thermanit L — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:		
G 25 4		

Characteristics and field of use

Stainless; corrosion-resistant similar to matching or similar Mo-free 25 % Cr(Ni) steels/cast steel grades. Should parent metal be susceptible to embrittlement interpass temperature must not be allowed to rise above 300 °C (572 °F). Resistant to scaling in air and oxidizing combustion gases up to 1150 °C (2102 °F). Good resistance in sulphureous combustion gases at elevated temperatures. For matching and similar heat resistant steels/cast steel grades.

Base materials

1.4340 – GX40CrNi27-4 1.4347 – GX8CrNi26-7
1.4821 – X20CrNiSi25-4 AISI 327; ASTM A297HC

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
0.06	0.8	0.8	26.0	5.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Hardness*
	MPa	*MPa*	*%*	*HB30*
untreated	500	650	20	180

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M12, M13

Dimensions (mm)

1.2	*1.6*			

Avesta 2507/P100 Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:		
G 25 9 4 N L		

Characteristics and field of use

Avesta 2507/P100 is intended for welding super duplex alloys such as 2507, ASTM S32760, S32550 and S31260. Welding can be performed using short, spray or pulsed arc. Welding using pulsed arc provides good results in both horizontal and vertical- up positions. The best flexibility is achieved by using pulsed arc and Ø 1.20 mm wire. The weldability of duplex steels is excellent but the welding should be adapted to the base material, considering fluidity, joint design, heat input etc.

Corrosion resistance

Very good resistance to pitting and stress corrosion cracking in chloride containing environments. PREN>41.5. Meets the corrosion test requirements per ASTM G48 Methods A, B and E (40°C).

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
2507	1.4410	S32750	-	Z3 CND 25-06 Az	2328

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N
0.015	0.35	0.5	25.0	9.5	3.9	0.25

Ferrite 50 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-50°C:*
untreated	600	830	27	140	100

Operating data

Polarity = +

Shielding gas:
1. Ar
2. Ar + 30% He + 2.5% CO_2
3. Ar + 2% O2 or Ar + 2–3% CO_2.

Welding using pure argon will give a porosity free weld, but at the cost of arc stability. Mixtures with 2%CO_2 or 2% O_2 can also be used but may result in some porosity.
Gas flow rate 12 – 16 l/min.

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Thermanit 25/09 CuT — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 25 9 4 N L	ER2594	

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion (Application temp.: –50 °C (-58°F) up to +220 °C (48°F). Very good resistance to pitting corrosion and stress corrosion cracking due to the high CrMo(N) content (pitting index ≥40). Well suited for conditions in the offshore field.

Base materials

1.4501 – X2CrNiMoCuN25-7-4 - UNS S32760
1.4515 – GX3CrNiMoCuN26-6-3
1.4517 - GX3CrNiMoCuN25-6-3-3
25 % Cr-superduplex steels

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	N	Cu	W
0.02	0.3	1.5	25.5	3.7	9.5	0.22	0.8	0.6

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-46°C:*
untreated	650	750	25	80	50

Operating data

Polarity = +

Shielding gas (EN ISO 14175):
M12, M13

Dimensions (mm)

1.0	*1.2*			

Thermanit 17/15 TT — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:		
G Z 17 15 Mn W		

Characteristics and field of use

Permitting toughness at subzero temperatures as low as–196 °C (–321 °F). Suitable for joining applications with cryogenic austenitic CrNi(N) steels/cast steel grades and cryogenic Ni steels suitable for quenching and tempering.

Base materials

TÜV-certified parent metal
1.5662 – X8Ni9 1.4311 – X2CrNiN18-10

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	W
0.2	0.4	10.5	17.5	14.0	3.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	430	600	30	80	50

Operating data

Polarity = +

Shielding gas (EN ISO 14175):
M12, M13, M21

Dimensions (mm)

1.2

Approvals

TÜV (2890.), BV (SAW (-196)), GL (5680S), LR (ftV13R-12), DNV (NV 5; [M13])

Thermanit 439 Ti — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G Z 18 Ti L	ER439(mod.)	

Characteristics and field of use

Stainless. Scaling resistant up to 900 °C (1652 °F). For joining and surfacing of similar and matching steels. Exhaust systems.

Base materials

1.4016 – X6Cr17 – AISI 430, 1.4502 – X8CrTi18, 1.4510 – X3CrTi17, AISI 439

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ti
≤0.03	0.8	0.8	18.0	≥12xC

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Hardness*	
	MPa	*MPa*	*%*	*HB30*	
AW				≈150	
800 °C/1 h	280	430	20	≈130	

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M12, M13

Dimensions (mm)				
1.0	*1.2*			

UTP A 2133 Mn

Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:		
G Z 21 33 Mn Nb		

Characteristics and field of use

UTP A 2133 Mn is suitable for joining and surfacing heat resistant base materials of identical and of similar nature, such as

1.4859	G X 10 NiCrNb 32 20	
1.4876	X 10 NiCrAlTi 32 21	UNS N08800
1.4958	X 5 NiCrAlTi 31 20	UNS N08810
1.4959	X 8 NiCrAlTI 31 21	UNS N08811

A typical application is the root welding of centrifugally cast pipes in the petrochemical industry for operation temperatures up to 1050° C in dependence with the atmosphere.

Welding characteristics and special properties of the weld metal

Scale resistant up to 1050°C. Good resistance to carburising atmosphere.

Welding instruction

Clean the weld area thoroughly. Low heat input. Max. interpass temperature 150°C.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Nb	Fe
0.12	0.3	4.5	21.0	33.0	1.2	balance

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	400	600	20	70

Operating data

Polarity = +

Shielding gas:
I1

Dimensions (mm)

0.8	*1.0*	*1.2*	

Approvals

TÜV (10451.)

UTP A 2535 Nb

Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:		
G Z 25 35 Zr		

Characteristics and field of use

UTP A 2535 Nb is suitable for joinings and building up on identical and similar high heat resistant CrNi cast steel (centrifugal- and mould cast parts), such as

1.4852 1.4857	G–X 40 NiCrSiNb 35 25 G–X 40 NiCrSi 35 25

Welding characteristics and special properties of the weld metal
The weld deposit is applicable in a low sulphur, carbon enriching atmosphere up to 1150° C, such as reformer ovens in petrochemical installations.
Welding instruction
Clean welding area carefully. No pre heating or post weld heat treatment. Keep heat input as low as possible and interpass temperature at max. 150° C.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Nb	Ti	Zr	Fe
0.4	1.0	1.7	25.5	35.5	1.2	+	+	balance

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	
untreated	> 480	> 680	> 8	

Operating data

Polarity = +

Shielding gas:
I1

Dimensions (mm)

1.0	*1.2*		

BÖHLER SKWAM-IG

Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:		
G Z17 Mo		

Characteristics and field of use

Solid wire electrode for hard facings on stainless steels with 13-18% Cr, as well as on gas, water and steam fittings of unalloyed or low-alloy steels for operating temperatures up to +500°C. Outstanding sliding and feeding characteristics. Very good welding and flow behaviour. Resistant to sea water and to scaling up to +900°C. The weld metal is usually still machinable, and has the same colour as base materials of a similar alloy. For joint welding, we recommend BÖHLER A 7-IG for the filler passes to increase toughness, and BÖHLER SKWAM-IG as the cover pass.

Base materials

Corrosion-resistant surfacings: all unalloyed and low-alloy base materials suitable for welding. Joints: corrosion-resistant, Cr steels, suitable for quenching and tempering, with C contents ≤0.20% (repair welding). Pay attention to dilution and heat control.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni
≤0.02	0.65	0.55	17.0	1.1	0.4

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Hardness*
	MPa	*MPa*	*%*	*HB*
untreated				350
annealed*	≥ 500	≥ 700	≥ 15	200

*annealed, 720°C/2 h – shielding gas Ar + 8-10% CO_2

Operating data

Polarity = +

Shielding gas:
Argon + 8-10% CO_2
Argon + 3% O_2 or max. 5% CO_2

Dimensions (mm)

1.2	*1.6*		

Approvals

KTA 1408.1 (08044.), DB (20.014.19), SEPROZ, CE

Similar alloy filler metals

SMAW electrode:	*FOX SKWA* *FOX SKWAM*	*GTAW rod:*	*KWA-IG* *SKWA-IG*

BÖHLER CAT 430 L Cb-IG

Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G Z18 L Nb	ER430 (mod.)	

Characteristics and field of use

Special wire electrode for catalytic converters and silencers, exhaust mufflers, pipe junctions and intake manifolds made of same-type or similar-type materials.
Resistant to scaling up to +900°C. Outstanding sliding and feeding characteristics.
Very good welding and flow behaviour.

Base materials

1.4511 X3CrNb17, 1.4016 X6Cr17 AISI 430

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Nb
0.02	0.5	0.5	18.0	>12xC

Mechanical properties of all-weld metal

Brinell-hardness HB:

untreated	150
annealed	130

untreated, as-welded – shielding gas Ar + 8-10% CO_2
annealed, 760°C/2h – shielding gas Ar + 8-10% CO_2

Operating data

Polarity = +

Shielding gas:
Argon + 5-10% CO_2
Argon + 1-3% O_2

Dimensions (mm)

1.0			

BÖHLER CAT 430 L Cb Ti-IG

Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G ZCr 18 NbTi L	ER430Nb (mod.)	

Characteristics and field of use

Special wire electrode for joints and surfacings in exhaust systems with same-type or similartype materials. Double stabilised (Nb + Ti) with reduced tendency to the formation of coarse grains. Resistant to scaling up to +900°C.
Outstanding sliding and feeding characteristics. Very good welding and flow behaviour.

Base materials

1.4509 X2CrTiNb18, 1.4016 X6Cr17, 1.4511 X3CrNb17 AISI 430, AISI 441

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Nb	Ti
0.02	0.5	0.5	18.0	>12xC	0.4

Mechanical properties of all-weld metal

Brinell-hardness HB:

untreated	150
annealed	130

untreated, as-welded – shielding gas Ar + 0.5-5% CO_2
annealed, 760°C/2h – shielding gas Ar + 0.5-5% CO_2

Operating data

Polarity = +

Shielding gas:
Argon + 0.5-5% CO_2
Argon + 0.5-3% O_2

Dimensions (mm)

1.0	*1.2*		

UTP A 80 M — Solid Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 4060 (NiCu30Mn3Ti)	ERNiCu-7	

Characteristics and field of use

Particularly suited for the following materials: 2.4360 NiCu30Fe, 2.4375 NiCu30Al.
UTP A 80 M is also used for joining different materials, such as steel to copper and copper alloys, steel to nickel-copper alloys. These materials are employed in high-grade apparatus construction, primarily for the chemical and petrochemical industries. A special application field is the fabrication of seawater evaporation plants and marine equipment.

Welding characteristics and special properties of the weld metal

he weld metal has an excellent resistance to a large amount of corrosive medias, from pure water to non-oxidising mineral acids, alkali and salt solutions.

Welding instructions

Clean the weld area thoroughly to avoid porosity. Opening groove angle about 70°. Weld stringer beads.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cu	Ni	Ti	Fe
< 0.02	0.3	3.2	29.0	balance	2.4	<1.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	> 300	> 450	> 30	> 80

Operating data

Polarity = +

Shielding gas:
I1, Z-ArHeHC-30/2/0.05

Dimensions (mm)

0.8	*1.0*	*1.2*	

Approvals

TÜV (00249.; 00250.), ABS, GL

Thermanit Nimo C 24 — Solid Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6059 (NiCr23Mo16)	ERNiCrMo-13	

Characteristics and field of use

Nickel based alloy. High corrosion resistance in reducing and, above all, in oxidzing environments. For joining and surfacing with matching and similar alloys and cast alloys.For welding the cladded side of plates of matching and similar alloys.

Base materials

TÜV-certified parent metals
1.4565 – Alloy 24 – UNS S34565 – X2CrNiMnMoNbN25-18-5-4
2.4602 – Alloy C-22 – UNS N06022 – NiCr21Mo14W
2.4605 – Alloy 59 – UNS N06059 – NiCr23Mo16Al
2.4610 – Alloy C-4 – UNS N06455 – NiMo16Cr16Ti
2.4819 – Alloy C-276 – UNS N10276 – NiMo16Cr15W

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	Fe
0.01	0.10	< 0.5	23.0	16.0	balance	< 1.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	420	700	40	60

Operating data

Polarity = +, pulsed arc

Shielding gas (DIN EN ISO 14175):
I1;
Z - ArHeHC - 30/2/<0.1

Dimensions (mm)

1.0	*1.2*	*1.6*		

Approvals

TÜV (6461.)

UTP A 759 — Solid Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6059 (NiCr23Mo16)	ERNiCrMo-13	

Characteristics and field of use

UTP A 759 is suitable for welding components in plants for chemical processes with highly corrosive media. For joining materials of the same or similar natures, e. g.

2.4602	NiCr21Mo14W	UNS N06022
2.4605	NiCr23Mo16Al	UNS N06059
2.4610	NiMo16Cr16Ti	UNS N06455
2.4819	NiMo16Cr15W	UNS N10276

and these materials with low alloyed steels such as for surfacing on low alloyed steels.

Welding characteristics and special properties of the weld metal

Good corrosion resistance against acetic acid and acetic hydride, hot contaminated sulphuric and phosphoric acids and other contaminated oxidising mineral acids. Intermetallic precipitation will be largely avoided.

Welding instructions

The welding area has to be free from inpurities (oil, paint, markings). Minimize heat input. The interpass temperature should not exceed 150 °C. Linear energy input < 12 kJ/cm

Typical composition of solid wire (Wt-%)

C	Si	Cr	Mo	Ni	Fe
< 0.01	0.1	22.5	15.5	balance	<1.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	> 450	> 720	> 35	> 100

Operating data

Polarity = +

Shielding gas: Z-ArHeHC-30/2/0.05

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals

TÜV (06065.; 06068.), GL

BÖHLER NIBAS 70/20-IG/NICR 70 NB-IG A* — Solid Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3	

Characteristics and field of use

MIG wire electrode for high-quality welded joints to nickel-based alloys, creep resistant and highly creep resistant materials, heat resistant and cryogenic materials, and also for low-alloy, hardto-weld steels and dissimilar joints. Also for ferrite-austenite joints at operating temperatures ≥ 300°C or heat treatments. Suitable for pressure vessel construction for -196°C to +550°C, otherwise with scaling resistance up to +1200°C (sulphur-free atmosphere). Does not tend to embrittlement, high resistance to hot cracking, in addition to which the C-diffusion at high temperatures or during heat treatment of dissimilar joints is largely inhibited. Resistant to thermal shock, stainless, fully austenitic.Low expansion coefficient between C-steel and austenitic Cr-Ni-(Mo) steel. The wire and the weld metal meet the highest quality requirements.

Base materials

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, Alloy 600, Alloy 600 L Nickel and nickel alloys, low-temperature steels up to X8Ni9, high-alloy Cr and CrNiMo steels, particularly for dissimilar joints, and their joints to unalloyed, low-alloy, creep resistant and highly creep resistant steels. Also suitable for the Alloy 800 (H) material.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Ti	Nb	Fe
0.02	0.1	3.1	20.5	bal	+	2.6	≤1.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C*	*-196°C*
untreated	420	680	40	160	80

Operating data

Polarity = -

Shielding gas:
100% Argon
M12 (Argon + 30% He + 0.5% CO_2)
Ar + 28% He + 2% H_2 + 0.05% CO_2
The pulsed arc technique with argon or argon-helium mixtures is recommended for welding.

Dimensions (mm)

0.8	*1.0*	*1.2*	

Approvals

TÜV (04327.), Statoil, NAKS, SEPROZ, CE (NiCr 70 Nb-IG A: TÜV (09402.), CE)

Similar alloy filler metals

SMAW electrode:	*FOX NIBAS 70/20*	*GMAW solid wire:*	*NIBAS 70/20-IG NiCr 70 Nb-IG A**
Flux cored wire:	*NIBAS 70/20-FD NIBAS 70/20 Mn-FD*	*SAW combination:*	*NIBAS 70/20-UP/BB 444*

** Product name in Germany*

Thermanit Nicro 82 — Solid Wire

Classifications — high-alloyed

EN ISO 18274:	AWS A5.14:	
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3	

Characteristics and field of use

Nickel based alloy; heat resistant; high temperature resistant. Cold toughness at subzero temperatures as low as -269°C (-452°F). Good for welding austenitic-ferritic joints. No Cr carbide zone that become brittle in the ferrite weld deposit transition zone, even as a result of heat treatments above 300°C (572°F). Good for fabricating tough joints and surfacing with heat resistant Cr and CrNi steels/cast steel grades and Ni-base alloys. Temperature limits: 500°C (932°F) in sulphureous atmospheres, 800°C (1472°F) max. for fully stressed welds. Resistant to scaling up to 1000°C (1832°F).

Base materials

1.4876 - Alloy 800 - UNS N08800 - X10NiCrAlTi32-20, 1.4877 - X5NiCrCeNb32-27, 1.4958 - Alloy 800 H - UNS N08810 - X5NiCrAlTi31-20, 2.4816 - Alloy 600 - UNS N06600 - NiCr15Fe, 2.4817 - Alloy 600 L - UNS N06600 - LC-NiCr15Fe, 2.4858 - Alloy 825 - UNS N08825 - NiCr21Mo, 2.4851 - Alloy 601 - UNS N06601 - NiCr23Fe; Combinations of 1.4539 - X1NiCrMoCu25-20-5 1.4583 - X10CrNiMoNb18-12 and ferritic boiler steels; 1.5662 - X8Ni9; 1.7380 - 10CrMo9-10

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Nb	Fe
0.02	0.2	2.8	19.5	> 67	2.5	< 2.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	380	620	35	90	

Operating data

Polarity = +

Shielding gas (EN ISO 14175): I1

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals

TÜV (3089.), DNV (NV 5 Ni), GL (NiCr20Nb)

UTP A 068 HH

Solid Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3	

Characteristics and field of use

UTP A 068 HH is predominantly used for joining identical or similar high heat resistant Ni-base alloys, heat resistant austenites, and for joining heat resistant austenitic-ferritic materials such as

2.4816 2.4817 1.4876 1.6907	NiCr15Fe LC- NiCr15Fe X10 NiCrAlTi 32 20 X3 CrNiN 18 10	UNS N06600 UNS N10665 UNS N08800

Also used for joinings of high C content 25/35 CrNi cast steel to 1.4859 or 1.4876 for petrochemical installations with working temperatures up to 900° C.

Welding characteristics and special properties of the weld metal

The welding deposit is hot cracking resistant and does not tend to embrittlement.

Welding instructions

Clean weld area thoroughly. Keep heat input as low as possible and interpass temperature at approx. 150° C.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Nb	Fe
< 0.02	< 0.2	3.0	20.0	balance	2.7	0.8

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C*	*-196°C*
untreated	> 420	680	40	160	80

Operating data

Polarity = +

Shielding gas:
Z-ArHeHC-30/2/0.05

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals

TÜV (00882.; 00883.), KTA, ABS, GL, DNV

UTP A 776 — Solid Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6276 (NiCr15Mo16Fe6W4)	ERNiCrMo-4	

Characteristics and field of use

UTP A 776 is suitable for joint welding of matching base materials, as

2.4819	NiMo16Cr15W	UNS N10276

and surface weldings on low-alloyed steels.UTP A 776 is employed primarily for welding components in plants for chemical processes with highly corrosive media, but also for surfacing press tools, punches, etc. which operate at high temperature.

Welding characteristics and special properties of the weld metal
Excellent resistance against sulphuric acids at high chloride concentrations.

Welding instructions
To avoid intermetallic precipitations, stick electrodes should be welded with lowest possible heat input and interpass temperature.

Typical composition of solid wire (Wt-%)

C	Si	Cr	Mo	Ni	V	W	Fe
< 0.01	0.07	16.0	16.0	balance	0.2	3.5	6.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	> 450	> 750	> 30	> 90

Operating data

Polarity = +

Shielding gas:
R1 Z-ArHeHC-30/2/0.05

Dimensions (mm)

0.8	*1.0*	*1.2*	

Approvals

TÜV (05586.; 05587.)

Thermanit 617

Solid Wire

Classifications high-alloyed

EN ISO 18274:	AWS A5.14:	
S Ni 6617 (NiCr22Co12Mo9)	ERNiCrCoMo-1	

Characteristics and field of use

Resistant to scaling up to 1100°C (2012°F), high temperature resistant up to 1000°C (1832°F). High resistance to hot gases in oxidizing resp. carburizing atmospheres. Suited for joining and surfacing applications with matching and similar heat resistant steels and alloys. For joining and surfacing work on cryogenic Ni steels suitable for quenching and tempering.

Base materials

1.4876 - Alloy 800 - UNS N08800 - X10NiCrAlTi32-20, 1.4958 - Alloy 800 H - UNS N08810 - X5NiCrAlTi31-20, 1.4859 - UNS N08151 - GX10NiCrNb32-20, 2.4851 - Alloy 601 - UNS N06601 - NiCr23Fe, 2.4663 - Alloy 617 - UNS 06617 - NiCr23Co12Mo

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	Co	Al	Ti	Fe
0.05	0.1	0.1	21.5	9.0	balance	11.0	1.3	0.5	1.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	400	700	40	100	

Operating data

Polarity = +

Shielding gas (EN ISO 14175):
I1, M12
Ar + 30% He + 0.5% CO_2

Dimensions (mm)

1.0	*1.2*		

UTP A 6170 Co

Solid Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6617 (NiCr22Co12Mo9)	ERNiCrCoMo-1	

Characteristics and field of use

UTP A 6170 Co is particularly used for joining heat resistant and creep resistant nickel base alloys of identical and similar nature, high temperature austenitic and cast alloys, such as

1.4958 1.4959 2.4663	X5NiCrAlTi 31 20 X8NiCrAlTi 32 21 NiCr23Co12Mo	UNS N08810 UNS N08811 UNS N06617

Welding characteristics and special properties of the weld metal
The weld metal is resitant to hot-cracking. It is used for operating temperatures up to 1100° C. Scale-resistant at temperatures up to 1100° C in oxidizing resp. carburizing atmospheres, e. g. gas turbines, ethylene production plants.
Welding instructions
Clean welding area carefully. Keep heat input as low as possible and interpass temperature at max. 150° C.

Typical composition of solid wire (Wt-%)

C	Si	Cr	Mo	Ni	Co	Ti	Al	Fe
0.06	< 0.3	22.0	8.5	balance	11.5	0.4	1.0	1.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	> 450	> 750	> 30	> 120

Operating data

Polarity = +

Shielding gas:
I1, Z-ArHeHC-30/2/0.05

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals

TÜV (05450; 05451)

Avesta P12 — Solid Wire

Classifications — high-alloyed

EN ISO 18274:	AWS A5.14:	
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	

Characteristics and field of use

Avesta P12 is a nickel base alloy designed for welding 6Mo-steels such as Outokumpu 254 SMO. It is also suitable for welding nickel base alloys type 625 and 825 and for dissimilar welds between stainless or nickel base alloys and mild steel. To minimise the risk of hot cracking when welding fully austenitic steels and nickel base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	Nb	Fe
0.01	0.2	0.1	22.0	balance	9.0	3.5	<1.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C*	*-40°C*	*-196°C*
untreated	460	740	41	150	140	130

Operating data

Polarity = +

Shielding gas:
Welding is best performed using, pulsed arc with a shielding gas of pure argon or Ar + 30% He + 2.5% CO_2. The addition of helium (He), will increase the energy of the arc. Gas flow rate 12 - 16l/min.

Dimensions (mm)	*Amperage (A)*
0.8	*90 - 130*
1.0	*185 - 215*
1.2	*200 - 250*

BÖHLER NIBAS 625-IG/NiCr 625-IG A* — Solid Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	

Characteristics and field of use

Alloy 825 and also to CrNiMo steels with a high Mo content (e.g. „6 Mo“ steels). This type is also suitable for creep resistant and highly creep resistant steels, heat resistant and cryogenic materials, dissimilar joints and low-alloy, hard-to-weld steels. Suitable for pressure vessel construction for -196°C to +550°C, otherwise with scaling resistance up to +1200°C (sulphur-free atmosphere). Because of the embrittlement of the base material between 600 and 850°C, use in this temperature range should be avoided. High resistance to hot cracking, in addition to which the C-diffusion at high temperatures or during heat treatment of dissimilar joints is largely inhibited. Extremely high resistance to stress corrosion cracking and pitting (PREN 52). Resistant to thermal shock, stainless, fully austenitic. Low expansion coefficient between C-steel and austenitic CrNi(Mo) steel. The wire and the weld metal meet the highest quality requirements.

Base materials

2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo, 2.4816 NiCr15Fe, 1.4583 X10CrNiMoNb18-12, 1.4876 X10NiCrAlTi32-21, 1.4529 X1NiCrMoCuN25-20-7, X2CrNiMoCuN20-18-6, 2.4641 NiCr2 Mo6Cu, Joints of the above-mentioned materials with unalloyed and low-alloy steels such as P265GH, P285NH, P295GH, S355N, 16Mo3, X8Ni9, ASTM A 553 Gr.1, N 08926, Alloy 600, Alloy 625, Alloy 800 (H), 9% Ni steels

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	Nb	Fe	Ti
≤ 0.02	0.1	0.1	22.0	balance	9.0	3.6	≤ 0.5	+

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C*	*-196°C*
untreated	510	780	40	130	80

Operating data

Polarity = +

Shielding gas:
100% Argon
M12 (Argon +30% He + 0.5% CO_2)
Ar + 28% He + 2% H_2 + 0.05% CO_2
The pulsed arc technique with argon or argon-helium mixtures is recommended for welding.

Dimensions (mm)

1.6	*2.0*	*2.4*

Approvals

TÜV (04323.), Statoil, SEPROZ, CE (NiCr 625-IG A: TÜV (09404.), DB (43.014.25), CE

Similar alloy filler metals

SMAW electrode:	*FOX NIBAS 625*	*GTAW rod:*	*NIBAS 625-IG NiCr 625-IG A**
Flux cored wire:	*NIBAS 625 PW-FD*	*SAW combination:*	*NIBAS 625-UP/BB 444*

** Product name in Germany*

Thermanit 625 — Solid Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	

Characteristics and field of use

Nickel based alloy; high resistance to corrosive environment. Resistant to stress corrosion cracking. Resistant to scaling up to 1100 °C (2012 °F). Temperature limit: 500°C (932°F) max. in sulphureous atmospheres. High temperature resistant up to 1000 °C (1832 °F). Cold toughness at subzero temperatures as low as –196 °C (–321 °F). For joining and surfacing work with matching/similar corrosion-resistant materials as well as with matching and similar heat resistant, high temperature resistant steels and alloys. For joining and surfacing work on cryogenic austenitic CrNi(N) steels/cast steel grades and on cryogenic Ni steels suitable for quenching and tempering.

Base Materials

TÜV certified parent metals
1.4547 – Alloy 254SMO – UNS S31254 – X1CrNiMoCuN20-18-7
1.4876 – Alloy 800 – UNS N08800 – X10NiCrAlTi32-20
1.4958 – Alloy 800 H – UNS N08810 – X5NiCrAlTi31-20
2.4816 – Alloy 600 – UNS N06600 – NiCr15Fe
2.4856 – Alloy 625 – UNS N06625 – NiCr22Mo9Nb
as well as combinations of forementioned Materials with ferritic steels
up to S355J, 10CrMo9-10 9% Ni steels

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	Nb	Fe
0.03	0.25	0.20	22.0	9.0	bal.	3.6	<1.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C*	*-196°C*
untreated	> 460	> 740	> 30	60	40

Operating data

Polarity = +

Shielding gas:
100% Argon
M12 (Argon +30% He + 0.5% CO_2)
Ar + 28% He + 2% H_2 + 0.05% CO_2
The pulsed arc technique with argon or argon-helium mixtures is recommended for welding.

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals

TÜV (03460.; 03461.), GL, DNV, ABS, LR (1.2mm MIG)

UTP A 6222 Mo

Solid Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	

Characteristics and field of use

UTP A 6222 Mo has a high nickel content and is suitable for welding high-strength and high-corrosion resistant nickel-base alloys, e. g.

