böhler welding
by voestalpine

Lasting Connections

PRODUCT CATALOGUE

voestalpine Böhler Welding
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Böhler Welding Product Catalogue

Lasting Connections

As a pioneer in innovative welding consumables, Böhler Welding offers a unique product por olio for joint welding worldwide. More than 2000 products are adapted continuously to the current industry specifications and customer requirements, certified by well-respected institutes and thus approved for the most demanding welding applications. As a reliable partner for customers, “lasting connections” are the brand’s philosophy in terms of both welding and people.

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BÖHLER FOX CM 9 Kb	3580-A	E CrMo9 B 4 2 H5	A5.5 / -5.5	E8018-B8 H4	150
BÖHLER FOX DCMS Kb	3580-A	E CrMo1 B 4 2 H5	A5.5 / -5.5	E8018-B2 H4	144
BÖHLER FOX DCMV	3580-A	E Z CrMoV1 B 4 2 H5	A5.5 / -5.5	E9018-G	145
BÖHLER FOX DMO Kb	3580-A	E Mo B 4 2 H5	A5.5 / -5.5	E7018-A1 H4	143
BÖHLER FOX P 22	3580-A	E CrMo2 B 4 2 H5	A5.5 / -5.5	E9018-B3	159
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BÖHLER P 92 Ti-FD	17634-A	T ZCrWMo9VNb P M21 1	A5.36 / -5.36	E91T1-M21PZ-B92	234
Thermanit Chromo 9 V	3580-A	E CrMo91 B 4 2 H5	A5.5 / -5.5	E9015-B91 H4 R	154
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Thermanit MTS 3	21952-A	G CrMo 9 1	A5.28 / -5.28	ER90S-B9	181
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Thermanit MTS 3 - Marathon 543	24598-A	S S CrMo91 FB	A5.23 / -5.23	F9PZ-EB91-B91	211
Thermanit MTS 3 LNi			A5.28 / -5.28	ER90S-B9	170
Thermanit MTS 3 LNI - Marathon 543	24598-A	S S ZCrMo91 FB	A5.23 / -5.23	F9PZ-EB91-B91	212
Thermanit MTS 3 PW	17634-A	T ZCrMo9VNb P M21 1 H5	A5.36 / -5.36	E91T1-M21PY-B91-H4	235
Thermanit MTS 3-LNI			A5.28 / -5.28	ER90S-B9	182
Thermanit MTS 3-LNi	3580-A	E Z CrMo91 B 4 2 H5	A5.5 / -5.5	E9015-B91 H4	153
Thermanit MTS 4 - Marathon 543	24598-A	S S CrMoWV12 FB	A5.23 / -5.23	F9PZ-EG-G	215
Thermanit MTS 4 Si	21952-A	G CrMoWV 12 Si	A5.9 / -5.9	ER505 (mod.)	183
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Nickel-based welding consumables

Overview of Standards

	SMAW		GMAW/GTAW	
Welding consumables for steel <460 MPa	EN ISO 2560	AWS A5.1	EN ISO 14341 EN ISO 636	AWS A5.18
Welding consumables for steels with yield strength >460 MPa	EN ISO 18275 EN ISO 2560	AWS A5.5	EN ISO 636 EN ISO 14341 EN ISO 16834	AWS A5.28
Welding consumables for creep resistant steels	EN ISO 3580	AWS A5.5	EN ISO 21952	AWS A5.28
Welding consumables for pipe steels	EN ISO 18275 EN ISO 2560	AWS A5.1 AWS A5.5	EN ISO 14341 EN ISO 16834	AWS A5.18 AWS A5.28
Welding consumables for martensitic stainless steels	EN ISO 3581	AWS A5.4	EN ISO 14343	AWS A5.9
Welding consumables for ferritic stainless steels	EN ISO 3581	AWS A5.4	EN ISO 14343	AWS A5.9
Welding consumables for austenitic stainless steels	EN ISO 3581	AWS A5.4	EN ISO 14343	AWS A5.9
Welding consumables for duplex stainless steels	EN ISO 3581	AWS A5.4	EN ISO 14343	AWS A5.9
Welding consumables for dissimilar joints and special applications	EN ISO 3581	AWS A5.4	EN ISO 14343	AWS A5.9
Welding consumables for heat and creep resistant stainless steels	EN ISO 3581	AWS A5.4	EN ISO 14343	AWS A5.9
Nickel-based welding consumables	EN ISO 14172	AWS A5.11	EN ISO 18274	AWS A5.14
Welding consumables for aluminium and aluminium alloys	DIN 1732*	AWS A5.3	EN ISO 18273	AWS A5.10
Welding consumables for titanium and titanium alloys			EN ISO 24034	AWS A5.16

*DIN 1732 replaced by EN ISO 18273

	FCAW/MCAW		SAW			
			wire		flux	
	EN ISO 17632	AWS A5.36	EN ISO 14171	AWS A5.17	EN ISO 14174	Welding consumables for steel <460 MPa
	EN ISO 17632 EN ISO 18276	AWS A5.36	EN ISO 14171 EN ISO 26304	AWS A5.23	EN ISO 14174	Welding consumables for steels with yield strength >460 MPa
	EN ISO 17634	AWS A5.36	EN ISO 14171 EN ISO 24598	AWS A5.23	EN ISO 14174	Welding consumables for creep resistant steels
	EN ISO 17632 EN ISO 18276	AWS A5.36	EN ISO 14171 EN ISO 26304	AWS A5.23	EN ISO 14174	Welding consumables for pipe steels
	EN ISO 17633	AWS A5.22	EN ISO 14343	AWS A5.9	EN ISO 14174	Welding consumables for martensitic stainless steels
	EN ISO 17633	AWS A5.22	EN ISO 14343	AWS A5.9	EN ISO 14174	Welding consumables for ferritic stainless steels
	EN ISO 17633	AWS A5.22	EN ISO 14343	AWS A5.9	EN ISO 14174	Welding consumables for austenitic stainless steels
	EN ISO 17633	AWS A5.22	EN ISO 14343	AWS A5.9	EN ISO 14174	Welding consumables for duplex stainless steels
	EN ISO 17633	AWS A5.22	EN ISO 14343	AWS A5.9	EN ISO 14174	Welding consumables for dissimilar joints and special applications
	EN ISO 17633	AWS A5.22	EN ISO 14343	AWS A5.9	EN ISO 14174	Welding consumables for heat and creep resistant stainless steels
	EN ISO 12153	AWS A5.34	EN ISO 18274	AWS A5.14	EN ISO 14174	Nickel-based welding consumables
						Welding consumables for aluminium and aluminium alloys
						Welding consumables for titanium and titanium alloys

Comparison EN/AWS-classification

ISO	Class	AWS/SFA	Class	Product	Page
Welding consumables for steel <460 MPa					
12536	O I	A5.2 / -5.2	R45-G	BÖHLER BW VII	61
12536	O III	A5.2 / -5.2	R60-G	BÖHLER BW XII	62
14341-A	G 38 3 M21 2Si1	A5.18	ER70S-3	BÖHLER EMK 4	23
14341-A	G 38 3 M21 2Si	A5.18	ER70S-3	BÖHLER EMK 4 NC	24
14341-A	G 42 4 M21 3Si1	A5.18 / -5.18	ER 70S-6	BÖHLER EMK 6	25
636-A	W 3Si1	A5.18 / -5.18	ER70S-6	BÖHLER EMK 6	21
14341-A	G 42 3 M21 3Si1	A5.18 / -5.18	ER70S-6	BÖHLER EMK 6 D	26
14341-A	G 42 4 M21 3Si1	A5.18 / -5.18	ER70S-6	BÖHLER EMK 6 NC	27
14341-A	G 46 4 M21 4Si1	A5.18 / -5.18	ER70S-6	BÖHLER EMK 8	29
636-A	W 4Si1	A5.18 / -5.18	ER70S-6	BÖHLER EMK 8	22
14341-A	G 46 4 M21 4Si1	A5.18 / -5.18	ER70S-6	BÖHLER EMK 8 D	30
14341-A	G 46 4 M21 4Si1			BÖHLER EMK 8 NC	31
636-A	W 2 Si	A5.18 / -5.18	ER70S-3	BÖHLER EML 5	20
2560-A	E 42 0 RR 1 2	A5.1 / -5.1	E6013	BÖHLER FOX ETI	7
2560-A	E 38 4 B 4 2 H5	A5.1 / -5.1	E7016-1 H4 R	BÖHLER FOX EV 47	11
2560-A	E 42 5 B 4 2 H5	A5.1 / -5.1	E7018-1 H4 R	BÖHLER FOX EV 50	14
2560-A	E 42 5 B 1 2 H5	A5.1 / -5.1	E7016-1 H4 R	BÖHLER FOX EV 50-W	13
				BÖHLER FOX NUT	19
2560-A	E 38 0 RC 1 1	A5.1 / -5.1	E6013	BÖHLER FOX OHV	6
2560-A	E 38 2 RB 1 2	A5.1 / -5.1	E6013 (mod.)	BÖHLER FOX SPE	8
17632-A	T 46 3 M M21 1 H5	A5.36 / -5.36	E70T15-M21A2-S1-H4	BÖHLER HL 46 T-MC	58
17632-A	T 46 2 M M21 1 H5	A5.36 / -5.36	E70T15-M21A0-CS1-H4	BÖHLER HL 46-MC	57
17632-A	T46 4 M M21 1 H5	A5.36 / A5.36	E71T15-M21A4-CS2-H4	BÖHLER HL 51 L-MC	59
17632-A	T 46 6 M M21 1 H5	A5.36 / -5.36	E70T15-M21A8-CS1-H4	BÖHLER HL 51 T-MC	60
17632-A	T 42 4 B M21 1 H5	A5.36 / -5.36	E71T5-M21A4-CS1-H4	BÖHLER Kb 46 T-FD	47
17632-A	T 46 4 B M21 3 H5	A5.36 / -5.36	E70T5-M21A4-CS1-H4	BÖHLER Kb 52 T-FD	48
14341-A	G 42 3 M21 3Si1	A5.18 / -5.18	ER70S-6	BÖHLER SG 2	28
14341-A	G 46 4 M21 4Si1	A5.18	ER70S-6	BÖHLER SG 3	32
14171-A	S 46 6 FB T3 H5	A5.17 / -5.17	F7A8-EC1 / F7P8-EC1	BÖHLER SUBARC T55 HP - UV 419 TT-W	46
14171-A	S 46 6 FB T3 H5	A5.17 / -5.17	F7A8-EC1 / F7P8-EC1	BÖHLER SUBARC T55 HP - UV 421 TT	45
14171-A	S 50 4 AR T3 H5	A5.17 / -5.17	F7A5-ECG	BÖHLER SUBARC T55 HP - UV 306	44
17632-A	T 46 2 R M21 3 H5	A5.36 / -5.36	E70T1-M21A0-CS1-H4	BÖHLER Ti 42 T-FD	49
17632-A	T46 3 P M21 1 H5	A5.36 / A5.36	E71T1-M21A2-CS2-H4	BÖHLER Ti 46 T-FD	50
17632-A	T 46 2 P M21 1 H10	A5.36 / -5.36	E71T1-M21A0-CS1-H8	BÖHLER Ti 46-FD	51
17632-A	T 46 4 P M 1 H5	A5.36 / -5.36	E71T1-M21A4-CS1-DH4	BÖHLER Ti 52 T-FD	53
17632-A	T 46 3 P C1 1 H5	A5.36 / -5.36	E71T1-C1A2-CS1-H4	BÖHLER Ti 52 T-FD (CO_2)	54
17632-A	T 46 5 P M21 1 H5	A5.36 / -5.36	E71T1-M21AP6-CS2-H4	BÖHLER Ti 52 T-FD (HP)	55
17632-A	T 42 4 P C1 1 H5	A5.36 / -5.36	E71T12-C1AP4-CS1-H4	BÖHLER Ti 52 T-FD SR (CO_2)	56
17632-A	T 46 4 P M21 1 H10	A5.36 / -5.36	E71T1-M21A4-CS1-H8	BÖHLER Ti 52-FD	52
2560-A	E 42 0 RC 1 1	A5.1 / -5.1	E6013	Phoenix Blau	5
2560-A	E 42 0 R 1 2	A5.1 / -5.1	E6012	Phoenix Grün	4
2560-A	E 42 4 B 4 2	A5.1 / -5.1	E7015	Phoenix K 50	10
2560-A	E 42 2 RA 5 3	A5.1 / -5.1	E7024-1	Phoenix Rot AR 160	17
2560-A	E 42 2 RB 5 3	A5.1 / -5.1	E7028	Phoenix Rot BR 160	18
2560-A	E 42 0 RR 5 3	A5.1 / -5.1	E7024-1	Phoenix Rot R 160	16
2560-A	E 42 0 RR 5 3	A5.1 / -5.1	E7014	Phoenix SH Multifer 130	9

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2560-A	E 42 0 RR 7 3	A5.1 / -5.1	E7024	Phoenix SH Multifer 180	15
2560-A	E 42 3 B 1 2 H10	A5.1 / -5.1	E7016	Phoenix Spezial D	12
14171-A	S 38 0 AR S2			Union S 2 - UV 305	33
14171-A	S 42 3 AR S2			Union S 2 - UV 306	34
14171-A	S 38 4 AB S2			Union S 2 - UV 400	35
14171-A	S 42 A AR S2Si	A5.17 / -5.17	F7AZ-EM12K	Union S 2 Si - UV 305	36
14171-A	S 42 3 AR S2Si	A5.17 / -5.17	F7A2-EM12K / F7P2-EM12K	Union S 2 Si - UV 306	37
14171-A	S 42 5 FB S2Si	A5.17 / -5.17	F7A6-EM12K / F6P8-EM12K	Union S 2 Si - UV 421 TT	38
14171-A	S 42 4 AB S3Si	A5.23 / -5.23	F7A6-EH12K	Union S 3 Si - UV 310 P	39
14171-A	S 46 6 FB S3Si	A5.17 / -5.17	F7A8-EH12K / F7P8-EH12K	Union S 3 Si - UV 418 TT	40
14171-A	S 46 6 FB S3Si	A5.17 / -5.17	F7A8-EH12K / F7P8-EH12K	Union S 3 Si - UV 419 TT-W	42
14171-A	S 46 6 FB S3Si	A5.17 / -5.17	F7A8-EH12K / F7P8-EH12K	Union S 3 Si - UV 421 TT	41
		A5.17 / -5.17	F7A8-EH12K-H4 / F7P8-EH12K-H4	Union S 3 Si - UV 422 TT-LH	43
Welding consumables for steels with yield strength >460 MPa					
636-A	W 46 8 2Ni2	A5.28 / -5.28	ER80S-Ni2	BÖHLER 2,5 Ni-IG	78
16834-A	G 79 5 M21 Mn4Ni1,5CrMo	A5.28 / -5.28	ER110S-G	BÖHLER alform 700-IG	89
16834-A	G 89 6 M Mn4Ni2CrMo	A5.28 / -5.28	ER120S-G	BÖHLER alform 900-IG	90
16834-A	G 89 5 M21 Mn4Ni2,5CrMo	A5.28 / -5.28	ER120S-G	BÖHLER alform 960-IG	91
18276-A	T 69 6 Mn2NiCrMo M M21 1 H5	A5.36 / A5.36	E111T15-M21A8-K4-H4	BÖHLER alform® 700 L-MC	135
18276-A	T89 5 ZMn2NiCrMo M M21 1 H5	A5.36 / A5.36	E131T15-M21A6-K4-H4	BÖHLER alform® 900 L-MC	136
18276-A	T89 4 ZMn2NiCrMo M M21 1 H5	A5.36 / A5.36	E131T15-M21A4-K4-H4	BÖHLER alform® 960 L-MC	137
2560-A	E 46 8 2Ni B 4 2 H5	A5.5 / -5.5	E8018-C1 H4 R	BÖHLER FOX 2,5 Ni	67
2560-A	E 46 6 1Ni B 4 2 H5	A5.5 / -5.5	E8018-C3 H4 R	BÖHLER FOX EV 60	68
2560-A	E 50 4 B 4 2 H5	A5.5 / -5.5	E8018-G H4 R	BÖHLER FOX EV 63	69
18275-M	E6218-G A H5	A5.5 / -5.5	E8018-G H4 R	BÖHLER FOX EV 65	70
18275-A	E 55 6 1NiMo B 4 2 H5	A5.5 / -5.5	E9018-G H4 R	BÖHLER FOX EV 70	71
18275-A	E 62 6 Mn2NiCrMo B 4 2 H5	A5.5 / -5.5	E10018-G H4 R	BÖHLER FOX EV 75	73
18275-A	E 69 6 Mn2NiCrMo B 4 2 H5	A5.5 / -5.5	E11018-G H4 R	BÖHLER FOX EV 85	75
2560-A	E 46 4 Z1NiCrCu B 4 2 H5	A5.5 / -5.5	E8018-W2 H4 R	BÖHLER FOX NiCuCr	66
17632-A	T 50 6 1 Ni M M21 1 H5	A5.36 / -5.36	E80T15-M21A8-Ni1-H4	BÖHLER HL 53 T-MC	132
17632-A	T 55 6 1NiMo M M21 1 H5	A5.36 / -5.36	E90T15-M21A8-K1-H4	BÖHLER HL 65 T-MC	133
17632-A	T 62 4 Z M M21 1 H5	A5.36 / -5.36	E101T15-M21A4-G-H4	BÖHLER HL 75 T-MC	134
17632-A	T 46 6 1Ni B M21 3 H5	A5.36 / -5.36	E80T5-M21P8-Ni1-H4	BÖHLER Kb 60 T-FD	122
18276-A	T 55 4 1NiMo B M21 3 H5	A5.36 / -5.36	E90T5-M21A4-GH4	BÖHLER Kb 65 T-FD	123
18276-A	T 69 6 1Mn2NiCrMo B M21 3 H5	A5.36 / -5.36	E110T5-M21A8-K4-H4	BÖHLER Kb 85 T-FD	129
18276-A	T69 4 Mn2NiCrMo B C1 3 H5	A5.36 / A5.36	E110T5-C1A4-K4-H4	BÖHLER Kb 85 T-FD (CO_2)	130
18276-A	T89 4 Mn2Ni1CrMo B M21 3 H5	A5.36 / -5.36	E130T5-GM-H4	BÖHLER Kb 90 T-FD	131
17632-A	T 46 6 Z B M21 3 H5	A5.36 / -5.36	E80T5-M21A8-GH4	BÖHLER Kb NiCu1 T-FD	113
14341-A	G 42 4 M21 Z3Ni1Cu	A5.28 / -5.28	ER80S-G	BÖHLER NiCu 1-IG	79
17632-A	T 46 4 Z P M21 1 H5	A5.36 / -5.36	E81T1-M21A4-GH4	BÖHLER NiCu1 Ti T-FD	112
17632-A	T 46 6 Z M M21 1 H5	A5.36 / -5.36	E80T15-M21A8-GH4	BÖHLER NiCu1 T-MC	114
14171-A	S 50 6 FB TZ3Ni1 H5	A5.23 / -5.23	F8A8-ECNi1-Ni1	BÖHLER SUBARC T60 - UV 419 TT-W	99
26304-A	S 79 5 FB TZ H5	A5.23 / -5.23	F12A6-EC-F5-H4	BÖHLER SUBARC T85 - UV 422 TT-LH	110
14171-A	S 46 4 AR T2Ni1Cu	A5.23 / 5.23	F8A5-ECG-G	BÖHLER SUBARC TNiCu1 - UV 306	92
14171-A	S 46 6 AB T2Ni1Cu	A5.23 / -5.23	F7A8-ECG-G	BÖHLER SUBARC TNiCu1 - UV 400	93
17632-A	T 50 6 2Ni P M21 1 H4	A5.36 / -5.36	E81T1-M21A8-Ni2-H4	BÖHLER Ti 2 Ni T-FD	124

ISO	Class	AWS/SFA	Class	Product	Page
17632-A	T 50 6 1,5Ni P C1 1 H5	A5.36 / -5.36	E81T1-C1A8-K2-H4	BÖHLER Ti 60 K2 T-FD (CO_2)	120
17632-A	T 50 6 1Ni P M21 1 H5	A5.36 / -5.36	E81T1-M21A8-Ni1-H4	BÖHLER Ti 60 T-FD	118
17632-A	T 46 4 1Ni P C1 1 H5	A5.36 / -5.36	E81T1-C1A4-Ni1-H4	BÖHLER Ti 60 T-FD (CO_2)	119
17632-A	T 50 6 1Ni P M21 1 H5	A5.36 / -5.36	E81T1-M21AP8-Ni1-H4	BÖHLER Ti 60 T-FD SR	121
18276-A	T 64 4 Mn1.5Ni P M21 1 H5	A5.36 / -5.36	E101T1-M21A4K2-H4	BÖHLER Ti 75 T-FD	125
18276-A	T 69 6 Z P M21 1 H5	A5.36 / -5.36	E111T1-M21A8-GH4	BÖHLER Ti 80 T-FD	126
18276-A	T69 6 Mn2NiCrMo M M21 1 H5	A5.36 / A5.36	E110T15-M21A8-K4-H4	BÖHLER X70 L-MC	117
18276-A	T89 5 ZMn2NiCrMo M M21 1 H5	A5.36 / A5.36	E131T15-M21A6-K4-H4	BÖHLER X90 L-MC	116
18276-A	T89 4 ZMn2NiCrMo M M21 1 H5	A5.36 / A5.36	E131T15-M21A4-K4-H4	BÖHLER X96 L-MC	115
18276-A	T 69 6 Mn2NiMo P M21 1 H5	A5.36 / -5.36	E111T1-M21AP5-K3-H4	BÖHLER Subarc 700 RC-SR	127
26304-A	S 69 6 FB TZ H5	A5.23 / -5.23	F11A10-ECF5-F5 / F11P6-ECF5-F5	BÖHLER Subarc S 700 HP - UV 422 TT-LH	109
26304-A	S 89 4 FB TZ H5	A5.23 / -5.23	F13A6-ECG-G	BÖHLER Subarc S 900 HP UV 422 TTLH	111
18275-A	E 89 4 Mn2Ni1CrMo B 4 2 H5	A5.5 / -5.5	E12018-G	Phoenix SH Ni 2 K 130	76
2560-A	E 50 4 Z1NiMo B 4 2 H5	A5.5 / -5.5	E9018-G	Phoenix SH Schwarz 3 K Ni	72
18275-A	E 62 4 Mn1NiMo B 4 2 H5	A5.5 / -5.5	E10018-D2 H4	Thermanit NiMo 100	74
636-A	W 46 8 2Ni2	A5.28 / -5.28	ER80S-Ni2	Union I 2,5 NI	77
14341-A	G 50 5 M21 3Ni1	A5.28 / -5.28	ER80S-G	Union K 5 NI	80
16834-A	G 62 5 M21 Mn3Ni1Mo	A5.28 / -5.28	ER90S-G	Union MoNi	82
440- G 50 8 M G2Ni2	440- G 50 8 M G2Ni2	A5.28 / -5.28	ER80S-Ni2	Union NI 2,5	81
16834-A	G 69 6 M21 Mn4Ni1,5CrMo	A5.28 / -5.28	ER100S-G	Union NiMoCr	83
14171-A	S 46 8 FB S2Ni2	A5.23 / -5.23	F8A10-ENi2-Ni2 / F7P10-ENi2-Ni2	Union S 2 Ni 2,5 - UV 421 TT	94
14171-A	S 42 8 FB S2Ni3	A5.23 / -5.23	F7A15-ENi3-Ni3 / F7P15-ENi3-Ni3	Union S 2 Ni 3,5 - UV 421 TT	95
14171-A	S 50 6 FB SZ2Ni1Mo	A5.23 / 5.23	F8A8-ENi1-Ni1 - F8P8-ENi1-Ni1	Union S 2 NiMo 1 - UV 419 TT-W	97
14171-A	S 50 6 FB SZ2Ni1Mo	A5.23 / -5.23	F8A8-ENi1-Ni1 - F8P8-ENi1-Ni1	Union S 2 NiMo 1 - UV 420 TTR-C	98
14171-A	S 50 6 FB SZ2Ni1Mo	A5.23 / -5.23	F8A10-ENi1-Ni1 - F8P10-ENi1-Ni1	Union S 2 NiMo 1 - UV 421 TT	96
26304-A	S 50 6 FB S3Ni1,5Mo	A5.23 / -5.23	F9A8-EG-F1 / F8P9-EG-F1	Union S 3 NiMo - UV 420 TTR	106
26304-A	S 55 6 FB S3Ni1Mo	A5.23 / -5.23	F9A8-EF3-F3 / F9P8-EF3-F3	Union S 3 NiMo 1 - UV 419 TT-W	101
26304-A	S 55 4 FB S3Ni1Mo	A5.23 / -5.23	F9A8-EF3-F3-N / F9P8-EF3-F3-N	Union S 3 NiMo 1 - UV 420 TTR	102
26304-A	S 62 4 FB S3Ni1Mo	A5.23 / -5.23	F10A6-EF3-F3 H4 / F9P6-EF3-F3 H4	Union S 3 NiMo 1 - UV 420 TTR-C	104
26304-A	S 55 6 FB S3Ni1Mo	A5.23 / -5.23	F9A8-EF3-F3	Union S 3 NiMo 1 - UV 421 TT	100
26304-A	S 55 6 FB S3Ni1Mo H5	A5.23 / -5.23	F9A8-EF3-F3	Union S 3 NiMo 1 - UV 422 TT-LH	103
26304-A	S 69 6 FB SZ3Ni2,5CrMo	A5.23 / -5.23	F11A8-EG-F6	Union S 3 NiMoCr - UV 421 TT	107
26304-A	S 69 6 FB SZ3Ni2,5CrMo H5	A5.23 / -5.23	F11A8-EG-F6-H4	Union S 3 NiMoCr UV 422 TTLH	108
26304-A	S 62 4 FB SZ3Ni0,9MoCr	A5.23	F10A6-EG-G / F9P6-EG-G	Union S Ni1MoCr - UV 420 TTR-C	105
16834-A	G 69 4 M21 Mn3Ni1CrMo	A5.28 / -5.28	ER100S-G	Union X 69	84
16834-A	G 79 5 M21 Mn4Ni1,5CrMo	A5.28 / -5.28	ER110S-G	Union X 85	86
16834-A	G 69 6 M21 Mn3Ni2,5CrMo	A5.28 / -5.28	ER110S-G	Union X 85 T	85
16834-A	G 89 6 M21 Mn4Ni2CrMo	A5.28 / -5.28	ER120S-G	Union X 90	87
16834-A	G 89 5 M21 Mn4Ni2,5CrMo	A5.28 / -5.28	ER120S-G	Union X 96	88

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Welding consumables for creep resistant steels					
17634-B	T69T1-1M21-G-H5			BOEHLER DCMV Ti T-FD	224
17634-A	T ZCrMo9VNb P M21 1 H5	A5.36 / -5.36	E91T1-M21PY-B91-H4	BÖHLER C 9 MV Ti-FD	231
17634-B	T69T15-1G-9C1MV	A5.36 / -5.36	E90T15-M12PY-B91-H4	BÖHLER C 9 MV-MC	232
17634-A	T ZCrMoW9VNb P M21 1	A5.36 / -5.36	E91T1-M21PY-G	BÖHLER C 9 MVW Ti-FD	233
17634-A	T ZCrMoCo9VNbNB P M21 1	A5.36 / -5.36	E91T1-M21PY-G	BÖHLER CB 2 Ti-FD	230
17634-A	T CrMo2 B M21 4 H5	A5.36 / -5.36	E90T5-M21PY-B3-H4	BÖHLER CM 2 Kb T-FD	228
17634-A	T CrMo2 P M21 1 H10	A5.36 / -5.36	E91T1-M21PY-B3-H8	BÖHLER CM 2 Ti-FD	226
17634-A	T CrMo2 M M21 1 H5	A5.36 / -5.36	E90T15-M21PY-B3-H4	BÖHLER CM 2 T-MC	227
17634-A	T CrMo5 B M21 3 H5	A5.36 / -5.36	E80T5-M21PY-B6-H4	BÖHLER CM 5 Kb T-FD	229
21952-A	G CrMo5Si	A5.28 / -5.28	ER80S-B6	BÖHLER CM 5-IG	179
21952-A	W CrMo5Si	A5.28 / -5.28	ER80S-B6	BÖHLER CM 5-IG	163
21952-A	WZ CrMo9 Si	A5.28 / -5.28	ER80S-B8	BÖHLER CM 9-IG	165
24598-A	S S CrMo9 FB	A5.23 / -5.23	F8PZ-EB8-B8	BÖHLER CM 9-UP - Marathon 543	210
17634-A	T CrMo1 B M21 3 H5	A5.36 / -5.36	E80T5-M21PY-B2-H4	BÖHLER DCMS Kb T-FD	223
17634-A	T CrMo1 P M21 1 H5	A5.36 / A5.36	E81T1-M21PY-B2-H4	BÖHLER DCMS Ti T-FD	221
17634-A	T CrMo1 P M21 1 H10	A5.36 / -5.36	E81T1-M21PY-B2H8	BÖHLER DCMS Ti-FD	220
17634-A	T CrMo1 M M21 1 H5	A5.36 / -5.36	E80T15-M21PY-B2-H4	BÖHLER DCMS T-MC	222
21952-A	G CrMo1Si	A5.28 / -5.28	ER80S-G	BÖHLER DCMS-IG	178
21952-A	W CrMo1Si	A5.28 / -5.28	ER80S-G	BÖHLER DCMS-IG	162
17634-A	T Z B M21 3 H5	A5.36 / -5.36	E90T5-M21PY-GH4	BÖHLER DCMV Kb T-FD	225
17634-A	T Mo B M21 3 H5	A5.36 / -5.36	E80T5-M21P8-A1-H4	BÖHLER DMO Kb T-FD	219
17634-A	T46 0 Mo P M21 1 H5	A5.36 / -5.36	E81T1-M21P0-A1-H4	BÖHLER DMO Ti T-FD	217
17634-A	T MoL P M21 1 H10	A5.36 / -5.36	E81T1-M21PY-A1H8	BÖHLER DMO Ti-FD	216
17634-A	T Mo M M21 1 H5	A5.36 / -5.36	E80T15-M21P0-A1-H4	BÖHLER DMO T-MC	218
636-A	W MoSi	A5.28 / -5.28	ER70S-A1 (ER80S-G)	BÖHLER DMO-IG	161
21952-A	G MoSi	A5.28 / -5.28	ER70S-A1 (ER80S-G)	BÖHLER DMO-IG	177
21952-A	G MoVSi	A5.28 / -5.28	ER80S-G	BÖHLER DMV 83-IG	180
21952-A	W MoVSi	A5.28 / -5.28	ER80S-G	BÖHLER DMV 83-IG	164
3580-A	E CrMoWV12 B 4 2 H5			BÖHLER FOX 20 MVW	151
3580-A	E CrMo91 B 4 2 H5	A5.5 / -5.5	E9015-B91 H4	BÖHLER FOX C 9 MV	152
3580-A	E CrMo2 B 4 2 H5	A5.5 / -5.5	E9018-B3 H4 R	BÖHLER FOX CM 2 Kb	146
3580-A	E CrMo5 B 4 2 H5	A5.5 / -5.5	E8018-B6 H4 R	BÖHLER FOX CM 5 Kb	149
3580-A	E CrMo9 B 4 2 H5	A5.5 / -5.5	E8018-B8 H4	BÖHLER FOX CM 9 Kb	150
3580-A	E CrMo1 B 4 2 H5	A5.5 / -5.5	E8018-B2 H4	BÖHLER FOX DCMS Kb	144
3580-A	E Z CrMoV1 B 4 2 H5	A5.5 / -5.5	E9018-G	BÖHLER FOX DCMV	145
3580-A	E Mo B 4 2 H5	A5.5 / -5.5	E7018-A1 H4	BÖHLER FOX DMO Kb	143
3580-A	E CrMo2 B 4 2 H5	A5.5 / -5.5	E9018-B3	BÖHLER FOX P 22	159
3580-A	E CrMo2L B 4 2 H5	A5.5 / -5.5	E8018-B3L	BÖHLER FOX P 22 (LC)	158
17634-A	T ZCrWMo9VNb P M21 1	A5.36 / -5.36	E91T1-M21PZ-B92	BÖHLER P 92 Ti-FD	234
3580-A	E CrMo91 B 4 2 H5	A5.5 / -5.5	E9015-B91 H4 R	Thermanit Chromo 9 V	154
3580-A	E Z CrMo91 B 4 2 H5	A5.5 / -5.5	E9015-B91 H4 R	Thermanit Chromo 9 V Mod	155
21952-A	G CrMo 9 1	A5.28 / -5.28	ER90S-B9	Thermanit MTS 3	181
21952-A	W CrMo 9 1	A5.28 / -5.28	ER90S-B9	Thermanit MTS 3	169
24598-A	S S CrMo91 FB	A5.23 / -5.23	F9PZ-EB91-B91	Thermanit MTS 3 - Marathon 543	211
		A5.28 / -5.28	ER90S-B9	Thermanit MTS 3 LNi	170
24598-A	S S ZCrMo91 FB	A5.23 / -5.23	F9PZ-EB91-B91	Thermanit MTS 3 LNI - Marathon 543	212
17634-A	T ZCrMo9VNb P M21 1 H5	A5.36 / -5.36	E91T1-M21PY-B91-H4	Thermanit MTS 3 PW	235
		A5.28 / -5.28	ER90S-B9	Thermanit MTS 3-LNI	182
3580-A	E Z CrMo91 B 4 2 H5	A5.5 / -5.5	E9015-B91 H4	Thermanit MTS 3-LNi	153
24598-A	S S CrMoWV12 FB	A5.23 / -5.23	F9PZ-EG-G	Thermanit MTS 4 - Marathon 543	215
21952-A	G CrMoWV 12 Si	A5.9 / -5.9	ER505 (mod.)	Thermanit MTS 4 Si	183
21952-A	W CrMoWV 12 Si	A5.9 / -5.9	ER90S-G	Thermanit MTS 4 SI	171
21952-A	W Z CrCoMoV 10 1 1	A5.28 / -5.28	ER110S-G	Thermanit MTS 5 CO 1	172

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3580-A	E Z CrCoMoV 10 11 B 4 2 H5	A5.5 / -5.5	E9015-G	Thermanit MTS 5 Co 1	160
21952-A	W Z CrCoW 11 2 2	A5.28 / -5.28	ER110S-G	Thermanit MTS 5 CoT	173
21952-A	G Z CrMoWVNb 9 0,5 1,5	A5.28 / -5.28	ER90S-G	Thermanit MTS 616	184
21952-A	W Z CrMoWVNb 9 0,5 1,5	A5.28 / -5.28	ER90S-G	Thermanit MTS 616	174
3580-A	E Z CrMoWVNb9 0,5 2 B 4 2 H5	A5.5 / -5.5	E9015-B92 H4	Thermanit MTS 616	156
24598-A	S S ZCrMoWVNb9 0.5 1.5 FB	A5.23 / -5.23	F9PZ-EG-G	Thermanit MTS 616 - Marathon 543	213
3580-A	E Z CrMoWVNb9 0,5 2 B 4 2 H5	A5.5 / -5.5	E9015-B92 H4	Thermanit MTS 616 LNi	157
21952-A	W Z CrMoWVNb 9 1 1	A5.28 / -5.28	ER90S-G	Thermanit MTS 911	168
24598-A	S S ZCrMoWVNb9 1 1 FB	A5.23 / -5.23	F9PZ-EG-G	Thermanit MTS 911 - Marathon 543	214
3580-A	E Z CrWV2 1,5 B 4 2 H5	A5.5 / -5.5	E9015-B23	Thermanit P 23	147
3580-A	E Z CrMo2VNb B 4 2 H5	A5.5 / -5.5	E 9015-B24	Thermanit P 24	148
		A5.28 / -5.28	ER80S-B2	Union ER 80S-B2	175
21952-A	W CrMo2	A5.28 / -5.28	ER90S-B3	Union ER 90S-B3	176
636-A	W MoSi	A5.28 / -5.28	ER90S-G	Union I CrMo 910	166
		A5.28 / -5.28	ER90S-G	Union I CrMo 910 Spezial	167
24598-A	S T ZCrMo2 AR	A5.23 / -5.23	F11AZ-ECB3-G / F10PZ-ECB3-G	Union MV CrMo 910 S UV 305	200
24598-A	S T ZCrMo1 AR	A5.23 / -5.23	F10AZ-ECB2-G / F9PZ- ECB2-G	Union MV CrMo S - UV 305	194
24598-A	S T Mo AR	A5.23 / -5.23	F8AZ-ECA2-A2 / F8PZ- ECA2-A2	Union MV Mo S - UV 305	186
24598-A	S S CrMo2 AR	A5.23 / -5.23	F11AZ-EB3R-B3	Union S 1 CrMo 2 - UV 305	199
24598-A	S S CrMo2 FB	A5.23 / -5.23	F8P2-EB3R-B3R	Union S 1 CrMo 2 - UV 420 TTR	201
24598-A	S S CrMo 2 FB	A5.23 / -5.23	F9P2-EB3R-B3R	Union S 1 CrMo 2 - UV 420 TTR-C	202
24598-A	S S CrMo2 FB	A5.23 / -5.23	F9P2-EB3R-B3R	Union S 1 CrMo 2 - UV 420 TTR-W	203
24598-A	S S ZCrMoV2 FB	A5.23 / -5.23	F9PZ-EG-G	Union S 1 CrMo 2 V - UV 430 TTR-W	208
24598-A	S S CrMo5 FB	A5.23 / -5.23	F8PZ-EB6-B6	Union S 1 CrMo 5 - Marathon 543	209
24598-A	S S CrMo1 AR	A5.23 / -5.23	F10AZ-EB2R-B2	Union S 2 CrMo - UV 305	193
24598-A	S S CrMo1 FB	A5.23 / -5.23	F8P2-EB2R-B2	Union S 2 CrMo - UV 419 TT-W	195
24598-A	S S CrMo1 FB	A5.23 / -5.23	F8P2-EB2R-B2R	Union S 2 CrMo - UV 420 TTR	196
24598-A	S S CrMo 1 FB	A5.23 / -5.23	F8P2-EB2R-B2R	Union S 2 CrMo - UV 420 TTR-C	197
24598-A	S S CrMo1 FB	A5.23 / -5.23	F8P2-EB2R-B2R	Union S 2 CrMo - UV 420 TTR-W	198
14171-A	S 46 0 AR S2Mo	A5.23 / -5.23	F8A0-EA2-A2	Union S 2 Mo - UV 305	185
14171-A	S 46 2 AR S2Mo	A5.23 / -5.23	F8A2-EA2-A2	Union S 2 Mo - UV 306	187
14171-A	S 46 4 AB S2Mo	A5.23 / -5.23	F8A4-EA2-A2 / F8P4- EA2-A2	Union S 2 Mo UV 400	188
14171-A	S 46 4 FB S2Mo	A5.23 / -5.23	F8A6-EA2-A2 / F8P6- EA2-A2	Union S 2 Mo - UV 421 TT	189
14171-A	S 46 4 FB S3Mo	A5.23 / -5.23	F8A4-EA4-A4 / F8P6- EA4-A4	Union S 3 Mo - UV 420 TT	190
14171-A	S 50 4 FB S4Mo	A5.23 / -5.23	F9A4-EA3-A3 / F8P6- EA3-A3	Union S 4 Mo - UV 420 TTR	191
14171-A	S 50 4 FB S4Mo	A5.23 / -5.23	F9A6-EA3-A3 / F8P6- EA3-A3	Union S 4 Mo - UV 421 TT	192
24598-A	S S ZCrWV 2 1,5 AR	A5.23 / -5.23	F11AZ-EB23-B23	Union S P23 - UV 305	204
24598-A	S S Z CrWV 2 1,5 FB			Union S P23 - UV P23	205
24598-A	S S Z CrMo2VNb AR	A5.23 / -5.23	F11AZ-EB24-B24	Union S P24 - UV 305	206
24598-A	S S ZCrMo 2VNb FB			Union S P24 - UV P24	207

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Welding consumables for pipe steels					
18275-A	E 62 5 Z2Ni B 4 5	A5.5 / -5.5	E10018-G	BÖHLER FOX BVD 100	250
2560-A	E 46 5 1Ni B 4 5 H5	A5.5 / -5.5	E8045-P2 H4 R	BÖHLER FOX BVD 85	248
18275-A	E 55 5 Z2Ni B 4 5 H5	A5.5 / -5.5	E9018-G H4 R	BÖHLER FOX BVD 90	249
2560-A	E 38 3 C 2 1	A5.1 / -5.1	E6010	BÖHLER FOX CEL	240
2560-A	E 42 3 C 2 5	A5.5 / -5.5	E7010-P1	BÖHLER FOX CEL 70-P	242
2560-A	E 42 3 C 2 5	A5.5 / -5.5	E7010-P1	BÖHLER FOX CEL 75	243
2560-A	E 46 3 1Ni C 2 5	A5.5 / -5.5	E8010-P1	BÖHLER FOX CEL 80-P	245
2560-A	E 46 4 1Ni C 2 5	A5.5 / -5.5	E8010-P1	BÖHLER FOX CEL 85	246
2560-A	E 50 3 1Ni C 2 5	A5.5 / -5.5	E9010-P1	BÖHLER FOX CEL 90	247
2560-A	E 42 3 Mo C 2 5	A5.5 / -5.5	E7010-A1	BÖHLER FOX CEL Mo	244
2560-A	E 38 2 C 2 1	A5.1 / -5.1	E6010	BÖHLER FOX CEL+	241
2560-A	E 50 4 1Ni B 1 2 H5	A5.5 / -5.5	E8016-G H4 R	BÖHLER FOX EV 60 PIPE	252
18275-A	E 55 4 ZMn2NiMo B 1 2 H5	A5.5 / -5.5	E9016-G H4 R	BÖHLER FOX EV 70 PIPE	253
2560-A	E 42 4 B 1 2	A5.1 / -5.1	E7016-1	BÖHLER FOX EV PIPE	251
16834-A	W 55 6 I1 Mn3Ni1Mo	A5.28 / -5.28	ER90S-G	BÖHLER NiMo1-IG	254
		A5.36 / -5.36	E71T8-A4-K6	BÖHLER Pipeshield 71 T8-FD	273
		A5.36 / -5.36	E71T8-A4-Ni1	BÖHLER Pipeshield 71.1 T8-FD	274
		A5.36 / -5.36	E81T8-A4-Ni2	BÖHLER Pipeshield 81 T8-FD	275
		A5.36 / -5.36	E91T8-A4-G	BÖHLER Pipeshield 91 T8-FD	276
14171-A	S 50 6 FB TZ3Ni1 H5	A5.23 / -5.23	F8A8-ECNi1-Ni1	BÖHLER SUBARC T60 - UV 419 TT-W	99
18276-A	T 55 5 Mn1Ni P M21 1 H5	A5.36 / -5.36	E91T1-M21A6-K2-H4	BÖHLER Ti 70 Pipe T-FD	277
18276-A	T55 6 Z P M21 1 H5	A5.36 / A5.36	E91T1-M21A8-G-H4	BÖHLER Ti 70 Pipe T-FD-N	278
18276-A	T 69 4 Z P M21 1 H5	A5.36 / -5.36	E111T1-M21A4-GH4	BÖHLER Ti 80 Pipe T-FD	279
14341-A	G 46 5 M21 Z3Si1	A5.18 / -5.18	ER70S-G	Pipeshield X65	255
14341-B	G 55A 4 M21 S6	A5.18 / -5.18	ER70S-6	Pipeshield X70	256
14341-A	G 50 6 M21 Z3Ni1	A5.28 / -5.28	ER80S-G	Pipeshield X80	257
16834-A	G 55 6 M21 Mn3Ni1Mo	A5.28 / -5.28	ER90S-G	Pipeshield X90	258
14171-A	S 46 4 AB S2Mo	A5.23 / -5.23	F8A4-EA2-A2	Union S 2 Mo - UV 309 P	262
14171-A	S 46 4 AB S2Mo	A5.23 / -5.23	F8A4-EA2-A2	Union S 2 Mo - UV 310 P	263
14171-A	S 50 6 FB SZ2Ni1Mo	A5.23 / 5.23	F8A8-ENi1-Ni1 - F8P8-ENi1-Ni1	Union S 2 NiMo 1 - UV 419 TT-W	97
14171-A	S 38 2 AB S2Si	A5.23 / -5.23	F7A2-EM12K	Union S 2 Si - UV 310 P	259
14171-A	(S 46 Z AB S2MoTiB)	A5.23 / -5.23	(F8AZ-EA2TiB-G)	Union S 3 MoTiB - UV 309 P	267
14171-A	(S 46 Z AB S2MoTiB)	A5.23 / -5.23	(F8AZ-EA2TiB-G)	Union S 3 MoTiB - UV 310 P	268
14171-A	(S 46 Z FB S2MoTiB)	A5.23 / -5.23	(F8AZ-EA2TiB-G)	Union S 3 MoTiB - UV 419 TT-W	269
26304-A	S 55 6 FB S3Ni1Mo	A5.23 / -5.23	F9A8-EF3-F3 / F9P8-EF3-F3	Union S 3 NiMo 1 - UV 419 TT-W	101
14171-A	S 42 4 AB S3Si	A5.23 / 5.23	F7A5-EH12K	Union S 3 Si - UV 309 P	260
14171-A	S 42 4 AB S3Si	A5.23 / -5.23	F7A6-EH12K	Union S 3 Si - UV 310 P	39
14171-A	(S 46 Z AB SZ)	A5.23 / -5.23	(F8AZ-EG-G)	Union S 3 TiB - UV 309 P	265
14171-A	(S 46 Z AB SZ)	A5.23 / -5.23	(F8AZ-EG-G)	Union S 3 TiB - UV 310 P	266
14171-A	S 46 4 AB S4Mo	A5.23 / -5.23	F8A4-EA3-A3	Union S 4 Mo - UV 310 P	264
Welding flux for unalloyed, low-alloyed and medium-alloyed steels					
14174	S A FB 1 55 DC H5			Marathon 543	298
14174	S A AR 1 76 AC H5			UV 305	283
14174	S A AR 1 77 AC H5			UV 306	284
14174	S A AB 1 65 AC H5			UV 309 P	285
14174	S A AB 1 55 AC H5			UV 310 P	286
14174	S A AB 1 67 AC H5			UV 400	287
14174	S A FB 1 55 AC H5			UV 418 TT	288
14174	S A FB 1 55 DC H5			UV 419 TT-W	290
14174	S A FB 1 65 DC			UV 420 TT	293
14174	S A FB 1 65 DC H5			UV 420 TT-LH	292
14174	S A FB 1 65 DC			UV 420 TTR	294

ISO	Class	AWS/SFA	Class	Product	Page
14174	S A FB 1 65 DC			UV 420 TTR-C	296
14174	S A FB 1 65 AC			UV 420 TTR-W	295
14174	S A FB 1 55 AC H5			UV 421 TT	289
14174	S A FB 1 65 DC H4			UV 422 TT-LH	291
14174	S A FB 1 55 AC			UV 430 TTR-W	297

Welding consumables for martensitic stainless steels

ISO	Class	AWS/SFA	Class	Product	Page
14174	S A AF 2 DC	A5.9 / -5.9	EG	Avesta 248 SV - Avesta Flux 805	309
17633-A	T 13 4 P M21 (C1) 1 (H5)	A5.22 / -5.22	E410NiMoT1-4(1)	BÖHLER CN 13/4 PW-FD	310
14343-A	G 13 4	A5.9 / -5.9	ER410NiMo (mod.)	BÖHLER CN 13/4-IG	307
14343-A	W 13 4	A5.9 / -5.9	ER410NiMo (mod.)	BÖHLER CN 13/4-IG	305
17633-A	T 13 4 M M12 2	A5.22 / -5.22	EC410NiMo (mod.)	BÖHLER CN 13/4-MC	311
17633-A	T 13 4 M M12 2	A5.22 / -5.22	EC410NiMo (mod.)	BÖHLER CN 13/4-MC (F)	312
17633-A	T 13 4 M M12 2	A5.22 / -5.22	EC410NiMo (mod.)	BÖHLER CN 13/4-MC HI	313
14174	S A FB 2 DC	A5.9 / -5.9	ER410NiMo (mod.)	BÖHLER CN 13/4-UP - BÖHLER BB 203	308
3581-A	E 13 4 B 6 2	A5.4 / -5.4	E410NiMo-15	BÖHLER FOX CN 13/4	301
3581-A	E 13 4 B 4 2	A5.4 / -5.4	E410NiMo-15	BÖHLER FOX CN 13/4 SUPRA	302
3581-A	E Z 16 6 Mo B 6 2 H5			BÖHLER FOX CN 16/6 M-HD	303
3581-A	E Z 17 4 Cu B 4 3 H5	A5.4 / -5.4	E630-15 (mod.)	BÖHLER FOX CN 17/4 PH	304
14343-A	G Z 13	A5.9 / -5.9	ER410 (mod.)	BÖHLER KW 10-IG	306

Welding consumables for ferritic stainless steels

ISO	Class	AWS/SFA	Class	Product	Page
14343-A	G Z 13 Nb L	A5.9 / -5.9	ER409Nb	BÖHLER CAT 409 Cb-IG	319
14343-A	G Z 18 L Nb	A5.9 / -5.9	ER430 (mod.)	BÖHLER CAT 430L Cb-IG	320
17633-A	T Z 17 Nb M M12 1	A5.22 / -5.22	EC439Nb	BÖHLER CAT 430L Cb-MC	326
14343-A	G Z 18 L NbTi	A5.9 / -5.9	ER430 (mod.)	BÖHLER CAT 430L CbTi-IG	321
17633-A	T Z 17 Nb Ti L M M12 1	A5.22 / -5.22	EC430G, EC439Nb	BÖHLER CAT 430L CbTi-MC	327
14343-A	G Z 18 L Ti	A5.9 / -5.9	ER439	BÖHLER CAT 439L Ti-IG	322
17633-A	T Z 17 Ti L M M12 1	A5.22 / -5.22	EC439	BÖHLER CAT 439L Ti-MC	328
3581-A	E 17 B 2 2	A5.4 / -5.4	E430-15	BÖHLER FOX SKWA	317
3581-A	E Z 17 Mo B 2 2			BÖHLER FOX SKWAM	318
14343-A	G Z 17 Ti	A5.9 / -5.9	ER430 (mod.)	BÖHLER SKWA-IG	323
14343-A	G Z 17 Mo H			BÖHLER SKWAM-IG	324
14174	S A FB 2 DC	A5.9 / -5.9	ER430 (mod.)	BÖHLER SKWAM-UP - BÖHLER BB 203	325

Welding consumables for austenitic stainless steels

ISO	Class	AWS/SFA	Class	Product	Page
3581-A	E 19 12 3 L R 3 2	A5.4 / -5.4	E316L-17	Avesta 316L/SKR-4D	338
14343-A	G 19 13 4 L	A5.9 / -5.9	ER317L	Avesta 317L/SNR	367
14343-A	W 19 13 4 L	A5.9 / -5.9	ER317L	Avesta 317L/SNR	352
3581-A	E Z 19 13 4 N L	A5.4 / -5.4	E317L-17	Avesta 317L/SNR	339
14174	S A AF 2 DC	A5.9 / -5.9	ER317L	Avesta 317L/SNR - Avesta Flux 805	380
3581-A	E 20 25 5 Cu N L R	A5.4 / -5.4	E385-17	Avesta 904L	347
17633-A	T 19 9 L P M21 (C1) 1	A5.22 / -5.22	E308LT1-4(1)	Avesta FCW 308L/MVR Cryo	399
17633-A	T 19 9 L P M21 (C1) 1	A5.22 / -5.22	E308LT1-4(1)	Avesta FCW 308L/MVR-PW	396
17633-A	T 19 12 3 L P M21 (C1) 1	A5.22 / -5.22	E316LT1-4(1)	Avesta FCW 316L/SKR-PW	405
17633-A	T 19 9 L R M21 (C1) 3	A5.22 / -5.22	E308LT0-4(1)	Avesta FCW-2D 308L/MVR	394
17633-A	T 19 12 3 L R M21 (C1) 3	A5.22 / -5.22	E316LT0-4(1)	Avesta FCW-2D 316L/SKR	403
14343-A	18 8 Mn	A5.9 / -5.9	ER307 (mod.)	BÖHLER A 7 CN-IG	360
14174	S A FB 2 AC	A5.9 / -5.9	EG	BÖHLER AM 500-UP - Marathon 104	391
14343-A	W Z 18 16 5 N L	A5.9 / -5.9	ER317L (mod.)	BÖHLER ASN 5-IG	353
14343-A	G Z 18 16 5 N L	A5.9 / -5.9	ER317L (mod.)	BÖHLER ASN 5-IG (Si)	368
14174	S A FB 2 DC	A5.9 / -5.9	ER317L (mod.)	BÖHLER ASN 5-UP - BÖHLER BB 203	381
14343-A	W Z 20 25 5 Cu L NL	A5.9 / -5.9	ER385 (mod.)	BÖHLER CN 20/25 M-IG	359
14343-A	G Z 20 25 5 Cu N L	A5.9 / -5.9	ER385 (mod.)	BÖHLER CN 20/25 M-IG (Si)	372

ISO	Class	AWS/SFA	Class	Product	Page
17633-A	T Z 19 13 4 L P M21 (C1) 1	A5.22 / -5.22	E317LT1-4(1)	BÖHLER E 317L PW-FD	408
17633-A	T Z 19 13 4 L R M21 (C1) 3	A5.22 / -5.22	E317LT0-4(1)	BÖHLER E 317L-FD	407
17633-A	T 19 9 L P M21 (C1) 1	A5.22 / -5.22	E308LT1-4(1)	BÖHLER EAS 2 PW-FD	395
17633-A	T 19 9 L P M21 (C1) 1	A5.22 / -5.22	E308LT1-4(1)	BÖHLER EAS 2 PW-FD (LF)	400
17633-A	T 19 9 L R M21 (C1) 3	A5.22 / -5.22	E 308LT0-4(1)	BÖHLER EAS 2-FD	393
14343-A	G 19 9 L	A5.9 / -5.9	ER308L	BÖHLER EAS 2-IG (LF)	363
14343-A	W 19 9 L	A5.9 / -5.9	ER308L	BÖHLER EAS 2-IG (LF)	349
17633-A	T 19 9 L M M12 2	A5.22 / -5.22	EC308L	BÖHLER EAS 2-MC	392
14174	S A FB 2 DC	A5.9 / -5.9	ER308L	BÖHLER EAS 2-UP (LF) - BÖHLER BB 203	376
17633-A	T 19 12 3 L R M21 (C1) 3	A5.22 / -5.22	E316LT0-4(1)	BÖHLER EAS 4 M-FD	402
17633-A	T 19 12 3 L M M12 2	A5.22 / -5.22	EC316L	BÖHLER EAS 4 M-MC	401
17633-A	T 19 12 3 L P M21 (C1) 1	A5.22 / -5.22	E316LT1-4(1)	BÖHLER EAS 4 PW-FD	404
17633-A	T Z 19 12 3 L P M21 (C1) 1	A5.22 / -5.22	E316LT1-4(1)	BÖHLER EAS 4 PW-FD (LF)	406
3581-A	E 19 9 L B 2 2	A5.4 / -5.4	E308L-15	BÖHLER FOX EAS 2	332
3581-A	E 19 9 L B 2 2	A5.4 / -5.4	E308L-15	BÖHLER FOX EAS 2 (LF)	334
3581-A	E 19 9 L R 3 2	A5.4 / -5.4	E308L-17	BÖHLER FOX EAS 2-A	333
3581-A	E 19 12 3 L B 2 2	A5.4 / -5.4	E316L-15	BÖHLER FOX EAS 4 M	335
3581-A	E Z 19 12 3 L B 2 2	A5.4 / -5.4	E316L-15	BÖHLER FOX EAS 4 M (LF)	337
3581-A	E 19 12 3 L R 3 2	A5.4 / -5.4	E 316L-17	BÖHLER FOX EAS 4 M-A	336
3581-A	E 19 9 Nb B 2 2	A5.4 / -5.4	E347-15	BÖHLER FOX SAS 2	341
3581-A	E 19 9 Nb R 3 2	A5.4 / -5.4	E347-17	BÖHLER FOX SAS 2-A	342
3581-A	E 19 12 3 Nb B 2 2	A5.4 / -5.4	E318-15	BÖHLER FOX SAS 4	343
3581-A	E 19 12 3 Nb R 3 2	A5.4 / -5.4	E318-17	BÖHLER FOX SAS 4-A	344
17633-A	T 19 9 Nb P M21 (C1) 1	A5.22 / -5.22	E347T1-4(1)	BÖHLER SAS 2 PW-FD	398
17633-A	T 19 9 Nb R M21 (C1) 3	A5.22 / -5.22	E 347T0-4(1)	BÖHLER SAS 2-FD	397
17633-A	T 19 12 3 Nb P M21 (C1) 1			BÖHLER SAS 4 PW-FD	410
17633-A	T 19 12 3 Nb R M21 (C1) 3			BÖHLER SAS 4-FD	409
14343-A	W 19 12 3 Nb Si	A5.9 / -5.9	ER318 (mod.)	BÖHLER SAS 4-IG (Si)	357
14343-A	S G Z 17 15 Mn W			Thermanit 17/15 TT	361
14343-A	S G 20 16 3 Mn N L	A5.9 / -5.9	ER316LMn	Thermanit 19/15	366
3581-A	E 20 16 3 Mn N L B 2 2	A5.4 / -5.4	E316LMn-15	Thermanit 19/15 H	340
14174	S A FB 2 AC	A5.9 / -5.9	EG	Thermanit 20/16 SM - Marathon 104	388
14343-A	G 20 25 5 Cu L	A5.9 / -5.9	ER385	Thermanit 20/25 Cu	371
14343-A	W 20 25 5 Cu L	A5.9 / -5.9	ER385	Thermanit 20/25 Cu	356
14174	S A FB 2 AC	A5.9 / -5.9	ER385	Thermanit 20/25 Cu - Marathon 104	389
3581-A	E 20 25 5 Cu N L R 3 2	A5.4 / -5.4	E385-16	Thermanit 20/25 CuW	345
3581-A	E Z 25 22 2 L B 2 2	A5.4 / -5.4	E310Mo-15 (mod.)	Thermanit 25/22 H	346
14174	S A FB 2 AC	A5.9 / -5.9	ER310 (mod.)	Thermanit 25/22 H - Marathon 104	390
14343-A	W 19 12 3 Nb	A5.9 / -5.9	ER318	Thermanit A	354
14174	S A AF 2 DC	A5.9 / -5.9	ER318	Thermanit A - Avesta Flux 805	387
14174	S F CS 2 DC	A5.9 / -5.9	ER318	Thermanit A - Marathon 213	385
14174	S A FB 2 DC	A5.9 / -5.9	ER318	Thermanit A - Marathon 431	386
14343-A	G 19 12 3 Nb Si	A5.9 / -5.9	ER318 (mod.)	Thermanit A Si	369
12072	G 19 12 3 L	A5.9 / -5.9	ER316L	Thermanit GE-316L	364
14343-A	W 19 12 3 L	A5.9 / -5.9	ER316L	Thermanit GE-316L	350
14174	S A AF 2 DC	A5.9 / -5.9	ER316L	Thermanit GE-316L - Avesta Flux 805	378
14174	S F CS 2 DC	A5.9 / -5.9	ER316L	Thermanit GE-316L - Marathon 213	377
14174	S A FB 2 DC	A5.9 / -5.9	ER316L	Thermanit GE-316L - Marathon 431	379
14343-A	G 19 12 3 L Si	A5.9 / -5.9	ER316LSi	Thermanit GE-316L Si	365
14343-A	W 19 12 3 L Si	A5.9 / -5.9	ER316LSi	Thermanit GE-316L Si	351
14343-A	G 19 9 Nb Si	A5.9 / -5.9	ER347Si	Thermanit H Si	370
14343-A	W 19 9 Nb	A5.9 / -5.9	ER347	Thermanit H-347	355

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14174	S A AF 2 DC	A5.9 / -5.9	ER347	Thermanit H-347 - Avesta Flux 805	384
14174	S F CS 2 DC	A5.9 / -5.9	ER347	Thermanit H-347 - Marathon 213	382
14174	S A FB 2 DC	A5.9 / -5.9	ER347	Thermanit H-347 - Marathon 431	383
14343-A	W 19 9 L	A5.9 / -5.9	ER308L	Thermanit JE-308L	348
14174	S A AF 2 DC	A5.9 / -5.9	ER308L	Thermanit JE-308L - Avesta Flux 805	375
14174	S F CS 2 DC	A5.9 / -5.9	ER308L	Thermanit JE-308L - Marathon 213	373
14174	S A FB 2 DC	A5.9 / -5.9	ER308L	Thermanit JE-308L - Marathon 431	374
14343-A	G 19 9 L Si	A5.9 / -5.9	ER308LSi	Thermanit JE-308L Si	362
Welding consumables for duplex stainless steels					
14343-A	G 22 9 3 N L	A5.9 / -5.9	ER2209	Avesta 2205	422
14343-A	W 22 9 3 N L	A5.9 / -5.9	ER2209	Avesta 2205	418
14174	S A AF 2 DC	A5.9 / -5.9	ER2209	Avesta 2205 - Avesta Flux 805	427
3581-A	E 22 9 3 N L R	A5.4 / -5.4	E2209-17	Avesta 2205-PW AC/DC	413
14343-A	G 23 7 N L	A5.9 / -5.9	ER2307	Avesta 2304	421
14343-A	W 23 7 N L	A5.9 / -5.9	ER2307	Avesta 2304	417
14174	S A AF 2 DC	A5.9 / -5.9	ER2307	Avesta 2304 - Avesta Flux 805	426
14343-A	G 25 9 4 N L	A5.9 / -5.9	ER2594	Avesta 2507/P100	423
14343-A	W 25 9 4 N L	A5.9 / -5.9	ER2594	Avesta 2507/P100	419
3581-A	E 25 9 4 N L R 3 2	A5.4 / -5.4	E2594-17	Avesta 2507/P100	416
3581-A	E 25 9 4 N L R 4 2	A5.4 / -5.4	E2594-16	Avesta 2507/P100 rutile	415
14343-A	G 25 9 4 N L	A5.9 / -5.9	ER2595	Avesta 2507/P100 Cu/W	424
14343-A	W 25 9 4 N L	A5.9 / -5.9	ER2595	Avesta 2507/P100 Cu/W	420
14174	S A AF 2 DC	A5.9 / -5.9	ER2594	Avesta 2507/P100 Cu/W - Avesta Flux 805	429
17633-A	T 22 9 3 N L P M21 (C1) 1	A5.22 / -5.22	E2209T1-4(1)	Avesta FCW 2205-PW	436
17633-A	T 23 7 N L R M21 (C1) 1	A5.22 / -5.22	E2307T1-4(1)	Avesta FCW 2304-PW	434
17633-A	T 25 9 4 N L P M21 (C1) 2	A5.22 / -5.22	E2594T1-4(1)	Avesta FCW 2507/P100-PW	438
17633-A	T 25 9 4 N L P M21 (C1) 2	A5.22 / -5.22	E2594T1-4(1)	Avesta FCW 2507/P100-PW NOR	439
17633-A	T 23 7 N L P M21 (C1) 1	A5.22 / -5.22	E2307T1-4(1)	Avesta FCW LDX 2101-PW	432
17633-A	T Z 25 9 4 N L P M21 (C1) 2	A5.22 / -5.22	E2594T1-G	Avesta FCW LDX 2404-PW	437
17633-A	T 22 9 3 N L R M21 (C1) 3	A5.22 / -5.22	E2209T0-4(1)	Avesta FCW-2D 2205	435
17633-A	T 23 7 N L R M21 (C1) 3	A5.22 / -5.22	E2307T0-4(1)	Avesta FCW-2D 2304	433
17633-A	T 23 7 N L R M21 (C1) 3	A5.22 / -5.22	E2307T0-4(1)	Avesta FCW-2D LDX 2101	431
3581-A	E Z 23 7 N L R 3 2	A5.4 / -5.4	E2307-17 (mod.)	Avesta LDX 2101	414
14174	S A AF 2 DC	A5.9 / -5.9	ER2307	Avesta LDX 2101 - Avesta Flux 805	425
14174	S A FB 2 DC	A5.9 / -5.9	ER2209	Thermanit 22/09 - Marathon 431	428
14174	S A FB 2 DC	A5.9 / -5.9	ER2594	Thermanit 25/09 CuT - Marathon 431	430
Welding consumables for dissimilar joints and special applications					
17633-A	T 23 12 L P M21 (C1) 1	A5.22 / -5.22	E309LT1-4(1)	Avesta FCW 309L-PW	473
17633-A	T 23 12 L R M21 (C1) 3	A5.22 / -5.22	E309LT0-4(1)	Avesta FCW-2D 309L	471
14174	S A AF 2 DC	A5.9 / -5.9	ER309LMo (mod.)	Avesta P5 - Avesta Flux 805	465
14174	S A AF 2 DC	A5.9 / -5.9	ER312	Avesta P7 - Avesta Flux 805	466
14174	S A FB 2 DC	A5.9 / -5.9	ER307 (mod.)	BÖHLER A 7 CN-UP - BÖHLER BB 203	461
17633-A	T 18 8 Mn P M21 (C1) 2	A5.22 / -5.22	E307T1-G	BÖHLER A 7 PW-FD	468
17633-A	T 18 8 Mn R M21 (C1) 3	A5.22 / -5.22	E307T0-G	BÖHLER A 7-FD	467
17633-A	T 18 8 Mn M M12 1	A5.22 / -5.22	EC307 (mod.)	BÖHLER A 7-MC	469

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17633-A	T 23 12 2 L P M21 (C1) 1	A5.22 / -5.22	E309LMoT1-4(1)	BÖHLER CN 23/12 Mo PW-FD	476
17633-A	T 23 12 2 L R M21 (C1) 3	A5.22 / -5.22	E309LMoT0-4(1)	BÖHLER CN 23/12 Mo-FD	475
14343-A	G 23 12 2 L	A5.9 / -5.9	ER309LMo	BÖHLER CN 23/12 Mo-IG	459
14343-A	W 23 12 2 L	A5.9 / -5.9	ER309LMo	BÖHLER CN 23/12 Mo-IG	454
17633-A	T 23 12 L P M21 (C1) 1	A5.22 / -5.22	E309LT1-4(1)	BÖHLER CN 23/12 PW-FD	472
17633-A	T 23 12 L R M21 (C1) 3	A5.22 / -5.22	E309LT0-4(1)	BÖHLER CN 23/12-FD	470
17633-A	T 23 12 L M M12 2	A5.22 / -5.22	EC309L	BÖHLER CN 23/12-MC	474
3581-A	E 18 8 Mn B 2 2	A5.4 / -5.4	E307-15 (mod.)	BÖHLER FOX A 7	443
3581-A	E Z 18 9 MnMo R 3 2	A5.4 / -5.4	E307-16 (mod.)	BÖHLER FOX A 7-A	444
3581-A	E 20 10 3 R 3 2	A5.4 / -5.4	E308Mo-17 (mod.)	BÖHLER FOX CN 19/9 M	445
3581-A	E 23 12 2 L R 3 2	A5.4 / -5.4	E309LMo-17	BÖHLER FOX CN 23/12 Mo-A	448
3581-A	E 23 12 L R 3 2	A5.4 / -5.4	E309L-17	BÖHLER FOX CN 23/12-A	447
3581-A	E 29 9 R 3 2	A5.4 / -5.4	E312-17	BÖHLER FOX CN 29/9-A	450
14343-A	G 20 10 3	A5.9 / -5.9	ER308Mo (mod.)	Thermanit 20/10	456
3581-A	E 20 10 3 R 5 3	A5.4 / -5.4	E308Mo-17 (mod.)	Thermanit 20/10 W 140 K	446
14343-A	G 23 12 L Si	A5.9 / -5.9	ER309LSi	Thermanit 25/14 E-309L	457
14343-A	W 23 12 L	A5.9 / -5.9	ER309L	Thermanit 25/14 E-309L	452
14174	S A AF 2 DC	A5.9 / -5.9	ER309L	Thermanit 25/14 E-309L - Avesta Flux 805	464
14174	S F CS 2 DC	A5.9 / -5.9	ER309L	Thermanit 25/14 E-309L - Marathon 213	462
14174	S A FB 2 DC	A5.9 / -5.9	ER309L	Thermanit 25/14 E-309L - Marathon 431	463
12072	G 23 12 L Si	A5.9 / -5.9	ER309LSi	Thermanit 25/14 E-309L Si	458
14343-A	23 12 L Si	A5.9 / -5.9	ER309LSi	Thermanit 25/14 E-309L Si	453
14343-A	G 29 9	A5.9 / -5.9	ER312	Thermanit 30/10	460
3581-A	E 29 9 R 1 2	A5.4 / -5.4	E312-16 (mod.)	Thermanit 30/10 W	449
14343-A	G 18 8 Mn	A5.9 / -5.9	ER307 (mod.)	Thermanit X	455
14343-A	W 18 8 Mn	A5.9 / -5.9	ER307 (mod.)	Thermanit X	451
Welding consumables for heat and creep resistant stainless steels					
3581-A	E 21 10 N R			Avesta 253 MA	480
14174	S A AF 2 DC	A5.9 / -5.9	EG	Avesta 253 MA - Avesta Flux 805	510
3581-A	E 22 12 R	A5.4 / -5.4	E309-17	Avesta 309 AC/DC	486
3581-A	E 25 20 R 3 2	A5.4 / -5.4	E310-17	Avesta 310	489
14343-A	G Z 21 33 Mn Nb			BÖHLER CN 21/33 Mn-IG	507
14343-A	W Z 21 33 Mn Nb			BÖHLER CN 21/33 Mn-IG	499
17633-A	T Z19 9 H P M21 (C1) 1	A5.22 / -5.22	E308HT1-4(1)	BÖHLER E 308 H PW-FD	513
17633-A	T Z19 9 H R M21 (C1) 3	A5.22 / -5.22	E308HT0-4(1)	BÖHLER E 308 H-FD	512
17633-A	T 23 12 L P M21 (C1) 1	A5.22 / -5.22	E309LT1-4(1)	BÖHLER E 309L H PW-FD	515
17633-A	T 23 12 L R M21 (C1) 3	A5.22 / -5.22	E309LT0-4(1)	BÖHLER E 309L H-FD	514
17633-A	T 19 9 Nb P M21 (C1) 1	A5.22 / -5.22	E347HT1-4(1)	BÖHLER E 347 H PW-FD	517
17633-A	T 19 9 Nb R M21 (C1) 3	A5.22 / -5.22	E347T0-4(1)	BÖHLER E 347L H-FD	516
14343-A	G 25 4			BÖHLER FA-IG	503
14343-A	W 25 4			BÖHLER FA-IG	494
14343-A	G 25 20 Mn	A5.9 / -5.9	ER310 (mod.)	BÖHLER FFB-IG	506
14343-A	W 25 20 Mn	A5.9 / -5.9	ER310 (mod.)	BÖHLER FFB-IG	497
14343-A	G 22 12 H	A5.9 / -5.9	ER309 (mod.)	BÖHLER FF-IG	504
14343-A	W 22 12 H	A5.9 / -5.9	ER309 (mod.)	BÖHLER FF-IG	495
17633-A	T 22 12 H M M13 1	A5.22 / -5.22	EC308H (mod.)	BÖHLER FF-MC	518
3581-A	E Z 16 13 Nb B 4 2			BÖHLER FOX CN 16/13	482
3581-A	E 19 9 B 4 2	A5.4 / -5.4	E308-15	BÖHLER FOX CN 18/11	481
3581-A	E 19 9 H R 4 2	A5.4 / -5.4	E308H-16	BÖHLER FOX E 308 H	484
3581-A	E 19 9 Nb B	A5.4 / -5.4	E347-15	BÖHLER FOX E 347 H	483
3581-A	E 25 4 B 2 2			BÖHLER FOX FA	485
3581-A	E 25 20 B 2 2	A5.4 / -5.4	E310-15 (mod.)	BÖHLER FOX FFB	487
3581-A	E 25 20 R 3 2	A5.4 / -5.4	E310-16	BÖHLER FOX FFB-A	488
3581-A	E Z 21 33 B 4 2			Thermanit 21/33 So	490
14343-A	G 25 35			Thermanit 25/35 R	508

ISO	Class	AWS/SFA	Class	Product	Page
14343-A	W Z 25 35			Thermanit 25/35 R	500
3581-A	E Z 23 35 Nb B 2 2			Thermanit 25/35 R	491
14343-A	W Z 18 16 1 Cu H	A5.9 / -5.9	ER308H (mod.)	Thermanit 304 H Cu	493
14343-A	G 25 20	A5.9 / -5.9	ER310	Thermanit 310	505
14343-A	W 25 20	A5.9 / -5.9	ER310	Thermanit 310	496
18274	S Ni Z (NiCr36Fe15Nb0.8)			Thermanit 35/45 Nb	501
14343-A	G 19 9 H	A5.9 / -5.9	ER19-10H	Thermanit ATS 4	502
14343-A	W 19 9 H	A5.9 / -5.9	ER19-10H	Thermanit ATS 4	492
14174	S A FB 2 AC	A5.9 / -5.9	ER19-10H	Thermanit ATS 4 - Marathon 104	509
14343-A	W Z 25 20 H	A5.9 / -5.9	ER310 (mod.)	Thermanit CR	498
14174	S A FB 2 AC	A5.9 / -5.9	ER309 (mod.)	Thermanit D - Marathon 104	511
Nickel-based welding consumables					
12153	T Ni 6625 P M21 2	A5.34 / -5.34	ENiCrMo3T1-4	BÖHLER NIBAS 625 PW-FD	549
12153	T Ni 6083 R M21 3	A5.34 / -5.34	ENiCr3T0-4 (mod.)	BÖHLER NIBAS 70/20 Mn-FD	548
12153	T Ni 6082 R M21 3	A5.34 / -5.34	ENiCr3T0-4	BÖHLER NIBAS 70/20-FD	547
18274	S Ni 6022 (NiCr21Mo13Fe4W3)	A5.14 / -5.14	ERNiCrMo-10	Thermanit 22	536
18274	S Ni 6022 (NiCr21Mo13Fe4W3)	A5.14 / -5.14	ERNiCrMo-10	Thermanit 22	529
18274	S Ni 6617 (NiCr22Co12Mo9)	A5.14 / -5.14	ERNiCrCoMo-1	Thermanit 617	540
18274	S Ni 6617 (NiCr22Co12Mo9)	A5.14 / -5.14	ERNiCrCoMo-1	Thermanit 617	533
14172	E Ni 6117 (NiCr22Co12Mo)	A5.11 / -5.11	ERNiCrCoMo-1 (mod)	Thermanit 617	523
18274	S Ni 6625 (NiCr22Mo9Nb)	A5.14 / -5.14	ERNiCrMo-3	Thermanit 625	535
18274	S Ni 6625 (NiCr22Mo9Nb)	A5.14 / -5.14	ERNiCrMo-3	Thermanit 625	528
14172	E Ni 6625 (NiCr22Mo9Nb)	A5.11 / -5.11	ENiCrMo-3	Thermanit 625	524
14174	S A FB 2 AC	A5.14 / -5.14	ERNiCrMo-3	Thermanit 625 - Marathon 104	541
14174	S A FB 2 AC	A5.14 / -5.14	ERNiCrMo-3	Thermanit 625 - Marathon 444	543
14174	S A BA 2 AC	A5.14 / -5.14	ERNiCrMo-3	Thermanit 625 - Marathon 504	542
18274	S Ni 6686 (NiCr21Mo16W4)	A5.14 / -5.14	ERNiCrMo-14	Thermanit 686	538
18274	S Ni 6686 (NiCr21Mo16W4)	A5.14 / -5.14	ERNiCrMo-14	Thermanit 686	531
18274	S Ni 6052 (NiCr30Fe9)	A5.14 / -5.14	ERNiCrFe-7	Thermanit 690	539
18274	S Ni 6052 (NiCr30Fe9)	A5.14 / -5.14	ERNiCrFe-7	Thermanit 690	532
14172	E Ni 6152 (NiCr30Fe9)	A5.11 / -5.11	ENiCrFe-7	Thermanit 690	525
14172	E Ni 6182 (NiCr15Fe6Mn)	A5.11 / -5.11	ENiCrFe-3	Thermanit Nicro 182	521
18274	S Ni 6082 (NiCr20Mn3Nb)	A5.14 / -5.14	ERNiCr-3	Thermanit Nicro 82	534
18274	S Ni 6082 (NiCr20Mn3Nb)	A5.14 / -5.14	ERNiCr-3	Thermanit Nicro 82	527
14172	E Ni 6082 (NiCr20Mn3Nb)	A5.11 / -5.11	ENiCrFe-3 (mod.)	Thermanit Nicro 82	522
14174	S A FB 2 AC	A5.14 / -5.14	ERNiCr-3	Thermanit Nicro 82 - Marathon 104	544
14174	S A FB 2 AC	A5.14 / -5.14	ERNiCr-3	Thermanit Nicro 82 - Marathon 444	545
18274	S Ni 6059 (NiCr23Mo16)	A5.14 / -5.14	ERNiCrMo-13	Thermanit Nimo C 24	537
18274	S Ni 6059 (NiCr23Mo16)	A5.14 / -5.14	ERNiCrMo-13	Thermanit Nimo C 24	530
14172	E Ni 6059 (NiCr23Mo16)	A5.11 / -5.11	ENiCrMo-13	Thermanit Nimo C 24	526
14174	S A FB 2 AC	A5.14 / -5.14	ERNiCrMo-4	Thermanit Nimo C 276 - Marathon 104	546

ISO	Class	AWS/SFA	Class	Product	Page
Welding flux for stainless steels and nickel-base alloys					
14174	S A GS 2 DC			Avesta Flux 801	553
14174	S A AF 2 DC			Avesta Flux 805	555
14174	S A FB 2 DC			BÖHLER BB 203	557
14174	S A FB 2 AC			Marathon 104	559
14174	S F CS 2 DC			Marathon 213	554
14174	S A FB 2 DC			Marathon 431	556
14174	S A FB 2 AC			Marathon 444	558
14174	S A BA 2 AC			Marathon 504	560
Welding consumables for aluminum and aluminum alloys					
18273	S Al 1450 (Al99,5Ti)	A5.10 / -5.10	ER1450	Union 99,5 Ti	595
18273	S Al 1070 (Al99,7)	A5.10 / -5.10	ER1070	Union 99,5 Ti	583
18273	S Al 1070 (Al99,7)	A5.10 / -5.10	ER1070	Union Al 99,7	596
18273	S Al 1070 (Al99,7)	A5.10 / -5.10	ER1070	Union Al 99,7	584
18273	S Al 2319 (AlCu6MnZrTi)	A5.10 / -5.10	ER2319	Union AlCu 6 Mn	608
18273	S Al 5554 (AlMg2,7Mn)	A5.10 / -5.10	ER5554	Union AlMg 2,7 Mn 0,8	585
18273	S Al 5554 (AlMg2,7Mn)	A5.10 / -5.10	ER5554	Union AlMg 2,7 Mn 0,8	597
18273	S Al 5754 (AlMg3)	A5.10 / -5.10	ER5754	Union AlMg 3	598
18273	S Al 5754 (AlMg3)	A5.10 / -5.10	ER5754(mod.)	Union AlMg 3	586
18273	S Al 5183 (AlMg 4,5Mn0,7(A))	A5.10 / -5.10	ER5183	Union AlMg 4,5 Mn	599
18273	S Al 5183	A5.10 / -5.10	ER5183	Union AlMg 4,5 Mn	587
18273	S Al 5087 (AlMg4,5MnZr)	A5.10 / -5.10	ER5087	Union AlMg 4,5 Mn Zr	600
18273	S Al 5087 (AlMg4,5MnZr)	A5.10 / -5.10	ER5087	Union AlMg 4,5 Mn Zr	588
18273	S Al 5356 (AlMg5Cr(A))	A5.10 / -5.10	ER5356	Union AlMg 5	601
18273	S Al 5356 (AlMg5Cr(A))	A5.10 / -5.10	ER5356	Union AlMg 5	589
18273	S Al 5556A (AlMg5Mn1(A))	A5.10 / -5.10	ER5556A	Union AlMg 5 Mn	602
18273	S Al 5556A (AlMg5Mn1(A))	A5.10 / -5.10	ER5556A	Union AlMg 5 Mn	591
18273	S Al 5556 (AlMg5Mn1Ti(A))	A5.10 / -5.10	ER5556	Union AlMg 5 Mn Ti	603
18273	S Al 5556 (AlMg5Mn1Ti(A))	A5.10 / -5.10	ER5556	Union AlMg 5 Mn Ti	590
18273	S Al 4145 (AlSi10Cu4)	A5.10 / -5.10	ER4145	Union AlSi 10 Cu 4	606
18273	S Al 4145 (AlSi10Cu4)	A.10 / -5.10	ER4145	Union AlSi 10 Cu 4	593
18273	S Al 4047A (AlSi12(A))	A5.10 / -5.10	ER4047A	Union AlSi 12	607
18273	S Al 4047A (AlSi12(A))	A5.10 / -5.10	ER4047A	Union AlSi 12	594
18273	S Al 4043A (AlSi5(A))	A5.10 / -5.10	ER4043A	Union AlSi 5	604
18273	S Al 4043A (AlSi5(A))	A5.10 / -5.10	ER4043A	Union AlSi 5	592
18273	S Al 4018 (AlSi7Mg)	A5.10 / -5.10	ER4018	Union AlSi 7 Mg	605
18273	E Al 4047 (AlSi12)			UTP 48	580
18273 -	E Al 4043 (AlSi5)	A5.3 / -5.3	E4043	UTP 485	582
18273 -	E Al 3103 (AlMn1)	A5.3 / -5.3	E3003	UTP 49	581
Welding consumables for titanium and titanium alloys					
24034	S Ti 3401 (TiNi0,7Mo0,3)	A5.16 / -5.16	ERTi-12	BÖHLER ER Ti 12-IG	614
24034	S Ti 0120 (Ti99,6)	A5.16 / -5.16	ERTi-2	BÖHLER ER Ti 2-IG	611
24034	S Ti 6402 (TiAl6V4B)	A5.16 / -5.16	ERTi-5	BÖHLER ER Ti 5-IG	612
24034	ERTi-7	A5.16 / -5.16	ERTi-7	BÖHLER ER Ti 7-IG	613

Examples of the classification system using various welding consumables

Classification system according to EN ISO 18275-A using a BÖHLER FOX EV 70 Mo as an example.