X1 NiCrMoCuN25206	1.4529	UNS N08926
X1 NiCrMoCuN25205	1.4539	UNS N08904
NiCr21Mo	2.4858	UNS N08825
NiCr22Mo9Nb	2.4856	UNS N06625

It can be used for joining ferritic steel to austenitic steel as well as for surfacing on steel. It is also possible to weld 9 % nickel steels using this wire due to its high yield strength. Its wide range of uses is of particular signifiance in aviation, in chemical industry and in applications involving seawater.

Welding characteristics and special properties of the weld metal

The special features of the weld metal of UTP A 6222 Mo include a good creep rupture strength, corrosion resistance, resistance to stress and hot cracking. It is highly resistant and tough even at working temperatures up to 1100° C. It has an extremely good fatigue resistance due to the alloying elements Mo and Nb in the NiCr-matrix. The weld metal is highly resistant to oxidation and is almost immune to stress corrosion cracking. It resists intergranular penetration without having been heat-treated.

Welding instructions

The welding area has to be free from inpurities (oil, paint, markings). Minimize heat input. The interpass temperature should not exceed 150 °C. Linear energy input < 12 kJ/cm

Typical composition of solid wire (Wt-%)

C	Si	Cr	Mo	Ni	Nb	Fe
< 0.02	< 0.2	22.0	9.0	balance	3.5	1.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C*	*-196°C*
untreated	> 460	> 740	> 30	> 100	> 85

Operating data

Polarity = +

Shielding gas:
Z-ArHeHC-30/2/0.05

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals

TÜV (03460.; 03461.), GL, DNV, ABS, LR (1.2mm MIG)

Thermanit 35/45 Nb — Solid Wire

Classifications		high-alloyed
EN ISO 18274:		
S Ni Z (NiCr36Fe15Nb0.8)		

Characteristics and field of use

Resistant to scaling up to 1180 °C (2156 °F). For joining and surfacing work on matching/similar heat resistant cast steel grades.

Base materials

GX45NiCrNbSiTi45-35

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Nb
0.42	1.5	1.0	35.0	45.5	0.8

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	245	450	6	-

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M12, M13

Dimensions (mm)

1.2				

UTP A 3545 Nb — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:		
GZ 35 45 Nb		

Characteristics and field of use

UTP A 3545 Nb is suitable for joining and surfacing on identical and similar high heat resistant cast alloys (centrifugal- and mould cast parts), such as G X-45NiCrNbSiTi 45 35. The main application field is for tubes and cast parts of reformer and pyrolysis ovens at temperatures up to 1175°C/air.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Nb	Ti	Zr	Fe
0.45	1.5	0.8	35.0	45.0	1.0	0.1	0.05	balance

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	450	650	8	-

Operating data

	Polarity = +	Shielding gas (EN ISO 14175): J I1

Dimensions (mm)

1.2			

Thermanit JE-308L Si — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 19 9 L Si	ER308LSi	

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Corrosion-resistant similar to matching low-carbon and stabilized austenitic 18/8 CrNi(N) steels/cast steel grades. Cold toughness at subzero temperatures as low as –196 °C (–321 °F). For joining and surfacing applications with matching and similar – stabilized and non-stabilized – austenitic CrNi(N) and CrNiMo(N) steels/cast steel grades. For joining and surfacing work on cryogenic matching/similar austenitic CrNi(N) steels/cast steel grades.

Base materials

TÜV-certified parent metal 1.4301 – X5CrNi18-10 1.4311 – X2CrNiN18-10; 1.4550 – X6CrNiNb18-10 AISI 304, 304L, 304LN, 302, 321, 347; ASTM A157 Gr. C9, A320 Gr. B8C or D.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
0.02	0.9	1.7	20.0	10.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	350	570	35	75	35

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M11, M12, M13

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (0555.), DB (43.132.08), CWB (ER 308L-Si), DNV

Thermanit 25/14 E-309L Si — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 23 12 L Si	ER309LSi	

Characteristics and field of use

Stainless; (wet corrosion up to 350 °C (662 °F)). Well suited for depositing intermediate layers when welding cladded materials. Favourably high Cr and Ni contents, low C content. For joining unalloyed/low-alloy steels/cast steel grades or stainless heat resistant Cr steels/cast steel grades to austenitic steels/cast steel grades. For depositing intermediate layers when welding the side of plates clad with low-carbon – non stabilized or stabilized – austenitic CrNiMo(N) austenitic metals.

Base materials

Joints of and between high-tensile, unalloyed and alloyed quenched and tempered, stainless, ferritic Cr and austenitic CrNi steels, high manganese steels as well as weld claddings for the first layer of chemical resistant weld claddings on ferriticpearlitic steels up to fine grained structural steel S500N for steam boiler and pressure boiler constructions, as well as on creep resistant fine grained structural steels 22NiMoCr4-7 axx. to leaflet “SEW-Werkstoffblatt” No. 365, 366, 20MnMoNi5-5 and G18NiMoCr3-7.

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni
0.03	0.9	2.0	24.0	13.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	400	550	30	55	

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M12, M13

Dimensions (mm)

0.8	*1.0*	*1.2*

Approvals and certificates

GL (4332 S), CBW (ER309LSi)

Thermanit GE-316L Si — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 19 12 3 L Si	ER316LSi	

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistance similar to matching low-carbon and stabilized austenitic 18/8 CrNiMo steels/cast steel grades. For joining and surfacing application with matching and similar – non-stabilized – austenitic CrNi(N) and CrNiMo(N) steels and cast steel grades.

Base materials

TÜV-certified parent metal 1.4583 – X10CrNiMoNb18-12; UNS S31653; AISI 316Cb, 316L, 316Ti

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni
0.02	0.8	1.7	18.8	2.8	12.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	380	560	35	70	

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M12, M13

Dimensions (mm)

0.8	*1.0*	*1.2*	*1.6*

Approvals and certificates

TÜV (0489.), DB (43.132.10), LR (ftV7R-12), CWB (ER 316L-Si), GL (4429S), DNV

Thermanit H Si — Solid Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
G 19 9 Nb Si	ER347Si	

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistant similar to matching stabilized austenitic CrNi steels/cast steel grades. For joining and surfacing application with matching and similar – stabilized and non-stabilized – austenitic CrNi(N) steels and cast steel grades.

Base materials

TÜV-certified parent metal 1.4550 – X6CrNiNb18-10 and the parent metals also covered by VdTÜV-Merkblatt 1000; AISI 347, 321, 302, 304, 304L, 304LN; ASTM A296 Gr. CF 8C; A157 Gr. C9; A320 Gr. B8C or D

Typical composition of solid wire (Wt-%)

C	Si	Mn	Cr	Ni	Nb
0.06	0.8	1.5	19.5	9.5	≥12xC

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	400	570	30	65	

Operating data

Polarity = +

Shielding gas (EN ISO 14175): M12, M13

Dimensions (mm)

0.8	*1.0*	*1.2*		

Approvals and certificates

TÜV (0604.), DB (43.132.06)

Chapter 4.1 - SAW Wire (low-alloyed, unalloyed)

BÖHLER EMS 2 / BÖHLER BB 24

SAW Wire

Classifications		unalloyed
EN ISO 14171-A:	AWS A5.17:	
S 38 6 FB S2	F7A8-EM12K (F6P6-EM12K)	

Characteristics and field of use

The BÖHLER EMS 3 wire electrode is universally applicable in shipbuilding, steel construction and in the fabrication of boilers and containers. It is suitable for joint welding of general structural steels and fine-grained structural steels. BÖHLER BB 24 is a fluoride-basic flux, and features an almost neutral metallurgical behaviour. The weld metal demonstrates good toughness properties down to -40°C. A good seam appearance and good wetting properties, together with good slag detachability and low hydrogen content in the weld metal (≤ 5 ml/100 g) characterise this wire/flux combination. It is particularly suitable for multi-pass welding of thick plates.
More detailed information about BÖHLER BB 24 can be found in the product datasheet for the welding flux.

Base materials

Steels up to a yield strength of 420 MPa (60 ksi) S235JR-S355JR, S235JO-S355JO, S235J2-S355J2, S275N-S420N, S275M-S420M, P235GH-P355GH, P275NL1-P355NL1, P215NL, P265NL, P355N, P285NH-P420NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L415NB, L245MBL415MB, GE200-GE240 ASTM A 106 Gr. A, B, C; A 181 Gr. 60, 70; A 283 Gr. A, C; A 285 Gr. A, B, C; A 350 Gr. LF1; A 414 Gr. A, B, C, D, E, F, G; A 501 Gr. B; A 513 Gr. 1018; A 516 Gr. 55, 60, 65, 70; A 573 Gr. 58, 65, 70; A 588 Gr. A, B, C, K; A 633 Gr. C, D, E; A 662 Gr. B; A 711 Gr. 1013; A 841 Gr. A, B, C; API 5 L Gr. B, X42, X52, X56, X60

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn		
0.07	0.25	1.2		

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-20°C:*	*-60°C:*
untreated	440	520	30	185	170	90

Operating data

Polarity = ±

re-drying for flux: ø mm
300-350°C, min. 2 h

Dimensions (mm)

2.0	*2.5*	*3.0*	*4.0*

Approvals and certificates

Wire/flux combination: TÜV (7808.) Wire: TÜV (02603.), KTA 1408.1 (8058.), DB (52.014.03), SEPROZ, CE

Union S 2

SAW Wire

Classifications		unalloyed
EN ISO 14171-A:	AWS A5.17:	
S2	EM12K	

Characteristics and field of use

General structural steels up to S355JR, boiler plates up to P295GH, shipbuilding steels, pipe steels up to L360 and unalloyed boiler tubes, fine grained structural steels up to P355N, S355N.

Base materials

ASTM A36 Gr. all; A106 Gr. A, B; A214; A242 Gr. 1-5; A266 Gr. 1, 2, 4; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A299 Gr. A, B; A328; A366; A515 Gr. 60, 65, 70; A516 Gr. 55; A556 Gr. B2A; A570 Gr. 30, 33, 36, 40, 45; A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A841; A851 Gr. 1, 2; A935 Gr. 45; A936 Gr. 50;

Typical analysis of the wire (Wt-%)

C	Si	Mn		
0.1	0.1	1.0		

Available flux

Flux: UV 420 TT, UV 421 TT, UV 418 TT, UV 306, UV 400.

Operating data

Polarity = ±

Dimensions (mm)

2.0	*2.5*	*3.0*	*4.0*

Union S 2 Si

SAW Wire

Classifications unalloyed

EN ISO 14171-A:	AWS A5.17:	
S2Si	EM12K	

Characteristics and field of use

General structural steels up to S355JR, boiler plates up to P295GH, especially for pipe steels up to L360 and unalloyed boiler tubes.

Base materials

-

Typical analysis of the wire (Wt-%)

C	Si	Mn		
0.1	0.3	1.0		

Available flux

UV 306, UV 400, UV 421 TT, UV 418 TT

Operating data

Polarity = ±

Dimensions (mm)

2.5	*3.0*	*4.0*	

Union S 3

SAW Wire

Classifications		unalloyed
EN ISO 14171-A:	AWS A5.17:	
S3	EH10K	

Characteristics and field of use

General structual steels up to S355JR, boiler plates up to P355GH, ship building steels, fine grained structural steels up to P355N, S355N.

Base materials

ASTM A36 Gr. all; A106 Gr. A, B; A214; A242 Gr. 1-5; A266 Gr. 1, 2, 4; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A299 Gr. A, B; A328; A366; A515 Gr. 60, 65, 70; A516 Gr. 55; A556 Gr. B2A; A570 Gr. 30, 33, 36, 40, 45; A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A841; A851 Gr. 1, 2; A935 Gr. 45; A936 Gr. 50

Typical analysis of the wire (Wt-%)

C	Si	Mn		
0.12	0.10	1.50		

Available flux

UV 420 TT, UV 421 TT, UV 418 TT, UV 306, UV 400

Operating data

Polarity = ±

Dimensions (mm)

3.0	*4.0*	*5.0*	

Union S 3 Si

SAW Wire

Classifications		unalloyed
EN ISO 14171-A:	AWS A5.17:	
S3Si	EH12K	

Characteristics and field of use

General structural steels and fine grained structural steels up to S460N, P460N. Expecially for offshore steels with flux UV 418 TT (COD tested).

Base materials

-

Typical analysis of the wire (Wt-%)

C	Si	Mn		
0.10	0.30	1.70		

Available flux

UV 421 TT, UV 418 TT

Operating data

Polarity = ±

Dimensions (mm)

2.5	*3.0*	*4.0*	

BÖHLER EMS 2 Mo / BÖHLER BB 24 — SAW Wire

Classifications		low-alloyed
EN ISO 14171-A:	AWS A5.23:	
S 46 4 FB S2Mo	F8A4-EA2-A2/F8P0-EA2-A2	

Characteristics and field of use

Wire/flux combination for joint welding of creep resistant steels in boiler, container and pipeline construction. High-quality, tough weld metal, cryogenic down to -40°C. Approved for long-term use at operating temperatures of up to +550°C. Bruscato ≤ 15 ppm. More detailed information about BÖHLER BB 24 can be found in the detailed product datasheet for this welding flux.

Base materials

creep resistant steels and cast steels of the same type, steels that are resistant to ageing and to caustic cracking, creep resistant structural steels with yield strengths up to 460 MPa. 16Mo3, 20MnMoNi4-5, 15NiCuMoNb5, S235JR-S355JR, S235JO-S355JO, S450JO, S235J2-S355J2, S275N-S460N, S275M-S460M, P235GH-P355GH, P355N, P285NH-P460NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L415NB, L450QB, L245MB-L450MB, GE200-GE300 ASTM A 29 Gr. 1013, 1016; A 106 Gr. C; A, B; A 182 Gr. F1; A 234 Gr. WP1; A 283 Gr. B, C, D; A 335 Gr. P1; A 501 Gr. B; A 533 Gr. B, C; A 510 Gr. 1013; A 512 Gr. 1021, 1026; A 513 Gr. 1021, 1026; A 516 Gr. 70; A 633 Gr. C; A 678 Gr. B; A 709 Gr. 36, 50; A 711 Gr. 1013; API 5 L B, X42, X52, X60, X65

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Mo	
0.07	0.25	1.15	0.5	

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-20°C:*
untreated	540	630	25	140	80

Operating data

Polarity = ±

re-drying of sub-arc flux: 300-350°C, min. 2h

Dimensions (mm)

1.0	*2.0*	*2.5*	*3.0*	*4.0*

Approvals and certificates

Wire/flux combination: TÜV (7810.), NAKS Wire: TÜV (02603.), KTA 1408 1 (8058./8060.), DB (52.014.06), SEPROZ, CE

Similar alloy filler metals

SMAW electrode:	*FOX DMO Kb* *FOX DMO Ti*	*Flux cored wire:*	*DMO Ti-FD*
GMAW solid wire: *GTAW rod:*	*DMO-IG*	*SAW combination:*	*EMS 2 Mo/BB 306* *EMS 2 Mo/BB 400* *EMS 2 Mo/BB 418 TT* *EMS 2 Mo/BB 421 TT*

Union S 2 Mo

SAW Wire

Classifications		low-alloyed
EN ISO 14171-A:	AWS A5.23:	
S2Mo	EA2	

Characteristics and field of use

Mo-alloyed steels and boiler plates of quality 16Mo3, fine grained structural steels up to S460N, P460N, and corresponding pipeline steels up to StE 480 TM.

Base materials

ASTM A355 Gr. P1, A161-94 Gr. T1A, A182M Gr. F1, A204M Gr. A, B, C, A250M Gr. T1, A217 Gr. WC1;

Typical analysis of the wire (Wt-%)

C	Si	Mn	Mo	
0.10	0.10	1.00	0.50	

Available flux

UV 420 TT, UV 421 TT, UV 418 TT, UV 400, UV 306, UV 309 P, UV 310 P

Operating data

Polarity = ±

Dimensions (mm)

3.0	*4.0*		

Union S 3 Mo		SAW Wire
Classifications		low-alloyed
EN ISO 14171-A:	AWS A5.23:	
S3Mo	EA4	

Characteristics and field of use

Mo-alloyed steels and boiler plates of quality 16Mo3 and fine grained structural steels up to S460N, P460N.

Base materials

-

Typical analysis of the wire (Wt-%)

C	Si	Mn	Mo	
0.12	0.10	1.50	0.50	

Available flux

UV 420 TT, UV 421 TT, UV 418 TT

Operating data

Polarity = ±

Dimensions (mm)

3.0	*4.0*	*5.0*	

Union S 2 NiMo 1

SAW Wire

Classifications		low-alloyed
EN ISO 14171-A:	AWS A5.23:	
SZ2Ni1Mo	ENi1	

Characteristics and field of use

Creep resistant and cryogenic fine grained structural steels up to S460NL, P460NL and corresponding offshore and pipe steels.

Base materials

-

Typical analysis of the wire (Wt-%)

C	Si	Mn	Mo	Ni
0.11	0.10	1.0	0.25	0.90

Available flux

UV 421 TT, UV 418 TT

Operating data

Polarity = ±

Dimensions (mm)

4.0			

BÖHLER 3 NiMo 1-UP / BÖHLER BB 24 — SAW Wire

Classifications — low-alloyed

EN ISO 26304-A:	AWS A5.23:	
S 55 4 FB S3Ni1Mo	F9A4-EF3-F3	

Characteristics and field of use

Wire/flux combination for joint welding of high-strength, quenched and tempered structural steels. The flux features an almost neutral metallurgical behaviour. The weld metal demonstrates good toughness properties at low temperatures. A good seam appearance and good wetting properties, together with good slag detachability and low hydrogen content in the weld metal (HD ≤ 5 ml/100 g) characterise this wire/flux combination. It is particularly suitable for multi-pass welding of thick plates.More detailed information about BÖHLER BB 24 can be found in the detailed product datasheet for this welding flux.

Base materials

fine-grained structural steels S460N, S460M, S460NL, S460ML, S460Q-S555Q, S460QL-S550QL, S460QL1-S550QL1, P460N, P460NH, P460NL1, P460NL2, 20MnMoNi4-5, 15NiCuMoNb5-6-4, L415NB, L415MBL555MB, L415QB-L555QB, alform 500 M, 550 M, aldur 500 Q, 500 QL, 500 QL1, aldur 550 Q, 550 QL, 550 QL1 ASTM A 572 Gr. 65; A 633 Gr. E; A 738 Gr. A; A 852; API 5 L X60, X65, X70, X80, X60Q, X65Q, X70Q, X80Q

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Ni	Mo
0.09	0.25	1.65	0.90	0.55

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*			
	MPa	*MPa*	*%*	*+20°C:*	*±0°C:*	*-20°C:*	*-40°C:*
untreated	600	690	22	180	160	100	60

Operating data

Polarity = ±

re-drying of sub-arc flux: 300-350°C, min. 2 h

Dimensions (mm)

2.5	*3.0*	*4.0*	

Approvals and certificates

Wire/flux combination: TÜV (07807.) Wire: TÜV (2603.), CE, NAKS

Union S 3 NiMo 1

SAW Wire

Classifications low-alloyed

EN ISO 14171-A:	AWS A5.23:	
S3Ni1Mo	EF3	

Characteristics and field of use

Reactor structural steels such as 22 NiMoCr 37, 20 MnMo 44, 20 MnMoNi55, WB 36, Welmonil 35, Welmonil 43,GS-18 NiMoCr 37; In Combination with UV 420 TTR tested according to KTA 1408.

Base materials

ASTM A517 Gr. A, B, C, E, F, H, J, K, M, P; A255 Gr. C; A633 Gr. E; A572 Gr. 65;

Typical analysis of the wire (Wt-%)

C	Si	Mn	Mo	Ni
0.12	0.10	1.60	0.60	0.95

Available flux

UV 420 TT (R), UV 421 TT, UV 418 TT

Operating data

Polarity = ±

Dimensions (mm)

2.5	*3.0*	*4.0*	

Union S 3 NiMo

SAW Wire

Classifications		low-alloyed
EN ISO 14171-A:	AWS A5.23:	
S3Ni1.5Mo	EG [EF1 (mod.)]	

Characteristics and field of use

-

Base materials

Creep resistant and cryogenic fine grained structural steels up to S550NL, P550ML and WB 35, WB 36, HY 80.

Typical analysis of the wire (Wt-%)

C	Si	Mn	Mo	Ni
0.08	0.10	1.50	0.45	1.50

Available flux

UV 420 TTR, UV 421 TT, UV 418 TT

Operating data

Polarity = ±

Dimensions (mm)

3.0	*4.0*		

Union S 3 NiMoCr

SAW Wire

Classifications		low-alloyed
EN ISO 26304-A:	AWS A5.23:	
S Z3Ni2.5CrMo	EG [EF6 (mod.)]	

Characteristics and field of use

-

Base materials

Fine grained structural steels water quenched and tempered up to P690Q such as N-A-XTRA 70, T 1 and HY 100. USS-T 1 etc.;

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni
0.14	0.10	1.70	0.35	0.60	2.10

Available flux

UV 421 TT, UV 418 TT

Operating data

Polarity = ±

Dimensions (mm)

2.0	*3.0*	*4.0*	

BÖHLER 3 NiCrMo 2.5-UP / BÖHLER BB 24

SAW Wire

Classifications		low-alloyed
EN ISO 26304-A:	AWS A5.23:	
S 69 6 FB S3Ni2.5CrMo	F11A8-EM4 (mod.)-M4H4	

Characteristics and field of use

Wire/flux combination specially suited to high-strength fine-grained structural steels. The weld metal is suitable for subsequent quenching and tempering. The flux features an almost neutral metallurgical behaviour. The weld metal demonstrates good toughness properties at low temperatures down to -60°C. A good seam appearance and good wetting properties, together with good slag detachability and low hydrogen content in the weld metal (≤ 5 ml/100 g) characterise this wire/flux combination. It is particularly suitable for multi-pass welding of thick plates.
More detailed information about BÖHLER BB 24 can be found in the detailed product datasheet for this welding flux.

Base materials

quenched and tempered fine-grained structural steels with high requirements for low-temperature toughness. S690Q, S690QL, S690QL1, alform plate 620 M, alform plate 700 M, aldur 620 Q, aldur 620 QL, aldur 620 QL1, aldur 700 Q, aldur 700 QL, aldur 700 QL1
ASTM A 514 Gr. F, H, Q; A 709 Gr. 100 Type B, E, F, H, Q; A 709 Gr. HPS 100W

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.06	0.3	1.5	0.5	2.2	0.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*			
	MPa	*MPa*	*%*	*+20°C:*	*-20°C:*	*-40°C:*	*-60°C:*
untreated	740	850	20	120	90	85	(≥ 47)

Operating data

Polarity = ±

re-drying of sub-arc flux:
300-350°C / min. 2 h

Dimensions (mm)

3.0	*4.0*		

Similar alloy filler metals

SMAW electrode:	*FOX EV 85*	*GMAW solid wire:*	*X 70-IG* *NiCrMo 2.5-IG*

BÖHLER EMS 2 CrMo / BÖHLER BB 24

SAW Wire

Classifications low-alloyed

EN ISO 24598-A:	AWS A5.23:	
S S CrMo1 FB	F8P2-EB2-B2	

Characteristics and field of use

Wire/flux combination for joint welding of creep resistant steels in boiler, container and pipeline construction. Approved for long-term use at operating temperatures of up to +570°C. Bruscato ≤15 ppm. A good seam appearance and good wetting properties, together with good slag detachability and low hydrogen content in the weld metal (≤ 5 ml/100 g) characterise this wire/flux combination. More detailed information about BÖHLER BB 24 can be found in the detailed product datasheet for this welding flux. For step cooling applications, the BÖHLER BB 24-SC welding flux, which is specially developed for this purpose, should be used.

Base materials

same alloy creep resistant steels and cast steel, case-hardening and nitriding steels with comparable composition, heat treatable steels with comparable composition, steels resistant to caustic cracking 1.7335 13CrMo4-5, 1.7262 15CrMo5, 1.7728 16CrMoV4, 1.7218 25CrMo4, 1.7225 42CrMo4, 1.7258 24CrMo5, 1.7354 G22CrMo5-4, 1.7357 G17CrMo5-5
ASTM A 182 Gr. F12; A 193 Gr. B7; A 213 Gr. T12; A 217 Gr. WC6; A 234 Gr. WP11; A335 Gr. P11, P12; A 336 Gr. F11, F12; A 426 Gr. CP12

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Mo	P	As	Sb	Sn
0.08	0.25	0.90	1.10	0.45	≤0.012	≤0.010	≤0.005	≤0.005

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*			
	MPa	*MPa*	*%*	*+20°C:*	*-30°C:*		
a*	(≥ 470)	(550-700)	(≥ 20)	(≥ 47)	(≥ 27)		
n+a*	≥ 330	≥ 480	30	120			

(*) a annealed, 680°C/2 h/furnace down to 300°C/air; n + a normalized 920°C and annealed 680°C/2 h

Operating data

Polarity = ±

re-drying of sub-arc flux: 300-350°C, min. 2 h

Dimensions (mm)

2.5	*3.0*	*4.0*	

Approvals and certificates

Wire/flux combination: TÜV (7809.), Wire: TÜV (02605.), SEPROZ, CE

Similar alloy filler metals

SMAW electrode:	*FOX DCMS Kb* *FOX DCMS Ti*	*SAW combination:*	*EMS 2 CrMo/BB 24 SC* *EMS 2 CrMo/BB 418 TT*
GTAW rod:	*DCMS-IG*	*Flux cored wire:*	*DCMS Ti-FD*
Gas welding rod:	*DCMS*	*GMAW solid wire:*	*DCMS-IG*

Union S 2 CrMo

SAW Wire

Classifications		low-alloyed
EN ISO 24598-A:	AWS A5.23:	
S S CrMo1	EB2R	

Characteristics and field of use

CrMo-alloyed boiler plates and boiler tubes of quality 13CrMo4-5 and similar steels.

Base materials

ASTM A193 Gr. B7, A355 Gr. P11 u. P12, A217 Gr. WC6;

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo
0.12	0.10	0.80	1.20	0.50

Available flux

UV 420 TTR (UV 420 TTR-W), UV 420 TT

Operating data

Polarity = ±

Dimensions (mm)

2.0	*2.5*	*3.0*	*4.0*

Union S 1 CrMo 2

SAW Wire

Classifications		low-alloyed
EN ISO 24598-A:	AWS A5.23:	
S S CrMo2	EB3R	

Characteristics and field of use

Creep resistant boiler structural steels 10CrMo9-10 i.g. 12CrMo9-10.

Base materials

ASTM A335 Gr. P22, A217 Gr. WC9; A387 Gr. 22;

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo
0.10	0.10	0.50	2.40	1.00

Available flux

UV 420 TTR, UV 420 TTR-W

Operating data

Polarity = ±

Dimensions (mm)

2.5	*3.0*	*4.0*	*5.0*

BÖHLER CM 2-UP / BÖHLER BB 418TT

SAW Wire

Classifications		low-alloyed
EN ISO 24598-A:	AWS A5.23:	
S S CrMo2 FB	EB3	

Characteristics and field of use

This consumable material is suitable for same alloy and similar alloy steels in boiler, pressure vessel and pipeline construction, and particularly for cracking plants in the petrochemical industry. The wire/flux combination can be used for long-term operating temperatures of up to +600°C. The heat control during the welding and the heat treatment following welding must be carried out similarly to the specifications of the steel manufacturer. More detailed information about BÖHLER BB 418 TT can be found in the detailed product datasheet for this welding flux. For step cooling applications, the BB 24 SC welding flux, which is specially developed for this purpose, should be used.