E 55 3 MnMo B T 4 2 H5

- H5 → Identifier of the hydrogen content of the applied weld metal
- 2 → Code number for welding positions
- 4 → Code number for the nominal electrode efficiency and type of current
- T → Abbreviation for stress-relieved condition
- B → Abbreviation for covering type
- MnMo → Identifier for the chemical composition of the weld metal
- 3 → Code number for the impact energy of the all weld metal
- 55 → Code number for the tensile properties and elongation of the all weld metal
- E → Abbreviation for products/welding process

Classification system according to EN ISO 14341-A taking an BÖHLER EMK 8 as an example

G 46 4 M21 4Si1

- 4Si1 → Identifier for the chemical composition of the wire electrode
- M21 → Identifier for the shielding gas
- 4 → Code number for the impact energy of the all weld metal
- 46 → Code number for the tensile properties and elongation of the all weld metal
- G → Abbreviation for products/welding process

Classification system according to EN ISO 3581-A using a BÖHLER FOX EAS 4 M as an example.

E 19 12 3 L B 2 2

- 2 → Code number for welding positions
- 2 → Code number for the nominal electrode efficiency and type of current
- B → Abbreviation for covering type
- 19 12 3 L → Nominal composition
- E → Abbreviation for products/welding process

Classification system according to EN ISO 17632-A taking a BÖHLER Ti 52-FD as an example

T 46 4 P M21 1 H10

- H10 → Identifier of the hydrogen content of the applied weld metal
- 1 → Code number for welding positions
- M21 → Abbreviation for the shielding gas
- P → Identifier for the slag type
- 4 → Code number for the impact energy of the all weld metal
- 46 → Code number for the tensile properties and elongation of the all weld metal
- T → Abbreviation for products/welding process

Abbreviations / code numbers for welding consumables classification A in EN ISO standards

Abbreviation for welding process / product

Abbrevation	Description	EN ISO standards concerned
E	Manual metal arc welding	2560, 3580, 3581, 14172, 18275
G	Gas shielded metal arc welding with solid wire electrodes	14341, 14343, 16834 , 21952
W	Tungsten inert gas welding	636, 14343, 16834, 21952
T	Gading with flux cored wires	12153, 17632, 17633, 17634, 18276
S (S/T)	Submerged arc welding (solid/flux cored wire)	14171, 14343, 24598, 26304
O	Gas welding	12536
P	Plasma welding	14341
S or B	Solid wire/stick or solid strip	14343, 18273, 18274

Code number for the yield strength, strength and elongation of the weld metal

Code number	ReL [MPa]	Rm [MPa]	As [%]	EN ISO standards concerned
35	355	440-570	22	636, 2560, 14341, 14171, 17632
38	380	470-600	20	
42	420	500-640	20	
46	460	530-680	20	
50	500	560-720	18	
55	550	610-780	18	16834, 18275, 18276, 26304
62	620	690-890	18	
69	690	760-960	17	
79	790	880-1080	16	
89	890	980-1180	15	

Code number for yield strength and strength with single-run/two-run welding

Code number	Yield strength of the weld metal [MPa]	Tensile strength of the weld metal [MPa]	EN ISO standards concerned
2T	275	370	14171
3T	355	470	14171, 17632
4T	420	520	
5T	500	600	

Identifier for impact energy

Code number	Temperature [°C] for impact energy > 47 J (one sample may be lower, but > 32 J)	EN ISO standards concerned
Z	No requirement	636, 2560, 14341, 14171, 16384, 18275, 18276, 26304
A	+20	
0	0	
2	-20	
3	-30	
4	-40	
5	-50	
6	-60	
7	-70	14171, 18275, 18276
8	-80	
10	-100	14171

Abbreviation for stress-relieved condition		
Abbrevation	Description	EN ISO standards concerned
T	Mechanical properties after annealing	16834, 18275
P	560-600°C / 1h / furnace down to 300°C / air	26304
	Mechanical properties in the welded condition	all

Code number for nominal efficiency and type of current			
Code number	Yield [%]Type of current		EN ISO standards concerned
1	≤ 105	Alternating and direct current	2560, 3580, 3581, 18275
2	≤ 105	Direct current	
3	≥ 105 ≤ 125	Alternating and direct current	
4	≥ 105 ≤ 125	Direct current	
5	≥ 125 ≤ 160	Alternating and direct current	2560, 3581, 18275
6	≥ 125 ≤ 160	Direct current	
7	≥ 160	Alternating and direct current	
8	≥ 160	Direct current	

Code number for welding positions		
Identifier	Description	EN ISO standards concerned
1	All positions	2560, 3580, 3581, 17633, 17634, 18276
2	All positions except for vertical down	
3	Butt weld in flat position, fillet weld in flat and horizontal positions 12153, 18275, 17632	
4	Butt weld in flat position, fillet weld in flat position	
5	Vertical down position, and positions as in code number 3	

Code number of hydrogen content in the weld-metal		
Code number	Maximum hydrogen content [ml/100g weld metal]	EN ISO standards concerned
H5	5	2560, 3580, 14171, 17632, 17634, 18275, 18276, 26304
H10	10	
H15	15	

Abbreviation for shielding gases		
Abbrevia-tion	Shielding gas type	EN ISO standards concerned
M	Shielding gas EN ISO 14175-M2, but without helium	17632, 17634, 18276
C	Shielding gas EN ISO 14175-C1, carbon dioxide	
e.g. M21	The abbreviation for the shielding gas must be accordance with EN ISO 14175	12153, 14341, 16834, 17633
Z	No shielding gas specified	14341, 16834
N	No shielding gas	17632, 18276
NO	No shielding gas	12153, 17633

Abbreviation for covering type		
Abbrevation	Covering type	EN ISO standards concerned
A	acid covering	2560
C	cellulosic covering	
R	rutile covering	2560, 3580, 3581
RR	rutile thick covering	2560
RC	rutile-cellulosic covering	
RA	rutile-acid covering	
RB	rutile-basic covering	
B	basic covering	2560, 3580, 3581, 18275

Abbreviation for flux type		
Abbrevation	Flux type (main)	EN ISO standards concerned
AB	aluminate basic	14174, 14171, 18274, 26304, 24598
AS	aluminate-silicate	
AF	aluminate-fluoride basic	
AR	aluminate-rutile	
BA	basic-aluminate	
CG	calcium-magnesium	
CS	calcium-silicate	
FB	fluoride basic	
MS	manganese-silicate	
RS	rutile-silicate	
ZS	zirconium-silicate	
Z	any other composition	

Identifier for the type of core		
Abbrevation	Type and properties	EN ISO standards concerned
R	Rutile, slowly solidifying slag, shielding gas required	12153, 17632, 17633, 17634, 18276
P	Rutile, fast solidifying slag, shielding gas required	
B	Basic, shielding gas required	
M	Metal powder, shielding gas required	
V	Rutile or basic/fluoride, shielding gas not required	17632
W	Basic/fluoride, slowly solidifying slag, shielding gas not required	
Y	asic/fluoride, fast solidifying slag, shielding gas not required	
Z	other types	12153, 17632, 17633, 17634, 18276
U	Without shielding gas, self-shielding	12153, 17633

Welding consumables for steel <460 MPa

◆ Content

Stick electrodes

Product name	C	Si	Mn	Mo
Phoenix Grün	0.08	0.35	0.50	
Phoenix Blau	0.09	0.35	0.50	
BÖHLER FOX OHV	0.06	0.40	0.45	
BÖHLER FOX ETI	0.07	0.40	0.50	
BÖHLER FOX SPE	0.08	0.20	0.45	
Phoenix SH Multifer 130	0.07	0.40	0.60	
Phoenix K 50	0.06	0.50	1.20	
BÖHLER FOX EV 47	0.06	0.30	0.90	
Phoenix Spezial D	0.06	0.65	1.05	
BÖHLER FOX EV 50-W	0.07	0.50	1.10	
BÖHLER FOX EV 50	0.08	0.40	1.20	
Phoenix SH Multifer 180	0.07	0.33	0.70	
Phoenix Rot R 160	0.07	0.35	0.65	
Phoenix Rot AR 160	0.08	0.30	0.90	
Phoenix Rot BR 160	0.08	0.40	0.85	
BÖHLER FOX NUT				

GTAW rods

Product name	C	Si	Mn
BÖHLER EML 5	0.10	0.60	1.20
BÖHLER EMK 6	0.08	0.90	1.45
BÖHLER EMK 8	0.10	1.00	1.70

Solid wires

Product name	C	Si	Mn
BÖHLER EMK 4	0.07	0.60	1.20
BÖHLER EMK 4 NC	0.07	0.70	1.20
BÖHLER EMK 6	0.08	0.90	1.45
BÖHLER EMK 6 D	0.08	0.90	1.45
BÖHLER EMK 6 NC	0.08	0.90	1.45
BÖHLER SG 2	0.07	0.85	1.50
BÖHLER EMK 8	0.10	1.00	1.70
BÖHLER EMK 8 D	0.10	1.00	1.70
BÖHLER EMK 8 NC	0.01	1.00	1.70
BÖHLER SG 3	0.09	0.95	1.70

SAW wire/flux combinations

Product name	C	Si	Mn
Union S 2 - UV 305	0.06	0.50	1.25
Union S 2 - UV 306	0.06	0.60	1.40
Union S 2 - UV 400	0.07	0.40	1.40
Union S 2 Si - UV 305	0.06	0.60	1.30
Union S 2 Si - UV 306	0.06	0.75	1.60
Union S 2 Si - UV 421 TT	0.07	0.30	1.10
Union S 3 Si - UV 310 P	0.05	0.30	1.50
Union S 3 Si - UV 418 TT	0.08	0.30	1.55
Union S 3 Si - UV 421 TT	0.08	0.30	1.55
Union S 3 Si - UV 419 TT-W	0.08	0.35	1.65
Union S 3 Si - UV 422 TT-LH	0.08	0.45	1.55
BÖHLER SUBARC T55 HP - UV 306	0.04	0.70	1.80
BÖHLER SUBARC T55 HP - UV 421 TT	0.07	0.40	1.40
BÖHLER SUBARC T55 HP - UV 419 TT-W	0.07	0.40	1.50

Flux cored wires

Product name	C	Si	Mn	Ni
BÖHLER HL 51 L-MC	0.07	0.70	1.50	
BÖHLER Ti 46 T-FD	0.06	0.45	1.30	
BÖHLER Ti 42 T-FD	0.04	0.50	1.30	
BÖHLER Ti 46-FD	0.05	0.50	1.20	
BÖHLER Ti 52-FD	0.06	0.50	1.20	
BÖHLER Ti 52 T-FD	0.06	0.40	1.45	
BÖHLER Ti 52 T-FD (HP)	0.06	0.45	1.30	0.35
BÖHLER Ti 52 T-FD (CO_2)	0.07	0.45	1.30	
BÖHLER Ti 52 T-FD SR (CO_2)	0.04	0.40	1.30	0.40
BÖHLER HL 46-MC	0.07	0.70	1.50	
BÖHLER HL 46 T-MC	0.06	0.80	1.50	
BÖHLER HL 51 T-MC	0.06	0.80	1.60	
BÖHLER Kb 46 T-FD	0.07	0.40	1.40	
BÖHLER Kb 52 T-FD	0.07	0.55	1.40	

Gas welding rods

Product name	C	Si	Mn	Ni
BÖHLER BW VII	0.08	0.10	0.60	
BÖHLER BW XII	0.01	0.15	1.10	0.45

Phoenix Grün

Stick electrode, unalloyed, rutile coated

Classifications

EN ISO 2560-A	**AWS A5.1 / SFA-5.1**
E 42 0 R 1 2	E6012

Characteristics and typical fields of application

Rutile coated electrode for tank construction and structural engineering. Particularly suitable for welding thin sheets in all welding positions (Ø 2.0/2.5 mm also in PG (3F) position).

Soft arc; low spatter; excellent striking and re-striking ability. Easy slag removal.

Base materials

S235JRG2 - S355J2, weld able thin sheets

Typical analysis of all-weld metal

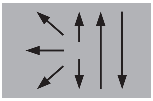
	C	Si	Mn
wt.-%	0.08	0.35	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	420	510	22	50

u untreated

Operating data



Polarity DC (-) / AC

Dimension mm	**Current A**
2.5 × 350	65 - 100
3.2 × 350	80 - 140

Approvals

DB (10.014.51), CE

Phoenix Blau

Stick electrode, unalloyed, rutile coated

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 42 0 RC 1 1	E6013

Characteristics and typical fields of application

Rutile cellulose coated electrode. General purpose; useable in all positions; excellent gap-bridging and arc-striking ability; for tack-welding and bad fit-ups. Well suited for welding rusty and primered plates (roughly 40 µm); excellent vertical down characteristics. Useable on small transformers (42 V, open circuit).

Base materials

S235JRG2 - S355J2; GS-38; GS-45; St35; St45; St35.8; boiler steels P235GH, P265GH, P295GH; shipbuilding steels corresp. to app.-grade 2; fine grained structural steels up to P355N; weldable ribbed reinforcing steel bars. ASTM A36 and A53 Gr. all; A106 Gr. A, B, C; A135 Gr. A, B; A283 Gr. A, B, C, D; A366; A285 Gr. A, B, C; A500 Gr. A, B, C; A570 Gr. 30, 33, 36, 40, 45; A607 Gr. 45; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A935 Gr. 45; A936 Gr. 50; API 5 L Gr. B, X42-X52

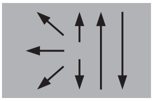
Typical analysis of all-weld metal

	C	Si	Mn
wt.-%	0.09	0.35	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	0 °C
u	440 (≥ 420)	540 (≥ 500 – 640)	22 (≥ 20)	80	55 (≥ 47)

Operating data



Polarity	DC (-) AC
Electrode identification	Phoenix Blau / E 42 0 RC / E 6013

Dimension mm	Current A
2.0 × 250	50 – 60
2.5 × 250	60 – 90
2.5 × 350	60 – 90
3.2 × 350	90 – 140
4.0 × 350	150 – 190
4.0 × 450	150 – 190
5.0 × 350	190 – 240
5.0 × 450	190 – 240

Approvals

TÜV (00425), DB (10.014.86), ABS, BV, LR, DNV GL, CE

BÖHLER FOX OHV

Stick electrode, mild steel, rutile coated

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 38 0 RC 1 1	E6013

Characteristics and typical fields of application

Rutile-cellulosic coated electrode with good weldability in all positions including vertical-down. Most popular E 6013 type.

For small welding machines, very good operating characteristics, flexible coating, good for tack welding. Versatile applications in structural welding, vehicle construction, boiler and tank welding, and in shipbuilding, also suitable for galvanised components.

Base materials

Steels up to a yield strength of 380 MPa (52 Ksi)

S235JR-S355JR, S235JO-S355JO, P195TR1-P265TR1, P195GH-P265GH, L245NB-L360NB, L245MB-L360MB, ship building steels: A, B, D

ASTM A 106, Gr. A, B; A 283 Gr. A, C; A 285 Gr. A, B, C; A 501, Gr. B; A 573, Gr. 58, 65; A 633, Gr. A, C; A 711 Gr. 1013; API 5 L Gr. B, X42, X52

Typical analysis of all-weld metal

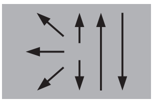
	C	Si	Mn
wt.-%	0.06	0.4	0.45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	0°C	-10°C
u	460 (≥ 380)	540 (470 – 600)	25 (≥ 20)	75	60 (≥ 47)	47

u untreated, as welded

Operating data



Polarity	DC – / AC
Electrode identification	FOX OHV 6013 E 38 0 RC
Redrying	not necessary

Dimension mm	Current A
2.0 × 250	45 – 80
2.5 × 250	60 – 100
2.5 × 350	60 – 100
3.2 × 350	90 – 130
3.2 × 450	90 – 130
4.0 × 350	110 – 170
4.0 × 450	110 – 170
5.0 × 450	170 – 240

Approvals

TÜV (05687), DB (10.014.12), ABS, DNV GL, LR, CE

BÖHLER FOX ETI

Stick electrode, mild steel, rutile coated

Classifications

EN ISO 2560-A	**AWS A5.1 / SFA-5.1**
E 42 0 RR 1 2	E6013

Characteristics and typical fields of application

Rutile coated electrode offering top weldability in all positions except vertical-down. Extremely smooth beads, self-detaching slag, minimum spattering and excellent welding properties on A.C. Excellent re-striking characteristics and easy handling. Good deposition lengths attainable. Versatile applications in trade and industry.

Base materials

Steels up to a yield strength of 420 MPa (60ksi)

S235JR-S355JR, S235JO-S355JO, P195TR1-P265TR1, P195GH-P265GH, L245NB-L360NB, L245MB-L360MB, L415NB, L415MB, ship building steels: A, B, D

ASTM A 106, Gr. A, B; A 283 Gr. A, C; A 285 Gr. A, B, C; A 501, Gr. B; A 573, Gr. 58, 65, 70; A 633, Gr. A, C; A 711 Gr. 1013; API 5 L Gr. B, X42, X52, X60

Typical analysis of all-weld metal

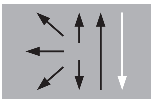
	C	Si	Mn
wt.-%	0.07	0.4	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-0°C
u	430 (≥ 420)	520 (≥ 500 – 640)	28 (≥ 20)	65	55 (≥ 47)

u untreated, as welded

Operating data



Polarity	DC – / AC
Electrode identification	FOX ETI 6013 E 42 0 RR
Redrying	not necessary

Dimension mm	Current A
2.0 × 250	45 – 80
2.5 × 250	60 – 110
2.5 × 350	60 – 110
3.2 × 350	90 – 140
3.2 × 450	90 – 140
4.0 × 350	110 – 190
4.0 × 450	110 – 190
5.0 × 450	170 – 240

Approvals

TÜV (01097), ABS, BV, DNV GL, LR, CE

BÖHLER FOX SPE

Stick electrode, mild steel, rutile coated

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 38 2 RB 1 2	E6013 (mod.)

Characteristics and typical fields of application

Rutile-basic coated electrode especially recommended for out-of-position work except vertical-down. Excellently suited for welding root passes. Produces first class X-ray quality welds. Excellent welding properties on A.C. Preferably used in structural and tank welding as well as in tube & pipe construction. High mechanical properties, thus suitable for many different base metals.

Base materials

Steels up to a yield strength of 380 MPa (52 ksi)

S235JR-S355JR, S235JO-S355JO, S275N-S355N, S275M-S355M, P235GH-P355GH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L360NB, L245MB-L360MB

ASTM A 106 Gr. A, B; A 283 Gr. A, C; A 285 Gr. A, B, C; A 414 Gr. A, B, D, G; A 501 Gr. B; A 516 Gr. 55, 60, 65, 70; A 573 Gr. 58, 65, 70; A 588 Gr. A, B; A 633 Gr. A, C, D; A 662 Gr. A, B, C; A 711, Gr. 1013; API 5 L Gr. B, X42, X52

Typical analysis of all-weld metal

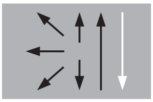
	C	Si	Mn
wt.-%	0.08	0.2	0.45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	0°C	-10°C	-20°C
u	420 (≥ 380)	500 (≥ 470 – 600)	28 (≥ 20)	90	75	70	60 (≥ 47)

u untreated, as welded

Operating data



Polarity	DC – / AC
Electrode identification	FOX SPE E 38 2 RB
Redrying	not necessary

Dimension mm	Current A
2.0 × 250	45 – 75
2.5 × 250	60 – 100
2.5 × 350	60 – 100
3.2 × 350	90 – 140
4.0 × 450	110 – 190
5.0 × 450	170 – 250

Approvals

TÜV (00731), DB (10.014.03), CE

Phoenix SH Multifer 130

Stick electrode, mild steel

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 42 0 RR 5 3	E7014

Characteristics and typical fields of application

Rutile coated high performance electrode with 140% weld metal recovery. Little spatter; self releasing slag; useable in diameters up to 4 mm for welding in the overhead and horizontal position; outstanding striking and restriking ability. Well suited for thin fillet welds.

Base materials

S235JRG2 – S355J2;

Boiler steels P235GH/P265GH/P295GH/P355GH;

Fine grained structural steels up to P355N- and M-grades;

Shipbuilding steels acc. A – E-grades, AH 32 - DH 36

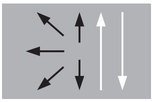
Typical analysis of all-weld metal

	C	Si	Mn
wt.-%	0.07	0.40	0.60

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	0°C
u	420	510	22	70	47
s	410	470	27	70	

Operating data



Polarity	DC – / AC
Electrode identification	SH Multifer 130 / E 42 0 RR / E 7014

Dimension mm	Current A
4.0 × 450	180 – 220
5.0 × 450	240 – 320

Approvals

TÜV (00583), DB (10.014.94), ABS, BV, DNV GL, LR CE

Phoenix K 50

Stick electrode, mild steel, basic coated

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 42 4 B 4 2	E7015

Characteristics and typical fields of application

Basic coated stick electrode. The smooth and stabile arc offers good welding characteristics and an easy handling.

Specially designed for welding of fine grained steels and fine grained structural steels, for boiler plates, tank construction and ship building.

Steels up to a C-content of 0.4% can be welded safe without cracks.

115% weld metal recovery; cold toughness down to – 40ºC.

Base materials

Boiler steels P235GH, P265GH, P295GH, P355GH

S235JRG2 – S355J2, E335

fine grained structural steel up to S420N

Pipeline steels P235, P265; X42 – X60.

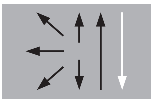
Typical analysis of all-weld metal

	C	Si	Mn
wt.-%	0.06	0.5	1.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-40°C
u	420	510	22	120	47
s	380	490	27	130	47

Operating data



Polarity	DC+
Electrode identification	Phoenix K 50/E 42 4 B/E 7015
Redrying	250-350°C/2h

Dimension mm	Current A
2.5 × 350	65 – 95
3.2 × 350	90 – 130
3.2 × 450	90 – 130
4.0 × 350	140 – 180
4.0 × 450	140 – 180
5.0 × 450	190 – 250

Approvals

DB (10.014.96), CE

BÖHLER FOX EV 47

Stick electrode, mild steel, basic coated

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 38 4 B 4 2 H5	E7016-1 H4 R

Characteristics and typical fields of application

Basic coated electrode for high-quality welds. Good weldability in all positions except vertical-down. Metal recovery about 110%. Very low hydrogen content (according AWS condition HD < 4 ml/100g weld metal). Weld metal extremely ductile, crack resistant and ageing resistant thus especially suited for rigid welds with heavy seam cross sections.

Base materials

Steels up to a yield strength of 380 MPa (52 ksi)

S235JR-S355JR, S235JO-S355JO, S235J2-S355J2, S275N-S355N, S275M-S355M, P235GH-P355GH, P355N, P275NL1-P355NL1, P215NL, P265NL, P285NH-P355NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L360NB, L245MB-L360MB, GE200-GE240

Ship-building 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, LF2; 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. A, C, D; A 662 Gr. A, B, C; A 678 Gr. A, B; A 711 Gr. 1013; API 5 L Gr. B, X42, X52, X56

Typical analysis of all-weld metal

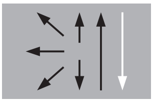
	C	Si	Mn
wt.-%	0.06	0.3	0.9

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-20°C	-40°C	-45°C
u	440 (≥ 380)	530 (≥ 470 – 600)	27 (≥ 20)	200	130	100 (≥ 47)	≥ 27
s	390 (≥ 380)	490 (≥ 470 – 600)	29 (≥ 20)	200	150	100 (≥ 47)	

u untreated, as welded
s stress relieved 600 °C/2h / furnace down to 300 °C / air

Operating data



Polarity DC (+)

Electrode identification FOX EV 47 7016-1 E 38 4 B

Redrying if necessary 300 – 350°C, min. 2h

Dimension mm	Current A
2.5 × 250	80 – 110
2.5 × 350	80 – 110
3.2 × 350	100 – 140
3.2 × 450	100 – 140
4.0 × 350	130 – 180
4.0 × 450	130 – 180
5.0 × 450	180 – 230
6.0 × 450	240 – 280

Approvals

TÜV (01098), DB (10.014.09), ABS, BV, DNV GL, LR, RMR, RINA, CE

Phoenix Spezial D

Stick electrode, mild steel, basic coated

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 42 3 B 1 2 H10	E7016

Characteristics and typical fields of application

Basic double coated electrode with excellent weldability in all positions except vertical-down.

Especially suited for out-of-position welding thanks to the well controlled arc. Excellent root penetration. Good suitability for welding on AC. Minimum spatter loss, very easy slag removal with uniform beads. well-suited for small transformers. Low hydrogen content in the weld deposit (HD < 10 ml/100 g deposit).

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, P355N, P285NH-P420NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L415NB, L245MB-L415MB, 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 414 Gr. A, B, C, D, E, F, G; A 501 Gr. B; A 516 Gr. 55, 60, 65, 70; A 573 Gr. 58, 65, 70; A 588 Gr. A, B; A 633 Gr. A, C, D; A 662 Gr. A, B, C; A 678 Gr. A, B; A 711 Gr. 1013; API 5 L Gr. B, X42, X52, X56, X60

Typical analysis of all-weld metal

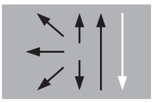
	C	Si	Mn
wt.-%	0.06	0.65	1.05

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-30°C
u	440 (≥ 420)	550 (500 - 640)	28 (≥ 20)	170	50 (≥ 47)
s	400	520	28	170	50

u untreated, as welded
s stress relieved 580 °C/2h / furnace down to 300 °C / air

Operating data



Polarity	DC+ / AC
Electrode identification	7016 E 42 3 B
Redrying	300 °C/2 h

Dimension mm	Current A
2.5 × 350	60 – 90
3.2 × 350	100 – 150
3.2 × 450	100 – 150
4.0 × 450	140 - 190
5.0 × 450	190 – 250

Approvals

TÜV (10572), DB (10.138.12), CE

BÖHLER FOX EV 50-W

Stick electrode, mild steel, basic coated

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 42 5 B 1 2 H5	E7016-1 H4 R

Characteristics and typical fields of application

Basic coated electrode for high-quality joint welds. Especially suited for root pass welding. Excellent weldability in all positions except vertical-down. Smooth and slag-free welds. Crack resistant deposits of high toughness at sub-zero temperatures. Very low hydrogen contents in the weld deposit (acc. AWS condition HD < 4 ml/100 g weld metal). Especially suited for welding on AC. For root pass welding, DC negative polarity is recommended.

Base materials

Steels up to a yield strength of 420 MPa (60ksi)

S235JR-S355JR, S235J0-S355J0, S235J2-S355J2, S275N-S420N, S275M-S420M, P235GH-P355GH, P355N, P215NL, P275NL1-P355NL1, P265NL, P285NH-P420NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L415NB, L245MB-L415MB, GE200-GE240, GE300, Ship building 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. A, C, D; A 662 Gr. A, B, C; A 678 Gr. A, B; A 711 Gr. 1013; API 5 L Gr. B, X42, X52, X56, X60

Typical analysis of all-weld metal

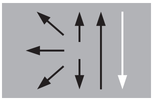
	C	Si	Mn
wt.-%	0.07	0.5	1.1

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-20°C	-50°C
u	480 (≥ 420)	570 (≥ 500 – 640)	28 (≥ 20)	200	150	80 (≥ 47)
s	430	540	28	200	160	

u untreated, as welded
s stress relieved 580 °C/2h / furnace down to 300 °C / air

Operating data



Polarity	DC+ / AC/DC- for root pass only
Electrode identification	FOX EV 50-W 7016-1 E 42 5 B
Redrying	if necessary 300 – 350°C, min. 2h

Dimension mm	Current A
2.5 × 350	55 – 85
3.2 × 350	80 – 140
3.2 × 450	80 – 140
4.0 × 350	110 – 180
4.0 × 450	110 – 180
5.0 × 450	180 – 230

Approvals

TÜV (04180), DNV GL

BÖHLER FOX EV 50

Stick electrode, mild steel, basic coated

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 42 5 B 4 2 H5	E7018-1 H4 R

Characteristics and typical fields of application

Basic coated electrode engineered for high-quality welds. Excellent strength and toughness properties down to -50ºC. Metal recovery approximately 110%. Good weldability in all position except for vertical-down. Very low hydrogen content (acc. AWS condition HD < 4 ml/100g weld metal). Suitable for welding steels with low purity and high carbon content. Welding in steel construction, boiler and tank manufacture, vehicle construction, shipbuilding, and machine construction as well as for buffer layers on build ups on high carbon steels. Especially suitable for off-shore construction, CTOD tested at -10 ºC. BÖHLER FOX EV 50 can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Test values for SSC-test are available too.

Base materials

Steels up to a yield strength of 420 MPa (60 ksi)

S235JR-S355JR, S235JO-S355JO, S235J2-S355J2, S275N-S420N, S275M-S420M, S275NLS420NL, S275ML-S420ML, P235GH-P355GH, P275NL1-P355NL1, P275NL2-P355NL2, P215NL, P265NL, P355N, P285NH-P420NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L415NB, L245MB-L415MB, GE200-GE240, GE300

Ship building steels: A, B, D, E, A 32-F 36, A 40-F 40

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, LF2; 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. A, C, D, E; A 662 Gr. A, B, C; A 707 Gr. L1, L2, L3; 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

	C	Si	Mn
wt.-%	0.08	0.4	1.2

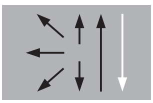
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-20°C	-50°C
u	460 (≥ 420)	570 (500 – 640)	30 (≥ 20)	190	160	70 (≥ 47)
s	430	520	32	200		90

u untreated, as welded

s stress relieved 600°C/2h / furnace down to 300°C / air

Operating data



Polarity DC+

Electrode identification FOX EV 50 7018-1 E 42 5 B

Redrying 300-350°C/2h

Dimension mm	Current A
2.5 × 250	80 – 110
2.5 × 350	80 – 110
3.2 × 350	100 – 140
3.2 × 450	100 – 140
4.0 × 350	130 – 180
4.0 × 450	130 – 180
5.0 × 450	180 – 230

Approvals

TÜV (00426), DB (10.014.02), ABS, BV, DNV GL, LR, RMR, RINA, CWB (Ø3,2-6,0 mm), CE

Phoenix SH Multifer 180

Stick electrode, mild steel, rutile

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 42 0 RR 7 3	E7024

Characteristics and typical fields of application

Rutile coated high performance electrode with 180% weld metal recovery.

High deposition rate; good strike and restrike ability; low spatter; self releasing slag; finely rippled weld pattern.

Preferred for fillet welds. Useable for shipbuilding, mechanical and structural engineering.

Base materials

S235JRG2 – S355J2;

Boiler steels P235GH/P265GH/P295GH/P355GH;

Fine grained structural steels up to P355N- and M-grades;

Shipbuilding steels acc. A – E-grades, AH 32 – DH 36;

ASTM A36 Gr. all; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A366; A570 Gr. 30, 33, 36, 40, 45; A607 Gr. 45; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A935 Gr. 45; A936 Gr. 50

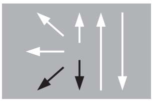
Typical analysis of all-weld metal

	C	Si	Mn
wt.-%	0.07	0.33	0.70

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	0°C
u	420	510	22	70	47

Operating data



Polarity	DC (-) AC
Electrode identification	SH Multifer 180 / E 42 0 RR / E7024

Dimension mm	Current A
3.2 × 450	120 – 180
4.0 × 450	180 – 220
5.0 × 450	250 – 330

Approvals

TÜV (01598), DB (10.014.97), ABS, BV LR, DNV GL, CE

Phoenix Rot R 160

Stick electrode, mild steel, rutile

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 42 0 RR 5 3	E7024-1

Characteristics and typical fields of application

Rutile coated high performance electrode with 160% weld metal recovery. Low spatter; fine rippled weld pattern; good striking and restriking ability; self releasing slag.

Well suited for thin fillet welds.

Base materials

S235JRG2 - S355J2;

Boiler steels P235GH/P265GH/P295GH/P355GH

Fine grained structural steels up to P355N- and M-grades;

Shipbuilding steels acc. A - E-grades, AH 32 - DH 36; ASTM

A36 Gr. all; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A366; A570 Gr. 30, 33, 36, 40, 45; A607 Gr. 45; A668 Gr. A, B;

A907 Gr. 30, 33, 36, 40; A935 Gr. 45; A936 Gr. 50

Typical analysis of all-weld metal

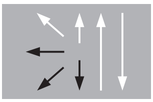
	C	Si	Mn
wt.-%	0.07	0.35	0.65

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	0°C
u	420	510	22	80	47
s	410	470	26	85	

u untreated, as welded
s stress released 600 °C / 2 h / oven down to 300 °C / air

Operating data



Polarity	DC (-) AC
Electrode identification	Phoenix Rot R 160 / E 42 0 RR / E7024-1

Dimension mm	Current A
3.2 × 450	120 – 160
4.0 × 450	160 – 230
5.0 × 450	250 – 340
6.0 × 450	300 – 400

Approvals

TÜV (00349), DB (10.014.53) ABS, BV, DNV GL, LR, CE

Phoenix Rot AR 160

Stick electrode, mild steel, rutil acid

Classifications

EN ISO 2560-A	**AWS A5.1 / SFA-5.1**
E 42 2 RA 5 3	E7024-1

Characteristics and typical fields of application

Rutile acid coated high performance electrode with roughly 160% weld metal recovery.

Particularly high deposition rate; outstanding welding characteristics on alternating current; the weld metal exhibits good runout qualities also in tight corners. High radiographic soundness. Useable for gravity and auto contact welding; unproblematic for welding rusty and primer-coated plates.

Base materials

S235JRG2 - S355J2;

Boiler steels P235GH/P265GH/P295GH/P355GH;

Fine grained structural steels up to P355N- and M-grades;

Shipbuilding steels acc. A - E-grades, AH 32 - DH 36

Typical analysis of all-weld metal

	C	Si	Mn
wt.-%	0.08	0.3	0.9

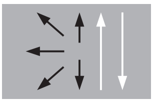
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-20°C
u	430 (≥ 420)	520 (≥ 510)	22 (≥ 20)	80	55 (≥ 47)
s	420	500	27	80	

u untreated, as welded

s stress released, 600 °C / 2 h / oven down to 300 °C / air

Operating data



Polarity DC– / AC

Electrode identification Phoenix Rot AR 160 /E 42 2 RA/E 7024-1

Dimension mm	Current A
3.2 × 450	120 – 160
4.0 × 450	160 – 240
5.0 × 450	250 – 350
6.0 × 450	300 – 400

Approvals

TÜV (00535), DB (10.014.84), ABS, BV, DNV GL, LR, CE

SMAW

Phoenix Rot BR 160

Stick electrode, mild steel, rutile-basic

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 42 2 RB 5 3	E7028

Characteristics and typical fields of application

Rutile-basic coated high performance electrode with ca. 160% weld metal recovery. Easy slag removal; fine rippled smooth welds; particularly good welding characteristics on primer-coated plates.

Base materials

S235JRG2 - S355J2;

Boiler steels P235GH/P265GH/P295GH;

Fine grained structural steels up to P355N- and M-grades;

Shipbuilding steels acc. A - E-grades, AH 32 to NVE 36

Typical analysis of all-weld metal

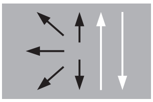
	C	Si	Mn
wt.-%	0.08	0.4	0.85

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-20°C
u	430 (≥ 420)	520 (≥ 510)	22 (≥ 20)	90	≥ 47
s	400	470	27	85	47

u untreated, as welded
s stress released, 600 °C / 2 h / oven down to 300 °C / air

Operating data



Polarity	DC (+/-) / AC
Electrode identification	Phoenix Rot BR 160 / E 42 2 RB / E7028
Redrying	200-250°C/2h

Dimension mm	Current A
3.2 × 450	120 – 170
4.0 × 450	180 – 230
5.0 × 450	240 – 300

Approvals

TÜV (01700), DB (10.014.85) ABS, BV LR, DNV GL, CE

BÖHLER FOX NUT

Stick electrode, mild steel, for gouging

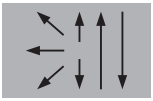
Characteristics and typical fields of application

Special electrode for gouging of various base materials, unalloyed up to high alloyed, cast steels, non ferro metals except copper. Easy to ignite, high gouging speed in all positions.

Suitable for edge bevelling, cutting grooves, removal of unsound material and cracks prior to repair welding.

For gouging use a flat angle (~ 15º), Keep contact with the base material, pulling forward ensures the expulsion of the molten material. Grinding is necessary before welding the notch.

Operating data



Polarity	DC– / AC
Electrode identification	FOX NUT
Redrying	not necessary

Dimension mm	Current A
3.2 × 350	180 – 240
4.0 × 350	250 – 320

Approvals

-

BÖHLER EML 5

TIG Rod, mild steel

Classifications

EN ISO 636-A	AWS A5.18 / SFA-5.18
W 2 Si	ER70S-3

Characteristics and typical fields of application

GTAW rod for high integrity welds. The low Si-content renders this filler metal particularly also for joint welds that are subjected to enamelling or galvanising. Especially suited for root pass welding (approved at -50°C). BöHLER EML 5 can be used in sour gas applications (HIC-Test acc. to NACE TM-02-84).

Base materials

Steels up to a yield strength of 460 MPa (67 ksi)

S235J2G3 – S355J2G3, E360, P235T1-P355T1, P235G1TH, L210, L290MB, P255G1TH, P235GH, P265GH, P295GH, P310GH, P255NH, S235JRS1 – S235J4S, S355G1S – S355G3S, S255N – S385N, P255NH-P385NH, GE200-GE260

ASTM A27 a. A36 Gr. all; 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; A570 Gr. 30, 33, 36, 40, 45; A 572 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; API 5 L Gr. B, X42-X60

Typical analysis of the wire rod

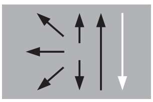
	C	Si	Mn
wt.-%	0.1	0.6	1.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-20°C	-50°C
u	520 (≥ 460)	620 (≥ 530 - 680)	26 (≥ 23)	220	200	90 (≥ 47)
s	480	580	28	200	210	

u untreated, as welded – shielding gas 100 % Argon
s stress relieved, 600 °C/2 h – shielding gas 100 % Argon

Operating data



Polarity	DC–
Shielding gas (EN ISO 14175)	I1
Rod marking	W2Si ER70S-3

Dimension mm
1.2 × 1000
1.6 × 1000
1.6 × 500
2.0 × 1000
2.0 × 500
2.4 × 1000
2.4 × 500
3.0 × 1000
3.2 × 1000

Approvals

TÜV (01096), DB (42.132.84), Equinor, CE

BÖHLER EMK 6

TIG Rod, mild steel

Classifications

EN ISO 636-A	**AWS A5.18 / SFA-5.18**
W 3Si1	ER70S-6

Characteristics and typical fields of application

GTAW rod with high silicon content. The welding rod is suited for joints in boiler and vessel fabrication as well as in structural steel engineering.

BöHLER EMK 6 can be used in sour gas applications (HIC-Test acc. to NACE TM-02-84). SSC-test results are also available.

Base materials

Steels with yield strength < 420 MPa (60 ksi)

S235JR-S355JR, S235J0-S355J0, 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, ship building 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 analysis of the wire rod

	C	Si	Mn
wt.-%	0.08	0.9	1.45

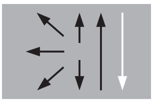
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C	-50°C
u	450 (≥ 420)	560 (≥ 500 - 640)	28 (≥ 20)	180	80	≥ 47
s	400	510	28	180	110	

u untreated, as welded – shielding gas 100 % Argon

s stress relieved, 600 °C/2h – shielding gas 100 % Argon

Operating data



Polarity	DC–
Shielding gas (EN ISO 14175)	I1
Rod marking	W3Si1 ER70S-6

Dimension mm
1.2 × 1000
1.6 × 1000

Approvals

TÜV (09717), CE

BÖHLER EMK 8

TIG rod, mild steel

Classifications

EN ISO 636-A	AWS A5.18 / SFA-5.18
W 4Si1	ER70S-6

Characteristics and typical fields of application

GTAW rod of W 4Si / ER70S-6 type with high silicon content. The welding rod is suited for joints in in structural steel engineering.

Base materials

Steels up to a yield strength < 460 MPa (67 ksi)

S235JR-S355JR, S235J0-S355J0, S450J0, 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,

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 the wire rod

	C	Si	Mn
wt.-%	0.1	1.0	1.7

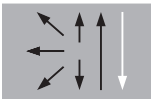
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Yield strength R_e MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -40°C
u	480 (≥ 460)	620 (≥ 530 – 680)	26 (≥ 20)	80 (≥ 47)
s	420 (≥ 355)	530 (≥ 440 – 570)	28 (≥ 22)	90 (≥ 47)

u untreated, as welded – shielding gas 100 % Argon

s stress relieved, 600 °C/2h – shielding gas 100 % Argon

Operating data



Polarity	DC-
Shielding gas (EN ISO 14175)	I1
Rod marking	W4Si1 ER70S-6

Dimension mm
2.4 × 1000
3.2 × 1000

Approvals

-

BÖHLER EMK 4

Solid wire, mild steel, non coppered

Classifications

EN ISO 14341-A	AWS A5.18
G 38 3 M21 2Si1	ER70S-3
G 35 2 C1 2Si1	

Characteristics and typical fields of application

Coppered solid wire for welding cinqed and aluminized plate material. Well suited for welding before cinq and aluminium plating. Suited for joining of structural steel and pipes.

Base materials

Steels up to a yield strength of 355 MPa.

S235JR-S355JR, S235JO-S355JO, S235J2-S355J2, S275N-S355N, P235GH-P355GH, P275NL1-P420NL1, P215NL, P265NL, P355N, P285NH-P355NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH

ship building steels: A, B, D, A 32-E 36

ASTM A 106 Gr. A, B, C; A 181 Gr. 60; A 283 Gr. A, C; A 285 Gr. A, B; A 350 Gr. LF1

Typical analysis of the solid wire

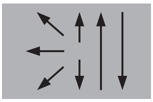
	C	Si	Mn
wt.-%	0.07	0.6	1.20

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20 °C	-30 °C
u	440 (≥ 355)	540	≥ 22	80	60 (≥ 47)

u untreated, as welded M21, CO_2

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

-

GMAW

BÖHLER EMK 4 NC

Solid wire, mild steel, non copper coated

Classifications

EN ISO 14341-A	**AWS A5.18**
G 38 3 M21 2Si	ER70S-3
G 35 2 C1 2Si	

Characteristics and typical fields of application

Non coppered solid wire of the G2Si / ER70-3 type for welding mild steel in general construction and pipe steel. It can be used to weld a soft root in constructions of higher tensile steel. It is very well suited for welding cinqed and aluminised plate material, even before cinq and aluminium plating.

The non coppered welding wires of the EMK NC series are characterised by very good feeding properties at high wire feeding rates, by a very stable arc performance and significant lower oxide / silicate forming on the weld surface. This makes them especially suited for fully mechanised processes where the wire comes in BASEdrum or the environmental friendly ECOdrum bulk package.

Base materials

Steels up to a yield strength of 355 MPa.

S235JR-S355JR, S235J0-S355J0, S235J2-S355J2, S275N-S355N, P235GH-P355GH, P275NL1-P420NL1, P215NL, P265NL, P355N, P285NH-P355NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH

ship building steels: A, B, D

ASTM A 106 Gr. A, B, C; A 181 Gr. 60; A 283 Gr. A, C; A 285 Gr. A, B; A 350 Gr. LF1

Typical analysis of the solid wire

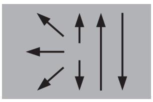
	C	Si	Mn
wt.-%	0.07	0.7	1.20

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -20°C
u	420 (≥ 355)	530	≥ 22	70 (≥ 47)

u untreated, as welded M21, CO_2

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

-

BÖHLER EMK 6

Solid Wire, mild steel

Classifications

EN ISO 14341-A	AWS A5.18 / SFA-5.18
G 42 4 M21 3Si1	ER 70S-6
G 42 4 C1 3Si1	

Characteristics and typical fields of application

GMAW Copper-coated solid wire of the G 3Si1 / ER70-6 type for metal transfer with minimum spatter when welding with mixed-gases as well as with CO_2.

Due to the high current load capacity, the stable arc and the nearly residual free weld surface the wire offers the best conditions for productive welding processes. Excellent feeding characteristics provides high wire feed rates especially during robotic welding. The coppered solid wires of the EMK series can be provided in bulk packages from ECOdrum 250 up to SQUAREdrum 550.

Base materials

Steels with yield strength < 420 MPa (60 ksi)

S235JR-S355JR, S235J0-S355J0, 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, ship building 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 analysis of the solid wire

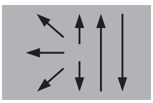
	C	Si	Mn
wt.-%	0.08	0.9	1.45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C
u	440 (≥ 420)	560 (≥ 500 – 640)	30 (≥ 20)	160	80 (≥ 47)
u2	440 (≥ 420)	540 (≥ 500 – 640)	29 (≥ 20)	120	50 (≥ 47)
s	380	490	30	160	

u untreated, as welded – shielding gas Ar + 15 – 25% CO_2
u2 untreated, as welded – shielding gas 100% CO_2
s stress relieved, 620 °C/2h – shielding gas Ar + 15 – 20% CO_2

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

TÜV (03036), DB (42.132.80), ABS, DNV GL, LR, CE

BÖHLER EMK 6 D

Solid Wire, mild steel

Classifications

EN ISO 14341-A	AWS A5.18 / SFA-5.18
G 42 3 M21 3Si1	ER70S-6
G 38 2 C1 3Si1	

Characteristics and typical fields of application

GMAW Copper-coated solid wire suited for universal applications in structural steel engineering, with good welding characteristics.

Base materials

Steels with yield strength < 420 MPa (60 ksi)

S235JR-S355JR, S235J0-S355J0, 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, ship building 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 analysis of the solid wire

	C	Si	Mn
wt.-%	0.08	0.9	1.45

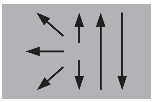
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-20°C	-30°C
u	440 (≥ 420)	530 (≥ 500 – 670)	30 (≥ 20)	160		≥ 47
u2	420 (≥ 380)	510 (≥ 470 – 600)	26 (≥ 20)	120	≥ 47	

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

u2 untreated, as-welded – shielding gas 100% CO_2

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

TÜV (09780), DB (42.132.81), DNV GL, NAKS, CE

BÖHLER EMK 6 NC

Solid wire, mild steel, non copper coated

Classifications

EN ISO 14341-A	AWS A5.18 / SFA-5.18
G 42 4 M21 3Si1	ER70S-6
G 42 4 C1 3Si1	

Characteristics and typical fields of application

Non coppered solid wire designed forwelding with a very low spatter level and an extremely stable arc performance over a broad parameter range.

The non coppered welding wires of the EMK NC series are characterised by very good feeding properties at high wire feeding rates, by a very stable arc performance and significant lower oxide / silicate forming on the weld surface. This makes them especially suited for fully mechanised processes where the wire comes in BASEdrum or the environmental friendly ECOdrum bulk package.

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,

ship building 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 analysis of the solid wire

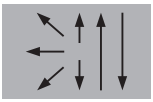
	C	Si	Mn
wt.-%	0.08	0.9	1.45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C
u	440 (≥ 420)	560 (500 – 640)	28	160	80 (≥ 47)

u untreated, as welded M21, CO_2

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

TÜV (19133), DB (42.132.66), CE

BÖHLER SG 2

Solid Wire, mild steel

Classifications

EN ISO 14341-A	AWS A5.18 / SFA-5.18
G 42 3 M21 3Si1	ER70S-6
G 38 2 C1 3Si1	

Characteristics and typical fields of application

GMAW solid wire for welding unalloyed and low alloy steels. Low spatter in short and spray arc transfer modes with CO_2 or gas mixture. The wire is used in boiler, pipeline and structural constructions, shipbuilding and vehicle manufacturing.

Base materials

Steels with yield strength < 420 MPa (60 ksi)

S235JR-S355JR, S235J0-S355J0, 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, ship building 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 analysis of the solid wire

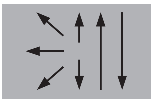
	C	Si	Mn
wt.-%	0.07	0.85	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -30°C
u	≥ 420	≥ 500 - 640	≥ 20	≥ 47
u2	≥ 420	≥ 500 - 640	≥ 20	≥ 47

u untreated, as welded – shielding gas Ar + 15 – 25% CO_2
u2 untreated, as welded – shielding gas 100% CO_2

Operating data



Dimension mm
0.8
0.9
1.0
1.2
1.6

Approvals

TÜV (13009), DB (42.236.01), ABS, DNV GL, CWB, CE

BÖHLER EMK 8

Solid Wire, mild steel

Classifications

EN ISO 14341-A	AWS A5.18 / SFA-5.18	Material-No.
G 46 4 M21 4Si1	ER70S-6	1.5130
G 46 4 C1 4Si1		

Characteristics and typical fields of application

GMAW Copper-coated solid wire of the G 4Si1 / ER70-6 type for metal transfer with minimum spatter when welding with mixed-gases as well as with CO_2.

Due to the high current load capacity, the stable arc and the nearly residual free weld surface the wire offers the best conditions for productive welding processes. Excellent feeding characteristics provides high wire feed rates especially during robotic welding. The coppered solid wires of the EMK series can be provided in bulk packages from ECOdrum 250 up to SQUAREdrum 550.

Base materials

Steels up to a yield strength < 460 MPa (67 ksi)

S235JR-S355JR, S235J0-S355J0, S450J0, 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,

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 the solid wire

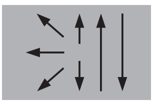
	C	Si	Mn
wt.-%	0.1	1.0	1.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C	-50°C
u	480 (≥ 460)	620 (≥ 530 – 680)	26 (≥ 20)	150	80 (≥ 47)	≥ 47
u2	470 (≥ 460)	580 (≥ 530 – 680)	28 (≥ 20)	110	50 (≥ 47)	≥ 47
s	410	540	28	130	70	≥ 47

u untreated, as welded – shielding gas Ar + 15 – 25% CO_2
u1 untreated, as welded – shielding gas 100% CO_2
s stress relieved, 600 °C/2h – shielding gas Ar + 15 – 25% CO_2

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

TÜV (03038), DB (42.132.82), ABS, DNV GL, LR, CE

BÖHLER EMK 8 D

Solid Wire, mild steel

Classifications

EN ISO 14341-A	AWS A5.18 / SFA-5.18
G 46 4 M21 4Si1	ER70S-6
G 46 2 C1 4Si1	

Characteristics and typical fields of application

GMAW Copper-coated solid wire suited for universal applications in structural steel engineering, with good welding characteristics.

Base materials

Steels with yield strength < 460 MPa (67 ksi)

S235JR-S355JR, S235J0-S355J0, S450J0, 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,

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 the solid wire

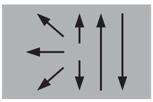
	C	Si	Mn
wt.-%	0.1	1.0	1.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-20°C	-40°C
u	480 (≥ 460)	610 (≥ 530 - 680)	26 (≥ 20)	150		50 (≥ 47)
u2	470 (≥ 460)	580 (≥ 530 - 680)	27 (≥ 20)	110	60 (≥ 47)	

u untreated, as welded – shielding gas Ar + 15 – 25% CO_2
u2 untreated, as welded – shielding gas 100% CO_2

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

TÜV (09781), DB (42.132.83), DNV GL, NAKS, CE

BÖHLER EMK 8 NC

Solid wire, mild steel, non coppered

Classifications

EN ISO 14341-A
G 46 4 M21 4Si1
G 46 4 C1 4Si1

Characteristics and typical fields of application

Non coppered solid wire designed for extremely low spatter formation and excellent feeding properties at high wire feed rates.

The non coppered welding wires of the EMK NC series are characterised by very good feeding properties at high wire feeding rates, by a very stable arc performance and significant lower oxide / silicate forming on the weld surface. This makes them especially suited for fully mechanised processes where the wire comes in BASEdrum or the environmental friendly ECOdrum bulk package.

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,

ship building 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 the solid wire

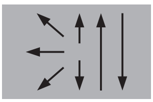
	C	Si	Mn
wt.-%	0.01	1.0	1.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C
u	480 (≥ 460)	620 (530 – 680)	26	150	80 (≥ 47)

u untreated, as welded M21, CO_2

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

TÜV (19132), DB (42.132.67), CE

BÖHLER SG 3

Solid wire, mild steel

Classifications

EN ISO 14341-A
G 46 4 M21 4Si1
G 42 2 C1 4Si1

AWS A5.18
ER70S-6

Characteristics and typical fields of application

GMAW solid wire for welding unalloyed and low alloy steels. Low spatter in short and spray arc transfer modes with CO_2 or gas mixture.

The wire is used in boiler, pipeline and structural constructions, shipbuilding and vehicle manufacturing.

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 analysis of the solid wire

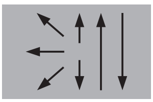
	C	Si	Mn
wt.-%	0.09	0.95	1.70

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40 °C	-20 °C
u	480 (≥ 460)	530 - 680	26 (≥ 20)	50 (≥ 47)	
u2	470 (≥ 460)	530 - 680	27 (≥ 20)		60 (≥ 47)

u untreated, as welded – shielding gas Ar + 15 – 25% CO_2
u2 untreated, as welded – shielding gas 100% CO_2

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

TÜV(18699), DB (42.236.02), ABS, CWB, DNV GL, CE

böhler welding by voestalpine

Union S 2 - UV 305

SAW wire/flux combination, mild steel

Classifications

EN ISO 14171-A
S 38 0 AR S2

Characteristics and typical fields of application

Union S 2 - UV 305 is a wire-flux combination for submerged-arc welding of unalloyed steel grades.

Very good slag detachability and nice bead appearance. It is recommended to be used for single-wire or Twin-arc welding with small wire diameter (e.g. with 2,0 mm) with high welding speed, especially for fillet welding in low wall thickness. (< 10 mm).

It is particularly well-suited to welding of water walls (tube-web-tube joint) for steam water-tube boiler.

UV 305 is an aluminate-rutile agglomerated flux suited for direct and alternating current. For information regarding this welding flux see our detailed data sheet.

Base materials

General and fine grained structural steels, shipbuilding steels, pipe steels up to 400 MPa minimum yield strength and boiler plates and tubes.

Typical analysis of the weld metal

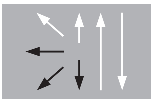
wt.-%	C	Si	Mn
wire	0.1	0.1	1.1
all-weld metal	0.06	0.5	1.25

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 0°C
u, DC+	425 (≥ 400)	520 (≥ 500)	29 (≥ 24)	65 (≥ 47)

u untreated / as welded

Operating data



Polarity DC / AC

Redrying 300 – 350 °C / 2 hrs min.

Dimension mm
1.6
2.0
2.5
3.0
3.2
4.0

Approvals

-

Union S 2 - UV 306

SAW wire/flux combination, mild steel

Classifications

EN ISO 14171-A
S 42 3 AR S2

Characteristics and typical fields of application

Union S 2 - UV 306 is a wire-flux combination for submerged-arc welding of unalloyed steel grades.

It is used in general purpose applications in structural steel and pipe. It can be used for single- and multi-wire welding with high welding speed using the two-run technique as well as for fillet welding. The flux is donating Mn and Si to the weld pool (desoxidation) and therefore it is less sensitive for porosity issues due to dirt and rust on the plate.

Most suitable for single run or 2-run procedures. Multi-run procedures should be limited to weld thickness of max 20 mm. For higher wall thickness UV 400 or UV 418 TT to be preferred.

UV 306 is an aluminate-rutile agglomerated flux with medium Si and Mn pick-up for joining un-alloyed and low alloyed steel grades. Very good slag detachability and nice bead appearance. For more information regarding this welding flux see our detailed data sheet.

Base materials

General and fine grained structural steels, shipbuilding steels, pipe steels up to 420 MPa minimum yield strength.

Typical analysis of the weld metal

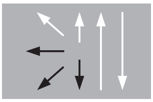
wt.-%	C	Si	Mn
wire	0.1	0.1	1.1
all-weld metal	0.06	0.6	1.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -30°C	-20°C	20°C
u, DC+	500 (≥ 420)	580 (≥ 530)	26 (≥ 22)	≥ 47	65 (≥ 47)	≥ 60

u untreated / as welded

Operating data



Polarity DC / AC

Dimension mm
1.6
2.0
2.5
3.0
3.2
4.0

Approvals

TÜV (02590), DB (51.132.04), ABS, DNV GL, LR, CE

Union S 2 - UV 400

SAW wire/flux combination, mild steel

Classifications

Type	EN ISO 14171-A
Multi-run	S 38 4 AB S2
2-run	S 3T 2 AB S2

Characteristics and typical fields of application

Union S 2 - UV 400 is a wire-flux combination for submerged arc welding of unalloyed, fine grained and pipeline steel grades.

UV 400 is an agglomerated, aluminate-basic flux. Its characteristic is a low Silicon and a middle Manganese pickup. It can be used on AC and DC. The good weld ability and the good mechanical properties offer a universal application. For information regarding UV 400 flux see our detailed data sheet.

Base materials

Steels up to a yield strength of 380 MPa (56 ksi)

S235JR-S355JR, S235JO-S355JO, S235J2-S355J2, S275N-S355N, S275M-S355M, S275NL-S355NL, S275ML-S355ML, P235GH-P355GH, P275NL1-P355NL1, P275NL2-P355NL2, P215NL, P265NL, P355N, P285NH-P355NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L360NB, L245MB-L360MB, 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, LF2; 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; A 633 Gr. A, C, D; A 662 Gr. A, B, C; A 707 Gr. L1, L3; A 711 Gr. 1013; A 841 Gr. A, B, C; API 5 L Gr. B, X42, X52, X56

Typical analysis of the weld metal

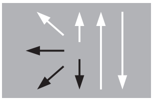
wt.-%	C	Si	Mn
wire	0.1	0.1	1.1
all-weld metal	0.07	0.4	1.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e	Tensile strength R_m	Elongation A ($L_0=5d_0$)	Impact values ISO-V KV J		
	MPa	MPa	%	-40°C	0°C	20°C
u, DC+	420 (≥ 400)	520 (≥ 480)	27 (≥ 22)	60 (≥ 47)	100 (≥ 47)	100 (≥ 47)
a1, DC+	400 (≥ 355)	500 (≥ 480)	28 (≥ 25)	70 (≥ 47)	120 (≥ 47)	120 (≥ 47)
a2, DC+	≥ 290	≥460	≥22		≥60	

u untreated, as welded ; a1 = 5 hours 580°C ; a2 = 1 hour 920 °C + air

Operating data



Polarity	DC +/–
Redrying	300 – 350 °C / 2 hrs min.

Dimension mm
1.6
2.0
2.5
3.0
3.2
4.0

Approvals

TÜV (06170), DB (51.132.03), ABS, BV, LR, DNV GL, CE

Union S 2 Si - UV 305

SAW wire/flux combination, mild steel

Classifications

EN ISO 14171-A	AWS A5.17 / SFA-5.17
S 42 A AR S2Si	F7AZ-EM12K

Characteristics and typical fields of application

Union S 2 Si - UV 305 is a wire-flux combination for submerged-arc welding of unalloyed steel grades. It is recommended to be used for single-wire or Twin-arc welding with small wire diameter (e.g. with 2,0 mm) with high welding speed, especially for fillet welding in low wall thickness (< 10 mm). It is particularly well-suited to welding of "water walls" (tube-web-tube joint) for steam water-tube boiler. It has outstanding good slag detachability and allows high welding speed with a nice bead appearance

UV 305 is an aluminate-rutile agglomerated flux with medium Si and Mn pick-up for joining un-alloyed and low alloyed steel grades. For more information regarding this welding flux see our detailed data sheet.

Base materials

General and fine grained structural steels, shipbuilding steels, pipe steels up to 420 MPa minimum yield strength and boiler plates and tubes.

Typical analysis of the weld metal

wt.-%	C	Si	Mn
wire	0.10	0.30	1.10
all-weld metal	0.06	0.60	1.30

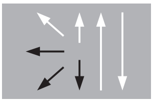
SAW

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u, DC+	450 (≥ 420)	550 (≥ 550)	18 (≥ 24)	70 (≥ 47)

u untreated, as welded

Operating data



Polarity DC / AC

Dimension mm
2.4
2.5
3.0
3.2
4.0

Approvals

-

Union S 2 Si - UV 306

SAW wire/ flux combination, mild steel

Classifications

EN ISO 14171-A
S 42 3 AR S2Si

AWS A5.17 / SFA-5.17
F7A2-EM12K / F7P2-EM12K

Characteristics and typical fields of application

Union S 2 Si - UV 306 is a wire-flux combination for submerged-arc welding of unalloyed steel grades. It is used in general purpose applications in structural steel and pipe. It can be used for single- and multi-wire welding with high welding speed using the two-run technique as well as for fillet welding. The flux is donating Mn and Si to the weld pool (desoxidation) and therefore it is less sensitive for porosity issues due to dirt and rust on the plate. Most suitable for single run or 2-run procedures. Multi-run procedures should be limited to weld thickness of max 20 mm. For higher wall thickness UV 400 or UV 418 TT is to be preferred. Very good slag detachability and nice bead appearance.

UV 306 is an aluminate-rutile agglomerated flux with medium Si and Mn pick-up for joining un-alloyed and low alloyed steel grades. For more information regarding this welding flux see our detailed data sheet.

Base materials

General and fine grained structural steels, shipbuilding steels, pipe steels up to 420 MPa minimum yield strength.

Typical analysis of the weld metal

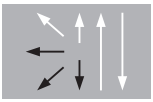
wt.-%	C	Si	Mn
wire	0.10	0.30	1.10
all-weld metal	0.06	0.75	1.60

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -30°C	-20°C	20°C
u, DC+	500 (≥ 420)	590 (≥ 540)	26 (≥ 22)	≥ 47	65 (≥ 47)	≥ 70
a1, DC+	480 (≥ 420)	570 (≥ 520)	26 (≥ 22)	≥ 27	≥ 35	≥ 50

u untreated, as welded; a1 = 1 hour 620 °C

Operating data



Polarity DC / AC

Dimension mm
2.4
2.5
3.0
3.2
4.0

Approvals

LR, CE

SAW

Union S 2 Si - UV 421 TT

SAW wire/flux combination, mild steel

Classifications

EN ISO 14171-A	AWS A5.17 / SFA-5.17
S 42 5 FB S2Si	F7A6-EM12K / F6P8-EM12K

Characteristics and typical fields of application

Union S 2 Si - UV 421 TT is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behavior. It is suitable for single (AC and DC) and tandem (DC and AC or AC and AC) welding. Very good slag detachability also for narrow gap welding. Flux can especially be used for multi-pass butt welding of medium and high tensile steels. Very good impact toughness of weld metal at low temperatures.

UV 421 TT is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behavior. For more information regarding this welding flux see our detailed data sheet.

Base materials

General purpose structural steels and fine grained structural steels up to 420 MPa min. yield strength. S235J2G3 – S355J2G3, S255N – S380N, S255NL – S420NL, P275NL1 – P420NL1, P235GH – P355GH, L210 – L360

ASTM A36 Gr. all; A106 Gr. all, A214; A266, A283 Gr. all; A285 Gr. all; A299, A515 Gr. all; A516 Gr. all; A556; A570, A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B

Typical analysis of the weld metal

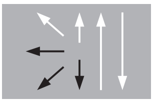
wt.-%	C	Si	Mn
wire	0.10	0.30	1.10
all-weld metal	0.07	0.30	1.10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -60°C	-40°C	20°C
u, DC+	≥ 420	≥ 530	≥ 22	≥ 47	≥ 80	≥ 150
a1, DC+	≥ 360	≥ 480	≥ 25	≥ 60	≥ 120	≥ 180

u untreated, as welded; a1 = 1 hour 620 °C

Operating data



Polarity	DC / AC
Redrying	300 - 350 °C / 2 hrs min.

Dimension mm
2.4
2.5
3.0
3.2
4.0

Preheating and Interpass temperature: 180 – 220ºC

Heat Input < 2,0 kJ/mm

Approvals

-

Union S 3 Si - UV 310 P

SAW wire/flux combination, mild steel

Classifications

Type	EN ISO 14171-A	AWS A5.23 / SFA-5.23	AWS A5.17 / SFA-5.17
Multi-run	S 42 4 AB S3Si		F7A6-EH12K
2-run	S 3T 2 AB S3Si	F7TA0G-EH12K	

Characteristics and typical fields of application

Union S 3 Si - UV 310 P is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. This wire-flux combination can be used for 2-run and multi-run welding technique with single wire (DC+) and tandem (DC+ and AC) welding processes, with very good welding performance and low failure rate.

UV 310 P is an agglomerated neutral flux, that does not add Manganese, neither Silicon to the weld metal, with very low hydrogen content. For more details on the flux, see our detailed datasheet of UV 310 P.

Base materials

Fine grained structural and pipe steel grades up to YS = 420 MPa.

Typical analysis of the weld metal

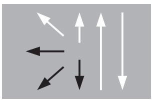
wt.-%	C	Si	Mn
wire	0.10	0.30	1.65
all-weld metal	0.05	0.30	1.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -50 °C	-40 °C
u, DC+	450 (≥ 420)	540 (500-640)	29 (≥ 22)	45 (≥ 27)	65 (≥ 47)

u untreated, as welded, single wire

Operating data



Polarity DC / AC

Dimension mm
2.5
3.0
4.0
4.8

The mechanical properties of weld metal by two-run technique are strongly influenced by:

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
    - o welding parameters (heat input)
    - o wall thickness (2 - resp. 3 dimensional cooling)
    - o preheat / interpass temperature

Approvals

-

SAW

Union S 3 Si - UV 418 TT

SAW wire/flux combination, mild steel

Classifications

EN ISO 14171-A	AWS A5.17 / SFA-5.17
S 46 6 FB S3Si	F7A8-EH12K / F7P8-EH12K

Characteristics and typical fields of application

Union S 3 Si - UV 418 TT is a wire flux combination for submerged arc welding of unalloyed steel grades up to a minimum specified yield strength of 460 MPa. Especially recommended to be used for multi-pass butt welding. Very good impact toughness. Suitable for single wire, twin-arc and tandem welding configurations. Very good slag detachability also for narrow gap welding preparations.

UV 418 TT is an agglomerated fluoride basic flux for submerged arc welding of unalloyed and low alloyed steel grades. It has a high basicity and neutral metallurgical behaviour and is designed for medium and high strength fine grained structural steels. Detailed information about the flux can be found in the separate datasheet of the flux.

Base materials

General purpose structural steels and fine grained structural steels up to 460 MPa min. yield strength. S235J2G3 – S355J2G3, GE200 – GE260, S255N – S380N, S255NL – S460NL, P275NL1 – P460NL1, P235GH – P355GH, L210 – L415NB

ASTM A36 Gr. all; A 106 Gr. all, A214; A 242; A266 Gr. 1, 2, 4; A285; A299; A328; A366; A515 Gr. all; A516 Gr. all; A570 Gr. 30 – 45; A572 Gr. 42, 50; A606 Gr. all; 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; API 5L X42 – X60

Typical analysis of the weld metal

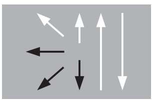
wt.-%	C	Si	Mn
wire	0.10	0.30	1.65
all-weld metal	0.08	0.30	1.55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -73 °C	-60 °C	-10 °C
u	475 (≥ 460)	560 (530-650)	28 (≥ 25)		150 (≥ 47)	170 (≥ 70)
a1	450 (≥ 420)	535 (520-630)	28 (≥ 25)		160 (≥ 80)	175 (≥ 80)
a2	450 (≥ 420)	550 (520-630)	28 (≥ 25)	50 (≥ 27)	200 (≥ 80)	-
a3	380 (≥ 360)	500 (485-590)	30 (≥ 25)	150 (≥ 27)	220 (≥ 80)	-

u untreated, as welded ; a1 = 15 hours 580 °C ; a2 = 1 hour 620 °C ; a3 = 16 hours 620 °C

Operating data



Dimension mm
2.0
2.5
3.0
4.0
4.8

Recommendation :

Single wire DC+ : Preheating and interpass temperature 180 – 220ºC,

heat input < 2,0 kJ/mm.