Base materials

same type as creep-resistant steels and cast steels, similar alloy quenched and tempered steels up to 980 MPa strength, similar alloy case-hardening and nitriding steels 1.7380 10CrMo9-10, 1.7276 10CrMo11, 1.7281 16CrMo9-3, 1.7383 11CrMo9-10, 1.7379 G17CrMo9-10, 1.7382 G19CrMo9-10 ASTM A 182 Gr. F22; A 213 Gr. T22; A 234 Gr. WP22; 335 Gr. P22; A 336 Gr. F22; A 426 Gr. CP22

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Mo	P	As	Sb	Sn
0.08	0.2	0.7	2.4	0.95	≤0.010	≤0.015	≤0.005	≤0.010

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*			
	MPa	*MPa*	*%*	*+20°C:*	*-30°C:*		
a*	(≥ 470)	(≥ 550-700)	(≥ 18)	(≥ 47)	(≥ 27)		

(*) a annealed, 690-750°C/2 h/furnace down to 300°C/air

Operating data

Polarity = ±

re-drying of sub-arc flux: 300-350°C, min. 2h

Dimensions (mm)

2.5	*3.0*	*4.0*	

Approvals and certificates

Wire/flux combination: – Wire: TÜV (02605.), KTA 1408.1 (8060.), SEPROZ, CE

Similar alloy filler metals

SMAW electrode:	*FOX CM 2 Kb* *FOX CM 2 Kb SC*	*SAW combination:*	*CM 2 SC-UP/BB 24* *CM 2 SC-UP/BB 24 SC*
GTAW rod:	*CM 2-IG*	*Flux cored wire:*	*CM 2 Ti-FD*
GMAW solid wire:	*CM 2-IG*		

Union S 1 CrMo 2 V — SAW Wire

Classifications		low-alloyed
EN ISO 24598-A:	AWS A5.23:	
S S ZCrMoV2	EG	

Characteristics and field of use

Base materials

Creep resistant steel of type 2 1/4 % Cr, 1 % Mo, 0.25 % V.

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo	Nb	others
0.12	0.10	0.60	2.50	1.00	0.02	0.30 V

Available flux

Operating data

Polarity = ±

Dimensions (mm)

4.0			

BÖHLER Ni 2-UP / BÖHLER BB 24

SAW Wire

Classifications		low-alloyed
EN ISO 14171-A:	AWS A5.23:	
S 46 6 FB S2Ni2	F8A8-ENi2-Ni2	

Characteristics and field of use

Wire/flux combination for joint welding of cryogenic structural and nickel steels. The weld metal (untreated and stress-relieved) is characterised by outstanding low-temperature toughness and ageing resistance. The flux features an almost neutral metallurgical behaviour. A good seam appearance and good wetting properties, together with good slag detachability and low hydrogen content in the weld metal (≤ 5 ml/100 g) characterise this wire/flux combination. It is particularly suitable for multi-pass welding of thick plates. More detailed information about BÖHLER BB 24 can be found in the detailed product datasheet for this welding flux.

Base materials

cryogenic fine-grained structural and Ni-alloy steels 10Ni14, 12Ni14, 13MnNi6-3, 15NiMn6, S275N-S460N, S275NL-S460NL, S275M-S460M, S275ML-S460ML, P275NL1-P460NL1, P275NL2-P460NL2
ASTM A 203 Gr. D, E; A 333 Gr. 3; A334 Gr. 3; A 350 Gr. LF1, LF2, LF3; A 420 Gr. WPL3, WPL6; A 516 Gr. 60, 65; AA 529 Gr. 50; A 572 Gr. 42, 65; A 633 Gr. A, D, E; A 662 Gr. A, B, C; A 707 Gr. L1, L2, L3; A 738 Gr. A; A 841 A, B, C

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Ni	
0.07	0.25	1.15	2.2	

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*			
	MPa	*MPa*	*%*	*+20°C:*	*-20°C:*	*-60°C:*	
untreated	(≥ 460)	(550-740)	(≥ 20)	160	100	(≥ 47)	

Operating data

Polarity = ±

re-drying of sub-arc flux: 300-350°C, min. 2 h

Dimensions (mm)

2.5	*3.0*		

Approvals and certificates

Wire/flux combination: –
Wire: TÜV (2603.), KTA 1408.1 (8058.), DB (52.014.10), SEPROZ. CE

Similar alloy filler metals

SMAW electrode:	*FOX 2.5 Ni*	*GTAW rod:*	*2.5 Ni-IG*
GMAW solid wire:	*2.5 Ni-IG*		

Union S 2 Ni 2.5 SAW Wire

Classifications		low-alloyed
EN ISO 14171-A:	AWS A5.23:	
S2Ni2	ENi2	

Characteristics and field of use

Cryogenic fine grained structural steels up to S460NL, P460NL and special structural steels such as 12 Ni 14 G 1.

Base materials

ASTM A633 Gr. E, A572 Gr. 65, A203 Gr. D, A333 and 334 Gr. 3, A350 Gr. LF;

Typical analysis of the wire (Wt-%)

C	Si	Mn	Ni	
0.10	0.10	1.00	2.50	

Available flux

UV 421 TT, UV418 TT

Operating data

Polarity = ±

Dimensions (mm)

2.5	*3.0*	*4.0*	

Union S 2 Ni 3.5 — SAW Wire

Classifications		low-alloyed
EN ISO 14171-A:	AWS A5.23:	
S2Ni3	ENi3	

Characteristics and field of use

Base materials

For the welding of cryogenic steels: 10Ni14, SA350G.LF3, SA 203 Gr. D.

Typical analysis of the wire (Wt-%)

C	Si	Mn	Ni	
0.09	0.15	0.90	3.30	

Available flux

UV 421 TT, UV 418 TT

Operating data

Polarity = ±

Dimensions (mm)

3.0	*4.0*		

Union S P 24 — SAW Wire

Classifications		low-alloyed
EN ISO 24598-A:	AWS A5.23:	
S Z CrMo2VNb	EG	

Characteristics and field of use

Union S P 24 is a matching filler metal for welding high temperature, creep resistant steels such as 7CrMoVTiB10-10 (P24/T24 acc. to ASTM A213). The chemistry of the wire will be optimized with respect to the creep rupture properties.

Base materials

7CrMoVTiB10-10; (1.7378); T/P 24

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo	others
0.10	0.20	0.60	2.50	1.0	V= 0.24 Ti/Nb= 0.05

Available flux

UV P24

Operating data

Polarity = ±

Dimensions (mm)

2.0			

Chapter 4.2 - SAW Wire (high-alloyed)

Product name	EN ISO		AWS		P
Thermanit MTS 3	EN ISO 24598-A	S S CrMo91	AWS A5.23	EB9	344
Thermanit MTS 616	EN ISO 24598-A	S Z CrMoWVNb 9 0.5 1.5	AWS A5.23	EG [EB9(mod.)]	345
BÖHLER A7 CN-UP / BÖHLER BB 203	EN ISO 14343-A	S 18 8 Mn	AWS A5.9	ER307 (mod.)	346
Thermanit X	EN ISO 14343-A	S 18 8 Mn	AWS A5.9	ER307(mod.)	347
Avesta 308L/MVR	EN ISO 14343-A	S 19 9 L	AWS A5.9	ER308L	348
Thermanit JE-308L	EN ISO 14343-A	S 19 9 L	AWS A5.9	ER308L	349
Avesta 309L	EN ISO 14343-A	S 23 12 L	AWS A5.9	ER309L	350
Thermanit 25/14 E-309L	EN ISO 14343-A	S 23 12 L	AWS A5.9	ER309L	351
Avesta 316L/SKR	EN ISO 14343-A	S 19 12 3 L	AWS A5.9	ER316L	352
BÖHLER EAS 4 M-UP / BÖHLER BB 202	EN ISO 14343-A	S 19 12 3 L	AWS A5.9	ER316L	353
Thermanit GE-316L	EN ISO 14343-A	S 19 12 3 L	AWS A5.9	ER316L	354
Thermanit A	EN ISO 14343-A	S 19 12 3 Nb	AWS A5.9	ER318	355
Thermanit H-347	EN ISO 14343-A	S 19 9 Nb	AWS A5.9	ER347	356
Avesta 2205	EN ISO 14343-A	S 22 9 3 N L	AWS A5.9	ER2209	357
Thermanit 22/09	EN ISO 14343-A	S 22 9 3 N L	AWS A5.9	ER2209	358
Avesta P5	EN ISO 14343-A	S 23 12 2 L	AWS A5.9	ER309LMo(mod.)	359
Avesta LDX 2101	EN ISO 14343-A	S 23 7 N L	-	-	360
Avesta 2507/P100 Cu/W	EN ISO 14343-A	S 25 9 4 N L	AWS A5.9	ER2594	361
BÖHLER CN 13/4-UP/ BÖHLER BB 203	EN ISO 14343-A	S 13 4	AWS A5.9	ER410NiMo (mod.)	362
Avesta P12	EN ISO 18274	S Ni 6625 (NiCr22Mo9Nb)	AWS A5.14	ERNiCrMo-3	363
Thermanit 625	EN ISO 18274	S Ni 6625 (NiCr22Mo9Nb)	AWS A5.14	ERNiCrMo-3	364
UTP UP 6222 Mo	EN ISO 18274	S Ni 6625 (NiCr22Mo9Nb)	AWS A5.14	ERNiCrMo-3	365
Thermanit Nicro 82	EN ISO 18274	S Ni 6082 (NiCr20Mn3Nb)	AWS A5.14	ERNiCr-3	366
Thermanit Nimo C 276	EN ISO 18274	S Ni 6276 (NiCr15Mo16Fe6W4)	AWS A5.14	ERNiCrMo-4	367

Thermanit MTS 3

SAW Wire

Classifications high-alloyed

EN ISO 24598-A:	AWS A5.23:	
S S CrMo91	EB9	

Characteristics and field of use

SAW wire for high temperature, creep resistant martensitic 9 - 12% chromium steels in turbine and boiler fabrication and in the chemical industry. Especially designed for the ASTM steels T91/P91. Approved in long-term condition up to 650 °C service temperature.

Base materials

Creep resistant 9 % Cr-Steel such as X 10 CrMoVNb 9 1, A 213-T 91, A 335-P 91. ASTM A199 Gr. T91, A335 Gr. P91 (T91), A213/213M Gr. T91;

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	Nb	others
0.12	0.25	0.80	9.0	0.95	0.45	0.06	0.22 V

Available flux

Marathon 543

Operating data

Polarity = ±

Dimensions (mm)

2.0	*2.5*	*3.2*	

Thermanit MTS 616 — SAW Wire

Classifications		high-alloyed
EN ISO 24598-A:	AWS A5.23:	
S Z CrMoWVNb9 0.5 1.5	EG [EB9 (mod.)]	

Characteristics and field of use

Creep resistant martensitic steel of type P 92 0.22 V acc. to ASTM A 335.

Base materials

ASTM A355 Gr. P92 (T92), A213/213M Gr. T92;

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	Nb	others
0.11	0.25	0.80	8.8	0.45	0.45	0.06	1.65 W 0.22 V

Available flux

Marathon 543

Operating data

Polarity = ±

Dimensions (mm)

2.5	*3.0*		

BÖHLER A7 CN-UP / BÖHLER BB 203

SAW Wire

Classifications high-alloyed

EN ISO 14343-A:	AWS A5.9:	
S 18 8 Mn	ER307(mod.)	

Characteristics and field of use

For joint welding between CrNi steels and unalloyed steels, and for build-up welding of the sealing surfaces of fittings and build-up welding on cogging, billet and profiled rolls. Properties of the weld metal: suitable for strain-hardening, very good cavitation resistance, crack resistant, resistant to thermal shock, resistant to scaling up to +850°C, no tendency to sigma-phase embrittlement above 500°C. Cryogenic down to -100°C. Heat treatment is possible. BÖHLER BB 203 is an agglomerated, fluoride-basic welding flux, and yields clean, finely rippled weld seams. Good slag detachability and low hydrogen content. More detailed information about BÖHLER BB 203 can be found in the detailed product datasheet for this welding flux.

Base materials

high-strength, unalloyed and alloyed structural, quenched and tempered and armour steels among themselves or among each other; unalloyed and alloyed boiler or structural steels with high-alloy Cr and Cr-Ni steels; heat-resistant steels up to +850°C; austenitic manganese steels together and with other steels; cryogenic plate and pipe steels together with cryogenic austenitic materials.

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.08	0.8	6.0	18.7	9.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*-100°C:*		
untreated	(≥ 350)	(≥500)	(≥ 25)	(≥ 40)		

Operating data

Polarity = ±

re-drying of sub-arc flux: 300-350°C, 2 h

Dimensions (mm)

2.4	*3.0*				

Approvals and certificates

Wire/flux combination: – Wire: TÜV (02604.), CE

Similar alloy filler metals

SMAW electrode:	*FOX A 7 / FOX A 7 CN* FOX A 7-A*	*Flux cored wire:*	*A 7-MC, A 7-FD, A 7 PW-FD*
GMAW solid wire:	*A 7-IG / A 7 CN-IG**	*GTAW rod:*	*A 7 CN-IG / A 7 CN-IG**

Thermanit X

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 18 8 Mn	ER307(mod.)	

Characteristics and field of use

Joints and surfacings on high tensile, unalloyed and alloyed structural, quenched and tempered, and armur steels, same parent metal or in combination; unalloyed and alloyed boiler or structural steels with highalloyed Cr and CrNi steels; heat resistant steels up to 850 °C (1562 °F); austenitic high manganese steel with matching and other steels. Cryogenic sheet metals and pipe steels in combination with austenitic parent metals.

Base materials

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.1	1.0	7.0	19.0	9.0

Available flux

Marathon 104

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated				

Operating data

Polarity = ±

Dimensions (mm)

2.0	*2.4*	*3.0*	*4.0*		

Avesta 308L/MVR

SAW Wire

Classifications high-alloyed

EN ISO 14343-A:	AWS A5.9:	
S 19 9 L	ER308L	

Characteristics and field of use

Avesta 308L/MVR is designed for welding 1.4301/ASTM 304 type stainless steels. It can also be used for welding steels that are stabilized with titanium or niobium, such as 1.4541/ASTM 321 and 1.4550/ASTM 347 in cases where the construction will be operating at temperatures below 400°C. For higher temperatures a niobium stabilised consumable such as Avesta 347/MVNb is required. Very good under fairly severe conditions, e.g. in oxidising acids and cold or dilute reducing acids.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
4301	1.4301	304	304S31	Z7 CN 18-09	2333
4307	1.4307	304L	304S11	Z3 CN 18-10	2352
4311	1.4311	304LN	304S61	Z3 CN 18-10 Az	2371
4541	1.4541	321	321S31	Z6 CNT 18-10	2337

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.02	0.40	1.7	20.0	10.0

Ferrite 8 FN; WRC - 92

Available flux

801, 805

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*-20°C:*	*-40°C:*	*-196°C:*
801	410	590	37	65	50	35
805	410	580	36	80	60	35

Operating data

Polarity = ±

Dimensions (mm)

1.6	*2.4*	*3.2*	*4.0*		

Thermanit JE-308L

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 19 9 L	ER308L	

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Corrosion-resistant similar to matching low-carbon and stabilized austenitic 18/8 CrNi(N) steels/cast steel grades. High toughness at subzero temperatures as low as –196 °C (–321 °F). For joining and surfacing applications with matching and similar – stabilized and non-stabilized – austenitic CrNi(N) and CrNiMo(N) steels/cast steel grades. For joining and surfacing work on cryogenic matching/similar austenitic CrNi(N) steels/cast steel grades.

Base materials

1.4301; 1.4541; AISI 347, 321, 304, 304L, 304LN; ASTM A296 Gr. CF 8 C, A157 Gr. C9; A320 Gr. B8C or D

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Ni
0.025	0.6	1.8	20.0	9.8

Available flux

Marathon 431

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*		
untreated	≥ 320	≥ 550	35	65		

Operating data

Polarity = ±

Shielding gas (EN ISO 14175): I1, I3

Dimensions (mm)

2.4	*3.0*				

Approvals and certificates

TÜV (9451.), DB (43.132.19), CWB (ER 308L), DNV

Avesta 309L — SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 23 12 L	ER309L	

Characteristics and field of use

Avesta 309L is a high-alloy 23 Cr 13 Ni wire primarily intended for surfacing low-alloy steels and for dissimilar welding between mild steels and stainless steels, offering a ductile and crack resistant weldment. The chemical composition, when surfacing, is equivalent to that of 1.4301/ASTM 304 from the first run. One or two layers of 309L are usually combined with a final layer of 308L, 316L or 347. Superior to type 308L. When used for overlay welding on mild steel a corrosion resistance equivalent to that of 1.4301/ASTM 304 is obtained already in the first layer.

Base materials

For welding steels such as

Outokumpu	EN	ASTM	BS	NF	SS

Avesta 309L is primarily used when joining non-molybdenum-alloyed stainless and carbon steels and for surfacing unalloyed or low-alloy steels.

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Ni
0.02	0.40	1.80	23.5	14.0

Ferrite 9 FN; WRC-92

Available flux

801, 805

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*	
801	430	590	32	60	50	
805	440	580	32	70	60	

Operating data

Polarity = ±

Dimensions (mm)

2.0	*2.4*	*3.2*			

Thermanit 25/14 E-309L

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 23 12 L	ER309L	

Characteristics and field of use

Stainless; wet corrosion up to 350 °C (662 °F). Favourably high Cr- and Ni-contents, low C content. For joining unalloyed/low-alloy steels/cast steel grades or stainless heat resistant Cr-steels/cast steel grades to austenitic steels/cast steel grades.

Base materials

Joinings: of and between high-tensile, unalloyed and alloyed quenched and tempered steels, stainless, ferritic Cr and austenitic CrNi steels, high manganese steels. Weld claddings: for first layer of chemical resistant claddings on ferritic-pearlitic steels up to fine grained steel S500N used in steam boiler and pressure boiler construction, moreover for creep resistant fine grained structural steels 22NiMoCr4-7 acc. to leaflet “SEW-Werkstoffblatt” No. 365, 366, 20MnM0Ni5-5 and G18NiMoCr3-7.

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
≤ 0.02	≤ 0.6	1.8	24.0	13.2

Available flux

Marathon 431

Operating data

Polarity = ±

Dimensions (mm)

2.4	*3.2*	*4.0*			

Avesta 316L/SKR

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 19 12 3 L	ER316L	

Characteristics and field of use

Avesta 316L/SKR is designed for welding 1.4436/ASTM 316 type stainless steels. It is also suitable for welding steels that are stabilised with titanium or niobium, such as 1.4571/ASTM 316Ti, for service temperatures not exceeding 400°C. For higher temperatures, a niobium stabilised consumable such as Avesta 318/SKNb should be used. Excellent resistance to general, pitting and intergranular corrosion in chloride containing environments. Intended for severe service conditions, e.g. in dilute hot acids.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
4436	1.4436	316	316S33	Z7 CND 18-12-03	2343
4432	1.4432	316L	316S13	Z3 CND 17-12-03	2353
4429	1.4429	S31653	316S63	Z3 CND 17-12-Az	2375
4571	1.4571	316Ti	320S31	Z6 CndT 17-12	2350

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.02	0.40	1.7	18.5	12.2	2.6

Ferrite 7 FN; WRC -92

Available flux

801, 805

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*	*-196°C:*
801	410	570	35	70	60	30
805	415	560	36	80	70	35

Operating data

Polarity = ±

Dimensions (mm)

1.6	*2.0*	*2.4*	*3.2*	*4.0*	

BÖHLER EAS 4 M-UP / BÖHLER BB 202

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 19 12 3 L	ER316L	

Characteristics and field of use

Wire/flux combination for single pass and multi-pass welding of austenitic CrNiMo steels. Smooth seam surface, easy slag removal without slag residues and good welding properties, including when used for fillet welds, characterise this combination. Applications in reactor construction, the construction of chemical apparatus and containers, in fitting manufacture in the textile, cellulose and dyeing industries etc. Usable for operating temperatures between -120°C and +400°C. BÖHLER BB 202 is an agglomerated, fluoride-basic welding flux characterised by low flux consumption and by good slag detachability. More detailed information about BÖHLER BB 202 can be found in the detailed product datasheet for this welding flux.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-13-3, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12, 1.4409 GX2CrNiMo19-11-2 UNS S31603, S31653; AISI 316L, 316Ti, 316Cb

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.02	0.60	1.2	18.0	12.2	2.8

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*			
	MPa	*MPa*	*%*	*+20°C:*	*-50°C:*	*-100°C*	*-120°C*
untreated	(≥ 320)	(≥ 510)	(≥ 25)	80	≥ 60	≥ 50	(≥ 32)

Operating data

Polarity = ±

re-drying of sub-arc flux: 300-350°C, min. 2 h

Dimensions (mm)

2.0	*2.4*	*3.2*	*4.0*		

Approvals and certificates

Wire/flux combination: TÜV (07508.), TÜV (09175 with BB 203)
Wire: TÜV (02604.), DB (52.014.13), SEPROZ, CE

Similar alloy filler metals

SMAW electrode:	*FOX EAS 4 M* *FOX EAS 4 M (LF)* *FOX EAS 4 M-A* *FOX EAS 4 M-VD*	*Flux cored wire:*	*EAS 4 M-MC* *EAS 4 M-FD* *EAS 4 PW-FD* *EAS 4 PW-FD (LF)*
GTAW rod:	*EAS 4 M-IG*	*GMAW solid wire:*	*EAS 4 M-IG (Si)*

Thermanit GE-316L

SAW Wire

Classifications high-alloyed

EN ISO 14343-A:	AWS A5.9:	
S 19 12 3 L	ER316L	

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistance similar to matching low-carbon and stabilized austenitic 18/8 CrNiMo steels/cast steel grades. For joining and surfacing application with matching and similar – non-stabilized and stabilized – austenitic CrNi(N) and CrNiMo(N) steels and cast steel grades.

Base materials

Joints and surfacing with matching 431/213 CrNiMo steels such as 1.4404; 1.4541; 1.4435; UNS S31653; AISI 316, 316L, 316Ti, 316Cb

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	others
≤ 0.02	≤ 0.6	1.7	18.5	2.8	12.2	N 0.04

Available flux

Marathon 431

Operating data

Polarity = ±

Dimensions (mm)

2.0	*2.4*	*3.2*	*4.0*		

Thermanit A

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 19 12 3 Nb	ER318	

Characteristics and field of use

Joints and surfacing with matching stabilized and non stabilized CrNiMo steels such as 1.4571; 1.4583;

Base materials

AISI 316, 316L, 316Ti, 316 Cb

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	Nb
≤ 0.05	≤ 0.6	1.7	19.5	2.8	11.5	12xC

Available flux

Marathon 431

Operating data

Polarity = ±

Dimensions (mm)

2.4	*3.2*	*4.0*			

Thermanit H-347

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 19 9 Nb	ER347	

Characteristics and field of use

Joints and surfacing with matching stabilized and non stabilized austenitic steels such as 1.4301; 1.4541;

Base materials

1.4301; 1.4541; AISI 347, 321, 304, 304L, 304LN; ASTM A296 Gr. CF 8 C, A157 Gr. C9; A320 Gr. B8C or D

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Ni	Nb
≤ 0.06	≤ 0.6	1.8	19.5	9.5	≥ 12xC

Available flux

Marathon 431

Operating data

Polarity = ±

Dimensions (mm)

2.4	*3.0*	*4.0*			

Avesta 2205

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 22 9 3 N L	ER2209	

Characteristics and field of use

Avesta 2205 is primarily designed for welding the duplex grade Outokumpu 2205 and similar steels. Avesta 2205 provides a ferritic-austenitic weldment that combines many of the good properties of both ferritic and austenitic stainless steels. Very good resistance to pitting and stress corrosion cracking in chloride containing environments.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
2205	1.4462	S32205	318S13	Z3 CDN 22-05 Az	2328

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N
0.02	0.5	1.6	22.8	8.5	3.1	0.17

Ferrite 50 FN; WRC-92

Available flux

805

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-46°C:*
805	600	800	27	100	70

Operating data

Polarity = ±

Dimensions (mm)

2.4	*3.2*	*4.0*			

Thermanit 22/09

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 22 9 3 N L	ER2209	

Characteristics and field of use

Joints on matching Duplex steels such as 1.4462;

Base materials

1.4462 UNS S31803, S32205

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	others
≤ 0.02	≤ 0.5	1.6	23.0	3.2	8.8	N 0.15

Available flux

Marathon 431

Operating data

Polarity = ±

Dimensions (mm)

2.0	*2.5*	*3.0*			

Avesta P5

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 23 12 2 L	ER309LMo(mod.)	

Characteristics and field of use

Avesta P5 is a high-alloy low carbon wire of the 309LMo type, primarily designed for surfacing low-alloy steels and for welding dissimilar joints between stainless and mild or low-alloy steels. It is also suitable for welding steels like durostat® and alform®. When used for surfacing, a composition equivalent to that of 1.4401/ASTM 316 is obtained already in the first layer. Superior to type 316L. When used for overlay welding on mild steel a corrosion resistance equivalent to that of 1.4401/ ASTM 316 is obtained already in the first layer.

Base materials

For welding steels such as

Outokumpu	EN	ASTM	BS	NF	SS

Avesta P5 is primarily used when joining molybdenum-alloyed stainless and carbon steels and for surfacing unalloyed or low-alloy steels.

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.0015	0.35	1.4	21.5	15.0	2.6

Ferrite 8 FN; WRC-92

Available flux

801, 805

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*	
801	470	620	31	50	45	
805	410	600	35	60	50	

Operating data

Polarity = ±

Dimensions (mm)

2.4	*3.2*				

Avesta LDX 2101

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:		
S 23 7 N L		

Characteristics and field of use

Avesta LDX 2101 is designed for welding the duplex stainless steel Outokumpu LDX 2101®. LDX 2101 is a “lean duplex” steel with excellent strength and medium corrosion resistance. The steel is used in many various applications such as bridges, process equipment in desalination, pressure vessel in the pulp/paper industry and transport and storage tanks for chemicals. To ensure the right ferrite balance in the weld metal, Avesta LDX 2101 is over-alloyed with respect to nickel. The weldability of duplex steels is excellent but the welding should be adapted to the base material, considering fluidity, joint design, heat input etc. Good resistance to general corrosion. Better resistance to pitting, crevice corrosion and stress corrosion cracking than 1.4301/AISI 304.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
LDX 2101®	1.4162	S32101	-	-	-

Typical analysis the wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N
0.02	0.50	0.8	23.0	7.0	< 0.5	0.14

Ferrite 45 FN; WRC-92

Available flux

805

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*	
805	550	700	28	90	40	

Operating data

Polarity = ±

Dimensions (mm)

2.4	*3.2*				

Avesta 2507/P100 Cu/W

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 25 9 4 N L	ER2594	

Characteristics and field of use

Avesta 2507/P100Cu/W is intended for welding super duplex alloys such as 2507, ASTM S32760, S32550 and S31260. It can also be used for welding duplex type 2205 if extra high corrosion resistance is required, e.g. in root runs in tubes. The weldability of duplex and super duplex steels is excellent but the welding should be adapted to the base material, considering fluidity, joint design, heat input etc. Very good resistance to pitting and stress corrosion cracking in chloride containing environments. PREW>46. Meets the corrosion test requirements per ASTM G48 Methods A, B and E (40°C).

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
2507	1.4410	S32750	-	Z3 CDN 25-06 Az	2328

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N
0.02	0.35	0.4	25.0	9.5	4.0	0.25

Ferrite 50 FN; WRC-92

Available flux

805

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-46°C:*	
805	600	800	27	80	60	

Operating data

Polarity = ±

Dimensions (mm)

2.4	*3.2*				

BÖHLER CN 13/4-UP/ BÖHLER BB 203

SAW Wire

Classifications		high-alloyed
EN ISO 14343-A:	AWS A5.9:	
S 13 4	ER410NiMo (mod.)	

Characteristics and field of use

Wire/flux combination for same-type corrosion-resistant, martensitic and martensitic-ferritic rolled, forged and cast steels. Used in the construction of water turbines and compressors, and in the construction of steam power stations. Resistant to water and steam. BÖHLER BB 203 is an agglomerated, fluoride-basic welding flux, and yields well-flowed, smooth weld seams. Good slag detachability and low hydrogen content (HD ≤ 5 ml/100 g). More detailed information about BÖHLER BB 203 can be found in the detailed product datasheet for this welding flux.