Approvals

TÜV (07276), DB (51.132.05), CE, DNV GL, LR, BV, ABS

Union S 3 Si - UV 421 TT

SAW wire/flux combination, mild steel

Classifications

EN ISO 14171-A	AWS A5.17 / SFA-5.17
S 46 6 FB S3Si	F7A8-EH12K / F7P8-EH12K

Characteristics and typical fields of application

Union S 3 Si - UV 421 TT is a wire flux combination for submerged arc welding of unalloyed steel grades up to a minimum specified yield strength of 460 MPa. Especially recommended to be used for multi-pass butt welding. Very good impact toughness. Suitable for single wire, twin-arc and tandem welding configurations. Very good slag detachability also for narrow gap welding preparations.

UV 421 TT is an agglomerated fluoride basic flux for submerged arc welding of unalloyed and low alloyed steel grades. It has a high basicity and neutral metallurgical behaviour and is designed for medium and high strength fine grained structural steels. Detailed information about the flux can be found in the separate datasheet of the flux.

Base materials

General purpose structural steels and fine grained structural steels up to 460 MPa min. yield strength. S235J2G3 – S355J2G3, GE200 – GE260, S255N – S380N, S255NL – S460NL, P275NL1 – P460NL1, P235GH – P355GH, L210 – L415NB

ASTM A36 Gr. all; A 106 Gr. all, A214; A 242; A266 Gr. 1, 2, 4; A285; A299; A328; A366; A515 Gr. all; A516 Gr. all; A570 Gr. 30 – 45; A572 Gr. 42, 50; A606 Gr. all; 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; API 5L X42 – X60

Typical analysis of the weld metal

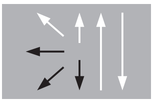
wt.-%	C	Si	Mn
wire	0.10	0.30	1.65
all-weld metal	0.08	0.30	1.55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -73°C	-60°C	-40°C
u, DC+	475 (≥460)	560 (530-650)	28 (≥25)		150 (≥47)	170 (≥70)
a1, DC+	450 (≥420)	535 (520-630)	28 (≥25)		160 (≥80)	175 (≥80)
a2, DC+	450 (≥420)	550 (520-630)	28 (≥25)	50 (≥27)	200 (≥80)	-

u untreated, as welded ; a1 = 15 hours 580 °C ; a2 = 1 hour 620 °C

Operating data



Polarity DC+

Dimension mm
2.0
2.5
3.0
4.0
4.8

Preheating and Interpass temperature: 180 – 220ºC

Heat Input < 2,0 kJ/mm

Approvals

TÜV (10424), DNV GL, LR, CE, ABS

Union S 3 Si - UV 419 TT-W

SAW wire/flux combination, mild steel

Classifications

EN ISO 14171-A	AWS A5.17 / SFA-5.17
S 46 6 FB S3Si	F7A8-EH12K / F7P8-EH12K

Characteristics and typical fields of application

Union S 3 Si - UV 419 TT-W is a wire flux combination for submerged arc welding of unalloyed steel grades up to a minimum specified yield strength of 460 MPa. Especially recommended to be used for multi-pass butt welding. Very good impact toughness and strength in as welded condition and after PWHT. Suitable for single wire, twin-arc and tandem welding configurations. Very good slag detachability also for narrow gap welding preparations.

UV 419TT-W is an agglomerated fluoride basic flux for submerged arc welding of unalloyed and low alloyed steel grades. It has a high basicity and neutral metallurgical behaviour and is designed for medium and high strength fine grained structural steels. Detailed information about the flux can be found in the separate datasheet of the flux.

Base materials

General purpose structural steels and fine grained structural steels up to 460 MPa min. yield strength.

S235J2G3 – S355J2G3, GE200 – GE260, S255N – S380N, S255NL – S460NL, P275NL1 – P460NL1, P235GH – P355GH, L210 – L415NB

ASTM A36 Gr. all; A 106 Gr. all, A214; A 242; A266 Gr. 1, 2, 4; A285; A299; A328; A366; A515 Gr. all; A516 Gr. all; A570 Gr. 30 – 45; A572 Gr. 42, 50; A606 Gr. all; 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; API 5L X42 – X60

SAW

Typical analysis of the weld metal

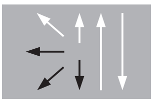
wt.-%	C	Si	Mn
wire	0.10	0.30	1.65
all-weld metal	0.08	0.35	1.65

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e	Tensile strength R_m	Elongation A (L_0=5d_0)	Impact values ISO-V KV J	
	MPa	MPa	%	-60 °C	-40 °C
u, DC+	475 (≥460)	550 (530-650)	27 (≥25)	130 (≥47)	170 (≥70)
a1, DC+	450 (≥420)	530 (520-630)	28 (≥25)	160 (≥80)	175 (≥80)
a2, DC+	450 (≥420)	540 (520-630)	28 (≥25)	100 (≥80)	170 (≥80)
a3, DC+	420 (≥400)	530 (>500)	29 (≥25)	110 (≥80)	170 (≥80)

u untreated, as welded ; a1 = 15 hours 580 °C ; a2 = 1 hour 620 °C ; a3 = 12 hours 620 °C

Operating data



Polarity DC + / AC

Dimension mm
2.0
2.5
3.0
4.0
4.8

Preheating and Interpass temperature: 180 – 220°C

Heat Input ≤ 2,0 kJ/mm

Approvals

TÜV (12935)

Union S 3 Si - UV 422 TT-LH

SAW wire/flux combination, mild steel

Classifications

AWS A5.17 / SFA-5.17
F7A8-EH12K-H4 / F7P8-EH12K-H4

Characteristics and typical fields of application

Union S 3 Si - UV 422 TT-LH is a wire flux combination for submerged arc welding of unalloyed steel grades up to a minimum specified yield strength of 460 MPa. Especially recommended to be used for multi-pass butt welding with very low hydrogen level. Very good impact toughness. Suitable for single wire, twin-arc and tandem welding configurations. Very good slag detachability also for narrow gap welding preparations.

UV 422 TT-LH is an agglomerated fluoride-basic flux with high basicity, neutral metallurgical behavior and very low level of diffusible hydrogen. For information regarding this welding flux see our detailed data sheet.

Base materials

General purpose structural steels and fine grained structural steels up to 460 MPa min. yield strength.

S235JR-S355JR, S235JO-S355JO, S235J2-S355J2, S235J2G3- S355J2G3, GE200- GE260, S275M-S460M, S255N-S380N, S255NL-S460NL, P275NL1- P460NL1, P235GH- P355GH, L210- L415NB

ASTM A36 Gr. all; A 106 Gr. all, A214; A 242; A266 Gr. 1, 2, 4; A285; A299; A328; A366; A515 Gr. all; A516 Gr. all; A570 Gr. 30 – 45; A572 Gr. 42, 50; A606 Gr. all; 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; API 5L X42 – X60

Typical analysis of the weld metal

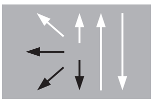
wt.-%	C	Si	Mn
wire	0.10	0.30	1.65
all-weld metal	0.08	0.45	1.55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C	-40°C	-20°C
u, DC+	485 (≥460)	585 (530-650)	28 (≥25)	110 (≥47)	140 (≥70)	165 (≥47)
a1, DC+	435 (≥420)	550 (520-630)	30 (≥25)	120 (≥80)		150 (≥80)
a2, DC+	375	510	31 (≥25)	135 (≥80)	-	165 (≥80)

u untreated, as welded ; a1 = 1 hour 620 °C ; a2 = 16 hours 620 °C

Operating data



Polarity DC +

Dimension mm
2.0
2.5
3.0
4.0
4.8

Preheating and Interpass temperature: 180 – 220 °C
Heat Input < 2,0 kJ/mm

Approvals

-

SAW

BÖHLER SUBARC T55 HP - UV 306

SAW-flux cored wire/flux combination, mild steel

Classifications

EN ISO 14171-A	AWS A5.17 / SFA-5.17
S 50 4 AR T3 H5	F7A5-ECG

Characteristics and typical fields of application

SUBARC T55 HP - UV 306 is a wire-flux combination for submerged arc welding of unalloyed structural steels and fine-grained structural steels up to MSYS = 500 MPa. The weld metal demonstrates relative good toughness properties at low temperatures and can be used in a very wide range of applications. The aluminate-rutile flux has a relative low basicity index and is selected for its excellent welding properties and is suitable for high welding speed. Also a very good welding behavior in PC position and for 2-run technology this combination shows an improved welding behavior (nicer bead appearance and higher welding speed) compared to a solid wire.

The wire is a coppered seamless basic flux cored wire with a good resistance to deformation (wire feed rollers) and is very easy to straighten to ensure the best current transfer with a low contact tip consumption. The wire is not sensitive to moisture pick up.

This combination gives the fabricator the possibility to weld with high productivity: e.g: single wire 3,2 mm, 800 Amps (~17 kg/hour) with a good bead appearance, nice fusion and good slag detachability. The combination can be used for joining applications in unlimited thickness, with DC+ or AC current, which allows Tandem process (~ 30 kg/hour) with 2 wires (3,2 or 4,0 mm).

Base materials

S235JR-S355JR, S235J0-S355J0, S235J2-S355J2, S275N-S460N, S275M-S460M, S275NL-S460NL, S275ML-S460ML, P235GH-P460GH, P275NL1-P460NL1, P215NL, P265NL, P355N, P285NH-P355NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L445NB, L245MB-L445MB, GE200-GE240

Ship building 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, LF2; 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; A 633 Gr. A, C, D; A 662 Gr. A, B, C; A 707 Gr. L1, L3; A 711 Gr. 1013; A 841 Gr. A, B, C; API 5 L Gr. B, X42, X52, X56, X60, X65

Typical analysis of the weld metal

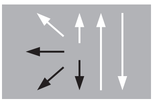
wt.-%	C	Si	Mn
all-weld metal	0.04	0.7	1.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -46°C	-40°C	-20°C
u, DC+	560 (≥ 500)	630 (480-650)	25 (≥ 20)	40 (≥ 27)	50 (≥ 47)	90 (≥ 47)

u untreated

Operating data



Polarity DC+

Dimension mm
2.4
3.2
4.0

Mechanical properties depend of the applied welding procedure; e.g. possible reduction in ISO-V toughness to 40J @-20ºC in as welded condition when welded with heat input 3,5 kJ/mm.

Approvals

TÜV (in progress); DB (in progress)

SAW

BÖHLER SUBARC T55 HP - UV 421 TT

Seamless SAW-basic flux cored wire/flux combination, mild steel

Classifications

EN ISO 14171-A	**AWS A5.17 / SFA-5.17**
S 46 6 FB T3 H5	F7A8-EC1 / F7P8-EC1

Characteristics and typical fields of application

SUBARC T55 HP - UV 421 TT is a wire-flux combination for submerged arc welding of unalloyed structural steels and fine-grained structural steels up to MSYS = 460 MPa. The weld metal demonstrates very good toughness properties at low temperatures.

The wire is a coppered seamless basic flux cored wire with a good resistance to deformation (wire feed rollers) and is very easy to straighten to ensure the best current transfer with a low contact tip consumption. The wire is not sensitive to moisture pick up.

This combination gives the fabricator the possibility to weld with high productivity: e.g: single wire 3,2 mm, 800 Amps (~17 kg/hour) with a good bead appearance, nice fusion and good slag detachability. The combination can be used for joining applications in unlimited thickness, with DC+ or AC current, which allows Tandem process (~ 30 kg/hour) with 2 wires (3,2 or 4,0 mm).

UV 421 TT is an agglomerated flux with a high basicity index and has been designed to be applied in unlimited thickness (neutral metallurgical behavior) with low level of diffusible hydrogen level. For more flux properties see separate datasheet of the flux.

Base materials

S235JR-S355JR, S235J0-S355J0, S235J2-S355J2, S275N-S460N, S275M-S460M, S275NL-S460NL, S275ML-S460ML, P235GH-P460GH, P275NL1-P460NL1, P275NL2-P460NL2, P215NL, P265NL, P355N, P285NH-P355NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L445NB, L245MBL445MB, GE200-GE240,

Ship building 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, LF2; 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; A 633 Gr. A, C, D; A 662 Gr. A, B, C; A 707 Gr. L1, L3; A 711 Gr. 1013; A 841 Gr. A, B, C; API 5 L Gr. B, X42, X52, X56, X60, X65

Typical analysis of the weld metal

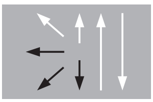
wt.-%	C	Si	Mn
all-weld metal	0.07	0.4	1.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -60°C	-40°C
u, DC+	470 (≥ 460)	560 (530–680)	27 (≥ 22)	150 (≥ 47)	160 (≥ 47)
a1, DC+	450 (≥ 420)	530 (490–660)	28 (≥ 22)	150 (≥ 47)	160 (≥ 47)

u untreated, as welded ; a1 = 1 hour 620 °C

Operating data



Polarity DC +/– / AC

Dimension mm
2.4
3.2
4.0

Mechanical properties depend of the applied welding procedure; e.g. a possible reduction in ISO-V toughness to 70J @-40ºC in as welded condition when welded with heat input 3,5 kJ/mm.

Approvals

DNV GL, LRS, ABS, TÜV

SAW

BÖHLER SUBARC T55 HP - UV 419 TT-W

Seamless SAW-basic flux cored wire/flux combination, mild steel

Classifications

EN ISO 14171-A	AWS A5.17 / SFA-5.17
S 46 6 FB T3 H5	F7A8-EC1 / F7P8-EC1

Characteristics and typical fields of application

BÖHLER SUBARC T55 HP - UV 419 TT-W is a wire-flux combination for submerged arc welding of unalloyed structural steels and fine-grained structural steels up to MSYS = 460 MPa. Especially recommended for applications with PWHT. The weld metal maintains very good strength properties after relative long PWHT durations (e.g. pressure vessels 16 hours at 620ºC).

The wire is a coppered seamless basic flux cored wire with a good resistance to deformation (wire feed rollers) and is very easy to straighten to ensure the best current transfer with a low contact tip consumption. The wire is not sensitive to moisture pick up.

This combination gives the fabricator the possibility to weld with high productivity: e.g: single wire 3,2 mm, 800 Amps (~17 kg/hour) with a good bead appearance, nice fusion and good slag detachability. The combination can be used for joining applications in unlimited thickness, with DC+ or AC current, which allows Tandem process (~ 30 kg/hour) with 2 wires (3,2 or 4,0 mm).

UV 419 TT-W is an agglomerated flux with a high basicity index and has been designed to be applied in unlimited thickness (neutral metallurgical behavior) with low level of diffusible hydrogen level. For more flux properties see separate datasheet of the flux.

Base materials

SAW

S235JR-S355JR, S235JO-S355JO, S235J2-S355J2, S275N-S460N, S275M-S460M, S275NL-S460NL, S275ML-S460ML, P235GH-P460GH, P275NL1-P460NL1, P275NL2-P460NL2, P215NL, P265NL, P355N, P285NH-P355NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L445NB, L245MBL445MB, GE200-GE240, Ship building 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, LF2; 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; A 633 Gr. A, C, D; A 662 Gr. A, B, C; A 707 Gr. L1, L3; A 711 Gr. 1013; A 841 Gr. A, B, C; API 5 L Gr. B, X42, X52, X56, X60, X65

Typical analysis of the weld metal

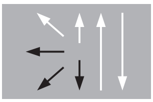
wt.-%	C	Si	Mn
all-weld metal	0.07	0.4	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -60 °C	-40 °C
u, DC+	490 (≥460)	580 (530–680)	27 (≥22)	120 (≥47)	160 (≥47)
a1, DC+	460 (≥420)	550 (490–660)	29 (≥22)	160 (≥47)	170 (≥47)
a2, DC+	450 (≥400)	540 (490–660)	29 (≥22)	170 (≥47)	200 (≥47)

u untreated; a1 = 4 hours 620 °C; a2 = 16 hours 620 °C

Operating data



Polarity DC+ (AC)

Dimension mm
2.4
3.2
4.0

Mechanical properties depend of the applied welding procedure.

Approvals

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BÖHLER Kb 46 T-FD

Flux-cored wire, seamless, mild steel, basic type

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 42 4 B M21 1 H5	E71T5-M21A4-CS1-H4
T 42 4 B C1 1 H5	E71T5-C1A4-CS1-H4

Characteristics and typical fields of application

Seamless basic flux-cored wire for singleor multilayer welding of carbon, carbon-manganese steels and similar steels, including fine grain steels with Argon-CO_2 shielding gas or pure CO_2 . Main features: excellent weldability in flat and horizontal position, smooth and bright bead, very low spatter losses, easy to remove slag and exceptional mechanical properties even at low temperatures.

Base materials

S235JR-S355JR, S235JO-S355JO, S235J2-S355J2, S275N-S355N, S275M-S355M, S275NL- S355NL, S275ML-S355ML, P235GH-P355GH, P275NL1-P355NL1, P275NL2-P355NL2, P215NL, P265NL, P355N, P285NH-P355NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH-P265GH, L245NB-L360NB, L245MB-L360MB, GE200-GE240

Ship building 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, LF2; 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; A 633 Gr. A, C, D; A 662 Gr. A, B, C; A 707 Gr. L1, L3; A 711 Gr. 1013; A 841 Gr. A, B, C; API 5 L Gr. B, X42, X52, X56

Typical analysis of the wire

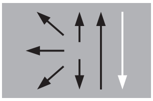
	Gas	C	Si	Mn
wt.-%	M21	0.07	0.40	1.40
wt.-%	C1	0.06	0.30	1.30

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C	-60°C
u	450 (≥ 420)	550 (500–640)	28 (≥ 20)	140 (≥ 47)	100
u1	430 (≥ 420)	530 (500–640)	30 (≥ 20)	90 (≥ 47)	80

u untreated, as welded – shielding gas M21
u1 untreated, as welded – shielding gas C1

Operating data



		Dimension mm
Polarity	DC+	1.2
Shielding gas (EN ISO 14175)	M21 – M35, C1	1.6

Welding with conventional or pulsed power sources using DC+

Approvals

TÜV, CE

FCW

BÖHLER Kb 52 T-FD

Flux-cored wire, seamless, mild steel, basic type

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 46 4 B M21 3 H5	E70T5-M21A4-CS1-H4
T 42 4 B C1 3 H5	E70T5-C1A4-CS1-H4

Characteristics and typical fields of application

Seamless basic flux-cored wire for singleor multilayer welding of carbon, carbon-manganese steels and similar steels, including fine grain steels with Argon-CO_2 shielding gas or pure CO_2 . Main features: excellent weldability in flat and horizontal position, smooth and bright bead, very low spatter losses, easy to remove slag and exceptional mechanical properties even at low temperatures. This wire is especially suitable for welding components of different material or as buffer layer for hardfacing applications.

Base materials

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

Ship building 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 the wire

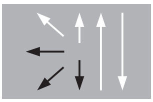
	Gas	C	Si	Mn
wt.-%	M21	0.07	0.55	1.4
wt.-%	C1	0.06	0.50	1.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-40°C	-60°C
u	500 (≥ 460)	610 (550–660)	28 (≥ 20)	160 (≥ 47)	100 (≥ 47)	80
u1	430 (≥ 420)	510 (500–640)	29 (≥ 20)	140	80 (≥ 47)	

u untreated, as welded – shielding gas M21
u1 untreated, as welded – shielding gas C1

Operating data



Polarity DC+

Shielding gas (EN ISO 14175) M21 – M35, C1

Dimension mm
1.2
1.4
1.6
2.4

Welding with conventional or pulsed power sources using DC+

Approvals

TÜV, DB, DNV GL, ABS, LR, BV, RINA, CE

FCW

BÖHLER Ti 42 T-FD

Flux cored wire, seamless, mild steel, rutile type

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 46 2 R M21 3 H5	E70T1-M21A0-CS1-H4
T 42 0 R C1 3 H5	E70T1-C1AZ-CS1-H4

Characteristics and typical fields of application

Seamless rutile flux-cored wire for single or multilayer welding of carbon, carbon-manganese steels and similar types of steels including fine grain steels with Argon-CO_2 shielding gas or pure CO_2.

Main features: good weldability in both flat and horizontal positions, slow freezing and easy to remove slag and bead is smooth and bright. This wire is especially suitable for ship building, steel structural work or wherever good bead appearance is required.

Base materials

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

ship building steels: A, B, D

AH 32-DH 40

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

Typical analysis of the wire

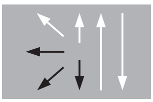
	Gas	C	Si	Mn
wt.-%	M21	0.04	0.50	1.30
wt.-%	C1	0.03	0.35	1.10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 0°C	-20°C
u	500 (≥ 460)	590 (550–660)	28 (≥ 22)	100	70 (≥ 47)
u1	450 (≥ 420)	520 (500–640)	26 (≥ 22)	60 (≥ 47)	

u untreated, as welded – shielding gas M21
u1 untreated, as welded – shielding gas C1

Operating data



		Dimension mm
Polarity	DC+	1.0
Shielding gas (EN ISO 14175)	M21, C1	1.2
		1.4
		1.6
		2.0
		2.4

Welding with standard GMAW-facilities possible

Approvals

CE

FCW

BÖHLER Ti 46 T-FD

Flux cored wire, seamless, mild steel, rutile type

Classifications

EN ISO 17632-A	**AWS A5.36 / SFA A5.36**
T46 3 P M21 1 H5	E71T1-M21A2-CS2-H4
T42 2 P C1 1 H5	E71T1-C1A0-CS2-H4

Characteristics and typical fields of application

Seamless copper coated flux-cored wire for single- or multipass welding of carbon- and high strength steels, using M21 (Ar/CO_2) shielding gas or pure CO_2. The weld deposit has excellent mechanical properties till -30ºC in mix gas application. The main features of this wire are excellent weldability in all positions, excellent bead appearance, low amount of spatters and easy to remove slag. In position PF very high welding speeds are possible due to an optimized slag characteristic. Due to the seamless design of the wire: hydrogen pickup during operation and storage can be avoided; no porosity issues even on primer plates and very good feeding performance are achievable. The average hydrogen content of the pure weld metal is about 1-3 ml/100g weld metal.

Base materials

Steels up to a yield strength of 460 MPa (67 ksi)

S235JR-S355JR, S235J0-S355J0, S450J0, 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 analysis of the wire

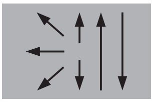
	Gas	C	Si	Mn
wt.-%	M21	0.06	0.45	1.3
wt.-%	C1	0.05	0.35	1.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ Mpa	Tensile strength R_m Mpa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20°C	-30°C
u	530 (≥460)	590 (550-660)	24 (≥22)	90	70 (≥47)
u1	470 (≥420)	550 (500-640)	25 (≥22)	60 (≥47)	

u untreated, as welded – shielding gas M21: Argon+15-25% CO_2
u1 untreated, as welded – shielding gas C1: 100% CO_2

Operating data



Polarity	DC+	
Shielding gas (EN ISO 14175)	M21 , C1	

Dimension mm
1.0
1.2
1.6

Welding with standard GMAW-facilities possible

Approvals

ABS; BV; DNV-GL; LR; TÜV, DB, CE

FCW

BÖHLER Ti 46-FD

Flux-cored wire, mild steel, rutile

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 46 2 P M21 1 H10	E71T1-M21A0-CS1-H8
T 42 2 P C1 1 H5	E71T1-C1A0-CS1-H4

Characteristics and typical fields of application

All position rutile flux-cored wire with fast freezing slag system. User friendly welding characteristics in all positions with one wire diameter 1,2 mm and same parameter setting. Excellent mechanical properties, easy slag removal, low spatter loss, smooth, finely rippled bead surface, high X-ray safety. The product performs to the highest productivity with significant savings in time and economical aspects when used for positional welding.

Base materials

Steels up to a yield strength of 460 MPa (67 ksi)

S235JR-S355JR, S235J0-S355J0, S450J0, 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 analysis of the wire

	Gas	C	Si	Mn
wt.-%	-	-	-	-
wt.-%	M21	0.05	0.5	1.2

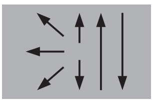
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-20°C
u	500 (≥ 460)	580 (530 – 680)	26 (≥ 20)	160	90 (≥ 47)
u1	480 (≥ 420)	550 (500 – 640)	25 (≥ 20)	140	80 (≥ 47)

u untreated, as welded – shielding gas M21
u1 untreated, as welded – shielding gas C1

FCW

Operating data



Polarity	DC+	
Shielding gas (EN ISO 14175)	M21, C1	

Dimension mm
1.2

Welding with standard GMAW-facilities possible

Approvals

TÜV, ABS, LR, DNV GL, CWB, CE

BÖHLER Ti 52-FD

Flux-cored wire, mild steel, rutile

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 46 4 P M21 1 H10	E71T1-M21A4-CS1-H8
T 42 2 P C1 1 H5	E71T1-C1A2-CS1-H4

Characteristics and typical fields of application

All position rutile flux-cored wire with fast freezing slag system. User friendly welding characteristics in all positions with one wire diameter 1.2 mm and same parameter setting. Excellent mechanical properties, easy slag removal, low spatter loss, smooth, finely rippled bead surface, high X-ray safety. The product performs to the highest productivity with significant savings in time and economical aspects when used for positional welding.

Base materials

Steels up to a yield strength of 460 MPa (67 ksi) (shielding gas M21)

S235JR-S355JR, S235J0-S355J0, S450J0, 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 steel: 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 the wire

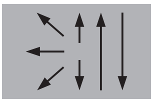
	Gas	C	Si	Mn
wt.-%	M21	0.06	0.50	1.20
wt.-%	C1	0.05	0.45	1.10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-20°C	-40°C
u	500 (≥ 460)	580 (550 – 740)	26 (≥ 20)	180	130	90 (≥ 47)
u1	480 (≥ 420)	550 (500 – 670)	25 (≥ 20)	160	110 (≥ 47)	

u untreated, as welded – shielding gas M21
u1 untreated, as welded – shielding gas C1

Operating data



		Dimension mm
Polarity	DC+	1.2
Shielding gas (EN ISO 14175)	M21, C1	1.6

Welding with standard GMAW-facilities possible

Approvals

TÜV, DB, ABS, LR, DNV GL, BV, CRS, CE

BÖHLER Ti 52 T-FD

Flux-cored wire, seamless, mild steel, rutile

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 46 4 P M 1 H5	E71T1-M21A4-CS1-DH4
T 46 2 P C 1 H5	E71T1-C1A2-CS1-DH4

Characteristics and typical fields of application

Seamless rutile flux cored wire for single- or multilayer welding of Carbon, Carbon-Manganese steels and similar types of steels including fine grain steels with Argon-CO_2 shielding gas or pure CO_2. Main features: excellent weldability in all positions with high performance welding speed, very low spatter losses, good bead appearance, fast freezing and easy to remove slag. This wire is especially suitable for ship building, structural steel work or wherever good bead appearance is required. D1.8 Seismic Supplement approved. Typical hydrogen value 2.5 – 3.5ml/100g weld metal.

Base materials

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

ship building 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 the wire

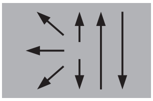
	Gas	C	Si	Mn
wt.-%	M21	0.06	0.40	1.45
wt.-%	C1	0.04	0.35	1.25

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20°C	-40°C
u	500 (≥ 460)	590 (550–660)	26 (≥ 20)	100 (≥ 47)	70 (≥ 47)
u1	470 (≥ 460)	560 (550–660)	28 (≥ 20)	80 (≥ 47)	

u untreated, as welded – shielding gas M21
u1 untreated, as welded – shielding gas C1

Operating data



Polarity	DC+
Shielding gas (EN ISO 14175)	M21 , C1

Dimension mm
1.0
1.2
1.4
1.6

Welding with standard GMAW-facilities possible

Approvals

TÜV, DB, DNV GL, DNV, ABS, LR, BV, RINA, RS, CE; D1.8 seismic supplement;

BÖHLER Ti 52 T-FD (CO_2)

Flux-cored wire, seamless, mild steel, rutile

Classifications

EN ISO 17632-A	**AWS A5.36 / SFA-5.36**
T 46 3 P C1 1 H5	E71T1-C1A2-CS1-H4

Characteristics and typical fields of application

Seamless rutile flux-cored wire for singleor multilayer welding of carbon, carbon-manganese steels and similar types of steels including fine grain steels with pure CO_2 shielding gas. Main features: excellent weldability in all positions especially vertical upward position, also with high parameters (300 A), very low spatter losses, fast freezing, easy to remove slag and smooth and bright bead. This wire is especially suitable for ship building where excellent performance and welding speed are needed.

Base materials

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-GE240

Ship building 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 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 the wire

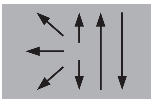
	C	Si	Mn
wt.-%	0.065	0.45	1.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-20°C	-30°C
u	520 (≥ 460)	580 (550-660)	25 (≥ 20)	100	95	70 (≥ 47)

u untreated, as welded – shielding gas C1

Operating data



Polarity	DC+	**Dimension mm**
Shielding gas (EN ISO 14175)	C1	1.2
		1.6

Welding with standard GMAW-facilities possible

Approvals

TÜV, DB, DNV GL, ABS, LR, BV, RINA, RS, CE

BÖHLER Ti 52 T-FD (HP)

Flux-cored wire, seamless, mild steel, rutile

Classifications

EN ISO 17632-A	**AWS A5.36 / SFA-5.36**
T 46 5 P M21 1 H5	E71T1-M21AP6-CS2-H4
T 42 2 P C 1 H5	E71T1-C1A0-CS2-H4

Characteristics and typical fields of application

High performance seamless rutile flux cored wire for single or multipass welding of Carbon, Carbon-Manganese steels and similar including fine grain steels with Argon-CO_2 shielding gas or pure CO_2. Main features: excellent weldability in all positions, excellent bead appearance, very low spatter losses, fast freezing slag with an easy removal. The good mechanical properties of this wire make it especially suitable for hardest applications in off-shore and ship building industry even at low temperatures. This product can be used in sour gas applications. (HIC tested acc. to NACE TM-0284). Test values for SSC are available upon request.

Base materials

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

Ship building 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 the wire

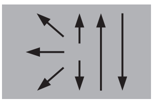
	Gas	C	Si	Mn	Ni
wt.-%	M21	0.06	0.45	1.30	0.35
wt.-%	C1	0.05	0.35	1.00	0.30

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20°C	-40°C	-46°C	-51°C
u	500 (≥ 460)	590 (550–660)	28 (≥ 20)	110	90 (≥ 47)		80 (≥47)
u1	450 (≥ 420)	550 (500–640)	24 (≥ 20)	100 (≥ 47)			
s1	510(≥460)	590 (550-660)	26 (≥20)			80 (≥ 27)	60 (≥ 27)
s2	500 (≥460)	580 (550–660	22 (≥20)	-		62	60

u untreated, as welded – shielding gas M21
u1 untreated, as welded – shielding gas C1
s1 stress released, 620 °C x 1 hr - shielding gas M21
s2 stress released, 620 °C x 5 hr - shielding gas M21

Operating data



Polarity	DC+
Shielding gas (EN ISO 14175)	M21, C1

Dimension mm
1.0
1.2
1.4
1.6

Welding with standard GMAW-facilities possible

Approvals

DNV GL, LR, RINA, CWB, CE

FCW

BÖHLER Ti 52 T-FD SR (CO_2)

Flux cored wire, seamless, mild steel, rutile type

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 42 4 P C1 1 H5	E71T12-C1AP4-CS1-H4

Characteristics and typical fields of application

Seamless rutile flux cored wire for single- or multilayer welding of Carbon, Carbon-Manganese steels and similar types of steels including fine grain steels with pure CO_2 shielding gas.

Main features: excellent weldability in all positions and excellent toughness at low temperatures in as welded conditions and after post weld heat treatments. This wire is especially suitable for ship building, pressure vessels, bridge construction, and earthmoving equipment. The seamless technology guarantees constant low diffusible Hydrogen in all situations of humidity and environment. CTOD tested at -10 °C (14 °F)

Base materials

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-GE240

Ship building 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 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 the wire

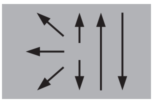
	Gas	C	Si	Mn	Ni
wt.-%	C1	0.04	0.40	1.3	0.40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J		
				-40 °C	-50 °C	-60°C
u	500 (≥ 420)	570 (500–640)	24 (≥ 20)	110 (≥ 47)	100 (≥47)	60
s1	460 (≥ 420)	550 (500–640)	28 (≥ 20)	80 (≥ 47)	75 (≥47)	55
s2	460 (≥420)	550 (500-640)	29 (≥20)	95 (≥47)	90 (≥47)	60

u untreated, as welded – shielding gas C1
s1 stress released 620°C / 3h – shielding gas C1
s2 stress released 620°C / 13h – shielding gas C1

Operating data



Polarity	DC+
Shielding gas (EN ISO 14175)	C1

Dimension mm
1.2
1.4
1.6

Welding with standard GMAW-facilities possible

Approvals

ABS, DNV-GL, BV, LR, CE

BÖHLER HL 46-MC

Metal-cored wire, mild steel

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 46 2 M M21 1 H5	E70T15-M21A0-CS1-H4

Characteristics and typical fields of application

Metal-cored high-efficiency wire for semi-automatic and fully automatic joint welding of unalloyed and fine-grained constructional steels and service temperatures from -20ºC to +450ºC. Very high metal recovery between 93 and 97% and deposition rate up to 9 kg/hr. Steady spray arc-like droplet transfer with minimal spatter formation. Good penetration, high resistance to porosity, good wetting behaviour as well as low hydrogen contents (< 5 ml/100 g deposit) are further quality features of this flux-cored wire. Ideal for horizontal and flat fillet welds. Compared to solid wires 20% higher productivity can be achieved. This wire is designed for minimum oxide residues permit the welding of multi passes without the need for inter-run cleaning.

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, P355N, P285NH-P460NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH- P265GH, L245NB-L415NB, L450QB, L245MB-L450MB, GE200-GE240, ship building steel: 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 414 Gr. A, B, C, D, E, F, G; A 501 Gr. B; A 516 Gr. 55, 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, X65

Typical analysis of the wire

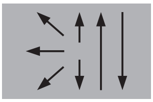
	C	Si	Mn
wt.-%	0.07	0.7	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-20°C
u	490 (≥ 460)	590 (≥ 550 – 740)	25 (≥ 20)	110	50 (≥ 47)

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

Operating data



		Dimension mm
Polarity	DC+	1.2
Shielding gas (EN ISO 14175)	M21	1.4
		1.6

Welding with conventional or pulsed power sources using DC+

Approvals

TÜV, DB , DNV GL, LR, BV, ABS, CWB, CE

BÖHLER HL 46 T-MC

Metal-cored wire, seamless, mild steel

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 46 3 M M21 1 H5	E70T15-M21A2-CS1-H4

Characteristics and typical fields of application

Seamless metal-cored wire for semi-automatic and fully automatic joint welding of unalloyed and fine-grained constructional steels utilizing service temperatures from -30ºC to +450ºC. Steady spray arc-like droplet transfer with minimal spatter formation. High resistance to porosity, good wetting behaviour as well as low hydrogen contents (< 5 ml/100 g deposit) are further quality features of this metal-cored wire. Ideal for horizontal and flat fillet welds. This wire is designed for minimum oxide residues permit the welding of multi passes without the need for inter-run cleaning.

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, P355N, P285NH-P460NH, P195TR1-P265TR1, P195TR2-P265TR2, P195GH- P265GH, L245NB-L415NB, L450QB, L245MB-L450MB, GE200-GE240, ship building steel: 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 414 Gr. A, B, C, D, E, F, G; A 501 Gr. B; A 516 Gr. 55, 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, X65

Typical analysis of the wire

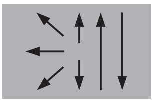
	Gas	C	Si	Mn
wt.-%	M21	0.06	0.8	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20°C	-30°C	-40°C
u	480 (≥460)	580 (≥ 550-660)	29 (≥22)	120	90 (≥47)	70 (≥27)

u untreated, as welded – shielding gas Ar + 5 – 25% CO_2

Operating data



		Dimension mm
Polarity	DC+	1.0
Shielding gas (EN ISO 14175)	M21; M20; (Ar + 5 – 25% CO_2)	1.2
		1.6

Welding with conventional or pulsed power sources using DC+

Approvals

TÜV; DB; ABS; BV; DNV-GL; LR, CWB, CE

FCW

BÖHLER HL 51 L-MC

Metal cored wire, seamless, mild steel

Classifications

EN ISO 17632-A	AWS A5.36 / SFA A5.36
T46 4 M M21 1 H5	E71T15-M21A4-CS2-H4 E71T15-M20A4-CS2-H4

Characteristics and typical fields of application

Seamless all positional metal-cored high-efficency wire manufactured with seamless laser technology is especially designed for semi-automatic and fully automatic joint welding of unalloyed an fine-grained constructional steels. The production technology by laser welding of wire possesses higher ridigity-as a result it offers exact ignition accurancy. Very high metal recovery between 95-97% are additional benefit of this wire. Steady spray arc-like droplet with minimal spatter formation, good penetration, high resistance to porosity, good wetting behaivour as well as low hydrogens contents (<2 ml/100 g weld deposit) are further quality features of this metal cored wire. Minimum oxide residues permit the welding of multipasses without the need for inter-run cleaning. Ideal for horizontal and flat fillet welds.

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, ship building 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 the wire

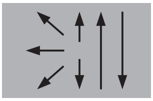
	Gas	C	Si	Mn
wt.-%	M21	0.07	0.7	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C	-46°C
u	490 (≥460)	600 (550-740)	27 (≥20)	170	120 (≥47)	70 (≥27)
s1	450	550	27	180	100	

u untreated, as welded – shielding gas Ar + 5 – 25 % CO_2
s1 stress relieved, 620 °C/2 h - shielding gas Ar + 5 – 25 % CO_2

Operating data



Polarity	DC+
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.0
1.2
1.4
1.6

Welding with standard GMAW power source possible - the wire meets the requirements AWS A5.18: E70C-6MH4

Approvals

TÜV, DB, ABS, BV, DNV GL, CWB, LR, CE

FCW

BÖHLER HL 51 T-MC

Metal-cored wire, seamless, mild steel

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 46 6 M M21 1 H5	E70T15-M21A8-CS1-H4
T 42 5 M C1 1 H5	E70T15-C1A6-CS1-H4

Characteristics and typical fields of application

Seamless metal cored wire for single- or multilayer welding of Carbon, Carbon-Manganese and similar types of steels, including fine grain steels with Argon-CO_2 or pure CO_2 shielding gas.Features include: high yield, good weldability, excellent bead appearance, very low spatter losses and exceptional mechanical properties at low temperatures (-60ºC) in as welded conditions as well with post weld heat treatment. This wire is especially suitable for automated-robotized applications and for root pass welding for piping and butt-joints. This product can be used in sour gas applications. (HIC tested acc. to NACE TM-0284). Test values for SSC are available upon reques

Base materials

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

Shipp building 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 the wire

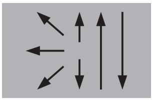
	Gas	C	Si	Mn
wt.-%	M21	0.06	0.80	1.60
wt.-%	C1	0.05	0.60	1.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C	-50°C	-60°C
u	500 (≥ 460)	600 (550-660)	29 (≥ 20)	120		80 (≥ 47)
u1	460 (≥ 420)	560 (530-640)	30 (≥ 20)	80	60 (≥ 47)	
s	420	510	24	90		

u untreated, as welded – shielding gas M21
u1 untreated, as welded – shielding gas C1
s stress relieved 620°C / 2h – shielding gas M21

Operating data



Polarity DC+/– in PG-Position

Shielding gas (EN ISO 14175) M21, C1

Dimension mm
1.0
1.2
1.4
1.6

Welding with conventional or pulsed power sources using DC+

Approvals

TÜV, DB, DNV-GL, ABS, LR, BV, RINA, CWB, CE

FCW

BÖHLER BW VII

Gas Welding Rod, mild steel

Classifications

W.Nr.	EN 12536	AWS A5.2 / SFA-5.2
1.0324	O I	R45-G

Characteristics and typical fields of application

Copper coated unalloyed gas welding rod for joining mild steel up to S235.

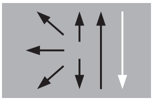
Base materials

S235JR, P195TR1-P235TR1

ASTM A 29 Gr. 1013; A 510 Gr. 1013, A 711 Gr. 1013

	C	Si	Mn
wt.-%	0.08	0.1	0.6

Operating data



Dimension mm
2.0 × 1000
2.5 × 1000
3.2 × 1000
4.0 × 1000

Approvals

-

BÖHLER BW XII

Gas welding rod for gas welding, mild steel

Classifications

EN 12536	AWS A5.2 / SFA-5.2	W.Nr.
O III	R60-G	1.6215

Characteristics and typical fields of application

Gas welding rod, nickel alloyed. Easy to operate due to very easy weld pool and slag control and good gap bridging ability.

Weld pools are not susceptible to overheating when welded with a too hot flame.

Base materials

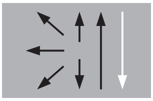
Steels up to a yield strength of 275 MPa (40 ksi)

S235JR - S275JR, P195GH-P275GH, L245NB-L290NB, L245MB-L290MB

ASTM A 29 Gr. 1013, 1016; A 283 Gr. C, D; A 510 Gr. 1013, A 711 Gr. 1013, A 501 Gr. B; A 512 Gr. 1021; A 513 Gr. 1016, 1021; A 572 Gr. 42, 65; A 633 Gr. A, C: A 659 Gr. 1016; A 709 Gr. 36, 50

	C	Si	Mn	Ni
wt.-%	0.01	0.15	1.1	0.45

Operating data



Dimension mm
2.0 × 1000
2.5 × 1000
3.2 × 1000
4.0 × 1000
5.0 × 1000

Approvals

TÜV (02323), DB (70.132.08), CE

Welding consumables for steels with yield strength >460 MPa

◆ Content

Stick electrodes

Product name	C	Si	Mn	Cr	Ni	Mo	S	P	Cu
BÖHLER FOX NiCuCr	0.05	0.40	0.70	0.60	0.60				0.45
BÖHLER FOX 2,5 Ni	0.04	0.30	0.80		2.40				
BÖHLER FOX EV 60	0.07	0.40	1.15		0.90				
BÖHLER FOX EV 63	0.08	0.70	1.70						
BÖHLER FOX EV 65	0.06	0.30	1.20		0.80	0.35			
BÖHLER FOX EV 70	0.04	0.30	1.20		0.90	0.40			
Phoenix SH Schwarz 3 K Ni	0.06	0.30	1.40		0.95	0.50	$\leq$ 0.01	$\leq$ 0.01	$\leq$ 0.08
BÖHLER FOX EV 75	0.05	0.40	1.60	0.40	2.00	0.40			
Thermanit NiMo 100	0.09	0.30	1.90		0.90	0.40			
BÖHLER FOX EV 85	0.05	0.40	1.70	0.40	2.10	0.50			
Phoenix SH Ni 2 K 130	0.08	0.40	1.45	0.80	2.20	0.50			

GTAW rods

Product name	C	Si	Mn	Ni
BÖHLER 2,5 NI-IG	0.08	0.60	1.00	2.40

Solid wires

Product name	C	Si	Mn	Cr	Ni	Mo	Cu
BÖHLER NiCu 1-IG	0.10	0.50	1.10		0.90		0.40
Union K 5 NI	0.10	0.70	1.40		1.40		
Union MoNi	0.10	0.65	1.55		1.10	0.40	
Union NiMoCr	0.08	0.60	1.70	0.20	1.50	0.50	
Union X 69	0.09	0.55	1.50	0.35	1.40	0.25	
Union X 85 T	0.08	0.60	1.40	0.27	2.45	0.40	
Union X 85	0.09	0.70	1.70	0.30	1.85	0.60	
Union X 90	0.10	0.80	1.80	0.35	2.30	0.60	
Union X 96	0.12	0.82	1.90	0.45	2.35	0.55	
BÖHLER alform 700-IG	0.09	0.70	1.70	0.30	1.85	0.60	
BÖHLER alform 900-IG	0.10	0.80	1.80	0.35	2.30	0.60	
BÖHLER alform 960-IG	0.12	0.80	1.90	0.45	2.35	0.55	

SAW wire/flux combinations

Product name	C	Si	Mn	Cr	Ni	Mo	S	P	Cu
BÖHLER SUBARC TNiCu1 - UV 306	0.04	0.60	1.50		1.00				0.53
BÖHLER SUBARC TNiCu1 - UV 400	0.04	0.35	1.40		1.00				0.53
Union S 2 Ni 2,5 - UV 421 TT	0.07	0.20	1.00		2.20		$\leq$ 0.010	$\leq$ 0.012	
Union S 2 Ni 3,5 - UV 421 TT	0.06	0.20	1.00		3.25		$\leq$ 0.010	$\leq$ 0.012	
Union S 2 NiMo 1 - UV 421 TT	0.06	0.20	1.20		0.93	0.25	$\leq$ 0.010	$\leq$ 0.012	
Union S 2 NiMo 1 - UV 419 TT-W	0.08	0.20	1.30		0.95	0.25			
Union S 2 NiMo 1 - UV 420 TTR-C	0.09	0.25	1.30		0.93	0.25	$\leq$ 0.010	$\leq$ 0.012	
BÖHLER SUBARC T60 - UV 419 TT-W	0.06	0.40	1.70		0.90	0.16			
Union S 3 NiMo 1 - UV 421 TT	0.08	0.20	1.55		0.90	0.55			
Union S 3 NiMo 1 - UV 419 TT-W	0.08	0.25	1.60		0.90	0.50			
Union S 3 NiMo 1 - UV 420 TTR	0.08	0.25	1.70		0.90	0.55	$\leq$ 0.010	$\leq$ 0.014	
Union S 3 NiMo 1 - UV 422 TT-LH	0.07	0.45	1.65		0.90	0.55			
Union S 3 NiMo 1 - UV 420 TTR-C	0.10	0.30	1.75		0.95	0.55	< 0.012	$\leq$ 0.015	

Union S Ni1MoCr - UV 420 TTR-C	0.09	0.50	1.70	0.24	0.90	0.45		
Union S 3 NiMo - UV 420 TTR	0.05	0.20	1.60		1.45	0.40	≤ 0.015	≤ 0.015
Union S 3 NiMoCr - UV 421 TT	0.08	0.15	1.60	0.32	2.00	0.58		
Union S 3 NiMoCr UV 422 TTLH (AC)	0.11	0.30	1.65	0.35	2.00	0.55		
Union S 3 NiMoCr UV 422 TTLH (DC+)	0.07	0.35	1.65	0.35	2.00	0.57		
BÖHLER SUBARC T80 HP - UV 422 TT-LH	0.05	0.30	1.60	0.30	2.70	0.50		
BÖHLER SUBARC T85 - UV 422 TT-LH	0.07	0.40	1.60	0.50	2.30	0.50		
BÖHLER SUBARC T95 HP UV 422 TTLH	0.07	0.40	1.70	0.50	2.70	0.50		

Flux cored wires

Product name	C	Si	Mn	Cr	Ni	Mo	Cu
BÖHLER NiCu1 Ti T-FD	0.05	0.40	1.20		1.20		0.40
BÖHLER Kb NiCu1 T-FD	0.05	0.45	1.20		1.20		0.50
BÖHLER NiCu1 T-MC	0.06	0.45	1.20		0.50		0.50
BÖHLER X96 L-MC	0.06	0.70	1.90	0.60	2.20	0.50	
BÖHLER X90 L-MC	0.06	0.70	1.90	0.50	2.10	0.40	
BÖHLER X70 L-MC	0.07	0.70	1.60	0.35	2.00	0.30	
BÖHLER Ti 60 T-FD	0.05	0.45	1.30		0.85		
BÖHLER Ti 60 T-FD (CO_2)	0.07	0.35	1.10		0.85		
BÖHLER Ti 60 K2 T-FD (CO_2)	0.04	0.30	1.20		1.50		
BÖHLER Ti 60 T-FD SR	0.07	0.45	1.30		0.85		
BÖHLER Kb 60 T-FD	0.06	0.45	1.35		0.95		
BÖHLER Kb 65 T-FD	0.05	0.35	1.40		1.20	0.40	
BÖHLER Ti 2 Ni T-FD	0.06	0.45	1.30		2.00		
BÖHLER Ti 75 T-FD	0.05	0.30	1.30		1.50	0.30	
BÖHLER Ti 80 T-FD	0.07	0.40	1.70		2.00	0.15	
BÖHLER Ti 80 T-FD SR	0.04	0.25	1.80		2.30	0.40	
BÖHLER Ti 85 T-FD	0.04	0.30	1.85		2.30	0.40	
BÖHLER Kb 85 T-FD	0.06	0.40	1.40	0.40	2.20	0.40	
BÖHLER Kb 85 T-FD (CO_2)	0.07	0.35	1.40	2.10	0.40	0.50	
BÖHLER Kb 90 T-FD	0.06	0.40	1.40	0.40	2.20	0.40	
BÖHLER HL 53 T-MC	0.06	0.50	1.30		0.90		
BÖHLER HL 65 T-MC	0.06	0.45	1.30		1.00	0.50	
BÖHLER HL 75 T-MC	0.10	0.50	1.80		0.90	0.55	
BÖHLER alform® 700 L-MC	0.07	0.70	1.60	0.35	2.00	0.30	
BÖHLER alform® 900 L-MC	0.06	0.70	1.90	0.50	2.10	0.40	
BÖHLER alform® 960 L-MC	0.06	0.70	1.90	0.60	2.20	0.50	

BÖHLER FOX NiCuCr

Stick electrode, low-alloyed, basic coated, weather-resistant

Classifications

EN ISO 2560-A	AWS A5.5 / SFA-5.5
E 46 4 Z1NiCrCu B 4 2 H5	E8018-W2 H4 R

Characteristics and typical fields of application

NiCuCr alloyed basic coated electrode for welding weather resistant constructional steels. Excellent mechanical properties and high crack resistance even when subjected to restraint.

Metal recovery approximately 115%. Easily welding in all positions except vertical-down. Very low hydrogen contents (acc. AWS condition HD < 4 ml/100 g weld metal).

Base materials

Weather resistant constructional 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 analysis of all-weld metal

	C	Si	Mn	Cr	Ni	Cu
wt.-%	0.05	0.4	0.7	0.6	0.6	0.45

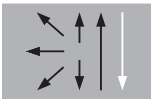
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C
u	520 (≥ 460)	570 (≥ 530 – 680)	27 (≥ 20)	200	130 (≥ 70)
s	500	550	27	190	

u untreated, as-welded

s stress relieved 580 °C/2h / furnace down to 300 °C / air

Operating data



Polarity	DC (+)
Electrode identification	FOX NiCuCr 8018-W2 E 46 4 Z B
Redrying	if necessary: 300 – 350 °C, min. 2 h

Dimension mm	Current A
2.5 × 350	80 – 110
3.2 × 350	130 – 150
4.0 × 450	150 – 190
5.0 × 450	200 – 240

Approvals

RMR, CE

BÖHLER FOX 2,5 Ni

Stick electrode, low-alloyed, basic coated, cryogenic

Classifications

EN ISO 2560-A	AWS A5.5 / SFA-5.5
E 46 8 2Ni B 4 2 H5	E8018-C1 H4 R

Characteristics and typical fields of application

Basic Ni-alloyed electrode for unalloyed and Ni-alloyed fine grained construction steels. Tough, crack resistant weld deposit. Low temperature toughness to –80ºC.

Good weldability in all position except vertical down. Very low hydrogen content (acc. AWS condition HD < 4 ml/100 g weld metal).

Base materials

Cryogenic constructional steels and Ni-steels, cryogenic steels for ship building

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

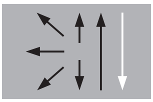
	C	Si	Mn	Ni
wt.-%	0.04	0.3	0.8	2.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-80°C
u	490 (≥ 460)	570 (≥ 530 – 680)	30 (≥ 20)	180	110 (≥ 47)
s	470	550	30	200	

u untreated, as welded
s stress relieved 580 °C/2h / furnace down to 300 °C/air

Operating data



Polarity	DC+
Electrode identification	FOX 2.5 Ni 8018-C1 E 46 8 2Ni B
Redrying	if necessary: 300 – 350 °C / min. 2 h

Dimension mm	Current A
2.5 × 350	70 – 100
3.2 × 350	110 – 140
4.0 × 450	140 – 180
5.0 × 450	190 – 230

Preheat, interpass temperature and post-weld heat treatment as required by the base metal.

Approvals

TÜV (00147), DB (10.014.16),ABS, WIWEB, DNV GL, LR, RINA, CE

BÖHLER FOX EV 60

Stick electrode, low-alloyed, basic coated, high-strength

Classifications

EN ISO 2560-A	AWS A5.5 / SFA-5.5
E 46 6 1Ni B 4 2 H5	E8018-C3 H4 R

Characteristics and typical fields of application

Basic coated, Ni- alloyed electrode with excellent mechanical properties, particularly high toughness and crack resistance. For higher strength fine- grained constructional steels.

Suitable for service temperatures at –60ºC to +350ºC. Very good impact strength in aged condition. Metal recovery about 115%. Easy weldability in all positions except vertical-down.

Very low hydrogen content (acc. AWS condition HD < 4 ml/100 g weld metal).

Base materials

Constructional steels, pipe- and vessel steels, cryogenic fine-grained steels and special grades

S275N-S460N, S275NL-S460NL, S275M-S460M, S275ML-S460ML, P355N, P355NH, P460N, P460NH, P275NL1-P460NL1, P275NL2-P460NL2, L360NB, L415NB, L360MB-L450MB, L360QB-L450QB

alform plate 460M; durostat 400, 450, 500, durostat B2

ASTM A 203 Gr. D, E; A 350 Gr. LF1, LF2, LF3; A 420 Gr. WPL3, WPL6; A 516 Gr. 60, 65, 70; A 572 Gr. 42, 50, 55, 60, 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; API 5 L X52, X60, X65, X52Q, X60Q, X65Q

Typical analysis of all-weld metal

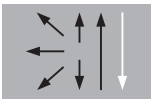
	C	Si	Mn	Ni
wt.-%	0.07	0.4	1.15	0.9

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-60°C
u	510 (≥ 460)	600 (550 – 740)	29 (≥ 20)	200	120 (≥ 47)
s	470	580	27	180	

u untreated, as welded
s stress relieved 580°C/2h / furnace down to 300°C / air

Operating data



Polarity	DC+
Electrode identification	FOX EV 60 8018-C3 E 46 6 1Ni B
Redrying	if necessary 300 – 350°C, min. 2h

Dimension mm	Current A
2.5 × 350	80 – 100
3.2 × 350	110 – 140
4.0 × 350	140 – 180
4.0 × 450	140 – 180
5.0 × 450	190 – 230

Approvals

TÜV (01524), DNV GL, RMR, CRS, VG 95132, ABS, CE

BÖHLER FOX EV 63

Stick electrode, low-alloyed, basic coated, high-strength

Classifications

EN ISO 2560-A	AWS A5.5 / SFA-5.5
E 50 4 B 4 2 H5	E8018-G H4 R

Characteristics and typical fields of application

Basic coated, Ni- alloyed electrode with excellent mechanical properties, particularly high toughness and crack resistance. For higher strength fine- grained constructional steels with a carbon content up to 0.6%.

Suitable for service temperatures at –60ºC to +350ºC. Very good impact strength in aged condition. Metal recovery about 115%. Easy weldability in all positions except vertical-down.

Very low hydrogen content (acc. AWS condition HD < 4 ml/100 g weld metal).

Base materials

Constructional steels, pipe steels, rail steels

S460N, S460M, S460NL, S460ML, S460Q-S500Q, S460QL-S500QL, P460N, P460NH, P460NL1, P460NL2, L415NB, L415MB-L485MB, L415QB-L485QB, alform 500 M, aldur 500 Q, aldur 500 QL, GE300

ASTM A 572 Gr. 65; A 633 Gr. E; A 738 Gr. A; A 852; API 5 L X60, X65, X70, X60Q, X65Q, X70Q

Typical analysis of all-weld metal

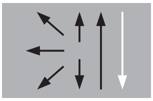
	C	Si	Mn
wt.-%	0.08	0.7	1.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-40°C
u	580 (≥ 500)	630 (≥ 560 – 720)	26 (≥ 18)	170	90 (≥ 47)
s	560	610	26	130	

u untreated, as welded
s stress relieved 580 °C/2h / furnace down to 300 °C / air

Operating data



Polarity	DC+
Electrode identification	FOX EV 63 8018-G E 50 4 B
Redrying	if necessary 300 – 350°C, min. 2h

Dimension mm	Current A
2.5 × 350	80 – 110
3.2 × 350	100 – 140
4.0 × 450	140 – 180
5.0 × 450	190 – 230

Approvals

TÜV (00730), DB (10.014.07 / 81.014.01), RMR, CE

BÖHLER FOX EV 65

Stick electrode, low-alloyed, basic coated, high-strength

Classifications

EN ISO 18275-M	EN ISO 18275-A	AWS A5.5 / SFA-5.5
E6218-G A H5	E 55 6 1NiMo B 4 2 H5	E8018-G H4 R E8018-D1 H4 R (mod.)

Characteristics and typical fields of application

Basic coated electrode with high ductility and crack resistance, for high- strength fine- grained steels.

Ductile down to -60ºC. Resistant to ageing. Easy to handle in all positions, except vertical-down.

Very low hydrogen content (acc. to AWS condition HD <4 ml/100 g weld metal).

BÖHLER FOX EV 65 can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Test values for SSC-test are available too.

Base materials

Constructional steels, pipe- and vessel steels, cryogenic fine-grained steels and special grades

S460N, S460M, S460NL, S460ML, S460Q-S550Q, S460QL-S550QL, S460QL1-S550QL1, P460N, 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, GE300, 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 analysis of all-weld metal

	C	Si	Mn	Ni	Mo
wt.-%	0.06	0.3	1.2	0.8	0.35

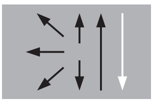
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-60°C
u	590 (≥ 550)	650 (610 – 780)	25 (≥ 18)	190	90 (≥ 47)
s	580	630	25	160	

u untreated, as welded

s stress relieved 580 °C/2h / furnace down to 300 °C / air

Operating data



Polarity	DC+
Electrode identification	FOX EV 65 8018-G E 55 6 1NiMo B
Redrying	if necessary 300 – 350°C, min. 2h

Dimension mm	Current A
2.5 × 350	80 – 100
3.2 × 350	100 – 140
4.0 × 350	140 – 180
4.0 × 450	140 – 180
4.8 × 450	180 – 220
5.0 × 450	190 – 230

Preheating and interpass temperature, as well as post-welds heat treatment as required by the base metal.

Approvals

TÜV (01802),NAKS, VG 95132, BV, RMR, ABS, CE

BÖHLER FOX EV 70

Stick electrode, low-alloyed, basic coated, high-strength

Classifications

EN ISO 18275-A	AWS A5.5 / SFA-5.5
E 55 6 1NiMo B 4 2 H5	E9018-G H4 R E9018-D1 H4 R (mod.)

Characteristics and typical fields of application

Basic coated, Mo-Ni alloyed electrode with high ductility and crack resistance for applications on high-strength fine-grained steels. Suitable for service temperatures between –60ºC and +350ºC.

Metal recovery approximately 115%. Easy to handle in all positions except vertical-down. Very low hydrogen content (acc. AWS condition HD < 4 ml/100 g weld metal).

Base materials

S460N, S460M, S460NL, S460ML, S460Q-S555Q, S460QL-S550QL, S460QL1-S550QL1, P460N, 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, GE300

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

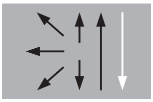
	C	Si	Mn	Ni	Mo
wt.-%	0.04	0.3	1.2	0.9	0.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-60°C
u	590 (≥ 550)	670 (≥ 620 – 780)	24 (≥ 18)	160	70 (≥ 47)
s	590	670	24	130	

u untreated, as welded
s stress relieved 580 °C/2h / furnace down to 300 °C / air

Operating data



Polarity	DC+
Electrode identification	FOX EV 70 9018-G E 55 6 1NiMo B
Redrying	if necessary 300 – 350°C, min. 2h

Dimension mm	Current A
2.5 × 350	80 – 100
3.2 × 350	100 – 140
4.0 × 450	140 – 180
5.0 × 450	190 – 230

Preheat and interpass temperatures, as well as post-weld heat treatment as required by the base metal.

Approvals

TÜV (00112),CE

Phoenix SH Schwarz 3 K Ni

Stick electrode, low-alloyed, basic coated, high-strength

Classifications

EN ISO 2560-A	AWS A5.5 / SFA-5.5
E 50 4 Z1NiMo B 4 2 H5	E9018-G

Characteristics and typical fields of application

Basic coated NiMo alloyed electrode with a weld metal of special metallurgical purity for nuclear reactor construction. Very low hydrogen content < 5 ml/100 g; NDT-tested. Used preferably for the welding of steels in the construction of nuclear reactors, boiler and pressure vessels; for fine grained structural steels up to S500Q.

Base materials

20MnMoNi55, 22NiMoCr37, ASTM A 508 Cl 2, ASTM A 533 Cl 1 Gr. B, 15NiCuMoNb5 S 1 (WB 36), GS-18NiMoCr37, 11NiMoV53, 12MnNiMo55, S420N - S500Q, P460NH; ASTM A302 Gr. A-D; A517 Gr. A, B, C, E, F, H, J, K, M, P; A225 Gr. C; A572 Gr. 65

Typical analysis of all-weld metal

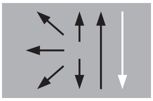
	C	Si	Mn	Ni	Mo	S	P	Cu
wt.-%	0.06	0.3	1.4	0.95	0.5	≤ 0.01	≤ 0.01	≤ 0.08

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C
u	540 (≥ 530)	620	20 (≥ 18)	140	60 (≥ 47)
s	500	590	21	140	47

u untreated, as welded
s stress released 620°C / 1h

Operating data



Polarity	DC+ / AC
Electrode identification	E 9018-G/SH Schwarz 3 K Ni
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 350	70 – 110
3.2 × 350	100 – 150
4.0 × 350	140 – 200
5.0 × 450	170 – 250

Approvals

TÜV (00512 / 08100), CE

BÖHLER FOX EV 75

Stick electrode, low-alloyed, basic coated, high-strength

Classifications

EN ISO 18275-A	AWS A5.5 / SFA-5.5
E 62 6 Mn2NiCrMo B 4 2 H5	E10018-G H4 R E10018M H4 R (mod.)

Characteristics and typical fields of application

Basic coated, Mn-Ni-Cr-Mo - alloyed electrode with high ductility and crack resistance for high-strength, quenched and tempered fine-grained constructional steels. Suitable for service temperatures at –60ºC to +400ºC.

Weld metal recovery approximately 120%. Easy weldability in all positions except vertical-down.

Very low hydrogen content (acc. AWS condition HD < 4 ml/100 g weld metal).

Base materials

Quenched and tempered fine-grained steels up to 620 MPa yield strength, QT-steels up to 730 MPa tensile strength

S500Q-S620Q, S500QL-S620QL, S500QL1-S620QL1, L485MB-L555MB, L485QB-L555QB, alform 500 M, 550 M, 600 M, 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 X70, X80, X70Q, X80Q

Typical analysis of all-weld metal

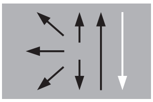
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.05	0.4	1.6	0.4	2.0	0.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-60°C
u	700 (≥ 620)	760 (≥ 690 – 890)	22 (≥ 18)	130	≥ 47
s	680	730	22	110	
v	450	610	24	120	

u untreated, as welded
s stress relieved 580 °C/2h / furnace down to 300 °C / air
v quenched/tempered 910 °C/1h / air and 600 °C/2h / furnace down to 300 °C / air

Operating data



Polarity	DC+
Electrode identification	FOX EV 75 10018-G E 62 6 Mn2NiCr-Mo B
Redrying	if necessary 300 – 350°C, min. 2h

Dimension mm	Current A
2.5 × 350	80 – 100
3.2 × 350	100 – 140
4.0 × 450	140 – 180
5.0 × 450	190 – 230

Preheating and interpass temperature and post-weld heat treatment as required by the base metal.

Approvals

CE

Thermanit NiMo 100

Stick electrode, low-alloyed, basic coated, high-strength

Classifications

EN ISO 18275-A	AWS A5.5 / SFA-5.5
E 62 4 Mn1NiMo B 4 2 H5	E10018-D2 H4

Characteristics and typical fields of application

Basic coated MnNiMo alloyed electrode.

Very low H2-content < 5 ml/100 g; extremely high resistance to cracking and high toughness at temperatures as low as –40ºC.

For creep resistant steels and cast steel grades, valves and oil tools according to sour gas specification; postweld heat treatment: stress relieving according to parent metal.

Base materials

G30CrMoV6-4, GS-30CrMoV6-4

Steels acc. ASTM A 487-4Q; AISI 4130

Typical analysis of all-weld metal

	C	Si	Mn	Ni	Mo
wt.-%	0.09	0.3	1.9	0.9	0.4

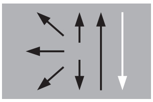
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C	-50°C
u	650 (≥ 620)	770 (690 - 890)	20 (≥ 18)	120	70 (≥ 47)	60
s	630	730	21	130	70	60

u untreated, as welded

s stress released at 635°C/4h

Operating data



Polarity	DC+
Electrode identification	NiMo 100/10018-D2/E 62 4 Mn1NiMo B
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 350	70 – 100
3.2 × 350	100 – 150
4.0 × 450	140 – 200
5.0 × 450	180 – 250

Choose preheating, interpass temperature and post weld heat treatment (PWHT) as required by the base material.

Approvals

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BÖHLER FOX EV 85

Stick electrode, low-alloyed, basic coated, high-strength

Classifications

EN ISO 18275-A	AWS A5.5 / SFA-5.5
E 69 6 Mn2NiCrMo B 4 2 H5	E11018-G H4 R E11018M H4 R (mod.)

Characteristics and typical fields of application

Basic coated, Mn-Ni-Mo-alloyed electrode with high ductility and crack resistant for high-strength fine-grained constructional steels. Low-temperature ductility at –60ºC.

Easy weldability in all positions except vertical-down. Very low hydrogen content (acc. AWS condition HD < 4 ml/100 g).

Base materials

Quenched and tempered fine-grained steels up to 690 MPa yield strength

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 analysis of all-weld metal

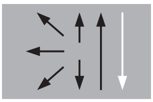
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.05	0.4	1.7	0.4	2.1	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-60°C
u	780 (≥ 690)	840 (≥ 760 – 960)	20 (≥ 17)	110	60 (≥ 47)
s	750	800	20	80	
v	750	790	20	80	

u untreated, as-welded
s stress relieved 580 °C/2h / furnace down to 300 °C / air

Operating data



Polarity	DC+
Electrode identification	FOX EV 85 11018-G E 69 6 Mn2NiCr-Mo B
Redrying	if necessary 300 – 350°C, min. 2h

Dimension mm	Current A
2.5 × 350	80 – 100
3.2 × 350	100 – 140
3.2 × 450	100 – 140
4.0 × 450	140 – 180
5.0 × 450	190 – 230

Preheat, interpass temperature and post-weld heat treatment as required by the base metal.

Approvals

TÜV (04313), DB (10.014.22),BV, CE

Phoenix SH Ni 2 K 130

Stick electrode, low-alloyed, basic coated, high-strength

Classifications

EN ISO 18275-A	AWS A5.5 / SFA-5.5
E 89 4 Mn2Ni1CrMo B 4 2 H5	E12018-G (E12018M mod.)

Characteristics and typical fields of application

Basic coated NiCrMo alloyed electrode for welding of high strength steels (typical yield strength 890 MPa)

Low hydrogen content <5 ml/100 g (HD) in the weld metal. For high strength fine grained structural steels.

Suitable for bridge building, steel and crane construction; the weld metal is insensitive to cold cracking.

Base materials

Quenched and tempered fine grained structural steels up to 890 MPa yield strength.

High strength fine grained structural steels S890Q, S890QL, aldur 900 Q, aldur 900 QL, HY 130

Typical analysis of all-weld metal

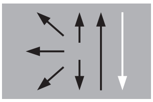
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.08	0.40	1.45	0.80	2.20	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C
u	930 (≥ 890)	1000 (980 - 1180)	17	90	47

u untreated, as welded

Operating data



Polarity	DC+
Electrode identification	E 12018-M/SH Ni 2 K 130
Redrying	300-350°C/2h

Dimension mm	Current A
3.2 × 350	90 – 140
4.0 × 350	140 – 190
4.0 × 450	140 – 190
5.0 × 450	170 – 240

Approvals

CE

böhler welding by voestalpine

Union I 2,5 NI

TIG Rod, low-alloyed, cryogenic

Classifications

EN ISO 636-A	AWS A5.28 / SFA-5.28
W 46 8 2Ni2	ER80S-Ni2

Characteristics and typical fields of application

TIG rod for unalloyed and Ni-alloyed fine grained construction steels. Tough, crack resistant weld deposit. Low temperature toughness down to -80°C. For thin sheets and root pass welding.

Base materials

Cryogenic constructional steels and Ni-steels, cryogenic steels for ship building

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

Operating data

Dimension mm
2.4 × 1000
2.5 × 1000
3.0 × 1000

Preheating, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

-

BÖHLER 2,5 Ni-IG

TIG Rod, low-alloyed, cryogenic

Classifications

EN ISO 636-A	AWS A5.28 / SFA-5.28
W 46 8 2Ni2	ER80S-Ni2

Characteristics and typical fields of application

TIG rod for unalloyed and Ni-alloyed fine grained construction steels. Tough, crack resistant weld deposit. Low temperature toughness down to -80°C. For thin sheets and root pass welding.

Base materials

Cryogenic constructional steels and Ni-steels, cryogenic steels for ship building

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 the wire rod

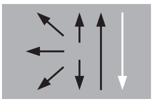
	C	Si	Mn	Ni
wt.-%	0.08	0.6	1.0	2.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-60°C	-80°C
u	510 (≥ 460)	600 (550 - 740)	26 (≥ 20)	280	80	≥ 47

u untreated, as welded – shielding gas Argon

Operating data



Polarity	DC–
Shielding gas (EN ISO 14175)	I1
Rod marking	W 2Ni2 ER80S-Ni 2

Dimension mm
2.0 × 1000
2.4 × 1000
3.0 × 1000

Preheating, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

TÜV (01081), DNV GL, BV, Equinor, NAKS, CE

Alternative products

Union I 2,5 NI

BÖHLER NiCu 1-IG

Solid Wire, low-alloyed, high strength

Classifications

EN ISO 14341-A	AWS A5.28 / SFA-5.28
G 42 4 M21 Z3Ni1Cu	ER80S-G

Characteristics and typical fields of application

GMAW Ni-Cu-alloyed solid wire for weatherproof structural steels. The weld metal has the same corrosion properties as matching weatherproof structural steels. For use with CO_2 and gas mixture. Outstanding toughnesss of the weld metal at low temperatures.

For use in steel framed structures, in bridge building and rail vehicle manufacture.

Base materials

Weather-resistant constructional steels, special grade constructional 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 analysis of the solid wire

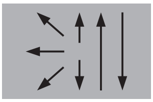
	C	Si	Mn	Ni	Cu
wt.-%	0.1	0.5	1.1	0.9	0.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C
u	500 (≥ 47)	580 (≥ 500 – 670)	26 (≥ 20)	130	≥ 47
s	460	540	20	130	

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

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

DB (42.132.69), CE

GMAW

Union K 5 Ni

Solid Wire, low-alloyed, cryogenic

Classifications

EN ISO 14341-A	AWS A5.28 / SFA-5.28
G 50 5 M21 3Ni1	ER80S-G
G 46 3 C1 3Ni1	

Characteristics and typical fields of application

GMAW Ni alloyed solid wire electrode for joining of cryogenic fine-grained structural steels with yield strength up to 500 Mpa. Very good low temperature toughness when deposited in combination with gas mixtures.

Base materials

S275N-S500N, S275NL-S500NL, S275M-S500M, S275ML-S500ML, S460QL1, S500QL1, P355N, P460N, P355Q-P500Q, P275NL1-P460NL1, P275NL2-P460NL2, L360NB, L415NB, L290MB-L485MB, L360QB-L485QB

ASTM A 203 Gr. D, E; A 350 Gr. LF1, LF2, LF3; A 420 Gr. WPL3, WPL6; A 516 Gr. 60, 65, 70; A 572 Gr. 42, 50, 55, 60, 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; API 5 L X52, X60, X65, X70

Typical analysis of the solid wire

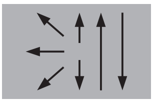
	C	Si	Mn	Ni
wt.-%	0.10	0.70	1.40	1.40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-30°C	-50°C	Shielding gas
u1	500	590	24	130		47	M21
u2	460	560	24	110	47		CO^2

u1 untreated, as welded – shielding gas Ar + 15 – 25 % CO_2
u2 untreated, as welded – shielding gas 100 % CO_2

Operating data



Dimension mm
1.0
1.2

Approvals

TÜV (00514), DB (42.132.13), CE

Union Ni 2,5

Solid Wire, low-alloyed, cryogenic

Classifications

EN 440- G 50 8 M G2Ni2	AWS A5.28 / SFA-5.28
440- G 50 8 M G2Ni2	ER80S-Ni2

Characteristics and typical fields of application

Solid wire for high quality welds in the construction of storage tanks and piping systems for cryogenic applications. The weld deposit is noted for its particularly good low temperature and non-ageing properties down to -80°C.

Base materials

Cryogenic constructional steels and Ni-steels, cryogenic steels for ship building

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 the solid wire

	C	Si	Mn	Ni
wt.-%	0.08	0.60	1.00	2.35

Mechanical properties of all-weld metal - typical values (min. values)

u1 untreated, as welded
u2 stress relieved 560°C / 4 h

Operating data

Dimension mm
1.0
1.2

Preheating, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

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Union MoNi

Solid wire, medium-alloyed, high strength

Classifications

EN ISO 16834-A	AWS A5.28 / SFA-5.28
G 62 5 M21 Mn3Ni1Mo	ER90S-G

Characteristics and typical fields of application

Medium-alloyed coppered solid wire for joining of quenched and tempered, thermomechanically rolled fine-grained structural steels and 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

S460N, S460M, S460NL, S460ML, S460Q-S555Q, S460QL-S550QL, S460QL1-S550QL1, 460N,P460NH, P460NL1, P460NL2, L415NB, L415MB-L555MB, L415QB-L555QB, 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 analysis of the solid wire

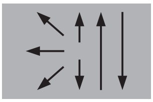
	C	Si	Mn	Ni	Mo
wt.-%	0.10	0.65	1.55	1.10	0.40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C	-50°C	Shielding gas
u	550	640	20	80	47		CO^2
u	620	700	18	100		47	M21

u untreated, as welded

Operating data



Dimension mm
0.8
1.0
1.2

Approvals

TÜV (00926), DB (42.132.09), DNV GL, WIWEB, VG 95132-1, CE

böhler welding by voestalpine

Union NiMoCr

Solid wire, medium-alloyed, high strength

Classifications

EN ISO 16834-A	AWS A5.28 / SFA-5.28
G 69 6 M21 Mn4Ni1,5CrMo	ER100S-G

Characteristics and typical fields of application

Medium-alloyed coppered solid wire for joining of quenched and tempered, thermomechanically rolled fine-grained structural steels with yield strength of 690 MPa. Suitable for welding armor steel and wear resistant steels. For use with CO_2 and gas mixture. Outstanding toughnesss of the weld metal at low temperatures. For use in crane and vehicle manufacturing.