Base materials

1.4317 GX4CrNi13-4, 1.4313 X3CrNiMo13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4
ACI Gr. CA 6 NM

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.015	0.65	0.7	11.8	4.7	0.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*		
untreated	(≥ 500)	(≥ 750)	(≥ 15)	(≥ 50)		

Operating data

Polarity = ±

re-drying of sub-arc flux:
300-350°C, min. 2 h

Preheating and interpass temperature of thick-walled parts 100-160°C. Heat input max. 15 kJ/cm. Tempering at 580-620°C.

Dimensions (mm)

2.0	*2.4*	*3.0*			

Approvals and certificates

Wire/flux combination: SEPROZ, CE
Wire: SEPROZ

Similar alloy filler metals

SMAW electrode:	*FOX CN 13/4* *FOX CN 13/4 SUPRA*	*Flux cored wire:*	*CN 13/4-MC* *CN 13/4-MC (F)*
GMAW solid wire:	*CN 13/4-IG*	*GTAW rod:*	*CN 13/4-IG*

Avesta P12

SAW Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	

Characteristics and field of use

Avesta P12 is a nickel base alloy designed for welding 6Mo-steels such as Outokumpu 254 SMO. It is also suitable for welding nickel base alloys type 625 and 825 and for dissimilar welds between stainless or nickel base alloys and mild steel. To minimise the risk of hot cracking when welding fully austenitic steels and nickel base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Excellent resistance to general corrosion in various types of acids and to pitting, crevice corrosion and stress corrosion cracking in chloride containing environments. Meets the corrosion test requirements per ASTM G48 Methods A, B and E (50°C).

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
254 SMO®	1.4547	S31254	-	-	2378
20-25-6	1.4529	N08926	-	-	-

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Nb	Fe	Ni	Mo
0.01	0.2	0.1	22.0	3.5	< 1.0	bal.	9.0

Ferrite 0 FN

Available flux

805

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*	
805	470	730	41	90	80	

Operating data

Polarity = ±

Dimensions (mm)

2.4	*3.2*				

Thermanit 625 — SAW Wire

Classifications — high-alloyed

EN ISO 18274:	AWS A5.14:	
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	

Characteristics and field of use

Joints of austenitic-ferritic steels, dissimilar joints of stainless steels, heat resistant, creep resistant and cryogenic steels

Base materials

2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo, 2.4816 NiCr15Fe, 1.4583 X10CrNiMoNb18-12, 1.4876 X10NiCrAlTi32-21, 1.4529 X1NiCrMoCuN25-20-7, X2CrNiMoCuN20-18-6, 2.4641 NiCr21Mo6Cu-Dissimilar joints of the steels above with unalloyed and low alloyed steels like P265GH, P285NH, P295GH, 16Mo3, S355N, X8Ni9, ASTM A 553 Gr.1, B443, B446, UNS N06625 N 08926, Alloy 600, Alloy 625, Alloy 800, steels with 9% Ni

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	Fe	Nb
0.015	0.15	0.2	22.0	9.0	bal.	< 0.5	3.6

Available flux

Marathon 444

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*		
untreated	≥ 420	≥ 700	≥ 40	≥ 80		

Operating data

Polarity = ±

Dimensions (mm)

1.6	*2.0*	*2.4*			

UTP UP 6222 Mo
UTP UP FX 6222 Mo

SAW Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	

Characteristics and field of use

UTP UP 6222 Mo and the flux UTP UP FX 6222 Mo are applied for joint welding of base materials with the same or with a similar composition, e. g. Alloy 625 (UNS N06625) or NiCr22Mo9Nb, Material-No. 2.4856 or mixed combinations with stainless steels and carbon steels. Furthermore the wire-flux combination is used for cold-tough Ni-steels, e. g. X8Ni9 for LNG projects.
UTP UP 6222 Mo / UTP UP FX 6222 Mo is also applied on alloyed or unalloyed steels for cladding of corrosion resistant plants.

Base materials

2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo, 2.4816 NiCr15Fe, 1.4583 X10CrNiMoNb18-12, 1.4876 X10NiCrAlTi32-21, 1.4529 X1NiCrMoCuN25-20-7, X2CrNiMoCuN20-18-6, 2.4641 NiCr21Mo6Cu-Dissimilar joints of the steels above with unalloyed and low alloyed steels like P265GH, P285NH, P295GH, 16Mo3, S355N, X8Ni9, ASTM A 553 Gr.1, B443, B446, UNS N06625 N 08926, Alloy 600, Alloy 625, Alloy 800, steels with 9% Ni

Typical analysis of all-weld metal (Wt-%)

C	Si	Cr	Mo	Ni	Nb	Fe
< 0.02	< 0.2	21.0	9.0	balance	3.3	2.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*	
untreated	460	725	40	> 80	65	

Operating data

Polarity = ±

The welding area has to be free from impurities (oil, paint, markings etc.). Welding must be performed with a low heat input. The maximum interpass temperature is at 150° C. Flux has to be re-dried prior to welding: 2 hours at 300 - 400° C.
Flux height: approx. 25 mm
Stick out: approx. 25 mm

Dimensions (mm)

1.6	*2.0*	*2.4*	*3.2*		

Approvals and certificates

TÜV (03918.)

Thermanit Nicro 82 — SAW Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3	

Characteristics and field of use

Joints of austenitic-ferritic steels, dissimilar joints of stainless steels, heat resistant, creep resistant and cryogenic steels

Base materials

2.4816 NiCr15Fe, 2.4817 LC- NiCr15Fe, Alloy 600, Alloy 600 L

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Ni	Nb	Fe
0.02	0.2	3.2	20.5	bal.	2.6	≥ 2

Available flux

Marathon 104

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*		
untreated	≥ 380	≥ 600	≥ 35	≥ 100		

Operating data

Polarity = ±

Dimensions (mm)

2.0	*2.4*	*3.2*			

Thermanit Nimo C 276

SAW Wire

Classifications		high-alloyed
EN ISO 18274:	AWS A5.14:	
S Ni 6276 (NiCr15Mo16Fe6W4)	ERNiCrMo-4	

Characteristics and field of use

Vessels and construction of chemical apparatus, especially for low temperatures application down to -163°C e.g. LNG tanks.
The weld metal is stainless and corrosion resistant to reducing and oxidating substances.

Base materials

2.4819 NiMo16Cr15W UNS N10276

Typical analysis of the wire (Wt-%)

C	Si	Mn	Cr	Mo	Ni	Fe	W
0.012	0.1	0.5	15.5	16	bal.	7.0	3.8

Available flux

Marathon 104

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*		
untreated	≥ 460	≥ 730	≥ 40	≥ 90		

Operating data

Polarity = ±

Dimensions (mm)

2.4					

Chapter 4.3 - SAW Flux

Product name	EN ISO		AWS		P
BÖHLER BB 418 TT	EN ISO 14174	SA FB 1 55 AC H5	-	-	370
UV 418 TT	EN ISO 14174	SA FB 1 55 AC H5	-	-	372
UV 421 TT	EN ISO 14174	SA FB 1 55 AC H5	-	-	374
BÖHLER BB 24	EN ISO 14174	SA FB 1 65 DC H5	-	-	377
UV 420 TT	EN ISO 14174	SA FB 1 65 DC H5	-	-	379
UV 420 TTR/ UV 420 TTR-W	EN ISO 14174	SA FB 1 65 DC/SA FB 1 65 AC	-	-	382
UV 420 TTR-C	EN ISO 14174	SA FB 1 65 DC	-	-	385
UV 310 P	EN ISO 14174	SA AB 1 55 AC H5	-	-	386
BÖHLER BB 400	EN ISO 14174	SA AB 1 67 AC H5	-	-	387
UV 400	EN ISO 14174	SA AB 1 67 AC H5	-	-	388
UV 309 P	EN ISO 14174	SA AB 1 65 AC H5	-	-	390
UV 305	EN ISO 14174	SA AR 1 76 AC H5	-	-	391
UV 306	EN ISO 14174	SA AR 1 77 AC H5	-	-	392
Avesta Flux 805	EN ISO 14174	SA AF 2 Cr DC	-	-	394
BÖHLER BB 202	EN ISO 14174	SA FB 2 DC	-	-	395
Marathon 431	EN ISO 14174	SA FB 2 DC	-	-	396
Marathon 543	EN ISO 14174	SA FB 2 55 DC H5	-	-	398
Avesta Flux 801	EN ISO 14174	SA CS 2 Cr DC	-	-	399

BÖHLER BB 418 TT

SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA FB 1 55 AC H5		

Characteristics and field of use

BÖHLER BB 418 TT is an agglomerated fluoride-basic welding flux for joint and build-up welding of various steels, but particularly suited for high-strength and cryogenic fine-grained structural steels. The flux can be welded using almost any wire electrode. The welding flux can be used with DC or AC power, and can be employed for tandem and multiple wire welding. It features good slag detachability.

Base materials

Unalloyed steels, creep resistant and highly creep resistant steels, low-temperature steels, fine-grained structural steels

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2	
15	35	20	25	

Operating data

Polarity = + / ~

basicity acc. Boniczewski:	3.5 Mol.%	2.6 weight %
grain size acc. EN ISO 14174:	3-20 (0.3-2.0 mm)	
flux consumption:	1.0 kg flux per kg wire	
re-drying:	300-350°C, 2 h	

Approvals and certificates

As wire-flux combination for BÖHLER BB 418 TT together with BÖHLER wires:
TÜV: EMS 2, EMS 2 Mo,3 NiMo 1-UP, DB: (51.014.04) EMS 2, EMS 2 Mo,

BÖHLER BB 418 TT

Typical analysis for wire and weld metal in wt. %:

Designation SAW Wires	*C*	*Si*	*Mn*	*Cr*	*Mo*	*Ni*	*EN ISO (wire) EN ISO (wire/flux comb)AWS A5.17 – AWS A5.23*
BÖHLER EMS 2	0.07	0.2	0.95				S 2 S 38 5 FB S2 F7A5-EM12K / F48A4-EM12K
BÖHLER EMS 2 Mo	0.07	0.2	0.95		0.45		S 2 Mo S 46 4 FB S2Mo F8A6-EA2-A2 / F55A5-EA2-A2
BÖHLER Ni 2-UP	0.06	0.25	0.95			2.25	S2Ni2 S 46 8 FB S2Ni2 F8A10-ENi2-Ni2 / F55A8-ENi2-Ni2
BÖHLER 3 NiMo 1-UP	0.08	0.25	1.55		0.55	0.9	S3Ni1Mo S 55 6 FB S3Ni1Mo F7A8-EH12K / F48A6-EH12K
BÖHLER 3 NiCrMo 2.5-UP	0.05	0.3	1.3	0.5	0.5	2.2	S3Ni2.5CrMo S 69 6 FB S3Ni2.5CrMo F11A8-EM4 (mod.)-M4H4 / F76A6-EM4 (mod.)-M4H4
BÖHLER EMS 2 CrMo	0.8	0.15	0.9	1.1	0.45		S CrMo1 S S CrMo1 FB F8P2-EB2-B2 / F55P3-EB2-B2
BÖHLER CM 2-UP	0.08	0.2	0.7	2.4	0.95		S CrMo2 S S CrMo2 FB F8P2-EB3-B3 / F55P3-EB3-B3

UV 418 TT

SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA FB 1 55 AC H5		

Characteristics and field of use

UV 418 TT is an agglomerated flux of fluoride basic type for joining and surfacing and applications with dissimilar steels. Mainly for high strength and cryogenic fine grained structural steels. The Si and Mn pick-ups and burn-off rates are neutral because of its metallurgical behaviour.
The flux is weldable with almost every wire electrode. When used in combination with Union S 3 Si wire electrode, the weld metal has high toughness properties up to –60 °C (–76 °F) and very good CTOD values up to –30 °C (–22 °F), so that this combination is outstandingly suited for offshore constructions. The flux can be used for tandem and multi wire welding with DC and AC.
Very good slag detachability.

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2	
15	38	20	25	

Operating data

Polarity = - / ~

basicity acc. Boniczewski: 3.5 Mol.% 2.6 weight %
grain size acc. EN ISO 14174: 3-20 (0.3-2.0 mm)
re-drying: 300-350°C, 2 h

Approvals	TÜV	DB	DNV	GL	LR	BV
Union S 2	10410	51.132.05				
Union S 2 Mo	11576	51.132.05				
Union S 2 Ni 2.5	11575					
Union S 3 Si	07276	51.132.05	X	X	X	X

UV 418 TT

Typical analysis for wire and weld metal in wt. %:

Designation	*C*	*Si*	*Mn*	*Cr*	*Mo*	*Ni*	*EN ISO 14171 / EN ISO 26304-A • AWS A5.17 – SFA 5.17 •• AWS A5.23 – SFA 5.23*
Union S 2 Weld metal	0.10 0.07	0.10 0.20	1.00 0.95				S 35 4 FB S2 F7A5-EM12 ••
Union S 2 Mo Weld metal	0.10 0.07	0.10 0.20	1.00 0.95		0.50 0.45		S 46 4 FB S2Mo F8A6-EA2-A2
Union S 2 Ni 2.5 Weld metal	0.10 0.07	0.10 0.20	1.00 0.95			2.30 2.20	S 46 8 FB S2Ni2 F8A10-ENi2-Ni2
Union S 2 Ni 3.5 Weld metal	0.09 0.06	0.15 0.20	0.90 0.85			3.30 3.20	S 46 8 FB S2Ni3 F8A15-ENi3-Ni3
Union S 2 NiMo 1 Weld metal	0.11 0.07	0.10 0.20	1.00 0.95		0.25 0.23	0.90 0.85	S 50 6 FB SZ2Ni1Mo F8A10-ENi1-Ni1
Union S 2 Si Weld metal	0.10 0.08	0.30 0.30	1.10 1.10				S 42 5 FB S2Si F7A6-EM12K ••
Union S 3 Weld metal	0.12 0.08	0.10 0.20	1.50 1.35				S 38 4 FB S3 F7A6-EH10K ••
Union S 3 Mo Weld metal	0.12 0.08	0.10 0.20	1.50 1.35		0.50 0.45		S 46 4 FB S3Mo F8A5-EA4-A4
Union S 3 NiMo Weld metal	0.08 0.06	0.10 0.20	1.50 1.40		0.45 0.40	1.50 1.40	S 50 6 FB S3Ni1.5Mo F9A8-EG-F1
Union S 3 NiMo 1 Weld metal	0.12 0.08	0.10 0.25	1.60 1.55		0.60 0.55	0.95 0.90	S 50 6 FB S3Ni1Mo F9A8-EG-F3
Union S 3 NiMoCr Weld metal	0.14 0.08	0.10 0.20	1.75 1.50	0.35 0.32	0.60 0.58	2.10 2.00	S 69 6 FB SZ3Ni2,5CrMo • F11A8-EG-F6
Union S 3 Si Weld metal	0.10 0.08	0.30 0.30	1.70 1.55				S 46 6 FB S3Si F7A8-EH12K ••

UV 421 TT

SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA FB 1 55 AC H5		

Characteristics and field of use

Agglomerated fluoride basic flux with high basicity and neutral metallurgical behaviour.
It is suitable for single (DC or AC) and tandem (DC and AC) welding.
Very good slag detachability. Excellent for narrow gap welding. UV 421 TT can be used in combination with suitable sub arc wires for joint welding of mild, medium alloyed and high tensile steels. Very good impact toughness of weld metal at low temperatures.

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2	
15	38	20	25	

Operating data

Polarity = + / ~

basicity acc. Boniczewski: 3.5 Mol.% 2.6 weight %
grain size acc. EN ISO 14174: 3-20 (0.3-2.0 mm)
re-drying: 300-350°C, 2 h

Approvals	TÜV	ABS	BV	WIWEB	GL	LR	DNV	DB
Union S 2	05497					X		51.132.06
Union S 2 Mo	03344					X		51.132.06
Union S 2 Ni 2.5	02213	X	X		X	X	X	51.132.06
Union S 3	05498					X	X	51.132.06
Union S 3 Si	10424					X	X	
Union S 3 NiMo				X	X			
Union S 3 NiMo1	10425					X	X	
Union S 3 NiMoCr	05063	X	X	X	X	X	X	51.132.06

UV 421 TT

Typical analysis for wire and weld metal in wt. %:

Designation	*C*	*Si*	*Mn*	*Cr*	*Mo*	*Ni*	*EN ISO* 14171 EN ISO 26304-A • AWS A5.17 – SFA 5.17 •• AWS A5.23 – SFA-5.23
Union S 2 Weld metal	0.10 0.07	0.10 0.20	1.00 1.05				S 35 4 FB S2 F7A6-EM12 ••
Union S 2 Mo Weld metal	0.10 0.07	0.10 0.20	1.00 1.05		0.50 0.47		S 46 4 FB S2Mo F8A4-EA2-A2
Union S 2 Ni 2.5 Weld metal	0.10 0.07	0.10 0.20	1.00 1.05			2.30 2.20	S 46 8 FB S2Ni2 F8A10-ENi2-Ni2
Union S 2 Ni 3.5 Weld metal	0.09 0.06	0.15 0.20	0.90 0.90			3.30 3.20	S 46 8 FB S2Ni3 F8A15-ENi3-Ni3
Union S 2 NiMo 1 Weld metal	0.11 0.08	0.10 0.20	1.00 1.05		0.25 0.22	0.90 0.85	S 50 6 FB SZ2Ni1 F8A8-ENi1-Ni1
Union S 3 Weld metal	0.12 0.08	0.15 0.25	1.50 1.50				S 38 5 FB S3 F7A6-EH10K ••
Union S 3 NiMo Weld metal	0.08 0.06	0.10 0.20	1.50 1.50		0.45 0.42	1.50 1.45	S 55 6 FB S3Ni1.5Mo F9A8-EG-F1
Union S 3 NiMo 1 Weld metal	0.12 0.08	0.10 0.20	1.60 1.55		0.60 0.55	0.95 0.90	S 55 6 FB S3Ni1Mo F9A8-EG-F3
Union S 3 NiMoCr Weld metal	0.14 0.08	0.10 0.20	1.75 1.60	0.35 0.32	0.60 0.58	2.10 2.00	S 69 6 FB SZ3Ni2.5CrMo • F11A8-EG-F6
Union S 3 Si Weld metal	0.10 0.08	0.30 0.30	1.70 1.55				S 46 5 FB S3Si F7A8-EH12K ••

UV 421 TT

Mechanical properties of the weld metal, as welded:

Wire electrodes used	*Yield strength 0.2%*	*Tensile strength*	*Elongation ($L_0=5d_0$)*	*Impact values in ≥ J CVN*				
	≥ MPa	*≥ MPa*	*≥ %*	*+20°C*	*± 0 °C*	*– 20 °C*	*– 40 °C*	*– 60 °C*
Union S 2	400	510	26	150	130	100	47	27
Union S 2 Mo	470	560	24	140	120	100	47	
Union S 2 Ni 2.5	470	550	24	160	140	120	80	60
Union S 2 Ni 3.5	470	560	25	160	140	120	100	47
Union S 2 NiMo 1	500	560	24	160	140	120	100	47
Union S 3	420	530	26	150	150	120	60	27
Union S 3 NiMo	560	620	22	140	120	100	80	47
Union S 3 NiMo1	560	640	22	140	120	100	70	47
Union S 3 NiMoCr	690	780	17	120	100	80	60	47
Union S 3 Si	460	550	26	150	120	80	60	47

* Average values from 3 tests

BÖHLER BB 24

SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA FB 1 65 DC H5		

Characteristics and field of use

Agglomerated, fluoride-basic welding flux characterised by its neutral metallurgical behaviour. In combination with suitable wire electrodes, the weld metal exhibits exceptional toughness properties in the low temperature range. The field of application is joint and build-up welding of general structural steels, fine-grained structural steels and creep resistant steel grades. The flux is one of the hydrogen controlled fluxes; the diffusible hydrogen content is max. 5 ml/100 g of weld metal.

Base materials

unalloyed steels, creep resistant and highly creep resistant steels, low-temperature steels, fine-grained steels

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2	
15	35	21	26	

Operating data

Polarity = + / ~

basicity acc. Boniczewski: 3.4 Mol.% 2.5 weight %
bulk density: 1.0 kg/dm^3
grain size acc. EN ISO 14174: 3-25 (0.3-2.5 mm)
flux consumption: 1.0 kg flux per kg wire
re-drying: 300-350°C, 2 h

Approvals and certificates

DB (51.014.02), NAKS; As wire-flux combination BÖHLER BB 24 together with BÖHLER wires:
TÜV: EMS 2, EMS 2 Mo, EMS 2 CrMo, CM 2-UP, 3 NiMo 1-UP

BÖHLER BB 24

Typical analysis for wire and weld metal in wt. %:

Designation SAW Wires	*C*	*Si*	*Mn*	*Cr*	*Mo*	*Ni*	*EN ISO (wire) EN ISO (wire/flux comb)AWS A5.17 – AWS A5.23*
BÖHLER EMS 2	0.07	0.25	1.2				S 2 S 38 6 FB S2 F7A8-EM12K / F48A6-EM12K
BÖHLER EMS 2 Mo	0.07	0.25	1.15		0.45		S 2 Mo S 46 4 FB S2Mo F8A4-EA2-A2 / F55A4-EA2-A2
BÖHLER Ni 2-UP	0.07	0.25	1.15			2.2	S2Ni2 S 46 6 FB S2Ni2 F8A8-ENi2-Ni2 / F55A6-ENi2-Ni2
BÖHLER 3 NiMo 1-UP	0.09	0.25	1.65		0.55	0.9	S3Ni1Mo S 50 4 FB S3Ni1Mo F9A4-EF3-F3 / F62A4-EF3-F3
BÖHLER 3 NiCrMo 2.5-UP	0.06	0.3	1.5	0.5	0.5	2.2	S3Ni2.5CrMo S 69 6 FB S 3Ni2.5CrMo F11A8-EM4(mod)-M4 / F76A6-EM4(mod)-M4
BÖHLER EMS 2 CrMo	0.08	0.25	0.95	1.1	0.45		S CrMo1 - F8P2-EB2-B2 / F55P3-EB2-B2
BÖHLER CM 2-UP	0.08	0.25	0.75	2.4	0.95		S CrMo2 - F8P2-EB3-B3 / F55P3-EB3-B3

UV 420 TT

SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA FB 1 65 DC H5		

Characteristics and field of use

UV 420 TT is an agglomerated flux of fluoride basic type for joining and surfacing applications with general purpose structural steels, fine grained structural steels and creep resistant steels. It is characterized by its neutral metallurgical behaviour. When used in combination with suitable wire electrodes the weld metal has high toughness properties at subzero temperatures.
It is suited for single wire and tandem welding.

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2	
15	35	21	26	

Operating data

Polarity = - / ~

basicity acc. Boniczewski: 3.4 Mol.% 2.5 weight %
grain size acc. EN ISO 14174: 3-20 (0.3-2.0 mm)
re-drying: 300-350°C, 2 h

Approvals:	TÜV	DB
Union S 2	03358	51.132.02
Union S 2 CrMo	01794	
Union S 2 Mo	01793	
Union S 3	01795	
Union S 3 Mo	01796	
Union S 3 NiMo	01797	
Union S 3 NiMo 1	03020	
Union S 3 NiMoCr	02206	

UV 420 TT

Typical analysis for wire and weld metal in wt. %:

Designation	*C*	*Si*	*Mn*	*Cr*	*Mo*	*Ni*	*V*	*W*	*Cu*	*EN ISO 14171* *EN ISO 26304*-A • EN ISO 24598-A ••• AWS A5.17 – SFA 5.17 •• *AWS A5.23 – SFA 5.23*
Union S 2 Weld metal	0.10 0.07	0.10 0.25	1.00 1.05							S 35 4 FB S2 F7A4-EM12 ••
Union S 2 Mo Weld metal	0.10 0.07	0.10 0.25	1.00 1.05		0.50 0.45					S 46 4 FB S2Mo F8A4-EA2-A2
Union S 3 Weld metal	0.12 0.08	0.10 0.25	1.50 1.50							S 38 4 FB S3 F7A4-EH10K ••
Union S 3 Mo Weld metal	0.12 0.08	0.10 0.25	1.50 1.50		0.50 0.45					S 46 4 FB S3Mo F8A4-EA4-A4
Union S 1 CrMo 2 Weld metal	0.10 0.07	0.10 0.25	0.50 0.75	2.40 2.25	1.00 0.95					S S CrMo2 FB ••• F9P0-EB3R-B3
Union S 2 CrMo Weld metal	0.12 0.08	0.10 0.25	0.80 0.95	1.20 1.10	0.50 0.45					S S CrMo1 FB ••• F8P0-EB2R-B2
Union S 2 Ni 2.5 Weld metal	0.10 0.07	0.10 0.25	1.00 1.05			2.50 2.40				S 46 6 FB S2Ni2 F8A8-ENi2-Ni2
Union S 3 NiMo Weld metal	0.08 0.06	0.10 0.25	1.50 1.50		0.45 0.40	1.50 1.40				S 50 6 FB S3Ni1.5Mo F9A8-EG-F1
Union S 3 NiMo 1* Weld metal	0.12 0.08	0.10 0.25	1.60 1.55		0.60 0.55	0.95 0.90				S 50 6 FB S3Ni1Mo F9A8-EG-F3
Union S 3 NiMoCr Weld metal	0.14 0.08	0.10 0.25	1.70 1.55	0.35 0.32	0.60 0.58	2.10 2.00				S 69 4 FB SZ3Ni2.5CrMo • F11A6-EG-F6

* Tramp elements Co and Ta, in conformidity with regulations on reactor construction

UV 420 TT

Mechanical properties of the weld metal, as welded:

Wire electrodes used	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in ≥ J CVN*			
	≥ MPa	*≥ MPa*	*≥ %*	*+20°C*	*±0 °C*	*– 20 °C*	*– 30 °C*
Union S 2	400	510	26	160	140	100	47
Union S 2 Mo	470	550	24	140	120	80	47
Union S 2 Ni 2.5	470	550	24	160	140	100	47
Union S 3	400	510	26	160	140	100	47
Union S 3 Mo	470	550	24	140	120	80	47
Union S 3 NiMo	560	620	22	160	140	80	47
Union S 3 NiMo 1	560	620	20	160	140	80	47
Union S 3 NiMoCr	690	760	17	100	80	60	47

* Average values from 3 tests

UV 420 TTR / UV 420 TTR-W

SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA FB 1 65 DC ; SA FB 1 65 AC		

Characteristics and field of use

UV 420 TTR is an agglomerated flux of fluoride basic type, mainly for joining and surfacing applications with creep resistant steels. It displays neutral metallurgical behaviour and is characterised by a high degree of purity. It is particularly suitable for welding hydrocrackers because of the low P pick-up of 0.004 % max. When used in combination with wire electrodes Union S 2 CrMo and Union S 1 CrMo 2 it is possible to meet the most stringent toughness requirements at subzero temperatures even after step-cooling treatment. UV 420 TTR-W permits sound welding on AC, by this achieving a higher level of toughness when welding with CrMo-alloyed sub arc wires.

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2	
15	35	21	26	

Operating data

Polarity = - / ~

basicity acc. Boniczewski: 3.4 Mol.% 2.5 weight %
grain size acc. EN ISO 14174: 3-20 (0.3-2.0 mm)
re-drying: 300-350°C, 2 h

Approvals	TÜV	LR
Union S 1 CrMo 2*	06541	
Union S 1 CrMo 2	02734	
Union S 2	03437	
Union S 2 CrMo	03439	
Union S 2 Mo	03438	
Union S 3	03440	X
Union S 3 Mo	03441	
Union S 3 NiMo	03442	
Union S 3 NiMo 1	03021 / 08015	
Union S 3 NiMoCr	03443	

* with UV 420 TTR-W, all others only with UV 420 TTR.