Base materials

S620Q, S620QL, S620QL1, S690Q, S690QL, S690QL1;

S600MC, S650MC, S700MC;

L690M, L830M;

ASTM A 514 Gr. F, H, Q; A 709 Gr. 100 Type B, E, F, H, Q; A 709 Gr. HPS 100W;

API 5L X90, X100, X120

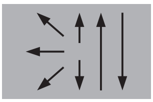
Typical analysis of the solid wire

	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.08	0.60	1.70	0.20	1.50	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-40°C	-60°C	Shielding gas
u	680	740	18	80	47		CO^2
u	720	780	16	100		47	M21

Operating data



Dimension mm
0.8
0.9
1.0
1.2
1.4

Approvals

TÜV (02760), DB (42.132.08), ABS, BV, DNV GL, LR, VG 95132-1, CE

Union X 69

Solid Wire, low-alloyed, high strength

Classifications

EN ISO 16834-A	AWS A5.28 / SFA-5.28
G 69 4 M21 Mn3Ni1CrMo	ER100S-G

Characteristics and typical fields of application

GMAW low-alloyed solid wire for joining of quenched and tempered and thermomechanically rolled fine-grained structural steels. For use in bulding, crane and vehicle constructions.

Base materials

S620Q, S620QL, S690Q, S690QL;

S600MC, S650MC, S700MC;

ASTM A 514 Gr. F, H, Q; A 709 Gr. 100 Type E, F, H, Q; A 709 Gr. HPS 100W

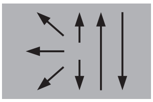
Typical analysis of the solid wire

	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.09	0.55	1.50	0.35	1.40	0.25

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C
u	700	780	17	80	> 47

Operating data



Dimension mm
0.8
1.0
1.2

Approvals

TÜV (18928), DB (42.132.59), CE

Alternative products

BÖHLER X 70-IG

Union X 85 T

Solid Wire, low-alloyed, high strength

Classifications

EN ISO 16834-A	**AWS A5.28 / SFA-5.28**
G 69 6 M21 Mn3Ni2,5CrMo	ER110S-G
G 62 4 C1 Mn3Ni2,5CrMo	

Characteristics and typical fields of application

GMAW low-alloyed solid wire electrode for joining of quenched and tempered and thermomechanically rolled fine-grained structural steels with yield strength of 690 MPa. Due to the higher Ni-content, outstanding tough weld metal at low temperatures when deposited with mixed gas M21 is achieved.

Good resistance to cold cracking, stable arc with low spatter formation also when welding out of position (i.e. welding of pipe knots of crane towers). For use in crane and vehicle constructions. Also used in the offshore industry.

Base materials

S690Q, S690QL, S690QL1;

S650MC, S700MC;

ASTM A 514 Gr. F, H, Q; A 709 Gr. 100 Type B, E, F, H, Q; A 709 Gr. HPS 100W;

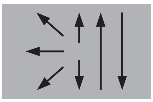
Typical analysis of the solid wire

	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.08	0.6	1.40	0.27	2.45	0.40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J -60°C	Shielding gas
u	700	790	18	100	47	M21

Operating data



Dimension mm
1.0

Approvals

DB (42.132.74), ABS, DNV GL, CE

Alternative products

BÖHLER NiCrMo 2,5-IG

Union X 85

Solid Wire, low-alloyed, high strength

Classifications

EN ISO 16834-A	AWS A5.28 / SFA-5.28
G 79 5 M21 Mn4Ni1,5CrMo	ER110S-G

Characteristics and typical fields of application

GMAW low-alloyed solid wire electrode for joininng of quenched and tempered and thermomechanically rolled fine-grained structural steels / high-strength tubes. Outstandingly tough weld metal at low temperatures when deposited with gas mixture.

Good deformability; outstanding mechanical properties even with higher heat input per unit length of weld. For use in crane, building and vehicle constructions.

Base materials

S690Q, S690QL, S770QL;

S700MC, S760MC;

P690Q, P690QL1;

ASTM A 514 Gr. F, H, Q; A 709 Gr. 100 Type E, F, H, Q; A 709 Gr. HPS 100W

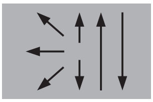
Typical analysis of the solid wire

	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.09	0.7	1.70	0.30	1.85	0.60

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-50°C	Shielding gas
u	720	770	17	80		CO^2
u	790	880	16	90	47	M21

Operating data



Dimension mm
1.0
1.2

Approvals

DB (42.132.21), CE

böhler welding by voestalpine

Union X 90

Solid Wire, low-alloyed, high strength

Classifications

EN ISO 16834-A	AWS A5.28 / SFA-5.28
G 89 6 M21 Mn4Ni2CrMo	ER120S-G

Characteristics and typical fields of application

GMAW low-alloyed solid wire electrode for joining of quenched and tempered and thermomechanically rolled fine-grained structural steels with yield strength of 890 MPa.

Due to the micro-alloying concept, the weld metal is outstandingly tough with high-strength and good resistance to cold cracking at low temperatures when deposited with gas mixture. Used in crane and vehicle constructions.

Base materials

S890Q, S890QL, S890QL1;

S890MC;

USS-T1;

ASTM A 709 Gr. 100 Type B, E, F, H, Q, HPS 100W

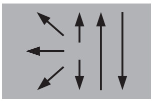
Typical analysis of the solid wire

	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.10	0.80	1.80	0.35	2.30	0.60

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J -60°C	Shielding gas
u	890	950	15	90	47	M21

Operating data



Dimension mm
1.0
1.2

Approvals

TÜV (07675), DB (42.132.12), CE

Alternative products

BÖHLER X 90-IG

Union X 96

Solid Wire, low-alloyed, high strength

Classifications

EN ISO 16834-A	AWS A5.28 / SFA-5.28
G 89 5 M21 Mn4Ni2,5CrMo	ER120S-G

Characteristics and typical fields of application

GMAW low-alloyed solid wire electrode for joining of quenched and tempered and thermomechanically rolled fine-grained structural steels in crane and vehicle constructions. Good deformability in spite of very high strength values. Good resistance to cold cracking.

Base materials

S960Q, S960QL;

S890Q, S890QL;

S890MC;

S960MC

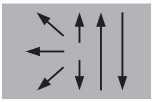
Typical analysis of the solid wire

	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.12	0.82	1.90	0.45	2.35	0.55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-50°C	Shielding gas
u	930	980	14	80	47	M21

Operating data



Dimension mm
0.8
1.0
1.2

Approvals

DB (42.132.26), CE

BÖHLER alform 700-IG

Solid wire, low-alloyed, high strength

Classifications

EN ISO 16834-A	AWS A5.28 / SFA-5.28
G 79 5 M21 Mn4Ni1,5CrMo	ER110S-G

Characteristics and typical fields of application

High-strength, medium solid wire electrode for shielded arc welding of quenched and tempered fine grained structural steel alform® 700 M. Outstanding tough weld metal at low temperature 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.

Typical analysis of the solid wire

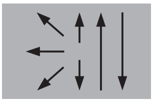
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.09	0.7	1.70	0.30	1.85	0.60

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-50°C
u	≥ 790	≥ 880 - 1080	≥ 16	≥ 90	≥ 47

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

Operating data



Dimension mm
1.0
1.2

Preheating and interpass temperature as required by the base metal.

Approvals

DB (42.132.60), NAKS, CE

BÖHLER alform 900-IG

Solid wire, low-alloyed, high strength

Classifications

EN ISO 16834-A	AWS A5.28 / SFA-5.28
G 89 6 M Mn4Ni2CrMo	ER120S-G

Characteristics and typical fields of application

High-strength, medium solid wire electrode for shielded arc welding of quenched and tempered fine grained structural steel alform® 900 x-treme. Outstanding tough weld metal at low temperature when deposited with gas mixture. Good resistance to cold cracking due to high purity of the wire surface. For use in crane and vehicle manufacturing.

Base materials

S890 and higher strength grades, thermo mechanically treated fine grain steels.

S890Q, S890QL, alform® 900 x-treme (wire is especially balanced for this plate steel)

ASTM A 709 Gr. 100 Type B, E, F, H, Q, HPS 100W

Typical analysis of the solid wire

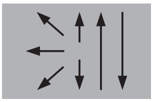
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.10	0.80	1.80	0.35	2.30	0.60

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C
u	≥ 890	≥ 940 – 1180	≥ 15	≥ 47

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

Operating data



Dimension mm
1.0
1.2

Preheating and interpass temperature as required by the base metal.

Approvals

-

BÖHLER alform 960-IG

Solid Wire, low-alloyed, high strength

Classifications

EN ISO 16834-A	AWS A5.28 / SFA-5.28
G 89 5 M21 Mn4Ni2,5CrMo	ER120S-G

Characteristics and typical fields of application

High-strength, medium alloy solid wire electrode for shielded arc welding of quenched and tempered fine grained structural steels.

Optimized and tested welding results with the steel alform® 960 x-treme. Outstanding tough weld metal at low temperature. Good resistance to cold cracking due to high purity of the wire surface.

For use in crane and vehicle manufacturing.

Base materials

S960 and higher strength grades, thermo mechanically treated fine grain steels aligned to alform® 960 x-treme

Typical analysis of the solid wire

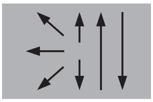
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.12	0.80	1.90	0.45	2.35	0.55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -50°C
u nach EN ISO	≥ 930	≥ 980	14	≥ 47

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

Operating data



Dimension mm
1.0
1.2

Preheating and interpass temperature as required by the base metal.

Approvals

DB (42.132.64), CE

GMAW

BÖHLER SUBARC TNiCu1 - UV 306

SAW wire/flux combination, low-alloyed, weather resistant

Classifications

EN ISO 14171-A	AWS A5.23 / SFA 5.23
S 46 4 AR T2Ni1Cu	F8A5-ECG-G

Characteristics and typical fields of application

BÖHLER SUBARC TNiCu1 – UV 306 is a wire flux combination for submerged arc welding of weather resistant applications. The weld metal is alloyed with Ni and Cu to make the weld metal weather-resistant and to give its characteristic rusty brown colouring after exposure to weather conditions. It is mainly applied to clad facades, for bridges and other engineering structures. The basic-cored wire provides higher toughness properties and higher deposit rate compared to similar solid SAW wire.

UV 306 is an aluminate-rutile flux and is recommended and applied for high welding speed and nice bead appearance. For more flux properties see separate datasheet of the flux.

Base materials

S235JRG2Cu, S235J2G4Cu, S235J0Cu, S235JRW, S355J0Cu, S355J2G3Cu, S355J0W, S235J2W-S355J2W, S355K2W

ASTM A 588 Gr. A, B, C, K; A 618 Gr. II; 709 Gr. C

Typical analysis of the weld metal

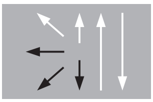
wt.-%	C	Si	Mn	Ni	Cu
all-weld metal	0.04	0.6	1.5	1.0	0.53

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -46 °C	-40 °C	-20 °C
u, DC+	510 (≥470)	590 (550-680)	21 (≥20)	60 (≥27)	80 (≥47)	120 (≥47)

u untreated, as welded

Operating data



Polarity DC+

Dimension mm
2.4
3.2
4.0

Approvals

-

SAW

BÖHLER SUBARC TNiCu1 - UV 400

SAW wire/flux combination, low-alloyed, weather resistant

Classifications

EN ISO 14171-A	AWS A5.23 / SFA-5.23
S 46 6 AB T2Ni1Cu	F7A8-ECG-G

Characteristics and typical fields of application

BÖHLER SUBARC TNiCu1 – UV 400 is a wire flux combination for submerged arc welding of weather resistant applications. The basic-cored wire provides higher deposit rate compared to solid SAW wire and is alloyed with Ni and Cu to make the weld metal weather-resistant and to give its characteristic rusty brown colouring after exposure to weather conditions. It is mainly applied to clad facades, for bridges and other engineering structures. With UV 400 it can be applied for all wall thicknesses with high toughness properties.

UV 400 is an aluminate-basic flux. For more flux properties see separate datasheet of the flux.

Base materials

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 analysis of the weld metal

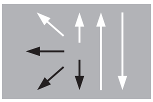
wt.-%	C	Si	Mn	Ni	Cu
all-weld metal	0.04	0.35	1.4	1.0	0.53

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -60 °C	-40 °C	-20 °C
u, DC+	475 (≥460)	565 (480-650)	26 (≥20)	135 (≥ 47)	150 (≥ 47)	170 (≥ 47)

u untreated, as welded

Operating data



Polarity DC+

Dimension mm
2.4
3.2
4.0

Approvals

-

Union S 2 Ni 2,5 - UV 421 TT

SAW wire/flux combination, low-alloyed, cryogenic

Classifications

EN ISO 14171-A	AWS A5.23 / SFA-5.23
S 46 8 FB S2Ni2	F8A10-ENi2-Ni2 / F7P10-ENi2-Ni2

Characteristics and typical fields of application

Union S 2 Ni 2,5 - UV 421 TT is a wire flux combination for submerged arc welding of fine-grained structural steels. The wire flux-combination has been designed to achieve optimum toughness properties of the weld metal (at -80ºC), produced by multi-pass welding technique. It is suitable for cryogenic application such as pressure vessel and liquefied gas storage equipment manufacturing till a minimum temperature of -80ºC (e.g. for CO_2 and Ethane) and arctic off-shore- constructions.

UV 421 TT is an agglomerated fluoride-basic flux with high basicity has a neutral metallurgical behavior, and is suitable for single (AC or DC) and tandem welding, however the tandem process is not recommended for this combination. Very good slag detachability also for narrow gap welding. Detailed information about the flux can be found in the separate datasheet of the flux.

Base materials

Cryogenic constructional steels and Ni-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 the weld metal

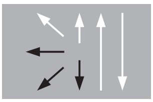
wt.-%	C	Si	Mn	Ni	S	P
wire	0.09	0.10	1.00	2.30	≤ 0.010	
all-weld metal	0.07	0.20	1.00	2.20	≤ 0.010	≤ 0.012

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -80°C	20°C
u, DC+	≥ 470	≥ 530	≥ 24	≥ 60	≥ 140
a1, DC+	≥ 400	≥ 500	≥ 24	≥ 54	≥ 150

u untreated, as welded ; a1 = 1 hour 620 °C

Operating data



Polarity DC + / AC

Dimension mm
2.4
2.5
3.0
4.0

Preheating and Interpass temp.: 130 – 180ºC ; Heat Input < 2,0 kJ/mm

Approvals

TÜV (02213), DB (51.123.06), LR, DNV GL, ABS, BV, CE

SAW

Union S 2 Ni 3,5 - UV 421 TT

SAW wire/flux combination, low-alloyed, cryogenic

Classifications

EN ISO 14171-A	AWS A5.23 / SFA-5.23
S 42 8 FB S2Ni3	F7A15-ENi3-Ni3 / F7P15-ENi3-Ni3

Characteristics and typical fields of application

Union S 2 Ni 3,5 - UV 421 TT is a wire flux combination for submerged arc welding of fine-grained structural steels and especially 3,5%Ni steel grades with matching wire composition. The wire flux-combination has been designed to achieve optimum toughness properties of the weld metal (at -80ºC / -105ºC), produced by multi-pass welding technique. It is suitable for cryogenic application such as pressure vessel and liquefied gas storage equipment manufacturing till a minimum temperature of -105ºC (e.g. for CO_2 and Ethane) and arctic off-shore- constructions. Very good slag detachability also for narrow gap welding.

UV 421 TT is an agglomerated fluoride-basic flux with high basicity with a neutral metallurgical behavior and is suitable for single (AC or DC) and tandem welding, however the tandem process is not recommended for this combination. For information regarding this welding flux see our detailed data sheet.

Base materials

12 Ni 14 (EN) or SA 350 Gr. LF3 and SA 203 Gr. D & E (ASME)

Typical analysis of the weld metal

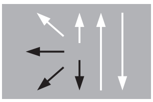
wt.-%	C	Si	Mn	Ni	S	P
wire	0.08	0.15	0.90	3.25	≤ 0.010	≤ 0.010
all-weld metal	0.06	0.20	1.00	3.25	≤ 0.010	≤ 0.012

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -105°C	-80°C	-60°C	20°C
u, DC+	≥ 420	≥ 520	≥ 25	≥ 27	≥ 47	≥ 90	≥ 160
a1, DC+	≥ 420	≥ 520	≥ 25	≥ 35	≥ 54	≥ 90	≥ 160

u untreated, as welded ; a1 = 1 hour 620 °C

Operating data



Polarity	DC + / AC

Dimension mm
2.4
3.2
4.0

Preheating and Interpass temp.: 130 – 180ºC; Heat Input < 2,0 kJ/mm

Approvals

-

Union S 2 NiMo 1 - UV 421 TT

SAW wire/flux combination, low-alloyed, high strength

Classifications

EN ISO 14171-A	**AWS A5.23 / SFA-5.23**
S 50 6 FB SZ2Ni1Mo	F8A10-ENi1-Ni1 - F8P10-ENi1-Ni1

Characteristics and typical fields of application

Union S 2 NiMo 1 - UV 421 TT is a wire flux combination for submerged arc welding of non- and low alloyed steel grades. Recommended for multi-pass butt welding of medium and high tensile steels e.g. in off-shore constructions (wind power) and oil and gas industry including sour service applications. Very good impact toughness of weld metal at low temperatures.

UV 421 TT is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behavior. Detailed information about the flux can be found in the separate datasheet of the flux.

Base materials

General purpose structural steels, fine grained structural steels, medium and high tensile steels up to 460 MPa minimum yield strength.

Typical analysis of the weld metal

wt.-%	C	Si	Mn	Ni	Mo	S	P
wire	0.11	0.15	1.10	0.95	0.25	≤ 0.010	≤ 0.010
all-weld metal	0.06	0.20	1.20	0.93	0.25	≤ 0.010	≤ 0.012

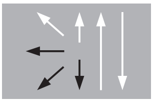
SAW

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C	-40°C	20°C
u, DC+	≥ 500	≥ 570	≥ 25	≥ 70	≥ 120	≥ 180
a1, DC+	≥ 470	≥ 550	≥ 25	≥ 80	≥ 140	≥ 180
a2, DC+	≥ 470	≥ 550	≥ 25	≥ 80	≥ 140	≥ 180
a3, DC+	≥ 260	≥ 480	≥ 30	≥ 27	≥ 50	≥ 120
a4, DC+	≥ 350	≥ 470	≥ 30	≥ 140	≥ 180	≥ 200

u untreated, as welded ; a1 = 15 hours 580 °C ; a2 = 1 hour 620 °C ; a3 = 1 hour 920 °C / air ;
a4 = 1 hour 920 °C / air + 2 hours 620 °C / air

Operating data



Polarity DC + / AC

Dimension mm
2.5
3.2
4.0

Approvals

LRS 5Y46M, DNV-GL VY46M, ABS 5YQ460M

Union S 2 NiMo 1 - UV 419 TT-W

SAW wire/flux combination, low alloyed, high strength

Classifications

EN ISO 14171-A	**AWS A5.23 / SFA 5.23**
S 50 6 FB SZ2Ni1Mo	F8A8-ENi1-Ni1 - F8P8-ENi1-Ni1

Characteristics and typical fields of application

Union S 2 NiMo 1 - UV 419 TT-W is a wire flux combination It is suitable for single (AC or DC) and tandem (DC and AC or AC and AC) welding. Very good slag detachability also for narrow gap welding. Flux can especially be used for multi-pass butt welding of medium and high tensile steels. Very good impact toughness of weld metal at low temperatures.

UV 419 TT-W is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behavior. For more information regarding this welding flux see our detailed data sheet.

Base materials

General purpose structural steels, fine grained structural steels, medium and high tensile steels up to 500 MPa minimum yield strength.

Typical analysis of the weld metal

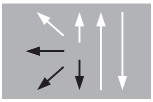
wt.-%	C	Si	Mn	Ni	Mo	S	P
wire	0.11	0.15	1.10	0.95	0.25	≤ 0.010	≤ 0.010
all-weld metal	0.08	0.20	1.30	0.95	0.25		

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C	-60°C
u, DC+	530 (≥500)	620 (≥570)	26 (≥22)	(≥180)	150 (≥100)	100 (≥70)
a1, DC+	490 (≥470)	600 (≥550)	26 (≥22)	(≥180)	160 (≥120)	110 (≥80)

u untreated, as welded ; a1 = 1 hour 620 °C

Operating data



Polarity DC+ (AC)

Dimension mm
2.5
3.2
4.0

Preheating and interpass temperature as required by the base metal.

Approvals

-

Union S 2 NiMo 1 - UV 420 TTR-C

SAW wire/flux-combination, low-alloyed, high strength

SAW

Classifications

EN ISO 14171-A	AWS A5.23 / SFA-5.23
S 50 6 FB SZ2Ni1Mo	F8A8-ENi1-Ni1 - F8P8-ENi1-Ni1

Characteristics and typical fields of application

Union S 2 NiMo 1 - UV 420 TTR-C is a wire flux combination for submerged arc welding of unalloyed and low alloyed steel grades. It is mainly recommended for weldments that will be exposed to a normalising / quenching heat treatment (N+A / Q +A).

UV 420 TTR-C is agglomerated fluoride basic flux with the special feature of a Carbon support resulting in a compensated Carbon loss (when combined with Union S 2 NiMo 1). Detailed information about the flux can be found in the separate datasheet of the flux.

Base materials

General purpose structural steels, fine grained structural steels, medium and high tensile steels up to 460 MPa minimum yield strength.

Typical analysis of the weld metal

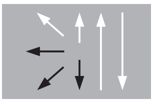
wt.-%	C	Si	Mn	Ni	Mo	S	P
wire	0.11	0.15	1.10	0.95	0.25	≤ 0.010	≤ 0.010
all-weld metal	0.09	0.25	1.30	0.93	0.25	≤ 0.010	≤ 0.012

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -60°C	-40°C	-20°C
u, DC+	560 (≥ 520)	640 (550-690)	25 (≥ 20)	120 (≥ 47)	135 (≥ 60)	175 (≥ 75)
a1, DC+	≥ 500	≥ 590	≥ 20	≥ 47	≥ 60	≥ 75
a2, DC+	575	665	23	45	75	135

u untreated, as welded ; a1 = 1 hour 620 °C ; a2 = 25 min 920 °C + water + 50 min 620 °C + air

Operating data



Polarity DC +

Dimension mm
2.5
3.2
4.0

Preheating and interpass temperature as required by the base metal.

Approvals

-

BÖHLER SUBARC T60 - UV 419 TT-W

SAW wire/flux combination, low alloyed, high strength

Classifications

EN ISO 14171-A	AWS A5.23 / SFA-5.23
S 50 6 FB TZ3Ni1 H5	F8A8-ECNi1-Ni1

Characteristics and typical fields of application

BÖHLER SUBARC T60 - UV 419 TT-W is a wire - flux combination submerged arc welding of high-strength, quenched and tempered fine grained structural steels up to MSYS = 500 MPa. The basic-cored wire provides weld metal with good toughness properties at low temperatures (-60ºC), a fine bead appearance and good wetting properties, together with good slag detachability and low hydrogen content in the weld metal (< 5 ml/100g acc. to EN ISO 3690) characterize this wire/flux combination. With a Nickel content below 1% this wire-flux combination meets the NACE-requirements and can be used for sour gas applications. The seamless coppered wire is not sensitive to moisture pick up, has a good resistance to deformation (wire feed rollers) and is very easy to straighten to ensure the best current transfer with low contact tip consumption.

UV 419 TT-W is a flux with high basicity index and has been designed to be applied in unlimited thickness for a low level of diffusible hydrogen (to decrease the risk of cold cracking). The flux features a neutral metallurgical behavior.

Base materials

Constructional steels, pipe- and vessel steels, cryogenic fine-grained steels and special grades

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 the weld metal

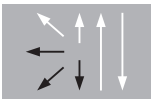
wt.-%	C	Si	Mn	Ni	Mo
all-weld metal	0.06	0.4	1.7	0.9	0.16

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -60 °C	-40 °C
u, DC+	575 (≥ 500)	650 (610-690)	25 (≥ 20)	90 (≥ 50)	120 (≥ 70)

u untreated, as welded

Operating data



Polarity DC + (AC)

Dimension mm
2.0
2.4
3.2
4.0

Approvals

-

Union S 3 NiMo 1 - UV 421 TT

SAW wire/flux combination, low-alloyed, high strength

Classifications

EN ISO 26304-A	AWS A5.23 / SFA-5.23
S 55 6 FB S3Ni1Mo	F9A8-EF3-F3

Characteristics and typical fields of application

Union S 3 NiMo 1 - UV 421 TT is a wire flux combination for submerged arc welding non-alloyed and low-alloyed steel grades with high strength. Very good impact toughness of weld metal at low temperatures. Very good slag detachability also for narrow gap welding. It is suitable for single (DC) and tandem (DC and AC) welding. Applications can be found in as welded condition (e.g. off shore) and PWHT condition (pressure vessels).

UV 421 TT is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour. For more information regarding this sub-arc welding flux see our detailed data sheet.

Base materials

Quenched and tempered fine-grained steels

S460N, S460M, S460NL, S460ML, S460Q-S555Q, S460QL-S550QL, S460QL1-S550QL1, P460N, P460NH, P460NL1, P460NL2, 20MnMoNi4-5, 15NiCuMoNb5-6-4, L415NB, L415MB-L555MB, L415QB-L555QB, alform 500 M, aldur 500 Q, 500 QL, 500 QL1, aldur 550 Q, 550 QL, 550 QL1, ASTM A572 Gr. 65; A633 Gr. E; A738 Gr. A; A852; API 5 L X60 - X80, X60Q, X65Q, X70Q, X80Q

Typical analysis of the weld metal

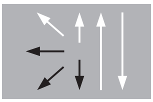
wt.-%	C	Si	Mn	Ni	Mo
wire	0.12	0.20	1.75	0.95	0.55
all-weld metal	0.08	0.20	1.55	0.90	0.55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C	-40°C	-20°C	20°C
u, DC+	≥ 560	≥ 640	≥ 20	≥ 47	≥ 70	≥ 120	≥ 140
a1, DC+	≥ 560	≥ 640	≥ 20	≥ 47	≥ 70	≥ 120	≥ 140

u untreated, as welded ; a1 = 2 hours 560 - 620 °C

Operating data



Polarity DC / AC

Dimension mm
1.6
2.0
2.5
3.0
3.2
4.0

Preheating and interpass temperature: 180 – 220ºC

Approvals

TÜV (10425), LR, DNV GL, CE

SAW

Union S 3 NiMo 1 - UV 419 TT-W

SAW wire/flux combination, low-alloyed, high strength

Classifications

EN ISO 26304-A	**AWS A5.23 / SFA-5.23**
S 55 6 FB S3Ni1Mo	F9A8-EF3-F3 / F9P8-EF3-F3

Characteristics and typical fields of application

Union S 3 NiMo 1 - UV 419 TT-W is a wire flux combination for submerged arc welding non-alloyed and low-alloyed steel grades with high strength. Very good impact toughness of weld metal at low temperatures. Very good slag detachability also for narrow gap welding. It is suitable for single (AC or DC) and tandem (DC and AC) welding. Applications can be found in as welded condition (e.g. off shore) and PWHT condition (pressure vessels).

UV 419 TT-W is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour. For more information regarding this sub-arc welding flux see our detailed data sheet.

Base materials

Quenched and tempered fine-grained steels

S460N, S460M, S460NL, S460ML, S460Q-S555Q, S460QL-S550QL, S460QL1-S550QL1, P460N, P460NH, P460NL1, P460NL2, 20MnMoNi4-5, 15NiCuMoNb5-6-4, L415NB, L415MB-L555MB, L415QB-L555QB, alform 500 M, aldur 500 Q, 500 QL, 500 QL1, aldur 550 Q, 550 QL, 550 QL1,

ASTM A572 Gr. 65; A633 Gr. E; A738 Gr. A; A852; API 5 L X60 - X80, X60Q, X65Q, X70Q, X80Q

Typical analysis of the weld metal

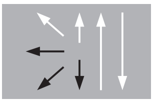
wt.-%	C	Si	Mn	Ni	Mo
wire	0.12	0.20	1.75	0.95	0.55
all-weld metal	0.08	0.25	1.60	0.90	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -60°C	-40°C
u, DC+	580 (≥ 550)	690 (≥ 640)	24 (≥ 20)	70 (≥ 47)	90
a1, DC+	560 (≥ 550)	670 (≥ 640)	25 (≥ 20)	70 (≥ 47)	90

u untreated, as welded; a1 = 2 hours 560 -620 °C

Operating data



Polarity	DC / AC

Dimension mm
1.6
2.0
2.5
3.0
3.2
4.0

Preheating and interpass temperature: 180 – 220ºC

Approvals

-

Union S 3 NiMo 1 - UV 420 TTR

SAW wire/flux combination, low-alloyed, high strength

Classifications

EN ISO 26304-A	AWS A5.23 / SFA-5.23
S 55 4 FB S3Ni1Mo	F9A8-EF3-F3-N / F9P8-EF3-F3-N

Characteristics and typical fields of application

Union S 3 NiMo 1 - UV 420 TTR is a wire flux combination for submerged arc welding of unalloyed and low alloyed steel grades. The wire / flux combination Union S 3 NiMo 1 – UV 420 TTR is extensively used for the manufacturing of nuclear pressure vessels and also used in oil and gas industry for the welding of high strength low alloy steel grades where good strength and toughness properties are required with controlled hardness levels. Excellent weldability, good slag detachability and side wall fusion and a nice bead appearance. It is mostly applied in single wire technique on DC+ polarity.

UV 420 TTR is an agglomerated fluoride-basic flux with high basicity with neutral metallurgical behavior and characterised by a high degree of purity. Detailed information in separate datasheet of the flux.

Base materials

Reactor structural steels such as 22 NiMoCr 37, 20 MnMo 44, 20 MnMoNi 55, 15NiCuMoNb5-6-4, WB 36, Welmonil 35, Welmonil 43, GS-18 NiMoCr 37, tested acc. to KTA 1408.

Quenched and tempered fine-grained steels S460N, S460M, S460NL, S460ML, S460Q-S555Q, S460QL-S550QL, S460QL1-S550QL1, P460N, P460NH, P460NL1, P460NL2, L415NB, L415MB-L555MB, L415QB-L555QB, alform 500 M, aldur 500 Q, 500 QL, 500 QL1, aldur 550 Q, 550 QL, 550 QL1, ASTM A572 Gr. 65; A633 Gr. E; A738 Gr. A; A852; API 5 L X60 - X80, X60Q, X65Q, X70Q, X80Q

SAW

Typical analysis of the weld metal

wt.-%	C	Si	Mn	Ni	Mo	S	P
wire	0.12	0.20	1.75	0.95	0.55		
all-weld metal	0.08	0.25	1.70	0.90	0.55	≤ 0.010	≤ 0.014

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Tensile test Temperature °C	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C	-40°C	-20°C	0°C	20°C
u	+20°C	≥ 560	≥ 680	≥ 22	≥ 47	≥ 70	≥ 100	≥ 120	≥ 140
a1	+20°C	≥ 560	≥ 660	≥ 22	≥ 47	≥ 70			≥ 140
a1	+350°C	≥ 420	≥ 590	≥ 24					
a1	+550°C	≥ 290	≥ 410	≥ 25					
a2	+20°C	≥ 560	≥ 630	≥ 22	≥ 47	≥ 80			≥ 140
a3	+20°C	≥ 500	≥ 620	≥ 24					≥ 140
a3	+350°C	≥ 420	≥ 580	≥ 24					
a3	+550°C	≥ 190	≥ 330	≥ 32					

u = as welded; a1 = 2 hours 600 °C ; a2 = 20 hours 620°C ; a3 = 60 hours 550 °C + 40 hours 620 °C + air

Operating data

Polarity DC +

Dimension mm
2.5
3.0
3.2
4.0

SAW – single wire process DC+ ; Preheating and Interpass temp.: 180 – 240ºC ; Heat Input < 2.3 kJ/mm.

Approvals

TÜV (03021 / 08015), CE

böhler welding by voestalpine

Union S 3 NiMo 1 - UV 422 TT-LH

SAW wire/flux combination, low-alloyed, high strength

Classifications

EN ISO 26304-A	AWS A5.23 / SFA-5.23
S 55 6 FB S3Ni1Mo H5	F9A8-EF3-F3

Characteristics and typical fields of application

Union S 3 NiMo 1 - UV 422 TT-LH is a wire flux combination for submerged arc welding non-alloyed and low-alloyed steel grades with high strength. Very good impact toughness of weld metal at low temperatures. Very good slag detachability also for narrow gap welding. Applications can be found in as welded condition (e.g. off shore) with very low hydrogen level.

UV 422 TT-LH is an agglomerated fluoride-basic flux with high basicity, neutral metallurgical behavior and very low level of diffusible hydrogen. For information regarding this welding flux see our detailed data sheet.

Base materials

Quenched and tempered fine-grained steels

S460N, S460M, S460NL, S460ML, S460Q-S550Q, S460QL-S550QL, S460QL1-S550QL1, P460N, P460NH, P460NL1, P460NL2, 20MnMoNi4-5, 15NiCuMoNb5-6-4, L415NB, L415MB-L555MB, L415QB-L555QB, alform 460-500M, aldur 500Q-550Q, 500 QL, 500 QL1, 550 QL, 550 QL1,

ASTM A572 Gr. 65; A633 Gr. E; A738 Gr. A; A852; API 5 L X60 - X80, X60Q, X65Q, X70Q, X80Q

Typical analysis of the weld metal

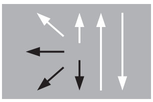
wt.-%	C	Si	Mn	Ni	Mo
wire	0.12	0.20	1.75	0.95	0.55
all-weld metal	0.07	0.45	1.65	0.90	0.55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -60°C	-40°C	-20°C
u, DC+	575 (≥550)	690 (640-760)	25 (≥22)	75 (≥47)	100 (≥65)	120
a1, DC+	560 (≥540)	655 (620-760)	27 (≥22)	80 (≥47)	110 (≥70)	135

u untreated, as welded ; a1 = 2 hours 620 °C

Operating data



Polarity DC +

Dimension mm
1.6
2.0
2.5
3.0
3.2
4.0

Preheating and interpass temperature: 180 – 220°C

Approvals

-

SAW

Union S 3 NiMo 1 - UV 420 TTR-C

SAW wire/flux combination, low-alloyed, high strength

Classifications

EN ISO 26304-A	AWS A5.23 / SFA-5.23
S 62 4 FB S3Ni1Mo	F10A6-EF3-F3 H4 / F9P6-EF3-F3 H4

Characteristics and typical fields of application

Union S 3 NiMo1 - UV 420 TTR-C is a wire flux combination for submerged arc welding of un-alloyed and low alloyed high strength steel grades. It is applied in high strength applications in oil and gas industry. Especially in joining castings, forgings and pipe connections in steel grades like AIS 4130 and 8630 that need a PWHT at relative high temperatures (e.g. 630 – 660ºC) for long (cumulative) duration. It is suitable for welding procedures with single wire with DC+ and tandem (DC+ and AC) welding.

UV 420 TTR-C has the special feature of a Carbon support resulting in a reduced loss in C% (when combined with Union S 3 NiMo 1). Mostly not recommended for applications in as welded condition. Detailed information about the flux can be found in the separate datasheet of the flux.

Base materials

For joining and surfacing applications in forging parts in F22, AISI 8630, AISI 4130, and dissimilar joints to pipe grades API 5L – X75 and X80.

Typical analysis of the weld metal

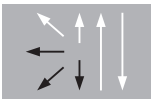
wt.-%	C	Si	Mn	Ni	Mo	S	P
wire	0.12	0.20	1.75	0.95	0.55		
all-weld metal	0.10	0.30	1.75	0.95	0.55	< 0.012	≤ 0.015

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -51°C	-40°C	-20°C
u, DC+	≥ 620	≥ 690	≥ 18	≥ 27	≥ 47	≥ 100
a1, DC+	≥ 590	≥ 690	≥ 18	≥ 47	≥ 70	≥ 100
a2, DC+	≥ 550	≥ 660	≥ 18	≥ 47	≥ 70	≥ 100

u untreated, as welded ; a1 = 2 hours 620 °C ; a2 = 8 hours 660 °C

Operating data



Polarity DC +

Dimension mm
1.6
2.0
2.5
3.0
3.2
4.0

Preheating and interpass temperature: 180 – 240ºC

Approvals

-

Union S Ni1MoCr - UV 420 TTR-C

SAW wire/flux combination, low-alloyed, high strength

Classifications

EN ISO 26304-A	AWS A5.23
S 62 4 FB SZ3Ni0,9MoCr	F10A6-EG-G / F9P6-EG-G

Characteristics and typical fields of application

Union S Ni1MoCr - UV 420 TTR-C is a wire flux combination for submerged arc welding of low alloyed high strength steel grades. It is applied in high strength applications in oil and gas industry (sour service Ni < 1%, + PWHT). Especially for joining castings, forgings and pipe connections in steel grades like AIS 4130 and 8630 that need a PWHT at relative high temperatures (e.g. 630 – 660ºC) for long (cumulative) duration.

UV 420 TTR-C is agglomerated fluoride basic flux with the special feature of a Carbon support resulting in a compensated Carbon loss (when combined with Union S Ni1MoCr. Mostly not recommended for applications in as welded condition. Detailed information about the flux can be found in the separate datasheet of the flux.

Base materials

For joining and surfacing applications in forging parts in F22, AISI 8630, AISI 4130, and dissimilar joints to pipe grades API 5L – X75 and X80.

Typical analysis of the weld metal

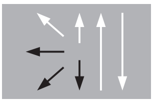
wt.-%	C	Si	Mn	Cr	Ni	Mo
wire	0.10	0.55	1.55	0.25	0.95	0.50
all-weld metal	0.09	0.50	1.70	0.24	0.90	0.45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C	-50°C	-40°C
u, DC+	650 (≥620)	760 (700-830)	20 (≥18)	40	50 (≥27)	65 (≥47)
a1, DC+	625 (≥610)	720 (690-830)	21 (≥18)	40	50 (≥27)	65 (≥47)
a2, DC+	580	670	23 (≥18)	40		70 (≥47)
a3, DC+	580	670	24 (≥18)	40		70 (≥47)

u untreated, as welded ; a1 = 1 hour 620 °C ; a2 = 4 hours 650 °C ; a3 = 6 hours 660 °C

Operating data



Polarity DC+

Dimension mm
2.5
3.2

Preheating and interpass temperature depending on the base metal

General recommendation: 180 – 240ºC

Approvals

-

SAW

Union S 3 NiMo - UV 420 TTR

SAW wire/flux combination, low-alloyed, high strength

Classifications

EN ISO 26304-A	**AWS A5.23 / SFA-5.23**
S 50 6 FB S3Ni1,5Mo	F9A8-EG-F1 / F8P9-EG-F1

Characteristics and typical fields of application

Union S 3 NiMo - UV 420 TTR is a wire flux combination for submerged arc welding of un and low-alloyed steel grades. It is suitable for single (DC) and tandem (DC and AC) welding. Very good slag detachability also for narrow gap welding. Flux can especially be used for multi-pass butt welding of medium tensile steels. Very good impact toughness of weld metal at low temperatures.

UV 420 TTR is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour. For more information regarding this welding flux see our detailed data sheet.

Base materials

Quenched and tempered fine-grained steels

S460N, S460M, S460NL, S460ML, S460Q - S555Q, S460QL1 - S550QL1, P460N, P460NH, P460NL1, P460NL2, L415NB, L415MB - L555MB, L415QB - L555QB, alform 500 M, alform 550 M, aldur 500 Q, 500 QL, 500 QL1, aldur 550 Q, 550 QL, 550 QL120MnMoNi4-5, 15NiCuMoNb5-6-4,.

ASTM A572 Gr. 65; A633 Gr. E; A738 Gr. A; A852; API 5 L X60, X65, X70, X80, X60Q, X65Q, X70Q, X80Q

SAW

Typical analysis of the weld metal

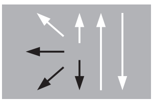
wt.-%	C	Si	Mn	Ni	Mo	S	P
wire	0.09	0.10	1.60	1.50	0.45	≤ 0.012	≤ 0.012
all-weld metal	0.05	0.20	1.60	1.45	0.40	≤ 0.015	≤ 0.015

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -60°C	-40°C	-20°C	20°C
u, DC+	≥ 560	≥ 660	≥ 22	≥ 47	≥ 80	≥ 100	≥ 140
a1, DC+	≥ 560	≥ 660	≥ 22	≥ 47	≥ 47	≥ 100	≥ 150
a2, DC+	≥ 420	≥ 540	≥ 24				≥ 120

u untreated, as welded ; a1 = 2 hours 620 °C ; a2 = 920 °C + air + 2 hours 600 °C

Operating data



Polarity DC +

Dimension mm
3.0
4.0

Preheating and interpass temperature: 180 – 220 ºC

Approvals

TÜV (03442), CE

Union S 3 NiMoCr - UV 421 TT

SAW wire/flux combination, low-alloyed, high strength

Classifications

EN ISO 26304-A	AWS A5.23 / SFA-5.23
S 69 6 FB SZ3Ni2,5CrMo	F11A8-EG-F6

Characteristics and typical fields of application

Union S 3 NiMoCr – UV 421 TT is a wire – flux combination for Submerged Arc Welding of high strength steel grades. Very good slag detachability also for narrow gap welding.

UV 421 TT is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour. For more information regarding this sub-arc welding flux see our detailed data sheet.

Base materials

Fine grained structural steels, especially for HT steels with yield strength up to 690 MPa.

Typical analysis of the weld metal

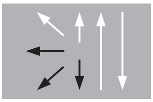
wt.-%	C	Si	Mn	Cr	Ni	Mo
wire	0.14	0.05	1.75	0.35	2.10	0.60
all-weld metal	0.08	0.15	1.60	0.32	2.00	0.58

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -60°C	-40°C	-20°C	20°C
u, DC+	≥ 690	≥ 770	≥ 17	≥ 47	≥ 60	≥ 80	≥ 120

u untreated, as welded

Operating data



Polarity DC / AC

Dimension mm
2.0
2.4
2.5
3.0
4.0

Preheating and interpass temperature as required by the base material: 150 – 180ºC

Heat Input < 2.0 kJ/mm

Approvals

TÜV (05063), ABS, BV, DB (51.132.06), DNV GL, LR, CE

Union S 3 NiMoCr - UV 422 TT-LH

SAW wire/flux combination, low-alloyed, high strength

Classifications

EN ISO 26304-A
S 69 6 FB SZ3Ni2,5CrMo H5

AWS A5.23 / SFA-5.23
F11A8-EG-F6-H4

Characteristics and typical fields of application

Union S 3 NiMoCr - UV 422 TT-LH is a wire-flux combination for submerged arc welding of high strength steel grades. This combination is recommended for overmatching strength requirements in S690 applications, combined with the highest requirements to charpy toughness. Very low amount of diffusible hydrogen (ISO 3690). Applications in the off shore construction (jack up rigs), heavy cranes, and pressure pipes in pumped-storage hydropower plants and other high strength applications.

UV 422 TT-LH is an agglomerated fluoride-basic flux with high basicity, neutral metallurgical behavior and very low level of diffusible hydrogen. For information regarding this welding flux see our detailed data sheet.

Base materials

Fine grained structural steels, especially for steel grades with yield strength 690 MPa (overmatching); S690QL1, S770QL1, Alform 700 M.

Typical analysis of the weld metal

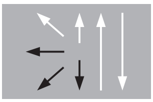
wt.-%	C	Si	Mn	Cr	Ni	Mo
wire	0.14	0.05	1.75	0.35	2.10	0.60
DC+	0.07	0.35	1.65	0.35	2.0	0.57
AC	0.11	0.30	1.65	0.35	2.0	0.55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C	-80°C	-40°C	-20°C	20°C
u, DC+	780 (≥ 760)	835 (≥ 820)	19 (≥ 17)	100 (≥ 69)	80 (≥ 27)	105	117	125
a1, DC+	750 (≥ 720)	850 (≥ 800)	21 (≥ 18)	77 (≥ 47)			101	119
a2, DC+	760 (≥ 720)	850 (≥ 800)	21 (≥ 18)	61 (≥ 27)			96	115
u, AC	830 (≥ 760)	935 (≥ 820)	18	110 (≥ 69)				

u untreated, as welded; a1 = 1 hour 580 °C ; a2 = 5 hours 560 °C

Operating data



Polarity DC + (AC)

Dimension mm
2.0
2.4
3.0
4.0

Approvals

-

SAW

BÖHLER SUBARC T80 HP - UV 422 TT-LH

SAW-flux cored wire/flux combination, high strength

Classifications

EN ISO 26304-A	AWS A5.23 / SFA-5.23
S 69 6 FB TZ H5	F11A10-ECF5-F5 / F11P6-ECF5-F5

Characteristics and typical fields of application

SUBARC T80 HP - UV 422 TT-LH is a wire flux combination for joint welding of high-strength, quenched and tempered fine grained structural steels up to MSYS = 690 MPa. The weld metal demonstrates very good toughness at low temperatures and strength properties, which allows to weld with relative high heat-input at high welding speed resulting in high productivity with a good bead appearance, nice fusion and good slag detachability. The wire has a high deposit rate (~13 kg/hr for single wire 3,2 mm, 750 Amp, DC+). The seamless coppered wire is not sensitive to moisture pick up, has a good resistance to deformation (wire feed rollers) and is very easy to straighten to ensure the best current transfer with low contact tip consumption. Low level of diffusible hydrogen (max 5 ml/100 gr according to ISO 3690).

UV 422 TT-LH is an agglomerated fluoride-basic flux with high basicity, neutral metallurgical behavior and very low level of diffusible hydrogen. For information regarding this welding flux see our detailed data sheet.

Base materials

S690Q,QL,QL1; S770QL1, alform plate 620 M, 700 M, aldur 620Q, aldur 700Q, 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 analysis of the weld metal

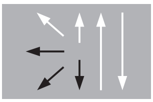
wt.-%	C	Si	Mn	Cr	Ni	Mo
all-weld metal	0.05	0.3	1.6	0.3	2.7	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60 °C	-51 °C	0 °C
u, DC+	730 (≥ 690)	790 (770-900)	20 (≥ 17)	80 (≥ 69)	100 (≥ 69)	140 (≥ 90)

u untreated, as welded

Operating data



Polarity DC +

Dimension mm
2.4
3.2
4.0

Mechanical properties depend on thermal weld cycle and dilution.

Approvals

In preparation (CE, ABS, DNV GL, LRS)

SAW

BÖHLER SUBARC T85 - UV 422 TT-LH

SAW-flux cored wire/flux combination, high strength

Classifications

EN ISO 26304-A	**AWS A5.23 / SFA-5.23**
S 79 5 FB TZ H5	F12A6-EC-F5-H4

Characteristics and typical fields of application

SUBARC T85 - UV 422 TT-LH is a wire flux combination for joint welding of high-strength, quenched and tempered fine grained structural steels up to MSYS = 770 MPa. The wire is basic flux cored. The combination is targeted for applications with overmatching strength requirements. Superior bead appearance and good wetting properties, together with good slag detachability characterize this wire/flux combination. The seamless coppered wire is not sensitive to moisture pick up, has a good resistance to deformation (wire feed rollers) and is very easy to straighten to ensure the best current transfer with low contact tip consumption.

UV 422 TT-LH is an agglomerated fluoride-basic flux with high basicity, neutral metallurgical behavior and very low level of diffusible hydrogen. For information regarding this welding flux see our detailed data sheet.

Base materials

S690Q,QL,QL1; S770QL1, alform plate 620 M, 700 M, aldur 620Q, aldur 700Q, 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 analysis of the weld metal

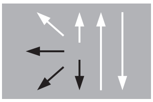
wt.-%	C	Si	Mn	Cr	Ni	Mo
all-weld metal	0.07	0.4	1.6	0.5	2.3	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C	-51°C	-40°C
u, DC+	830 (≥ 800)	860 (≥ 830)	20 (≥ 17)	47	55 (≥ 27)	70 (≥ 47)
a1, DC+	780 (≥ 750)	840 (≥ 800)	20 (≥ 17)	-	-	40

u untreated, as welded; a1 = 2 hours 580 °C

Operating data



Polarity DC +

Dimension mm
2.4
3.2
4.0

Mechanical properties depend on thermal weld cycle and dilution.

Approvals

-

BÖHLER SUBARC T95 HP - UV 422 TT-LH

SAW-flux cored wire/flux combination, high strength

Classifications

EN ISO 26304-A	AWS A5.23 / SFA-5.23
S 89 4 FB TZ H5	F13A6-ECG-G

Characteristics and typical fields of application

SUBARC T95 HP - UV 422 TT-LH is a wire flux combination for joint welding of high-strength, quenched and tempered fine grained structural steels up to MSYS = 890 MPa.

The special design of the wire gives the special benefit to weld with relative high deposit rate at a relative low welding current. Advantage are better welding characteristics at relative fast thermal cycle, with nice bead appearance, fusion and good slag detachability.

The seamless coppered wire is not sensitive to moisture pick up, has a good resistance to deformation (wire feed rollers) and is very easy to straighten to ensure the best current transfer with low contact tip consumption. Low level of diffusible hydrogen (max 5 ml/100 gr according to ISO 3690).

UV 422 TT-LH is an agglomerated fluoride-basic flux with high basicity, neutral metallurgical behavior and very low level of diffusible hydrogen. For information regarding this welding flux see our detailed data sheet.

Base materials

S890Q,QL,QL1.

Typical analysis of the weld metal

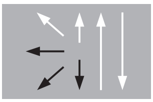
wt.-%	C	Si	Mn	Cr	Ni	Mo
all-weld metal	0.07	0.4	1.7	0.5	2.7	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -51 °C	-40 °C	20 °C
u, DC+	910 (≥ 890)	970 (940–1035)	16 (≥ 15)	60 (≥ 27)	70 (≥ 47)	90 (≥ 47)

u untreated, as welded

Operating data



Polarity DC +

Dimension mm
2.4
3.2

Mechanical properties depend on thermal weld cycle and dilution.

Approvals

-

BÖHLER NiCu1 Ti T-FD

Flux cored wire, seamless, weather resistant, rutile type

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 46 4 Z P M21 1 H5	E81T1-M21A4-GH4

Characteristics and typical fields of application

Seamless rutile, Nickel-Copper alloyed, flux cored wire for single- or multilayer welding of atmospheric corrosion resistant steels with Ar-CO_2 shielding gas. Main features: excellent weldability, good bead appearance and easy slag removal.

Base materials

S235JRG2Cu, S235J2G4Cu, S235J0Cu, S235JRW, S355J0Cu, S355J2G3Cu, S355J0W, 235J2W-S355J2W, S355K2W, Cor-ten A, Patinax 37

ASTM A 588 Gr. A, B, C, K; A 618 Gr. II; 709 Gr. C

Typical analysis of the wire

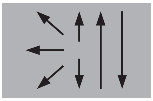
	Gas	C	Si	Mn	Ni	Cu
wt.-%	-	0.05	0.40	1.20	1.20	0.40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40 °C
u	530 (≥ 470)	620 (550–680)	25 (≥ 20)	70 (≥ 47)

u untreated, as welded – shielding gas M21

Operating data



		Dimension mm
Polarity	DC +	1.0
Shielding gas (EN ISO 14175)	(EN ISO 14175) M21	1.2
		1.4
		1.6

Welding with standard GMAW power source possible

Approvals

CE

FCW

BÖHLER Kb NiCu1 T-FD

Flux cored wire, seamless, weather resistant, basic type

Classifications

EN ISO 17632-A	**AWS A5.36 / SFA-5.36**
T 46 6 Z B M21 3 H5	E80T5-M21A8-GH4

Characteristics and typical fields of application

Seamless basic, Copper-Nickel alloyed, flux cored wire for single- or multilayer welding of corrosion resistant steels with Ar-CO_2 shielding gas.

Features include: excellent weldability in flat and horizontal positions, smooth and bright bead, low spatter losses, easy to remove slag and exceptional mechanical properties at low temperatures (-60ºC).

Base materials

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 analysis of the wire

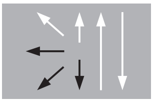
	Gas	C	Si	Mn	Ni	Cu
wt.-%	-	0.05	0.45	1.20	1.20	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C
u	480 (≥ 470)	570 (550–680)	30 (≥ 20)	130 (≥ 47)

u untreated, as welded – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.0
1.2
1.4
1.6

Welding with conventional or pulsed power sources using DC+

Approvals

CE

FCW

BÖHLER NiCu1 T-MC

Metal cored wire, seamless, weather resistant

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 46 6 Z M M21 1 H5	E80T15-M21A8-GH4

Characteristics and typical fields of application

Seamless, Nickel-Copper alloyed, metalcored wire for singleor multilayer welding of corrosion resistant steels with Ar-CO_2 shielding gas.

Features include: high yield, good weldability, excellent bead appearance, low spatter losses and exceptional mechanical properties at low temperatures. This wire is especially suitable for bridge constructions and chimney.

Base materials

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

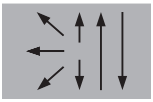
Typical analysis of the wire

	Gas	C	Si	Mn	Ni	Cu
wt.-%	-	0.06	0.45	1.20	0.50	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -40°C	-60°C
u	490 (≥ 470)	590 (550–680)	27 (≥ 20)	100	70 (≥ 47)

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2
1.6

Welding with standard GMAW-facilities possible

Approvals

CE

BÖHLER X96 L-MC

metal cored wire, seamless, high strength

Classifications

EN ISO 18276-A	AWS A5.36 / SFA A5.36
T89 4 ZMn2NiCrMo M M21 1 H5	E131T15-M21A4-K4-H4

Characteristics and typical fields of application

BÖHLER X96 L-MC metal cored wire manufactured with seamless laser technology is developed for shielded arc welding of thermo mechanically and quenched and tempered produced fine grained structural steels. A balanced metallurgy combined with a very precise production technology results in high strength combined with very good toughness behaviour and excellent welding behaviour. This seamless tubular wire possesses higher rigidity – as a result it offers exact ignition and excellent feeding characteristic. Due to the manufacturing technology metal cored wire ensures lowest diffusible hydrogen content of < 2 ml / 100g. This metal cored wire is designed for welding under mixture gas (Ar + CO_2) in PA and PB-position. Good results were also achieved after using alternative gases, 8 – 10 % CO_2 + Ar and different welding positions (PG). This filler material is used for high strength steel constructions and also for crane and vehicle manufacturing.

Base materials

S960 and higher grades

Typical analysis of the wire

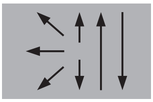
	Gas	C	Si	Mn	Cr	Ni	Mo
wt.-%	M21	0.06	0.7	1.9	0.6	2.2	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J +20°C	-40°C
u	980 (≥890)	1020 (940-1180)	16 (≥15)	80	60 (≥47J)

u untreated, as welded – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Preheating and interpass temperature as required by the base material

Approvals

TÜV, DB, CE

FCW

BÖHLER X90 L-MC

Metal-cored wire, seamless, high-strength

Classifications

EN ISO 18276-A	**AWS A5.36 / SFA A5.36**
T89 5 ZMn2NiCrMo M M21 1 H5	E131T15-M21A6-K4-H4

Characteristics and typical fields of application

BÖHLER X90 L-MC metal cored wire, manufactured with seamless laser technology, is developed for shielded arc welding of thermo mechanically and quenched and tempered produced fine grained structural steels. A balanced metallurgy combined with a very precise production technology results in high strength combined with very good toughness behaviour and excellent welding performance. This tubular wire possesses higher rigidity – as a result it offers exact ignition and excellent feeding characteristic. Due to the manufacturing technology, this metal cored wire ensures low diffusible hydrogen content of < 2 ml / 100g weld metal. This metal cored wire is designed for welding under mixture gas (Ar + CO_2) in PA and PB-position. Good results were also achieved after using alternative gases, 8 – 10 % CO_2 + Ar and different welding positions (PG). This filler material is used for high strength steel constructions, crane and vehicle manufacturing, for ship building, offshore applications.

Base materials

S890 and higher strength grades, thermo mechanically treated and quenched and tempered fine grain steels

S890Q, S890QL, XABO 90, QX 1002, ASTM A 709 Gr. 100 Type B, E, F, H, Q, HPS 100W

Typical analysis of the wire

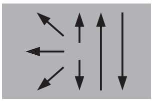
	Gas	C	Si	Mn	Cr	Ni	Mo
wt.-%	M21	0.06	0.7	1.9	0.5	2.1	0.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ Mpa	Tensile strength R_m Mpa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J +20°C	Hardness -50°C
u	920 (≥890)	980 (940-1180)	17 (≥15)	80	70 (≥47)

u untreated, as welded – shielding gas M21

Operating data



Polarity	DC +	
Shielding gas (EN ISO 14175)	M21	

Dimension mm
1.2

Preheating and interpass temperature as required by the base material

Approvals

TÜV, DB, CE

BÖHLER X70 L-MC

Metal-cored wire, seamless, high-strength

Classifications

EN ISO 18276-A	AWS A5.36 / SFA A5.36
T69 6 Mn2NiCrMo M M21 1 H5	E110T15-M21A8-K4-H4

Characteristics and typical fields of application

The BÖHLER X70 L-MC metal cored wire manufactured with seamless laser technology is developed for shielded arc welding of thermo mechanically and quenched and tempered fine grained structural steels. The metallurgy combined with a very precise production technology results in high strength combined with very good toughness behaviour and excellent welding performance. This tubular wire possesses higher rigidity – as a result it offers exact ignition and excellent feeding characteristic. Due to the manufacturing technology, this metal cored wire ensures low diffusible hydrogen content of <2 ml / 100g. This metal cored wire is designed for welding under mixture gas (Ar + CO_2) in PA and PB-position. Good results were also achieved after using alternative gases CO_2, 8 – 10 % CO_2 + Ar and different welding positions (PG). This filler material is used for high strength steel constructions, crane and vehicle manufacturing, for ship building, offshore applications and also for penstocks

Base materials

thermo mechanically treated and quenched and tempered fine grain steels up to 690 MPa.

S550Q-S690Q, S550QL-S690QL, P550Q-P690Q, P550QL-P690QL

ASTM A 514 Gr. F, H, Q ; A 709 Gr. 100 Type E, F, H, Q; A 709 Gr. HPS 100W

Typical analysis of the wire

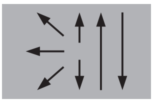
	Gas	C	Si	Mn	Cr	Ni	Mo
wt.-%	-	0.07	0.7	1.6	0.35	2.0	0.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ Mpa	Tensile strength R_m Mpa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C	-60°C
u	770 (≥690)	830 (770-900)	19 (≥17)	130	85 (≥47)

u untreated, as welded – shielding gas Ar + 18 % CO_2

Operating data



		Dimension mm
Polarity	DC +	1.0
Shielding gas (EN ISO 14175)	M21; M20	1.2
		1.6

Preheating and interpass temperature as required by the base metal

Approvals

TÜV, DB, DNV GL, CWB, CE

BÖHLER Ti 60 T-FD

Flux cored wire, seamless, high strength, rutile type

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 50 6 1Ni P M21 1 H5	E81T1-M21A8-Ni1-H4

Characteristics and typical fields of application

Seamless rutile, Nickel alloyed, flux cored wire for single- or multilayer welding of Carbon, Carbon-Manganese steels and high strength steels with Argon-CO_2. Main features: excellent weldability in all positions, excellent bead appearance, very low spatter losses, fast freezing and easy to remove slag. The exceptional mechanical properties of this wire even at low temperatures (-60ºC), also after post weld heat treatment make it especially suitable for offshore applications. The wire is CTOD tested at -10ºC. (14ºF) This product can be used in sour gas applications. (HIC tested acc. to NACE TM-0284). Test values for SSC are available upon request.

Base materials

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 the wire

	Gas	C	Si	Mn	Ni
wt.-%	M21	0.05	0.45	1.3	0.85

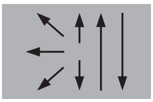
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C	-60°C
u	550 (≥ 500)	610 (560–690)	25 (≥ 19)	100	75 (≥ 47)
s	520 (≥ 500)	580 (560–690)	29 (≥ 19)	60	

u untreated, as welded – shielding gas M21
s stress relieved 550 -600°C / 2h – shielding gas M21

FCW

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21, M33

Dimension mm
1.0
1.2
1.4
1.6

Welding with standard GMAW-facilities possible

Approvals

TÜV , DB , DNV GL, ABS, LR, BV, RINA, RS, CWB, CE

BÖHLER Ti 60 T-FD (CO_2)

Flux cored wire, seamless, high strength, rutile type

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 46 4 1Ni P C1 1 H5	E81T1-C1A4-Ni1-H4

Characteristics and typical fields of application

Seamless rutile, nickel alloyed, flux-cored wire for singleor multilayer welding of carbon, carbon-manganese steels and high strength steels with pure CO_2 shielding gas. Main features: excellent weldability in all positions, excellent bead appearance, very low spatter losses and fast freezing and easy to remove slag.

The exceptional mechanical properties of this wire even at low temperatures make it especially suitable for offshore applications.

Base materials

S355JR, S355J0, S355J2, S450J0, S355N-S460N, S355NL-S460NL, S355M-S460M, S355ML-S460ML, S460Q, S460QL, P355GH, P355NH, P420NH, P460NH, P355N-P460N, P355NH-P460NH, L245NB-L415NB, L245MB-L485MB, L360QB-L485QB,

ASTM A 350 Gr. LF1; A 516 Gr. 65, 70; A 572 Gr. 42, 50, 60, 65; A 573 Gr. 65, 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; A 841 Gr. A, B, C; API 5 L X42, X52, X60, X65, X70, X52Q, X60Q, X65Q, X70Q

Typical analysis of the wire

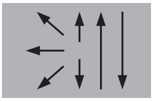
	Gas	C	Si	Mn	Ni
wt.-%	C1	0.07	0.35	1.1	0.85

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20°C	-40°C
u	550 (≥ 470)	620 (550–680)	24 (≥ 20)	110	80 (≥ 47)

u - untreated, as welded – shielding gas C1

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	C1

Dimension mm
1.2
1.4
1.6

Welding with standard GMAW-facilities possible

Approvals

TÜV , DNV GL, ABS, LR, CE

FCW

BÖHLER Ti 60 K2 T-FD (CO_2)

Flux cored wire, seamless, high strength, rutile type

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 50 6 1,5Ni P C1 1 H5	E81T1-C1A8-K2-H4

Characteristics and typical fields of application

High performance seamless rutile flux cored wire, for the welding of medium alloyed steel and for low temperature applications with pure CO_2 shielding gas. Main features: excellent weldability in all positions, fast freezing and easy removable slag, no spatter at low parameters, good mechanical properties also after long post weld heat treatment. The good mechanical properties of this wire even at the low temperature (–60ºC) as well as the low content of diffusible hydrogen make it especially suitable for offshore applications.

Base materials

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,

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 the wire

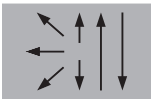
	Gas	C	Si	Mn	Ni
wt.-%	C1	0.04	0.3	1.2	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20°C	-40°C	-60°C
u	580 (≥ 500)	605 (≥ 560 – 690)	25 (≥ 18)	-	100	90 (≥47)
s	520	580	27	120	100	80
s1	500	570	29	110	90	70

u - untreated, as welded – shielding gas 100 % CO_2
s - stress relieved 635°C / 3h – shielding gas 100 % CO_2
s 1 stress relieved 635°C / 15h – shielding gas 100 % CO_2

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	C1

Dimension mm
1.2

Welding with standard GMAW-facilities possible

Approvals

ABS, BV, DNV GL, LR, RS

FCW

BÖHLER Ti 60 T-FD SR

Flux cored wire, seamless, high strength, rutile type

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 50 6 1Ni P M21 1 H5	E81T1-M21AP8-Ni1-H4

Characteristics and typical fields of application

Seamless rutile, Nickel alloyed, flux cored wire for single- or multilayer welding of carbon, carbon manganese steels and high strength steels with Ar-CO_2 shielding gas. Main features: excellent impact values at very low temperature (-60ºC) in as welded conditions and after post weld heat treatments, excellent weldability in all positions, very low spatter losses make it especially suitable for more special applications. CTOD tested at -10ºC (14ºF)

Base materials

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 the wire

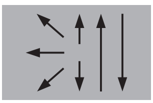
	Gas	C	Si	Mn	Ni
wt.-%	M21	0.07	0.45	1.3	0.85

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C	-60°C
u	520 (≥ 500)	600 (560–690)	25 (≥ 20)	120	100 (≥ 47)
s	500 (≥ 470)	580 (550–680)	29 (≥ 20)	120	90 (≥ 47)
s1	490 (≥470)	570 (550-680)	30 (≥20)	110	60 (≥47)

u - untreated, as welded – shielding gas M21
s - stress relieved 620°C / 2h – shielding gas M21
s1 - stress relieved 620°C / 6h – shielding gas M21

Operating data



Polarity	DC +	
Shielding gas (EN ISO 14175)	M21	

Dimension mm
1.2
1.6

Welding with standard GMAW-facilities possible

Approvals

TÜV, ABS, DNV-GL; LR, CE

FCW

BÖHLER Kb 60 T-FD

Flux cored wire, seamless, high strength, basic type

Classifications

EN ISO 17632-A	**AWS A5.36 / SFA-5.36**
T 46 6 1Ni B M21 3 H5	E80T5-M21P8-Ni1-H4

Characteristics and typical fields of application

Seamless Ni-alloyed copper-coated basic flux-cored wire for welding with Ar-CO_2 shielding gas. It is suitable for welding fine grain steels as well as joining of wear-resistant steels. The weld metal deposit has good properties like elongation, toughness and reliability against cracking, even with post weld heat treatment.

Base materials

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 the wire

	Gas	C	Si	Mn	Ni
wt.-%	M21	0.06	0.45	1.35	0.95

Mechanical properties of all-weld metal - typical values (min. values)

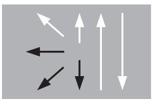
Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -40°C	-60°C
u	500 (≥ 470)	600 (550–680)	24 (≥ 20)	100	80 (≥ 47)
s	480 (≥ 470)	570 (550–680)	26 (≥ 20)		≥ 47

u - untreated, as welded – shielding gas M21

s - stress relieved 620°C / 60min – shielding gas M21

FCW

Operating data



Polarity	DC +	**Dimension mm**
		1.2
Shielding gas (EN ISO 14175)	M21, C1	1.6

Welding with conventional or pulsed power sources using DC+

Approvals

CE

böhler welding by voestalpine

BÖHLER Kb 65 T-FD

Flux cored wire, seamless, high strength, basic type

Classifications

EN ISO 18276-A	AWS A5.36 / SFA-5.36
T 55 4 1NiMo B M21 3 H5	E90T5-M21A4-GH4

Characteristics and typical fields of application

Seamless basic flux-cored wire for welding of high strength Nickel-Molybdenum alloyed steels with Ar-CO_2 shielding gas.

Features include: excellent weldability in flat and horizontal positions, smooth and bright bead, very low spatter losses, easy to remove slag, exceptional mechanical properties at low temperatures with low content of diffusible hydrogen in the weld metal (< 3ml/100g).

Base materials

S420N-S460N, S420M-S460M, S460Q-S555Q, S460QL-S550QL, P460N,P460NH, L415NB, L415MB-L555MB, L415QB-L555QB, PAS 460-550, alform 500 M, 550 M, aldur 500 Q, 500 QL, aldur 550 Q, 550 QL, 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 analysis of the wire

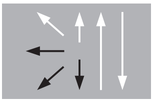
	Gas	C	Si	Mn	Ni	Mo
wt.-%	M21	0.05	0.35	1.40	1.20	0.40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C
u	590 (≥ 550)	670 (640–760)	22 (≥ 18)	100 (≥ 47)

u - untreated, as welded – shielding gas M21

Operating data



		Dimension mm
Polarity	DC +	1.2
Shielding gas (EN ISO 14175)	M21	

Welding with conventional or pulsed power sources using DC+

Approvals

CE

BÖHLER Ti 2 Ni T-FD

Flux cored wire, seamless, high strength, rutile type

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 50 6 2Ni P M21 1 H4	E81T1-M21A8-Ni2-H4

Characteristics and typical fields of application

Seamless rutile nickel alloyed flux-cored wire for singleor multilayer welding of carbon, carbon-manganese steels and fine grain steels with Ar-CO_2 shielding gas.

Main features: excellent weldability in all positions, excellent bead appearance, low spatter losses, fast freezing and easy to remove slag. The exceptional mechanical properties of this wire even at low temperatures (-60ºC) as well as the low content of diffusible hydrogen make it especially suitable for off-shore applications. This wire is CTOD tested at -50ºC.

Base materials

10Ni14, 12Ni14, 13MnNi6-3, 15NiMn6, S275N-S460N, S275NL-S460NL, S275M-S460M, S275ML- S460ML, P275NL1-P460NL1, P275NL2-P460NL2, L245NB-L415NB, L245MB-L450MB, L360QB- L450QB

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, API 5 L X42, X52, X60, X65, X52Q, X60Q, X65Q

Typical analysis of the wire

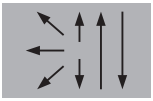
	Gas	C	Si	Mn	Ni
wt.-%	M21	0.06	0.45	1.30	2.00

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C
u	580 (≥ 500)	640 (≥ 570 – 690)	25 (≥ 18)	80 (≥ 47)

u - untreated, as welded – shielding gas M21

Operating data



		Dimension mm
Polarity	DC +	1.2
Shielding gas (EN ISO 14175)	M21	1.6

Welding with standard GMAW-facilities possible

Approvals

ABS, DNV-GL, LR, RS, CE

böhler welding by voestalpine

BÖHLER Ti 75 T-FD

Flux cored wire, seamless, high strength, rutile type

Classifications

EN ISO 18276-A	AWS A5.36 / SFA-5.36
T 64 4 Mn1.5Ni P M21 1 H5	E101T1-M21A4K2-H4

Characteristics and typical fields of application

Seamless rutile nickel-molybdenum alloyed flux-cored wire for singleor multilayer welding of carbon, carbon-manganese steels and high strength steels with Ar-CO_2 shielding gas.

Main features: excellent weldability in all positions, excellent bead appearance, low spatter losses, fast freezing and easy to remove slag. The exceptional mechanical properties of this wire even at low temperatures as well as the low content of diffusible hydrogen make it especially suitable for off-shore applications.

Base materials

S500Q-S620Q, S500QL-S620QL, L485MB-L555MB, L485QB-L555QB, alform 500 M, 550 M, 600 M, aldur 550 Q, 550 QL, 620 M, PAS 460-550

ASTM A 572 Gr. 65; A 633 Gr. E; A 738 Gr. A; A 852; API 5 L X70, X80, X70Q, X80Q

Typical analysis of the wire

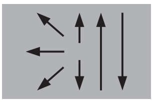
	Gas	C	Si	Mn	Ni	Mo
wt.-%	M21	0.05	0.30	1.30	1.50	0.30

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C
u	670 (≥ 620)	730 (700–760)	20 (≥ 18)	90 (≥ 47)

u - untreated, as welded – shielding gas M21

Operating data



Polarity	DC +	
Shielding gas (EN ISO 14175)	M21	

Dimension mm
1.2
1.6

Welding with standard GMAW-facilities possible

Approvals

CE

FCW

BÖHLER Ti 80 T-FD

Flux cored wire, seamless, high strength, rutile type

Classifications

EN ISO 18276-A	AWS A5.36 / SFA-5.36
T 69 6 Z P M21 1 H5	E111T1-M21A8-GH4

Characteristics and typical fields of application

Seamless rutile, Nickel-Molybdenum alloyed, flux-cored wire for singleor multilayer welding of high strength steels with Argon-CO_2 shielding gas.

Main features: excellent weldability in all positions, excellent bead appearance, very low spatter losses, fast freezing and easy to remove slag. The good mechanical properties of this wire even at low temperatures (-60°C) as well as the low content of diffusible Hydrogen make it especially suitable for off-shore, pipeline applications and crane applications

Base materials

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 analysis of the wire

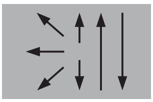
	Gas	C	Si	Mn	Ni	Mo
wt.-%	M21	0.07	0.40	1.70	2.00	0.15

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C	-60°C
u	770 (≥ 690)	800 (770-900)	19 (≥ 17)	75	60 (≥ 47)

u - untreated, as welded – shielding gas M21

Operating data



		Dimension mm
Polarity	DC +	1.0
Shielding gas (EN ISO 14175)	M21	1.2
		1.6

Welding with standard GMAW-facilities possible

Approvals

TÜV, DNV-GL, ABS, LR, BV, CE

FCW

BÖHLER Ti 80 T-FD SR

Flux cored wire, seamless, high strength, rutile type

Classifications

EN ISO 18276-A	**AWS A5.36 / SFA-5.36**
T 69 6 Mn2NiMo P M21 1 H5	E111T1-M21AP5-K3-H4

Characteristics and typical fields of application

Seamless rutile, Nickel-Molybdenum alloyed, flux cored wire for single- or multilayer welding of high strength steels to be used with Argon-CO_2 shielding gas. This core wire with its easy to remove and fast freezing slag shows excellent weldability in all positions, excellent bead appearance and very low spatter losses. The low diffusible hydrogen content of the pure weld metal (2-3ml/100g) and the outstanding mechanical properties at low temperatures (-60ºC) make this wire perfect suitable for applications using high- and ultra-high strength steel grades. In particular this product is dedicated to be performed after PWHT for Q&T and also for TMCP steels thanks to his particular formulation that reduce the embrittlement of the weld metal after such treatments with good toughness till -40ºC.

Base materials

Thermo mechanically treated and quenched and tempered fine grain steels up to 690 MPa. S550Q-S690Q, S550QL-S690QL, P550Q-P690Q, P550QL-P690QL ASTM A 514 Gr. F, H, Q ; A 709 Gr. 100 Type E, F, H, Q; A 709 Gr. HPS 100W

Typical analysis of the wire

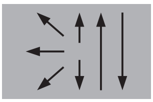
	Gas	C	Si	Mn	Ni	Mo
wt.-%	M21	0.04	0.25	1.80	2.30	0.40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -40 °C	-46°C	-60 °C
u	740 (≥ 690)	800 (770–900)	18 (≥ 17)	70	65	55 (≥47)
s	730 (≥ 690)	790 (770–900)	19 (≥ 17)	47	35(≥27)	
s1	730 (≥690)	780 (770-900)	19 (≥17)	55	40(≥27)	

u - untreated, as welded – shielding gas M21
s stress releived 570°C x 3h – shielding gas M21 (recommended max. T. (°C) for Q&T steels)
s 1 stress releived 510°C x 3h – shielding gas M21 (recommended max. T. (°C) for TMCP steels)

Operating data



Polarity	DC+	**Dimension mm**
Shielding gas (EN ISO 14175)	M21	1.2

Welding with standard GMAW-facilities possible

Approvals

CE

FCW

BÖHLER Ti 85 T-FD

Flux cored wire, seamless, high strength, rutile type

Classifications

EN ISO 18276-A	**AWS A5.36 / SFA A5.36**
T69 4 Z P M21 2 H5	E111T1-M21A8-K3-H4

Characteristics and typical fields of application

Seamless rutile, Nickel-Molybdenum alloyed, flux cored wire for single- or multilayer welding of high strength steels to be used with Argon-CO_2 shielding gas.

This core wire with its easy to remove and fast freezing slag shows excellent weldability in all positions, excellent bead appearance and very low spatter losses. The low diffusible hydrogen content of the pure weld metal (2-3ml/100g) and the outstanding mechanical properties at low temperatures (-40ºC) make this wire perfect suitable for applications using high- and ultra high strength steel grades.

Base materials

S620Q, S620QL, S690Q, S690QL, S620QL1-S690QL1, 620 QL, 620 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 the wire

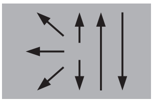
	Gas	C	Si	Mn	Ni	Mo
wt.-%	M21	0.04	0.30	1.85	2.30	0.40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40 °C	-60 °C
u	780 (≥ 690)	810 (770–900)	17 (≥ 17)	65 (≥ 47)	55 (≥ 27)

u untreated, as welded – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Welding with standard GMAW-facilities possible

Approvals

-

BÖHLER Kb 85 T-FD

Flux cored wire, seamless, high strength, basic type

Classifications

EN ISO 18276-A	AWS A5.36 / SFA-5.36
T 69 6 1Mn2NiCrMo B M21 3 H5	E110T5-M21A8-K4-H4

Characteristics and typical fields of application

Seamless basic flux-cored wire for welding of high strength Nickel-Chromium-Molybdenum alloyed steels with Ar-CO_2 shielding gas.

Features include: excellent weldability in flat and horizontal positions, smooth and bright bead, low spatter losses easy to remove slag, exceptional mechanical properties at low temperatures (-60ºC) with low content of diffusible hydrogen (<3ml/100g).

Base materials

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 analysis of the wire

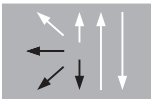
	Gas	C	Si	Mn	Cr	Ni	Mo
wt.-%	M21	0.06	0.40	1.40	0.40	2.20	0.40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -60°C
u	740 (≥ 690)	800 (770–900)	20 (≥ 17)	80 (≥ 47)

u - untreated, as welded – shielding gas M21

Operating data



		Dimension mm
Polarity	DC +	1.2
Shielding gas (EN ISO 14175)	M21	1.6

Welding with conventional or pulsed power sources using DC+

Approvals

TÜV, ABS, DNV-GL, LR, CE

FCW

BÖHLER Kb 85 T-FD (CO_2)

Flux cored wire, seamless, high strength, basic type

Classifications

EN ISO 18276-A	AWS A5.36 / SFA A5.36
T69 4 Mn2NiCrMo B C1 3 H5	E110T5-C1A4-K4-H4

Characteristics and typical fields of application

Seamless basic flux cored wire for welding of high strength Nickel-Chromium-Molybdenum alloyed steels with pure CO_2 shielding gas. Features include: excellent weldability in flat and horizontal positions, smooth and bright bead, low spatter losses easy to remove slag, exceptional mechanical properties at low temperatures (-40ºC) with low content of diffusible hydrogen (<3ml/100g).

Base materials

S620Q, S620 QL, S 690Q, S690QL, S620QL1-S690QL1, alform plate 620M, 700 M, aldur 620 Q, 620 QL, 620 QL1, aldur 700 Q, 700 QL, 700 QL1

ASTM A 514 Gr. F, H, Q; A 790 Gr.100 Type B, E, F, H, Q; A 709 Gr. HPS 100W

Typical analysis of the wire

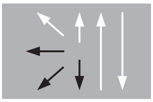
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.07	0.35	1.40	2.10	0.40	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ Mpa	Tensile strength R_m Mpa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C
u	720 (≥690)	830 (770-900)	18 (≥17)	80 (≥47)

u untreated, as welded – shielding gas C1

Operating data



Polarity DC +

Dimension mm
1.2

Welding with standard GMAW power source possible

Approvals

CE

FCW

BÖHLER Kb 90 T-FD

Flux cored wire, seamless, high strength, basic type

Classifications

EN ISO 18276-A	**AWS A5.36 / SFA-5.36**
T89 4 Mn2Ni1CrMo B M21 3 H5	E130T5-GM-H4

Characteristics and typical fields of application

Seamless basic flux-cored wire for welding of very high strength Nickel-Chromium-Molybdenum alloyed steels with Ar-CO_2 shielding gas.

Features include: excellent weldability in flat and horizontal positions, smooth and bright bead, less spatter, easy to remove slag and very high mechanical properties at low temperatures.

Base materials

S690Q-S890Q, S690QL-S890QL, S960Q, S960QL, N-A-XTRA M 700, PAS 700, alform 700 M, alform 900 x-treme, alform 960 x-treme

ASTM A 709 Gr. 100 Type B, E, F, H, Q, HPS 100W

Typical analysis of the wire

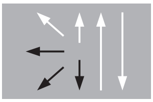
	Gas	C	Si	Mn	Cr	Ni	Mo
wt.-%	M21	0.06	0.40	1.40	0.40	2.20	0.40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C
u	960 (≥ 890)	1010 (940–1180)	19 (≥ 15)	75 (≥ 47)
u				

u - untreated, as welded – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Welding with conventional or pulsed power sources using DC+

Approvals

CE

FCW

BÖHLER HL 53 T-MC

Metal cored wire, seamless, high strength

Classifications

EN ISO 17632-A	**AWS A5.36 / SFA-5.36**
T 50 6 1 Ni M M21 1 H5	E80T15-M21A8-Ni1-H4

Characteristics and typical fields of application

Seamless all positional metalcored wire, Nickel alloyed, metal cored wire for single- or multilayer welding of carbon, carbon-manganese and high strength steels with Ar-CO_2 shielding gas. Features include: high yield, good weldability, excellent bead appearance, very low spatter losses and exceptional mechanical properties at low temperatures (-60ºC) in as welded conditions as well after post weld heat treatment. This wire is especially suitable for root-pass welding in off-shore and pipeline applications. This product can be used in sour gas applications. (HIC tested acc. to NACE TM-0284). Test values for SSC are available upon request. This wire is CTOD tested at -40ºC.

Base materials

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 the wire

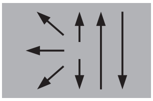
	Gas	C	Si	Mn	Ni
wt.-%	M21	0.06	0.50	1.3	0.90

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C
u	530 (≥ 500)	620 (570-590)	27 (≥ 18)	90 (≥ 47)
s	500	560	26	90
n	360	520	33	100

u untreated, as welded – shielding gas M21
s stress relieved 580°C / 3h – shielding gas M21
n normalized 920°C / 30min – shielding gas M21

Operating data



Polarity	DC +	
Shielding gas (EN ISO 14175)	M21	

Dimension mm
1.2
1.6

Welding with conventional or pulsed power sources using DC+

Approvals

TÜV, DB, ABS, DNV-GL, CWB, CE

BÖHLER HL 65 T-MC

Metal cored wire, seamless, high strength

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 55 6 1NiMo M M21 1 H5	E90T15-M21A8-K1-H4

Characteristics and typical fields of application

Seamless, Nickel-Molybdenum alloyed, metalcored wire for singleor multilayer welding of low alloyed and high strength steels with Ar-CO_2 shielding gas.

Features include: high yield, good weldability, excellent bead appearance, low spatter losses and exceptional mechanical properties at low temperatures. This wire is especially suitable for root pass welding in off-shore and pipeline applications.

Base materials

S420N-S460N, S420M-S460M, S460Q-S555Q, S460QL-S550QL, P460N,P460NH, L415NB, L415MB-L555MB, L415QB-L555QB, PAS 460-550, alform 500 M, 550 M, aldur 500 Q, 500 QL, aldur 550 Q, 550 QL, 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 analysis of the wire

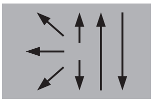
	Gas	C	Si	Mn	Ni	Mo
wt.-%	M21	0.06	0.45	1.3	1.00	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C
u	690 (≥ 550)	750 (640–820)	22 (≥ 18)	60 (≥ 47)

u untreated, as welded – shielding gas M21

Operating data



Polarity DC +

Shielding gas (EN ISO 14175) M21

Dimension mm
1.2
1.4
1.6

Welding with conventional or pulsed power sources using DC+

Approvals

CE

FCW

BÖHLER HL 75 T-MC

Metal cored wire, seamless, high strength

Classifications

EN ISO 17632-A	AWS A5.36 / SFA-5.36
T 62 4 Z M M21 1 H5	E101T15-M21A4-G-H4

Characteristics and typical fields of application

Seamless, Nickel-Molybdenum alloyed, metal-cored wire for single - or multilayer welding of high strength steels with pure Argon or Ar-CO_2 shielding gas. This wire is especially suitable for pipe welding of special base material like ASTM A519 Gr. 4130; it meets the requirements of NACE requirements.

Features include: high yield, good weldability, excellent bead appearance, low spatter losses and exceptional mechanical properties at low temperatures.

Base materials

30CrMo4

ASTM A519 Gr. 4130

Typical analysis of the wire

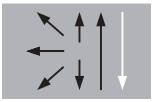
	Gas	C	Si	Mn	Ni	Mo
wt.-%	M21	0.10	0.50	1.80	0.90	0.55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -29°C	-40°C
u	780 (≥ 620)	820 (700–830)	20 (≥ 17)		70 (≥ 47)
s	670 (≥ 620)	750 (700–830)	22 (≥ 17)		60 (≥ 47)
s1	720 (≥ 620)	800 (700–830)	20 (≥ 17)	55 (≥ 35)	

u untreated, as welded – shielding gas M21
s stress relieved 650°C x 4h - shielding gas M21
s1 stress relieved 650°C x 4h - shielding gas I1

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21, I1

Dimension mm
1.2
1.6

Welding with conventional or pulsed power sources using DC+

Approvals

ABS, DNV GL

BÖHLER alform® 700 L-MC

metal cored wire, seamless, high strength

Classifications

EN ISO 18276-A	**AWS A5.36 / SFA A5.36**
T 69 6 Mn2NiCrMo M M21 1 H5	E111T15-M21A8-K4-H4

Characteristics and typical fields of application

The BÖHLER alform® 700 L-MC metal cored wire manufactured with seamless laser technology, is developed for shielded arc welding of thermo mechanically produced fine grained structural steels. A balanced metallurgy combined with a very precise production technology results in high strength combined with very good toughness behaviour and excellent welding performance. This tubular wire possesses higher rigidity – as a result it offers exact ignition and excellent feeding characteristic. Due to the manufacturing technology, this metal cored wire ensures low diffusible hydrogen content of <2 ml / 100g weld metal. This metal cored wire is designed for welding under mixture gas (Ar + CO_2) in PA and PB-position. Good results were also achieved after using alternative gases, 8 – 10 % CO_2 + Ar and different welding positions (PG). This filler material is used for high strength steel constructions, crane and vehicle manufacturing, for ship building, offshore applications and also for penstocks.

Base materials

S690 and higher strength grades and thermo mechanically treated fine grain steels up to 690 MPa.

S690Q, S690QL, aldur 700Q, 700QL, alform® 700 M (wire is especially balanced for this plate steel).

ASTM A 514 Gr. F, H, Q ; A 709 Gr. 100 Type E, F, H, Q; A 709 Gr. HPS 100W

Typical analysis of the wire

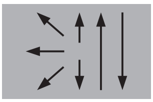
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.07	0.7	1.6	0.35	2.0	0.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C	-60°C
u	770 (≥690)	830 (770-900)	19 (≥17)	130	85 (≥47)

u untreated, as welded – shielding gas Ar + 18 % CO_2

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21; M20

Dimension mm
1.0
1.2
1.6

Preheating and interpass temperature as required by the base metal

Approvals

TÜV, DB, DNV GL, LR, CE

FCW

BÖHLER alform® 900 L-MC

Metal cored wire, seamless, high strength

Classifications

EN ISO 18276-A	AWS A5.36 / SFA A5.36
T89 5 ZMn2NiCrMo M M21 1 H5	E131T15-M21A6-K4-H4

Characteristics and typical fields of application

The BÖHLER alform® 900 L-MC metal cored wire, manufactured with seamless laser technology, is developed for shielded arc welding of thermo mechanically produced fine grained structural steels. A balanced metallurgy combined with a very precise production technology results in high strength combined with very good toughness behaviour and excellent welding performance. This tubular wire possesses higher rigidity – as a result it offers exact ignition and excellent feeding characteristic. Due to the manufacturing technology, this metal cored wire ensures low diffusible hydrogen content of < 2 ml / 100g weld metal. This metal cored wire is designed for welding under mixture gas (Ar + CO_2) in PA and PB-position. Good results were also achieved after using alternative gases, 8 – 10 % CO_2 + Ar and different welding positions (PG). This filler material is used for high strength steel constructions, crane and vehicle manufacturing, for ship building, offshore applications.

Base materials

S890 and higher strength grades, thermo mechanically treated fine grain steels

S890Q, S890QL, XABO 90, QX 1002, alform® 900 x-treme (wire is especially balanced for this plate steel).

ASTM A 709 Gr. 100 Type B, E, F, H, Q, HPS 100W

Typical analysis of the wire

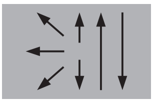
	Gas	C	Si	Mn	Cr	Ni	Mo
wt.-%	M21	0.06	0.7	1.9	0.5	2.1	0.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ Mpa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J +20°C	-50°C
u	920 (≥890)	980 (940-1180)	17 (≥15)	80	70 (≥47)

u untreated, as welded – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Preheating and interpass temperature as required by the base metal

Approvals

TÜV, DB, CE

BÖHLER alform® 960 L-MC

Metal cored wire, seamless, high strength

Classifications

EN ISO 18276-A	**AWS A5.36 / SFA A5.36**
T89 4 ZMn2NiCrMo M M21 1 H5	E131T15-M21A4-K4-H4

Characteristics and typical fields of application

The BÖHLER alform® 960 L-MC metal cored wire manufactured with seamless laser technology is developed for shielded arc welding of thermo mechanically produced fine grained structural steels. A balanced metallurgy combined with a very precise production technology results in high strength combined with very good toughness behaviour and excellent welding behaviour. This seamless tubular wire possesses higher rigidity – as a result it offers exact ignition and excellent feeding characteristic. Due to the manufacturing technology metal cored wire ensures lowest diffusible hydrogen content of < 2 ml / 100g. This metal cored wire is designed for welding under mixture gas (Ar + CO_2) in PA and PB-position. Good results were also achieved after using alternative gases 8 – 10 % CO_2 + Ar and different welding positions (PG). This filler material is used for high strength steel constructions and also for crane and vehicle manufacturing. The chemical analysis and the mechanical properties of the welding filler material are especially designed for the base material alform® 960 x-treme.

Base materials

S 960 and higher strength grades, thermo mechanically treated fine grain steels

aligned to alform® 960 x-treme base material

Typical analysis of the wire

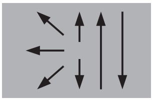
	Gas	C	Si	Mn	Cr	Ni	Mo
wt.-%	M21	0.06	0.7	1.9	0.6	2.2	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J +20°C	-40°C
u	980 (≥890)	1020 (940-1180)	16 (≥15)	80	60 (≥47)

u untreated, as welded – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Preheating and interpass temperature as required by the base material

Approvals

TÜV, DB , CE

Welding consumables for creep resistant steels

◆ Content

Stick electrodes

Product name	C	Si	Mn	Cr	Ni	Mo	W	V	Co	Nb	N
BÖHLER FOX DMO Kb	0.08	0.40	0.80			0.50					
BÖHLER FOX DCMS Kb	0.08	0.25	0.80	1.10		0.50					
BÖHLER FOX DCMV	0.12	0.30	0.90	1.20		1.00		0.22			
BÖHLER FOX CM 2 Kb	0.08	0.30	0.70	2.20		1.00					
Thermanit P23	0.06	0.20	0.50	2.20			1.70	0.22		0.04	
Thermanit P24	0.10	0.30	0.50	2.40		1.00		0.22		0.01	
BÖHLER FOX CM 5 Kb	0.08	0.30	0.80	5.00		0.60					
BÖHLER FOX CM 9 Kb	0.08	0.25	0.65	9.00		1.00					
BÖHLER FOX 20 MVW	0.18	0.30	0.70	11.00	0.55	0.90	0.50	0.25			
BÖHLER FOX C 9 MV	0.10	0.20	0.60	8.50	0.50	0.90		0.20		0.05	0.04
Thermanit MTS 3-LNi	0.10	0.20	0.80	9.00	0.10	1.10		0.20		0.05	0.04
Thermanit Chromo 9 V	0.09	0.20	0.60	9.00	0.80	1.10		0.20		0.05	0.04
Thermanit Chromo 9 V Mod	0.10	0.20	0.80	9.00	0.10	1.10		0.20		0.05	0.04
Thermanit MTS 616	0.11	0.20	0.60	8.80	0.60	0.50	1.70	0.20		0.04	0.04
Thermanit MTS 616 LNi	0.11	0.20	0.70	8.80	0.40	0.50	1.60	0.20		0.05	0.05
BÖHLER FOX P 22 (LC)	0.04	0.30	0.60	2.20		1.00					
BÖHLER FOX P 22	0.06	0.30	0.70	2.20		1.00					
Thermanit MTS 5 Co 1	0.12	0.30	0.80	9.40	0.20	1.50		0.20	1.00	0.05	0.03

GTAW rods

Product name	C	Si	Mn	Cr	Ni	Mo	W	V	Co	Nb	N
BÖHLER DMO-IG	0.10	0.60	1.10			0.50					
BÖHLER DCMS-IG	0.10	0.60	1.00	1.20		0.50					
BÖHLER CM 5-IG	0.08	0.40	0.50	5.60		0.60					
BÖHLER DMV 83-IG	0.08	0.60	0.90	0.45		0.85		0.35			
BÖHLER CM 9-IG	0.07	0.40	0.50	9.00		1.00					
Union I CrMo 910	0.07	0.60	1.00	2.55		1.00					
Union I CrMo 910 Spezial	0.10	0.10	0.50	2.40		1.00					
Thermanit MTS 911	0.10	0.30	0.50	9.00	0.50	1.00	1.00	0.20			
Thermanit MTS 3	0.10	0.30	0.50	9.00	0.50	1.00		0.20		0.06	
Thermanit MTS 3 LNi	0.10	0.30	0.70	9.00	< 0.3	1.00		0.20		0.06	
Thermanit MTS 4 SI	0.20	0.30	0.60	11.00	0.40	1.00	0.50	0.30			
Thermanit MTS 5 CO 1	0.12	0.40	0.60	9.40	0.20	1.40		0.20	1.10	0.05	0.03
Thermanit MTS 5 CoT	0.16	0.40	0.40	11.40	0.40	0.30	1.50	0.20	1.55	0.06	0.04
Thermanit MTS 616	0.10	0.25	0.50	8.50	0.50	0.40	1.60	0.20		0.06	0.04
Union ER 80S-B2	0.10	0.55	0.60	1.30		0.50					
Union ER 90S-B3	0.09	0.55	0.60	2.55		1.05					

Solid wires

Product name	**C**	**Si**	**Mn**	**Cr**	**Ni**	**Mo**	**W**	**V**	**Nb**	**N**	
BÖHLER DMO-IG	0.10	0.60	1.10			0.50					
BÖHLER DCMS-IG	0.11	0.60	1.00	1.20		0.50					
BÖHLER CM 5-IG	0.06	0.40	0.50	5.60		0.60					
BÖHLER DMV 83-IG	0.08	0.60	0.90	0.45		0.82		0.35			
Thermanit MTS 3	0.10	0.30	0.50	9.00	0.50	1.00		0.20	0.06		
Thermanit MTS 3 LNi	0.11	0.25	0.65	9.00	< 0.15	0.95		0.20	0.06	0.05	≤ 1.0
Thermanit MTS 4 Si	0.20	0.30	0.60	11.00	0.40	1.00	0.50	0.30			
Thermanit MTS 616	0.10	0.25	0.50	8.50	0.50	0.40	1.60	0.20	0.06	0.04	

SAW wire/flux combinations

Product name	**C**	**Si**	**Mn**	**Cr**	**Ni**	**Mo**	**W**	**V**	**Nb**	**N**	**P**
Union S 2 Mo - UV 305	0.06	0.50	1.20			0.50					
Union MV Mo S - UV 305	0.04	0.40	1.25			0.60					
Union S 2 Mo - UV 306	0.06	0.60	1.40			0.50					
Union S 2 Mo UV 400	0.06	0.35	1.35			0.50					
Union S 2 Mo - UV 421 TT	0.07	0.25	1.10			0.50					
Union S 3 Mo - UV 420 TT	0.06	0.30	1.50			0.45					
Union S 4 Mo - UV 420 TTR	0.07	0.20	1.85			0.45					
Union S 4 Mo - UV 421 TT	0.08	0.20	1.80			0.48					
Union S 2 CrMo - UV 305	0.07	0.40	0.90	1.15		0.50					
Union MV CrMo S - UV 305	0.04	0.70	1.30	1.00		0.50					
Union S 2 CrMo - UV 419 TT-W	0.08	0.25	0.90	1.15		0.48					
Union S 2 CrMo - UV 420 TTR	0.08	0.20	1.00	1.15		0.50					
Union S 2 CrMo - UV 420 TTR-C	0.10	0.20	1.00	1.15		0.55					≤ 0.010
Union S 2 CrMo - UV 420 TTR-W (AC)	0.10	0.20	1.00	1.10		0.45					≤ 0.012
Union S 2 CrMo - UV 420 TTR-W (DC+)	0.08	0.20	1.00	1.10		0.45					≤ 0.012
Union S 1 CrMo 2 - UV 305	0.07	0.35	0.80	2.30		1.00					
Union MV CrMo 910 S UV 305	0.05	0.70	1.30	2.30		0.90					
Union S 1 CrMo 2 - UV 420 TTR	0.08	0.20	0.75	2.30		1.00					
Union S 1 CrMo 2 - UV 420 TTR-C	0.10	0.20	0.80	2.40		1.00					
Union S 1 CrMo 2 - UV 420 TTR-W (AC)	0.10	0.15	0.75	2.30		1.00					
Union S 1 CrMo 2 - UV 420 TTR-W (DC+)	0.08	0.20	0.75	2.30		1.00					
Union S P23 - UV 305	0.04	0.65	1.10	2.30			1.50	0.19	0.03		
Union S P23 - UV P23	0.06	0.40	0.70	2.40			1.60	0.18	0.03		
Union S P24 - UV 305	0.06	0.50	0.90	2.30		1.00		0.22	0.04		
Union S P24 - UV P24	0.09	0.20	0.75	2.40		0.95		0.22	0.05		
Union S 1 CrMo 2 V - UV 430 TTR-W	0.10	0.10	1.20	2.30		1.00		0.25	0.01		
Union S 1 CrMo 5 - Marathon 543	0.07	0.30	0.60	5.80		0.60					
BÖHLER CM 9-UP - Marathon 543	0.07	0.30	0.60	8.70		0.95					
Thermanit MTS 3 - Marathon 543	0.09	0.22	0.70	8.90	0.45	0.95		0.18	0.05	0.04	
Thermanit MTS 3 LNI - Marathon 543	0.09	0.20	0.80	8.90	< 0.15	0.95		0.18	0.05	0.04	
Thermanit MTS 616 - Marathon 543	0.09	0.15	0.70	8.70	0.40	0.43	1.65	0.18	0.05	0.04	
Thermanit MTS 911 - Marathon 543	0.09	0.22	0.60	8.90	0.45	0.98	1.00	0.18	0.05	0.04	
Thermanit MTS 4 - Marathon 543	0.18	0.20	0.90	11.20	0.60	0.88	0.50	0.22		0.30	

Flux cored wires

Product name	C	Si	Mn	Cr	Ni	Mo	W	V	Co	Nb	N
BÖHLER DMO Ti-FD	0.04	0.25	0.75			0.50					
BÖHLER DMO Ti T-FD	0.06	0.20	0.75			0.40					
BÖHLER DMO T-MC	0.09	0.35	1.10			0.50					
BÖHLER DMO Kb T-FD	0.08	0.35	1.00			0.50					
BÖHLER DCMS Ti-FD	0.06	0.22	0.75	1.20		0.47					
BÖHLER DCMS Ti T-FD	0.07	0.30	0.70	1.10		0.40					
BÖHLER DCMS T-MC	0.06	0.40	1.10	1.20		0.50					
BÖHLER DCMS Kb T-FD	0.06	0.45	1.10	1.20		0.50					
BÖHLER DCMV Ti T-FD	0.10	0.50	1.10	1.20	0.45	0.90		0.20			
BÖHLER DCMV Kb T-FD	0.10	0.50	1.10	1.20	0.40	0.90		0.20			
BÖHLER CM 2 Ti-FD	0.08	0.25	0.80	2.25		1.10					
BÖHLER CM 2 T-MC	0.06	0.35	1.10	2.20		1.00					
BÖHLER CM 2 Kb T-FD	0.07	0.45	1.10	2.20		1.00					
BÖHLER CM 5 Kb T-FD	0.07	0.45	1.10	5.00		0.50					
BÖHLER CB 2 Ti-FD	0.12	0.20	0.80	9.00	0.20	1.40		0.20	1.00	0.03	0.02
BÖHLER C 9 MV Ti-FD	0.10	0.20	0.70	9.00	0.20	1.00		0.20		0.04	0.04
BÖHLER C 9 MV-MC	0.10	0.30	0.60	9.00	0.70	1.00		0.20		0.05	0.04
BÖHLER C 9 MVW Ti-FD	0.10	0.30	0.60	9.00	0.70	1.00	1.00	0.20		0.03	0.04
BÖHLER P 92 Ti-FD	0.10	0.20	0.60	9.00	0.50	0.50	1.50	0.20		0.04	0.04
Thermanit MTS 3 PW	0.10	0.20	0.70	9.00	0.20	1.00		0.20		0.05	0.04

böhler welding by voestalpine

BÖHLER FOX DMO Kb

Stick electrode, low-alloyed, creep resistant

Classifications

EN ISO 3580-A	EN ISO 2560-A	AWS A5.5 / SFA-5.5
E Mo B 4 2 H5	E 46 5 Mo B 4 2 H5	E7018-A1 H4

Characteristics and typical fields of application

Basic low-hydrogen electrode for 0.5% Mo-alloyed boiler, plates, and tube steels. Approved in long-term condition up to 550ºC service temperature. For high quality welds of long term stressed components with reliable mechanical properties under high and low temperature conditions. Crack resistant, tough and ageing resistant. Very low hydrogen content (acc. to AWS condition HD < 4 ml/100 g). Metal recovery approximately 115%.

Base materials

Creep resistant steels and similar alloyed cast steels, steels resistant to caustic cracking and ageing resistant steels

16Mo3, 20MnMoNi4-5, 15NiCuMoNb5, S235JR-S355JR, S235J0-S355J0, S450J0, 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

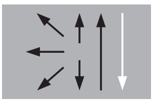
	C	Si	Mn	Mo
wt.-%	0.08	0.4	0.8	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-50°C
u	490 (≥ 460)	590 (530 – 680)	24 (≥ 22)	170	50 (≥ 47)
a	480 (≥ 460)	580 (530 – 680)	27 (≥ 22)	160 (≥ 47)	75 (≥ 47)

u untreated, as welded
a annealed 620°C/2h / furnace down to 300°C / air

Operating data



Polarity	DC+
Electrode identification	FOX DMO Kb 7018-A1 E Mo B
Redrying	300 - 350 °C/2h

Dimension mm	Current A
2.5 × 250	80 – 110
2.5 × 350	80 – 110
3.2 x 350	100-140
4.0 x 350/450	130-180
5.0 x 450	190-230

Preheating, interpass temperature, and post-weld heat treatment as required by the base metal.

Approvals

TÜV (00019), KTA 1408.1 (8053), DB (10.014.82), ABS, DNV GL, CE

SMAW

BÖHLER FOX DCMS Kb

Stick electrode, low-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E CrMo1 B 4 2 H5	E8018-B2 H4

Characteristics and typical fields of application

Basic coated, core wire alloyed low hydrogen electrode for 1% Cr 0.5% Mo alloyed boiler, plate, and tube steels. Approved in long-term condition up to +570°C service temperature. Fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant. High ductility and crack resistance. The weld metal deposit is heat treatable. Very low hydrogen content (acc. AWS condition HD < 4 ml/100 g). Metal recovery approximately 115%. Suitable for step-cooling application. Bruscato ≤ 15ppm. post-weld tempering at 660 – 700°C for at least ½ h followed by cooling in furnace down to 300°C and still air.

Base materials

Creep resistant steels and similar alloyed cast steels, case hardening and nitrite able steels of similar chemical composition, similar alloyed heat treatable steels with tensile strength 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

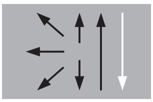
	C	Si	Mn	Cr	Mo	P	Sb	Sn	As
wt.-%	0.08	0.25	0.8	1.1	0.5	≤ 0.010	≤ 0.005	≤ 0.005	≤ 0.005

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a	480 (≥ 460)	580 (≥ 550)	23 (≥ 20)	160 (≥ 47)
v	380	520	28	190

a annealed 680 °C/2h / furnace down to 300 °C / air
v quenched/tempered 930 °C/0.5 h / air 680 °C/10 h / furnace down to 300 °C / air

Operating data



Polarity	DC+
Electrode identification	FOX DCMS Kb 8018-B2 E CrMo1 B
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 250	80 – 110
2.5 × 350	80 – 110
3.2 × 350	100 – 140
4.0 × 350	130 – 180
4.0 × 450	130 – 180
5.0 × 450	180 – 220

Preheat and interpass temperature acc. to the requirements of the base material (for 13CrMo4-5 at 200 - 250ºC, annealing after welding at 660 - 700ºC, min 1/2 h / oven to 300ºC / air cooling).

Approvals

TÜV (00728.), DB (10.014.42), ABS, DNV GL, NAKS (Ø 3.2 mm; Ø 4.0 mm), CE

BÖHLER FOX DCMV

Stick electrode, low-alloyed, creep resistant

Classifications

EN ISO 3580-A	**AWS A5.5 / SFA-5.5**
E Z CrMoV1 B 4 2 H5	E9018-G

Characteristics and typical fields of application

Basic coated electrode for highly stressed joint welds on GS-17 CrMoV5-10 type of high temperature cast steel used in the construction of steam turbines and valve casings. Approved in long- term condition up to +600ºC service temperature.

High creep rupture strength thanks to the C, Cr, Mo and V-content. High fracture toughness, low hydrogen content, good welding characteristics. The deposit is heat treatable. Metal recovery approximately 115%. Synthetic coating concept.

Base materials

Similar alloyed creep resistant steels and cast steels

1.7706 G17CrMoV5-10

Typical analysis of all-weld metal

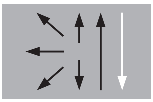
	C	Si	Mn	Cr	Mo	V
wt.-%	0.12	0.30	0.9	1.2	1.0	0.22

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	720	1000	12	22
a	680 (≥ 530)	770 (≥ 620)	19 (≥ 17)	90 (≥ 47)
v	500	630	20	155

u untreated, as welded
a annealed, 680°C/8 h / furnace down to 300 °C / air
v quenched/tempered 940 °C/0.5 h / oil 720 °C/12 h / furnace down to 300 °C / air

Operating data



Polarity	DC (+)
Electrode identification	FOX DCMV 9018-G E Z CrMoV1 B
Redrying	300-350°C/2h

Dimension mm	Current A
3.2 × 350	90 – 140
4.0 × 450	130 – 180
5.0 × 450	180 – 230

Preheat and interpass temperatures 300 – 350ºC, stress relieving > 20ºC below the tempering temperature of the cast steel, but not less than 680ºC.

Approvals

TÜV (06077), LTSS, CE

SMAW

BÖHLER FOX CM 2 Kb

Stick electrode, low-alloyed, creep resistant

Classifications

EN ISO 3580-A	**AWS A5.5 / SFA-5.5**
E CrMo2 B 4 2 H5	E9018-B3 H4 R

Characteristics and typical fields of application

Basic coated, core wire alloyed stick electrode for welding 2.25% Cr 1% Mo alloyed steels. Approved in long-term condition up to +600°C service temperature. Applicable for welds in refineries, boiler construction, and thermal power plants. Core wire alloyed electrode which will provide reliable creep rupture properties. Crack resistant and ductile deposit, high creep rupture strength, low hydrogen content (acc. AWS condition HD < 4 ml/100 g). Good weldability in all positions except vertical down. Deposit is nitride-able and heat treatable. Metal recovery approximately 110%. Suitable for Step Cooling.

Base materials

high temperature steels and similar alloyed cast steels, QT-steels similar alloyed up to 980 MPa tensile strength, similar alloyed case hardening steels, 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

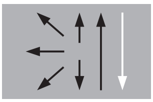
	C	Si	Mn	Cr	Mo	P	Sb	Sn	As
wt.-%	0.08	0.3	0.7	2.2	1.0	≤ 0.010	≤ 0.005	≤ 0.006	≤ 0.005

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
a1	580 (≥ 400)	680 (≥ 500)	19 (≥ 18)	150 (≥ 47)
a2	530 (≥ 400)	630 (≥ 500)	20 (≥ 18)	180
v	490 (≥ 400)	600 (≥ 500)	21	180

a1 annealed, 720 °C/1h / furnace down to 300 °C / air
a2 annealed, 720 °C/2h / furnace down to 200 °C / air
v quenched/tempered 930 °C/0.5 h/ air + 680 °C/15 h / air

Operating data



Polarity	DC+
Electrode identification	FOX CM 2 Kb 9018-B3 E CrMo2 B
Redrying	300-350°C/2h

Dimension mm	**Current A**
2.5 × 250	80 – 110
3.2 × 350	100 – 140
4.0 × 350	130 – 180
4.0 × 450	130 – 180
5.0 × 450	180 – 230

Preheating and interpass temperatures 200 – 350ºC. post-weld annealing at 700 – 750ºC at least 1 hour followed by cooling in furnace down to 300ºC and still air.

Approvals

TÜV (00722), DB (10.014.81), ABS, DNV GL, CE, NAKS (Ø 3,2; Ø 4,0 mm)

böhler welding by voestalpine

Thermanit P 23

Stick electrode, low-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E Z CrWV2 1,5 B 4 2 H5	E9015-B23

Characteristics and typical fields of application

Basic coated medium alloyed electrode for the welding of similar creep resistant materials. Good welding characteristics even in out-of-postion welding.

Field of use is the welding of creep resistant steels in boiler, tank and pipeline construction and reactor fabrication.

Base materials

HCM2S; Grade T23 (ASTM A213); Grade P23 (ASTM A335);

7CrWVMoNb9-6 (EN 10216-2)

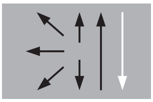
Typical analysis of all-weld metal

	C	Si	Mn	Cr	W	V	Nb
wt.-%	0.06	0.2	0.5	2.2	1.7	0.22	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
740 °C / 2 h	540	620	19	130

Operating data



Polarity DC (+)

Electrode identification Thermanit P23 9015-23 EZCrWV2 1,5 B

Redrying 300-350°C/2h

Dimension mm	Current A
2.5 × 250	70 – 100
3.2 × 350	100 – 140

Preheating / Interpass temperature	Post weld heat treatment (PWHT)	Cooling down before PWHT
200 – 220 °C / 200 – 280 °C	740 °C / 2h	RT

Approvals

TÜV (10272), IBR, CE

Thermanit P 24

Stick electrode, low-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E Z CrMo2VNb B 4 2 H5	E 9015-B24

Characteristics and typical fields of application

Basic coated medium alloyed electrode for the welding of similar creep resistant materials. Good welding characteristics even in out-of-postion welding.

Field of use is the welding of creep resistant steels in boiler, tank and pipeline construction and reactor fabrication.

Base materials

1.7378 – 7CrMoVTiB10-10; T/P24

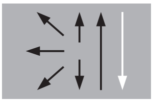
Typical analysis of all-weld metal

	C	Si	Mn	Cr	Mo	V	Nb	Ti
wt.-%	0.1	0.3	0.5	2.4	1.0	0.22	0.01	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
740 °C / 2 h	540	620	19	130

Operating data



Polarity	DC +
Electrode identification	Thermanit P24 9015-B24 EZCrMo-2VNb B
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 250	70 – 100
3.2 × 350	100 – 145
4.0 × 350	140 – 190

Preheating / Interpass temperature	Post weld heat treatment (PWHT)	Cooling down before PWHT
200 – 220 °C / 200 – 280 °C	740 °C / 2h	RT

Approvals

TÜV (10156), CE

BÖHLER FOX CM 5 Kb

Stick electrode, low-alloyed, creep resistant

Classifications

EN ISO 3580-A	**AWS A5.5 / SFA-5.5**
E CrMo5 B 4 2 H5	E8018-B6 H4 R

Characteristics and typical fields of application

Basic coated, core wire alloyed electrode for creep resistant steels, suited in pressure vessels and in the crude oil industry. Preferably suited for X12CrMo5 (5 Cr 0.5 Mo) steels. Approved in long-term condition up to +650 °C service temperature. High crack resistance, very low hydrogen content (acc. AWS condition HD < 4 ml/100 g). Good weldability in all positions except vertical down. The weld deposit is heat treatable. Metal recovery approximately 115 %.

Base materials

Creep resistant steels and similar alloyed cast steels, QT-steels similar alloyed up to 1180 MPa tensile strength

1.7362 X12CrMo5

ASTM A 182 Gr. F5; A 193 Gr. B5; A 213 Gr. T5; A217 Gr. C5; A 234 Gr. WP5; A 314 Gr. 501; A335 Gr. P5 u. P5c; A 369 Gr. FB 5; A 387 Gr. 5; A 426 Gr. CP5

Typical analysis of all-weld metal

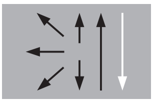
	C	Si	Mn	Cr	Mo
wt.-%	0.08	0.3	0.8	5.0	0.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a	520 (≥ 460)	620 (≥ 590)	21 (≥ 17)	90 (≥ 47)
a2	≥ 460	≥ 590	≥ 17	
v	440	580	26	110

a annealed, 730 °C/2h / furnace down to 300 °C / air
a2 annealed, 760 °C/1h/ furnace down to 200 °C / air
v quenched/tempered 960 °C/0.5 h / oil 730 °C/0.5 h / furnace down to 300 °C / air

Operating data



Polarity	DC +
Electrode identification	FOX CM 5 Kb 8018-B6 E CrMo 5 B
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 250	70 – 90
3.2 × 350	110 – 130
4.0 × 350	140 – 170

Preheat and interpass temperatures 300 – 350ºC. post-weld annealing at 730 – 760ºC for at least 1 hour followed by cooling in furnace down to 300ºC and still air.

Approvals

TÜV (00725), CE

SMAW

BÖHLER FOX CM 9 Kb

Stick electrode, low-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E CrMo9 B 4 2 H5	E8018-B8 H4

Characteristics and typical fields of application

Basic coated, core wire alloyed electrode for creep resistant steels, suited in pressure vessel, particularly in the petrochemical industry. Preferably used for 9% Cr 1% Mo steels e.g. X12CrMo9-1 (P9).Approved in long-term condition up to +600°C service temperature.

The weld metal is heat treatable. Metal recovery approximately 115%.

Base materials

Highly creep resistant steels, same alloyed

1.7386 X11CrMo9-1, 1.7388 X7CrMo9-1

ASTM A 182 Gr. F9; A 213 Gr. T9; A 217 Gr. C12; A 234 Gr. WP9; A 335 Gr. P9; A 336 Gr. F9; A 369 Gr. FB9; A 387 Gr. 9 u. 9CR; A 426 Gr. CP9; A 989 Gr. K90941

Typical analysis of all-weld metal

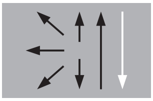
	C	Si	Mn	Cr	Mo
wt.-%	0.08	0.25	0.65	9.0	1.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a	610 (≥ 530)	730 (≥ 620)	20 (≥ 18)	70 (≥ 34)
v	600	730	25	100

a annealed, 760 °C/1 h / furnace down to 300 °C / air
v quenched/tempered, 930 °C/10 min / air 740 °C/2 h / air

Operating data



Polarity	DC +
Electrode identification	FOX CM 9 Kb 8018-B8 E CrMo9 B
Redrying	300-350°C/2h

Dimension mm	**Current A**
2.5 × 250	70 – 90
3.2 × 350	100 – 130
4.0 × 350	130 – 160
5.0 × 450	180 – 210

Preheating and interpass temperatures 250 – 350°C. post-weld annealing at 710 – 760°C for at least 1 h followed by cooling in furnace down to 300°C and still air.

Approvals

TÜV (02183), CE

BÖHLER FOX 20 MVW

Stick electrode, high-alloyed, creep resistant

Classifications

EN ISO 3580-A
E CrMoWV12 B 4 2 H5

Characteristics and typical fields of application

Basic coated, core wire alloyed electrode for high temperature, heat treatable 12% Cr-steels in turbine and boiler construction as well as in the chemical industry. Preferably used for X20CrMoV12–1. Approved in long-term condition up to +650ºC service temperature.

High creep rupture strength and excellent toughness under long term stresses. Optimum chemical composition ensures a high quality weld metal. Low hydrogen content (HD < 5 ml/100 g). Good weldability in all positions except vertical down. The weld metal deposit is heat treatable. Metal recovery approximately 115%.

Base materials

Similar alloyed creep resistant steels

1.4922 X20CrMoV11-1 (T550 Extra), 1.4935 X20CrMoWV12-1, 1.4923 X22CrMoV12-1,

1.4926 X21CrMoV12-1, 1.4913 X19CrMoNbVN 11-1 (T560 Extra), 1.4931 GX23CrMoV12-1

Typical analysis of all-weld metal

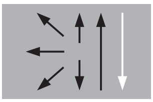
	C	Si	Mn	Cr	Ni	Mo	W	V
wt.-%	0.18	0.3	0.7	11.0	0.55	0.9	0.5	0.25

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a	580 (≥ 550)	780 (≥ 690)	18 (≥ 15)	45 (≥ 34)
v	590	790	18	45

a annealed 760 °C/4 h / furnace down to 300°C/air
v quenched/tempered 1050 °C/0.5 h / oil + 760 °C/2 h / furnace down to 300°C/air

Operating data



Polarity	DC (+)
Electrode identification	FOX 20 MVW E CrMoWV12 B
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 250	60 – 80
3.2 × 350	90 – 120
4.0 × 350	110 – 140
5.0 × 450	150 – 180

Preheating and interpass temperatures:

400 – 450 ºC (austenitic welding) or

250 – 300 ºC (martensitic welding).

Root passes should principally be welded in the martensitic range. Lower preheat and interpass temperatures are possible, yet must be approved by practical welding tests and process qualification tests.

After welding cooling down to 90±10 ºC, followed by tempering at 720 – 760 ºC for three minutes / mm wall thickness (at least for 2 hours). Quenching and tempering if specified, at 1050 ºC for ½ hour/oil and annealing at 760 ºC for 2 hours.

Approvals

TÜV (01082.), KTA 1408.1 (8088), CE

SMAW

BÖHLER FOX C 9 MV

Stick electrode, low-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E CrMo91 B 4 2 H5	E9015-B91 H4

Characteristics and typical fields of application

Basic coated CrMoVNb core wire alloyed electrode, specially designed for welding of creep resistant tempered martensitic 9% Cr steels for turbine and boiler fabrication in thermal power plants as well as in the chemical industry. Approved for long-term use at service temperatures up to 650ºC. Böhler FOX C 9 MV provides good welding characteristics in all positions except vertical down, a stable arc, low spattering, good slag detachability and excellent striking and re-striking properties. The chemical composition is optimized in order to provide a high creep resistant and ductile weld metal and is characterized by low hydrogen content and low level of trace elements.

Base materials

Modified 9Cr-1Mo steels like 1.4903, X10CrMoVNb9-1, GX12CrMoVNbN9-1, ASTM Grade 91

Typical analysis of all-weld metal

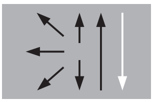
	C	Si	Mn	Cr	Ni	Mo	V	Nb	N
wt.-%	0.1	0.2	0.6	8.5	0.5	0.9	0.2	0.05	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
a1, Test @ 20°C	580 (≥ 530)	710 (≥ 620)	19 (≥ 17)	70 (≥ 47)
a1, Test @ 500°C	420 (≥ 300)	490 (≥ 380)	19 (≥ 17)	-

a1 annealed, 760 °C/2h / furnace down to 300 °C/air

Operating data



Polarity	DC+
Electrode identification	FOX C 9 MV 9015-B9 E CrMo91 B
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 250	60 – 80
3.2 × 350	90 – 120
4.0 × 350	110 – 150
5.0 × 450	150 – 210

Re-drying not necessary straight from the tin.

Preheating / Interpass temperature	Post weld heat treatment (PWHT)	Cooling down before PWHT
180 - 300 °C	760 °C min. 2 Std. max. 10 Std	< 100 °C

Approvals

TÜV (06762), CE

böhler welding by voestalpine

SMAW

Thermanit MTS 3-LNi

Stick electrode, medium-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E Z CrMo91 B 4 2 H5	E9015-B91 H4

Characteristics and typical fields of application

Basic coated CrMoVNb alloyed electrode specially designed for welding of creep resistant tempered martensitic 9% Cr steels used for turbine and boiler fabrication in thermal power plants as well as in the chemical industry.

Thermanit MTS 3 LNi provides good welding characteristics in all positions except vertical down, a stable arc, low spattering, good slag detachability and excellent striking and re-striking properties.

The chemical composition is optimized in order to provide a high creep resistant and ductile weld metal and meets the requirement for restricted Mn + Ni content (< 1 wt. %). It is characterized by low hydrogen content and low level of trace elements.

Base materials

Modified 9Cr-1Mo steels like 1.4903, X10CrMoVNb9-1, GX12CrMoVNbN9-1, ASTM Grade 91

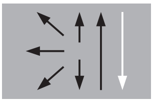
Typical analysis of all-weld metal

	C	Si	Mn	Cr	Ni	Mo	V	Nb	N
wt.-%	0.1	0.2	0.8	9.0	0.1	1.1	0.2	0.05	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
760°C / 2 h	≥ 550	≥ 680	≥ 17	≥ 47

Operating data



Polarity	DC +
Electrode identification	Thermanit MTS 3-LNi E ZCrMo91B 9015-B91
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 250	70 – 100
3.2 × 350	100 – 145
4.0 × 350	140 – 190

Preheating / Interpass temperature	Post weld heat treatment (PWHT)	Cooling down before PWHT
180 – 300 °C	760 °C min. 2 h, max. 10 h	< 100 °C

Approvals

-

SMAW

Thermanit Chromo 9 V

Stick electrode, medium-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E CrMo91 B 4 2 H5	E9015-B91 H4 R

Characteristics and typical fields of application

Basic coated, core wire CrMoVNb-alloyed electrode specially designed for welding of creep resistant tempered martensitic 9% Cr steels used for turbine and boiler fabrication in thermal power plants as well as in the chemical industry.

Generally for vertical up welding with very good welding characteristics.

The chemical composition is optimized in order to provide a high creep resistant and ductile weld metal and is characterized by low hydrogen content and low level of trace elements. This electrode is core wire alloyed thus a very homogeneous alloy dispersal is provided.

Base materials

1.4903 – X 10 CrMoVNb 91, ASTM A199 Gr. T91; A213/213M Gr. T91; A355 Gr. P91 (T91)

Typical analysis of all-weld metal

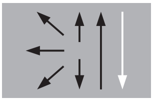
	C	Si	Mn	Cr	Ni	Mo	V	Nb	N
wt.-%	0.09	0.2	0.6	9.0	0.8	1.1	0.2	0.05	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
(760 °C / 2 h) Test @ 20°C	610 (≥ 530)	740 (≥ 620)	19 (≥ 17)	75 (≥ 47)
(760 °C / 2 h) Test @ 500°C	420 (≥ 300)	490 (≥ 380)	19 (≥ 17)	-

Creep rupture properties: According to base metal P91

Operating data



Polarity	DC (+)
Electrode identification	Chromo 9V/9015-B91/E CrMo91 B
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 250	70 – 100
3.2 × 350	100 – 145
4.0 × 350	140 – 190
5.0 × 450	160 – 240

Preheating / Interpass temperature	Post weld heat treatment (PWHT)	Cooling down before PWHT
200 - 250 °C / 200 - 300 °C	760 °C min. 2 h, max. 10 h	< 100 °C

Approvals

TÜV (06173.), IBR, CE

Thermanit Chromo 9 V Mod

Stick electrode, medium-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E Z CrMo91 B 4 2 H5	E9015-B91 H4 R

Characteristics and typical fields of application

Basic coated CrMoVNb alloyed electrode specially designed for welding of creep resistant tempered martensitic 9% Cr steels used for turbine and boiler fabrication in thermal power plants as well as in the chemical industry.

Thermanit Chromo 9 V Mod provides good welding characteristics in all positions except vertical down, a stable arc, low spattering, good slag detachability and excellent striking and re-striking properties.

The chemical composition is optimized in order to provide a high creep resistant and ductile weld metal and meets the requirement for restricted Mn + Ni content (< 1 wt. %). It is characterized by low hydrogen content and low level of trace elements. This electrode has a half-synthetic cover concept.

Base materials

1.4903 – X10CrMoVNb9-1

ASTM A199 Gr. T91; A213/213M Gr. T91; A355 Gr. P91 (T91)

Typical analysis of all-weld metal

	C	Si	Mn	Cr	Ni	Mo	V	Nb	N
wt.-%	0.1	0.2	0.8	9.0	0.1	1.1	0.2	0.05	0.04

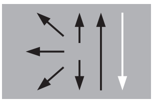
Content of Mn and Ni in total <1.0 %

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
(760 °C / 2 h) Test @ 20°C	610 (≥ 530)	740 (≥ 620)	19 (≥ 17)	75 (≥ 47)
(760 °C / 2 h) Test @ 500°C	445 (≥ 300)	525 (≥ 380)	19 (≥ 17)	-

Creep rupture properties: According to base metal P91

Operating data



Polarity	DC (+)
Electrode identification	Chromo 9V Mod EZ CrMo91 B 4 2
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 250	70 – 100
3.2 × 350	100 – 145
4.0 × 350	140 – 190
5.0 × 450	160 – 240

Preheating / Interpass temperature	Post weld heat treatment (PWHT)	Cooling down before PWHT
200 - 250 °C / 200 - 300 °C	760 °C min. 2 h, max. 10 h	< 100 °C

Approvals

-

SMAW

Thermanit MTS 616

Stick electrode, medium-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E Z CrMoWVNb9 0,5 2 B 4 2 H5	E9015-B92 H4 E9015-G

Characteristics and typical fields of application

Basic coated, core wire alloyed electrode, specially designed for welding of creep resistant tempered martensitic 9% Cr steels. The electrode is used for the fabrication of turbine and boiler components in thermal power plants.

It features good welding characteristics in all positions except vertical down, a stable arc, low spattering, good slag detachability and excellent striking and re-striking properties.

The chemical composition is optimized in order to provide a high creep resistant and ductile weld metal and is characterized by low hydrogen content and low level of trace elements.

Base materials

1.4901 – X10CrWMoVNb9-2; NF 616

ASTM A355 Gr. P92 (T92); A213 Gr. T 92

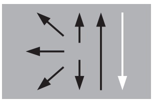
Typical analysis of all-weld metal

	C	Si	Mn	Cr	Ni	Mo	W	V	Nb	N
wt.-%	0.11	0.2	0.6	8.8	0.6	0.5	1.7	0.2	0.04	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
760 °C / 2 h	590 (≥ 530)	730 (≥ 620)	19 (≥ 17)	50 (≥ 41)

Operating data



Polarity	DC +
Electrode identification	Thermanit MTS 616 9015-B92
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 300	70 – 100
3.2 × 350	90 – 135
4.0 × 350	130 – 170
5.0 × 450	160 – 240

Preheating / Interpass temperature	Post weld heat treatment (PWHT)	Cooling down before PWHT
200 – 250 °C / 250 – 350 °C	760 °C min. 2 h, max. 10 h	< 100 °C

Approvals

TÜV (09289.), IBR, CE

böhler welding by voestalpine

Thermanit MTS 616 LNi

Stick electrode, medium-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E Z CrMoWVNb9 0,5 2 B 4 2 H5	E9015-B92 H4 E9015-G

Characteristics and typical fields of application

Basic coated core wire alloyed electrode, specially designed for welding of creep resistant tempered martensitic 9% Cr steels. The electrode is used for the fabrication of turbine and boiler components in thermal power plants.

It features good welding characteristics in all positions except vertical down, a stable arc, low spattering, good slag detachability and excellent striking and re-striking properties.

The chemical composition is optimized in order to provide a high creep resistant and ductile weld metal and meets the requirement for restricted Mn + Ni content (< 1.2 wt. %). It is characterized by low hydrogen content and low level of trace elements.

Base materials

1.4901 – X10CrWMoVNb9-2; NF 616

ASTM A355 Gr. P92 (T92); A213 Gr. T 92

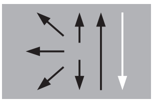
Typical analysis of all-weld metal

	C	Si	Mn	Cr	Ni	Mo	W	V	Nb	N
wt.-%	0.11	0.2	0.7	8.8	0.4	0.5	1.6	0.2	0.05	0.05
Mn + Ni ≤ 1.2										

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
760 °C / 2 h	≥530	≥620	≥17	≥41

Operating data



Polarity	DC +
Electrode identification	Thermanit MTS 616-LNi E9015-B92
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 300	70 – 100
3.2 × 350	90 – 135
4.0 × 350	130 – 170
5.0 × 450	160 – 240

Preheating / Interpass temperature	Post weld heat treatment (PWHT)	Cooling down before PWHT
200 – 250 °C / 250 – 350 °C	760 °C min. 2 h, max. 10 h	≤ 100 °C

Approvals

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BÖHLER FOX P 22 (LC)

Stick electrode, low-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E CrMo2L B 4 2 H5	E8018-B3L

Characteristics and typical fields of application

Fully synthetic basic coated Cr-Mo alloyed low carbon electrode, preferred for welding of creep-resistant steels alloyed with 2,25% Cr, 1% Mo. Recommended for steam generating power plants (for welding piping, heavy-duty boilers, superheaters, superheater-lines).

The fully synthetic cover ensures easy handling, designed for welding under difficult welding conditions.

Compared to BÖHLER FOX P 22 the lower carbon version (LC) is also applicable for weld repair when post-weld heat treatment is not possible. The lower carbon content provides lower hardness in the "as-welded" condition.

For higher creep strength requirements, we recommend BÖHLER FOX P 22.

Base materials

10CrMo9-10, 12CrMo9-10, 10CrSiMoV7, 15CrMoV5-10;

ASTM A335 Gr. P22, A217 Gr. WC9

Typical analysis of all-weld metal

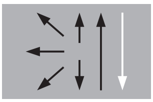
	C	Si	Mn	Cr	Mo
wt.-%	0.04	0.3	0.6	2.2	1.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-20°C
u	≥ 510	≥ 680	≥ 20	≥ 80	
a	≥ 460	≥ 550	≥ 22	≥ 120	≥ 47
a1	≥ 460	≥ 550	≥ 22	≥ 120	≥ 47

u - as welded
a annealed, 690 °C/1 h
a1 annealed, 690 °C/10 h

Operating data



Polarity	DC (+)
Electrode identification	FOX P 22 LC 8018-B3L E CrMo2L B
Redrying	300-350°C/2h

Dimension mm	Current A
2.5 × 350	80 – 105
3.2 × 350	100 – 150
4.0 × 350	140 – 200

Approvals

-

BÖHLER FOX P 22

Stick electrode, low-alloyed, creep resistant

Classifications

EN ISO 3580-A	**AWS A5.5 / SFA-5.5**
E CrMo2 B 4 2 H5	E9018-B3

Characteristics and typical fields of application

Fully synthetic basic coated CrMo alloyed electrode preferred for welding of creep-resistant steels alloyed with 2,25% Cr, 1% Mo. Recommended for steam generating power plants (for welding piping, heavy-duty boilers, super heaters and super heater lines).

The fully synthetic cover ensures easy handling, designed for welding under difficult welding conditions.

For repairs of aged material, the low carbon type BÖHLER FOX P 22 LC (C < 0.05%) is recommended.

Base materials

10CrMo9-10, 12CrMo9-10, 10CrSiMoV7, 15CrMoV5-10;

ASTM A335 Gr. P22, A217 Gr. WC9

Typical analysis of all-weld metal

	C	Si	Mn	Cr	Mo
wt.-%	0.06	0.3	0.7	2.2	1.0

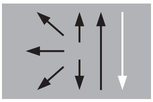
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -20°C	20°C
a	≥ 530	≥ 620	≥ 22	≥ 47	≥ 120
a1	≥ 530	≥ 620	≥ 22	≥ 47	≥ 120

a annealed, 690 °C/1 h

a1 annealed, 690 °C/10 h

Operating data



Polarity	DC +
Electrode identification	FOX P 22 9018-B3 E CrMo2 B
Redrying	300-350°C/2h

Dimension mm	**Current A**
2.5 x 350	80 – 105
3.2 x 350	100 – 150
4.0 x 350	140 – 200

Approvals

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SMAW

Thermanit MTS 5 Co 1

Stick electrode, medium-alloyed, creep resistant

Classifications

EN ISO 3580-A	AWS A5.5 / SFA-5.5
E Z CrCoMoV 10 11 B 4 2 H5	E9015-G

Characteristics and typical fields of application

Basic coated electrode for welding of the creep resistant, cast material COST CB2

Creep resistant up to 650°C. For joining and surfacing applications with matching / similar 9% Cr cast steel grades.

Base materials

Similar alloyed creep resistant steels like COST CB2/FB2

GX12CrMoCoVNbB9-2-1, GX13CrMoCoVNbNB10-1-1

Typical analysis of all-weld metal

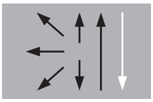
	C	Si	Mn	Cr	Ni	Mo	V	Co	Nb	N	B
wt.-%	0.12	0.3	0.8	9.4	0.2	1.5	0.2	1.0	0.05	0.03	0.003

Structure: tempered Martensite

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
740 °C / 10h	560	720	15	27

Operating data



Polarity DC +

Redrying 300-350°C/2h

Dimension mm	Current A
3.2 × 350	80 – 130
4.0 × 350	100 – 170
5.0 × 450	150 – 220

Preheating / Interpass temperature	Post weld heat treatment (PWHT)	Cooling down before PWHT
According to wall thickness: 200 / 200 – 280 °C	After welding cooling to = 100 °C. Heating thick walls 80 – 120 °C/h = 10 mm / = 500 °C/h. Annealing approx. 10 h 740 ±10 °C. Cooling 80 – 120 °C/h = 300 °C / air	< 100 °C

Approvals

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BÖHLER DMO-IG

TIG Rod, low-alloyed, creep resistant

Classifications

EN ISO 636-A	EN ISO 21952-A	AWS A5.28 / SFA-5.28
W 2Mo / W 46 3 2Mo	W MoSi	ER70S-A1 (ER80S-G)

Characteristics and typical fields of application

GTAW rod/wire for welding of low alloy and creep resistant steels.

Application area includes boiler, pressure vessel, tanks, pipeline, and crane constructions as well as in structural steel engineering.

Approved in long-term service up to 550°C.

Base materials

Creep resistant steels and similar alloyed cast steels, ageing resistant and steels resistant to caustic cracking

16Mo3, 20MnMoNi4-5, 15NiCuMoNb5, S235JR-S355JR, S235J0-S355J0, S450J0, 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 the wire rod

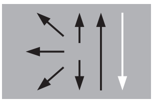
	C	Si	Mn	Mo
wt.-%	0.1	0.6	1.1	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-30°C
u	530 (≥ 460)	650 (≥ 550 - 740)	26 (≥ 22)	200	80 (≥ 47)
a	480	570	27	230	

u untreated, as-welded – shielding gas Argon
a annealed, 620°C /1h / furnace down to 300 °C / air – shielding gas Argon

Operating data



Shielding gas (EN ISO 14175)	I1	**Dimension mm**
Rod marking	WMoSi 1.5424	1.6 × 1000

Preheating, interpass temperature and post weld heat treatment as required by the base metal.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

TÜV (00020), KTA 1408.1 (8066), DB (42.132.70), BV (UP), DNV GL, CRS, NAKS, CE

Alternative products

Union I Mo

GTAW

BÖHLER DCMS-IG

TIG Rod, low-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.28 / SFA-5.28
W CrMo1Si	ER80S-G

Characteristics and typical fields of application

GTAW rod for 1.25% Cr 0.5% Mo alloyed boiler, plate and tube steels as well as for the welding of quenched and tempered and case hardening steels. Preferably used for the steels 13CrMo4-5 or ASTM A335 P11 / P12. Approved in long-term service up to 570°C . Suitable for step-cooling applications. Bruscato ≤ 15 ppm.

The deposit is noted for its good mechanical properties and good toughness with good resistance to cracking in caustic soda. Creep rupture strength values are within the scatter band of the base material 13CrMo4-5.

Base materials

Creep resistant steels and similar alloyed cast steels, case hardening and nitriding steels of similar chemical composition, similar alloyed heat treatable steels with tensile strength up to 780 MPa, steels resistant to caustic cracking

1.7335 – 13CrMo4-5, 1.7262 – 15CrMo5, 1.7728 – 16CrMoV4, 1.7218 – 25CrMo4, 1.7258 – 24CrMo5, 1.7354 – G22CrMo5-4, 1.7357 – G17CrMo5-5

ASTM A193 Gr. B7, A335 Gr. P11 u. P12, A217 Gr. WC6

Typical analysis of the wire rod

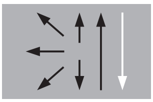
	C	Si	Mn	Cr	Mo	P	Sb	Sn	As
wt.-%	0.1	0.6	1.0	1.2	0.5	≤ 0.015	≤ 0.005	≤ 0.006	≤ 0.010

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a	440 (≥ 355)	570 (≥ 550)	25 (≥ 20)	250 (≥ 47)
a1	510	620	22	200

a annealed, 680°C/1h / furnace down to 300°C / air – shielding gas Argon
a1 annealed, 620°C/1h / furnace down to 320°C / air – shielding gas Argon

Operating data



Shielding gas (EN ISO 14175)	I1	
Rod marking	W CrMo1 Si 1.7339	

Dimension mm
1.6 × 1000
2.0 × 1000
2.4 × 1000
3.0 × 1000

Preheat, interpass temperature and post weld heat treatment as required by the base metal.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

TÜV (00727),CE, NAKS (Ø 2.4 mm; Ø 3.0 mm)

Alternative products

Union I CrMo

BÖHLER CM 5-IG

TIG rod, medium-alloyed, creep resistant

Classifications

EN ISO 21952-A	**AWS A5.28 / SFA-5.28**
W CrMo5Si	ER80S-B6

Characteristics and typical fields of application

GTAW rod for 5% Cr 0.5% Mo steels and steels for pressurized hydrogen service, particularly for application in oil refineries. Preferably used for steel grades such as X12CrMo5 and Gr. P5. Approved in long-term service up to 650°C.

Base materials

High temperature steels and similar alloyed cast steels, QT-steels similar alloyed up to 1180 MPa

1.7362 – X12CrMo5

ASTM A 182 Gr. F5; A 193 Gr. B5; A 213 Gr. T5; A217 Gr. C5; A 234 Gr. WP5; A 314 Gr. 501; A335 Gr. P5 u. P5c; A 369 Gr. FB 5; A 387 Gr. 5; A 426 Gr. CP5

Typical analysis of the wire rod

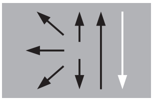
	C	Si	Mn	Cr	Mo
wt.-%	0.08	0.4	0.5	5.6	0.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a	500 (≥ 470)	620 (≥ 590)	20 (≥ 17)	200 (≥ 47)

a annealed 730 °C/2 h, cooling down to 300 °C / air.
Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Operating data



Shielding gas (EN ISO 14175) I1

Dimension mm
1.6 × 1000
2.0 × 1000
2.4 × 1000
3.0 × 1000

Preheating and interpass temperatures 150 – 300°C. Tempering at 730 – 760°C for at least 1 h followed by cooling in furnace down to 300°C and still air.

Approvals

TÜV (00724),CE

BÖHLER DMV 83-IG

TIG Rod, low-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.28 / SFA-5.28	Material-No.
W MoVSi	ER80S-G	1.5407

Characteristics and typical fields of application

GTAW rod specially designed for the base metal 14MoV6-3 (½ Cr ½ Mo ¼ V). Approved in long-term condition up to 560°C service temperature. Tough weld deposit with good creep rupture strength.

Base materials

Creep resistant steels and similar alloyed cast steels

1.7715 – 14MoV6-3

Typical analysis of the wire rod

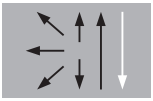
	C	Si	Mn	Cr	Mo	V
wt.-%	0.08	0.6	0.9	0.45	0.85	0.35

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a	520 (≥ 355)	670 (≥ 620)	24 (≥ 18)	220 (≥ 47)

a annealed, 700 °C/2h / furnace down to 300 °C / air – shielding gas Argon

Operating data



		Dimension mm
Shielding gas (EN ISO 14175)	I1	2.4 × 1000
Rod marking	W MoV Si 1.5407	3.2 × 1000

Preheating and interpass temperatures 200 – 300 °C. Tempering at 700 – 720 °C at least 2h followed by cooling down to 300 °C and still air.

Shielding gas: 100% Ar, 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (01093), DB (42.014.02), LTSS, CE

BÖHLER CM 9-IG

TIG rod, high-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.28 / SFA-5.28
WZ CrMo9 Si	ER80S-B8

Characteristics and typical fields of application

GTAW rod for 9% Cr 1% Mo creep resistant steels and steels for hot hydrogen service, particularly for application in oil refineries and the base metals X12CrMo9-1 (P9). Approved in long-term condition up to 600°C service temperature.

Base materials

Similar alloyed creep resistant steels

1.7386 X11CrMo9-1, 1.7388 X7CrMo9-1

ASTM A 182 Gr. F9; A 213 Gr. T9; A 217 Gr. C12; A 234 Gr. WP9; A 335 Gr. P9; A 336 Gr. F9; A 369 Gr. FB9; A 387 Gr. 9 u. 9CR; A 426 Gr. CP9; A 989 Gr. K90941

Typical analysis of the wire rod

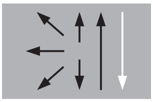
	C	Si	Mn	Cr	Mo
wt.-%	0.07	0.4	0.5	9.0	1.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20 °C
a	530 (≥ 470)	670 (≥ 590)	24 (≥ 18)	220 (≥ 34)

a annealed 760 °C / 2 h, cooling down to 300 °C / air – shielding gas Argon

Operating data



Shielding gas (EN ISO 14175) I1

Dimension mm
1.6 × 1000
2.0 × 1000
2.4 × 1000

Preheating and interpass temperature 250 – 350°C. Tempering at 710 – 760°C for at least 1 h followed by cooling in furnace down to 300°C/air.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

TÜV (2182), CE

Union I CrMo 910

TIG Rod, low-alloyed, creep resistant

Classifications

EN ISO 636-A	EN ISO 21952-A	EN ISO 21952-A	AWS A5.28 / SFA-5.28
W 46 3 2Mo	W CrMo2Si	W MoSi	ER80S-G

Characteristics and typical fields of application

Low-alloyed welding rod / wire for the welding with argon. Suitable for manufacturing creep resistant steels in boiler, tank, pipeline and nuclear reactor construction.

Base materials

1.7380 – 10CrMo9-10 – ASTM A335 Gr. P22

1.7379 – G17CrMo9-10 – ASTM A217 Gr. WC9

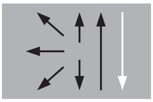
Typical analysis of the wire rod

	C	Si	Mn	Cr	Mo
wt.-%	0.07	0.60	1.0	2.55	1.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20 °C
a	470	590	20	80

Operating data



Shielding gas (EN ISO 14175)	I1-3
Rod marking	W CrMo2 Si / ER 90S-G

Dimension mm
2.0 × 1000
2.4 × 1000
2.5 × 1000
3.0 × 1000
3.2 × 1000

Shielding gas: Ar I1 – I3. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

TÜV (00908), DB (42.132.41), CE

Union I CrMo 910 SPEZIAL

TIG Rod, low-alloyed, creep resistant

Classifications

AWS A5.28 / SFA-5.28
ER90S-G

Characteristics and typical fields of application

Low-alloyed welding rod / wire for the welding with argon. Suitable for manufacturing creep resistant steels in boiler, cracker, tank, pipeline and nuclear reactor construction.

Extra low content for tramp elements. Step cooling tested, largely insensitive to long temperature-embrittlement.

Base materials

1.7380 – 10CrMo9-10 – ASTM A335 Gr. P22 – ASTM A387 Gr. P22

And similar steels

Typical analysis of the wire rod

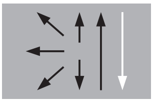
	C	Si	Mn	Cr	Mo	Cu
wt.-%	0.10	0.10	0.50	2.40	1.0	0.1*

* incl. copper coating

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
Spannungsarm geglüht	470	590	20	150

Operating data



Shielding gas (EN ISO 14175)	I1-3
Rod marking	I CRMO 910 SPEZIAL / ER 90S-G

Dimension mm
1.6 × 1000
2.4 × 1000

Shielding gas: Ar I1 – I3. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

On request

Thermanit MTS 911

TIG Rod, low-alloyed, creep resistant

Classifications

EN ISO 21952-A	**AWS A5.28 / SFA-5.28**
W Z CrMoWVNb 9 1 1	ER90S-G

Characteristics and typical fields of application

TIG-rod, high temperature resistant. Suited for joining and surfacing applications with high temperature resistant martensitic steels particularly for matching X11CrMoWVNb9-1-1(E911) parent metal.

Base materials

1.4905 – X11CrMoWVNb9-1-1;

ASTM A 335 Gr. P911; A 213 Gr. T911

Typical analysis of the wire rod

	C	Si	Mn	Cr	Ni	Mo	W	V
wt.-%	0.1	0.3	0.5	9.0	0.5	1.0	1.0	0.2

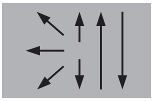
Structure: Martensite, suitable for quenching and tempering

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
760 °C / ≥ 2 h	560	720	15	41

Creep rupture properties: According to matching high temperature resistant parent metal

Operating data



Shielding gas (EN ISO 14175)	I1
Rod marking	E911

Dimension mm
2.0 × 1000
2.4 × 1000

Preheating and Interpass temperature 200 – 250°C (392 – 482 °F) / 200 – 300°C (392 – 572 °F).

Cooling down before PWHT at ≤ 100°C.

Post weld heat treatment 760°C – at least 2 h / air.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

TÜV (07992), CE

böhler welding by voestalpine

Thermanit MTS 3

TIG rod, medium-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.28 / SFA-5.28
W CrMo 9 1	ER90S-B9

Characteristics and typical fields of application

TIG rod / wire for joining and surfacing applications with quenched and tempered 9% Cr steels in turbine and boiler fabrication and in the chemical industry, particularly for matching high temperature resistant parent metal T91 / P91 according to ASTM. Creep resistant up to 650°C.

Base materials

1.4903 – X10CrMoVNb9-1;

ASTM A 199 Gr. T91; A 355 Gr. P91 (T91); A 213/213M Gr. T91

Typical analysis of the wire rod

	C	Si	Mn	Cr	Ni	Mo	V	Nb
wt.-%	0.1	0.3	0.5	9.0	0.5	1.0	0.2	0.06

Structure: Martensite, suitable for quenching and tempering

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
760 °C / 2 h	530	620	17	50

Creep rupture properties: According to matching high temperature resistant parent metal

Operating data

Shielding gas (EN ISO 14175)	I1

Dimension mm
1.6 × 1000
2.0 × 1000
2.4 × 1000
3.2 × 1000
4.0 × 1000

Tempering at 760°C min. 2 h, max 10 h / cooling down to 300°C; air heating / cooling rate below 550°C max. 150°C/h, above 550°C max. 80°C/h. When tempering below 2 h the requirements need to be verified by a WPQR.
Preheat and interpass temperature 200 – 300°C. Cool down to 100°C before post-weld heat treatment.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (06166), CE

Thermanit MTS 3 LNi

TIG rod, medium-alloyed, creep resistant

Classifications

AWS A5.28 / SFA-5.28
ER90S-B9

Characteristics and typical fields of application

TIG rod / wire 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. High temperature creep resistant up to 650°C.

Base materials

1.4903 – X10CrMoVNb9-1;

ASTM A 199 Gr. T91; A 355 Gr. P91 (T91); A 213/213M Gr. T91

Typical analysis of the wire rod

	C	Si	Mn	Cr	Ni	Mo	V	Nb
wt.-%	0.1	0.3	0.7	9.0	< 0.3	1.0	0.2	0.06

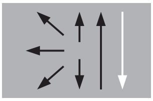
Structure: tempered martensite

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
760 °C / 2 h	540	620	17	50

Creep rupture properties: According to matching high temperature resistant parent metal

Operating data



Redrying: 300 – 350 °C / 2 h (572 – 662 °F)

Shielding gas (EN ISO 14175): I1

Dimension mm	Current A
2.0 × 1000	
2.4 × 1000	
3.2 × 1000	90 – 120

Tempering at 760°C min. 2 h, max 10 h / cooling down to 300°C in oven; air heating / cooling rate below 550°C max. 150°C/h, above 550°C max. 80°C/h. When tempering below 2 h the requirements need to be verified by a WPQR.
Preheat and interpass temperature 200 – 300°C. Cool down to 100°C before post-weld heat treatment.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

-

böhler welding by voestalpine

Thermanit MTS 4 SI

TIG rod, medium-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.9 / SFA-5.9	AWS A5.28 / SFA-5.28	AWS A5.28 / SFA-5.28
W CrMoWV 12 Si	ER505 (mod.)	EG	ER90S-G

Characteristics and typical fields of application

TIG rod, high temperature resistant up to 550°C.

For surfacing and joining applications on 12% Cr steels / cast steel grades suitable for quenching and tempering.

Base materials

TÜV certified parent metals

1.4922 – X20CrMoV12-1; 1.4937 – X23CrMoWV12-1

matching high temperature resistant steels:

1.4922 – X20CrMoV12-1; 1.4935 – X20CrMoWV12-1; 1.4923 – X22CrMoV12-1;

1.4913 – X19CrMoVNb11-1; 1.4931 – GX22CrMoV12-1; (Turbotherm, 20MVNb)

Typical analysis of the wire rod

	C	Si	Mn	Cr	Ni	Mo	W	V
wt.-%	0.20	0.3	0.6	11.0	0.4	1.0	0.5	0.3

Structure: Martensite, suitable for quenching and tempering

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20 °C
760 °C / 4 h	590	700	15	35

Creep rupture properties: According to matching high temperature resistant parent metal

Operating data

		Dimension mm
Shielding gas (EN ISO 14175)	I1	2.4 × 1000
Rod marking	W CrMoWV12Si / 1.4937	

Preheating according to wall thickness: 250 – 300°C (482 – 572°F)

For smaller welding jobs, cool slowly to 120 °C – (furnace, warm sand), tempering for approx. 4 hrs 720 – 760°C/air or quench and temper at 1050°C / air or oil and 4 h. 700 – 760°C / air. For larger welding jobs, intermediate stress-relieving at first from welding temperature 2 h at 550°C – max. 580°C, cool slowly to 120°C tempering or quenching and tempering as above.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

TÜV (02624), CE

GTAW

Thermanit MTS 5 CO 1

TIG rod, medium-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.28 / SFA-5.28
W Z CrCoMoV 10 1 1	ER110S-G

Characteristics and typical fields of application

TIG rod for joining and surfacing creep resistant 9% Cr Co Mo steels like CB2.

Creep resistant up to 650°C.