UV 420 TTR / UV 420 TTR-W

Typical analysis for wire and weld metal in wt. %:

Designation	*C*	*Si*	*Mn*	*Cr*	*Mo*	*Ni*	*EN ISO 14171* *EN ISO 24598-A •* *AWS A5.23 – SFA-5.23*
Union S 1 CrMo 2 Weld metal	0.10 0.07	0.10 0.20	0.50 0.75	2.40 2.25	1.00 0.95		S S CrMo2 FB • F9P2-EB3R-B3R
Union S 2 CrMo Weld metal	0.12 0.08	0.10 0.20	0.80 1.00	1.20 1.10	0.50 0.45		S S CrMo1 FB • F8P2-EB2R-B2
Union S 2 Mo Weld metal	0.10 0.07	0.10 0.20	1.00 1.05		0.50 0.45		S 46 4 FB S2Mo F8A4-EA2-A2
Union S 3 NiMo Weld metal	0.08 0.05	0.10 0.20	1.50 1.50		0.45 0.40	1.50 1.40	S 50 6 FB S3Ni1.5Mo F9A8-EG-F1
Union S 3 NiMo 1 Weld metal	0.12 0.08	0.10 0.20	1.60 1.55		0.60 0.55	0.95 0.90	S 50 4 FB S3Ni1Mo F9A6-EF3-F3-N

Mechanical properties of the weld metal, as welded:

Wire electrodes used	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in ≥ J CVN*				
	≥ MPa	*≥ MPa*	*≥ %*	*+20°C*	*± 0 °C*	*– 20 °C*	*– 40 °C*	*– 60 °C*
Union S 2 Mo	470	550	25	140	120	100	47	
Union S 3 NiMo	560	660	22	140	120	100	47	47
Union S 3 NiMo 1	560	680	22	140	120	100	47	27

* Average values from 3 tests

UV 420 TTR / UV 420 TTR-W

Mechanical properties of the weld metal of different heat treatments and test temperatures:

Wire electrodes used	*Heat Treatment*	*Test temperature 350°C**			*Test temperature 550°C*		
		Yield strength 0.2%	*Tensile strength*	*Elongation (L_0=5d_0)*	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*
		≥ MPa	*≥ MPa*	*≥ %*	*≥ MPa*	*≥ MPa*	*≥ %*
Union S 1 CrMo 2	a*	380^{+}	500^{+}	20^{+}	270	360	26
Union S 2 CrMo	a* n + a*	380 200	540 440	22 19	280 180	420 340	26 24
Union S 2 Mo	s n + a	370 220	570 420	24 25	280 170	380 310	26 30
Union S 3 NiMo	s n + a	450 320	600 510	20 25	320 220	410 350	24 28
Union S 3 NiMo 1	s so	420^{++} 420^{++}	590^{++} 580^{++}	24^{++} 24^{++}	290 190	410 330	25 32

a = tempered, 580 – 620 °C/Luft
a* = tempered, 670 – 700 °C

s = stress relieved, 580 – 620 °C
so = 60 h 550 °C + 40 h 620 °C/air
n = normalized, 920 °C/Luft

* = Average values from 3 tests
$^{+}$ = Values at test temperature 450 °C
$^{++}$ = Values at test temperature 400 °C

UV 420 TTR-C

SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA FB 1 65 DC		

Characteristics and field of use

UV 420 TTRC is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour. UV 420 TTRC is a special variant of flux UV 420 TTR. It supports the C-content of the wire electrode when DC-welding. In comparison with UV 420 TTR the C-content in the all weld metal is about 0.03 - 0.04 % higher. It is suitable for multipass welding, for single- and tandem-wire systems. UV 420 TTRC has prime importance for SAW of the high-temperature resistant steel, for joining and surfacing applications.

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2	
15	35	21	26	

Operating data

Polarity = - / ~

basicity acc. Boniczewski: 3.4 Mol.% 2.5 weight %
grain size acc. EN ISO 14174: 3-20 (0.3-2.0 mm)
re-drying: 300-350°C, 2 h

Weld metal with	*AWS A5.23*	*EN ISO 26304-A*
Union S 3 NiMo1	F10A6-EF3-F3	S 62 6 FB S3Ni1Mo

UV 310 P

SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA AB 1 55 AC H5		

Characteristics and field of use

UV 310 P is an agglomerated aluminate-basic flux with high basicity and neutral metallurgical behaviour. It is suitable for single electrode (DC+), twin electrodes (DC+) and tandem electrodes (DC+ and AC) welding. The flux is especially suited for Mn-, Mo-, Ti, and B or Mn-, Tiand B-alloyed wire electrodes like Union S 3 MoTiB and Union S 3 TiB. It is suited to achieve optimal charakteristics for the toughness of the weld metal.

UV 310 P is suitable for the welding of pipe steels according to API X 60, X 65, X 70, X 80 or acc. to EN 10208-2: L415 MB, L450 MB, L485 MB and L555 MB.

Note:
The mechanical-technological behaviour of the weld metal produced by the two-run technique (mainly the toughness) is not only influenced by the wire-/flux-combination but by many other factors such as:

- the influence of chemical composition of the parent metal due to the high dilution (60 up to 70%)
- the influence of the relative long cooling time t8/5 from the

welding heat by:
– welding parameter (heat input)
– wall thickness (two resp. three dimensional heat flow)
– preheat and interpass temperature

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
18	25	32	18

Operating data

Polarity = + / ~	basicity acc. Boniczewski:	2.2 Mol.% 1.5 weight %
	grain size acc. EN ISO 14174:	3-20 (0.3-2.0 mm)
	re-drying:	350-400°C, 2 h

BÖHLER BB 400

SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA AB 1 67 AC H5		

Characteristics and field of use

BÖHLER BB 400 is an agglomerated welding flux of the aluminate-basic type for joint and buildup welding of general structural steels, fine-grained structural steels, boiler and pipe steels. The welding flux is characterised by low silicon pick-up and medium manganese pick-up.
BÖHLER BB 400 can be welded using DC or AC power. Its good welding properties, and the good technical properties of the weld metals that can be achieved with different wire electrodes permit universal application.

Base materials

General structural steels, fine-grained structural, boiler and pipe steels.

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
20	30	28	16

Operating data

Polarity = + / - / ~

basicity acc. Boniczewski:	2.3 Mol.%	1.7 weight %
grain size acc. EN ISO 14174:	3-20 (0.3-2.0 mm)	
flux consumption:	1.0 kg flux per kg wire	
re-drying:	300-350°C, 2 h	

Typical analysis for wire and weld metal in wt. %:

Designation SAW Wires	*C*	*Si*	*Mn*	*Cr*	*Mo*	*Ni*	*EN ISO (wire) EN ISO (wire/flux comb)AWS A5.17 – AWS A5.23*
BÖHLER EMS 2	0.06	0.35	1.35				S 2 S 38 AB S2 F7A4-EM12K / F48A4-EM12K
BÖHLER EMS 2 Mo	0.06	0.35	1.35		0.35		S 2 Mo S 46 4 AB S2Mo F8A4-EA2-A4 / F55A4-EA2-A4

Approvals and certificates

DB (51.014.03)
As wire-flux combination BÖHLER BB 400 together with BÖHLER wires:
TÜV: EMS 2, EMS 2 Mo
DB: EMS 2, EMS 2 Mo

UV 400 — SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA AB 1 67 AC H5		

Characteristics and field of use

UV 400 is an agglomerated flux of aluminate basic type designedfor joining and surfacing applica tions with general-purpose structural steels, fine grained structural steels, boiler and pipe steels. The flux is characterized by its low silicon and moderate manganese pickup. It can be used on DC and AC. Its good welding characteristics and the technological properties of the weld metal produced with different wires permit universal use.

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2	
20	30	28	16	

Operating data

Polarity = - / ~

basicity acc. Boniczewski: 2.3 Mol.% 1.7 weight %
grain size acc. EN ISO 14174: 3-20 (0.3-2.0 mm)
re-drying: 300-350°C, 2 h

Typical analysis for wire and weld metal in wt. %:

Designation	*C*	*Si*	*Mn*	*Mo*	*EN ISO 14171* *AWS A5.17 – SFA 5.17* • *AWS A5.23 – SFA 5.23*
Union S 2 Weld metal	0.10 0.06	0.10 0.35	1.00 1.35		S 38 4 AB S2 F7A4-EM12 •
Union S 2 Mo Weld metal	0.10 0.06	0.10 0.35	1.00 1.35	0.50 0.45	S 46 4 AB S2Mo F8A4-EA2-A2
Union S 2 Si Weld metal	0.10 0.06	0.30 0.35	1.00 1.50		S 42 4 AB S2Si F7A4-EM12K •
Union S 3 Weld metal	0.12 0.07	0.10 0.35	1.50 1.60		S 42 4 AB S3 F7A4-EH10K •

UV 400

Mechanical properties of the weld metal, as welded:

Wire electrodes used	*Condition*	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in ≥ J CVN*			
		≥ MPa	*≥ MPa*	*≥ %*	*+20°C*	*± 0 °C*	*– 20 °C*	*– 40 °C*
Union S 2	u s n	400 355 290	480 480 460	22 25 22	120 140 80	100 120 60	60 100 47	47 47
Union S 2 Mo	u s	470 470	550 550	22 22	100 100	90 100	47 60	47 47
Union S 2 Si	u s	420 355	500 480	22 25	100 140	80 120	47 80	47 47
Union S 3	u s	420 380	500 500	22 25	120 140	120 120	60 100	47 47

* Average values from 3 tests

u = as welded
s = stress relieved: 580 °C / 5 h / air
n = normalized: 920 °C / 1 h / air

Approvals	TÜV	DB	ABS	BV	GL	LR	DNV
Union S 2	06170	51.132.03	X	X	X	X	X
Union S 2 Mo	06233	51.132.03	X	X	X	X	X

UV 309 P — SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA AB 1 65 AC H5		

Characteristics and field of use

UV 309 P is an agglomerated flux of the aluminate basic type with neutral metallurgical behaviour. It is especially suited for welding single and multi wire (DC and AC) when manufacturing longitudinal and spiral-seam pipes with two-run technique. For the two-run welding of pipe steels of API Grade A 25, A, B, X 42, X 46, X 52, X 56, X 60, X 65, X 70, X 80 and according to EN 10208-2 L290MB up to L555MB if welded in combination with corresponding sub arc wires such as Union S 2, Union S 2 Mo, Union S 2 NiMo1, Union S 3 NiMo 1.

Note:
The mechanical-technological behaviour of the weld metal produced by the two-run technique (mainly the toughness) is not only influenced by the wire-/flux-combination but by many other factors such as:

- the influence of chemical composition of the parent metal due to the high dilution (60 up to 70%)
- the influence of the relative long cooling time t8/5 from the
- welding heat by:
  – welding parameter (heat input)
  – wall thickness (two resp. three dimensional heat flow)
  – preheat and interpass temperature

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2	
22	26	30	15	

Operating data

Polarity = - / ~

basicity acc. Boniczewski: 2.1 Mol.% 1.4 weight %
grain size acc. EN ISO 14174: 3-20 (0.3-2.0 mm)
re-drying: 350-400°C, 2 h

UV 305 — SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA AR 1 76 AC H5		

Characteristics and field of use

UV 305 is an agglomerated flux of aluminate-rutile type for joining and surface welding. Suited for direct and alternating current. The flux is suited for butt welding in two-run technique and for sheet thickness up to 10 mm for fillet welding. It is especially suited for welding tube walls.

Suited sub-arc wires:
Union S 2, S 2 Si, S 2 Mo and for boiler walls also Union S 2 CrMo, S 1 CrMo 2, Union S P24. It has outstanding good slag detachability (even in narrow grooves) and allows high welding speed.

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	Al_2O_3+MnO	CaF_2+CaO+ MgO	
30	55	8	

Operating data

Polarity = - / ~

basicity acc. Boniczewski: 0.7 Mol.% 0.6 weight %
grain size acc. EN ISO 14174: 4 - 14 (0.4-1.4 mm)
re-drying: 300-350°C, 2 h

TÜV approvals (for membrane walls)

Union S 2 Mo, Union S 2 CrMo, Union S 1 CrMo2, Union SP 24

UV 306 — SAW Flux

Classifications		unalloyed
EN ISO 14174:		
SA AR 1 77 AC H5		

Characteristics and field of use

UV 306 is an agglomerated flux designed for joining applications on general-purpose structural and pipe steels. Suitable for use on DC and AC. For single- and multi-wire welding with high welding speed using the two-run technique as well as for fillet welding. Very good slag removability.

Composition of Sub-arc Welding Flux

SiO_2+TiO_2	Al_2O_3+MnO	CaF_2+ CaO+MgO	
24	50	14	

Operating data

Polarity = - / ~

basicity acc. Boniczewski: 0.8 Mol.% 0.6 weight %
grain size acc. EN ISO 14174: 3 - 16 (0.3 - 1.6 mm)
re-drying: 300-350°C, 2 h

Typical analysis for wire and weld metal in wt. %:

Designation	*C*	*Si*	*Mn*	*Mo*	*EN ISO 14171* *AWS A5.17 – SFA 5.17* • *AWS A5.23 – SFA 5.23*
Union S 2 Weld metal	0.10 0.06	0.10 0.60	1.00 1.40		S 42 3 AR S2 F7A2-EM12 •
Union S 2 Mo Weld metal	0.10 0.06	0.10 0.60	1.00 1.40	0.50 0.45	S 46 2 AR S2Mo F8A2-EA2-A2
Union S 2 Si Weld metal	0.10 0.06	0.30 0.75	1.00 1.60		S 42 2 AR S2Si F7A2-EM12K •
Union S 3 Weld metal	0.12 0.07	0.10 0.60	1.50 1.60		S 42 3 AR S3 F7A2-EH10K •

UV 306

Mechanical properties of the weld metal, as welded:							
Wire electrodes used	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in ≥ J CVN*			
	≥ MPa	*≥ MPa*	*≥ %*	*+20°C*	*± 0 °C*	*– 20 °C*	*– 30 °C*
Union S 2	420	530	22	80	60	47	47
Union S 2 Mo	470	550	22	70	60	47	28
Union S 2 Si	420	540	22	70	50	47	28
Union S 3	420	520	22	80	60	47	47
* Average values from 3 tests							

Approvals	TÜV	DB	ABS	GL	LR	DNV
Union S 2	02590	51.132.04	X	X	X	X
Union S 2 Mo	07739					
Union S 2 Si					X	

Avesta Flux 805 SAW Flux

Classifications		high-alloyed
EN ISO 14174:		
SA AF 2 Cr DC		

Characteristics and field of use

Avesta Flux 805 is a basic, slightly chromiumcompensated agglomerated flux. It is primarily designed for welding with high-alloyed stainless fillers such as Avesta P12, 904L and 2205. Standard Cr-Ni and Cr-Ni-Mo fillers can also be welded with excellent results. Flux 805 is especially suitable for applications where high impact strength values are required. Flux 805 provides neat weld surfaces, very good welding properties and easy slag removal.

- Bulk density: 1.0 kg/dm^3
- Basicity index: 1.7 (Boniszewski)
- Consumption: 0.5 kg flux/kg wire (26 V) 0.8 kg flux/kg wire (34 V)

Flux care
The flux should be stored indoors in a dry place. Moist flux can be redried at 250 – 300°C for 2 hours. Both heating and cooling must be carried out slowly.

Basic materials

For welding with submerged arc wire such as Avesta Welding
LDX 2101, 2304, 2205, 2507/P100, 904L, P12 and P16, but also with 308L/MVR, 347/MVNb, 316L/SKR, 318/SKNb, 309L and P5

Typical analysis for wire and weld metal in wt. %:

Designation	*C*	*Si*	*Mn*	*Cr*	*Ni*	*Mo*	*FN**
316L/SKR	0.02	0.6	1.2	19.5	12.0	2.6	11
2205	0.02	0.7	1.0	23.5	8.0	3.1	50
P12	0.01	0.3	0.1	22.0	bal.	8.5	

* According to WRC-92.

Wire electrodes used	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	≥ MPa	*≥ MPa*	*≥ %*	*+20°C*	*– 40°C*	*– 196°C*
316L/SKR	415	560	36	80	40	35
2205	600	800	27	100	70	

BÖHLER BB 202

SAW Flux

Classifications		high-alloyed
EN ISO 14174:		
SA FB 2 DC		

Characteristics and field of use

Agglomerated, fluoride-basic welding flux for joint welding to Cr steels and to unstabilised or stabilised austenitic CrNi(Mo) steels and to austenitic-ferritic duplex steels. The BÖHLER BB 202 flux yields a well-flowed, smooth seam, a very thin slag and therefore a low flux consumption. The flux also features good slag detachability and good fillet welding properties.

Base materials

Cr steels and unstabilised or stabilised austenitic CrNi(Mo) steels, as well as austenitic-ferritic duplex steels

Composition of Sub-arc Welding Flux

SiO_2	Al_2O_3	CaF_2	
10	38	50	

Operating data

Polarity = ±

basicity acc. Boniczewski:	2.3 Mol.%
bulk density:	1.0 kg/dm³
grain size acc. EN ISO 14174:	4-14 (0.4-1.4 mm)
flux consumption:	0.7 kg flux per kg wire
re-drying:	300-350°C, 2 h

Typical analysis for wire and weld metal in wt. %:

Designation SAW Wires	*C*	*Si*	*Mn*	*Cr*	*Mo*	*Ni*	*EN ISO (wire) A5.17 – AWS A5.23*
BÖHLER EAS 4 M-U	0.02	0.6	1.2	18.0	2.8	12.2	S 19 12 3 L ER316L

Approvals and certificates

BÖHLER BB 202 together with BÖHLER EAS 4 M-UP: TÜV

Marathon 431

SAW Flux

Classifications		high-alloyed
EN ISO 14174:		
SA FB 2 DC		

Characteristics and field of use

Marathon 431 is an agglomerated basic welding flux for welding stainless high alloyed CrNi(Mo) steels. The weld seams are smooth and finely rippled without any slag residues. Besides the good slag detachability the flux also provides good fillet weld properties. The weld metals show high degree of purity and good mechanical properties.

Composition of Sub-arc Welding Flux

SiO_2	Al_2O_3	CaF_2	
10	38	50	

Operating data

Polarity = ±

basicity acc. Boniczewski: 2.3 Mol.%
grain size acc. EN ISO 14174: 4 - 14 (0.4 - 1.4 mm)
re-drying: 300-350°C, 2 h

Typical analysis for wire and weld metal in wt. %:

Designation	*C*	*Si*	*Mn*	*Cr*	*Mo*	*Ni*	*Nb*	*N*
Thermanit A Weld metal	0.040 0.038	0.50 0.60	1.7 1.2	19.5 19.0	2.8 2.8	11.5 11.5	0.65 0.50	
Thermanit GE-316L Weld metal	0.012 0.012	0.50 0.60	1.7 1.2	18.5 18.0	2.8 2.8	12.2 12.2		
Thermanit H-347 Weld metal	0.040 0.038	0.50 0.60	1.8 1.3	19.5 19.0		9.5 9.5	0.65 0.50	
Thermanit JE-308L Weld metal	0.016 0.015	0.50 0.60	1.8 1.3	20.0 19.5		9.8 9.8		
Thermanit 22/09 Weld metal	0.015 0.013	0.40 0.50	1.6 1.1	23.0 22.5	3.2 3.2	8.8 8.8		0.15 0.15
Thermanit 25/14 E-309L Weld metal	0.014 0.013	0.50 0.60	1.8 1.3	24.0 23.8		13.2 13.2		

Marathon 431

Mechanical properties of the weld metal, as welded:

Designation	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN at RT*
	≥ MPa	*≥ MPa*	*≥ %*	*≥ J*
Thermanit A	380	550	30	70
Thermanit GE-316L	350	550	30	70
Thermanit H-347	380	550	30	65
Thermanit JE-308L	320	550	35	65
Thermanit 22/09	480	690	25	80
Thermanit 25/14 E-309L	380	600	30	100

Examples of application

Material specification	*Material No.*	*Designation*
X2CrNiMoN22-5	1.4462	Thermanit 22/09
X6CrNiMoTi17-12-2	1.4571	Thermanit A
X2CrNiMo17-13-2	1.4404	Thermanit GE-316L
X6CrNiNb18-9	1.4550	Thermanit H-347
X2CrNi19-11	1.4306	Thermanit JE-308L

Approvals	TÜV	ABS	DNV	GL	LR
Thermanit A	06985				
Thermanit GE-316L	06113				
Thermanit H-347	06479				
Thermanit JE-308L	06114				
Thermanit 22/09	06112	X	X	X	X

Marathon 543 — SAW Flux

Classifications		high-alloyed
EN ISO 14174:		
SA FB 2 55 DC H5		

Characteristics and field of use

Marathon 543 is an agglomerated flux of fluoride basic type with a high basicity. Outstanding good welding properties. For joining and surfacing applications of creep resistant CrMo steels such as e.g. 12CrMo19-5 (Mat. No. 1.7362), P 91/T 91, X10CrMoVNb9-1 (Mat. No. 1.4903), P92/T92, X20CrMoWV12-1 (Mat. No. 1.4935). In combination with the new sub arc wires Thermanit MTS 616 the flux is suited for welding steels of type P 92 according to ASTM A 335.

Composition of Sub-arc Welding Flux

$SiO_2 + Al_2O_3$	$CaF_2 + CaO + MgO$	
35	60	

Operating data

Polarity = - / ~

basicity acc. Boniczewski:
grain size acc. EN ISO 14174: 3 – 20 (0.3 – 2.0 mm)
re-drying: 300-350°C, 2 h

Approvals	TÜV
Thermanit MTS 3	06527
Thermanit MTS 616	09391

Typical analysis for wire and weld metal in wt. %:

Marke	*C*	*Si*	*Mn*	*Cr*	*Mo*	*Ni*	*V*	*Nb*	*N*	*W*
Thermanit MTS 3	0.11	0.25	0.50	9.00	0.95	0.40	0.22	0.06	0.05	
Weld metal	0.09	0.22	0.70	8.90	0.93	0.40	0.18	0.05	0.04	
Thermanit MTS 616	0.11	0.25	0.50	8.90	0.45	0.40	0.22	0.06	0.05	1.70
Weld metal	0.09	0.22	0.70	8.80	0.43	0.40	0.18	0.05	0.04	1.70

Mechanical properties of the weld metal, as welded:

Designation	*Heat Treatment*	*Test temp.*	*Yield strength 0.2%*	*Tensile strength*	*Elongation ($L_0=5d_0$)*	*Impact values in J CVN*
		°C	*≥ MPa*	*≥ MPa*	*≥ %*	*≥ J*
Thermanit MTS 3	750 °C / 4 h	+ 20 °C 400 460 500	540 400 380 360	700 540 500 360	18 14 14 14	47
Thermanit MTS 616	760 °C / 4 h	+ 20 °C 600	560 290	700 350	18 16	41

*Special heat treatment

Avesta Flux 801

SAW Flux

Classifications		high-alloyed
EN ISO 14174:		
SA CS 2 Cr DC		

Characteristics and field of use

Avesta Flux 801 is a neutral chromiumcompensated agglomerated flux. It is a generalpurpose flux designed for both joint welding stainless steel and for cladding onto unalloyed or low-alloyed steel. Flux 801 can be used in combination with all types of stabilised and non-stabilised Cr-Ni and Cr-Ni-Mo fillers. It provides neat weld surfaces, very good welding properties and easy slag removal. Flux 801 is chromium-alloyed to compensate for losses in the arc during welding.

- Bulk density: 0.8 kg/dm3
- Basicity index: 1.0 (Boniszewski)
- Consumption: 0.4 kg flux/kg wire (26 V) 0.7 kg flux/kg wire (34 V)

Flux care

The flux should be stored indoors in a dry place. Moist flux can be redried at 250 – 300°C for 2 hours. Both heating and cooling must be carried out slowly.

Basic materials

For welding with submerged arc wire such as Avesta Welding 308L/MVR, 316L/SKR, 309L and P5

Typical analysis for wire and weld metal in wt. %:

Designation	*C*	*Si*	*Mn*	*Cr*	*Ni*	*Mo*	*FN**
308L/MVR	0.02	0.9	1.0	20.0	9.5		11
316L/SKR	0.02	0.9	1.0	19.0	12.0	2.6	10

* According to WRC-92.

Wire electrodes used	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in ≥ J CVN*		
	≥ MPa	*≥ MPa*	*≥ %*	*+20°C*	*– 40 °C*	*– 60 °C*
308L/MVR	410	590	37	65	40	35
316L/SKR	430	580	36	70	60	30

Chapter 5.1 - Flux cored wire (unalloyed, low-alloyed)

Product name	EN ISO		AWS		P
BÖHLER Ti 52-FD	EN ISO 17632-A	T 46 4 P M 1 H10/T 42 2 P C 1 H5	AWS A5.36	E71T1-M21A4-CS1-H8/ E71T1-C1A2-CS1-H4	402
Union TG 55 M	EN ISO 17632-A	T 46 4 P M 1 H10/T 42 2 P C 1 H5	AWS A5.20	E71T-1MJH8/E71T-1CH4	403
BÖHLER PIPESHIELD 71 T8-FD	-	-	AWS A5.36	E71T8-A4-K6	404
BÖHLER PIPESHIELD 81 T8-FD	-	-	AWS A5.36	E81T8-A4-Ni2	405
BÖHLER Ti 60-FD	EN ISO 17632-A	T 50 6 1Ni P M 1 H5	AWS A5.36	E81T1-M21A8-Ni1-H4	406
BÖHLER Ti 70 Pipe-FD	EN ISO 18276-A	T 55 4 Mn1Ni P M 1 H5	AWS A5.36	E91T1-M21A4-G	407
BÖHLER DMO Ti-FD	EN ISO 17634-A	T MoL P M 1	AWS A5.36	A81T1-M21PY-A1H8	408
BÖHLER DCMS Ti-FD	EN ISO 17634-A	T CrMo1 P M 1 H10	AWS A5.36	E81T1-M21PY-B2H8	409

BÖHLER Ti 52-FD

Flux cored wire

Classifications unalloyed rutile

EN ISO 17632-A:	AWS A5.36:
T 46 4 P M 1 H10; T 42 2 P C 1 H5	E71T1-M21A4-CS1-H8; E71T1-C1A2-CS1-H4

Characteristics and field of use

Rutile flux cored wire with fast freezing slag. Outstanding welding properties in all positions. Excellent mechanical properties and good slag detachability, low spatter losses, smooth, finely rippled seam surface, high X-ray security, notch-free weld toes. Out-of-position welding can be carried out with increased welding current, and therefore very economically with increased deposition rate.

Base materials

Steels up to a yield strength of 460 MPa (67 ksi) (shielding gas M21)
S235JR-S355JR, S235JO-S355JO, S450JO, S235J2-S355J2, S275N-S460N, S275M-S460M, P235GH-P355GH, P275NL1-P460NL1, P215NL, P265NL, P355N, P285NH-P460NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NBL415NB, L450QB, L245MB-L450MB, GE200-GE240, shipbuilding steels: A, B, D, E, A 32-E 36
ASTM A 106 Gr. A, B, C; A 181 Gr. 60, 70; A 283 Gr. A, C; A 285 Gr. A, B, C; A 350 Gr. LF1; A 414 Gr. A, B, C, D, E, F, G; A 501 Gr. B; A 513 Gr. 1018; A 516 Gr. 55, 60, 65, 70; A 573 Gr. 58, 65, 70; A 588 Gr. A, B; A 633 Gr. C, E; A 662 Gr. B; A 711 Gr. 1013; A 841 Gr. A; API 5 L Gr. B, X42, X52, X56, X60, X65

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Ti	
0.06	0.5	1.2	0.05	

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-20°C:*	*-40°C:*
untreated	500	580	26	180	130	90

Operating data

Polarity = +

re-drying:
if necessary: 150°C/24 h
Shielding gas:
Argon + 15-25% CO_2
100% CO_2
Welding with conventional MAG devices.

Dimensions (mm)

1.2	*1.6*				

Approvals and certificates

TÜV (11164.), DB (42.014.35), ABS, GL, LR, DNV, BV, CRS, CE

Union TG 55 M

Flux cored wire

Classifications		unalloyed rutile
EN ISO 17632-A:	AWS A5.20:	
T 46 4 P M 1 H10; T 42 2 P C 1 H5	E71T-1MJH8; E71T-1CH4	

Characteristics and field of use

Union TG 55 M is an all position flux cored wire that displays exceptional high impact properties in the as welded as well as in the stress relieved condition with mixed gas M21 acc. to EN ISO 14175. This “welder friendly” wire with its soft, spatterfree arc always operates in the spray arc mode. It is possible to weld in all positions with one diameter (1.2 mm from 160 A to 250 A), so ideal for fit-up work. Deposition rates in vertical-up welding can reach 2.2 - 5.5 kg/h, making it one of the most productive consumables available. Because of spray arc operation, typical positional welding defects like lack of fusion and slag inclusions are avoided. The wire has a high tolerance for poor weld preparations. The slag is easily to detach. Good bead appearance with smooth tie-in. Single sided root runs are made economically on ceramic backing. Commercial application include construction, shipbuilding railcar and heavy equipment industries.

Base materials

S185, S235J2G3, S275JR, S355J2G3 (St 33, St 37-3N, St44-2, QSt 52-3N), E295 (St 50-2, P235GH, P265GH, P295GH, P355GH (HI, HII, 17 Mn 4, 19 Mn 6), P275N, P355N, P355NL2, P460N (StE 285, EstE 285, EstE 355, StE 460), S275N, S275NL, S355N, S355NL, S460N (StE 285, TStE 285, StE 355, TStE 355, StE 460), L210, L240, L290, L360 (StE 210.7, StE 240.7, StE 290.7, StE 360.7), L290NB, L360MB, L415MB (StE 290.7 TM, StE 360.7 TM, StE 415.7 TM), X42 / StE 290.7 TM – X65 / StE 445.7 TM (API-5LX), GS-38 – GS-52,

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	P	S	
0.05	0.45	1.35	≤ 0.015	≤ 0.015	

Mechanical properties of all-weld metal

Heat Treatment	*Shielding Gas*	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
		MPa	*MPa*	*%*	*+20°C:*	*-40°C:*
AW	M21	460	560	24	140	80
580°C/2h	M21	420	500	26	140	50
AW	C1	420	520	24	140	70

Operating data

Polarity = +

Shielding gas (EN ISO 14175):
M1- M3 and C1

Dimensions (mm)	*Amperage A*
1.2	*150-350*

Approvals and certificates

TÜV (1831.), DB (42.132.14)

BÖHLER PIPESHIELD 71 T8-FD

Self-shielding flux cored wire

Classifications	low-alloy pipeline
	AWS A5.36:
	E71T8-A4-K6

Characteristics and field of use

Self-shielding flux cored wire is specially developed for pipeline welding in the vertical down position (5G). Can also be used for welding unalloyed steel constructions. BÖHLER Pipeshield 71 T8-FD offers a fast freezing, easily removable slag, good welding properties, easy handling for the welder and high productivity. The wire has good mechanical properties and high impact energy values at low temperatures. Advantages in vertical down welding for hot pass, filler pass and cover pass welding. Thanks to the fluoride-basic core, the interpass temperature is similar to that of basic electrodes; we recommend 80-200°C. BÖHLER self-shielding flux cored wire offers easy handling for the welder as a result of the tolerant stick out. It also offers a low tendency to porosity, even when welded with relatively long arcs.

Base materials

According to API 5L: A, B, X42, X46, X52, X56, X60, (X65, X70)

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Al	Ni
0.045	0.14	1.1	0.8	0.7

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-30°C:*	*-40°C:*
untreated	435	535	28	200	150	100

Operating data

Polarity = -

no shielding gas
recommended stick out: 10-25 mm

Dimensions (mm)

2.0

Approvals and certificates

NAKS, GAZPROM

BÖHLER PIPESHIELD 81 T8-FD

Self-shielding flux cored wire

Classifications	low-alloy pipeline
	AWS A5.36:
	E81T8-A4-Ni2

Characteristics and field of use

BÖHLER Pipeshield 81 T8-FD is a self-shielding flux cored wire, and is specially developed for semiautomatic pipeline welding in the vertical down position (5G). Can also be used for welding low-alloy steel constructions. This wire offers a fast freezing, easily removable slag, and good welding properties in all positions. BÖHLER Pipeshield 81 T8-FD offers good mechanical properties and consistently high impact energy values at low temperatures. It offers advantages in vertical down welding for hot pass, filler pass and cover pass welding. Thanks to the fluoride-basic core, the interpass temperature is similar to that of basic electrodes; we recommend 80-200°C. BÖHLER self-shielding flux cored wire offers easy handling for the welder as a result of the tolerant stick out. It also offers a low tendency to porosity, even when welded with relatively long arcs.

Base materials

According to API 5L: X65, X70

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Al	Ni
0.05	0.15	1.4	0.8	1.95

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-30°C:*	*-40°C:*
untreated	500	600	25	170	120	90

Operating data

Polarity = -

no shielding gas
recommended stick out: 10-25 mm

Dimensions (mm)

2.0

Approvals and certificates

NAKS, GAZPROM

BÖHLER Ti 60-FD

Flux cored wire

Classifications	low-alloy rutile high strength
EN ISO 17632-A:	AWS A5.36:
T 50 6 1Ni P M 1 H5	E81T1-M21A8-Ni1-H4

Characteristics and field of use

Rutile flux cored wire with fast freezing slag for welding low-temperature steels. Outstanding welding properties in all positions. Exceptional mechanical strength and good slag detachability, low spatter losses, smooth, finely rippled seam surface, notch-free weld toes. Out-of-position welding can be carried out with increased welding current, and therefore very economically with increased deposition rate. For high-quality welding in shipbuilding, for offshore applications and steel structures with high strength requirements, as well as for low-temperature applications down to -60°C.

Base materials

general structural steels, pipe and boiler steels, cryogenic fine-grained structural steels and special qualities. S355JR, S355J0, S355J2, S450J0, S355N-S460N, S355NL-S460NL, S355M-S460M, S355ML-S460ML, S460Q, S500Q, S460QL, S500QL, S460QL1, S500QL1, P355GH, P355NH, P420NH, P460NH, P355N-P460N, P355NH-P460NH, P355NL1-P460NL1, P355NL2-P460NL2, L245NB-L415NB, L245MB-L485MB, L360QB-L485QB, aldur 500Q, aldur 500QL, aldur 500QL1 ASTM A 350 Gr. LF2; A 516 Gr. 65, 70; A 572 Gr. 42, 50, 60, 65; A 573 Gr. 70; A 588 Gr. B, C, K; A 633 Gr. A, C, D, E; A 662 Gr. B, C; A 678 Gr. B; A 707 Gr. L2, L3; A 841 Gr. A, B, C; API 5 L X42, X52, X60, X65, X70, X52Q, X60Q, X65Q, X70Q

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Ni	
0.06	0.45	1.3	0.9	

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*			
	MPa	*MPa*	*%*	*+20°C:*	*-20°C:*	*-40°C:*	*-60°C:*
untreated	530	570	27	140	120	100	60

Operating data

Polarity = +

re-drying: -
if necessary: 150°C / 24 h
Shielding gas:
Argon + 15-25% CO_2
Welding with conventional MAG devices.
Preheating and interpass temperature as required by the base metal.

Dimensions (mm)

1.2

Approvals and certificates

TÜV (12544.), DB (42.014.42), GL (6Y46H5S), DNV, ABS, LR, BV, CE

BÖHLER Ti 70 Pipe-FD

Flux cored wire

Classifications	low-alloy rutile high strength
EN ISO 18276-A:	AWS A5.36:
T 55 4 Mn1Ni P M 1 H5	E91T1-M21A4-G

Characteristics and field of use

Micro-alloyed rutile flux cored wire for single and multi-pass welding of carbon-manganese steels and high-strength steels using Ar-CO2 shielding gas. Outstanding welding properties in all positions, exceptional bead appearance, no spatter, fast freezing, easily removable slag. The unusual mechanical properties of this wire even at low temperatures (-40°C), along with its low hydrogen content, make it particularly useful for laying pipelines. Other applications are found in the offshore industry, in shipbuilding, and for constructions using high-strength steels.

Base materials

Pipe steels and fine-grained structural steels S460-S500N, S460NL-S500NL, S500NC-S550NC, L450MB-L485MB (L555MB) API spec. 5L: X65, X70, (X80)

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Ni	
0.07	0.5	1.5	0.95	

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*-40°C:*
untreated	≥ 550	640-820	≥ 18	≥ 47

Operating data

Polarity = +

re-drying if necessary: 150°C/24 h
Shielding gas:
Ar + 15-25% CO_2
14-20 l/min
Welding with conventional MAG devices.
The product is available on 5 kg and 16 kg spools.
Preheating and interpass temperature as required by the base metal.

Dimensions (mm)

1.2

Approvals and certificates

TÜV (12279.), CE, GAZPROM

BÖHLER DMO Ti-FD

Flux cored wire

Classifications	low-alloy rutile creep resistant
EN ISO 17634-A:	AWS A5.36:
T MoL P M 1	A81T1-M21PY-A1H8

Characteristics and field of use

BÖHLER DMO Ti-FD is a flux cored wire for welding in boiler, pressure vessel, pipeline and steel construction, preferably for creep resistant steel qualities with 0.5% Mo. The fast-hardening slag makes this flux cored wire particularly suitable for out-of-position welding, where significant savings in time and cost can be achieved through the use of a higher welding current. It is characterised by easy welding and spray arc welding in all welding positions. Good slag detachability, low spatter losses, smooth, clean-flowing seam profiles in X-ray quality are further characteristics of this flux cored wire.

Base materials

similar alloy creep resistant steels and cast steel 16Mo3, S235JR-S355JR, P195TR1-P265TR1, L245NB-L415NB, L450QB, L245MB-L450MB, GE200-GE300 ASTM A 29 Gr, 1016; A 106 Gr. A, B; A 182 Gr. F1; A 234 Gr. WP1; A 283 Gr., C, D; A 335 Gr. P1; A 501 Gr. B; A 510 Gr. 1013; A 512 Gr. 1021, 1026; A 513 Gr. 1021, 1026; A 711 Gr. 1013; API 5 L B, X42, X52, X60, X65

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Mo
0.04	0.25	0.75	0.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	540	600	23	120
annealed*	510	570	23	140

*620°C/1 h/furnace down to 300°C/air – shielding gas Ar + 18% CO_2

Operating data

Polarity = +

re-drying: –
in exceptional cases: 150°C/24 h
Shielding gas: Argon + 15-25% CO_2
Adapt the preheating and interpass temperatures and the subsequent heat treatment to the base material. Preheating to ≥ 150°C is recommended for thick components. Stress-relief at between 600°C and 630°C for a minimum duration of one hour.

Dimensions (mm)	*Amperage A*
1.2	*150-330*

Approvals and certificates

TÜV (11120.), CE

Similar alloy filler metals

GTAW rod:	*DMO-IG* *EMS 2 Mo/BB 400*	*SAW combination:*	*EMS 2 Mo/BB 24* *FOX DMO Ti* *EMS 2 Mo/BB 306*
SMAW electrode:	*FOX DMO Kb*	*GMAW solid wire:*	*DMO-IG* *EMS 2 Mo/BB 418 TT*
Gas welding rod:	*DMO* *EMS 2 Mo/BB 421 TT*		

BÖHLER DCMS Ti-FD

Flux cored wire

Classifications	low-alloy rutile creep resistant
EN ISO 17634-A:	AWS A5.36:
T CrMo1 P M 1 H10	E81T1-M21PY-B2H8

Characteristics and field of use

The BÖHLER DCMS Ti-FD welding consumable is a low-alloy, slagging flux cored wire with rutile core for welding in boiler, pressure vessel and pipeline construction, preferably for the creep resistant steel qualities alloyed with 1% chromium and 0.5% molybdenum. The fast-hardening slag makes this flux cored wire particularly suitable for out-of-position welding, where significant savings in time and cost can be achieved through the use of a higher welding current.

Base materials

same alloy creep resistant steels and cast steel, case-hardening and nitriding steels with comparable composition, heat treatable steels with comparable composition with tensile strengths up to 780 MPa, steels resistant to caustic cracking 1.7335 13CrMo4-5, 1.7262 15CrMo5, 1.7728 16CrMoV4, 1.7218 25CrMo4, 1.7225 42CrMo4, 1.7258 24CrMo5, 1.7354 G22CrMo5-4, 1.7357 G17CrMo5-5 ASTM A 182 Gr. F12; A 193 Gr. B7; A 213 Gr. T12; A 217 Gr. WC6; A 234 Gr. WP11; A335 Gr. P11, P12; A 336 Gr. F11, F12; A 426 Gr. CP12

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Mo	P	As	Sn	Sb
0.06	0.22	0.75	1.2	0.47	<0.015	<0.005	<0.005	<0.005

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
annealed*	≥ 460	555-740	≥ 20	≥ 47

*690°C/1 h – shielding gas Ar + 18% CO_2

Operating data

Polarity = +

re-drying: –
in exceptional cases: 150°C/24h
Shielding gas:
Argon + 15-25% CO_2
Adapt the preheating and interpass temperatures and the subsequent heat treatment to the base material.

Dimensions (mm)	*Amperage A*
1.2	*150-330*

Approvals and certificates

TÜV (11162.), CE

Similar alloy filler metals

SMAW electrode:	*FOX DCMS Kb*	*SAW combination:*	*EMS 2 CrMo/BB 24*
GTAW rod:	*DCMS-IG* *EMS 2 CrMo/BB 24 SC*	*GMAW solid wire:*	*DCMS-IG* *EMS 2 CrMo/BB 418 TT*
Gas welding rod:	*DCMS* *FOX DCMS Ti*		

Chapter 5.2 - Flux cored wire (high-alloyed)

Product name	EN ISO		AWS		P
Avesta FCW-2D 308L/MVR	EN ISO 17633-A	T 19 9 L P M21 3/T 19 9 L P C1 3	AWS A5.22	E308LT0-4/1	412
Avesta FCW 308L/MVR-PW	EN ISO 17633-A	T 19 9 L R M21 3/T 19 9 L R C1 3	AWS A5.22	E308LT1-4/1	413
BÖHLER EAS 2-FD	EN ISO 17633-A	T 19 9 L R M21 3/T 19 9 L R C1 3	AWS A5.22	E308LT0-4/1	414
BÖHLER EAS 2 PW-FD	EN ISO 17633-A	T 19 9 L P M21 1/T 19 9 L P C1 1[3]	AWS A5.22	E308LT1-4/1	415
Thermanit TG 308 L	EN ISO 17633-A	T 19 9 L R M21 3/T 19 9 L R C1 3	AWS A5.22	E308LT0-4/1	416
Avesta FCW-2D 309L	EN ISO 17633-A	T 23 12 L P M21 (C1) 3	AWS A5.22	E309LT0-4/1	417
Avesta FCW 309L-PW	EN ISO 17633-A	T 23 12 L P M21 1/T 23 12 L P C1 1	AWS A5.22	E309LT1-4/1	418
BÖHLER CN 23/12-FD	EN ISO 17633-A	T 23 12 L R M21 3/T 23 12 L R C1 3	AWS A5.22	E309LT0-4/1	419
BÖHLER CN 23/12 PW-FD	EN ISO 17633-A	T 23 12 L P M21 1/T 23 12 L P C1 1	AWS A5.22	E309LT1-4/1	420
Thermanit TG 309 L	EN ISO 17633-A	T 23 12 L R M21 3/T 23 12 L R C1 3	AWS A5.22	E309LT0-4/1	421
Avesta FCW-2D 316L/SKR	EN ISO 17633-A	T 19 12 3 L R M21 3/T 19 12 3 L R C1 3	AWS A5.22	E316LT0-4/1	422
Avesta FCW 316L/SKR-PW	EN ISO 17633-A	T 19 12 3 L P M21 1/T 19 12 3 L P C1 1	AWS A5.22	E316LT1-4/1	423
BÖHLER EAS 4 M-FD	EN ISO 17633-A	T 19 12 3 L R M21 3/T 19 12 3 L R C1 3	AWS A5.22	E316LT0-4/1	424
BÖHLER EAS 4 PW-FD	EN ISO 17633-A	T 19 12 3 L P M21 1/T 19 12 3 L P C1 1	AWS A5.22	E316LT1-4/1	425
BÖHLER EAS 4 PW-FD (LF)	EN ISO 17633-A	T Z19 12 3 L P M21 1/T Z19 12 3 L P C1 1	AWS A5.22	E316LT1-4/1	426
Thermanit TG 316 L	EN ISO 17633-A	T 19 12 3 L R M21 3/T 19 12 3 L R C1 3	AWS A5.22	E316LT0-4/1	427
Avesta FCW-2D 347/MVNb	EN ISO 17633-A	T 19 9 Nb R M21 3/T 19 9 Nb R C1 3	AWS A5.22	E347T0-4/1	428
BÖHLER SAS 2-FD	EN ISO 17633-A	T 19 9 Nb R M21 3/T 19 9 Nb R C1 3	AWS A5.22	E347T0-4/1	429
BÖHLER SAS 2 PW-FD	EN ISO 17633-A	T 19 9 Nb P M21 1/T 19 9 Nb P C1 1	AWS A5.22	E347T1-4/1	430
Avesta FCW-2D 2205	EN ISO 17633-A	T 22 9 3 N L R M21 3/T 22 9 3 N L R C1 3	AWS A5.22	E2209T0-4/1	431
Avesta FCW 2205-PW	EN ISO 17633-A	T 22 9 3 N L P M21 1/T 22 9 3 N L P C1 1	AWS A5.22	E2209T1-4/1	432
BÖHLER CN 22/9 PW-FD	EN ISO 17633-A	T 22 9 3 N L P M21 1/T 22 9 3 N L P C1 1	AWS A5.22	E2209T1-4/1	433
Avesta FCW-2D LDX 2101	EN ISO 17633-A	T 23 7 N L R M21 3/T 23 7 N L R C1 3	AWS A5.22	E2307T0-4(1)	434
Avesta FCW LDX 2101-PW	EN ISO 17633-A	T 23 7 N L P M21 1/T 23 7 N L P C1 1	AWS A5.22	E2307T1-4(1)	435
Avesta FCW 2507/P100-PW	EN ISO 17633-A	T 25 9 4 N L P M21 2/T 25 9 4 N L P C1 2	AWS A5.22	E2594T1-4/1	436
BÖHLER A 7-FD	EN ISO 17633-A	T 18 8 Mn R M21 3/T 18 8 Mn R C1 3	AWS A5.22	E307T0-G	437
BÖHLER A 7-MC	EN ISO 17633-A	T 18 8 Mn M M12 1	AWS A5.22	EC307 (mod.)	438
Avesta FCW-2D P5	EN ISO 17633-A	T 23 12 2 L R M21 3/T 23 12 2 L R C1 3	AWS A5.22	E309LMoT0-4/1	439
BÖHLER CN 23/12 Mo-FD	EN ISO 17633-A	T 23 12 2 L R M21 3/T 23 12 2 L R C1 3	AWS A5.22	E309LMoT0-4/1	440
BÖHLER CN 23/12 Mo PW-FD	EN ISO 17633-A	T 23 12 2 L P M21 1/T 23 12 2 L P C1 1	AWS A5.22	E309LMoT1-4/1	441
BÖHLER CN 13/4-MC	EN ISO 17633-A	T 13 4 M M12 2	AWS A5.22	EC410NiMo (mod.)	442
Avesta FCW P12-PW	EN ISO 12153	T Ni 6625 P M21 2	AWS A5.34	ENiCrMo3T1-4	443
BÖHLER NIBAS 625 PW-FD	EN ISO 12153	T Ni 6625 P M21 2	AWS A5.34	ENiCrMo3T1-4	444
UTP AF 6222 MoPW	EN ISO 12153	T Ni 6625 P M21 2	AWS A5.34	ENiCrMo3T1-4	445
BÖHLER NIBAS 70/20-FD	EN ISO 12153	T Ni 6082 R M21 3	AWS A5.34	ENiCr3T0-4	446
UTP AF 068 HH	EN ISO 12153	T Ni 6082 R M21 3	AWS A5.34	ENiCr3T0-4	447

Avesta FCW-2D 308L/MVR

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 9 L P M21 3 ; T 19 9 L P C1 3	E308LT0-4 ; E308LT0-1	

Characteristics and field of use

Avesta FCW-2D 308L/MVR is designed for welding 1.4301/ASTM 304 type stainless steels. It is also suitable for welding steels that are stabilised with titanium or niobium, such as 1.4541/ASTM 321, 1.4878/321H and 1.4550/347 in cases where the construction will be operating at temperatures below 400°C. For higher temperatures a niobium stabilised consumable such as Avesta FCW-2D 347/MVNb is required. Avesta FCW-2D 308L/MVR provides excellent weldability in flat as well as horizontalvertical position. Welding in vertical-up and overhead positions is preferably done using FCW 308L/MVR-PW. FCW-2D 308L/MVR diam. 0.9 mm can be welded in all positions. Avesta FCW-2D 308L/MVR should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm. Corrosion resistance: Very good under fairly severe conditions, e.g. in oxidising acids and cold or dilute reducing acids.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
4301	1.4301	304	304S31	Z7 CN 18-09	2333
4307	1.4307	304L	304S11	Z3 CN 18-10	2352
4311	1.4311	304LN	304S61	Z3 CN 18-10 Az	2371
4541	1.4541	321	321S31	Z6 CNT 18-10	2337

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.025	0.8	1.5	19.3	10.9

Ferrite 7 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*	*-196°C:*
untreated	380	560	35	60	50	35

Operating data

Polarity = +

Shielding gas: Ar + 15 – 25% CO_2
offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V).
Gas flow rate 20 – 25 l/min.

Dimensions (mm)	*Amperage*
0.9	*100-160*
1.2	*125-280*
1.6	*200-350*

Avesta FCW 308L/MVR-PW

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 9 L R M21 3 ; T 19 9 L R C1 3	E308LT1-4 ; E308LT1-1	

Characteristics and field of use

Avesta FCW 308L/MVR-PW is designed for welding 1.4301/ASTM 304 type stainless steels. It is also suitable for welding steels that are stabilised with titanium or niobium, such as 1.4541/ASTM 321, 1.4878/321H and 1.4550/347 in cases where the construction will be operating at temperatures below 400°C. For higher temperatures a niobium stabilized consumable such as Avesta FCW-2D 347/MVNb is required. Avesta FCW 308L/MVR-PW has a stronger arc and a faster freezing slag compared to the 2D type. It is designed for all-round welding and can be used in all positions without changing the parameter settings. Weldability is excellent in the vertical-up and overhead welding positions. Avesta FCW 308L/MVR-PW should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm.

Corrosion resistance:
Corresponding to 1.4301/ASTM 304, i.e. very good under fairly severe conditions, e.g. in oxidising acids and cold or dilute reducing acids.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
4301	1.4301	304	304S31	Z7 CN 18-09	2333
4307	1.4307	304L	304S11	Z3 CN 18-10	2352
4311	1.4311	304LN	304S61	Z3 CN 18-10 Az	2371
4541	1.4541	321	321S31	Z6 CNT 18-10	2337

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.025	0.7	1.4	19.7	10.2

Ferrite 9 FN;WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	390	570	39	60

Operating data

Polarity = +

Shielding gas: Ar + 15 – 25% CO_2
offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V).
Gas flow rate 20 – 25 l/min.

Dimensions (mm)	*Amperage*
1.2	*150-240*

BÖHLER EAS 2-FD

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 9 L R M21 3 ; T 19 9 L R C1 3	E308LT0-4 ; E308LT0-1	

Characteristics and field of use

Rutile, strip alloyed, flux cored wire for MAG welding of austenitic CrNi steels, primarily in flat and horizontal welding positions. The easy handling and high deposition rate of BÖHLER EAS 2-FD result in high productivity with excellent welding performance, self-releasing slag, very low spatter formation and seam oxidisation, finely rippled weld pattern with good wetting behaviour and even, reliable fusion penetration. In addition to the significant savings in time and costs of processing techniques, including the lower requirement for cleaning and pickling, BÖHLER guarantees a high level of quality and highly reliable avoidance of welding defects. The weld metal is cryogenic down to -196°C and resists intergranular corrosion up to +350°C. BÖHLER EAS 2-FD ø 0.9 mm is particularly suitable for joint welding of thin sheet (approx. 1.5 mm, in position from 5.0 mm). The nature of the slag has been designed so that this dimension can be used in all positions. The ø 1.2 mm electrode can be used for welding with wall thicknesses from about 3 mm.

Base materials

1.4306 X2CrNi19-11, 1.4301 X5CrNi18-10, 1.4311 X2CrNiN18-10, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10 AISI 304, 304L, 304LN, 302, 321, 347, ASTM A157 Gr. C9, A320 Gr. B8C or D

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.03	0.7	1.5	19.8	10.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	380	560	40	60	35

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: M1 – M3; C1
Welding with conventional MAG devices, slightly trailing torch position (angle of incidence about 80°); with 100% CO_2 the voltage must be 2 V higher. The gas quantity should be 15-18 l/min.

Dimensions (mm)	*Amperage A*
0.9	*100-160*
1.2	*125-280*
1.6	*200-350*

Approvals and certificates

TÜV (5348.), DB (43.014.14), CWB (E308LT0-1(4)), GL (4550 (C1, M21)), SEPROZ, CE

BÖHLER EAS 2 PW-FD

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 9 L P M21 1 ; T 19 9 L P C1 1	E308LT1-4 ; E308LT1-1	

Characteristics and field of use

BÖHLER EAS 2 PW-FD is a strip alloyed flux cored wire with a rutile slag characteristic for position welding of austenitic CrNi steels. The support provided by the fast-hardening slag allows out-of-position welding with high current magnitudes and high welding speeds. The fine droplet, low-spatter, very powerfully welding spray arc, the reliable fusion penetration, the selfreleasing slag and the effectively wetting seam formation result in a high weld quality at the same time as short welding times. Additional advantages to its application result from the ease of handling, the low heat input due to the high welding speed, and the small amounts of cleaning and pickling required. BÖHLER EAS 2-FD is preferred for flat and horizontal welding positions (PA, PB). The weld metal is cryogenic down to -196°C and resists intergranular corrosion up to +350°C.

Base materials

1.4306 X2CrNi19-11, 1.4301 X5CrNi18-10, 1.4311 X2CrNiN18-10, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10 AISI 304, 304L, 304LN, 302, 321, 347, ASTM A157 Gr. C9, A320 Gr. B8C or D

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.03	0.7	1.5	19.8	10.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	380	560	40	70	40

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: M1 – M3; C1
Welding with conventional MAG devices, slightly trailing torch position (angle of incidence about 80°), slight weaving of the torch is recommended in all positions. With 100% CO_2 the voltage must be raised by 2 V. The gas quantity should be 15-18 l/min.

Dimensions(mm)	*Amperage A*
1.2	*100-220*
1.6	*175-260*

Approvals and certificates

TÜV (09117.), DB (43.014.23), CWB (E308LT1-1(4)), GL (4550S (C1,M21)), SEPROZ, CE

Thermanit TG 308 L

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 9 L R M21 3 ; T 19 9 L R C1 3	E308LT0-4 ; E308LT0-1	

Characteristics and field of use

Thermanit TG 308 L is an austenitic CrNi flux cored wire with rutile slag characteristic. It is suited for GMAW welding with mixed gas M21 and C1 acc. to EN ISO 14175 on matching and similar, non stabilized and stabilized corrosion resistant CrNi(N) steels/cast steel grades. The weld metal is stainless and provides good resistance to nitric acid and intercrystalline corrosion – wet corrosion up to 350 °C (662 °F), cold toughness down to –196 °C (–320.8 °F) and resistance to scaling up to 800 °C (1472 °F). Weldable almost spatter free and due to the very slow freezing rutile slag the weld metal shows very fine and smooth bead appearance. Very good slag detachability and notch free seams with low annealing colouring, easy to clean and pickle. The root welding is proven on ceramic backing bar.