Base materials

Similar alloyed creep resistant steels like COST CB2/FB2

GX12CrMoCoVNbNB9-2-1, GX13CrMoVNbNB10-1-1

Typical analysis of the wire rod

	C	Si	Mn	Cr	Ni	Mo	V	Co	Nb	N	B
wt.-%	0.12	0.4	0.6	9.4	0.2	1.4	0.2	1.1	0.05	0.03	0.005

Structure: Martensite, heat treatable

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
740 °C / 10h*	560	720	15	27

*other PWHT according to producer's recommendation

Operating data

		Dimension mm
Polarity	DC –	2.4 × 1000
Shielding gas (EN ISO 14175)	I1	

According to wall thickness: 200 – 280°C (392 – 536 °F)

After welding cooling to ≤ 100°C (212° F.) Heating thick walls 80 – 120°C/h (144 – 216° F/h) ≤ 10 mm / ≤ 500°C/h. (900° F) Annealing appr. 10 h 740 ±10°C. (1364° F ±18° F) Cooling rate 80 – 120°C/h (144 – 216° F/h) ≤ 300°C (572° F) / air.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

-

Thermanit MTS 5 CoT

TIG rod, medium-alloyed, creep resistant

Classifications

EN ISO 21952-A	**AWS A5.28 / SFA-5.28**
W Z CrCoW 11 2 2	ER110S-G

Characteristics and typical fields of application

TIG rod, high creep resistant up to 650°C. Surfacing and joint welding of similar high creep resistant, heat-treatable 12% Cr-steel and cast steel.

Base materials

VM12-SHC – 1.4915 – X12CrCoWMoVNb12-2-2

Typical analysis of the wire rod

	C	Si	Mn	Cr	Ni	Mo	W	V	Co	Nb	N	B
wt.-%	0.16	0.4	0.4	11.4	0.4	0.3	1.5	0.2	1.55	0.055	0.04	0.003

Structure: Martensite, suitable for quenching and tempering

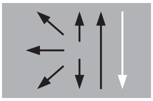
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
770 °C / ≥ 2h*	600	760	15	40

* depends on wall thickness; thin walled tubes ≥ 0,5 h

Creep rupture properties: According to matching high temperature resistant parent metal

Operating data



		Dimension mm
Shielding gas (EN ISO 14175)	I1	1.6 × 1000
Rod marking	VM12-SHC (X12CrCoWVNb12-2-2)	2.0 × 1000
		2.4 × 1000

According to wall thickness 200°C (392 °F) / 200 – 280°C (392 – 536 °F)

Cool down below 100°C after welding. Start PWHT with heating up rates between 80 – 120°C/h. Temper at 770°C +/- 10°C for up to 2 h. Cool down rates between 80 – 120°C/h.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (10578), CE

GTAW

Thermanit MTS 616

TIG rod, medium-alloyed, creep resistant

Classifications

EN ISO 21952-A	**AWS A5.28 / SFA-5.28**
W Z CrMoWVNb 9 0,5 1,5	ER90S-G

Characteristics and typical fields of application

GTAW rod / wire for joining and surfacing applications with matching high temperature resistant parent metal P92 according to ASTM A335. High temperature resistant.

Application temperature max. 650°C

Base materials

1.4901 – X10CrWMoVNb9-2; NF 616;

ASTM A 355 Gr. P92

Typical analysis of the wire rod

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

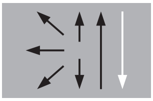
Structure: Martensite, suitable for quenching and tempering

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
760 °C / ≥ 2 h	560	720	15	41

Creep rupture properties: According to matching high temperature resistant parent metal

Operating data



Shielding gas (EN ISO 14175)	I1

Dimension mm
2.4 × 1000

Tempering at 760°C min. 2 h, max 10 h / cooling down to 300°C in oven; air heating / cooling rate below 550°C max. 150°C/h, above 550°C max. 80°C/h. When tempering below 2 h the requirements need to be verified by a WPQR.
Preheat and interpass temperature 200 – 300°C. Cool down to 100°C before post-weld heat treatment.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

TÜV (09290), CE

böhler welding by voestalpine

Union ER 80S-B2

TIG rod, low-alloyed, creep resistant

Classifications

AWS A5.28 / SFA-5.28
ER80S-B2

Characteristics and typical fields of application

TIG rod for 1% Cr 0,5% Mo alloyed boiler, plate and tube steels as well as in oil refineries.

Preferably used for base metal 10CrMo9-10 (ASTM A335 P22). Approved in long-term condition up to 600°C service temperature.

Base materials

Creep resisting steels and similar alloyed cast steels and case hardening steels

ASTM A182 Gr. F12 Cl. 1+2 – K11562+K11564 – 1.7335 – 13 CrMo4-5;

ASTM A213 Gr. T2, T12 – K11547, K11562

ASTM A217 Gr. WC6 – J12072 – 1.7357 – G17CrMo5-5

ASTM A217 Gr. WC11 – J11872; ASTM A234 Gr. WP12 Cl. 1+2 – K12062

ASTM A250 Gr. T2, T12 – K11547, K11562

ASTM A335 Gr. P2, P11, P12 – K11547, K11597, K11562

Typical analysis of the wire rod

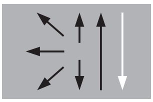
	C	Si	Mn	Cr	Mo
wt.-%	0.10	0.55	0.60	1.30	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20 °C
a	470	550	19	90

a annealed, 620 °C/1 h

Operating data



		Dimension mm
Shielding gas (EN ISO 14175)	I1-3	1.6 × 1000
Rod marking	ER90S-B3	2.0 × 1000
		2.4 × 1000
		3.2 × 1000

Preheating and interpass temperature 200 – 350°C. Tempering at 700 – 750°C at least 1 h followed by cooling down to 300°C and still air.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

On request

Union ER 90S-B3

TIG Rod, low-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.28 / SFA-5.28
W CrMo2	ER90S-B3

Characteristics and typical fields of application

TIG rod for welding of creep resistant steels in boiler, tank, pipeline and nuclear reactor construction.

Base materials

ASTMA 182 Gr. F22 Cl. 1+3 – K21590

ASTMA 213 Gr. T22 – K21590

ASTMA 234 Gr. WP22 Cl. 1+3 – K90941

ASTMA 335 Gr. P22 – K21590 – 1.7380 – 10CrMo9-10

ASTMA 217 Gr. WC9 – J21890 – 1.7379 – G17CrMo9-10

ASTMA 387 Gr. 22 – K21590

Typical analysis of the wire rod

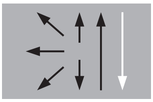
	C	Si	Mn	Cr	Mo
wt.-%	0.09	0.55	0.60	2.55	1.05

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
a	540 (≥ 400)	620 (≥ 550)	20 (≥ 18)	80 (≥ 47)

a annealed, 690 °C/1 h / 1275 °F /1 h

Operating data



		Dimension mm
Shielding gas (EN ISO 14175)	I1	2.0 × 1000
Rod marking	ER90S-B3	2.4 × 1000
		3.2 × 1000

Preheating and interpass temperature 200 – 350°C. Tempering at 700 – 750°C at least 1 h followed by cooling down to 300°C and still air.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

-

BÖHLER DMO-IG

Solid Wire, low-alloyed, creep resistant

Classifications

EN ISO 21952-A	EN ISO 14341-A	AWS A5.28 / SFA-5.28
G MoSi	G 46 4 M21 2Mo	ER70S-A1 (ER80S-G)

Characteristics and typical fields of application

GMAW solid wire electrode for welding of low alloy and creep resistant steels.

Suitable for joints produced with CO_2 or gas mixture. Application area includes boiler, pressure vessel, tanks, pipeline, and crane constructions as well as in structural steel engineering.

Approved in long-term service up to 550°C.

Base materials

Creep resistant steels and similar alloyed cast steels, ageing resistant and steels resistant to caustic cracking

16Mo3, 20MnMoNi4-5, 15NiCuMoNb5, S235JR-S355JR, S235J0-S355J0, S450J0, 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 the solid wire

	C	Si	Mn	Mo
wt.-%	0.1	0.6	1.1	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-40°C
u	500 (≥ 400)	600 (≥ 520)	25 (≥ 22)	150	≥ 47
u1	470 (≥ 400)	590 (≥ 520)	23 (≥ 22)	150	≥ 47
a	450 (≥ 400)	570 (≥ 520)	25 (≥ 17)	150 (> 47)	

u untreated, as-welded – shielding gas Ar + 18 % CO_2
u1 untreated, as-welded – shielding gas 100 % CO_2
a annealed, 620 °C/1h / furnace down to 300 °C / air – shielding gas Ar + 18 % CO_2

Operating data

Dimension mm
0.8
1.0
1.2
1.6

Preheating, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

TÜV (00021), DB (42.132.70), NAKS, CE

Alternative products

Union I Mo

GMAW

BÖHLER DCMS-IG

Solid Wire, low-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.28 / SFA-5.28
G CrMo1Si	ER80S-G

Characteristics and typical fields of application

GMAW solid wire for 1.25% Cr 0.5% Mo alloyed boiler, plate and tube steels as well as for the welding of quenched and tempered and case hardening steels. Preferably used for the steels 13CrMo4-5 or ASTM A335 P11/P12. Approved in long-term service up to 570°C.

The deposit is noted for its good mechanical properties and good toughness with good resistance to cracking in caustic soda. Creep rupture strength values are within the scatter band of the base material 13CrMo4-5.

Base materials

Creep resistant steels and similar alloyed cast steels, case hardening and nitriding steels of similar chemical composition, similar alloyed heat treatable steels with tensile strength up to 780 MPa, steels resistant to caustic cracking

1.7335 – 13CrMo4-5, 1.7262 – 15CrMo5, 1.7728 – 16CrMoV4, 1.7218 – 25CrMo4, 1.7258 – 24CrMo5, 1.7354 – G22CrMo5-4, 1.7357 – G17CrMo5-5

ASTM A193 Gr. B7, A335 Gr. P11 u. P12, A217 Gr. WC6

Typical analysis of the solid wire

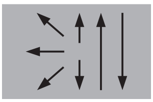
	C	Si	Mn	Cr	Mo
wt.-%	0.11	0.6	1.0	1.2	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a	440 (≥ 355)	570 (≥ 550)	23 (≥ 20)	140 (≥ 47)

a annealed, 680 °C/1h / furnace down to 300 °C / air – shielding gas Ar + 18 % CO_2

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Preheat, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

TÜV (01091), DB (42.014.15),CE

Alternative products

Union I CrMo

BÖHLER CM 5-IG

Solid wire, medium-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.28 / SFA-5.28
G CrMo5Si	ER80S-B6

Characteristics and typical fields of application

GMAW solid wire for 5% Cr 0.5% Mo alloyed steels and steels for pressurized hydrogen service, particularly in oil refineries. Preferably used for steel grades such as X12CrMo5 and Gr. P5. Approved in long-term service up to 650°C.

Base materials

High temperature steels and similar alloyed cast steels, QT-steels similar alloyed up to 1180 MPa

1.7362 – X12CrMo5

ASTM A 182 Gr. F5; A 193 Gr. B5; A 213 Gr. T5; A217 Gr. C5; A 234 Gr. WP5; A 314 Gr. 501; A335 Gr. P5 u. P5c; A 369 Gr. FB 5; A 387 Gr. 5; A 426 Gr. CP5

Typical analysis of the solid wire

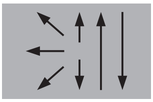
	C	Si	Mn	Cr	Mo
wt.-%	0.06	0.4	0.5	5.6	0.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a	520 (≥ 470)	620 (≥ 590)	20 (≥ 17)	200 (≥ 47)

a annealed, 730 °C / 2 h / furnace down to 300 °C / air – shielding gas Ar + 18 % CO_2

Operating data



Dimension mm
0.8
1.0
1.2
1.6
2.0
2.4
3.0

Preheating and interpass temperatures 150 – 300°C. Tempering at 730 – 760°C for at least 1 h followed by cooling in furnace down to 300°C and still air.

Approvals

-

GMAW

BÖHLER DMV 83-IG

Solid Wire, low-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.28 / SFA-5.28	Material-No.
G MoVSi	ER80S-G	1.5407

Characteristics and typical fields of application

GMAW solid wire for welding boiler, pressure vessels, plate and tube steels, especially for 14MoV6-3 (1/2 Cr 1/2 Mo 1/4 V). Approved in long-term service up to 580°C.

Tough weld deposit with good creep rupture strength.

Base materials

Creep resistant steels and similar alloyed cast steels

1.7715 – 14MoV6-3

Typical analysis of the solid wire

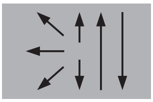
	C	Si	Mn	Cr	Mo	V
wt.-%	0.08	0.6	0.9	0.45	0.82	0.35

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a	610 (≥ 355)	710 (≥ 620)	20 (≥ 18)	70 (≥ 47)

a annealed, 700 °C/2h / furnace down to 300 °C / air – shielding gas Ar + 18 % CO_2

Operating data



Dimension mm
1.2

Preheating and interpass temperatures 200 – 300°C. Tempering at 700 – 720°C for at least 2h followed by cooling in furnace down to 300°C and still air.

Approvals

TÜV (01322),CE

Thermanit MTS 3

Solid wire, medium-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.28 / SFA-5.28	AWS A5.28 / SFA-5.28
G CrMo 9 1	ER90 S-B9	ER90S-B9

Characteristics and typical fields of application

GMAW solid wire for joining and surfacing applications with quenched and tempered 9% Cr steels in turbine and boiler fabrication and in the chemical industry, particularly for matching high temperature resistant parent metal T91 / P91 according to ASTM. Creep resistant up to 650°C.

Base materials

1.4903 – X10CrMoVNb9-1;

ASTM A 199 Gr. T91; A 355 Gr. P91 (T91); A 213/213M Gr. T91

Typical analysis of the solid wire

	C	Si	Mn	Cr	Ni	Mo	V	Nb
wt.-%	0.1	0.3	0.5	9.0	0.5	1.0	0.2	0.06

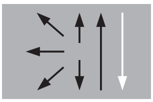
Structure: Martensite, suitable for quenching and tempering

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) MPa	Impact values ISO-V KV J J
760 °C / 2 h	520	620	16	50

Creep rupture properties: According to matching high temperature resitant parent metal

Operating data



Dimension mm
0.8
0.9
1.0
1.2
1.6

Tempering at 760°C min. 2 h, max 10 h / cooling down to 300°C in oven; air heating / cooling rate below 550°C max. 150°C/h, above 550°C max. 80°C/h. When tempering below 2 h the requirements need to be verified by a WPQR. For optimal toughness stringer beads (ca. 2mm) are recommended.

Preheat and interpass temperature 200 – 300°C. Cool down to 100°C before post-weld heat treatment.

Shielding gas: Ar + 8 – 10% CO_2, Ar + 2 – 3% CO_2 (M12) or Ar + 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Approvals

-

GMAW

Thermanit MTS 3-LNI

Solid wire, medium-alloyed, creep resistant

Classifications

AWS A5.28 / SFA-5.28
ER90S-B9

Characteristics and typical fields of application

Solid wire for high temperature, creep resistant martensitic 9% Cr steels, mainly used in thermal power plants, turbine and boiler fabrication and chemical industry.

Especially designed for ASTM steels P91 / T91.

High creep rupture strength and good toughness properties under long term stresses.

Meets Mn+Ni ≤ 1.0% and X-factor ≤ 15 ppm.

Base materials

1.4903 – X10CrMoVNb9-1;

ASTM A 199 Gr. T91; A 355 Gr. P91 (T91); A 213/213M Gr. T91

Typical analysis of the solid wire

	C	Si	Mn	Cr	Ni	Mo	V	Nb	N
wt.-%	0.11	0.25	0.65	9.0	< 0.15	0.95	0.2	0.06	0.045

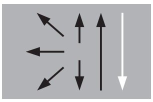
Structure: Martensite, suitable for quenching and tempering

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa / ksi	Tensile strength R_m MPa / ksi	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20 °C / 68 °F
760 °C / 2 h	520 / 75	620 / 90	23	50 / 37

Creep rupture properties: According to matching high temperature resistant parent metal

Operating data



Dimension mm
1.6
2.4
3.2

Tempering at 760°C min. 2 h, max 10 h / cooling down to 300°C in oven; air heating / cooling rate below 550°C max. 150°C/h, above 550°C max. 80°C/h. When tempering below 2 h the requirements need to be verified by a WPQR. For optimal toughness stringer beads (ca. 2mm) are recommended.
Preheat and interpass temperature 200 – 300°C. Cool down to 100°C before post-weld heat treatment.

Shielding gas: Ar + 8 – 10% CO_2, Ar + 2 – 3% CO_2 (M12) or Ar + 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Approvals

-

Thermanit MTS 4 Si

Solid wire, medium-alloyed, creep resistant

Classifications

EN ISO 21952-A	AWS A5.9 / SFA-5.9	AWS A5.28 / SFA-5.28
G CrMoWV 12 Si	ER505 (mod.)	EG

Characteristics and typical fields of application

Solid wire for joining and surfacing applications on 12% Cr steels / cast steel grades suitable for quenching and tempering. Creep resistant up to 550°C.

Base materials

1.4922 – X20CrMoV12-1; 1.4935 – X20CrMoWV12-1; 1.4937 – X23CrMoWV12-1; 1.4923 – X22CrMoV12-1; 1.4926 – X21CrMoV12-1; 1.4913 – X19CrMoNbVN 11-1; 1.4931 – GX23CrMoV12-1;

Typical analysis of the solid wire

	C	Si	Mn	Cr	Ni	Mo	W	V
wt.-%	0.20	0.3	0.6	11.0	0.4	1.0	0.5	0.3

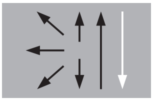
Structure: Martensite, suitable for quenching and tempering, ferrite-free

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) MPa	Impact values ISO-V KV J J
760 °C / 4 h	590	700	15	35

Creep rupture properties: In the range of matching high temperature resistant parent materials.

Operating data



Dimension mm
1.2

Preheating according to wall thickness: 250 – 300 °C (482 – 572 °F)

For smaller welding jobs, cool slowly to 120 °C – (furnace, warm sand), tempering for approx. 4 hrs 720 – 760 °C/air or quench and temper at 1050 °C / air or oil and 4 h. 700 – 760 °C / air. For larger welding jobs, intermediate stress-relieving at first from welding temperature 2 h at 550 °C – max. 580 °C, cool slowly to 120 °C tempering or quenching and tempering as above.

Shielding gas: Ar + 8 – 10% CO_2, Ar + 2 – 3% CO_2 (M12) or Ar + 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Approvals

-

Thermanit MTS 616

Solid wire, medium-alloyed, creep resistant

GMAW

Classifications

EN ISO 21952-A	AWS A5.28 / SFA-5.28	AWS A5.28 / SFA-5.28
G Z CrMoWVNb 9 0,5 1,5	ER90S-B9 (mod.)	ER90S-G

Characteristics and typical fields of application

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

Application temperature max. 650°C

Base materials

1.4901 – X10CrWMoVNb9-2; NF 616;

ASTM A 355 Gr. P92

Typical analysis of the solid wire

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

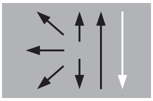
Structure: Martensite, suitable for quenching and tempering

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) MPa	Impact values ISO-V KV J J
(760 °C / ≥ 2 h)	560	720	15	41

Creep rupture properties: According to matching high temperature resistant parent metal

Operating data



Dimension mm
0.8
1.0
1.2

Tempering at 760°C min. 2 h, max 10 h / cooling down to 300°C in oven; air heating / cooling rate below 550°C max. 150°C/h, above 550°C max. 80°C/h. When tempering below 2 h the requirements need to be verified by a WPQR. For optimal toughness stringer beads (ca. 2mm) are recommended.

Preheat and interpass temperature 200 – 300°C. Cool down to 100°C before post-weld heat treatment.

Shielding gas: Ar + 8 – 10% CO_2, Ar + 2 – 3% CO_2 (M12) or Ar + 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Approvals

-

Union S 2 Mo - UV 305

SAW wire/flux combination, low-alloyed

Classifications

EN ISO 14171-A
S 46 0 AR S2Mo

AWS A5.23 / SFA-5.23
F8A0-EA2-A2

Characteristics and typical fields of application

Union S 2 Mo - UV 305 is a wire-flux combination for submerged-arc welding of unalloyed and low alloyed steel grades. Very good slag detachability and nice bead appearance. It is recommended to be used for single-wire or twin-arc welding with small wire diameter (e.g. with 2,0 mm) with high welding speed, especially for fillet welding in low wall thickness (< 10 mm). It is particularly well-suited to welding of "water walls" (tube-web-tube joint) for steam water-tube boiler.

UV 305 is an aluminate-rutile agglomerated flux suited for direct and alternating current. For information regarding this welding flux see our detailed data sheet.

Base materials

General and fine grained structural steels, shipbuilding steels, pipe steels up to 460 MPa minimum yield strength and boiler plates and tubes alloyed with 0,5% Mo like 16Mo3.

Typical analysis of the weld metal

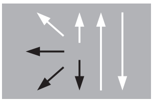
wt.-%	C	Si	Mn	Mo
wire	0.10	0.15	1.05	0.55
all-weld metal	0.06	0.50	1.20	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -18°C	0°C
u, DC+	≥ 460 (510)	≥ 540 (590)	≥ 20 (24)	≥ 27 (35)	≥ 47 (65)

u untreated, as welded

Operating data



Polarity DC / AC

Dimension mm
1.0
1.2
1.6
2.0
2.5
3.0
4.0

Approvals

TÜV (11214), CE

Union MV Mo S - UV 305

Seamless metal-cored wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S T Mo AR	F8AZ-ECA2-A2 / F8PZ-ECA2-A2

Characteristics and typical fields of application

Union MV Mo S – UV 305 is a wire flux combination for submerged arc welding.

The metalcored wire is alloyed with 0,5% Mo and has been designed for boiler construction and piping with operating temperatures up to 500ºC. Suitable for single pass and multi-pass welds.

Especially designed for fillet welds in fin-to-tube applications (water wall panels) with high welding speed.

UV 305 is aluminate-rutile flux. For more flux properties see separate datasheet of the flux.

Base materials

16Mo3, 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

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

SAW

Typical analysis of the weld metal

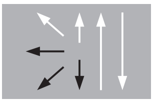
wt.-%	C	Si	Mn	Mo
all-weld metal	0.04	0.4	1.25	0.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -20 °C
u, DC+	550 (≥ 470)	630 (550 - 700)	25 (≥ 22)	80 (≥ 47)
a1, DC+	510 (≥ 470)	600 (550 – 700)	26 (≥ 22)	≥ 27

u untreated, as welded ; a1 = 1 hour 620 °C

Operating data



Polarity DC +

Dimension mm
2.0
2.4
3.2

Approvals

CE, TÜV

Union S 2 Mo - UV 306

SAW wire/flux combination, low-alloyed

Classifications

EN ISO 14171-A	**AWS A5.23 / SFA-5.23**
S 46 2 AR S2Mo	F8A2-EA2-A2

Characteristics and typical fields of application

Union S 2 Mo - UV 306 is a wire-flux combination for submerged-arc welding of unalloyed and low alloyed steel grades. Very good slag detachability and nice bead appearance. It is recommended to be used for single-wire, especially for 2 run, however also for fillet welding and single pass welding.

UV 306 is an aluminate-rutile agglomerated flux suited for direct and alternating current. For information regarding this welding flux see our detailed data sheet.

Base materials

General and fine grained structural steels, shipbuilding steels, pipe steels up to 460 MPa minimum yield strength and boiler plates and tubes alloyed with 0,5% Mo like 16Mo3.

Typical analysis of the weld metal

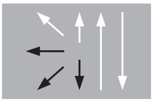
wt.-%	C	Si	Mn	Mo
wire	0.10	0.15	1.05	0.55
all-weld metal	0.06	0.60	1.40	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -29 °C	-20 °C	0 °C
u, DC+	≥ 470 (510)	≥ 550 (590)	≥ 22 (24)	≥ 27 (40)	≥ 47 (60)	≥ 60

u untreated, as welded

Operating data



Polarity DC / AC

Dimension mm
1.0
1.2
1.6
2.0
2.5
3.0
4.0

Approvals

TÜV (7739), CE

SAW

Union S 2 Mo - UV 400

SAW wire/flux combination, low-alloyed

Classifications

EN ISO 14171-A	AWS A5.23 / SFA-5.23
S 46 4 AB S2Mo	F8A4-EA2-A2 / F8P4-EA2-A2

Characteristics and typical fields of application

Union S 2 Mo - UV 400 is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. The combination is used in joining and surfacing applications with general-purpose structural steels, fine grained structural steels, boiler and pipe steels. It can be used on DC and AC. This combination combines very good welding characteristics with a high level of strength and toughness in the weld metal. It is suitable for single and multi-pass butt and fillet welding and also 2-run technique. Very good slag detachability.

UV 400 is an agglomerated flux of aluminate basic type. For information regarding this welding flux see our detailed data sheet.

Base materials

General and fine grained structural steels, shipbuilding steels, pipe steels up to 460 MPa minimum yield strength.

Typical analysis of the weld metal

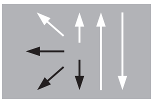
wt.-%	C	Si	Mn	Mo
wire	0.10	0.15	1.05	0.55
all-weld metal	0.06	0.35	1.35	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C	-20°C	20°C
u, DC+	≥ 470	≥ 550	≥ 22	≥ 47	≥ 60	≥ 100
a1, DC+	≥ 470	≥ 550	≥ 22	≥ 47	≥ 60	≥ 100

u untreated, as welded; a1 = 1 hour 620 °C

Operating data



Polarity DC / AC

Dimension mm
1.6
2.0
2.5
3.0
4.0

Approvals

TÜV (06233), DB (51.132.03), ABS, BV, DNV GL, LRS, CE

Union S 2 Mo - UV 421 TT

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 14171-A	AWS A5.23 / SFA-5.23
S 46 4 FB S2Mo	F8A6-EA2-A2 / F8P6-EA2-A2

Characteristics and typical fields of application

Union S 2 Mo - UV 421 TT is a wire/flux combination suited for fine-grained constructional steels of increased strength, specially used in boiler-, vessel- and pipeline construction. The metallurgical behaviour of the flux UV 421 TT is neutral. The wire/flux combination produces very good low temperature impact properties down to –40°C. Excellent slag detachability, smooth beads and good wetting are further important features. The flux can be used for tandem and multi wire welding on DC and AC.

UV 421 TT is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behavior. Detailed information about the flux can be found in the separate datasheet of the flux.

Base materials

Creep resistant steels and similar alloyed cast steels, ageing resistant and steels resistant to caustic cracking, creep resistant constructional steels with comparable yield strength.

16Mo3, S275JR, S275J2G3, S355J2G3, P275T1-P355T1, P275T2-P355T2, P255G1TH, S255N, P295GH, P310GH, P315N-P420N, P315NH-P420NH, BHW 2.5, WB 25

ASTM A335 Gr. P1; A161-94 Gr. T1; A182M Gr. F1, A204M Gr. A, B, C; A250M Gr. T1; A217 Gr. WC1, API 5L X52-X65

Typical analysis of the weld metal

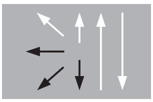
wt.-%	C	Si	Mn	Mo
wire	0.10	0.15	1.05	0.55
all-weld metal	0.07	0.25	1.10	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C	-20°C	20°C
u, DC+	≥ 470	≥ 560	≥ 24	≥ 47	≥ 100	≥ 140
a1, DC+	≥ 470	≥ 550	≥ 24	≥ 47	≥ 100	≥ 140

u untreated, as welded; a1 = 1 hour 620 °C

Operating data



Polarity DC +

Dimension mm
2.0
2.5
3.0
4.0

Preheating, interpass temperature and post weld heat treatment are determined by the base metal.

Approvals

TÜV (03344),DB (51.132.06), CE, LR

SAW

Union S 3 Mo - UV 420 TT

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 14171-A	**AWS A5.23 / SFA-5.23**
S 46 4 FB S3Mo	F8A4-EA4-A4 / F8P6-EA4-A4

Characteristics and typical fields of application

Union S 3 Mo - UV 420 TT is a wire flux combination for submerged arc welding of un and low-alloyed steel grades. It is suitable for single (DC) and tandem (DC and AC) welding. Very good slag detachability also for narrow gap welding. Flux can especially be used for multi-pass butt welding of medium tensile steels. Very good impact toughness of weld metal at low temperatures.

UV 420 TT is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour. For more information regarding this welding flux see our detailed data sheet.

Base materials

Creep resistant steels and similar alloyed cast steels, ageing resistant and steels resistant to caustic cracking, creep resistant constructional steels with comparable yield strength.

16Mo3, S275JR, S275J2G3, S355J2G3, P275T1-P355T1, P275T2-P355T2, P255G1TH, S255N, P295GH, P310GH, P315N-P420N, P315NH-P420NH, BHW 2.5, WB 25

ASTM A335 Gr. P1; A161-94 Gr. T1; A182M Gr. F1, A204M Gr. A, B, C; A250M Gr. T1; A217 Gr. WC1, API 5L X52-X65

S460N, S460M, S460NL, S460ML, S460Q, S460QL1, P460N, P460NH, P460NL1, P460NL2, L415NB, L415MB, L415QB, API 5 L X60, X65, X60Q, X65Q

SAW

Typical analysis of the weld metal

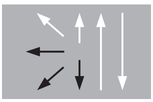
wt.-%	C	Si	Mn	Mo
wire	0.10	0.15	1.50	0.50
all-weld metal	0.06	0.30	1.50	0.45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -51 °C	-40 °C	-20 °C	20 °C
u, DC+	≥ 470	≥ 550	≥ 24		≥ 47	≥ 80	≥ 140
a1, DC+	≥ 470	≥ 550	≥ 24	≥ 27	≥ 47	≥ 80	≥ 140
a2, DC+	≥ 320	≥ 510	≥ 26				≥ 130

u untreated, as welded ; a1 = 2 hours 620 °C ; a2 = 920°C + air + 2 hours 600°C

Operating data



Polarity DC +

Dimension mm
2.4
3.0
4.0
5.0

Preheating and interpass temperature: 180 – 220ºC

Approvals

TÜV (1796), CE

Union S 4 Mo - UV 420 TTR

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 14171-A	AWS A5.23 / SFA-5.23
S 50 4 FB S4Mo	F9A4-EA3-A3 / F8P6-EA3-A3

Characteristics and typical fields of application

Union S 4 Mo - UV 420 TTR is a wire flux combination for submerged arc welding of un and low-alloyed steel grades. It is suitable for single (DC) and tandem (DC and AC) welding. Very good slag detachability also for narrow gap welding. Flux can especially be used for multi-pass butt welding of medium tensile steels. Good impact toughness of weld metal at low temperatures.

UV 420 TTR is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour. For more information regarding this welding flux see our detailed data sheet.

Base materials

Creep resistant steels and similar alloyed cast steels, ageing resistant and steels resistant to caustic cracking, creep resistant constructional steels with comparable yield strength.

16Mo3, S275JR, S275J2G3, S355J2G3, P275T1-P355T1, P275T2-P355T2, P255G1TH, S255N, P295GH, P310GH, P315N-P420N, P315NH-P420NH, BHW 2.5, WB 25

ASTM A335 Gr. P1; A161-94 Gr. T1; A182M Gr. F1, A204M Gr. A, B, C; A250M Gr. T1; A217 Gr. WC1, API 5L X52-X65

S460N, S460M, S460NL, S460ML, S460Q, S460QL1, P460N, P460NH, P460NL1, P460NL2, L415NB, L415MB, L415QB, API 5 L X60, X65, X60Q, X65Q

Typical analysis of the weld metal

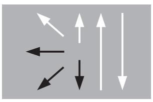
wt.-%	C	Si	Mn	Mo
wire	0.11	0.10	2.00	0.50
all-weld metal	0.07	0.20	1.85	0.45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -51 °C	-40 °C	-20 °C	20 °C
u, DC+	≥ 550	≥ 630	≥ 18		≥ 47	≥ 80	≥ 120
a1, DC+	≥ 500	≥ 600	≥ 24	≥ 27	≥ 47	≥ 80	≥ 140
a2, DC+	≥ 355	≥ 510	≥ 26				≥ 110

u untreated, as welded; a1 = 2 hours 600 °C ; a2 = 920°C + air + 2 hours 600°C

Operating data



Polarity DC +

Dimension mm
4.0

Preheating and interpass temperature: 180 – 220ºC

Approvals

-

SAW

Union S 4 Mo - UV 421 TT

SAW wire/flux combination, mild steel

Classifications

EN ISO 14171-A	**AWS A5.23 / SFA-5.23**
S 50 4 FB S4Mo	F9A6-EA3-A3 / F8P6-EA3-A3

Characteristics and typical fields of application

Union S 4 Mo - UV 421 TT is a wire – flux combination for submerged arc welding un and low alloyed steel grades. It is suitable for single (AC or DC) and tandem (DC and AC or AC and AC) welding. Very good slag detachability also for narrow gap welding.

UV 421 TT is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behavior. Detailed information about the flux can be found in the separate datasheet of the flux.

Base materials

Fine grained structural and boiler steels up to 500 MPa minimum yield strength.

Typical analysis of the weld metal

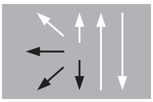
wt.-%	C	Si	Mn	Mo
wire	0.11	0.10	2.00	0.50
all-weld metal	0.08	0.20	1.8	0.48

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -50°C	-40°C	-20°C	20°C
u, DC+	≥ 540	≥ 620	≥ 22	≥ 27	≥ 47	≥ 80	≥ 120
a1, DC+	≥ 540	≥ 620	≥ 22	≥ 27	≥ 47	≥ 80	≥ 120

u untreated, as welded ; a1 = 1 hour 620 °C

Operating data



Polarity DC / AC

Dimension mm
4.0

Preheating: RT –150°C, depending on material and wall thickness. Interpass temp.: 150 – 200 °C. Heat Input < 2,0 kJ/mm

Approvals

-

Union S 2 CrMo - UV 305

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S CrMo1 AR	F10AZ-EB2R-B2

Characteristics and typical fields of application

Union S 2 CrMo - UV 305 is a wire flux combination for submerged arc welding of creep resistant steel grades with 1-1,5% Cr - 0,5% Mo. It is recommended to be used for single-wire or twin-arc welding with small wire diameter (e.g. with 2,0 mm) with high welding speed, especially for fillet welding in low wall thickness (<10 mm). It is particularly well-suited to welding of "water walls" (tube-web-tube joint) for steam water-tube boiler. Smooth beads, good wetting, excellent slag detachability.

UV 305 is an aluminate-rutile agglomerated flux suited for direct and alternating current. For information regarding this welding flux see our detailed data sheet.

Base materials

Creep resistant steels and similar alloys.

1.7335 - 13CrMo4-5, 1.7262 - 15CrMo5, 1.7728 - 16CrMoV4, 1.7218 - 25CrMo4, 1.7258 - 24CrMo5, 1.7354 - G22CrMo5-4, 1.7357 - G17CrMo5-5

ASTM A193 Gr. B7, A335 Gr. P11 and P12, A217 Gr. WC6

Typical analysis of the weld metal

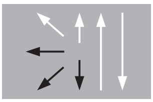
wt.-%	C	Si	Mn	Cr	Mo
wire	0.12	0.10	0.80	1.25	0.55
all-weld metal	0.07	0.40	0.90	1.15	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20 °C
u, DC+	≥610	≥690	≥16	≥27

u untreated, as welded

Operating data



Polarity DC +

Dimension mm
1.0
2.0
2.5
3.0
4.0

Preheating, interpass temperature and post weld heat treatment are determined by the base metal.

Approvals

TÜV (10290), CE

SAW

Union MV CrMo S - UV 305

Seamless metal-cored wire/flux combination, low alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S T ZCrMo1 AR	F10AZ-ECB2-G / F9PZ-ECB2-G

Characteristics and typical fields of application

Union MV CrMo S – UV 305 is a wire flux combination for submerged arc welding. The metalcored wire is alloyed with 1% Cr and 0,5% Mo and has been designed for boiler construction and piping with operating temperatures up to 570ºC. Suitable for single pass and multi-pass welds. Especially designed for fillet welds in fin-to-tube applications (water wall panels) with high welding speed.

UV 305 is aluminate-rutile flux. For more flux properties see separate datasheet of the flux.

Base materials

13CrMo45 , P11/P12

Typical analysis of the weld metal

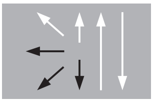
wt.-%	C	Si	Mn	Cr	Mo
all-weld metal	0.04	0.7	1.3	1.0	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u, DC+	700 (≥ 610)	750 (690–830)	19 (≥ 16)	29
a1, DC+	590 (≥ 540)	670 (620–760)	22 (≥ 20)	35 (≥ 27)

u untreated, as welded ; a1 = 1 hour 690°C

Operating data



Polarity DC +

Dimension mm
2.0
2.4
3.2

Approvals

-

Union S 2 CrMo - UV 419 TT-W

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S CrMo1 FB	F8P2-EB2R-B2

Characteristics and typical fields of application

Union S 2 CrMo - UV 419 TT-W is a wire flux combination for submerged arc welding of creep resistant steel grades with 1-1,5% Cr - 0,5% Mo. Applications are in long-term condition up to +570ºC service temperature. Smooth beads, good wetting, excellent slag detachability. The combination is ideally suited for multi-pass welding in applications with high thickness.

UV 419 TT-W is an agglomerated fluoride-basic welding flux with high basicity. For more information regarding this welding flux see our detailed data sheet.

Base materials

Creep resistant steels and similar alloyed cast steels, case hardening and nitriding steels of similar chemical composition, similar alloyed heat treatable steels with tensile strength up to 780 MPa, steels resistant to caustic cracking.

1.7335 - 13CrMo4-5, 1.7262 - 15CrMo5, 1.7728 - 16CrMoV4, 1.7218 - 25CrMo4, 1.7258 - 24CrMo5, 1.7354 - G22CrMo5-4, 1.7357 - G17CrMo5-5

ASTM A193 Gr. B7, A335 Gr. P11 and P12, A217 Gr. WC6

Typical analysis of the weld metal

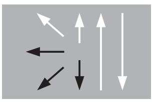
wt.-%	C	Si	Mn	Cr	Mo
wire	0.12	0.10	0.80	1.25	0.55
all-weld metal	0.08	0.25	0.90	1.15	0.48

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40 °C	-30 °C	20 °C
a1, DC+	≥ 470	≥ 550	≥ 22		≥ 47	≥ 100
a2, DC+	≥ 400	≥ 520	≥ 20	≥ 47	≥ 80	≥ 100

a1 = 1 hour 690 °C ; a2 = 12 hours 690 °C

Operating data



Polarity DC +, Tandem AC/DC +

Dimension mm
2.0
2.5
3.0
4.0

Preheating, interpass temperature and post weld heat treatment are determined by the base metal.

Approvals

TÜV (18746), CE

SAW

Union S 2 CrMo - UV 420 TTR

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S CrMo1 FB	F8P2-EB2R-B2R

Characteristics and typical fields of application

Union S 2 CrMo – UV 420 TTR is a wire-flux combination for submerged-arc welding of creep resistant steel grades with 1% Cr 0.5% Mo (in long-term condition up to +570ºC service temperature). Bruscato < 15 ppm. The sub-arc wire/flux combination produces smooth beads, good wetting, excellent slag detachability Very good welding behavior in narrow gap joint configurations without limitation in thickness.

UV 420 TTR is a fluoride-basic flux. For information regarding the sub-arc welding flux UV 420 TTR see our detailed data sheet.

Base materials

Creep resistant steels and similar alloyed cast steels, case hardening and nitriding steels of similar chemical composition, similar alloyed heat treatable steels with tensile strength up to 780 MPa, steels resistant to caustic cracking.

1.7335 - 13CrMo4-5, 1.7262 - 15CrMo5, 1.7728 - 16CrMoV4, 1.7218 - 25CrMo4, 1.7258 - 24CrMo5, 1.7354 - G22CrMo5-4, 1.7357 - G17CrMo5-5, ASTM A193 Gr. B7, A335 Gr. P11 and P12, A217 Gr. WC6

Typical analysis of the weld metal

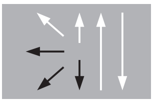
wt.-%	C	Si	Mn	Cr	Mo	X
wire	0.12	0.10	0.80	1.25	0.55	
all-weld metal	0.08	0.20	1.00	1.15	0.50	≤ 12

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -30°C	-20°C	20°C
a1, DC+	≥ 470	≥ 550	≥ 20	≥ 80	≥ 100	≥ 130

a1 = 2 hours 690 °C

Operating data



Polarity DC +

Dimension mm
2.0
2.5
3.0
4.0

Welding recommendations:

Preheat and Interpass temperature : 200 – 250ºC. Single wire (HI max 22 kJ/cm).

For 3.0/3.2 mm e.g. 450-520 A; 29-32 V; 45-55 cm/min. For 4.0 mm e.g. 500-580 A; 29-32 V; 50-55 cm/min.

Approvals

TÜV (03439), CE

Union S 2 CrMo - UV 420 TTR-C

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S CrMo 1 FB	F8P2-EB2R-B2R

Characteristics and typical fields of application

Union S 2 CrMo - UV 420 TTR-C is a wire flux combination for submerged arc welding of creep resistant steel grades with 1-1,5% Cr - 0,5% Mo. This combination is especially recommended for DC+ polarity in applications where a high strength level after (long) PWHT – duration is to be maintained, in e.g. pressure vessels. Mechanical properties are optimized for DC+ polarity, however the flux shows good operational characteristics in tandem (DC+ and AC) process.

UV 420 TTR-C is an agglomerated fluoride-basic welding flux with high basicity. It is characterized by its reduced burn-off behavior of carbon. In comparison with UV 420 TTR the C-content in the all weld metal is about 0.02 – 0.04% higher. For information regarding this welding flux see our detailed data sheet.

Base materials

Creep resistant steels and similar alloyed cast steels, case hardening and nitrating steels of similar chemical composition, like 1.7335 - 13CrMo4-5, 1.7262 - 15CrMo5, 1.7728 - 16CrMoV4, 1.7218 - 25CrMo4, 1.7258 - 24CrMo5, 1.7354 - G22CrMo5-4, 1.7357 - G17CrMo5-5, ASTM A193 Gr. B7, A335 Gr. P11 and P12, A217 Gr. WC6

Typical analysis of the weld metal

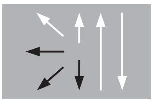
wt.-%	C	Si	Mn	Cr	Mo	P	Sb	Sn	As
wire	0.12	0.10	0.80	1.25	0.55				
all-weld metal	0.10	0.20	1.00	1.15	0.55	≤ 0.010	≤ 0.005	≤ 0.005	≤ 0.005

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -40°C	-29°C	20°C
a1, DC+	530 (≥470)	660 (550-690)	25 (≥20)		(≥ 27)	220 (≥ 100)
a2, DC+	430 (≥400)	550 (520-640)	28 (≥20)	(≥ 47)	(≥ 60)	(≥ 100)
a3, DC+	325	460	31	65	180	235

a1 = 1 hour 690 °C ; a2 = 26 hours 690 °C ; a3 = 30 Min 950 °C + cooling in air

Operating data



Polarity DC +

Dimension mm
2.0
2.5
3.0
4.0

Preheating, interpass temperature and post weld heat treatment are determined by the base metal.

Approvals

-

SAW

Union S 2 CrMo - UV 420 TTR-W

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S CrMo1 FB	F8P2-EB2R-B2R

Characteristics and typical fields of application

Union S 2 CrMo - UV 420 TTR-W is a wire flux combination for submerged arc welding of creep resistant steel grades with 1-1,5% Cr - 0,5% Mo. Applications are in long-term condition up to +570 ºC service temperature. Bruscato < 15 ppm. This combination is recommended to achieve the highest toughness and strength levels; for this, AC polarity is recommended.

Smooth beads, good wetting, excellent slag detachability, and low hydrogen contents (< 5 ml/100 g) are further important features. The combination is ideally suited for multi-pass welding in applications with high thickness.

UV 420 TTR-W is an agglomerated fluoride-basic welding flux with high basicity; optimised for welding on AC polarity. For information regarding this welding flux see our detailed data sheet.

Base materials

Creep resistant steels and similar alloyed cast steels, case hardening and nitriding steels of similar chemical composition, similar alloyed heat treatable steels with tensile strength up to 780 MPa, steels resistant to caustic cracking.

1.7335 - 13CrMo4-5, 1.7262 - 15CrMo5, 1.7728 - 16CrMoV4, 1.7218 - 25CrMo4, 1.7258 - 24CrMo5, 1.7354 - G22CrMo5-4, 1.7357 - G17CrMo5-5

ASTM A193 Gr. B7, A335 Gr. P11 and P12, A217 Gr. WC6

SAW

Typical analysis of the weld metal

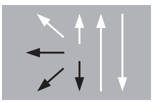
wt.-%	C	Si	Mn	Cr	Mo	P	Sb	Sn	As
wire	0.12	0.10	0.80	1.25	0.55				
DC+	0.08	0.20	1.00	1.10	0.45	≤ 0.012	≤ 0.005	≤ 0.005	≤ 0.01
AC	0.10	0.20	1.00	1.10	0.45	≤ 0.012	≤ 0.005	≤ 0.005	≤ 0.01

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -40°C	-30°C	20°C
a1, AC	≥ 470	≥ 550	≥ 20	≥ 27	≥ 47	≥ 100
a2, AC	≥ 420	≥ 520	≥ 24	≥ 80	≥ 100	≥ 150
a3, AC	≥ 380	≥ 520	≥ 24	≥ 80	≥ 100	≥ 150
a4, AC	≥ 470	≥ 550	≥ 22		≥ 47	≥ 100
a5, AC	≥ 400	≥ 520	≥ 20	≥ 47	≥ 80	≥ 120

a1 = 1 hour 690 °C ; a2 = 8 hours 690 °C ; A3 = 32 hours 690 °C ; A4 = 8 hours 650 °C ; A5 = 32 hours 650 °C

Operating data



Polarity AC / DC

Dimension mm
2.0
2.5
3.0
4.0

Preheating, interpass temperature and post weld heat treatment are determined by the base metal.

Approvals

-

Union S 1 CrMo 2 - UV 305

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S CrMo2 AR	F11AZ-EB3R-B3

Characteristics and typical fields of application

Union S 1 CrMo 2 - UV 305 is a wire – flux combination for submerged arc welding of 2.25% Cr 1% Mo alloyed boiler, plate and tube. . It is recommended to be used for single-wire or twin-arc welding with small wire diameter (e.g. with 2,0 mm) with high welding speed, especially for fillet welding in low wall thickness (<10 mm). It is particularly well-suited to welding of "water walls" (tube-web-tube joint) for steam water-tube boiler. Smooth beads, good wetting, excellent slag detachability.

UV 305 is an aluminate-rutile agglomerated flux suited for direct and alternating current. For information regarding this welding flux see our detailed data sheet.

Base materials

Creep resistance steels and similar alloys.

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 the weld metal

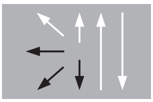
wt.-%	C	Si	Mn	Cr	Mo	X
wire	0.12	0.08	0.55	2.5	1.0	< 10
all-weld metal	0.07	0.35	0.80	2.3	1.0	

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20 °C
u, DC+	≥ 680	≥ 760	≥ 15	≥ 27

u untreated, as welded

Operating data



Polarity DC +

Dimension mm
2.5
3.0
4.0

Preheating, interpass temperature and post weld heat treatment are determined by the base metal.

Approvals

TÜV (10284), CE

SAW

Union MV CrMo 910 S - UV 305

SAW-metal-cored wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S T ZCrMo2 AR	F11AZ-ECB3-G / F10PZ-ECB3-G

Characteristics and typical fields of application

Union MV CrMo 910 S – UV 305 is a wire flux combination for submerged arc welding.

The metal-cored wire is alloyed with 2.25%Cr-1%Mo and has been designed for boiler construction and piping. Suitable for single pass and multi-pass welds. Especially designed for fillet welds in fin-to-tube applications (water wall panels) with high welding speed.

UV 305 is aluminate-rutile flux. For more flux properties see separate datasheet of the flux.

Base materials

Creep resistance steels 1.7380 – 10CrMo9-10, 1.7276 – 10CrMo11, 1.7281 – 16CrMo9-3, 1.7383 – 11CrMo9-10, A 213 Gr. T22

Typical analysis of the weld metal

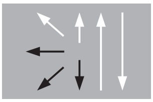
wt.-%	C	Si	Mn	Cr	Mo
all-weld metal	0.05	0.7	1.3	2.3	0.9

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20 °C
u, DC+	770 (≥ 680)	880 (760-900)	19 (≥ 15)	20
a1, DC+	640 (≥ 610)	730 (690-830)	20 (≥ 16)	20

u untreated, as welded ; a1 = 1 hour 710 °C

Operating data



Polarity DC +

Dimension mm
2.0
2.4
3.2

Approvals

-

Union S 1 CrMo 2 - UV 420 TTR

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S CrMo2 FB	F8P2-EB3R-B3R

Characteristics and typical fields of application

Union S 1 CrMo2 – UV 420 TTR is a wire-flux combination for submerged-arc welding of creep resistant steel grades with 2,25% Cr – 1% Mo.

To prevent long term temper-embrittlement the weld metal is characterized by a high degree of purity, and meets the most stringent toughness requirements at low/subzero temperatures, also after step-cool heat treatment.

After a PWHT of 5 hrs at 690ºC : $T_{t(54J)} + 2,5*\Delta T_{t(54J)SC} < +10$ºC (typical < -10ºC).

The very good welding behavior in narrow gap joint configurations without limitation in thickness.

UV 420 TTR is a fluoride-basic flux, designed for welding with DC+ polarity. For information regarding welding flux UV 420 TTR see our detailed data sheet.

Base materials

1.7380 10CrMo9-10, 11CrMo9-10, 12CrMo9-10

A335 Gr. P22, A387 Gr.22, A542BCl4 and other similar steel grades.

Typical analysis of the weld metal

wt.-%	C	Si	Mn	Cr	Mo	X
wire	0.12	0.08	0.55	2.5	1.0	< 10
all-weld metal	0.08	0.20	0.75	2.3	1.0	< 12

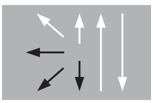
DC+

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Tensile test Temperature °C	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -40°C	-30°C	-20°C
a1, DC+	+20	600 (≥ 550)	720 (≥ 680)	20 (≥ 16)		≥ 54	≥ 80
a2, DC+	+20	480 (≥ 460)	580 (≥ 550)	22 (≥ 20)	≥ 54	≥ 100	≥ 120
a2, DC+	+500	360 (≥ 320)	430 (≥ 400)	16 (≥ 12)			
a3, DC+	+20	430 (≥ 400)	560 (≥ 520)	22 (≥ 20)	≥ 80	≥ 120	≥ 140
a3, DC+	+500	300 (≥ 280)	400 (≥ 360)	14 (≥ 12)			
a4, DC+	+20	600 (≥ 550)	720 (≥ 680)	20 (≥ 16)	≥ 27	≥ 54	≥ 80

a1 = 1 hour 690 °C ; a2 = 8 hours 690 °C ; a3 = 32 hours 690 °C ; a4 = 8 hours 650 °C

Operating data



Dimension mm
2.5
3.0
4.0

Welding recommendations: Preheat and Interpass temperature: 200 – 250ºC Single wire (HI max 22 kJ/cm) e.g. for 3.0/3.2 mm: 450-520 A; 29-32 V; 45-55 cm/min and for 4.0 mm : 500-580 A; 29-32 V; 50-55 cm/min.

It is strongly recommended to keep the weld at preheating temperature, unless it is possible to carry out ISR or DHT (350ºC/ min 4hrs) immediately after welding, in order to avoid cold cracking.

Approvals

TÜV (02734), CE

Union S 1 CrMo 2 - UV 420 TTR-C

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S CrMo 2 FB	F9P2-EB3R-B3R

Characteristics and typical fields of application

Union S 1 CrMo 2 - UV 420 TTR-C is a wire flux combination for submerged arc welding of creep resistant steel grades with 2,25% Cr – 1% Mo. This combination is especially recommended for DC+ polarity in normalising / quenching applications.

UV 420 TTR-C is an agglomerated fluoride-basic welding flux with high basicity. It is characterized by its reduced burn-off behavior of carbon. In comparison with UV 420 TTR the C-content in the all weld metal is about 0.02 – 0.04% higher (DC+). For information regarding this welding flux see our detailed data sheet.

Base materials

1.7380 10CrMo9-10, 11CrMo9-10, 12CrMo9-10

A335 Gr. P22, A387 Gr.22, A542BCl4 and other similar steel grades

Typical analysis of the weld metal

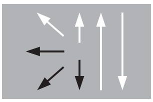
wt.-%	C	Si	Mn	Cr	Mo	X
wire	0.12	0.08	0.55	2.5	1.0	< 10
all-weld metal	0.10	0.20	0.80	2.4	1.0	

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -40 °C	-10 °C
a1, DC+	450	590	28		180
a2, DC+	380	530	33		150
a3, DC+	380	540	28	200	

a1 = 0.5 hour 940°C + cool in air + 0,5 hour 740°C ; a2 = 0,5 hour 940°C + cool in air + 0,5 hour 740°C + 3 x 2 hours 720°C ;
a3 = 1 hour 930°C + water + 2 hours 730°C + 26 hours 690°C

Operating data



Polarity DC+

Dimension mm
2.5
3.0
4.0

Preheating, interpass temperature and post weld heat treatment are determined by the base metal.

Approvals

-

SAW

Union S 1 CrMo 2 - UV 420 TTR-W

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S CrMo2 FB	F9P2-EB3R-B3R

Characteristics and typical fields of application

Union S 1 CrMo 2 – UV 420 TTR-W is a wire-flux combination for submerged-arc welding of creep resistant steel grades with 2,25% Cr – 1% Mo. To prevent long term temper-embrittlement the weld metal is characterized by a high degree of purity, and meets the most stringent toughness requirements at low/subzero temperatures, also after step-cool heat treatment. The very good welding behavior on AC and DC+ make it possible to weld with single wire (DC+ or AC) and tandem (DC+/AC or AC/AC) in narrow gap joint configurations without limitation in thickness. Highest toughness and strength levels are achieved using AC current.

After a PWHT of 5 hrs at 690ºC : TT(54)+2,5ΔTT(54)sc < +10ºC (typical < -10ºC).

UV 420 TTR-W is an agglomerated fluoride-basic welding flux with high basicity; optimised for welding on AC polarity. For information regarding this welding flux see our detailed data sheet.

Base materials

1.7380 10CrMo9-10, 11CrMo9-10, 12CrMo9-10

A335 Gr. P22, A387 Gr.22, A542BCl4 and other similar steel grades.

Typical analysis of the weld metal

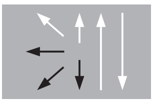
wt.-%	C	Si	Mn	Cr	Mo	X
wire	0.12	0.08	0.55	2.5	1.0	< 10
DC+	0.08	0.20	0.75	2.3	1.0	< 12
AC	0.10	0.15	0.75	2.3	1.0	< 12

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -40°C	-30°C	-20°C
a1, DC+	560 (≥ 540)	670 (≥ 620)	22 (≥ 18)	≥ 27	≥ 54	≥ 80
a1, AC	595 (≥ 540)	695 (≥ 620)	22 (≥ 18)	≥ 27	≥ 54	≥ 80
a2, DC+	550 (≥ 525)	660 (≥ 680)	22 (≥ 18)	≥ 27	≥ 54	≥ 80
a2, AC	575 (≥ 525)	680 (≥ 680)	22 (≥ 18)	≥ 27	≥ 54	≥ 80
a3, DC+	495 (≥ 475)	605 (≥ 550)	24 (≥ 20)	≥ 54	≥ 100	≥ 120
a3, AC	525 (≥ 475)	630 (≥ 550)	24 (≥ 20)	≥ 80	≥ 120	≥ 140
a4, DC+	460 (≥ 430)	565 (≥ 540)	26 (≥ 21)	≥ 80	≥ 120	≥ 140
a4, AC	485 (≥ 430)	590 (≥ 540)	26 (≥ 21)	≥ 100	≥ 140	≥ 150

a1 = 1 hour 690 °C ; a2 = 10 hours 650 °C ; a3 = 8 hours 690 °C ; a4 = 32 hours 690 °C

Operating data



Polarity AC / DC

Dimension mm
2.5
3.0
4.0

Welding recommendations: Preheat and Interpass temperature: 200 – 250ºC Single wire (HI max 22 kJ/cm).

For 3.0/3.2 mm e.g.: 450-520 A; 29-32 V; 45-55 cm/min. And for 4.0 mm: 500-580 A; 29-32 V; 50-55 cm/min.

Tandem: HI max 26 kJ/cm; welding speed 70-80 cm/min. Lead wire 4.0 mm: DC+ (or AC); 500-550 A; 28-30 V; Trail wire 4.0 mm: AC; 500-550 A; 30-33 V

It is strongly recommended to keep the weld at preheating temperature, unless it is possible to carry out ISR or DHT (350ºC/ min 4hrs) immediately after welding, in order to avoid cold cracking.

Approvals

TÜV (06541), CE

SAW

Union S P23 - UV 305

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	**AWS A5.23 / SFA-5.23**
S S ZCrWV 2 1,5 AR	F11AZ-EB23-B23

Characteristics and typical fields of application

Union S P23 - UV 305 is a wire – flux combination for submerged arc welding of creep resistant steel grade P23. It is recommended to be used for single-wire or twin-arc welding with small wire diameter (e.g. with 2,0 mm) with high welding speed, especially for fillet welding in low wall thickness (< 10 mm). It is particularly well-suited to welding of "water walls" (tube-web-tube joint) for steam water-tube boiler. Smooth beads, good wetting, excellent slag detachability.

UV 305 is an aluminate-rutile agglomerated flux suited for direct and alternating current. For information regarding this welding flux see our detailed data sheet.

Base materials

1.8201 – 7CrWVMoNb9-6 (EN 10216-2) – ASTM A213 Gr. T23

ASTM A335 Gr. P23; HCM2S – UNS K40712

Typical analysis of the weld metal

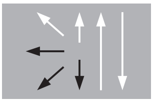
wt.-%	C	Si	Mn	Cr	Mo	W	V	Nb
wire	0.07	0.35	0.80	2.5	-	1.60	0.22	0.04
all-weld metal	0.04	0.65	1.10	2.3	-	1.50	0.19	0.03

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20 °C
u, DC+	700 (≥ 680)	950 (≥ 760)	17 (≥ 15)	27

u untreated, as welded

Operating data



Polarity DC +

Dimension mm
2.0
3.2

Preheating, interpass temperature and post weld heat treatment are determined by the base metal.

Approvals

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böhler welding by voestalpine

Union S P23 - UV P23

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A
S S Z CrWV 2 1,5 FB

Characteristics and typical fields of application

Union S P23 - UV P23 is a matching wire – flux combination for submerged arc welding of creep resistant steel grade 7CrWVMoNb9-6 (EN 10216-2) – ASTM A213 Gr. T23. It is recommended for butt welds.

UV P23 is a fluoride-basic agglomerated flux with high basicity. For information regarding this welding flux see our detailed data sheet.

Base materials

1.8201 – 7CrWVMoNb9-6 (EN 10216-2) – ASTM A213 Gr. T23

ASTM A335 Gr. P23; HCM2S – UNS K40712

Typical analysis of the weld metal

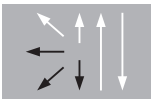
wt.-%	C	Si	Mn	Cr	Mo	W	V	Nb
wire	0.07	0.35	0.80	2.5	-	1.60	0.22	0.04
all-weld metal	0.06	0.40	0.70	2.4	-	1.60	0.18	0.03

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20 °C
u, DC+	710 (≥ 680)	960 (≥ 760)	17 (≥ 15)	≥ 27
a1, DC+	540 (≥ 470)	640 (≥ 550)	21 (≥ 20)	140 (≥ 54)

u untreated, as welded ; a1 = 2 hours 740 °C

Operating data



Polarity DC +

Dimension mm
2.0
2.5
3.2

Preheating, interpass temperature and post weld heat treatment are determined by the base metal. Preheating and interpass temperature 200 - 250ºC ; Heat input < 2,0 kJ/mm

Approvals

TÜV (10294), CE

SAW

Union S P24 - UV 305

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S Z CrMo2VNb AR	F11AZ-EB24-B24

Characteristics and typical fields of application

Union S P24 - UV 305 is a wire – flux combination for submerged arc welding of creep resistant steel grade 7CrMoVTiB10-10 (T24/P24). It is recommended to be used for single-wire or twin-arc welding with small wire diameter (e.g. with 2,0 mm) with high welding speed, especially for fillet welding in low wall thickness (<10 mm). It is particularly well-suited to welding of "water walls" (tube-web-tube joint) for steam water-tube boiler. Smooth beads, good wetting, excellent slag detachability.

UV 305 is an aluminate-rutile agglomerated flux suited for direct and alternating current. For information regarding this welding flux see our detailed data sheet.

Base materials

1.7378 – 7CrMoVTiB10-10 (T/P 24)

Typical analysis of the weld metal

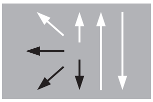
wt.-%	C	Si	Mn	Cr	Mo	V	Nb
wire	0.10	0.20	0.60	2.5	1.0	0.24	0.05
all-weld metal	0.06	0.50	0.90	2.3	1.0	0.22	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20 °C
u, DC+	≥ 680	≥ 760	≥ 15	≥ 27

u untreated, as welded

Operating data



Polarity DC +

Dimension mm
2.0

Preheating, interpass temperature and post weld heat treatment are determined by the base metal.

Approvals

TÜV (10457), CE

Union S P24 - UV P24

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A
S S ZCrMo 2VNb FB

Characteristics and typical fields of application

Union S P24 - UV P24 is a wire – flux combination for submerged arc welding of creep resistant steel grade 7CrMoVTiB10-10 (T24/P24). It is recommended for butt welds.

UV P24 is a fluoride-basic agglomerated flux with high basicity. For information regarding this welding flux see our detailed data sheet.

Base materials

1.7378 – 7CrMoVTiB10-10 (T/P 24)

Typical analysis of the weld metal

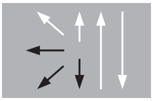
wt.-%	C	Si	Mn	Cr	Mo	V	Nb
wire	0.10	0.20	0.60	2.5	1.0	0.24	0.05
all-weld metal	0.09	0.20	0.75	2.4	0.95	0.22	0.05

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20 °C
u, DC+	≥ 680	≥ 760	≥ 15	27
a1, DC+	600 (≥ 540)	700 (≥ 620)	19 (≥ 17)	≥ 27
a2, DC+	580 (≥ 540)	680 (≥ 620)	20 (≥ 17)	≥ 47

u untreated, as welded ; a1 = 2 hours 740 °C ; a2 = 4 hours 740 °C

Operating data



Polarity DC +

Dimension mm
1.6
2.0
2.5

Preheating, interpass temperature and post weld heat treatment are determined by the base metal.

Approvals

-

SAW

Union S 1 CrMo 2 V - UV 430 TTR-W

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S ZCrMoV2 FB	F9PZ-EG-G

Characteristics and typical fields of application

Union S 1 CrMo 2 V - UV 430 TTR-W is wire – flux combination for submerged arc welding 2,25%Cr - 1%Mo - 0,25%V steel grades. The agglomerated fluoride-basic flux has a high basicity. It is characterized by a high degree of purity and therefore particularly suitable for use in reactor construction as well as for welding of hydrocrackers. The combination has been designed to give optimal mechanical properties with AC welding current. Also after step cool heat treatment the weld metal keeps a very high toughness level.

Base materials

Creep resistant 2,25%Cr - 1%Mo - 0,25%V steel grades and similar alloyed steels.

ASTM/ASME: A/SA832-22V; A/SA542-D-4/4a

EN 10028-2 : 13CrMoV9-10

Typical analysis of the weld metal

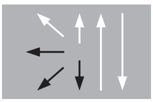
wt.-%	C	Si	Mn	Cr	Mo	V	Nb	X
wire	0.1	0.1	1.0	2.5	1.0	0.3	0.02	
all-weld metal	0.1	0.1	1.20	2.3	1.0	0.25	0.01	≤ 12

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Tensile test Temperature °C	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -30°C	-20°C
a1, AC	RT	≥ 415	585 – 760	≥ 18	≥ 54	≥ 100
a1, AC	482	≥ 365		≥ 16	-	-
a2, AC	RT	≥ 415	585 – 760	≥ 18	≥ 54	≥ 100
a2, AC	482	≥ 365		≥ 16	-	-

a1 = 10 hours 705 °C, single wire; a2 = 32 hours 705 °C, single wire

Operating data



Polarity AC

Dimension mm
1.6
2.4
3.2
3.2
4.0

Preheating, interpass temperature and post weld heat treatment are determined by the base metal.

Approvals

TÜV (10231), CE

Union S 1 CrMo 5 - Marathon 543

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S CrMo5 FB	F8PZ-EB6-B6

Characteristics and typical fields of application

Union S 1 CrMo 5 - Marathon 543 is a wire flux combination for submerged arc welding creep resistant steel grades with 5% Cr and 0,5% Mo.

Marathon 543 is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour. For information regarding this welding flux see our detailed data sheet.

Base materials

Similar alloyed creep resistant steels.

Creep resistant and steels resistant to hydrogen such as 12CrMo19-5 and similar steels (type 6% Cr 0,5% Mo).

Typical analysis of the weld metal

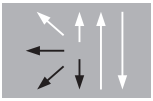
wt.-%	C	Si	Mn	Cr	Mo
wire	0.08	0.3	0.5	5.8	0.6
all-weld metal	0.07	0.3	0.6	5.8	0.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -20°C	20°C
a1, DC+	≥ 450	≥ 590	≥ 18	≥ 27	≥ 47

a1 = 2 hours 740 °C

Operating data



Polarity DC +

Dimension mm
2.5
3.0
4.0

Preheating and interpass temperature 200 – 250ºC. The recommended PWHT weld heat treatment is annealing at 740ºC/min. 2 hrs.

Approvals

-

BÖHLER CM 9-UP - Marathon 543

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S CrMo9 FB	F8PZ-EB8-B8

Characteristics and typical fields of application

BÖHLER CM 9-UP - Marathon 543 is a wire flux combination for submerged arc welding creep resistant steel grades with 9% Cr and 1% Mo. Applied for hot hydrogen service, particularly for application in oil refineries and the base metals X12CrMo9-1 (P9) in long-term condition up to +600ºC service temperature.

Marathon 543 is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour. For information regarding this welding flux see our detailed data sheet.

Base materials

Similar alloyed creep resistant steels

1.7386 X12CrMo9-1, 1.7388 X7CrMo9-1, 1.7389 GX12CrMo10

ASTM A217 Gr. C12, A 234 Gr. WP9, A335 Gr. P9

Typical analysis of the weld metal

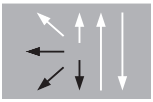
wt.-%	C	Si	Mn	Cr	Mo
wire	0.08	0.4	0.5	9.1	1.0
all-weld metal	0.07	0.3	0.6	8.7	0.95

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20 °C
a1, DC+	≥ 470	≥ 590	≥ 18	≥ 34

a1 = 3 hours 760 °C + cool down in furnace to 300°C + air cooling

Operating data



Polarity	DC +

Dimension mm
3.0

Preheating and interpass temperature 250 – 350ºC. Tempering at 710 – 760ºC for at least 3 h followed by cooling in furnace down to 300ºC / air. For detailed information about the welding technology please contact our service departments.

Approvals

-

Thermanit MTS 3 - Marathon 543

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	**AWS A5.23 / SFA-5.23**
S S CrMo91 FB	F9PZ-EB91-B91

Characteristics and typical fields of application

Thermanit MTS 3 – Marathon 543 is a wire flux combination for Submerged Arc Welding for welding high temperature and creep resistance 9% chromium steel like P91.

Marathon 543 is an agglomerated welding flux of the fluoride basic type with high basicity. For more information regarding this welding flux see our detailed data sheet.

Base materials

Similar alloyed creep resistant steels.

1.4903 - A213 -T91, A335-P91, X10CrMoVNb9-1

Typical analysis of the weld metal

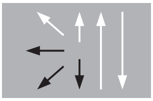
wt.-%	C	Si	Mn	Cr	Ni	Mo	V	Nb	N
wire	0.11	0.25	0.50	9.0	0.45	0.95	0.20	0.06	0.04
all-weld metal	0.09	0.22	0.70	8.9	0.45	0.95	0.18	0.05	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
a1, DC+	≥ 540	≥ 700	≥ 18	≥ 47

a1 = 4 hours 760 °C

Operating data



Polarity DC +

Dimension mm
1.2
1.6
2.0
2.4
2.5
3.0
3.2

Preheating and interpass temperature 200 – 280ºC. Heat Input < 1,8kJ/mm.

After welding the joint should cool down to below 80ºC to finish the martensite transformation. Pipe welds with wall thickness up to 45 mm can be cooled down to room temperature. For heavier wall thicknesses or stressed components, unfavourable possible stress condition must be considered.

The recommended PWHT weld heat treatment is annealing at 760ºC/ 4 hrs, (min. 2 / max. 10 hrs); heating/cooling rates below 550ºC max. 150ºC/hr, above 550ºC max 80ºC/hr.

Approvals

TÜV (06527), CE

Thermanit MTS 3 LNI - Marathon 543

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S ZCrMo91 FB	F9PZ-EB91-B91

Characteristics and typical fields of application

Thermanit MTS 3-LNi – Marathon 543 is a wire – flux combination for Submerged Arc Welding high temperature and creep resistance 9% chromium steel like P91.

Compared with standard Thermanit MTS 3- SAW wire, this wire has extra low content of Ni, to limit Mn + Ni < 1,0% in the weld metal. Creep rupture properties: According to the parent metal T (P) 91.

Marathon 543 is an agglomerated welding flux of the fluoride basic type with high basicity. For more information regarding this welding flux see our detailed data sheet.

Base materials

Similar alloyed creep resistant steels.

A213-T91, A335-P91, X10CrMoVNb9-1, ASTM A 387 Gr. 91, ASTM A 336 Gr. F91

Typical analysis of the weld metal

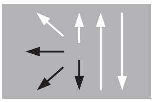
wt.-%	C	Si	Mn	Cr	Ni	Mo	V	Nb	N
wire	0.11	0.25	0.65	9.0		0.95	0.20	0.06	0.045
all-weld metal	0.09	0.20	0.80	8.9	< 0.15	0.95	0.18	0.05	0.040

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
a1, DC+	≥ 520	≥ 680	≥ 17	≥ 41

a1 = 4 hours 740 °C

Operating data



Polarity DC +

Dimension mm
1.6
2.4
3.2

Preheating and interpass temperature 200 – 260ºC. Heat Input < 1,8kJ/mm.

After welding the joint should cool down to below 80ºC to finish the martensite transformation. Pipe welds with wall thickness up to 45 mm can be cooled down to room temperature. For heavier wall thicknesses or stressed components, unfavourable possible stress condition must be considered.

The recommended PWHT weld heat treatment is annealing at 760ºC/ 4 hrs (min 2hrs. -max. 10 hrs); heating/cooling rates below 550ºC max. 150ºC/hr, above 550ºC max 80ºC/hr.

Approvals

-

SAW

böhler welding by voestalpine

Thermanit MTS 616 - Marathon 543

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S ZCrMoWVNb9 0.5 1.5 FB	F9PZ-EG-G

Characteristics and typical fields of application

Thermanit MTS 616 - Marathon 543 is a wire - flux combination for submerged arc welding of 9% Cr creep resistant steel, especially for P92 (NF616) acc. to ASTM A335. Approved in long-term condition up to +650ºC service temperature.

Marathon 543 is an agglomerated welding flux of the fluoride basic type with high basicity. For more information regarding Marathon 543 see our detailed data sheet.

Base materials

Similar alloyed creep resistant steels like 1.4901 - X10CrWMoVNb9-2, NF 616

ASTM A 213 Gr. T92 ; A 335 Gr. P92

Typical analysis of the weld metal

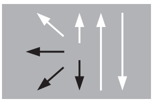
wt.-%	C	Si	Mn	Cr	Ni	Mo	W	V	Nb	N
wire	0.11	0.15	0.5	8.8	0.45	0.45	1.65	0.20	0.06	0.04
all-weld metal	0.09	0.15	0.7	8.7	0.40	0.43	1.65	0.18	0.05	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a1, DC+	≥ 560	≥ 700	≥ 18	≥ 41

a1 = 4 hours 760 °C + furnace down to 300 °C + air

Operating data



Polarity DC +

Dimension mm
1.2
1.6
2.0
2.5
3.0
3.2

Preheating and interpass temperature 200 – 280ºC. Heat Input < 1,8kJ/mm. For optimised toughness properties a technology which ensures thin welding layers is recommended.

After welding the joint should cool down below 80ºC in order to finish the martensite transformation. Pipe welds with wall thickness up to 45 mm can be cooled down to room temperature. For heavier wall thicknesses or stressed components, unfavourable possible stress condition must be considered.

The recommended post weld heat treatment is annealing at 760ºC/min. 2 hrs, max. 10 hrs., heating/cooling rates below 550ºC max. 150ºC/h, above 550ºC max 80ºC/h.

Approvals

TÜV (09391), CE

Thermanit MTS 911 - Marathon 543

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	AWS A5.23 / SFA-5.23
S S ZCrMoWVNb9 1 1 FB	F9PZ-EG-G

Characteristics and typical fields of application

Thermanit MTS 911 - Marathon 543 is a wire - flux combination for submerged arc welding of creep resistant 9% Cr steels, especially for E911. Approved in long-term condition up to +650°C service temperature. The wire and flux are precisely balanced to consistently meet the highest technical requirements. Creep rupture properties: According to the parent metal E911.

Marathon 543 is an agglomerated welding flux of the fluoride basic type with high basicity. For more information regarding this welding flux see our detailed data sheet.

Base materials

Similar alloyed creep resistant steels; 1.4905 - X11CrMoWVNb9-1-1, E911

Typical analysis of the weld metal

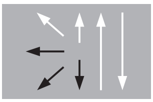
wt.-%	C	Si	Mn	Cr	Ni	Mo	W	V	Nb	N
wire	0.11	0.25	0.45	9.0	0.45	1.0	1.0	0.20	0.06	0.04
all-weld metal	0.09	0.22	0.60	8.9	0.45	0.98	1.0	0.18	0.05	0.035

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a1, DC+	≥ 560	≥ 700	≥ 18	≥ 41

a1 = 4 hours 760 °C + furnace down to 300 °C + air.

Operating data



Polarity DC +

Dimension mm
3.0

Preheating and interpass temperature 200 – 280°C. Heat Input < 1,8 kJ/mm.

After welding the joint should be allowed to cool down below 80°C to finish the martensitic transformation. In case of complex components or big wall thickness the possibility of residual stresses must be considered.

Recommended PWHT: Annealing at 760°C/min. 4 hrs, max. 10 hrs, heating and cooling rates below 550°C max. 150°C/hr, above 550°C max. 80°C/hr.

Approvals

TÜV (09228), CE

Thermanit MTS 4 - Marathon 543

SAW wire/flux combination, low-alloyed, creep resistant

Classifications

EN ISO 24598-A	**AWS A5.23 / SFA-5.23**
S S CrMoWV12 FB	F9PZ-EG-G

Characteristics and typical fields of application

Thermanit MTS 4 – Marathon 543 is a wire – flux combination for Submerged Arc Welding high temperature and creep resistance 12% Chromium steel like X20CrMoWV12-1.

Marathon 543 is an agglomerated welding flux of the fluoride basic type with high basicity. For more information regarding this welding flux see our detailed data sheet.

Base materials

Similar alloyed creep resistant steels.

X20CrMoV12-1

Typical analysis of the weld metal

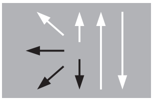
wt.-%	C	Si	Mn	Cr	Ni	Mo	W	V	N
wire	0.25	0.15	0.9	11.2	0.60	0.90	0.50	0.25	0.30
all-weld metal	0.18	0.20	0.9	11.2	0.60	0.88	0.50	0.22	0.30

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
a1	≥ 550	≥ 700	≥ 16	≥ 34

a1 = 4 hours 760 °C

Operating data



Polarity DC +

Dimension mm
2.5
3.0
4.0

Preheating and interpass temperature 240 – 280°C. Heat Input < 2,0 kJ/mm

Holding after welding at 80°C/min. 4hrs.

PWHT of 760°C for minimum 2 hours.

Approvals

TÜV (07814), CE

SAW

BÖHLER DMO Ti-FD

Flux-cored wire, low-alloyed, creep resistant

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T MoL P M21 1 H10	E81T1-M21PY-A1H8

Characteristics and typical fields of application

Rutile flux-cored wire which provides easy all-position weld ability, primarily designed for the welding of 0,5% Mo alloyed base metals, that are used for the fabrication of vessels, high-pressure storage tanks, pipe systems as well as for structural steel applications.

Due to the fast freezing slag system this flux-cored wire provides excellent positional welding characteristics and allows fast travel speeds to be used. It can be operated in spray arc mode in all positions and offers a controllable spatter free arc. Easy slag detachability with smooth, good profile, clean weld beads are further features of this wire.

Base materials

Creep resistant steels and similar alloyed cast steels,

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 LB, X42, X52, X60, X65;

Typical analysis of the wire

	C	Si	Mn	Mo
wt.-%	0.04	0.25	0.75	0.5

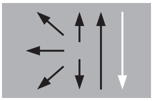
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	540 (≥ 470)	600 (550 – 690)	23 (≥ 22)	120 (≥ 47)
s	510 (≥ 470)	570 (550 – 690)	23 (≥ 22)	140 (≥ 47)

u untreated, as welded – shielding gas Ar + 18% CO_2

s stress relieved, 620°C/1h / furnace down to 300°C / air – shielding gas Ar + 18% CO_2

Operating data



Polarity	DC +	
Redrying	if necessary 150°C/24 h	
Shielding gas (EN ISO 14175)	M21	

Dimension mm
1.2

When using 100% CO_2 lower tensile properties can be expected.

Preheating, interpass temperature and post weld heat treatment as required by the base metal. For heavy walled components preheating to a min. 150ºC is recommended.

Slightly trailing torch position (angel appr. 80º), slight weaving is recommended for positional welding Final PWHT should be carried out between 600ºC and 630ºC for a minimum of 1 hour.

Approvals

TÜV, DB,CE

FCW

BÖHLER DMO Ti T-FD

Flux cored wire, seamless, creep resistant, rutile type

Classifications

EN ISO 17634-A	EN ISO 17632-A	AWS A5.36 / SFA-5.36
T MoL P M21 1 H5	T46 0 Mo P M21 1 H5	E81T1-M21P0-A1-H4

Characteristics and typical fields of application

Seamless rutile, Molybdenum alloyed flux cored wire, which provides easy all-position weld ability, primarily designed for the welding of 0,5% Mo alloyed base materials, that are used for the fabrication of vessels, high-pressure storage tanks, pipe systems as well as for structural steel applications. Main features: good weldability in all positions, good bead appearance and fast freezing, easy to remove slag and depositions with low contents of diffusible hydrogen. (< 4ml/100g weld metal)

Base materials

Creep resistant steels and similar alloyed cast steels,

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 the wire

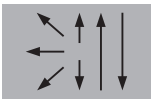
	C	Si	Mn	Mo
wt.-%	0.06	0.2	0.75	0.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20 °C	0 °C
s	550 (≥ 470)	630 (550 - 680)	24 (≥ 22)	60 (≥ 47)	100 (≥ 47)

s stress relieved 620°C / 1 h – shielding gas Ar + 15 – 25 % CO_2

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Preheating, interpass temperature and post weld heat treatment as required by the base metal. For heavy walled components an interpass temperature to a min. 150ºC recommended. Final PWHT should be carried out between 560ºC to 620ºC for a minimum of 1 hour.

Approvals

TÜV, CE

FCW

BÖHLER DMO T-MC

Metal cored wire, seamless, creep resistant

Classifications

EN ISO 17634-A	EN ISO 17632-A	AWS A5.36 / SFA-5.36
T Mo M M21 1 H5	T 46 2 Mo M M21 1 H5	E80T15-M21P0-A1-H4

Characteristics and typical fields of application

Seamless, Molybdenum alloyed, metalcored wire for singleor multilayer welding of creep resistant steels up to 450ºC with Ar-CO_2 shielding gas.

Features include: high yield, good weldability, excellent bead appearance and low spatter losses. Wire with very low amount of diffusible hydrogen (<3ml/100g) that reduces the risk of cracks.

Base materials

16Mo3, 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

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 the wire

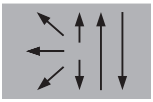
	C	Si	Mn	Mo
wt.-%	0.09	0.35	1.10	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20°C
s	550 (≥ 470)	630 (550 – 680)	25 (≥ 22)	90 (≥ 47)

s stress relieved 620°C / 60min – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.0
1.2
1.6

Preheating, interpass temperature and post weld heat treatment as required by the base metal. For heavy walled components preheating to a min. 150ºC is recommended.

Slightly trailing torch position (angel appr. 80º), slight weaving is recommended for positional welding Final PWHT should be carried out between 600ºC and 630ºC for a minimum of 1 hour.

Approvals

TÜV , DB , CE

FCW

BÖHLER DMO Kb T-FD

Flux cored wire, seamless, creep resistant, basic type

Classifications

EN ISO 17634-A	EN ISO 17632-A	AWS A5.36 / SFA-5.36
T Mo B M21 3 H5	T 46 6 Mo B M21 3 H5	E80T5-M21P8-A1-H4

Characteristics and typical fields of application

Seamless, Molybdenum alloyed, basic wire for singleor multilayer welding in boiler, pressure vessel, pipeline and steel construction, preferably for creep resistant steel qualities with 0.5% Mo up to 500ºC with Ar-CO_2 shielding gas.

Features include: excellent impact values at low temperatures (-60ºC) in as welded conditions and after long post weld heat treatments (620ºC / 15h) with low spatter losses. Wire with very low amount of diffusible hydrogen in weld metal (<1.5ml/100g) that reduces the risk of cracks.

Base materials

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 the wire

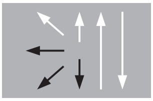
	C	Si	Mn	Mo
wt.-%	0.08	0.35	1.00	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C	-60°C
u	520 (≥ 470)	600 (550–680)	24 (≥ 22)	210	150	130 (≥ 47)
s	490 (≥ 470)	580 (550–680)	26 (≥ 22)	190	140	120 (≥ 47)

u untreated, as welded – shielding gas M21
s stress relieved 620°C / 3h – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Preheating, interpass temperature and post weld heat treatment as required by the base metal. For heavy walled components an interpass temperature to a min. 150ºC recommended. Final PWHT should be carried out between 560ºC to 620ºC for a minimum of 1 hour.

Approvals

TÜV, CE

BÖHLER DCMS Ti-FD

Flux-cored wire, low-alloyed, creep resistant

Classifications

EN ISO 17634-A	**AWS A5.36 / SFA-5.36**
T CrMo1 P M21 1 H10	E81T1-M21PY-B2H8

Characteristics and typical fields of application

The welding consumable Böhler DCMS Ti-FD is a low alloyed, flux-cored wire with rutile filling, primarily designed for the welding of 1% Cr and 0,5% Mo alloyed creep-resistant base metals, that are used for the fabrication of high-pressure vessels and pipe systems.

Due to the fast freezing slag system this flux-cored wire provides excellent positional welding characteristics and allows fast travel speeds to be used. This flux-cored wire is for welding with normal power sources on DCRP under Mixture gas (82% Ar + 18% CO_2).

Base materials

High temperature steels and similar alloyed cast steels, case hardening and nitriding steels of similar chemical composition, similar alloyed heat treatable steels with tensile strength 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 the wire

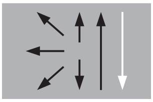
	C	Si	Mn	Cr	Mo	P	Sb	Sn	As
wt.-%	0.06	0.22	0.75	1.2	0.47	<0.005	<0.005	<0.005	<0.005

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
s	≥ 460	≥ 550 – 740	≥ 20	≥ 47

s stress relieved, 690 °C / 1h – shielding gas Ar + 18 % CO_2

Operating data



Polarity	DC +
Redrying	possible, 150 °C / 24 h
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Preheat, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

TÜV, CE

FCW

BÖHLER DCMS Ti T-FD

Flux cored wire, seamless, creep resistant, rutile type

Classifications

EN ISO 17634-A	AWS A5.36 / SFA A5.36
T CrMo1 P M21 1 H5	E81T1-M21PY-B2-H4

Characteristics and typical fields of application

Seamless rutile flux cored wire for welding creep resistant Chromium-Molybdenum alloyed steels, by using Ar-CO_2 shielding gas. The flux-cored wire is primarily designed for the welding of 1% Cr and 0,5% Mo alloyed creep-resistant base metals, that are used for the fabrication of high-pressure vessels and pipe systems.

Due to the fast freezing slag system this flux-cored wire provides excellent positional welding characteristics, fast travel speed, easy to remove slag and depositions with low contents of diffusible hydrogen. (< 4ml/100g weld metal)

Base materials

High temperature steels and similar alloyed cast steels, case hardening and nitriding steels of similar chemical composition, similar alloyed heat treatable steels with tensile strength 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 the wire

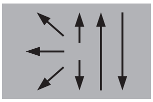
	C	Si	Mn	Cr	Mo
wt.-%	0.07	0.3	0.7	1.1	0.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20 °C
s	570 (≥ 460)	630 (≥ 550 - 740)	24 (≥ 10)	65 (≥ 47)

s stress relieved 690°C / 1 h – shielding gas Ar + 15 – 25 % CO_2

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Preheat, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

-

BÖHLER DCMS T-MC

Metal cored wire, seamless, creep resistant

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T CrMo1 M M21 1 H5	E80T15-M21PY-B2-H4

Characteristics and typical fields of application

Seamless, Cr-Mo alloyed, metalcored wire for singleor multilayer welding of creep resistant steels up to 500ºC with Ar-CO_2 shielding gas.

Features include: high yield, good weldability, excellent bead appearance, very low spatter losses.

Wire with very low amount of diffusible hydrogen (< 3ml/100g) that reduces the risk of cracks.

Base materials

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 the wire

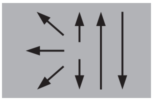
	C	Si	Mn	Cr	Mo
wt.-%	0.06	0.40	1.10	1.20	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-10°C	-20°C
s	520 (≥ 470)	620 (550–690)	22 (≥ 20)	110 (≥ 47)	90	80

s stress releived 690°C / 60min – shielding gas M21

Operating data



		Dimension mm
Polarity	DC +	1.2
Shielding gas (EN ISO 14175)	M21	1.6

Preheat, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

TÜV , CE

BÖHLER DCMS Kb T-FD

Flux cored wire, seamless, creep resistant, basic type

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T CrMo1 B M21 3 H5	E80T5-M21PY-B2-H4

Characteristics and typical fields of application

Seamless basic flux-cored wire for welding of Chromium-Molybdenum alloyed creep resistant steels with an application temperature up to 500ºC with Ar-CO_2 shielding gas.

Features include: excellent weldability in flat and horizontal positions, smooth and bright bead, low spatter losses, easy to remove slag, good mechanical properties and high deposition rates with very low contents of diffusible hydrogen in the weld metal (< 3ml/100g).

Base materials

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 the wire

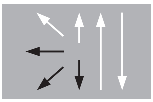
	C	Si	Mn	Cr	Mo
wt.-%	0.06	0.45	1.10	1.20	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
s	490 (≥ 470)	590 (550–690)	24 (≥ 20)	100 (≥ 47)

s stress relieved 690°C / 60min – shielding gas M21

Operating data



		Dimension mm
Polarity	DC +	1.2
Shielding gas (EN ISO 14175)	M21	1.6

Preheat, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

CE

FCW

BOEHLER DCMV Ti T-FD

Flux cored wire, seamless, creep resistant, rutile type

Classifications

EN ISO 17634-B	**EN ISO 17634-A**
T69T1-1M21-G-H5	T Z P M21 1 H5

Characteristics and typical fields of application

Seamless copper coated flux-cored wire for the welding of creep resistant steels up to 550ºC, Chromium-Molybdenum-Vanadium alloyed with Ar/CO2 shielding gas.

This wire is especially suitable for welding steel G17CrMoV5-10, with post-welding heat treatment. Main features: good weldability in all welding positions, fast freezing and easy to remove slag, no spatter at low parameters, good mechanical properties after heat treatment and low content of diffusible hydrogen.

Base materials

1.7706 G17CrMoV5-10

Typical analysis of the wire

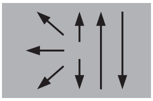
	C	Si	Mn	Cr	Ni	Mo	V
wt.-%	0.10	0.50	1.10	1.20	0.45	0.90	0.20

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m Mpa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J +20°C
s	760 (≥565)	800 (690-890)	17 (≥15)	50 (≥27)

s stress releived 690°C / 6h – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Welding with standard GMAW power source possible

Approvals

-

FCW

BÖHLER DCMV Kb T-FD

Flux cored wire, seamless, creep resistant, basic type

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T Z B M21 3 H5	E90T5-M21PY-GH4

Characteristics and typical fields of application

Seamless basic flux-cored wire for welding of Chromium-Molybdenum-Vanadium creep resistant steels with an application temperature up to 550ºC with Ar-CO_2 shielding gas. This wire is especially suitable for welding steel G17CrMoV5-10 with post-welding heat treatment.

Features include: excellent weldability in flat and horizontal positions, smooth and bright bead, low spatter losses, easy to remove slag, good mechanical properties and high deposition rates with very low contents of diffusible hydrogen in weld metal (< 3ml/100g).

Base materials

1.7706 G17CrMoV5-10

Typical analysis of the wire

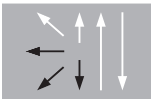
	C	Si	Mn	Cr	Ni	Mo	V
wt.-%	0.10	0.50	1.10	1.20	0.40	0.90	0.20

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
s	680 (≥ 540)	750 (620–760)	19	100 (≥ 47)

s stress relieved 690°C / 6 h - shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Preheat, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

TÜV, CE

FCW

BÖHLER CM 2 Ti-FD

Flux-cored wire, low-alloyed, creep resistant

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T CrMo2 P M21 1 H10	E91T1-M21PY-B3-H8

Characteristics and typical fields of application

The welding consumable Böhler CM 2 Ti-FD is a low alloyed, flux-cored wire with rutile filling, primarily designed for the welding of 2.25% Cr and 1% Mo alloyed creep-resistant base metals(e.g. 10CrMo9-10), that are used for the fabrication of high-pressure vessels and pipe systems.

Due to the fast freezing slag system this flux-cored wire provides excellent positional welding characteristics and allows fast travel speeds to be used. This flux-cored wire is for welding with normal power sources on DCEP under Mixture gas (82% Ar + 18% CO_2).

Base materials

Creep resistant steels and similar alloyed cast steels, similar alloyed case hardening steels up to 980 MPa tensile strength, 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 the wire

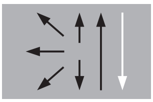
	C	Si	Mn	Cr	Mo	P	Sb	Sn	As
wt.-%	0.08	0.25	0.8	2.25	1.1	< 0.005	<0.005	<0.005	<0.005

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
s	600 (≥ 540)	700 (≥ 620 – 760)	19 (≥ 18)	70 (≥ 47)
s1	≥ 540	≥ 620 – 760	≥ 18	

s stress relieved, 720°C/2 h – shielding gas Ar + 18% CO_2
s1 stress relieved, 690°C/1 h – shielding gas Ar + 18% CO_2

Operating data



Polarity	DC +
Redrying	possible, 150°C / 10 h
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Welding with standard GMAW power source with DC+ polarity.

Approvals

TÜV , CE

BÖHLER CM 2 T-MC

Metal cored wire, seamless, creep resistant

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T CrMo2 M M21 1 H5	E90T15-M21PY-B3-H4

Characteristics and typical fields of application

Seamless, Cr-Mo alloyed, metalcored wire for singleor multilayer welding of creep resistant steels up to 600ºC with Ar-CO_2 shielding gas.

Features include: high yield, good weldability, excellent bead appearance, very low spatter losses.

Wire with very low amount of diffusible hydrogen (< 3ml/100g) that reduces the risk of cracks.

Base materials

10CrMo9-10, 10CrMo11, 16CrMo9-3, 11CrMo9-10, 26CrMo7, G17CrMo9-10, G19CrMo9-10,

ASTM A 182 Gr. F22; A 213 Gr. T22; A 234 Gr. WP22; A 335 Gr. P22; A 336 Gr. F22; A 426 CP22;

Typical analysis of the wire

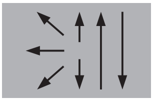
	C	Si	Mn	Cr	Mo
wt.-%	0.06	0.35	1.10	2.20	1.00

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-10°C
s	550 (≥ 540)	740 (620–760)	23 (≥ 18)	110 (≥ 47)	90

s stress relieved 710°C / 60min – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2
1.6

Welding with standard GMAW power source with DC+ polarity.

Approvals

TÜV , CE

BÖHLER CM 2 Kb T-FD

Flux cored wire, seamless, creep resistant, basic type

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T CrMo2 B M21 4 H5	E90T5-M21PY-B3-H4

Characteristics and typical fields of application

Seamless basic flux-cored wire for welding of Chromium-Molybdenum alloyed creep resistant steels with an application temperature up to 600ºC with Ar-CO_2 shielding gas.

Features include: excellent weldability in flat and horizontal positions, smooth and bright bead, low spatter losses, easy removable slag, good mechanical properties and high deposition rates with very low contents of diffusible hydrogen in weld metal (< 3ml/100g).

Base materials

CrMo9-10, 10CrMo11, 16CrMo9-3, 11CrMo9-10, 26CrMo7, G17CrMo9-10, G19CrMo9-10,

ASTM A 182 Gr. F22; A 213 Gr. T22; A 234 Gr. WP22; A 335 Gr. P22; A 336 Gr. F22; A 426 CP22;

Typical analysis of the wire

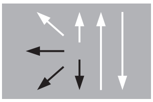
	C	Si	Mn	Cr	Mo
wt.-%	0.07	0.45	1.10	2.20	1.00

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
s	550 (≥ 540)	650 (620–760)	25 (≥ 18)	100 (≥ 47)

s stress relieved 710°C / 60min – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Welding with standard GMAW power source with DC+ polarity.

Approvals

CE

FCW

BÖHLER CM 5 Kb T-FD

Flux cored wire, seamless, creep resistant, basic type

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T CrMo5 B M21 3 H5	E80T5-M21PY-B6-H4

Characteristics and typical fields of application

Seamless basic flux-cored wire for welding of alloyed steels creep resistant and containing 5.00% Chromium and 0.50% Molybdenum with Ar-CO_2 shielding gas.

Features include: excellent weldability in flat and horizontal positions, smooth and bright bead, low spatter, easy to remove slag, good mechanical properties and depositions with very low contents of diffusible hydrogen (< 3ml/100g).

Base materials

X12CrMo5, GX12CrMo5

ASTM A 213 Gr. T5, A 335 Gr. P5

Typical analysis of the wire

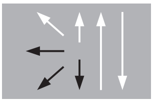
	C	Si	Mn	Cr	Mo
wt.-%	0.07	0.45	1.10	5.00	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
s	490 (≥ 470)	600 (550–690)	19 (≥ 17)	100 (≥ 47)

s stress relieved 745°C / 60min – shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Welding with standard GMAW power source with DC+ polarity.

Approvals

CE

FCW

BÖHLER CB 2 Ti-FD

Flux-cored wire, low-alloyed, creep resistant

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T ZCrMoCo9VNbNB P M21 1	E91T1-M21PY-G

Characteristics and typical fields of application

BÖHLER CB 2 Ti-FD is a rutile-basic flux-cored wire for welding creep resistant, cast material COST CB2. This flux-cored wire is developed for welding with conventional power sources on DC (+) under mixture gas (Ar + 15 – 25% CO_2). It is also suitable for positional welding.

Base materials

Similar alloyed creep resistant steels

GX12CrMoCoVNbB9-2-1, GX13CrMoCoVNbNB10-1-1

Typical analysis of the wire

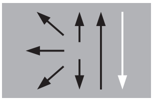
	C	Si	Mn	Cr	Ni	Mo	V	Co	Nb	N	B
wt.-%	0.12	0.2	0.8	9.0	0.2	1.4	0.2	1.0	0.03	0.02	0.006

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
s	590	740	17	30

s stress relieved 730 °C/24 h / furnace down to 300 °C / air – shielding gas Ar + 18 % CO_2

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Preheating and interpass temperature 200 – 250 °C. After welding, the weld joint should cool down below 80 °C to finish the marten site transformation. Soaking at 250 – 350 °C/ 2 – 4h is recommended.

The following post weld heat treatment is recommended: annealing 730 °C/min. 12 h, heating and cooling rates below 550 °C max. 150 °C/h, above 550 °C max. 80 °C/h.

Approvals

CE

böhler welding by voestalpine

BÖHLER C 9 MV Ti-FD

Flux-cored wire, high-alloyed, creep resistant

Classifications

EN ISO 17634-A	**AWS A5.36 / SFA-5.36**
T ZCrMo9VNb P M21 1 H5	E91T1-M21PY-B91-H4

Characteristics and typical fields of application

BÖHLER C 9 MV Ti-FD is a rutile- basic flux cored wire for the welding of creep resistant, tempered 9 % chromium steels in turbine-, boiler- and pipework construction as well as in the foundry industry. The wire is especially designed for the ASTM steels T91 / P91. The flux cored wire is designed for out of position welding technology. The chemistry of the product is according to LOW NICKEL content requirements, meaning (Ni + Mn) < 1wt.%.

Base materials

Similar alloyed creep resistant steels like

1.4903 X10CrMoVNb9-1, G-X12CrMoVNbN9-1

ASTM A335 Gr. P91, A336 Gr. P91, A369 Gr. FP91, A387 Gr. 91, A213/213M Gr. T91 A 234 WP91,

A182 F91

Typical analysis of the wire

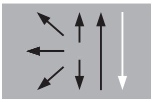
	C	Si	Mn	Cr	Ni	Mo	V	Nb	N
wt.-%	0.10	0.2	0.7	9.0	0.2	1.0	0.2	0.04	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
s	580 (≥ 565)	720 (≥ 690 – 760)	18 (≥ 14)	60 (≥ 32)
s1	590 (≥565)	730 (≥690 - 760)	18 (≥14)	40 (≥32)

s stress relieved 760°C / 4 h / furnace down to 300°C / air (acc. EN-ISO) shielding gas Ar + 18% CO2
s1 stress relieved 760°C / 2 h / furnace down to 300°C / air (acc. AWS) shielding gas Ar + 18% CO2

Operating data



Polarity	DC +
Redrying	possible, 150°C/24 h
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Welding with conventional or pulsed power sources (preferably slightly trailing torch position,

angle approx. 80º). Recommended stick out 15 - 20 mm and length of arc 3 – 5 mm. Preheating

and interpass temperature 200 – 300ºC (392 – 572 ºF). After welding, the weld joint should cool down below 80 ºC (176 ºF) to finish the martensite transformation. In case of greater wall thickness or complex components the possibility of residual stresses must be considered.

The following post weld heat treatment is recommended: annealing 760 ºC (1400 ºF)/min. 3h, max. 10h, heating and cooling rates below 550 ºC (1022 ºF) max. 150 ºC (302 ºF)/h, above 550 ºC (1022 ºF) max. 80 ºC (176 ºF).

Approvals

TÜV

FCW

BÖHLER C 9 MV-MC

Metal cored wire, high-alloyed, creep resistant

Classifications

EN ISO 17634-B	**AWS A5.36 / SFA-5.36**
T69T15-1G-9C1MV	E90T15-M12PY-B91-H4

Characteristics and typical fields of application

Metal cored 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. For optimised toughness values a welding technology should be applied which produces thin welding layers (approx. 2 mm), also a decisive influence on toughness values is given by the used shielding gas.

Base materials

Similar alloyed 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 analysis of the wire

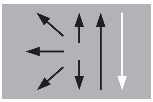
	C	Si	Mn	Cr	Ni	Mo	V	Nb	N
wt.-%	0.10	0.3	0.6	9.0	0.7	1.0	0.2	0.05	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
s	650 (≥ 565)	760 (≥ 690 – 890)	18 (≥ 14)	55 (≥ 32)

s stress relieved 760 °C/3 h / furnace down to 300 °C / air – shielding gas Argon + 2.5 % CO_2

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	Ar + 2,5 % CO_2

Dimension mm
1.2

Welding with conventional or pulsed power sources (preferably slightly trailing torch position, angle appr. 80º). Recommended stick out 18 – 20 mm and length of arc 3 – 5 mm.

Preheating and interpass temperature 200 – 300ºC. After welding, the weld joint should cool down below 80ºC to finish the martensite transformation. In case of greater wall thickness or complex components the possibility of residual stresses must be considered.

The following post weld heat treatment is recommended: annealing 760ºC 2 h min max. 10 hrs, heating and cooling rates below 550ºC max. 150ºC / h, > above 550ºC max. 80ºC / h.

Positional weldability of metal-cored wires is similar to solid wires.

Approvals

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FCW

BÖHLER C 9 MVW Ti-FD

Flux-cored wire, high-alloyed, creep resistant

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T ZCrMoW9VNb P M21 1	E91T1-M21PY-G

Characteristics and typical fields of application

BÖHLER C 9 MVW Ti-FD is a rutile- basic flux-cored wire for the welding of creep resistant, tempered 9% chromium steels in turbine-, boiler- and pipework construction as well as in the foundry industry. The wire is especially designed for out-of-position welding of the cast steel GX12CrMoWVNbN10-1-1.

Base materials

Similar alloyed creep resistant steels like

1.4905 X11CrMoWVNb9-1-1 (E911), GX12CrMoWVNbN10-1-1

ASTM A335 Gr. P911, A336 Gr. F911, A213/213M Gr. T911, A 234 WP911, A182 F911

Typical analysis of the wire

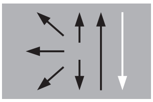
	C	Si	Mn	Cr	Ni	Mo	W	V	Nb	N
wt.-%	0.10	0.3	0.6	9.0	0.7	1.0	1.0	0.2	0.03	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Shielding gas
s	590	750	17	40	Ar + 18% CO^2
s1	580	740	17	45	Ar + 18% CO^2

s stress relieved 730°C / 24 h / furnace down to 300°C / air; shielding gas Ar + 18% CO2
s1 stress relieved 760°C / 4 h / furnace down to 300°C / air; shielding gas Ar + 18% CO2

Operating data



Polarity	DC +
Redrying	if necessary 150°C/24 h
Shielding gas (EN ISO 14175)	M21 Gas flow rate: 15 – 18 l/min.

Dimension mm
1.2

Welding with conventional or pulsed power sources (preferably slightly trailing torch position, angle approx. 80º). Recommended stick out 18 - 20 mm and length of arc 3–5 mm. Preheating and interpass temperature 200 – 300ºC (392 – 572 ºF). After welding, the weld joint should cool down below 80ºC (176 ºF) to finish the martensite transformation. In case of greater wall thickness or complex components the possibility of residual stresses must be considered.

The following post weld heat treatment is recommended: annealing 730ºC/24h or 760ºC (1400ºF)/min. 4h, heating and cooling rates below 550ºC (1022 ºF) max. 150ºC (302 ºF)/h, above 550ºC (1022 ºF) max. 80ºC (176 ºF).

Approvals

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BÖHLER P 92 Ti-FD

Flux-cored wire, low-alloyed, creep resistant

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T ZCrWMo9VNb P M21 1	E91T1-M21PZ-B92

Characteristics and typical fields of application

BÖHLER P 92 Ti-FD is a rutile- basic flux-cored wire for welding creep resistant, tempered 9-12% chromium steels in turbine-, boiler- and pipeline construction as well as in the foundry technology. The wire is especially designed for the ASTM steels T92/P92. This flux-cored wire is developed for welding with conventional power sources on DC + under mixture gas (Ar + 15- 25% CO_2). It is also suitable for positional welding.

Base materials

similar alloyed creep resistant steels

1.4901 X10CrWMoVNb9-2, NF 616

ASTM A 213 Gr. T92, ASTM A335 Gr. P92

Typical analysis of the wire

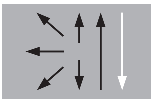
	C	Si	Mn	Cr	Ni	Mo	W	V	Nb	N
wt.-%	0.10	0.2	0.6	9.0	0.5	0.5	1.5	0.2	0.04	0.04

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
s	620 (≥ 565)	750 (690-890)	17 (≥ 16)	30 (≥ 27)

s stress relieved 760°C/4 h/furnace down to 300°C/air – shielding gas Ar + 18% CO2

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Preheating and interpass temperature 200-280ºC. After welding, the weld joint should cool down below 80ºC to finish the martensite transformation. In case of greater wall thickness or complex components the possibility of residual stresses must be considered.

The following post weld heat treatment is recommended: annealing 760ºC/min. 2 hrs, heating and cooling rates below 550ºC max. 150ºC/hr, above 550ºC max. 80ºC/hr.

For optimised toughness values a welding technology should be applied which produces thin welding layers.

Approvals

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FCW

Thermanit MTS 3 PW

Flux-cored wire, low-alloyed, creep resistant

Classifications

EN ISO 17634-A	AWS A5.36 / SFA-5.36
T ZCrMo9VNb P M21 1 H5	E91T1-M21PY-B91-H4

Characteristics and typical fields of application

Thermanit MTS 3 PW is a rutile- basic flux cored wire for the welding of creep resistant, tempered 9 % chromium steels in turbine-, boiler- and pipework construction as well as in the foundry industry. The wire is especially designed for the ASTM steels T91 / P91. The flux cored wire is designed for out of position welding technology. The chemistry of the product is according to LOW NICKEL content requirements, meaning (Ni + Mn) < 1wt.%.

Base materials

Similar alloyed creep resistant steels like

1.4903 X10CrMoVNb9-1, G-X12CrMoVNbN9-1

ASTM A335 Gr. P91, A336 Gr. P91, A369 Gr. FP91, A387 Gr. 91, A213/213M Gr. T91 A 234 WP91, A182 F91

Typical analysis of the wire

	C	Si	Mn	Cr	Ni	Mo	V	Nb	N
wt.-%	0.10	0.2	0.7	9.0	0.2	1.0	0.2	0.05	0.04

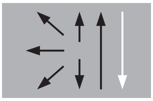
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
s	580 (≥ 565)	720 (690 – 760)	18 (≥ 14)	60 (≥ 32)
s1	590 (≥565)	730 (690-760)	18 (≥14)	40 (≥32)

s stress relieved, 760 °C (1400 °F) / 4 h / furnace, down to 300°C (572 °F) / Air (acc. EN-ISO); Ar + 18% CO2

s1 stress relieved, 760 °C (1400 °F) / 2 h / furnace, down to 300°C (572 °F) / Air (acc. AWS); Ar + 18% CO2

Operating data



Polarity	DC +	
Shielding gas (EN ISO 14175)	M21, M12 Gas flow rate: 15 – 18 l/min.	

Dimension mm
1.2

Welding with conventional or pulsed power sources (preferably slightly trailing torch position, angle appr. 80º). Recommended stick out 18 - 20 mm and length of arc 3 – 5 mm. Preheating and interpass temperature 200 – 300ºC (392 – 572 ºF). After welding, the weld joint should cool down below 80ºC (176 ºF) to finish the martensite transformation. In case of greater wall thickness or complex components the possibility of residual stresses must be considered.

The following post weld heat treatment is recommended: annealing 760ºC (1400 ºF)/min. 3h, max. 10h, heating and cooling rates below 550ºC (1022 ºF) max. 150ºC (302 ºF)/h, above 550ºC (1022 ºF) max. 80ºC (176 ºF).

Approvals

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FCW

Welding consumables for pipe steels

◆ Content

Stick electrodes

Product name	C	Si	Mn	Ni	Mo
BÖHLER FOX CEL	0.12	0.14	0.50		
BÖHLER FOX CEL+	0.17	0.15	0.60		
BÖHLER FOX CEL 70-P	0.15	0.10	0.45	0.17	
BÖHLER FOX CEL 75	0.14	0.14	0.70		
BÖHLER FOX CEL Mo	0.10	0.14	0.40		0.50
BÖHLER FOX CEL 80-P	0.15	0.15	0.70	0.80	
BÖHLER FOX CEL 85	0.14	0.15	0.75	0.70	
BÖHLER FOX CEL 90	0.17	0.15	0.90	0.80	
BÖHLER FOX BVD 85	0.05	0.40	1.10	0.90	
BÖHLER FOX BVD 90	0.05	0.30	1.20	2.20	
BÖHLER FOX BVD 100	0.07	0.40	1.20	2.30	
BÖHLER FOX BVD 120	0.07	0.40	1.85	2.25	0.35
BÖHLER FOX EV PIPE	0.06	0.60	0.90		
BÖHLER FOX EV 60 PIPE	0.07	0.60	1.20	0.90	
BÖHLER FOX EV 70 PIPE	0.06	0.50	1.70	2.20	0.30

GTAW rods

Product name	C	Si	Mn	Ni	Mo
BÖHLER NiMo1-IG	0.08	0.60	1.80	0.90	0.30

Solid wires

Product name	C	Si	Mn	Ni	Mo	Ti	S	P
Pipeshield X65	0.05	0.75	1.55			+		
Pipeshield X70	0.07	0.95	1.65				≤ 0.015	≤ 0.020
Pipeshield X80	0.65	0.69	1.55	0.90		+	≤ 0.015	≤ 0.020
Pipeshield X90	0.08	0.60	1.80	0.90	0.30			

SAW wire/flux combinations

Product name	C	Si	Mn	Ni	Mo	Ti	S	P
Union S 2 Si - UV 310 P	0.08	0.40	1.20					
Union S 3 Si - UV 309 P	0.06	0.45	1.50					
Union S 3 Si - UV 310 P	0.05	0.30	1.50					
Union S 2 Mo - UV 309 P	0.07	0.30	1.15		0.50			
Union S 2 Mo - UV 310 P	0.07	0.25	1.15		0.50			
Union S 4 Mo - UV 310 P	0.07	0.20	1.55		0.45			
Union S 3 TiB - UV 309 P	0.05	0.40	1.30			0.02	≤ 0.010	≤ 0.015
Union S 3 TiB - UV 310 P	0.05	0.30	1.30			0.02	≤ 0.010	≤ 0.015
Union S 3 MoTiB - UV 309 P	0.05	0.40	1.30		0.50	0.02	≤ 0.015	≤ 0.015
Union S 3 MoTiB - UV 310 P	0.05	0.30	1.30		0.50	0.02	≤ 0.015	≤ 0.015
Union S 3 MoTiB - UV 419 TT-W	0.05	0.35	1.30		0.50	0.02		
Union S 2 NiMo 1 - UV 419 TT-W	0.08	0.20	1.30	0.95	0.25			
BÖHLER SUBARC T60 - UV 419 TT-W	0.06	0.40	1.70	0.90	0.16			
Union S 3 NiMo 1 - UV 419 TT-W	0.08	0.25	1.60	0.90	0.50			

Flux cored wires

Product name	C	Si	Mn	Ni	Mo	Al
BÖHLER Pipeshield 71 T8-FD	0.05	0.14	1.10	0.70		0.80
BÖHLER Pipeshield 71.1 T8-FD	0.05	0.14	1.10	0.95		0.80
BÖHLER Pipeshield 81 T8-FD	0.05	0.15	1.40	1.95		0.80
BÖHLER PIPESHIELD 91 T8-FD	0.04	0.30	2.00	3.20		0.70
BÖHLER Ti 70 Pipe T-FD	0.05	0.30	1.60	1.00		
BÖHLER Ti 70 Pipe T-FD-N	0.05	0.35	1.60	0.85	0.25	
BÖHLER Ti 80 Pipe T-FD	0.07	0.30	1.70	2.50		

SMAW

BÖHLER FOX CEL

Stick electrode, mild steel, cellulose coated, pipeline welding

Classifications

EN ISO 2560-A	**AWS A5.1 / SFA-5.1**
E 38 3 C 2 1	E6010

Characteristics and typical fields of application

Cellulose electrode for vertical-down welding of large diameter pipelines; suitable for root runs (vertical down and vertical up), hot passes, filler and cover layers. Especially recommended for root run welding. Highly economical compared with vertical-up welding. Apart from its excellent welding and gap bridging characteristics FOX CEL offers a weld deposit with outstanding impact strength values and thus offers the benefit of still more safety in field welding of pipelines. BÖHLER FOX CEL can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Test values for SSC-test are available too.

Base materials

S235JR, S275JR, S235J2G3, S275J2G3, S355J2G3, P235GH, P265GH, P355T1, P235T2-P355T2, L210NB - L415NB, L290MB - L415MB, P235G1TH, P255G1TH

Root pass up to L555NB, L555MB

API Spec. 5 L: A, B, X 42, X 46, X 52, X 56, Root pass up to X 80

Typical analysis of all-weld metal

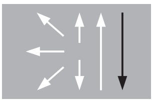
	C	Si	Mn
wt.-%	0.12	0.14	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	0°C	-20°C	-30°C
u	450 (≥ 380)	550 (470 – 600)	26 (≥ 22)	100	90	70	55 (≥ 47)

u untreated, as welded

Operating data



Polarity DC +/–, Minuspol für Wurzel

Electrode identification FOX CEL 6010 E 38 2 C

Redrying not allowed

Dimension mm	Current A
2.5 × 250	50 – 90
2.5 × 300	50 – 90
3.2 × 350	80 – 130
4.0 × 350	120 – 180
5.0 × 350	160 – 210

Approvals

TÜV (01281), DNV GL, CE

BÖHLER FOX CEL+

Stick electrode, mild steel, cellulose coated, pipeline welding

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 38 2 C 2 1	E6010

Characteristics and typical fields of application

Cellulose electrode for vertical-down welding of large diameter pipelines.

Especially recommended for root pass welding on D.C. positive polarity in the vertical down and vertical up welding positions.

Apart from its good welding and gap bridging characteristics Böhler FOX CEL+ provides a powerful arc that deposites well penetrated, smooth root passes with high travel speeds as well as high safety against the formation of piping or hollow bead and undercut. BÖHLER FOX CEL+ can be used in sour gas applications (HIC-Test acc. to NACE TM-02-84). Test values for SSC-test are available too.

Base materials

S235JR, S275JR, S235J2G3, S275J2G3, S355J2G3, P235GH, P265GH, P355T1, P235T2-P355T2, L210NB - L415NB, L290MB - L415MB, P235G1TH, P255G1TH

Root pass up to L555NB, L555MB

API Spec. 5 L: A, B, X 42, X 46, X 52, X 56, Root pass up to X 80

Typical analysis of all-weld metal

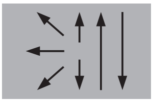
	C	Si	Mn
wt.-%	0.17	0.15	0.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	0°C	-20°C	-30°C
u	430 (≥ 380)	520 (470 - 600)	26 (≥ 22)	105	95	60 (≥ 47)	50 (≥ 27)

u untreated, as welded

Operating data



Polarity	DC (+/-)
Electrode identification	FOX CEL+ 6010 E 38 2 C
Redrying	not allowed

Dimension mm	Current A
2.5 × 300	50 – 90
3.2 × 350	80 – 130
4.0 × 350	120 – 180

Approvals

TÜV (19380.), CE

BÖHLER FOX CEL 70-P

Stick electrode, low-alloyed, cellulose coated, pipeline welding

Classifications

EN ISO 2560-A	AWS A5.5 / SFA-5.5
E 42 3 C 2 5	E7010-P1

Characteristics and typical fields of application

Cellulose electrode for vertical-down welding of high strength large diameter pipelines. Especially recommended for hot passes, filler and cover layers. Highly economical compared with conventional vertical-up welding. The BÖHLER FOX CEL 70-P provides a more intensive arc and a more fluid weld metal as compared to the well-known BÖHLER FOX CEL 75.

BÖHLER FOX CEL 70-P can be used in sour gas applications (HIC-Test acc. to NACE TM-02-84). Test values for SSC-test are available too.

Base materials

S235JR, S275JR, S235J2G3, S275J2G3, S355J2G3, P235GH, P265GH, L210-L415NB, L290MB-L415MB, L450MB, P355T1, P235T2-P355T2, P235G1TH, P255G1TH

API Spec. 5L: Grade A, B, X42, X 46, X52, X56, X60, X65, root pass up to X80

Typical analysis of all-weld metal

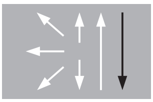
	C	Si	Mn	Ni
wt.-%	0.15	0.10	0.45	0.17

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-20°C	-30°C
u	460 (≥ 420)	560 (500 – 640)	23 (≥ 22)	100	80	65 (≥ 47)

u untreated, as welded

Operating data



Polarity	DC+/–, Minuspol für Wurzel
Electrode identification	FOX CEL 70-P 7010-P1 E 42 3 C
Redrying	not allowed

Dimension mm	Current A
3.2 × 350	60 – 130
4.0 × 350	100 – 180
4.8 × 350	130 – 200
5.0 × 350	140 – 210

Approvals

TÜV (11180), CE

BÖHLER FOX CEL 75

Stick electrode, mild steel, cellulose coated, pipeline welding

Classifications

EN ISO 2560-A	AWS A5.5 / SFA-5.5
E 42 3 C 2 5	E7010-P1

Characteristics and typical fields of application

Cellulose electrode for vertical-down welding of large diameter pipelines.

Especially recommended for hot passes, filler and cover layers. Highly economical compared with conventional vertical-up welding.

The penetrating arc characteristics and the low slag formation allow good bead control and ensure best performance even with the larger diameter electrodes and high amperages.

The weld metal has excellent impact values and welding is easy also under difficult weather conditions.

BÖHLER FOX CEL 75 can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Test values for SSC-test are available too.

Base materials

S235JR, S275JR, S235J2G3, S275J2G3, S355J2G3, P235GH, P265GH, L210-L415NB,

L290MB – L415MB, P355T1, P235T2 - P355T2, P235G1TH, P255G1TH root pass up to L480MB

API Spec. 5 L: Grade A, B, X42, X 46, X 52, X 56, X 60, Root pass up to X 70

Typical analysis of all-weld metal

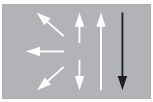
	C	Si	Mn
wt.-%	0.14	0.14	0.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	0°C	-20°C	-30°C
u	460 (≥ 420)	550 (500 – 640)	23 (≥ 22)	100	95	65	60 (≥ 47)

u untreated, as welded

Operating data



Polarity	DC+/–, Minuspol für Wurzel
Electrode identification	FOX CEL 75 7010-P1 E 42 3 C
Redrying	not allowed

Dimension mm	Current A
3.2 × 350	80 – 130
4.0 × 350	120 – 180
5.0 × 350	160 – 210

Approvals

CE

BÖHLER FOX CEL Mo

Stick electrode, low-alloyed, cellulose coated, pipeline welding

Classifications

EN ISO 2560-A	**AWS A5.5 / SFA-5.5**
E 42 3 Mo C 2 5	E7010-A1

Characteristics and typical fields of application

Mo-alloyed cellulose coated electrode for vertical-down welding of high strength large diameter pipelines. Highly economical compared with conventional vertical-up welding. Especially recommended for hot passes, filler and cover layers.

Excellent weld-metal toughness, easy welding, with an intensive arc and a deep penetration in order to ensure sound joint welds with good X-ray quality.

BÖHLER FOX CEL Mo can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Test values for SSC-test are available too.

Base materials

S235JR, S275JR, S235J2G3, S275J2G3, S355J2G3, P235GH, P265GH, L210 - L415NB, L290MB-L415MB, P355T1, P235T2 - P355T2, P235G1TH, P255G1TH

Root pass up to L555MB

API Spec. 5 L: Grade A, B, X 42, X 46, X 52, X 56, X 60

Root pass up to X 80

Typical analysis of all-weld metal

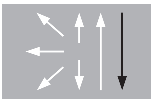
	C	Si	Mn	Mo
wt.-%	0.1	0.14	0.4	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	0°C	-20°C	-30°C	-40°C
u	480 (≥ 420)	550 (500-640)	23 (≥ 20)	100	95	85	50 (≥ 47)	42

u untreated, as welded

Operating data



Polarity DC +/–, Minuspol für Wurzel

Electrode identification FOX CEL Mo 7010-A1 E 42 3 Mo C

Redrying not allowed

Dimension mm	**Current A**
3.2 × 350	80 – 130
4.0 × 350	120 – 180
5.0 × 350	160 – 210

Approvals

TÜV (01325.), ABS, CE

BÖHLER FOX CEL 80-P

Stick electrode, low-alloyed, cellulose coated, pipeline welding

Classifications

EN ISO 2560-A	**AWS A5.5 / SFA-5.5**
E 46 3 1Ni C 2 5	E8010-P1
	E8010-G

Characteristics and typical fields of application

Cellulose electrode for vertical-down welding of high strength, large diameter pipelines. Highly economical compared with conventional vertical-up welding. Especially recommended for hot pass, filler and cover layers. The BÖHLER FOX CEL 80-P provides a more intensive arc and a more fluid weld metal as compared to the well-known BÖHLER FOX CEL 85.

BÖHLER FOX CEL 80-P can also be used in sour gas applications (HIC-Test acc. to NACE TM-02-84). Test values for SSC-test are available too.

Base materials

L415NB - L485NB, L415MB - L485MB

API Spec. 5 L: X 56, X 60, X 65, X 70

Typical analysis of all-weld metal

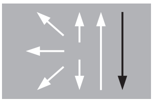
	C	Si	Mn	Ni
wt.-%	0.15	0.15	0.7	0.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-20°C	-30°C
u	490 (≥ 460)	580 (550 – 680)	23 (≥ 20)	90	80	60 (≥ 47)

u untreated, as welded

Operating data



Polarity	DC+
Electrode identification	FOX CEL 80-P 8010-P1 E 46 3 1Ni C
Redrying	not allowed

Dimension mm	Current A
3.2 × 350	60 – 130
4.0 × 350	100 – 180
4.8 × 350	130 – 200
5.0 × 350	140 – 210

Approvals

TÜV (11181.), CE

SMAW

BÖHLER FOX CEL 85

Stick electrode, low-alloyed, cellulose coated, pipeline welding

Classifications

EN ISO 2560-A	AWS A5.5 / SFA-5.5
E 46 4 1Ni C 2 5	E8010-P1

Characteristics and typical fields of application

Cellulose electrode for vertical-down welding of high strength large diameter pipelines. Highly economical compared with conventional vertical-up welding.

Especially recommended for hot passes, filler and cover layers.

BÖHLER FOX CEL 85 is one of the most popular cellulosic electrode which meets all the exacting demands of the field welding of cross country pipelines extremely well. Welding is easy also at difficult weather conditions. It ensures highest joint weld quality down to temperatures of –40°C.

BÖHLER FOX CEL 85 can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Test values for SSC-test are available too.

Base materials

L415NB - L485NB, L415MB - L485MB

API Spec. 5 L: X 56, X 60, X 65, X 70

Typical analysis of all-weld metal

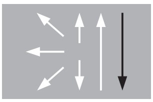
	C	Si	Mn	Ni
wt.-%	0.14	0.15	0.75	0.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	0°C	-20°C	-40°C
u	490 (≥ 460)	580 (550 – 680)	23 (≥ 20)	110	105	100	70 (≥ 47)

u untreated, as welded

Operating data



Polarity	DC+
Electrode identification	FOX CEL 85 8010-P1 E 46 4 1Ni C
Redrying	not allowed

Dimension mm	Current A
3.2 × 350	80 – 130
4.0 × 350	120 – 180
5.0 × 350	160 – 210
5.5 × 350	200 – 260

Approvals

TÜV (01361.), ABS, CE

böhler welding by voestalpine

BÖHLER FOX CEL 90

Stick electrode, low-alloyed, cellulose coated, pipeline welding

Classifications

EN ISO 2560-A	AWS A5.5 / SFA-5.5
E 50 3 1Ni C 2 5	E9010-P1 E9010-G

Characteristics and typical fields of application

Cellulose-coated electrode for vertical-down welding of high strength large diameter pipelines. Highly economical compared with conventional vertical-up welding. Especially recommended for hot passes, filler and cover layers. The special design of the coating and the core wire guarantees the highest metallurgical quality and soundness of the weld metal deposit with excellent mechanical properties. The electrode allows good weld pool visability, and easy manipulation, as well as high safety margins against porosity and slag inclusions.

BÖHLER FOX CEL 90 can be used in sour gas applications (HIC-Test acc. to NACE TM-02-84). Test values for SSC-test are available too.

Base materials

L450MB, L485MB

API Spec. 5 L: X 65, X 70, X 80

Typical analysis of all-weld metal

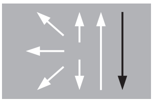
	C	Si	Mn	Ni
wt.-%	0.17	0.15	0.9	0.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	0°C	-20°C	-30°C	-40°C
u	560 (≥ 530)	650 (620 – 720)	21 (≥ 18)	100	90	75	65 (≥ 47)	40

u untreated, as welded

Operating data



Polarity	DC (+)
Electrode identification	FOX CEL 90 9010-P1 E 50 3 1Ni C
Redrying	not allowed

Dimension mm	Current A
4.0 × 350	120 – 180
5.0 × 350	160 – 210

Approvals

TÜV (01324.), CE

BÖHLER FOX BVD 85

Basic vertical down stick elekctrode, low-alloyed, pipeline welding

Classifications

EN ISO 2560-A	AWS A5.5 / SFA-5.5
E 46 5 1Ni B 4 5 H5	E8045-P2 H4 R E8018-G H4 R

Characteristics and typical fields of application

Basic coated electrodes for vertical-down welds of large diameter pipelines and for structural work. Suitable for filler and cover pass welding in pipeline construction. Deposit is extremely crack resistant, and features high toughness and a very low hydrogen content. Deposition rate is 80-100% higher than for vertical up welding. The weld deposit of BÖHLER FOX BVD 85 shows an ideal combination between high strength and cryogenic toughness down to –50°C. Special design and development work has enabled this electrode to provide exceptional striking characteristics and the avoidance of start porosity. Due to this and the good welding characteristics this special basic electrode offers easy handling even under field conditions.

Böhler FOX BVD 85 can be used in sour gas applications (HIC-Test acc. to NACE TM-02-84). Test values for SSC-test are available too.

Base materials

S235J2G3 - S355J2G3, L290NB - L450NB, L290MB - L450MB, P235GH - P295GH

API Spec. 5 L: A, B, X 42, X46, X 52, X 56, X 60, X 65, (X70)

Typical analysis of all-weld metal

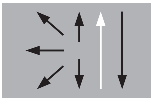
	C	Si	Mn	Ni
wt.-%	0.05	0.4	1.1	0.9

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-20°C	-30°C	-40°C	-50°C
u	500 (≥ 460)	560 (550 – 680)	27 (≥ 20)	170	140	120	100	65 (≥ 47)

u untreated, as welded

Operating data



Polarity	DC (+)
Electrode identification	FOX BVD 85 8045-P2 E 46 5 1Ni B
Redrying	if necessary: 300 – 350 °C / min. 2 h

Dimension mm	Current A
3.2 × 350	110 – 160
4.0 × 350	180 – 210
4.5 × 350	200 – 240

Recommended interpass temperature > 80°C

Approvals

TÜV (03531.), CE

BÖHLER FOX BVD 90

Basic vertical down stick elekctrode, low-alloyed, pipeline welding

Classifications

EN ISO 18275-A	AWS A5.5 / SFA-5.5
E 55 5 Z2Ni B 4 5 H5	E9018-G H4 R E9045-P2 H4 R (mod.)

Characteristics and typical fields of application

Basic coated electrode for vertical-down welds of large diameter pipelines and for structural work. Suitable for filler and cover pass welding in pipeline construction. Deposit is extremely crack resistant, and features high toughness and a very low hydrogen content. Special design and development work has enabled this electrode to provide exceptional striking characteristics and the avoidance of start porosity. Due to this and the good welding characteristics this special basic electrode offers easy handling even under field conditions. Deposition rate is 80 – 100% higher than for vertical up welding.

Base materials

L485MB, L555MB

API Spec. 5 L: X70, X80

Typical analysis of all-weld metal

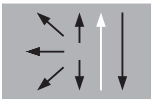
	C	Si	Mn	Ni
wt.-%	0.05	0.3	1.2	2.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-20°C	-30°C	-40°C	-50°C
u	580 (≥ 550)	650 (620 – 780)	27 (≥ 18)	170	130	110	90	70 (≥ 47)

u untreated, as welded

Operating data



Polarity DC (+)

Electrode identification FOX BVD 90 9018-G E 55 5 Z 2Ni B

Redrying if necessary: 300 – 350 °C / min. 2 h

Dimension mm	Current A
2.5 x 350	80 - 110
3.2 × 350	110 – 160
4.0 × 350	180 – 210
4.5 × 350	200 – 240

Recommended interpass temperature > 90°C

Approvals

TÜV (03402.), GAZPROM, CE

BÖHLER FOX BVD 100

Basic vertical down stick elekctrode, low-alloyed, pipeline welding

Classifications

EN ISO 18275-A	AWS A5.5 / SFA-5.5
E 62 5 Z2Ni B 4 5	E10018-G E10045-P2 (mod.)

Characteristics and typical fields of application

Basic coated electrodes for vertical-down welds of large diameter pipelines and for structural work. Suitable for filler and cover pass welding in pipeline construction. Deposit is extremely crack resistant, and features high toughness and a very low hydrogen content. Special design and development work has enabled this electrode to provide exceptional striking characteristics and the avoidance of start. Due to this and the good welding characteristics this special basic electrode offers easy handling even under field conditions. Deposition rate is 80 – 100% higher than for vertical up welding.

Base materials

L555MB

API Spec. 5 L: X80

Typical analysis of all-weld metal

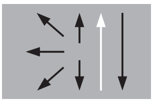
	C	Si	Mn	Ni
wt.-%	0.07	0.4	1.2	2.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-20°C	-30°C	-50°C
u	640 (≥ 620)	720 (690 – 890)	24 (≥ 18)	150	120	105	60 (≥ 47)

u untreated, as welded

Operating data



Polarity	DC (+)
Electrode identification	FOX BVD 100 10018-G E 62 5 Z2Ni B
Redrying	if necessary: 300 – 350 °C / min. 2 h

Dimension mm	Current A
3.2 × 350	100 – 160
4.0 × 350	180 – 210
4.5 × 350	200 – 240

Recommended interpass temperature > 100°C

Approvals

TÜV (06333.), CE

BÖHLER FOX EV PIPE

Stick electrode, mild steel, basic coated, pipeline welding

Classifications

EN ISO 2560-A	AWS A5.1 / SFA-5.1
E 42 4 B 1 2	E7016-1

Characteristics and typical fields of application

Basic coated electrode, excellent suited for positional welding of root passes using D.C. negative polarity as well as for filler and cover passes of pipes, tubes and plates on D.C. positive polarity, or even AC. It is user friendly and provides a good gap bridging ability together with easy slag removal to ensure minimum grinding. Weld metal toughness is available down to -46ºC. BÖHLER FOX EV PIPE offers considerable time savings against AWS E7018 type electrodes when welding root passes due to increased travel speeds. Also the use of dia. 3.2 mm is possible for root passes in case of wall thicknesses of 8 mm and more. BÖHLER FOX EV PIPE can be used in sour gas applications (HIC-Test acc. to NACE TM-02-84). Test values for SSC-test are available too.

Base materials

P235GH, P265GH, P295GH, P235T1, P275T1, P235G2TH, P255G1TH, (S255N-S420N *1)

S255NL1-S420NL1, L290NB-L360NB, L290MB-L415MB, (L450MB-L555MB *2)

API Spec. 5L: A, B, X 42, X46, X52, X56, X60, (X65-X80 *2)

ASTM: A53 Gr. A-B, A106 Gr. A-C, A179, A192, A210 Gr. A-1

*1) stress relieved up to S380N / S380NL1

*2) only for root pass

Typical analysis of all-weld metal

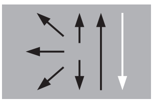
	C	Si	Mn
wt.-%	0.06	0.60	0.9

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-20°C	-40°C	-45°C
u	470 (≥ 420)	560 (500 – 640)	29 (≥ 20)	170	120	100 (≥ 47)	65 (≥ 27)

u untreated, as welded

Operating data



Polarity	DC +/–, Minuspol für Wurzel
Electrode identification	FOX EV PIPE 7016-1 E 42 4 B
Redrying	if necessary: 300 – 350°C, min. 2 h

Dimension mm	Current A
2.0 × 300	30 – 60
2.5 × 300	40 – 90
3.2 × 350	60 – 130
4.0 × 350	110 – 180

Preheated and interpass temperatures as required by the base material. The optimum gap width for root passes is 2 – 3 mm, the root face should be in the range 2 – 2.5 mm. The electrodes are ready for use straight from the hermetically sealed tins.

Approvals

TÜV (07620.), DB (10.014.77), CE, NAKS, GAZPROM

SMAW

BÖHLER FOX EV 60 PIPE

Stick electrode, low alloyed, basic coated, pipeline welding

Classifications

EN ISO 2560-A	AWS A5.5 / SFA-5.5
E 50 4 1Ni B 1 2 H5	E8016-G H4 R

Characteristics and typical fields of application

Basic coated electrode excellent suited for positional welding for filler and cover passes for pipes, tubes and plates. Good impact properties down to –40ºC, low hydrogen content (HD < 5 ml/100 g), as well as packaging in hermetically sealed tins are further features for the user.

Base materials

EN: S235J2G3 - S355J2G3, L210NB - L450NB, L210MB - L450MB, P235GH - P295GH, E295, E335, S355J2G3, C35-C45, P310GH, S380N - S460N, P380NH-P460NH, S380NL - S460NL, S380NL1 - S460NL2, GE260-GE300

API Spec. 5 L: X 42, X46, X 52, X 56, X 60, X 65

ASTM A516 Gr. 65, A572 Gr. 55, 60, 65, A633 Gr. E, A612, A618 Gr. I, A537 Gr. 1-3

Typical analysis of all-weld metal

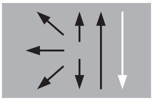
	C	Si	Mn	Ni
wt.-%	0.07	0.6	1.2	0.9

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	0°C	-20°C	-40°C	-45°C
u	540 (≥ 500)	620 (560 – 720)	26 (≥ 18)	170	150	140	110 (≥ 47)	60

u untreated, as welded

Operating data



Polarity	DC (+)
Electrode identification	FOX EV 60 PIPE 8016-G E 50 4 1 Ni B
Redrying	if necessary 300 – 350°C, min. 2h

Dimension mm	Current A
2.5 × 300	40 – 90
3.2 × 350	60 – 130
4.0 × 350	110 – 180
5.0 × 450	180 – 230

Preheat and interpass temperatures as required by the base material. The electrodes are ready for use straight from the tins.

Approvals

CE

BÖHLER FOX EV 70 PIPE

Stick electrode, low alloyed, basic coated, pipeline welding

Classifications

EN ISO 18275-A	AWS A5.5 / SFA-5.5
E 55 4 ZMn2NiMo B 1 2 H5	E9016-G H4 R

Characteristics and typical fields of application

Basic coated electrode for high strength steels. It is excellent suited for positional welding of filler and cover passes of pipes, tubes and plates on D.C. positive polarity. It is user friendly and provides a good gap bridging ability together with easy slag removal to ensure minimum grinding. Good impact properties down to -40ºC, low hydrogen content (HD < 5 ml/100 g).

Base materials

EN: L450MB, L485MB, L555MB

API Spec. 5 L: X65, X70, X80

Typical analysis of all-weld metal

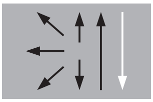
	C	Si	Mn	Ni	Mo
wt.-%	0.06	0.5	1.7	2.2	0.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e	Tensile strength R_m	Elongation A (L_0=5d_0)	Impact values ISO-V KV J			
	MPa	MPa	+20°C	20°C	-20°C	-40°C	-45°C
u	630 (≥ 550)	700 (620 – 780)	20 (≥ 18)	140	90	70 (≥ 47)	60

u untreated, as welded

Operating data



Polarity	DC (+)
Electrode identification	FOX EV 70 PIPE 9016-G
Redrying	if necessary 300 – 350°C, min. 2h

Dimension mm	Current A
2.5 × 300	40 – 90
3.2 × 350	60 – 130
4.0 × 350	110 – 180

Preheat and interpass temperature as required by the base material. The electrodes are ready for use straight from the hermetically sealed tins.

Approvals

TÜV (12809.), CE

BÖHLER NiMo1-IG

TIG rod, low-alloyed, high strength

GTAW

Classifications

EN ISO 16834-A	**AWS A5.28 / SFA-5.28**
W 55 6 I1 Mn3Ni1Mo	ER90S-G

Characteristics and typical fields of application

TIG rod for high strength, quenched and tempered fine-grained constructional steels. The wire is suited for joint welding in boiler, pressure vessel, pipeline and crane construction as well as in structural steel engineering. Typical composition of the wire fulfils the NORSOK- regulation requirements for "water injection systems". Due to the micro-alloying concept, NiMo 1-IG rod combines excellent ductility with high strength. Good toughness down to –60°C and low hydrogen contents in the deposit.

Base materials

S460N, S460M, S460NL, S460ML, S460Q-S555Q, S460QL-S550QL, S460QL1-S550QL1, P460N, 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

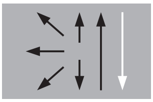
Typical analysis of the wire rod

	C	Si	Mn	Ni	Mo
wt.-%	0.08	0.6	1.8	0.9	0.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-40°C	-60°C
u	620 (≥ 550)	700 (≥ 640)	23 (≥ 18)	140	110	≥ 47

Operating data



Polarity	DC –
Shielding gas (EN ISO 14175)	I1
Rod marking	W Mn3Ni1Mo ER90S-G

Dimension mm
2.4 x 1000
3.2 × 1000

Preheat, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

-

Pipeshield X65

Solid Wire, mild steel

Classifications

EN ISO 14341-A	**AWS A5.18 / SFA-5.18**
G 46 5 M21 Z3Si1	ER70S-G
G 42 4 C1 Z3Si1	

Characteristics and typical fields of application

Pipeshield X series of solid wires for GMAW are specifically designed for fully automatic circumferential all position pipe welding. Pipeshield X combine the benefits of engineered wire surfaces and thoroughly controlled chemical compositions leading to good impact values even at low temperatures. Consistent wire geometry supports wire feeding and stable arc performance.

Pipeshield X65 covers pipe steel grades up to API X65 offering good impact toughness at low temperatures down to -40 °C (-50 °F). Often used for root pass welding with higher tensile pipe grades.

Base materials

EN: L290MB – L450MB

API Spec. 5L: X42, X46, X52, X56, X60, X65

Typical analysis of the solid wire

	C	Si	Mn	Ti
wt.-%	0.05	0.75	1.55	+

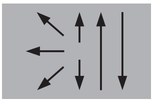
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa / KSI	Tensile strength R_m MPa / KSI	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -40 °C	Shielding gas
u1	632 / 91.6	692 / 100.4	29	58 / 43	CO_2
u2	673 / 97.6	726 / 105.3	30	102 / 75	M21

u1 untreated, as welded – shielding gas 100% CO_2

u2 untreated, as welded – shielding gas Ar + 15 – 25% CO_2

Operating data



Dimension mm
1.2

Approvals

-

Pipeshield X70

Solid Wire, mild steel

Classifications

EN ISO 14341-B	EN ISO 14341-A	AWS A5.18 / SFA-5.18
G 55A 4 M21 S6	G 46 4 M21 4Si1	ER70S-6
G 55A 2 C1 S6	G 46 2 C1 4Si1	

Characteristics and typical fields of application

Pipeshield X series of solid wires for GMAW are specifically designed for fully automatic circumferential all position pipe welding. Pipeshield X combines the benefits of engineered wire surfaces and thoroughly controlled chemical compositions leading to good impact values even at low temperatures. Consistent wire geometry supports wire feeding and stable arc performance. Pipeshield X70 covers pipe steel grades up to API X70 offering good impact toughness at low temperatures down to -40 °C (-40 °F) and CTOD values at -10 °C (14 °F). Root pass capability up to X80. This product can be used in sour gas applications. (HIC tested acc. to NACE TM-0284).

Base materials

API 5L: Grade B, X42, X52, X56, X60, X65 and X70, EN 10208-2: L245MB – L485MB; L245NB – L415NB

and similar steel grades

Typical analysis of the solid wire

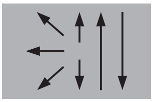
	C	Si	Mn	S	P
wt.-%	0.069	0.95	1.65	≤ 0.015	≤ 0.020

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa / KSI	Yield strength R_e MPa / KSI	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J –20°C J / ft*lbt	–40°C J / ft*lbt
u1	485 / 70.3 (460 / 66.7)	595 / 86.3 (570 / 82.7)	25	120 / 88.5 (50 / 36.9)	60 / 44.3
u2	530 / 76.9 (480 / 69.6)	615 / 89.2 (580 / 84.1)	24	140 / 103.3 (75 / 55.3)	115 / 84.8 (60 / 44.3)
u3	650 / 94.3	715 / 103.7	22	170 / 125	145 / 106.9

u1 untreated, as welded – shielding gas 100 % CO_2
u2 untreated, as welded – shielding gas Ar + 15 – 25 % CO_2
u3 untreated, as welded – shielding gas M21, field result, round tensile specimen, longitudinal

Operating data



Dimension mm
1.0
1.2

Approvals

TÜV (19421), CE

Pipeshield X80

Solid wire, mild steel

Classifications

EN ISO 14341-A
G 50 6 M21 Z3Ni1
G 46 4 C1 Z3Ni1

AWS A5.28 / SFA-5.28
ER80S-G

Characteristics and typical fields of application

Pipeshield X series of solid wires for GMAW are specifically designed for fully automatic circumferential all position pipe welding. Pipeshield X combines the benefits of engineered wire surfaces and thoroughly controlled chemical compositions leading to good impact values even at low temperatures. Consistent wire geometry supports wire feeding and stable arc performance. The 1%Ni-alloyed Pipeshield X80 covers pipe steel grades up to API X80 offering good impact toughness at low temperatures down to -60 °C (-76 °F) and CTOD values at -10 °C (14 °F). Root pass capability up to X100. This product can be used in sour gas applications. (HIC tested acc. to NACE TM-0284).

Base materials

API5L: X42, X52, X56, X60, X65, X70 and X80, EN 10208-2: L290MB – L555MB; L290NB – L415NB
and similar steel grades

Typical analysis of the solid wire

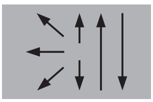
	C	Si	Mn	Ni	Ti	S	P
wt.-%	0.065	0.69	1.55	0.9	+	≤ 0.015	≤ 0.020

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$	Tensile strength R_m	Elongation A (L_0=5d_0)	Impact values ISO-V KV J	
	MPa / KSI	MPa / KSI	%	20 °C J / ft*lbt	-60 °C J / ft*lbt
u1	485 / 68.3	570 / 81.1	25	70 / 51.6	-
u2	500 / 72.5	600 / 24.0	24	125 / 92.2	60 / 44.3
u3	590 / 85.3	670 / 96.7	24.4	-	-
u4	-	608 / 88.2	-	170 / 125	90 / 66

u1 untreated, as welded – shielding gas 100% CO_2
u2 untreated, as welded – shielding gas Ar + 15 – 25% CO_2
u3 untreated, as welded – shielding gas M21, field result, round tensile specimen, longitudinal
u4 untreated, as welded – shielding gas M21, field result, round tensile specimen, transverse

Operating data



Dimension mm
1.0
1.2

Approvals

DNV GL

Pipeshield X90

Solid Wire, low-alloyed, high strength

Classifications

EN ISO 16834-A	AWS A5.28 / SFA-5.28
G 55 6 M21 Mn3Ni1Mo G 55 4 C1 Mn3Ni1Mo	ER90S-G

Characteristics and typical fields of application

Pipeshield X series of solid wires for GMAW are specifically designed for fully automatic circumferential all position pipe welding. Pipeshield X combine the benefits of engineered wire surfaces and thoroughly controlled chemical compositions leading to good impact values even at low temperatures. Consistent wire geometry supports wire feeding and stable arc performance. Pipeshield X90 covers pipe steel grades up to API X80Q and is designed for welding in all positions. Good cryogenic impact energy down to -60°C and low hydrogen contents in the deposit.

Base materials

S460N, S460M, S460NL, S460ML, S460Q-S555Q, S460QL-S550QL, S460QL1-S550QL1, 460N,P460NH, P460NL1, P460NL2, L415NB, L415MB-L555MB, L415QB-L555QB, 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 analysis of the solid wire

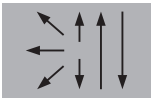
	C	Si	Mn	Ni	Mo
wt.-%	0.08	0.60	1.8	0.9	0.30

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-40°C	-60°C
u	620 (≥ 550)	700 (≥ 640)	23 (≥ 18)	140	110	≥ 47
u2	590 (≥ 550)	680 (≥ 640)	22 (≥ 18)	120	≥ 47	

u untreated, as welded – shielding gas Ar + 15 – 25% CO_2
u2 untreated, as welded – shielding gas 100% CO_2

Operating data



Dimension mm
0.9
1.0
1.2

Preheat, interpass temperature and post weld heat treatment as required by the base metal.

Approvals

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böhler welding by voestalpine

Union S 2 Si - UV 310 P

SAW wire/flux combination, mild steel

Classifications

Type	EN ISO 14171-A	AWS A5.23 / SFA-5.23	AWS A5.17 / SFA-5.17
Multi-run	S 38 2 AB S2Si		F7A2-EM12K
2-run	S 3T 0 AB S2Si	F6TA0G-EM12K	

Characteristics and typical fields of application

Union S 2 Si - UV 310 P is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. This wire-flux combination is recommended for two-run welding technique with multi-wire welding processes, with very good welding performance and low failure rate, and is applied in case of low requirements to strength and toughness properties. Also suitable for single wire (DC+), tandem (DC+ and AC).

UV 310 P is an aluminate-basic flux. For information regarding this welding flux see our detailed data sheet.

Base materials

Fine grained structural and line pipe steel grades up to API X 60 and EN 10208-2: L415 MB

Typical analysis of the weld metal

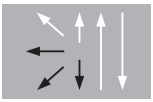
wt.-%	C	Si	Mn
wire	0.10	0.30	1.10
all-weld metal	0.08	0.40	1.20

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -30°C	-20°C
u, DC+	430 (≥ 400)	515 (480-600)	29 (≥ 22)	54 (≥ 27)	80 (≥ 47)

u untreated, as welded, single wire

Operating data



Polarity	DC / AC

Dimension mm
3.2
4.0

The mechanical properties of weld metal by two-run technique are strongly influenced by:

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
    - o welding parameters (heat input)
    - o wall thickness (2 - resp. 3 dimensional cooling)
    - o preheat / interpass temperature

Approvals

-

SAW

Union S 3 Si - UV 309 P

SAW wire/flux combination, mild steel

Classifications

Type	EN ISO 14171-A	AWS A5.23 / SFA 5.23	AWS A5.17 / SFA 5.17
Multi-run	S 42 4 AB S3Si	-	F7A5-EH12K
2-run	S 3T 2 AB S3Si	F7TA0G-EH12K	-

Characteristics and typical fields of application

Union S 3 Si - UV 309 P is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. This wire-flux combination can be used for 2 - run technique with multi wire welding processes, with very good welding performance.

UV 309 P is an agglomerated, with low hydrogen content. For more details on the flux, see our detailed datasheet of UV 309 P.

Base materials

Fine grained structural and pipe steel grades up to YS = 420 MPa.

Typical analysis of the weld metal

wt.-%	C	Si	Mn
wire	0.10	0.30	1.65
all-weld metal	0.06	0.45	1.50

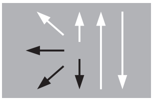
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -46 °C	-40 °C
u, DC+	450 (≥ 420)	540 (500-640)	29 (≥ 22)	45 (≥ 27)	60 (≥ 47)

u untreated, as welded, single wire

SAW

Operating data



Polarity DC+, AC

Dimension mm
3.0
4.0
4.8

The mechanical properties of weld metal by two-run technique are strongly influenced by:

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
    - o welding parameters (heat input)
    - o wall thickness (2 - resp. 3 dimensional cooling)
    - o preheat / interpass temperature

Approvals

-

Union S 3 Si - UV 310 P

SAW wire/flux combination, mild steel

Classifications

Type	EN ISO 14171-A	AWS A5.23 / SFA-5.23	AWS A5.17 / SFA-5.17
Multi-run	S 42 4 AB S3Si		F7A6-EH12K
2-run	S 3T 2 AB S3Si	F7TA0G-EH12K	

Characteristics and typical fields of application

Union S 3 Si - UV 310 P is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. This wire-flux combination can be used for 2-run and multi-run welding technique with single wire (DC+) and tandem (DC+ and AC) welding processes, with very good welding performance and low failure rate.

UV 310 P is an agglomerated neutral flux, that does not add Manganese, neither Silicon to the weld metal, with very low hydrogen content. For more details on the flux, see our detailed datasheet of UV 310 P.

Base materials

Fine grained structural and pipe steel grades up to YS = 420 MPa.

Typical analysis of the weld metal

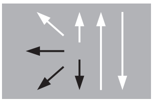
wt.-%	C	Si	Mn
wire	0.10	0.30	1.65
all-weld metal	0.05	0.30	1.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -50 °C	-40 °C
u, DC+	450 (≥ 420)	540 (500-640)	29 (≥ 22)	45 (≥ 27)	65 (≥ 47)

u untreated, as welded, single wire

Operating data



Polarity DC / AC

Dimension mm
2.5
3.0
4.0
4.8

The mechanical properties of weld metal by two-run technique are strongly influenced by:

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
    - o welding parameters (heat input)
    - o wall thickness (2 - resp. 3 dimensional cooling)
    - o preheat / interpass temperature

Approvals

-

Union S 2 Mo - UV 309 P

SAW wire/flux combination, low-alloyed

Classifications

Type	EN ISO 14171-A	AWS A5.23 / SFA-5.23
Multi-run	S 46 4 AB S2Mo	F8A4-EA2-A2
2-run	S 4T 4 AB S2Mo	F8TA4G-EA2

Characteristics and typical fields of application

Union S 2 Mo - UV 309 P is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. This wire-flux combination is recommended for two-run welding technique with multi-wire welding processes, with very good welding performance and low failure rate, and is applied in case of moderate requirements to strength and toughness properties. Especially recommended for longitudinal pipe manufacturing (pipe mill). Also suitable for single wire (DC+), tandem (DC+ and AC).

UV 309 P is an aluminate-basic flux. For information regarding this welding flux see our detailed data sheet.