Base materials

1.4301 – X5CrNi18-10	1.4311* – X2CrNiN18-10
1.4306 – X2CrNi19-11	1.4541 – X6CrNTi18-10
1.4308 – G-X6CrNi18-9	1.4550 – X6CrNiNb18-10
1.4552 - G-X5CrNiNb18-9	1.4948 - X6CrNi18-11

also included materials according to VdTÜV-Kennblatt 1000.26 * Material No. 1.4311 certified only with shielding gas of group M2 according to EN ISO 14175

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.03	0.7	1.5	18.9	10.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	350	560	35	47	32

Welding position

Polarity = +

Shielding gas (EN ISO 14175): M21 and C1,
Consumption : 15 - 20 l/min.

Dimensions (mm)	*Amperage A*
0.9	*100-180*
1.2	*120-280*
1.6	*200-350*

Approvals and certificates

TÜV (7538.) DB (43.132.15) GL, UDT

Avesta FCW-2D 309L

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 23 12 L R M21 3 ; T 23 12 L R C1 3	E309LT0-4 ; E309LT0-1	

Characteristics and field of use

Avesta FCW-2D 309L is a high-alloy wire, primarily intended for surfacing low-alloy steels and for dissimilar welds between mild steel and stainless steels. It can also be used for welding some high temperature steels, such as 1.4833/ASTM 309S. Avesta FCW-2D 309L provides excellent weldability in flat as well as horizontalvertical position. Welding in vertical-up and overhead positions is preferably done using FCW 309L-PW. FCW-2D 309L diam. 0.9 mm can be welded in all positions. Avesta FCW-2D 309L should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm.

Corrosion resistance

Superior to type 308L fillers. When used for overlay welding on mild steel a corrosions resistance equivalent to that of 1.4301/304 is obtained already in the first layer. Ferrite 15 FN; WRC-92

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
Avesta 309L is primarily used for surfacing unalloyed or low-alloy steels and when joining non-molybdenum-alloyed stainless and carbon steels.					

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.025	0.7	1.4	22.8	12.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-60°C:*
untreated	400	540	35	60	45

Operating data

Polarity = +

Shielding gas:
Ar + 15 – 25% CO_2 offers the best weldability,
but 100% CO_2 can also be used (voltage should be increased by 2V).
Gas flow rate 20–25 l/min.

Dimensions (mm)	*Amperage A*
0.9	*100-160*
1.2	*125-280*
1.6	*200-350*

Avesta FCW 309L-PW

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 23 12 L P M21 1 ; T 23 12 LP C1 1	E309LT1-4 ; E309LT1-1	

Characteristics and field of use

Avesta FCW 309L-PW is a high-alloy wire primarily intended for surfacing on low-alloy steels and for dissimilar welds between mild steel and stainless steels. It can also be used for welding some high temperature steels, such as 1.4833/ASTM 309S. Avesta FCW 309L-PW has a stronger arc and a faster freezing slag compared to the 2D type. It is designed for all-round welding and can be used in all positions without changing the parameter settings. Avesta FCW 309L-PW should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm.

Corrosion resistance:
Superior to type 308L fillers. When used for overlay welding on mild steel a corrosions resistance equivalent to that of 1.4301/304 is obtained already in the first layer.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
Avesta 309L is primarily used for surfacing unalloyed or low-alloy steels and when joining non-molybdenum-alloyed stainless and carbon steels.					

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.025	0.7	1.5	23.0	12.2

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	390	550	35	55

Operating data

Polarity = +

Shielding gas:
Ar + 15 – 25% CO_2 offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V).
Gas flow rate 20–25 l/min.

Dimensions (mm)	*Amperage A*
1.2	*150-240*

BÖHLER CN 23/12-FD

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 23 12 L R M21 (C1) 3	E309LT0-4 ; E309LT0-1	

Characteristics and field of use

Rutile, strip alloyed, flux cored wire for welding austenite-ferrite joints and for weld claddings primarily in the flat and horizontal welding positions. The easy handling and high deposition rate result in high productivity with excellent welding behaviour, self-releasing slag, low spatter formation and seam oxidisation, finely rippled weld seams with good wetting behaviour and even, reliable fusion penetration. The weld metal is suitable for operating temperatures between -60°C and +300°C. BÖHLER CN 23/12-FD Ø0.9 mm is particularly suitable for joint welding of thin sheet (approx. 1.5 mm, in position from 5.0 mm). The nature of the slag has been designed so that this dimension can be used in all positions. The Ø1.2 mm electrode can be used for welding with wall thicknesses from about 3 mm.

Base materials

Joints: of and between high-strength, unalloyed and alloyed quenched and tempered steels, stainless, ferritic Cr and austenitic Cr-Ni steels, austenitic manganese steels and weld claddings: for the first layer of chemically resistant weld claddings on the ferritic-pearlitic steels used for boiler and pressure vessel construction up to fine-grained structural steel S500N, and for the creep resistant fine-grained structural steels 22NiMoCr4-7, 20MnMoNi5-5 and GS-18NiMoCr 3 7

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.03	0.7	1.4	23.0	12.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-60°C:*
untreated	400	540	33	60	45

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: Argon + 15-25% CO_2 100% CO_2
The gas quantity should be 15-18 l/min.
Slightly trailing torch position (angle of incidence about 80°). It is recommended that the voltage is increased by 2 V if the shielding gas is 100% CO_2. Preheating and interpass temperature as required by the base metal.

Dimensions(mm)	*Amperage A*
0.9	*100-160*
1.2	*125-280*
1.6	*200-350*

Approvals and certificates

TÜV (5350.), DB (43.014.16), CWB (E309LT0-1(4)), GL (4332 (C1, M21)), LR (DX, CMn/SS), SEPROZ, CE, RINA (309L5), DNV

BÖHLER CN 23/12 PW-FD

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 23 12 L P M21 1 ; T 23 12 L P C1 1	E309LT1-4 ; E309LT1-1	

Characteristics and field of use

Rutile, strip alloyed, flux cored wire with fast freezing slag for position welding of austenite-ferrite joints, and for the first layer of weld claddings of unalloyed and low-alloy Base materials. The support provided by the fast-hardening slag allows out-of-position welding with high current magnitudes and high welding speeds. The fine droplet, low-spatter, very intense spray arc, the reliable fusion penetration, the self-releasing slag and the good wetting behaviour result in a high weld quality at the same time as short welding times. Additional advantages to its application are the ease of handling, the low heat input resulting from the high welding speed, and the small amounts of cleaning and pickling required. BÖHLER CN 23/12-FD should be used for flat and horizontal welding positions (PA, PB). The weld metal is suitable for operating temperatures between -60°C and +300°C.

Base materials

Joints: of and between high-strength, unalloyed and alloyed quenched and tempered steels, stainless, ferritic Cr and austenitic Cr-Ni steels, austenitic manganese steels and weld claddings: for the first layer of chemically resistant weld claddings on the ferritic-pearlitic steels used for boiler and pressure vessel construction up to fine-grained structural steel S500N, and for the creep resistant fine-grained structural steels 22NiMoCr4-7, 20MnMoNi5-5 and GS- 18NiMoCr 3 7

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.03	0.7	1.4	23.0	12.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-60°C:*
untreated	400	540	33	65	50

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: Argon + 15-25% CO_2, 100% CO_2
The gas quantity should be 15-18 l/min. Slightly trailing torch position (angle of incidence about 80°), slight weaving of the torch is recommended in all positions. It is recommended that the voltage is increased by 2 V if the shielding gas is 100% CO_2. Preheating and interpass temperature as required by the base metal.

Dimensions (mm)	*Amperage A*
1.2	*100-220*
1.6	*175-260*

Approvals and certificates

TÜV (09115.), DB (43.014.22), ABS (E 309 LT 1-1(4)), LR (DXV and O, CMn/SS), GL (4332S{C1,M21}), CWB (E309LT0-1(4)), SEPROZ, DNV, RINA; CE

Thermanit TG 309 L

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 23 12 L R M21 3 ; T 23 12 L R C1 3	E309LT0-4 ; E309LT0-1	

Characteristics and field of use

Thermanit TG 309 L is an austenitic CrNi flux cored wire with rutile slag characteristic. It is suited for GMAW welding with mixed gas M21 and C1 acc. to EN ISO 14175. For joint welding of high-alloyed CrNi(Mo, N) steels/cast steel grades with unalloyed/low alloyed steels (austenite ferrite joints) with a maximum application temperature of 300 °C (572 °F). It is also suited for joint welding of high alloyed CrNi(Mo, N) steels/cast steel grades with stainless and heat-resistant Cr steels/cast steel grades. For intermediate layers when welding the clad side of plates and cast materials clad with non stabilized and stabilized CrNi(Mo, N) austenitic metal. The weld metal is stainless (wet corrosion up to 350 °C (662 °F)). Weldable almost spatter-free and due to the very slow freezing slag the weld metal shows fine and smooth bead appearance. Very good slag detachability and notch free seams with low annealing colouring, easy to clean and pickle. Root welding is proven on ceramic backing strips.

Base materials

1.4301 – X5CrNi18-10	1.4436 – X5CrNiMo17-13-3
1.4306 – X2CrNi19-11	1.4541 – X6CrNiTi18-10
1.4308 – G-X6CrNi18-9	1.4550 – X6CrNiNb18-10
1.4401 – X5CrNi Mo17-12-2	1.4552 – G-X5CrNiNb18-9
1.4404 – X2CrNiMo17-13-2	1.4571 – X6CrNiMoTi17-12-2
1.4408 – G-X6CrNiMo	1.4580 – X6CrNiMoNb17-12-2
1.4435 – X2CrNiMo18-14-3	1.4581 – G-XCrNiMoNb18-10

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.03	0.7	1.4	23.0	12.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-60°C:*
untreated	380	540	35	47	32

Welding position

Polarity = +

Shielding gas (EN ISO 14175) M21 and C1,
Consumption: 15 - 20 l/min.

Dimensions (mm)	*Amperage A*
0.9	*100-180*
1.2	*120-280*
1.6	*200-350*

Approvals and certificates

TÜV (07540.), DB (43.132.14), GL, UDT

Avesta FCW-2D 316L/SKR

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 12 3 L R M21 3 ; T 19 12 3 L R C1 3	E316LT0-4 ; E316LT0-1	

Characteristics and field of use

Avesta FCW 316L is designed for welding 1.4436/ASTM 316 type stainless steels. It is also suitable for welding steels that are stabilized with titanium or niobium, such as 1.4571/ASTM 316Ti for service temperatures not exceeding 400°C. Avesta FCW-2D 316L/SKR provides excellent weldability in flat as well as horizontalvertical position. Welding in vertical-up and overhead positions is preferably done using FCW 316L/SKR-PW. FCW-2D 316L/SKR diam. 0.9 mm can be welded in all positions. Avesta FCW-2D 316L/SKR should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm.

Corrosion resistance

Excellent resistance to general, pitting and intercrystalline corrosion in chloride containing environments. Intended for severe service conditions, e.g. in dilute hot acids.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
4436	1.4436	316	316S33	Z7 CND 18-12-03	2343
4432	1.4432	316L	316S13	Z3 CND 17-12-03	2353
4429	1.4429	S31653	316S63	Z3 CND 17-12 Az	2375
4571	1.4571	316Ti	320S31	Z6 CNDT 17-12	2350

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.025	0.7	1.5	19.0	12.0	2.7

Ferrite 10 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*–40°C:*	*–196:°C*
untreated	400	560	33	55	50	28

Operating data

Polarity = +

Shielding gas:
Ar + 15 – 25% CO2 offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V).
Gas flow rate 20 – 25 l/min.

Dimensions (mm)	*Amperage A*
0.9	*100-160*
1.2	*125-280*
1.6	*200-350*

Avesta FCW 316L/SKR-PW

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 12 3 L P M21 1 ; T 19 12 3 L P C1 1	E316LT1-4 ; E316LT1-1	

Characteristics and field of use

Avesta FCW 316L/SKR-PW is designed for welding 1.4436/ASTM 316 type stainless steels. It is also suitable for welding steels that are stabilised with titanium or niobium, such as 1.4571/ASTM 316Ti for service temperatures not exceeding 400°C. Avesta FCW 316L/SKR-PW has a stronger arc and a faster freezing slag compared to the 2D type. It is designed for all-round welding and can be used in all positions without changing the parameter settings. Weldability is excellent in the vertical-up and overhead welding positions. Avesta FCW 316L/SKR-PW should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm.

Corrosion resistance

Excellent resistance to general, pitting and intercrystalline corrosion in chloride containing environments. Intended for severe service conditions, e.g. in dilute hot acids.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
4436	1.4436	316	316S33	Z7 CND 18-12-03	2343
4432	1.4432	316L	316S13	Z3 CND 17-12-03	2353
4429	1.4429	S31653	316S63	Z3 CND 17-12 Az	2375
4571	1.4571	316Ti	320S31	Z6 CNDT 17-12	2350

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.025	0.8	1.5	18.8	11.8	2.7

Ferrite 10 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*–40°C:*
untreated	400	560	37	60	55

Operating data

Polarity = +

Shielding gas:
Ar + 15 – 25% CO_2 offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V).
Gas flow rate 20–25 l/min.

Dimensions (mm)	*Amperage A*
1.2	*150-240*

BÖHLER EAS 4 M-FD

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 12 3 L R M21 3 ; T 19 12 3 L R C1 3	E316LT0-4 ; E316LT0-1	

Characteristics and field of use

Rutile, strip alloyed, flux cored wire for MAG welding of austenitic CrNiMo steels, primarily in flat and horizontal welding positions. The easy handling and high deposition rate of BÖHLER EAS 4 M-FD result in high productivity with excellent welding performance, self-releasing slag, very low spatter formation and seam oxidisation, finely rippled weld pattern with good wetting behaviour and even, reliable fusion penetration. In addition to the significant savings in time and costs of processing techniques, including the lower requirement for cleaning and pickling, BÖHLER EAS 4 M-FD allows a high level of quality and highly reliable avoidance of welding defects. The weld metal is cryogenic down to -120°C and resists intergranular corrosion up to +400°C. BÖHLER EAS 4 M-FD ø 0.9 mm is particularly suitable for joint welding of thin sheet (approx. 1.5 mm, in position from 5.0 mm). The nature of the slag has been designed so that this dimension can be used in all positions. The ø 1.2 mm electrode can be used for welding with wall thicknesses from about 3 mm.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-13-3, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12, 1.4409 GX2CrNiMo 19-11-2 UNS S31603, S31653; AISI 316L, 316Ti, 316Cb

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.03	0.7	1.5	19.0	12.0	2.7

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-120°C:*
untreated	400	560	38	55	35

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: M1 – M3; C1
Welding with conventional MAG devices, slightly trailing torch position (angle of incidence about 80°); with 100% CO_2 the voltage must be 2 V higher. The gas quantity should be 15-18 l/min.

Dimensions (mm)	*Amperage A*
0.9	*100-160*
1.2	*125-280*
1.6	*200-350*

Approvals and certificates

TÜV (5349.), DB (43.014.15), CWB (E316LT0-1(4)), GL (4571 (C1, M21)), LR (DX BF, 316L S), SEPROZ, CE, DNV

BÖHLER EAS 4 PW-FD

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 12 3 L P M21 1 ; T 19 12 3 L P C1 1	E316LT1-4 ; E316LT1-1	

Characteristics and field of use

BÖHLER EAS 4 PW-FD is a strip alloyed flux cored wire with a rutile slag characteristic for position welding of austenitic CrNiMo steels. The support provided by the fast-hardening slag allowsout-of-position welding with high current magnitudes and high welding speeds. The fine droplet, low-spatter, very powerfully welding spray arc, the reliable fusion penetration, the selfreleasing slag and the effectively wetting seam formation result in a high weld quality at the same time as short welding times. Additional advantages to its application result from the ease of handling, the low heat input due to the high welding speed, and the small amounts of cleaning and pickling required. BÖHLER EAS 4 M-FD is preferred for flat and horizontal welding positions (PA, PB). The weld metal is cryogenic down to -120°C and resists intergranular corrosion up to +400°C.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-13-3, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12, 1.4409 GX2CrNiMo 19-11-2 UNS S31603, S31653; AISI 316L, 316Ti, 316Cb

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.03	0.7	1.5	19.0	12.0	2.7

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-120°C:*
untreated	400	560	38	65	45

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: M1 – M3; C1
Welding with conventional MAG devices, slightly trailing torch position (angle of incidence about 80°), slight weaving of the torch is recommended in all positions. With 100% CO_2 the voltage must be raised by 2 V. The gas quantity should be 15-18 l/min.

Dimensions (mm)	*Amperage A*
1.2	*100-220*
1.6	*175-260*

Approvals and certificates

TÜV (09118.), DB (43.014.24), CWB (E316LT1-1(4)), LR (DXV and O, BF 316LS), GL (4571S (C1,M21)), SEPROZ, CE, DNV

BÖHLER EAS 4 PW-FD (LF)

Flux cored wire

Classifications high-alloyed rutile

EN ISO 17633-A:	AWS A5.22:	
T Z19 12 3 L P M21 1 ; T Z19 12 3 L P C1 1	E316LT1-4 ; E316LT1-1	

Characteristics and field of use

Rutile flux cored wire with controlled ferrite content (3-6 FN), particularly for applications in which special resistance to low temperatures and lateral expansion down to -196°C is specified, e.g. for LNG applications. The wire's slag system guarantees exceptional position welding properties and high welding speeds.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-13-3, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12, 1.4409 GX2CrNiMo 19-11-2 UNS S31603, S31653; AISI 316L, 316Ti, 316Cb

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.03	0.7	1.4	18.1	12.5	2.1

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	390	550	40	75	45

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: M1 – M3; C1
Welding with conventional MAG devices, slightly trailing torch position (angle of incidence about 80°); with 100% CO_2 the voltage must be 2 V higher. The gas quantity should be 15-18 l/min.

Dimensions (mm)	*Amperage A*
1.2	*100-220*

Thermanit TG 316 L

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 12 3 L R M21 3 ; T 19 12 3 L R C1 3	E316LT0-4 ; E316LT0-1	

Characteristics and field of use

Thermanit TG 316 L is an austenitic CrNiMo flux cored wire with rutile slag characteristic. It is suited for GMAW welding with mixed gas M21 and C1 acc. to EN ISO 14175 for joining of matching and similar, non stabilized and stabilized, corrosion resistant CrNi(N) and CrNiMo(N) steels/cast steel grades. The weld metal is stainless and resistant to intercrystalline corrosion (wet corrosion up to 400 °C / 752 °F), cold toughness down to –120 °C (–184 °F) and resistant to scaling up to 800 °C (1472 °F). Thermanit TG 316 L provides almost spatter free welding behaviour and due to the slow freezing rutile slag, the weld metal shows very fine and smooth bead appearance. Very good slag detachability and notch free seams with low annealing colouring, easy to clean and pickle. Root welding is proven on ceramic backing strips.

Base materials

1.4301 – X5CrNi18-10	1.4541 – X6CrNiTi18-10
1.4306 – X2CrNi19-11	1.4550 – X6CrNiNb18-10
1.4308 – G-X6CrNi18-9	1.4552 – G-X5CrNiNb18-9
1.4401 – X5CrNi Mo17-12-2	1.4583 – X10CrNiMoNb18-12
1.4404 – X2CrNiMo17-13-2	1.4571 – X6CrNiMoTi17-12-2
1.4408 – G-X6CrNiMo18-10	1.4573 – X10CrNiMoTi18-12
1.4435 – X2CrNiMo18-14-3	1.4580 – X6CrNiMoNb17-12-2
1.4436 – X5CrNiMo17-13-3	1.4581 – G-XCrNiMoNb18-10

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Mo	Ni
0.03	0.7	1.5	19.0	2.7	12.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-120°C:*
untreated	350	560	35	47	32

Welding position

Polarity = +

Shielding gas (EN ISO 14175):
M21 and C1
Consumption: 15 - 20 l/min.

Dimensions (mm)	*Amperage A*
0.9	*100-180*
1.2	*120-280*
1.6	*200-350*

Approvals and certificates

TÜV (7539.), DB (43.132.16), GL, UDT

Avesta FCW-2D 347/MVNb

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 9 Nb R M21 3 ; T 19 9 Nb R C1 3	E347T0-4 ; E347T0-1	

Characteristics and field of use

Avesta FCW-2D 347/MVNb is a Nb-stabilised Cr-Ni flux-cored wire for welding steels that are stabilised with titanium or niobium, such as 1.4541/ASTM 321. A stabilised weldment has improved high temperature properties, e.g. creep resistance, compared to low-carbon non-stabilised grades. This wire is primarily used for applications with service temperatures above 400°C. Avesta FCW-2D 347/MVNb provides excellent weldability in flat as well as horizontalvertical position. Welding in vertical-up and overhead positions is preferably done using FCW 347/MVNb-PW. Avesta FCW-2D 347/MVNb should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm.

Corrosion resistance:

Generally none. 347 type FCW can be used for cladding, which normally requires stress relieving at around 590°C. Such a heat treatment will reduce the ductility of the weld +20°C:. Always consult expertise before performing post-weld heat treatment.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
4541	1.4541	321	321S31	Z6 CNT 18-10	2337
-	1.4550	347	347S31	Z6 CNNb 18-10	2338

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Nb
0.03	0.6	1.6	19.4	10.5	>8xC

Ferrite 7 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	420	600	35	75

Operating data

Polarity = +

Shielding gas:
Ar + 15 – 25% CO_2 offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V).
Gas flow rate 20 – 25 l/min.

Dimensions (mm)	*Amperage A*
1.2	*125-280*

BÖHLER SAS 2-FD

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 9 Nb R M21 3 ; T 19 9 Nb R C1 3	E347T0-4 ; E347T0-1	

Characteristics and field of use

Rutile, strip alloyed, flux cored wire for MAG welding of stabilised, austenitic CrNi steels. For application in all branches of industry where same-type steels and ferritic 13% chrome steels are welded. Typical fields of application include the construction of chemical apparatus and containers, the textile and cellulose industries, dye works and so on. The easy handling and high deposition rate of BÖHLER SAS 2-FD result in high productivity with excellent welding performance, selfreleasing slag, very low spatter formation and seam oxidisation, finely rippled weld pattern with good wetting behaviour and even, reliable fusion penetration. In addition to the significant savings in time and costs of processing techniques, including the lower requirement for cleaning and pickling, BÖHLER SAS 2-FD allows a high level of quality and highly reliable avoidance of welding defects. The weld metal is cryogenic down to -196°C and resists intergranular corrosion up to +400°C.

Base materials

1.4550 X6CrNiNb18-10, 1.4541 X6CrNiTi18-10, 1.4552 GX5CrNiNb19-11, 1.4301 X5CrNi18-10, 1.4312 GX10CrNi18-8, 1.4546 X5CrNiNb18-10, 1.4311 X2CrNiN18-10, 1.4306 X2CrNi19-11
AISI 347, 321.302, 304, 304L, 304LN, ASTM A296 Gr. CF 8 C, A157 Gr. C9, A320 Gr. B8C or D

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Nb
0.03	0.6	1.4	19.0	1.4	+

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	420	600	35	75	45

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: M1 – M3; C1
Welding with conventional MAG devices, slightly trailing torch position (angle of incidence about 80°); with 100% CO_2 the voltage must be 2 V higher. The gas quantity should be 15-18 l/min.

Dimensions (mm)	*Amperage A*
1.2	*125-280*
1.6	*200-350*

Approvals and Certificates

TÜV (09740.), SEPROZ, CE

BÖHLER SAS 2 PW-FD

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 19 9 Nb P M21 1 ; T 19 9 Nb P C1 1	E347T1-4 ; E347T1-1	

Characteristics and field of use

BÖHLER SAS 2 PW-FD is a strip alloyed flux cored wire with a rutile slag characteristic for position welding of stabilised, austenitic CrNi steels. The support provided by the fast-hardening slag allows out-of-position welding with high current magnitudes and high welding speeds. For application in all branches of industry where same-type steels and ferritic 13% chrome steels are welded. Typical fields of application include the construction of chemical apparatus and containers, the textile and cellulose industries, dye works and so on. The fine droplet, lowspatter, very powerfully welding spray arc, the reliable fusion penetration, the self-releasing slag and the effectively wetting seam formation result in a high weld quality at the same time as short welding times. Additional advantages to its application result from the ease of handling, the low heat input due to the high welding speed, and the small amounts of cleaning and pickling required. BÖHLER SAS 2-FD is preferred for flat and horizontal welding positions (PA, PB). The weld metal is cryogenic down to -120°C and resists inter-granular corrosion up to +400°C.

Base materials

1.4550 X6CrNiNb18-10, 1.4541 X6CrNiTi18-10, 1.4552 GX5CrNiNb19-11, 1.4301 X5CrNi18-10, 1.4312 GX10CrNi18-8, 1.4546 X5CrNiNb18-10, 1.4311 X2CrNiN18-10, 1.4306 X2CrNi19-11
AISI 347, 321.302, 304, 304L, 304LN; ASTM A296 Gr. CF 8 C, A157 Gr. C9, A320 Gr. B8C or D

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Nb
0.03	0.7	1.4	19.0	10.4	+

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-120°C:*
untreated	420	600	35	75	38

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: M1 – M3; C1
Welding with conventional MAG devices, slightly trailing torch position (angle of incidence about 80°), slight weaving of the torch is recommended in all positions. With 100% CO_2 the voltage must be raised by 2 V. The gas quantity should be 15-18 l/min.

Dimensions (mm)	*Amperage A*
1.2	*100-220*

Approvals and Certificates

TÜV (10059.), SEPROZ, CE

Avesta FCW-2D 2205

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 22 9 3 N L R M21 3 ; T 22 9 3 N L R C1 3	E2209T0-4 ; E2209T0-1	

Characteristics and field of use

Avesta FCW-2D 2205 is primarily designed for welding duplex stainless steels such as 2205. Avesta FCW-2D 2205 provides excellent weldability in flat as well as horizontalvertical position. Welding in vertical-up and overhead positions is preferably done using FCW 2205-PW.Avesta FCW-2D 2205 should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm. The weldability of duplex steels is excellent, but the welding should be adapted to the base material, considering fluidity, joint design, heat input etc.

Corrosion resistance:

Very good resistance to pitting and stress corrosion cracking in chloride containing environments. PREN >35. Meets the corrosion test requirements per ASTM G48 Methods A, B and E (22°C), ASTM G36 and NACE TM 0177 Method A.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
2205	1.4462	S32205	318S13	Z3 CND 22-05 Az	2377

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N
0.025	0.7	0.9	22.9	9.2	3.2	0.13

Ferrite 45 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*–40°C:*
untreated	615	800	25	60	40

Operating data

Polarity = +

Shielding gas: Ar + 15 – 25% CO_2
offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V). Gas flow rate 20 – 25 l/min.

Dimensions (mm)	*Amperage A*
1.2	*125-280*
1.6	*200-350*

Avesta FCW 2205-PW

Flux cored wire

Classifications high-alloyed rutile

EN ISO 17633-A:	AWS A5.22:	
T 22 9 3 N L P M21 1 ; T 22 9 3 N L P C1 1	E2209T1-4 ; E2209T1-1	

Characteristics and field of use

Avesta FCW 2205-PW is primarily designed for welding duplex stainless steels such as 2205. Avesta FCW 2205-PW has a stronger arc and a faster freezing slag compared to the 2D type. It is designed for all-round welding and can be used in all positions without changing the parameter settings. Weldability is excellent in the vertical-up and overhead welding positions. Avesta FCW 2205-PW should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm. The weldability of duplex steels is excellent, but the welding should be adapted to the base material, considering fluidity, joint design, heat input etc.

Corrosion resistance:

Very good resistance to pitting and stress corrosion cracking in chloride containing environments. PREN >35. Meets the corrosion test requirements per ASTM G48 Methods A, B and E (22°C).

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
2205	1.4462	S32205	318S13	Z3 CND 22-05 Az	2377

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N
0.025	0.7	1.0	23.0	9.1	3.2	0.13

Ferrite 40 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*–40°C:*
untreated	600	800	27	80	55

Operating data

Polarity = +

Shielding gas: Ar + 15 – 25% CO_2
offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V). Gas flow rate 20 – 25 l/min.

Dimensions (mm)	*Amperage A*
1.2	*125-240*

BÖHLER CN 22/9 PW-FD

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 22 9 3 N L P M21 1 ; T 22 9 3 N L P C1 1	E2209T1-4 ; E2209T1-1	

Characteristics and field of use

BÖHLER CN 22/9 PW-FD is a strip alloyed, duplex steel rutile flux cored wire for position welding of duplex steels in the chemical apparatus, plant and container construction, for chemical tankers and in the offshore industry. The support provided by the fast-hardening slag allows out-of-position welding with high current magnitudes and high welding speeds. The advantage of the slag is its supporting effect on the weld pool. This permits, for example, welding with the stringer bead technique at a correspondingly high welding speed even in difficult pipe welding positions (5G, 6G). The fine droplet, low-spatter, very powerfully welding spray arc, the reliable fusion penetration, the self-releasing slag and the effectively wetting seam formation result in a high weld quality at the same time as short welding times. The structure of the weld metal consists of austenite and ferrite (FN 30-50). The pitting resistance equivalent is PREN ≥ 35 (%Cr+3.3%Mo+16%N). Testing the weld metal in accordance with ASTM G48 Method A resulted in a CPT (critical pitting temperature) of 25°C. Also suited to joining different materials and to weld cladding. Usable between -46°C and +250°C.

Base materials

Same-type duplex steels and similar-alloy, ferritic-austenitic materials of increased strength, as well as for dissimilar joints between duplex steels and unalloyed or low-alloy, creep resistant and austenitic steels. 1.4462 X2CrNiMoN22-5-3, 1.4362 X2CrNiN23-4, 1.4462 X2CrNiMoN22-5-3 with 1.4583 X10CrNiMoNb18-12, 1.4462 X2CrNiMoN22-5-3 with P235GH/ P265GH, S255N, P295GH, S460N, 16Mo3, UNS S31803, S32205

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
≤ 0.03	0.8	0.9	22.7	9.0	3.2	0.13	≥35	30-50

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*			
	MPa	*MPa*	*%*	*+20°C:*	*-20°C:*	*-40°C:*	*-46°C:*
untreated	600	800	27	80	65	55	45

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: M1 – M3; C1
Welding with conventional MAG devices, slightly trailing torch position (angle of incidence about 80°); slight weaving of the torch is recommended in all positions;
with 100% CO_2 the voltage must be 2 V higher. The gas quantity should be 15-18l/min.

Dimensions (mm)	*Amperage A*
1.2	*100-220*

Approvals and Certificates

TÜV (07666.), ABS (E 22 09 T1-4(1)), CWB (E2209T1-1(4)), DNV (X (M21;C1)), GL (4462S (M21)), LR (X (M21,C1)), RINA (2209 S), SEPROZ, CE

Avesta FCW-2D LDX 2101

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 23 7 N L R M21 3 ; T 23 7 N L R C1 3	E2307T0-4 ; E2307T0-1	

Characteristics and field of use

Avesta FCW-2D LDX 2101 is designed for welding the duplex stainless steel Outokumpu LDX 2101. The steel is a ”lean duplex” steel with excellent strength and medium corrosion resistance. LDX 2101 is mainly intended for applications such as civil engineering, storage tanks, containers etc. Avesta FCW-2D LDX 2101 provides excellent weldability in flat as well as horizontalvertical position. Welding in vertical-up and overhead positions is preferably done using FCW LDX 2101-PW. Avesta FCW-2D LDX 2101 should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20mm. The weldability of duplex steels is excellent, but the welding should be adapted to the base material, considering fluidity, joint design, heat input etc.

Corrosion resistance:

Good resistance to general corrosion. Better resistance to pitting, crevice corrosion and stress corrosion cracking than 1.4301/AISI 304.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
LDX 2101®	1.4162	S32101	-	-	-

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N
0.025	0.7	1.1	24.0	9.0	0.5	0.14

Ferrite 35 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*–40°C:*
untreated	550	740	31	65	45

Operating data

	Polarity = +	Shielding gas: Ar + 15 – 25% CO_2 offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V).Gas flow rate 20 – 25 l/min.

Dimensions (mm)	*Amperage A*
1.2	*125-280*

Avesta FCW LDX 2101-PW

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:		
T 23 7 N L P M21 1 ; T 23 7 N L P C1 1	E2307T1-4 ; E2307T1-1	

Characteristics and field of use

Avesta FCW LDX 2101-PW is designed for welding the duplex stainless steel Outokumpu LDX 2101. The steel is a "lean duplex" steel with excellent strength and medium corrosion resistance. LDX 2101 is mainly intended for applications such as civil engineering, storage tanks, containers etc. Avesta FCW LDX 2101-PW has a stronger arc and a faster freezing slag compared to the 2D type. It is designed for all-round welding and can be used in all positions without changing the parameter settings. Weldability is excellent in the vertical-up and overhead welding positions. Avesta FCW LDX 2101-PW should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm. The weldability of duplex steels is excellent, but the welding should be adapted to the base material, considering fluidity, joint design, heat input etc.

Corrosion resistance:

Good resistance to general corrosion. Better resistance to pitting, crevice corrosion and stress corrosion cracking than 1.4301/AISI 304.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
LDX 2101®	1.4162	S32101	-	-	-

Typical analysis of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N
0.025	0.7	0.9	24.3	9.0	0.3	0.13

Ferrite 30 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*–40°C:*
untreated	575	765	30	70	50

Operating data

Polarity = +

Shielding gas:
Ar + 15 – 25% CO_2 offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V).as flow rate 20 – 25 l/min.

Dimensions (mm)	*Amperage A*
1.2	*150-240*

Avesta FCW 2507/P100-PW

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 25 9 4 N L P M21 2 ; T 25 9 4 N L P C1 2	E2594T1-4 ; E2594T1-1	

Characteristics and field of use

Avesta FCW 2507/P100-PW is designed for welding super duplex steels like 2507/1.4410 and similar grades for use down to –50°C. Super duplex steels are praticularly popular for desalination, pulp &paper, flue gas cleaning and sea water system applications. Avesta FCW 2507/P100-PW is designed for all-round welding and can be used in all positions without changing the parameter settings. Weldability is excellent in the verticalup and overhead welding positions. Avesta FCW 2507/P100-PW should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm. The weldability of duplex and super duplex steels is excellent, but the welding should be adapted to the base material, considering fluidity, joint design, heat input etc.

Corrosion resistance:

Very good resistance to pitting and stress corrosion cracking in chloride containing environments. PREN >41. Meets the corrosion test requirements per ASTM G48 Methods A, B and E (40°C).

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
2507	1.4410	S32750	-	Z3 CND 25-06 Az	2328
4501	1.4501	S32760	-	-	-

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo	N
0.03	0.7	0.9	24.7	9.8	3.7	0.23

Ferrite 40 FN WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*–40°C:*
untreated	670	890	26	50	32

Operating data

Polarity = +

Shielding gas: Ar + 15 – 25% CO_2
offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V). Gas flow rate 20 – 25 l/min.

Dimensions (mm)	*Amperage A*
1.2	*150-240*

BÖHLER A 7-FD

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 18 8 Mn R M21 3 ; T 18 8 Mn R C1 3	E307T0-G	

Characteristics and field of use

Rutile flux cored wire predominantly for flat and horizontal welding positions. The easy handling and high deposition rate of Böhler A7-FD result in high productivity with excellent welding performance, self-releasing slag, very low spatter formation and seam oxidisation, finely rippled weld seams with good wetting behaviour and even, reliable fusion penetration. Properties of the weld metal: suitable for strain-hardening, very good cavitation resistance, crack resistant, resistant to thermal shock, resistant to scaling up to 850°C, no tendency to sigma-phase embrittlement above 500°C, cryogenic down to -60°C. Consultation with the manufacturer is recommended for operating temperatures above 650°C.

Base materials

high-strength, unalloyed and alloyed structural, quenched and tempered and armour steels among themselves or among each other; unalloyed and alloyed boiler or structural steels with high-alloy Cr and Cr-Ni steels; heat-resistant steels up to +850°C; austenitic manganese steels together and with other steels; cryogenic plate and pipe steels together with cryogenic austenitic materials.

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.1	0.7	6.5	18.5	8.8

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	
untreated	420	630	39	60	

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: Argon + 15-25% CO_2
100% CO_2
The gas quantity should be 15-18 l/min. Slightly trailing torch position (angle of incidence about 80°). It is recommended that the voltage is increased by 2 V if the shielding gas is 100% CO_2. Preheating and interpass temperature as required by the base metal.

Dimensions(mm)	*Amperage A*
1.2	*125-280*
1.6	*200-350*

Approvals and Certificates

TÜV (11101.), CE

BÖHLER A 7-MC

Metal cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 18 8 Mn M M12 1	EC307 (mod.)	

Characteristics and field of use

The metal cored wire is characterised by easy handling, high deposition rate, exceptional welding performance, very low spatter formation, finely rippled weld seams, good wetting behaviour and even, reliable fusion penetration. The arc, which is wider than that of solid wire, significantly reduces the risk of lack of fusion, and ensures good gap bridging. Properties of the weld metal: suitable for strain-hardening, very good cavitation resistance, crack resistant, resistant to thermal shock, resistant to scaling up to +850°C, no tendency to sigma-phase embrittlement above +500°C, heat treatment can be carried out without difficulty, cryogenic down to -110°C. Consultation with the manufacturer is recommended for operating temperatures above +650°C.

Base materials

For production, repair and maintenance welding. high-strength, unalloyed and alloyed structural, quenched and tempered and armour steels among themselves or among each other; unalloyed and alloyed boiler or structural steels with high-alloy Cr and Cr-Ni steels; heat-resistant steels up to +850°C; austenitic manganese steels together and with other steels; cryogenic plate and pipe steels together with cryogenic austenitic materials.

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni
0.1	0.6	6.3	18.8	9.2

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	400	600	42	70

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: Argon + 2.5% CO_2
The gas quantity should be 15-18 l/min. Preheating and interpass temperature as required by the base metal. A leading torch position is preferable (angle of incidence about 80°). Recommended free wire length 15-20 mm and arc length 3-5 mm. The Pulsarc technique is to be recommended for position welding, as it is with the solid wires.

Dimensions (mm)	*Amperage A*
1.2	*60-280*
1.6	*100-370*

Approvals and certificates

TÜV (10871.), DB (43.014.27), CE

Avesta FCW-2D P5

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 23 12 2 L R M21 3 ; T 23 12 2 L R C1 3	E309LMoT0-4 ; E309LMoT0-1	

Characteristics and field of use

Avesta FCW-2D P5 is a molybdenum alloyed wire of the 309MoL type, primarily designed for welding dissimilar joints between stainless steels and low-alloy steels. It is also widely used for surfacing low-alloy steels offering a composition similar to that of ASTM 316 from the first run. Avesta FCW-2D P5 provides excellent weldability in flat as well as horizontalvertical position. Welding in vertical-up and overhead positions is preferably done using FCW P5-PW. Avesta FCW-2D P5 should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm.

Corrosion resistance:
Superior to type 316L fillers. When used for overlay welding on mild steel a corrosions resistance equivalent to that of 1.4401/316 is obtained already in the first layer.

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
Avesta P5 is primarily used when surfacing unalloyed or low-alloy steels and when joining molybdenum-alloyed stainless and carbon steels.					

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.025	0.7	1.4	22.9	12.6	2.7

Ferrite 25 FN; WRC-92

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	500	700	30	55

Operating data

Polarity = +

Shielding gas: Ar + 15 – 25% CO_2
Ar + 15 – 25% CO_2 offers the best weldability, but 100% CO_2 can also be used (voltage should be increased by 2V).
Gas flow rate 20 – 25 l/min.

Dimensions (mm)	*Amperage A*
1.2	*125-280*
1.6	*200-350*

BÖHLER CN 23/12 Mo-FD — Flux cored wire

Classifications		igh-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 23 12 2 L R M21 3 ; T 23 12 2 L R C1 3	E309LMoT0-4 ; 309LMoT0-1	

Characteristics and field of use

Rutile, strip alloyed, flux cored wire for welding austenite-ferrite joints and for weld claddings primarily in the flat and horizontal welding positions. The flux cored wire is characterised by particularly good resistance to hot cracking even when subject to high dilution, and is necessary for the first layer of Mo-alloyed eld claddings. The easy handling and high deposition rate result in high productivity with excellent welding behaviour, self-releasing slag, low spatter formation and seam oxidisation, finely rippled weld seams with good wetting behaviour and even, reliable fusion penetration. The weld metal is suitable for an operating temperature range between -60°C and +300°C. BÖHLER CN 23/12 Mo-FD Ø0.9 mm is particularly suitable for joint welding of thin sheet (approx. 1.5 mm, in position from 5.0 mm). The nature of the slag has been designed so that this dimension can be used in all positions. The Ø1.2 mm electrode can be used for welding with wall thicknesses from about 3 mm.

Base materials

high-strength, unalloyed and alloyed structural and quenched and tempered steels among themselves or among each other, unalloyed and alloyed boiler or structural steels with high-alloy Cr, CrNi and CrNiMo steels. Austenite-ferrite joints for boiler and pressure vessel construction. Particularly suitable for the first layer of corrosion- resistant Mo-alloyed weld claddings on P235G1TH, P255G1TH, S255N, P295GH, S355N - S500N and on creep resistant, quenched and tempered fine-grained structural steels according to AD HP 0, test group 3

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.03	0.6	1.4	23.0	12.5	2.7

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-60°C:*
untreated	500	700	30	55	37

Welding position

Polarity = +

re-drying: - in exceptional cases: 150°C/24 h
Shielding gas: Argon + 15-25% CO_2
100% CO_2
The gas quantity should be 15-18 l/min. Slightly trailing torch position (angle of incidence about 80°). It is recommended that the voltage is increased by 2 V if the shielding gas is 100% CO_2. Preheating and interpass temperature as required by the base metal.

Dimensions(mm)	*Amperage A*
0.9	*120-160*
1.2	*125-280*
1.6	*200-350*

Approvals and Certificates

TÜV (5351.), DB (43.014.17), ABS (E 308 MoLT0-4), DNV (309MoL (M21)), GL (4459 (C1, M21)), LR (X (M21)), RINA (309MO S), SEPROZ, CE, CWB (E309LMoT0-1 (4))

BÖHLER CN 23/12 Mo PW-FD

Flux cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22	
T 23 12 2 L P M21 1 ; T 23 12 2 L P C1 1	E309LMoT1-4 ; E309LMoT1-1	

Characteristics and field of use

Rutile, strip alloyed, flux cored wire for position welding of austenite-ferrite joints, and for the first layer of weld claddings of unalloyed and low-alloy Base materials. The flux cored wire is characterised by particularly good resistance to hot cracking even when subject to high dilution, and is necessary for the first layer of Mo-alloyed weld claddings. The support provided by the fast-hardening slag allows out-of-position welding with high current magnitudes and high welding speeds. The fine droplet, low-spatter, very intense spray arc, the reliable fusion penetration, the self-releasing slag and the good wetting behaviour result in a high weld quality at the same time as short welding times. Additional advantages to its application are the ease of handling, the low heat input resulting from the high welding speed, and the small amounts of cleaning and pickling required. The weld metal is suitable for an operating temperature range between -60°C and +300°C. BÖHLER CN 23/12 Mo-FD is preferred for flat and horizontal welding positions (PA, PB).

Base materials

high-strength, unalloyed and alloyed structural and quenched and tempered steels among themselves or among each other, unalloyed and alloyed boiler or structural steels with high-alloy Cr, CrNi and CrNiMo steels. Austenite-ferrite joints for boiler and pressure vessel construction. Particularly suitable for the first layer of corrosion- resistant Mo-alloyed weld claddings on P235G1TH, P255G1TH, S255N, P295GH, S355N - S500N and on creep resistant, quenched and tempered fine-grained structural steels according to AD HP 0, test group 3

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
0.03	0.7	1.4	23.0	2.7	12.5

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-60°C:*
untreated	530	720	32	65	50

Welding position

Polarity = +

re-drying: -
in exceptional cases: 150°C/24 h
Shielding gas: Argon + 15-25% CO_2
The gas quantity should be 15-18 l/min. Slightly trailing torch position (angle of incidence about 80°), slight weaving of the torch is recommended in all positions. It is recommended that the voltage is increased by 2 V if the shielding gas is 100% CO_2. Preheating and interpass temperature as required by the base metal.

Dimensions(mm)	*Amperage A*
1.2	*100-220*

Approvals and certificates

TÜV (09116.), BV (309 Mo), LR (SS/CMn), SEPROZ, CE, DNV (309 MoL)

BÖHLER CN 13/4-MC

Metal cored wire

Classifications		high-alloyed rutile
EN ISO 17633-A:	AWS A5.22:	
T 13 4 M M12 2	EC410NiMo (mod.)	

Characteristics and field of use

Metal cored wire for same-type corrosion-resistant, soft martensitic and martensitic-ferritic rolled, forged and cast steels. Used for water turbine and compressor fabrication. The easy handling and high deposition rate of BÖHLER CN 13/4-MC result in high productivity with excellent welding performance, very low spatter formation, finely rippled weld pattern with good wetting behaviour and even, reliable fusion penetration. BÖHLER CN 13/4-MC features very good toughness properties for the heat-treated weld metal, along with very low hydrogen content in the weld metal (under AWS conditions HD max. 4 ml/100 g) and optimum feeding characteristics.

Base materials

1.4317 GX4CrNi13-4, 1.4313 X3CrNiMo13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4
ACI Grade CA 6 NM

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo
≤0.025	0.7	0.9	12.0	4.6	0.6

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-20°C:*
untreated	760	900	16	65	60

Welding position

Polarity = +

re-drying: -
Shielding gas: M1
Welding with conventional MAG devices or with a Pulsarc, slightly trailing torch position (angle of incidence about 80°). Recommended free wire length about 18-20 mm. Arc length ~ 3 mm. Preheating and interpass temperature of thick-walled components 100-160°C. Heat input max. 15 kJ/cm. Tempering at +580-620°C.

Dimensions(mm)	*Amperage A*
1.2	*130-370*
1.6	*250-550*

Approvals and certificates

SEPROZ

Avesta FCW P12-PW

Flux cored wire

Classifications		nickel-based
EN ISO 12153:	AWS A5.34:	
T Ni 6625 P M21 2	ENiCrMo3T1-4	

Characteristics and field of use

Avesta FCW P12-PW is a nickel base wire primarily intended for welding the nickel base alloys type 625 and 825 and 6 Mo steels such as Outokumpu 254 SMO. It can also be used for welding 9 Ni steels for use in cryogenic applications. Avesta FCW P12-PW is designed for allround welding and can be used in all positions without changing the parameter settings. Weldability is excellent in the verticalup and overhead welding positions. To minimise the risk of hot cracking when welding fully austenitic steels and nickel base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Avesta FCWP12-PW should be welded using direct current positive polarity (DC+) with a recommended wire stick-out of 15 – 20 mm.

Corrosion resistance:
Excellent resistance to general corrosion in various types of acids and to pitting, crevice corrosion and stress corrosion cracking in chloride containing environments. Meets the corrosion test requirements per ASTM G48 Methods A, B and E (50°C).

Base materials

For welding steels such as					
Outokumpu	EN	ASTM	BS	NF	SS
254 SMO®	1.4547	S31254	-	-	2378
Also for welding nickel base alloys to stainless or unalloyed steels and for surfacing.					

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Mo	Nb	Fe
0.02	0.4	0.1	20.5	bal.	8.7	3.3	<1.0

Ferrite 0 FN

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*		
	MPa	*MPa*	*%*	*+20°C:*	*-40°C:*	*-196°C:*
untreated	460	750	40	75	60	45

Operating data

	Polarity = +	Shielding gas: Ar + 15 – 25%CO_2 Gasflow rate 20 – 25 l/min.

Dimensions (mm)	*Amperage A*
1.2	*150-240*

BÖHLER NIBAS 625 PW-FD

Flux cored wire

Classifications		nickel-based
EN ISO 12153:	AWS A5.34:	
T Ni 6625 P M21 2	ENiCrMo3T1-4	

Characteristics and field of use

Flux cored wire containing rutile for high quality welded joints to nickel-based alloys with a high Mo content (e.g. Alloy 625 and Alloy 825) and also to CrNiMo steels with a high Mo content (e.g. „6 Mo“ steels). This type is also suitable for creep resistant and highly creep resistant steels, heat resistant and cryogenic materials, dissimilar joints and low-alloy, hard-to-weld steels. Suitable for pressure vessel construction for -196°C to +550°C, otherwise with scaling resistance up to +1200°C (sulphur-free atmosphere). Because of the embrittlement of the base material between 600 and 850°C, use in this temperature range should be avoided. High resistance o hot cracking, in addition to which the C-diffusion at high temperatures or during heat treatment of dissimilar joints is largely inhibited. Extremely high resistance to stress corrosion cracking and pitting (PREN 52). Resistant to thermal shock, stainless, fully austenitic. Low expansion coefficient between C-steel and austenitic CrNi(Mo) steel. Can be welded out-of-position.

Base materials

2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo, 2.4816 NiCr15Fe, 1.4583 X10CrNiMoNb18-12, 1.4876 X10NiCrAlTi32-21, 1.4529 X1NiCrMoCuN25-20-7, X2CrNiMoCuN20-18-6, 2.4641 NiCr21Mo6Cu, Joints of the above-mentioned materials with unalloyed and low-alloy steels such as P265GH, P285NH, P295GH, 16Mo3, S355N, X8Ni9, N 08926, ASTM A 553 Gr.1, Alloy 600, Alloy 625, Alloy 800, 9% Ni steels

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Mo	Ni	Nb	Fe
≤0.05	0.4	0.4	21.0	8.5	bal.	3.3	<1.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	500	740	40	90	80

Welding position

Polarity = +

Shielding gas:
Argon + 15-25% CO_2
Welding with conventional MAG devices, slightly trailing torch position (angle of incidence about 80°). The gas quantity should be 15-18 l/min.

Dimensions (mm)	*Amperage A*
1.2	*150-250*

Approvals and certificates

TÜV (11223.), CE

UTP AF 6222 MoPW

Flux cored wire

Classifications		nickel-based
EN ISO 12153:	AWS A5.34:	
T Ni 6625 P M21 2	ENiCrMo3 T1-4	

Characteristics and field of use

UTP AF 6222 MoPW tubular wire nickel alloy is applicable for bonding weld and coating weld in nickelbased materials and on materials from similar nature and on CrNi stainless steels and low alloy steels. It is also used for high temperature applications

Welding Characteristics:

UTP AF 6222 MoPW tubular wire nickel alloy exhibits excellent behavior in welds out position and high welding speed. This wire has a stable metal transfer through small droplets. The wide range of operational parameters enables its use for diverse thicknesses of base material.

Welding Instructions:

Clean the surface to be welded (shiny metal). Keep welding power and temperature low and maximum interpass temperature at 150 ° C.

Base materials

DIN Nomenclature	Material No.	UNS No.	Alloy type
NiCr22Mo9Nb	2.4856	N 06625	625
X NiCrMoCu25 20 5	1.4539	N 08904	904
X NiCrNb 18 12	1.4583		
StE 355	1.0562		
X 8Ni9	1.5662		A 553 Tp.1

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Mo	Nb	Fe	P	S	Ni
≤0.03	0.4	0.4	21.5	9.0	3.5	0.5	0.01	0.01	bal.

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*-196°C:*
untreated	490	750	30	60

Welding position

Polarity = +

Shielding gas:
Argon + 15 – 25% CO_2

Dimensions (mm)	*Amperage A*
1.2	*160-260*

Approvals and certificates

TÜV (10991.)

BÖHLER NIBAS 70/20-FD

Flux cored wire

Classifications		nickel-based
EN ISO 12153:	AWS A5.34:	
T Ni 6082 R M21 3	ENiCr3T0-4	

Characteristics and field of use

Flux cored wire containing rutile with basic components primarily for flat and horizontal welding positions. The easy handling and high deposition rate of BÖHLER NIBAS 70/20-FD result in high productivity with excellent welding performance, self-releasing slag, very low spatter formation and seam oxidisation, finely rippled weld pattern with good wetting behaviour and even, reliable fusion penetration. In addition to the significant savings in time and costs of processing techniques and to the lower requirement for cleaning and pickling, BÖHLER NIBAS 70/20-FD ensures a high level of quality and highly reliable avoidance of welding defects. Suitable for high-quality welded joints to nickel-based alloys, creep resistant and highly creep resistant materials, heat resistant and cryogenic materials, and also for low-alloy, hard-to-weld steels and dissimilar joints. Also for ferrite-austenite joints at operating temperatures ≥ 300°C or with subsequent heat treatments. Suitable for pressure vessel construction for -196°C to +550°C, otherwise with scaling resistance up to +1200°C (sulphur-free atmosphere). No tendency to embrittlement, while C-diffusion at high temperatures is largely inhibited. Resistant to thermal shock, stainless, fully austenitic, low coefficient of expansion.

Base materials

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, Alloy 600, Alloy 600 L Nickel and nickel alloys, low-temperature steels up to X8Ni9, high-alloy Cr and Cr-Ni-Mo steels, particularly for dissimilar joints, and their joints to unalloyed, low-alloy, creep resistant and highly creep resistant steels. Also suitable for the Alloy 800 (H) material.

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	Cr	Ni	Nb	Fe
≤0.03	0.4	3.2	19.5	bal.	2.5	≤2.0

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*	
	MPa	*MPa*	*%*	*+20°C:*	*-196°C:*
untreated	400	650	39	135	110

Welding position

Polarity = +

re-drying if necessary: –
Shielding gas:
Argon + 15-25% CO_2
Welding with conventional MAG devices, slightly trailing torch position (angle of incidence about 80°); avoid overheating, only slight torch weaving. The gas quantity should be 15-20 l/min.

Dimensions(mm)	*Amperage A*
1.2	*130-260*
1.6	*150-350*

Approvals and certificates

TÜV (10298.), CE

UTP AF 068 HH

Flux cored wire

Classifications		nickel-based
EN ISO 12153:	AWS A5.34:	
T Ni 6082 R M21 3	ENiCr3T0-4	

Characteristics and field of use

UTP AF 068 HH is a Ni-base flux cored wire (NiCr) for joining and surfacing of nickel alloys of the same or of similar nature, heterogeneous joints with C- and CrNi-steels, claddings on C-steels. Typical applications are high-temperature components.

Welding characteristics and special properties of the weld metal:

UTP AF 068 HH is characterised by its hot cracking resistance and tough weld metal and is used for service temperatures up to 900° C in long-term period. UTP AF 068 HH has outstanding welding characteristics with a regular and fine drop transfer. The seam is finely rippled and the transition from the weld to the base metal is regular and free from notches. The wide adjustment range of welding parameters enables an application on different wall thicknesses.

Base materials

DIN Nomenclature	Material No.	UNS No.	Alloy type
NiCr15Fe	2.4816	N06600	600
LC NiCr15Fe	2.4817	N01665	600 LC
X10CrNiMoNb18 12	1.4583*		
X10NiCrAlTi 32 21	1.4876		800
GX10NiCrNb32 20	1.4859		
StE 355	1.0562*		

*Dissimilar joints with nickel-alloys

Typical composition of all-weld metal (Wt-%)

C	Si	Mn	P	S	Cr	Ni	Nb	Fe
≤0.03	0.4	3.0	0.007	0.005	20.0	bal.	2.4	1.4

Mechanical properties of all-weld metal

Heat Treatment	*Yield strength 0.2%*	*Tensile strength*	*Elongation (L_0=5d_0)*	*Impact values in J CVN*
	MPa	*MPa*	*%*	*+20°C:*
untreated	400	650	39	135

Welding position

Polarity = +

Shielding gas:
Argon + 15 – 25% CO_2

Dimensions (mm)

1.2

Approvals and certificates

TÜV (10209.)