Base materials

Fine grained structural and line pipe steel grades up to API X 60, X65 and EN 10208-2: L415,450 MB

Typical analysis of the weld metal

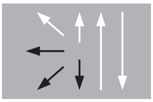
wt.-%	C	Si	Mn	Mo
wire	0.10	0.15	1.05	0.55
all-weld metal	0.07	0.30	1.15	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40 °C	-20 °C
u, DC+	≥ 470	550-680	≥ 20	≥ 47	≥ 60

u untreated, as welded, single wire

Operating data



Polarity	DC / AC

Dimension mm
3.0
4.0

The mechanical properties of weld metal by two-run technique are strongly influenced by:

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
    - o welding parameters (heat input)
    - o wall thickness (2 - resp. 3 dimensional cooling)
    - o preheat / interpass temperature

Approvals

-

Union S 2 Mo - UV 310 P

SAW wire/flux combination, low-alloyed

Classifications

Type	**EN ISO 14171-A**	**AWS A5.23 / SFA-5.23**
Multi-run	S 46 4 AB S2Mo	F8A4-EA2-A2
2-run	S 4T 4 AB S2Mo	F8TA4G-EA2

Characteristics and typical fields of application

Union S 2 Mo - UV 310 P is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. This wire-flux combination is recommended for two-run welding technique with multi-wire welding processes, with very good welding performance and low failure rate, and is applied in case of moderate requirements to strength and toughness properties. Especially recommended for longitudinal pipe welding (pipe mill). Also suitable for single wire (DC+), tandem (DC+ and AC).

UV 310 P is an aluminate-basic flux. For information regarding this welding flux see our detailed data sheet.

Base materials

Fine grained structural and line pipe steel grades up to API X 60, X65 and EN 10208-2: L415,450 MB

Typical analysis of the weld metal

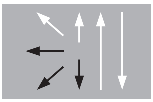
wt.-%	C	Si	Mn	Mo
wire	0.10	0.15	1.05	0.55
all-weld metal	0.07	0.25	1.15	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C	-20°C
u, DC+	≥ 470	550-680	≥ 20	≥ 47	≥ 60

u untreated, as welded, single wire

Operating data



Polarity DC / AC

Dimension mm
3.0
4.0

The mechanical properties of weld metal by two-run technique are strongly influenced by::

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
  - o welding parameters (heat input)
  - o wall thickness (2 - resp. 3 dimensional cooling)
  - o preheat / interpass temperature

Approvals

-

Union S 4 Mo - UV 310 P

SAW wire/flux combination, low-alloyed

Classifications

Type	EN ISO 14171-A	AWS A5.23 / SFA-5.23
Multi-run	S 46 4 AB S4Mo	F8A4-EA3-A3
2-run	S 4T 4 AB S4Mo	F8TA4G-EA3

Characteristics and typical fields of application

Union S 4 Mo - UV 310 P is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. This wire-flux combination is recommended for two-run welding technique with multi-wire welding processes, with very good welding performance and low failure rate, and is applied in case of moderate requirements to strength and toughness properties.

Also suitable for single wire (DC+), tandem (DC+ and AC).

UV 310 P is an aluminate-basic flux. For information regarding this welding flux see our detailed data sheet.

Base materials

Fine grained structural and line pipe steel grades up to API X 60, X65 and EN 10208-2: L415,450 MB

Typical analysis of the weld metal

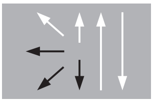
wt.-%	C	Si	Mn	Mo
wire	0.11	0.10	2.00	0.50
all-weld metal	0.07	0.20	1.55	0.45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40 °C	-20 °C
u, DC+	≥ 470	550-680	≥ 20	≥ 47	≥ 60

u untreated, as welded, single wire

Operating data



Polarity DC / AC

Dimension mm
4.0
4.8

The mechanical properties of weld metal by two-run technique are strongly influenced by::

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
  - o welding parameters (heat input)
  - o wall thickness (2 - resp. 3 dimensional cooling)
  - o preheat / interpass temperature

Approvals

-

SAW

böhler welding by voestalpine

Union S 3 TiB - UV 309 P

SAW wire/flux combination, mild steel

Classifications

Type	EN ISO 14171-A	AWS A5.23 / SFA-5.23
Multi-run	(S 46 Z AB SZ)	(F8AZ-EG-G)
2-run	S 5T 5 AB SZ	F8TA6G-EG

Characteristics and typical fields of application

Union S 3 TiB - UV 309 P is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. This wire-flux combination has been designed to achieve optimum toughness properties of weld metal produced by two-run welding technique. This wire-flux combination is not recommended for multi-pass welding. It is especially recommended for longitudinal pipe manufacturing (pipe mill) with typical welding procedures with

- 2-run-technique with high dilution rate (e.g. > 65%)
- combined with other alloyed / non-alloyed wires in multi-wire configuration
- for high CTOD / charpy toughness requirements at -20ºC / -50ºC
- to limit hardness in weld metal (e.g. X65 for sour service)

UV 309 P is an aluminate-basic flux. For information regarding this welding flux see our detailed data sheet.

Base materials

Fine grained structural and line pipe steel grades : API X60, X65, X70, EN 10208-2: L415 MB, L450 MB, L485 MB.

Typical analysis of the weld metal

wt.-%	C	Si	Mn	Mo	B	Ti	S	P
wire	0.07	0.3	1.55	-	0.013	0.15	≤ 0.005	≤ 0.015
all-weld metal	0.05	0.4	1.30	-	0.003	0.02	≤ 0.010	≤ 0.015

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20 °C	0 °C	20 °C
u, DC+	≥ 470	550 - 680	≥ 20	≥ 50	≥ 100	≥ 150

u untreated, as welded, single wire

Operating data

Polarity	DC + / AC

Dimension mm
3.2
4.0
5.0

The mechanical properties of weld metal by two-run technique are strongly influenced by:

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
  - o welding parameters (heat input)
  - o wall thickness (2 - resp. 3 dimensional cooling)
  - o preheat / interpass temperature

Approvals

-

SAW

Union S 3 TiB - UV 310 P

SAW wire/flux combination, mild steel

SAW

Classifications

Type	EN ISO 14171-A	AWS A5.23 / SFA-5.23
Multi-run	(S 46 Z AB SZ)	(F8AZ-EG-G)
2-run	S 5T 5 AB SZ	F8TA6G-EG

Characteristics and typical fields of application

Union S 3 TiB - UV 310 P is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. This wire-flux combination has been designed to achieve optimum toughness properties of weld metal produced by two-run welding technique. This wire-flux combination is not recommended for multi-pass welding. It is especially recommended for longitudinal pipe manufacturing (pipe mill) with typical welding procedures with

- 2 run-technique with high dilution rate (e.g. > 65%)
- combined with other alloyed / non-alloyed wires in multi-wire configuration
- for high CTOD / charpy toughness requirements at -20ºC / -50ºC
- to limit hardness in weld metal (e.g. X65 for sour service)

UV 310 P is an aluminate-basic flux. For information regarding this welding flux see our detailed data sheet.

Base materials

Fine grained structural and line pipe steel grades like API X 60, X 65, X70, and EN 10208-2: L415 MB, L450 MB, L485 MB.

Typical analysis of the weld metal

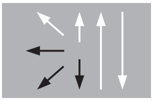
wt.-%	C	Si	Mn	Mo	B	Ti	S	P
wire	0.07	0.3	1.55	-	0.013	0.15	≤ 0.005	≤ 0.015
all-weld metal	0.05	0.3	1.30	-	0.003	0.02	≤ 0.010	≤ 0.015

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -20°C	0°C	20°C
u, DC+	≥ 470	550 - 580	≥ 20	≥ 50	≥ 100	≥ 150

u untreated, as welded, single wire

Operating data



Polarity DC + / AC

Dimension mm
3.2
4.0
5.0

The mechanical properties of weld metal by two-run technique are strongly influenced by:

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
  - o welding parameters (heat input)
  - o wall thickness (2 - resp. 3 dimensional cooling)
  - o preheat / interpass temperature

Approvals

-

Union S 3 MoTiB - UV 309 P

SAW wire/flux combination, low-alloyed

Classifications

Type	EN ISO 14171-A	AWS A5.23 / SFA-5.23
Multi-run	(S 46 Z AB S2MoTiB)	(F8AZ-EA2TiB-G)
2-run	S 5T 5 AB S2MoTiB	F9TA6G-EA2TiB

Characteristics and typical fields of application

Union S 3 MoTiB - UV 309 P is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. This wire-flux combination has been designed to achieve optimum toughness properties of weld metal produced by two-run welding technique. This wire-flux combination is not recommended for multi-pass welding. It is especially recommended for longitudinal pipe manufacturing (pipe mill) with typical welding procedures with

- 2-run-technique with high dilution rate (e.g. > 65%)
- combined with other alloyed / non-alloyed wires in multi-wire configuration
- for high CTOD / charpy toughness requirements at -40ºC / -60ºC
- high strength level of weld (e.g. YS > 580MPa; TS > 680 MPa (API-5L: X60-X80).

UV 309 P is an aluminate-basic flux. For information regarding this welding flux see our detailed data sheet.

Base materials

Fine grained structural and line pipe steel grades like API X60, X65, X70, X80 and EN 10208-2: L415 MB, L450 MB, L485 MB, L555 MB.

Typical analysis of the weld metal

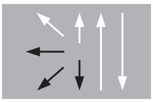
wt.-%	C	Si	Mn	Mo	B	Ti	S	P
wire	0.07	0.30	1.2	0.55	0.013	0.14		
all-weld metal	0.05	0.40	1.3	0.50	0.003	0.02	≤ 0.015	≤ 0.015

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J -20 °C	0 °C	20 °C
u, DC+	≥ 500	(570 - 720)	≥ 20	≥ 50	≥ 100	≥ 150

u untreated, as welded, single wire

Operating data



Polarity DC / AC

Dimension mm
3.0
4.0

The mechanical properties of weld metal by two-run technique are strongly influenced by:

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
    - o welding parameters (heat input)
    - o wall thickness (2 - resp. 3 dimensional cooling)
    - o preheat / interpass temperature

Approvals

TÜV (10450 : UV 309 P / Union S 3 Mo + 2 x Union S 3 MoTiB)

SAW

Union S 3 MoTiB - UV 310 P

SAW wire/flux combination, low-alloyed

Classifications

Type	EN ISO 14171-A	AWS A5.23 / SFA-5.23
Multi-run	(S 46 Z AB S2MoTiB)	(F8AZ-EA2TiB-G)
2-run	S 5T 5 AB S2MoTiB	F9TA6G-EA2TiB

Characteristics and typical fields of application

Union S 3 MoTiB - UV 310 P is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades. This wire-flux combination has been designed to achieve optimum toughness properties of weld metal produced by two-run welding technique. This wire-flux combination is not recommended for multi-pass welding. It is especially recommended for longitudinal pipe manufacturing (pipe mill) with typical welding procedures with

- 2-run-technique with high dilution rate (e.g. > 65%)
- combined with other alloyed / non-alloyed wires in multi-wire configuration
- for high CTOD / charpy toughness requirements at -40°C / -60°C
- high strength level of weld (e.g. YS > 580MPa; TS > 680 MPa (API-5L: X60-X80).

UV 310 P is an aluminate-basic flux. For information regarding this welding flux see our detailed data sheet.

Base materials

Fine grained structural and line pipe steel grades like API X 60, X 65, X70, X80 and EN 10208-2: L415 MB, L450 MB, L485 MB, L555 MB.

Typical analysis of the weld metal

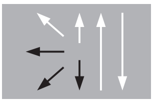
wt.-%	C	Si	Mn	Mo	B	Ti	S	P
wire	0.07	0.30	1.2	0.55	0.013	0.14		
all-weld metal	0.05	0.30	1.3	0.50	0.003	0.02	≤ 0.015	≤ 0.015

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20°C	0°C	20°C
u, DC+	≥ 500	(570 – 720)	≥ 20	≥ 50	≥ 100	≥ 150

u untreated, as welded, single wire

Operating data



Polarity DC / AC

Dimension mm
3.0
4.0

The mechanical properties of weld metal by two-run technique are strongly influenced by:

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
    - welding parameters (heat input)
    - wall thickness (2 - resp. 3 dimensional cooling)
    - preheat / interpass temperature

Approvals

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SAW

böhler welding by voestalpine

Union S 3 MoTiB - UV 419 TT-W

SAW wire/flux combination, low-alloyed

Classifications

Type	EN ISO 14171-A	AWS A5.23 / SFA-5.23
Multi-run	(S 46 Z FB S2MoTiB)	(F8AZ-EA2TiB-G)
2-run	S 5T 5 FB S2MoTiB	F9TA6G-EA2TiB

Characteristics and typical fields of application

Union S 3 MoTiB - UV 419 TT-W is a wire-flux combination for submerged-arc welding of unalloyed and low-alloyed steel grades.

This wire-flux combination is not recommended for multi-pass welding ; this wire-flux combination has been designed to achieve very good toughness properties of weld metal produced by two-run or back weld punch through technique (double-joint), with typically

- high dilution rate (e.g. > 50%)
- high heat-input (e.g. > 30 kJ/cm)
- for high CTOD and charpy toughness requirements at -40ºC / -60ºC

Base materials

Fine grained structural and line pipe steel grades like API X 60, X 65, X70, X80 and EN 10208-2: L415 MB, L450 MB, L485 MB, L555 MB.

Typical analysis of the weld metal

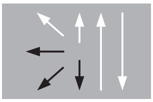
wt.-%	C	Si	Mn	Mo	B	Ti
wire	0.07	0.30	1.2	0.55	0.013	0.14
all-weld metal	0.05	0.35	1.3	0.50	0.003	0.02

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -20 °C	0 °C	20 °C
u, DC+	≥ 500	(570 - 720)	≥ 20	≥ 50	≥ 100	≥ 150

u untreated, as-welded

Operating data



Polarity	DC / AC

Dimension mm
3.0
4.0

The mechanical properties of weld metal by two-run technique are strongly influenced by:

- the high dilution rate (60 up to 70%)
- chemical composition of the base metal
- relative long cooling time t 8/5 of the weld cycle, depending on
    - o welding parameters (heat input)
    - o wall thickness (2 - resp. 3 dimensional cooling)
    - o preheat / interpass temperature

Approvals

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SAW

Union S 2 NiMo 1 - UV 419 TT-W

SAW wire/flux combination, low alloyed, high strength

Classifications

EN ISO 14171-A	AWS A5.23 / SFA 5.23
S 50 6 FB SZ2Ni1Mo	F8A8-ENi1-Ni1 - F8P8-ENi1-Ni1

Characteristics and typical fields of application

Union S 2 NiMo 1 - UV 419 TT-W is a wire flux combination It is suitable for single (AC or DC) and tandem (DC and AC or AC and AC) welding. Very good slag detachability also for narrow gap welding. Flux can especially be used for multi-pass butt welding of medium and high tensile steels. Very good impact toughness of weld metal at low temperatures.

UV 419 TT-W is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behavior. For more information regarding this welding flux see our detailed data sheet.

Base materials

General purpose structural steels, fine grained structural steels, medium and high tensile steels up to 500 MPa minimum yield strength.

Typical analysis of the weld metal

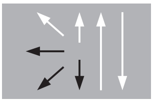
wt.-%	C	Si	Mn	Ni	Mo	S	P
wire	0.11	0.15	1.10	0.95	0.25	≤ 0.010	≤ 0.010
all-weld metal	0.08	0.20	1.30	0.95	0.25		

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	-40°C	-60°C
u, DC+	530 (≥500)	620 (≥570)	26 (≥22)	(≥180)	150 (≥100)	100 (≥70)
a1, DC+	490 (≥470)	600 (≥550)	26 (≥22)	(≥180)	160 (≥120)	110 (≥80)

u untreated, as welded ; a1 = 1 hour 620 °C

Operating data



Polarity DC+ (AC)

Dimension mm
2.5
3.2
4.0

Preheating and interpass temperature as required by the base metal.

Approvals

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BÖHLER SUBARC T60 - UV 419 TT-W

SAW wire/flux combination, low alloyed, high strength

Classifications

EN ISO 14171-A	AWS A5.23 / SFA-5.23
S 50 6 FB TZ3Ni1 H5	F8A8-ECNi1-Ni1

Characteristics and typical fields of application

BÖHLER SUBARC T60 - UV 419 TT-W is a wire - flux combination submerged arc welding of high-strength, quenched and tempered fine grained structural steels up to MSYS = 500 MPa. The basic-cored wire provides weld metal with good toughness properties at low temperatures (-60ºC), a fine bead appearance and good wetting properties, together with good slag detachability and low hydrogen content in the weld metal (< 5 ml/100g acc. to EN ISO 3690) characterize this wire/flux combination. With a Nickel content below 1% this wire-flux combination meets the NACE-requirements and can be used for sour gas applications. The seamless coppered wire is not sensitive to moisture pick up, has a good resistance to deformation (wire feed rollers) and is very easy to straighten to ensure the best current transfer with low contact tip consumption.

UV 419 TT-W is a flux with high basicity index and has been designed to be applied in unlimited thickness for a low level of diffusible hydrogen (to decrease the risk of cold cracking). The flux features a neutral metallurgical behavior.

Base materials

Constructional steels, pipe- and vessel steels, cryogenic fine-grained steels and special grades

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 the weld metal

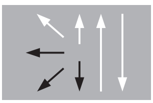
wt.-%	C	Si	Mn	Ni	Mo
all-weld metal	0.06	0.4	1.7	0.9	0.16

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60 °C	-40 °C
u, DC+	575 (≥ 500)	650 (610-690)	25 (≥ 20)	90 (≥ 50)	120 (≥ 70)

u untreated, as welded

Operating data



Polarity	DC + (AC)

Dimension mm
2.0
2.4
3.2
4.0

Approvals

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Union S 3 NiMo 1 - UV 419 TT-W

SAW wire/flux combination, low-alloyed, high strength

Classifications

EN ISO 26304-A	AWS A5.23 / SFA-5.23
S 55 6 FB S3Ni1Mo	F9A8-EF3-F3 / F9P8-EF3-F3

Characteristics and typical fields of application

Union S 3 NiMo 1 - UV 419 TT-W is a wire flux combination for submerged arc welding non-alloyed and low-alloyed steel grades with high strength. Very good impact toughness of weld metal at low temperatures. Very good slag detachability also for narrow gap welding. It is suitable for single (AC or DC) and tandem (DC and AC) welding. Applications can be found in as welded condition (e.g. off shore) and PWHT condition (pressure vessels).

UV 419 TT-W is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour. For more information regarding this sub-arc welding flux see our detailed data sheet.

Base materials

Quenched and tempered fine-grained steels

S460N, S460M, S460NL, S460ML, S460Q-S555Q, S460QL-S550QL, S460QL1-S550QL1, P460N, P460NH, P460NL1, P460NL2, 20MnMoNi4-5, 15NiCuMoNb5-6-4, L415NB, L415MB-L555MB, L415QB-L555QB, alform 500 M, aldur 500 Q, 500 QL, 500 QL1, aldur 550 Q, 550 QL, 550 QL1,

ASTM A572 Gr. 65; A633 Gr. E; A738 Gr. A; A852; API 5 L X60 - X80, X60Q, X65Q, X70Q, X80Q

Typical analysis of the weld metal

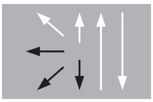
wt.-%	C	Si	Mn	Ni	Mo
wire	0.12	0.20	1.75	0.95	0.55
all-weld metal	0.08	0.25	1.60	0.90	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -60°C	-40°C
u, DC+	580 (≥ 550)	690 (≥ 640)	24 (≥ 20)	70 (≥ 47)	90
a1, DC+	560 (≥ 550)	670 (≥ 640)	25 (≥ 20)	70 (≥ 47)	90

u untreated, as welded; a1 = 2 hours 560 -620 °C

Operating data



Polarity DC / AC

Dimension mm
1.6
2.0
2.5
3.0
3.2
4.0

Preheating and interpass temperature: 180 – 220ºC

Approvals

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SAW

BÖHLER Pipeshield 71 T8-FD

Self-shielded flux cored wire mild steel

Classifications

AWS A5.36 / SFA-5.36
E71T8-A4-K6

Characteristics and typical fields of application

Böhler Pipeshield 71 T8-FD self-shielded flux-cored wire, especially developed and recommended for pipe welding in vertical down (5G) position. It is also suitable for welding of unalloyed steel constructions. This wire offers a fast freezing, easy removable slag, excellent welding characteristics, is easy to operate for the welders and this product provides high productivity.

Böhler Pipeshield 71 T8-FD is designed to provide good mechanical properties as well as high impact toughness at low temperatures. Basically outstanding benefits and advantages in vertical down position for (hot pass), fill and cap layers. Due to the fluoride-basic filling the interpass temperature can be arranged similar to that of basic electrodes, we recommend 80 – 200ºC.

Böhler self-shielded flux-cored wire provide an easy handling for the welder due to a very tolerant stick out length and loss tendency to porosity also when welding with a longer arc length as a result of higher voltage.

Base materials

Acc. to API 5L:

A, B, X42, X46, X52, X56, X60, (X65, X70)

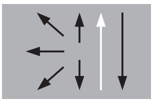
Typical analysis of the wire

	C	Si	Mn	Ni	Al
wt.-%	0.045	0.14	1.1	0.7	0.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J +20°C	-30°C	-40°C
u	435 (≥ 400)	535 (490 – 660)	28 (≥ 22)	200	150	100 (≥27)

Operating data



Polarity	DC–
Shielding gas (EN ISO 14175)	-

Dimension mm
2.0

Recommended stick out: 10 – 25 mm

Packaging and available sizes

6 kg coils: 1 unit contains 5 packed coils à 6 kg

Hermetically sealed metal can

Approvals

NAKS, GAZPROM

BÖHLER Pipeshield 71.1 T8-FD

Self-shielding flux-cored wire, mild steel

Classifications

AWS A5.36 / SFA-5.36
E71T8-A4-Ni1

Characteristics and typical fields of application

Böhler Pipeshield 71.1 T8-FD self-shielded flux-cored wire, especially developed and recommended for pipe welding in vertical down (5G) position. It is also suitable for welding of unalloyed steel constructions. This wire offers a fast freezing, easy removable slag, excellent welding characteristics, is easy to operate for the welders and this product provides high productivity.

Böhler Pipeshield 71.1 T8-FD is designed to provide good mechanical properties as well as high impact toughness at low temperatures. Basically outstanding benefits and advantages in vertical down position for (hot pass), fill and cap layers. Due to the fluoride-basic filling the interpass temperature can be arranged similar to that of basic electrodes, we recommend 80 – 200°C. Böhler self-shielded flux-cored wire provide an easy handling for the welder due to a very tolerant stick out length and loss tendency to porosity also when welding with a longer arc length as a result of higher voltage.

Base materials

Acc. to API 5L:

A, B, X42, X46, X52, X56, X60, (X65, X70)

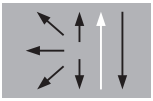
Typical analysis of the wire

	C	Si	Mn	Ni	Al
wt.-%	0.045	0.14	1.1	0.95	0.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-30°C	-40°C
u	435 (≥ 400)	535 (490 – 660)	28 (≥ 22)	200	150	120 (≥27)

Operating data



Polarity DC–

Shielding gas (EN ISO 14175) -

Dimension mm
2.0

Recommended stick out: 10 – 25 mm

Packaging and available sizes

6 kg coils: 1 unit contains 5 packed coils à 6 kg Hermetically sealed metal can

Approvals

-

FCW

böhler welding by voestalpine

BÖHLER Pipeshield 81 T8-FD

Self-shielded flux-cored wire, low alloyed

Classifications

AWS A5.36 / SFA-5.36
E81T8-A4-Ni2
E81T8-A4-G

Characteristics and typical fields of application

Böhler Pipeshield 81 T8-FD is a self-shielded flux-cored wire and is especially developed for semi- automatic vertical down welding of pipelines. It is also suitable for welding of low alloyed steel constructions. This wire offers a fast freezing, easy removable slag and excellent welding characteristics in all positions. Böhler Pipeshield 81 T8-FD is designed to offer both good mechanical properties and high impact toughness at low temperatures. The outstanding benefits are especially accessible in the vertical down position for (hot pass) filler and cap layers. Due to the fluoride-basic filling the interpass temperature can be arranged similar to that of basic electrodes, we recommend 80 – 200ºC.

Böhler self-shielded flux-cored wire provide an easy handling for the welder due to a very tolerant stick out length and loss tendency to porosity also when welding with a longer arc length as a result of higher voltage.

Base materials

Acc. to API 5L:

X65, X70

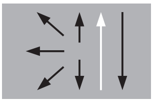
Typical analysis of the wire

	C	Si	Mn	Ni	Al
wt.-%	0.05	0.15	1.4	1.95	0.8

Mechanical properties of all-weld metal - typical values (min. values)

Yield strength R_e	Tensile strength R_m	Elongation A ($L_0=5d_0$)	Impact values ISO-V KV J		
MPa	MPa	%	20°C	-30°C	-40°C
500 (≥ 470)	600 (550 – 690)	25 (≥ 19)	170	120	90 (≥ 27)

Operating data



Polarity DC –

Shielding gas (EN ISO 14175) -

Dimension mm
2.0

Recommended stick out: 10 – 25 mm

Packaging and available sizes

6 kg coils: 1 unit contains 5 packed coils à 6 kg Hermetically sealed metal can

Approvals

NAKS, GAZPROM

FCW

BÖHLER Pipeshield 91 T8-FD

Self-shielded flux-cored wire, low-alloyed

Classifications

AWS A5.36 / SFA-5.36
E91T8-A4-G

Characteristics and typical fields of application

Böhler Pipeshield 91 T8-FD is a self-shielded flux-cored wire especially developed for vertical down welding of filler and cap layers in pipeline applications. It is also suitable for welding of low alloyed steel constructions. The wire offers excellent welding characteristics with high productivity. It has a fast freezing, easily removable slag system.

The weld metal shows excellent mechanical properties and superior impact toughness at low temperatures.

Due to the fluoride-basic filling, the recommended interpass temperature is 80 – 200ºC.

Base materials

Acc. to API 5L:

X65, X70, X80

Typical analysis of the wire

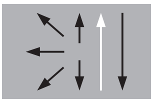
	C	Si	Mn	Ni	Al
wt.-%	0.04	0.30	2.0	3.20	0.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20 °C	-10 °C	-40 °C
u	610 (≥ 540)	680 (620 – 760) 680	23 (≥ 17)	155	150	105 (≥27)

u untreated condition

Operating data



Polarity DC –

Shielding gas (EN ISO 14175) -

Stick-Out 10 – 25 mm

Dimension mm
2.0

Recommended stick out: 10 – 25 mm

Packaging and available sizes

6 kg coils: 1 unit contains 5 packed coils à 6 kg Hermetically sealed metal can

Approvals

CNPC

BÖHLER Ti 70 Pipe T-FD

Flux-cored wire, seamless, for automatic pipeline welding, rutile type

Classifications

EN ISO 18276-A	AWS A5.36 / SFA-5.36
T 55 5 Mn1Ni P M21 1 H5	E91T1-M21A6-K2-H4

Characteristics and typical fields of application

Seamless rutile, Nickel-manganese alloyed, flux-cored wire for singleor multilayer welding of carbon, carbon-manganese steels and high strength steels with Ar-CO_2 shielding gas. Main features: excellent weldability in all positions, excellent bead appearance, very low spatter losses, fast freezing and easy to remove slag. The exceptional mechanical properties of this wire even at low temperatures as well as the low content of diffusible hydrogen make it especially suitable for pipeline applications.

Base materials

S355JR, S355J0, S355J2, S450J0, S355N-S460N, S355NL-S460NL, S355M-S460M, S355ML- S460ML, S460Q-S550Q, S460QL-S550QL, P355GH, P355NH, P420NH, P460NH, P355N-P460N, P355NH-P460NH, P355NL1-P460NL1, P355NL2-P460NL2, L360NB-L415NB, L360MB-L555MB, L360QB-L555QB, aldur 500Q-aldur 550Q, aldur 500QL-aldur 550QL

ASTM A 350 Gr. LF2; A 516 Gr. 65, 70; A 572 Gr. 50, 60, 65; A 573 Gr. 70; A 588 Gr. B, C, K; A 633 Gr. C, D, E; A 662 Gr. C; A 678 Gr. B; A 707 Gr. L2, L3; A 792 Gr. 550 Cl. 1; A 841 Gr. A, B, C; A 852; API 5 L X52, X60, X65, X70, X80, X52Q, X60Q, X65Q, X70Q, X80Q

Typical analysis of the wire

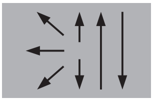
	Gas	C	Si	Mn	Ni
wt.-%	M21	0.05	0.30	1.6	1.00

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C	-50°C
u	620 (≥ 620)	680 (640–760)	22 (≥ 18)	90	80 (≥ 47)

u untreated, as welded - shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Welding with standard GMAW-facilities possible

Approvals

TÜV, CE

FCW

BÖHLER Ti 70 Pipe T-FD-N

Flux-cored wire, seamless, for automatic pipeline welding, rutile type

Classifications

EN ISO 18276-A	AWS A5.36 / SFA A5.36
T55 6 Z P M21 1 H5	E91T1-M21A8-G-H4

Characteristics and typical fields of application

Seamless rutile, Nickel-Manganese alloyed flux-cored wire for single- or multilayer welding of carbon, carbon-manganese steels and high strength steels with Ar-CO_2 shielding gas.

Main features: excellent weldability in all positions, excellent bead appearance, very low spatter losses, fast freezing and easy to remove slag. The exceptional mechanical properties of this wire even at low temperatures as well as the low content of diffusible hydrogen make it especially suitable for pipeline applications which have to meet the NACE requirements. This product is CTOD tested at -10ºC (14ºF). This product can be used in sour gas applications (HIC tested acc. to NACE TM-0284) Test values for SSC are available upon request.

Base materials

S355JR, S355J0, S355J2, S450J0, S355N-S460N, S355NL-S460NL, S355M-S460M, S355ML-S460ML, S460Q-S550Q, S460QL-S550QL, P355GH, P355NH, P420NH, P460NH, P355N-P460N, P355NH-P460NH, P355NL1-P460NL1, P355NL2-P460NL2, L360NB-L415NB, L360MB-L555MB, L360QB-L555QB, aldur 500Q-aldur 550Q, aldur 500QL-aldur 550QL

ASTM A 350 Gr. LF2; A 516 Gr. 65, 70; A 572 Gr. 50, 60, 65; A 573 Gr. 70; A 588 Gr. B, C, K; A 633 Gr. C, D, E; A 662 Gr. C; A 678 Gr. B; A 707 Gr. L2, L3; A 792 Gr. 550 Cl. 1; A 841 Gr. A, B, C; A 852; API 5 L X52, X60, X65, X70, X80, X52Q, X60Q, X65Q, X70Q, X80Q

Typical analysis of the wire

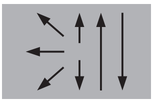
	Gas	C	Si	Mn	Ni	Mo
wt.-%	M21	0.05	0.35	1.6	0.85	0.25

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40 °C		-60 °C
u	620 (≥ 550)	690 (≥ 640 - 760)	22 (≥ 18)	100	-	80 (≥47)
s	560	620	24		55 (≥27)	

u untreated, as welded – shielding gas M21
s stress relieved 620°C / 2h - shielding gas M21

Operating data



Polarity	DC +
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.20

Welding with standard GMAW-facilities possible

Approvals

CE

böhler welding by voestalpine

BÖHLER Ti 80 Pipe T-FD

Flux-cored wire, seamless, for automatic pipeline welding, rutile type

Classifications

EN ISO 18276-A	AWS A5.36 / SFA-5.36
T 69 4 Z P M21 1 H5	E111T1-M21A4-GH4

Characteristics and typical fields of application

Seamless rutile Ni-Mo alloyed flux-cored wire for single or multipass welding of high strength steels with Ar-CO_2 shielding gas. Main features: excellent weldability in all positions, excellent bead appearance, no spatter; fast freezing and easy removable slag. The exceptional mechanical properties of this wire even at the low temperature (-40ºC) as well as the low content of diffusible hydrogen make it especially suitable for pipeline applications. Further applications are to be seen in the off-shore industry, ship building and structures built with high strength steels.

Base materials

Pipe steels and fine-grained steels

L485MB, L555MB

API Spec 5L: X70, X80

Typical analysis of the wire

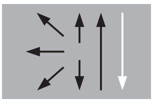
	Gas	C	Si	Mn	Ni
wt.-%	M21	0.07	0.3	1.7	2.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J -40°C
u	≥ 690	770 – 940	≥ 17	≥ 47

u untreated, as welded-shielding gas M21

Operating data



Polarity	DC +
Redrying	-
Shielding gas (EN ISO 14175)	M21

Dimension mm
1.2

Welding with standard GMAW-facilities possible

Approvals

-

FCW

Welding flux for unalloyed, low-alloyed and medium-alloyed steels

◆ Content

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böhler welding by voestalpine

UV 305

aluminate-rutile type

Classifications

EN ISO 14174
S A AR 1 76 AC H5

Characteristics and typical fields of application

UV 305 is an aluminate-rutile agglomerated flux with medium Si and Mn pick-up for joining un- alloyed and low alloyed steel grades,

The flux finds its most important applications in high speed fillet welding, especially fin-to-tube in water-wall construction for thermal power generation (boiler), with Union S 2 Mo, S 2 CrMo, S 1 CrMo 2 and S P24.

Also very good performance in two-run technique (longitudinal and circular seams), especially for very thin wall thickness.

Wall thickness is recommended up to 10 mm sheet thickness in other general purpose applications. It has outstanding good slag detachability (even in narrow grooves) and allows high welding speed. Best welding performance is with DC+ current with single wire and Twin-arc process.

Flux properties

Polarity	DC / AC
Basicity index (Boniszewski)	0.6
Grain size (EN ISO 14174)	4 – 14 (0.4 – 1.4 mm)
Flux consumption	1 kg flux per kg wire
Redrying	300 – 350°C. min 2 hrs
Diffusible hydrogen (ISO 3690)	< 5 ml / 100gr (as produced / re-dried)

Composition of sub-arc welding flux

	SiO_2+TiO_2	Al_2O_3+MnO	CaF_2+CaO+MgO
wt. %	30	55	8

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Union S 2	14171-A	S2		
Union S 2 Si	14171-A	S2Si	A5.17 / -5.17	EM12K
Union S 2 Mo	14171-A	S2Mo	A5.23 / -5.23	EA2
Union MV Mo S	14171-A	T2Mo	A5.23 / -5.23	ECA2
Union MV Mo S	24598-A	S T Mo	A5.23 / -5.23	ECA2
Union S 2 CrMo	24598-A	S S CrMo1	A5.23 / -5.23	EB2R
Union MV CrMo S	24598-A	S T CrMo1	A5.23 / -5.23	ECB2
Union S 1 CrMo 2	24598-A	S S CrMo2	A5.23 / -5.23	EB3R
Union MV CrMo 910 S	24598-A	S T CrMo2	A5.23 / -5.23	ECB3
Union S P23	24598-A	S S ZCrWV 2 1,5	A5.23 / -5.23	EB23
Union S P24	24598-A	S S ZCrMo2VNb	A5.23 / -5.23	EB24

Packaging

Type	Weight
DRY SYSTEM	25 kg
PE-bag	25 kg

UV 306

aluminate-rutile type

Classifications

EN ISO 14174
S A AR 1 77 AC H5

Characteristics and typical fields of application

UV 306 is an agglomerated aluminate-rutile flux submerged arc welding of unalloyed steel grades.

It is recommended for general-purpose applications and light steel constructions.

It is suited for direct and alternating current. It can be used for single- and multi-wire welding with high welding speed using the two-run technique as well as for fillet welding. Mainly for single pass welds on thin plates (or a few subsequent passes). Very good slag removability and nice bead appearance.

This flux has also been available on the market as "BÖHLER BB 306".

Flux properties

Polarity	DC / AC
Basicity index (Boniszewski)	0.6
Grain size (EN ISO 14174)	3 - 16 (0.3 - 1.6 mm)
Flux consumption	0.7 - 1.6 kg flux per kg wire
Redrying	300 – 350°C. min 2 hrs
Diffusible hydrogen (ISO 3690)	≤ 5 ml / 100gr (as produced / re-dried)

Composition of sub-arc welding flux

	SiO_2+TiO_2	Al_2O_3+MnO	$CaF_2+CaO+MgO$
wt. %	24	50	14

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Union S 2	14171-A	S2		
Union S 2 Si	14171-A	S2Si	A5.17 / -5.17	EM12K
BÖHLER SUBARC T55 HP	14171-A	T3	A5.17 / -5.17	EC1
Union S 2 Mo	14171-A	S2Mo	A5.23 / -5.23	EA2
BÖHLER SUBARC TNiCu1	14171-A	T2Ni1Cu	A5.23 / -5.23	ECG

Packaging

Type	Weight
PE-bag	25 kg

UV 309 P

aluminate-basic type

Classifications

EN ISO 14174
S A AB 1 65 AC H5

Characteristics and typical fields of application

UV 309 P is an agglomerated aluminate-basic flux for submerged arc welding for the manufacture of pipes, using the two-run technique, in unalloyed and low alloyed steel grades.

The flux has been designed to achieve best operative characteristics in multi-wire DSAW applications (2-5 wires). The flux generates a low amount of diffusible hydrogen content HD < 5 ml/100gr acc to ISO 3690.

The basic flux has a neutral metallurgical behaviour regarding to Mn and Si and is suitable for sour service applications.

Suitable for longitudinal and spiral pipe welding. Nice flat bead appearance with very good slag detachability. High current carrying capacity.

Depending on wire selection and welding conditions the flux can be used for pipe steel grades acc. to API: Grade X 42 to X 80.

Flux properties

Polarity	DC / AC
Basicity index (Boniszewski)	1.3
Grain size (EN ISO 14174)	3 – 20 (0.3 – 2.0 mm)
Apparent density	1.15-1.30 kg/dm3
Flux consumption	0.9 - 1.1 kg flux per kg wire
Redrying	300 – 350°C. min 2 hrs
Diffusible hydrogen (ISO 3690)	≤ 5 ml / 100gr (as produced / re-dried)
Moisture content (AWS A4.4M: 2001; 1050 °C)	≤ 0.05 % (as produced / re-dried)

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
wt. %	22	27	32	14

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Union S 2	14171-A	S2		
Union S 3 Si	14171-A	S3Si	A5.17 / -5.17	EH12K
Union S 3 TiB	14171-A	SZ	A5.23 / -5.23	EG
Union S 2 Mo	14171-A	S2Mo	A5.23 / -5.23	EA2
Union S 4 Mo	14171-A	S4Mo	A5.23 / -5.23	EA3
Union S 3 MoTiB	14171-A	S2MoTiB	A5.23 / -5.23	EA2TiB

Packaging

Type	Weight
BIGBAG DRY SYSTEM	500 kg / 1000 kg
DRY SYSTEM	25 kg
PE-bag	25 kg

UV 310 P

aluminate-basic type

Classifications

EN ISO 14174
S A AB 1 55 AC H5

Characteristics and typical fields of application

UV 310 P is an agglomerated aluminate-basic flux for submerged arc welding of unalloyed and low alloyed steel grades. The basic flux has a neutral metallurgical behaviour regarding to Mn and Si and is suitable for sour service applications. The flux has been optimised for the manufacture of pipes using the two-run technique and has a high current carrying capacity. Suitable for longitudinal pipe welding and spiral pipe welding with single wire, and especially multi-wire applications with 2-5 wires (DC+ / AC). Nice flat bead appearance with very good slag detachability.

The flux generates a very low amount of diffusible hydrogen content HD < 4 ml/100gr acc to ISO 3690 in the weld metal. During welding activities the flux shows a very low tendency concerning moisture pick-up and consequently a rapid increase of diffusible hydrogen in the weld metal is avoided.

The slag composition of UV 310 P has been adapted to reduce possible negative effects of the eventual presence of copper particles.

UV 310 P has been designed to achieve best CTOD- and charpy toughness properties in two-run applications with wires like Union S 3 MoTiB, Union S 3 TiB (and Union S 2 Mo). Depending on wire selection and welding conditions the flux can be used for pipe steel grades acc. to API: Grade X 42 to X 80.

Flux properties

Polarity	DC / AC
Basicity index (Boniszewski)	1.5
Grain size (EN ISO 14174)	3 – 20 (0.3 – 2.0 mm)
Apparent density	1.15-1.30 kg/dm³
Flux consumption	0.9 - 1.1 kg flux per kg wire
Redrying	300 – 350°C. min 2 hrs ; max 3 cycles
Diffusible hydrogen (ISO 3690)	≤ 4 ml / 100gr (as produced / re-dried).
Moisture content (AWS A4.4M: 2001; 1050 °C)	≤ 0.05 % (as produced / re-dried).

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
wt. %	18 %	25 %	35 %	17 %

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Union S 2	14171-A	S2		
Union S 2 Si	14171-A	S2Si	A5.17 / -5.17	EM12K
Union S 3 Si	14171-A	S3Si	A5.17 / -5.17	EH12K
Union S 3 TiB	14171-A	SZ	A5.23 / -5.23	EG
Union S 2 Mo	14171-A	S2Mo	A5.23 / -5.23	EA2
Union S 4 Mo	14171-A	S4Mo	A5.23 / -5.23	EA3
Union S 3 MoTiB	14171-A	S2MoTiB	A5.23 / -5.23	EA2TiB

Packaging

Type	Weight
BIGBAG DRY SYSTEM	500kg / 1000 kg
DRY SYSTEM	25 kg
PE-bag	25 kg

UV 400

aluminate-basic type

Classifications

EN ISO 14174
S A AB 1 67 AC H5

Characteristics and typical fields of application

UV 400 is an agglomerated flux of aluminate basic type designed for joining and surfacing applications 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.

This flux has also been available on the market as "BÖHLER BB 400".

Flux properties

Polarity	DC / AC
Basicity index (Boniszewski)	2.0
Grain size (EN ISO 14174)	3 – 20 (0.3 – 2.0 mm)
Flux consumption	1.0 kg flux per kg wire
Redrying	300 – 350 °C. 2 hrs min.
Diffusible hydrogen (ISO 3690)	≤ 5 ml / 100gr (as produced / re-dried)

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
wt. %	20	30	26	16

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Union S 2	14171-A	S2		
Union S 2 Si	14171-A	S2Si	A5.17 / -5.17	EM12K
Union S 2 Mo	14171-A	S2Mo	A5.23 / -5.23	EA2
BÖHLER SUBARC TNiCu1	14171-A	T2Ni1Cu	A5.23 / -5.23	ECG

Packaging

Type	Weight
DRY SYSTEM	25 kg
PE-bag	25 kg

UV 418 TT

fluoride-basic type

Classifications

EN ISO 14174
S A FB 1 55 AC H5

Characteristics and typical fields of application

UV 418 TT is an agglomerated fluoride basic flux for submerged arc welding of a very wide scope of unalloyed and low alloyed steel grades. It has a high basicity and neutral metallurgical behaviour and is designed for medium and high strength fine grained structural steels.

Delivers very good toughness properties at -60ºC and CTOD values at -30ºC in as welded and PWHT-condition.

The flux has, due to its great current carrying capacity, also a great capability for 2 run procedures with unalloyed and low alloyed wire grades (e.g. Union S 2 Mo and Union S 3 MoTiB), with very good toughness properties. In general the flux gives a very nice bead appearance with very good slag release, even in narrow gap preparations.

Flux properties

Polarity	DC / AC
Basicity index (Boniszewski)	2.7
Grain size (EN ISO 14174)	3 – 20 (0.3 – 2.0 mm)
Flux consumption	1.0 kg flux per kg wire
Redrying	300 – 350 °C. 2 hrs min.
Diffusible hydrogen (ISO 3690)	≤ 5 ml / 100gr (as produced / re-dried)

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2	CaF_2+CaO+MgO
wt. %	15	38	20	25	-

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Union S 2	14171-A	S2		
Union S 2 Si	14171-A	S2Si	A5.17 / -5.17	EM12K
Union S 3 Si	14171-A	S3Si	A5.17 / -5.17	EH12K
Union S 2 Mo	14171-A	S2Mo	A5.23 / -5.23	EA2
Union S 3 Mo	14171-A	S3Mo	A5.23 / -5.23	EA4
Union S 3 Mo	24598-A	S S MnMo	A5.23 / -5.23	EA4
Union S 4 Mo	14171-A	S4Mo	A5.23 / -5.23	EA3
Union S 2 Ni 2,5	14171-A	S2Ni2	A5.23 / -5.23	ENi2
Union S 2 Ni 3,5	14171-A	S2Ni3	A5.23 / -5.23	ENi3
Union S 2 NiMo 1	14171-A	SZ2Ni1Mo	A5.23 / -5.23	ENi1
Union S 3 NiMo 1	26304-A	S3Ni1Mo	A5.23 / -5.23	EF3
Union S 3 NiMo	14171-A	S3Ni1,5Mo	A5.23 / -5.23	EG

Packaging

Type	Weight
BIGBAG DRY SYSTEM	500 kg / 1000 kg
DRY SYSTEM	25 kg
Metal bucket	30 kg
PE-bag	25 kg

UV 421 TT

fluoride-basic type

Classifications

EN ISO 14174
S A FB 1 55 AC H5

Characteristics and typical fields of application

UV 421 TT is an agglomerated fluoride basic flux for submerged arc welding of unalloyed and low alloyed steel grades. It has a high basicity and neutral metallurgical behaviour and is designed for medium and high strength fine grained structural steels.

This flux finds its main application in welding shops as the multi-purpose flux to cover the widest range of applications in as welded and PWHT applications. It can be combined with many wire-grades types (solid and cored), supported by the widest collection of approvals.

Suited for very good toughness properties and CTOD values in as welded condition and PWHT-condition. In general the flux gives a very nice bead appearance with very good slag release, even in narrow weld preparations.

Flux properties

Polarity	DC / AC
Basicity index (Boniszewski)	2.7
Grain size (EN ISO 14174)	3 – 20 (0.3 – 2.0 mm)
Apparent density	1 kg/dm³
Flux consumption	1.0 kg flux per kg wire
Redrying	300 – 350 °C. 2 hrs min.
Diffusible hydrogen (ISO 3690)	≤ 5 ml / 100gr (as produced / re-dried)

Composition of sub-arc welding flux

	SiO_2+TiO_2	$CaO+MgO$	Al_2O_3+MnO	CaF_2
wt. %	15	38	20	25

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Union S 2	14171-A	S2		
Union S 2 Si	14171-A	S2Si	A5.17 / -5.17	EM12K
Union S 3 Si	14171-A	S3Si	A5.17 / -5.17	EH12K
BÖHLER SUBARC T55 HP	14171-A	T3	A5.17 / -5.17	EC1
Union S 2 Mo	14171-A	S2Mo	A5.23 / -5.23	EA2
Union S 3 Mo	14171-A	S3Mo	A5.23 / -5.23	EA4
Union S 3 Mo	24598-A	S S MnMo	A5.23 / -5.23	EA4
Union S 4 Mo	14171-A	S4Mo	A5.23 / -5.23	EA3
Union S 2 Ni 2,5	14171-A	S2Ni2	A5.23 / -5.23	ENi2
Union S 2 Ni 3,5	14171-A	S2Ni3	A5.23 / -5.23	ENi3
BÖHLER SUBARC TNiCu1	14171-A	T2Ni1Cu	A5.23 / -5.23	ECG
Union S 2 NiMo 1	14171-A	SZ2Ni1Mo	A5.23 / -5.23	ENi1
BÖHLER SUBARC T60	14171-A	TZ3Ni1	A5.23 / -5.23	ECNi1
Union S 3 NiMo 1	26304-A	S3Ni1Mo	A5.23 / -5.23	EF3
Union S 3 NiMo	14171-A	S3Ni1,5Mo	A5.23 / -5.23	EG
Union S 3 NiMoCr	26304-A	SZ3Ni2,5CrMo	A5.23 / -5.23	EG

Packaging

Type	Weight
DRY SYSTEM	25 kg
Metal bucket	30 kg
PE-bag	25 kg

UV 419 TT-W

fluoride-basic type

Classifications

EN ISO 14174	EN ISO 14174
S A FB 1 55 AC	S A FB 1 55 DC H5

Characteristics and typical fields of application

UV 419 TT-W is an agglomerated fluoride-basic flux for submerged arc welding of unalloyed and low alloyed steel grades. The basic flux has a neutral metallurgical behaviour regarding to Mn and Si, and is mainly recommended for multi-run procedures for relative great wall thickness. Nice flat bead appearance with very good slag detachability, especially in narrow gap applications.

Metallurgically, the flux has been optimised to provide excellent mechanical properties as well after PWHT-duration as also in as welded condition.

The flux generates a low amount of diffusible hydrogen content HD < 5 ml/100gr according to ISO 3690 in the weld metal.

Flux properties

Polarity	DC / AC
Basicity index (Boniszewski)	2.6
Grain size (EN ISO 14174)	3-20 (0.3 bis 2.0 mm)
Apparent density	1 kg/dm³
Flux consumption	0.9 - 1.1 kg flux per kg wire
Redrying	300 – 350°C. min 2 hrs
Diffusible hydrogen (ISO 3690)	≤ 5 ml / 100gr (as produced / re-dried. DC+)

Composition of sub-arc welding flux

	SiO_2+TiO_2	$CaO+MgO$	Al_2O_3+MnO	CaF_2
wt. %	15 %	35 %	21 %	26 %

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Union S 3 Si	14171-A	S3Si	A5.17 / -5.17	EH12K
BÖHLER SUBARC T55 HP	14171-A	T3	A5.17 / -5.17	EC1
Union S 2 Mo	14171-A	S2Mo	A5.23 / -5.23	EA2
Union S 3 MoTiB	14171-A	S2MoTiB	A5.23 / -5.23	EA2TiB
Union S 2 CrMo	24598-A	S S CrMo1	A5.23 / -5.23	EB2R
BÖHLER SUBARC T60	14171-A	TZ3Ni1	A5.23 / -5.23	ECNi1
Union S 2 NiMo 1	14171-A	SZ2Ni1Mo	A5.23 / -5.23	ENi1
Union S 3 NiMo 1	26304-A	S3Ni1Mo	A5.23 / -5.23	EF3

Packaging

Type	Weight
DRY SYSTEM	25 kg

UV 422 TT-LH

fluoride-basic type

Classifications

EN ISO 14174	EN ISO 14174
S A FB 1 65 AC H5	S A FB 1 65 DC H4

Characteristics and typical fields of application

UV 422 TT-LH is an agglomerated fluoride-basic flux for submerged arc welding of non-alloyed and low alloyed steel grades. The flux has good welding behaviour and can be used in single and multi- wire applications with solid and flux-cored SA-wires. Nice flat bead appearance with very good slag detachability.

The flux has been optimised for the highest strength levels (700 till 1100 MPa) with high toughness requirements. The flux generates a very low amount of diffusible hydrogen content HD < 4ml/100gr acc to ISO 3690 in the weld metal. Also during welding activities the flux shows a very low tendency concerning moisture pick-up and consequently a rapid increase of diffusible hydrogen in the weld metal is avoided.

Applications in high tensile strength constructions (S460-S1100) in off-shore industry and heavy lifting equipment and hydro-power.

Flux properties

Polarity	DC / AC
Basicity index (Boniszewski)	2.5
Grain size (EN ISO 14174)	3-20 (0.3 bis 2.0 mm)
Flux consumption	0.9 - 1.1 kg flux per kg wire
Redrying	300 – 350°C. min 2 hrs
Diffusible hydrogen (ISO 3690)	≤ 4 ml / 100gr (as produced / re-dried. DC+)
Moisture content (AWS A4.4M: 2001; 1050 °C)	≤ 0.1 % (as produced / re-dried)

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
wt. %	18 %	42 %	19 %	19 %

Typical wires to combine

Name	**EN ISO**	**Class**	**AWS / SFA**	**Class**
Union S 3 Si	14171-A	S3Si	A5.17 / -5.17	EH12K
BÖHLER SUBARC T55 HP	14171-A	T3	A5.17 / -5.17	EC1
Union S 3 NiMo 1	26304-A	S3Ni1Mo	A5.23 / -5.23	EF3
BÖHLER NiCrMo 1-UP	26304-A	SZ2Ni0,9MoCr	A5.23 / -5.23	EG
Union S 3 NiMoCr	26304-A	SZ3Ni2,5CrMo	A5.23 / -5.23	EG
BÖHLER Subarc S 700 HP	26304-A	TZ	A5.23 / -5.23	ECF5
BÖHLER SUBARC T85	26304-A	TZ	A5.23 / -5.23	ECF5
BÖHLER Subarc S 900 HP	26304-A	TZ	A5.23 / -5.23	ECG

Packaging

Type	**Weight**
DRY SYSTEM	25 kg
Metal bucket	30 kg

UV 420 TT-LH

fluoride-basic type

Classifications

EN ISO 14174
S A FB 1 65 DC H5

Characteristics and typical fields of application

UV 420 TT-LH is an agglomerated flux of fluoride basic type characterised by the neutral metallurgical behaviour. In combination with suitable wire electrodes, the weld metal exhibits good toughness properties at low temperatures. For joining and surfacing applications with general purpose structural steels, fine grained structural steels and creep resistant steels. It is suited for single wire and tandem welding.

This flux has also been available on the market as "BÖHLER BB 24".

Flux properties

Polarity	DC
Basicity index (Boniszewski)	2.5
Grain size (EN ISO 14174)	3 – 25 (0.3 – 2.5 mm)
Flux consumption	1.0 kg flux per kg wire
Redrying	300 – 350 °C. 2 hrs min.
Diffusible hydrogen (ISO 3690)	≤ 5 ml / 100gr (as produced / re-dried)

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
wt. %	15	35	21	28

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Union S 2	14171-A	S2		
Union S 3	14171-A	S3	A5.17 / -5.17	EH10
Union S 2 Mo	14171-A	S2Mo	A5.23 / -5.23	EA2
Union S 3 Mo	14171-A	S3Mo	A5.23 / -5.23	EA4
Union S 3 Mo	24598-A	S S MnMo	A5.23 / -5.23	EA4
Union S 4 Mo	14171-A	S4Mo	A5.23 / -5.23	EA3
Union S 2 Ni 2,5	14171-A	S2Ni2	A5.23 / -5.23	ENi2
Union S 3 NiMo 1	26304-A	S3Ni1Mo	A5.23 / -5.23	EF3
Union S 3 NiMo	14171-A	S3Ni1,5Mo	A5.23 / -5.23	EG
Union S 2 CrMo	24598-A	S S CrMo1	A5.23 / -5.23	EB2R
Union S 1 CrMo 2	24598-A	S S CrMo2	A5.23 / -5.23	EB3R
Union S 1 CrMo 5	24598-A	S S CrMo5	A5.23 / -5.23	EB6
Thermanit MTS 4	24598-A	S S CrMoWV12	A5.23 / -5.23	EG

Packaging

Type	Weight
DRY SYSTEM	25 kg
PE-bag	25 kg

SAW

UV 420 TT

fluoride-basic type

Classifications

EN ISO 14174
S A FB 1 65 DC

Characteristics and typical fields of application

UV 420 TT is an agglomerated flux of fluoride basic type characterised by the neutral metallurgical behaviour. In combination with suitable wire electrodes, the weld metal exhibits good toughness properties at low temperatures. For joining and surfacing applications with general purpose structural steels, fine grained structural steels and creep resistant steels. It is suited for single wire and tandem welding.

Flux properties

Polarity	DC
Basicity index (Boniszewski)	2.5
Grain size (EN ISO 14174)	Standard 3 – 20 (0.3 – 2.0 mm) ; on request 3 – 25 (0.3 – 2.5 mm)
Flux consumption	1.0 kg flux per kg wire
Redrying	300 – 350 °C. 2 hrs min.

Composition of sub-arc welding flux

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

Typical wires to combine

Name	**EN ISO**	**Class**	**AWS / SFA**	**Class**
Union S 2	14171-A	S2		
Union S 3	14171-A	S3	A5.17 / -5.17	EH10
Union S 2 Mo	14171-A	S2Mo	A5.23 / -5.23	EA2
Union S 3 Mo	14171-A	S3Mo	A5.23 / -5.23	EA4
Union S 3 Mo	24598-A	S S MnMo	A5.23 / -5.23	EA4
Union S 4 Mo	14171-A	S4Mo	A5.23 / -5.23	EA3
Union S 2 Ni 2,5	14171-A	S2Ni2	A5.23 / -5.23	ENi2
Union S 3 NiMo 1	26304-A	S3Ni1Mo	A5.23 / -5.23	EF3
Union S 3 NiMo	14171-A	S3Ni1,5Mo	A5.23 / -5.23	EG
Union S 2 CrMo	24598-A	S S CrMo1	A5.23 / -5.23	EB2R
Union S 1 CrMo 2	24598-A	S S CrMo2	A5.23 / -5.23	EB3R
Union S 1 CrMo 5	24598-A	S S CrMo5	A5.23 / -5.23	EB6
Thermanit MTS 4	24598-A	S S CrMoWV12	A5.23 / -5.23	EG

Packaging

Type	**Weight**
Metal bucket	30 kg
PE-bag	25 kg

UV 420 TTR

fluoride-basic type

Classifications

EN ISO 14174
S A FB 1 65 DC

Characteristics and typical fields of application

UV 420 TTR is an agglomerated fluoride-basic flux for Submerged Arc Welding of un- and low-alloyed steel grades. It is characterized by its neutral metallurgical behaviour and has been designed mainly for multi-pass welding. Very good slag detachability in narrow gap weld preparations.

UV 420 TTR has been optimised for welding operations in combination with wire electrodes Union S 1 CrMo 2 and Union S 2 CrMo to maintain high strength levels after long PWHT-durations with good toughness. The pick-up of Phosphorus is limited to +0.004 % and makes the flux suited for step-cooling requirements.

Flux properties

Polarity	DC
Basicity index (Boniszewski)	2.9
Grain size (EN ISO 14174)	3 – 20 (0.3 – 2.0 mm)
Apparent density	1.0 kg/dm³
Flux consumption	0.9 - 1.1 kg flux per kg wire
Redrying	300 – 350 °C. 2 hrs min.

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
wt. %	14	34	19	26

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Union S 3 Mo	14171-A	S3Mo	A5.23 / -5.23	EA4
Union S 3 Mo	24598-A	S S MnMo	A5.23 / -5.23	EA4
Union S 4 Mo	14171-A	S4Mo	A5.23 / -5.23	EA3
Union S 3 NiMo 1	26304-A	S3Ni1Mo	A5.23 / -5.23	EF3
Union S 3 NiMo	14171-A	S3Ni1,5Mo	A5.23 / -5.23	EG
Union S 2 CrMo	24598-A	S S CrMo1	A5.23 / -5.23	EB2R
Union S 1 CrMo 2	24598-A	S S CrMo2	A5.23 / -5.23	EB3R
Union S 1 CrMo 5	24598-A	S S CrMo5	A5.23 / -5.23	EB6

Packaging

Type	Weight
DRY SYSTEM	25 kg
Metal bucket	30 kg

böhler welding by voestalpine

UV 420 TTR-W

fluoride-basic type

Classifications

EN ISO 14174
S A FB 1 65 AC

Characteristics and typical fields of application

UV 420 TTR-W is an agglomerated fluoride-basic flux for Submerged Arc Welding of un- and low-alloyed steel grades. It is characterized by its neutral metallurgical behaviour and has been designed mainly for multi-pass welding. During welding the flux shows very nice operative characteristics on both AC and DC+, and is suitable for Tandem process. Also very good slag detachability in narrow gap weld is especially recommended for welding operations with AC-polarity in combination with wire electrodes Union S 1 CrMo 2 and Union S 2 CrMo, to maintain highest strength levels after long PWHT-durations and meet the most stringent toughness requirements at sub-zero temperatures even after step-cooling treatment. The pick-up of Phosphorus is limited to +0.004 %.

UV 420 TTR-W is particularly suitable for welding hydrocrackers with Union S 1 CrMo 2 on AC-polarity for the highest mechanical properties, however the flux can also be applied in DC+ polarity, and also with other wires grades.

Flux properties

Polarity	DC / AC
Basicity index (Boniszewski)	2.6
Grain size (EN ISO 14174)	3 – 20 (0.3 – 2.0 mm)
Apparent density	1.0 kg/dm³
Flux consumption	0.9 - 1.1 kg flux per kg wire
Redrying	300 – 350 °C. 2 hrs min.

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
wt. %	14	34	22	27

Typical wires to combine

Name	**EN ISO**	**Class**	**AWS / SFA**	**Class**
Union S 2 CrMo	24598-A	S S CrMo1	A5.23 / -5.23	EB2R
Union S 1 CrMo 2	24598-A	S S CrMo2	A5.23 / -5.23	EB3R

Packaging

Type	**Weight**
PE-bag	25 kg
DRY SYSTEM	25 kg
Metal bucket	30 kg

UV 420 TTR-C

fluoride-basic type

Classifications

EN ISO 14174
S A FB 1 65 DC

Characteristics and typical fields of application

UV 420 TTR-C is an agglomerated fluoride-basic welding flux with high basicity. It is characterized by its neutral metallurgical behaviour and has been designed mainly for multi-pass welding.

UV 420 TTR-C is applied in high strength and creep resistant applications that need PWHT at relative high temperatures (e.g. 632 – 660ºC) for long duration (e.g. 6-26 hrs). Also suited for for weldments that will be exposed to a normalising heat treatment (N+A / Q +A).

The flux has Carbon support as special feature. Depending on the Carbon content in the wire, it results in either a reduced loss or a small increase of Carbon. Compared to UV 420 TTR the Carbon content in the weld metal is about 0.02 – 0.04% higher.

Flux properties

Polarity	DC
Basicity index (Boniszewski)	2.6
Grain size (EN ISO 14174)	3 – 20 (0.3 – 2.0 mm)
Apparent density	1.0 kg/dm³
Flux consumption	0.9 - 1.1 kg flux per kg wire
Redrying	300 – 350°C. min 2 hrs

Composition of sub-arc welding flux

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

Typical wires to combine

Name	**EN ISO**	**Class**	**AWS / SFA**	**Class**
Union S 2 NiMo 1	14171-A	SZ2Ni1Mo	A5.23 / -5.23	ENi1
Union S 3 NiMo 1	26304-A	S3Ni1Mo	A5.23 / -5.23	EF3
Union S Ni1MoCr	26304-A	SZ3Ni0,9MoCr	A5.23 / -5.23	EG
Union S 2 CrMo	24598-A	S S CrMo1	A5.23 / -5.23	EB2R
Union S 1 CrMo 2	24598-A	S S CrMo2	A5.23 / -5.23	EB3R

Packaging

Type	**Weight**
PE-bag	25 kg
DRY SYSTEM	25 kg
Metal bucket	30 kg

SAW

böhler welding by voestalpine

UV 430 TTR-W

fluoride-basic type

Classifications

EN ISO 14174
S A FB 1 55 AC

Characteristics and typical fields of application

UV 430 TTR-W is a basic agglomerated welding flux with high basicity, for welding high temperature creep resistant steel grade 2,25%Cr – 1%Mo – 0,25%V.

It is characterised by its neutral metallurgical behaviour and is optimised for AC current to give highest toughness at low/sub-zero temperatures, even after step-cooling heat treatment.

Also suitable to use in tandem configuration (AC/AC and DC+/AC).

Flux properties

Polarity	AC or AC/DC+ or AC/AC
Basicity index (Boniszewski)	2.6
Grain size (EN ISO 14174)	3 – 16 (0.3 – 1.6 mm)
Apparent density	1.0 kg/dm³
Redrying	300 – 350 °C / 2 hrs min.

Composition of sub-arc welding flux

	SiO_2+TiO_2	$CaO+MgO$	Al_2O_3+MnO	CaF_2
wt. %	15	35	21	26

Typical wires to combine

Name	**EN ISO**	**Class**	**AWS / SFA**	**Class**
Union S 1 CrMo 2 V	24598-A	S S ZCrMoV2	A5.23 / -5.23	EG

Packaging

Type	**Weight**
DRY SYSTEM	25 kg

Marathon 543

fluoride-basic type

Classifications

EN ISO 14174
S A FB 1 55 DC H5

Characteristics and typical fields of application

Marathon 543 is an agglomerated fluoride-basic special welding flux with high basicity suitable for multi-run welding high creep resistant 9%Cr-steels like grade P91/T91, 1.4903 - X10CrMoVNb9-1, grade P92/T92, NF616 and 1.4905 - X11CrMoWVNb9-1-1.

The metallurgical behaviour concerning Si and Mn is neutral. The flux produces well contoured and smooth welding beads with good slag release as well as appropriate weld metal ductility and impact behaviour after tempering. Marathon 543 is a hydrogen-controlled welding flux with hydrogen contents of maximum 5 ml / 100 gr weld deposit.

This flux has also been available on the market as "BÖHLER BB 910".

Flux properties

Polarity	DC
Basicity index (Boniszewski)	2.9
Grain size (EN ISO 14174)	3-20 (0.3–2.0 mm)
Apparent density	1.0 kg/dm³
Redrying	300 – 350 °C / 2 hrs min.

SAW

Composition of sub-arc welding flux

	SiO2+Al2O3	CaF_2+CaO+MgO
wt. %	35	60

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Union S 1 CrMo 5	24598-A	S S CrMo5	A5.23 / -5.23	EB6
BÖHLER CM 9-UP	24598-A	S S CrMo9	A5.23 / -5.23	EB8
Thermanit MTS 3	24598-A	S S CrMo91	A5.23 / -5.23	EB91
Thermanit MTS 3 LNI	24598-A	S S ZCrMo91	A5.23 / -5.23	EB91
Thermanit MTS 616	24598-A	S S ZCrMoWVNb 9 0,5 1,5	A5.23 / -5.23	EG (EB91(mod.))
Thermanit MTS 911	24598-A	S S ZCrMoWVNb 9 1 1	A5.23 / -5.23	EG (EB91(mod.))
Thermanit MTS 4	24598-A	S S CrMoWV12	A5.23 / -5.23	EG

Packaging

Type	Weight
Metal bucket	30 kg
DRY SYSTEM	25 kg

Welding consumables for martensitic stainless steels

◆ Content

Stick electrodes

Product name	C	Si	Mn	Cr	Ni	Mo	Nb	Cu
BÖHLER FOX CN 13/4	0.04	0.30	0.50	12.20	4.50	0.50		
BÖHLER FOX CN 13/4 SUPRA	0.03	0.30	0.60	12.20	4.50	0.50		
BÖHLER FOX CN 16/6 M-HD	0.03	0.30	0.60	15.50	5.80	1.20		
BÖHLER FOX CN 17/4 PH	0.03	0.30	0.60	16.00	5.10	0.40	0.20	3.20

GTAW rods

Product name	C	Si	Mn	Cr	Ni	Mo
BÖHLER CN 13/4-IG	0.01	0.70	0.70	12.30	4.70	0.50

Solid wires

Product name	C	Si	Mn	Cr	Ni	Mo
BÖHLER KW 10-IG	0.06	0.07	0.60	13.60		
BÖHLER CN 13/4-IG	0.01	0.65	0.70	12.20	4.80	0.50

SAW wire/flux combinations

Product name	C	Si	Mn	Cr	Ni	Mo
BÖHLER CN 13/4-UP - BÖHLER BB 203	0.01	0.80	0.70	12.00	4.70	0.50
Avesta 248 SV - Avesta Flux 805	0.02	0.60	1.00	16.50	5.00	1.00

Flux-cored and metal-cored wire

Product name	C	Si	Mn	Cr	Ni	Mo
BÖHLER CN 13/4 PW-FD	0.03	0.70	0.90	12.00	5.00	0.50
BÖHLER CN 13/4-MC	0.02	0.70	0.90	12.00	4.60	0.60
BÖHLER CN 13/4-MC (F)	0.02	0.70	0.90	12.20	4.60	0.60
BÖHLER CN 13/4-MC HI	0.01	0.30	0.60	12.00	4.70	0.50

BÖHLER FOX CN 13/4

Stick electrode, high-alloyed, soft-martensitic stainless

Classifications

EN ISO 3581-A	**AWS A5.4 / SFA-5.4**
E 13 4 B 6 2	E410NiMo-15

Characteristics and typical fields of application

Basic coated low-hydrogen electrode of E 13 4 B / E410NiMo-15 type for welding soft-martensitic and martensitic-ferritic rolled, forged, and cast steels. Mainly used in the construction of hydro turbines and compressors. Corrosion resistance similar to matching 13Cr(Ni)-steels. Thanks to an optimum balance of alloying components, the weld deposit yields very good ductility and toughness and cracking resistance despite of its high strength. Excellent operating characteristics with easy slag removal, smooth bead appearance and low hydrogen weld metal (HD < 5 ml/100 g). The Ø 2.5 and 3.2 mm electrodes can be used for welding in all positions apart from vertical down. Higher recovery rate and better restriking properties than BÖHLER FOX CN 13/4 SUPRA.

Base materials

1.4313 X3CrNiMo13-4, 1.4317 GX4CrNi13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4

ACI Grade CA 6 NM

UNS S41500, J91540

Typical analysis of all-weld metal

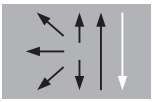
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.035	0.3	0.5	12.2	4.5	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–20°C	–60°C	Hardness HV_{10}
u	890	1090	12	33			401
a	680 (≥ 500)	910 (≥ 760)	17 (≥ 15)	66	55	50	301
a1	670 (≥ 500)	850 (≥ 760)	18 (≥ 15)	95			

u untreated, as-welded
a annealed, 600°C for 2 h / cooling in air
a1 quenched + tempered, 950°C for 0.5 h / cooling in air + 600°C for 2 h / cooling in air

Operating data



Polarity DC+

Electrode identification FOX CN 13/4 410NiMo-15 E 13 4 B

Dimension mm	Current A
2.5 × 350	60 – 90
3.2 × 450	90 – 130
4.0 × 450	120 – 170
5.0 × 450	160 – 220

Preheating and interpass temperatures of heavy-wall components 100 – 130ºC.
Maximum heat input 1.5 kJ/mm. Post-weld heat treatment at 580 – 620ºC.
Re-drying at 300 – 350ºC for min. 2 h if necessary.
Metal recovery approximately 130%.

Approvals

TÜV (03232), CE

SMAW

BÖHLER FOX CN 13/4 SUPRA

Stick electrode, high-alloyed, soft-martensitic stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 13 4 B 4 2	E410NiMo-15

Characteristics and typical fields of application

Basic coated, cored wire alloyed low-hydrogen electrode of E 13 4 B / E410NiMo-15 type for welding soft-martensitic and martensitic-ferritic rolled, forged, and cast steels. Mainly used in the construction of hydro turbines and compressors. Corrosion resistance similar to matching 13Cr(Ni)-steels. Thanks to an optimum balance of alloying components the weld deposit yields very good ductility and toughness and cracking resistance despite of its high strength. Excellent slag removability, smooth bead appearance and low hydrogen weld metal (HD < 5 ml/100 g).

Base materials

1.4313 X3CrNiMo13-4, 1.4317 GX4CrNi13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4

ACI Grade CA 6 NM UNS S41500

Typical analysis of all-weld metal

	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.03	0.3	0.6	12.2	4.5	0.5

Mechanical properties of all-weld metal - typical values (min. values)

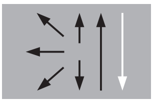
Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–20°C	–60°C	Hardness HV_{10}
u	800	950	16	35			370
a	680 (≥ 500)	910 (≥ 760)	18 (≥ 15)	70	60	55	270
a1	670 (≥ 500)	850 (≥ 760)	18 (≥ 15)	105			315

u untreated, as-welded

a annealed, 600°C for 2 h / cooling in air

a1 quenched + tempered, 950°C for 0.5 h / cooling in air + 600°C for 2 h / cooling in air

Operating data



Polarity DC+

Electrode identification FOX CN 13/4 SUPRA 410NiMo-15 E 13 4 B

Dimension mm	Current A
2.5 × 300	55 – 80
3.2 × 350	90 – 110
4.0 × 350/450	120 – 145
5.0 × 350/450	140 – 200

Preheating and interpass temperatures of heavy-wall components 100 – 130ºC.

Maximum heat input 1.5 kJ/mm.

Re-drying at 300 – 350ºC for min. 2 h if necessary.

Post-weld heat treatment at 580 – 620ºC. Metal recovery approximately 103%.

Approvals

TÜV (09081), CE

BÖHLER FOX CN 16/6 M-HD

Stick electrode, high-alloyed, soft-martensitic stainless

SMAW

Classifications

EN ISO 3581-A
E Z 16 6 Mo B 6 2 H5

Characteristics and typical fields of application

Basic coated high efficiency electrode of E Z 16 6 Mo B type for welding of soft-martensitic forged and cast steels. The high chromium content enhances the corrosion resistance in water, steam and seawater atmosphere. Main applications are found in turbines, pumps and compressor parts. Popular in hydro turbine engineering.

The electrode shows very good features in regard to arc stability, weld puddle control, slag detachability and seam cleanliness. The Ø 2.5 and 3.2 mm electrodes can be used for welding in all positions apart from vertical down. Low hydrogen is an essential and necessary prerequisite of this product.

Base materials

Soft-martensitic forged steels and cast steels

1.4405 GX4CrNiMo16-5-1, 1.4313 X3CrNiMo13-4, 1.4317 GX4CrNi13-4, 1.4418 X4CrNiMo16-5-1

ACI Grade CA 6 NM / UNS J91540

248 SV

Typical analysis of all-weld metal

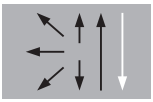
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.03	0.3	0.6	15.5	5.8	1.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–60°C	Hardness HV_{10}
u	520	1050	13	28	21	370
a	650	920	15	42	31	340
a1	640	920	16	48	30	330
a2	680	880	24	75	50	295

u untreated, as-welded
a annealed, 580°C for 4 h / cooling in air
a1 annealed, 590°C for 8 h / cooling in furnace down to 300°C then cooling in air
a2 solution annealed, 1030°C for 1 h / cooling in air + 590°C for 8 h / cooling in furnace down to 300°C then cooling in air

Operating data



Polarity DC+

Electrode identification FOX CN 16/6 M-HD EZ16 6 Mo B

Dimension mm	Current A
2.5 × 350	70 – 95
3.2 × 450	110 – 140
4.0 × 450	140 – 180
5.0 × 450	180 – 230

The interpass temperature should preferably be kept between 70ºC and 120ºC for joint welding. Low interpass temperature minimizes distortion and risk of cracks. Preheating normally not necessary. Post-weld heat treatment depends on the base material requirements. It is common to perform an annealing at 540 – 590ºC for 6 h / after the weld has cooled down to room temperature. To lower the hydrogen content, soaking can be performed at 250ºC for 2 h. This treatment should be started immediately after welding. A low cooling rate is necessary.

Re-drying at 300 – 350ºC for min. 2 h if necessary.

Metal recovery approximately 135%.

Approvals

TÜV (19071), CE

BÖHLER FOX CN 17/4 PH

Stick electrode, high-alloyed, precipitation hardening stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E Z 17 4 Cu B 4 3 H5	E630-15 (mod.)

Characteristics and typical fields of application

Basic coated electrode of E Z 17 4 Cu B / E630-15 (mod.) type with strength properties for joint and fabrication welding of similar precipitation hardening CrNiCu-alloyed rolled, forged and cast steels. Popular for components in the paper industry, rotors of compressors, fan blades, press plates in the plastic processing industry and for the aerospace industry. The electrode shows very good features in regard to arc stability and weld puddle control as well as slag detachability and seam cleanliness. Low hydrogen content in the deposit is a prerequisite (HD < 5 ml/100 g). Suitable for welding in all positions except vertical down. With the use of the proper PWHT (solution annealing + precipitation hardening impact values down to –50ºC are achievable.

Base materials

Precipitation hardening forged steels and cast steels

1.4405 GX4CrNiMo16-5-1, 1.4418 X4CrNiMo16-5-1, 1.4525 GX5CrNiCu16-4, 1.4532 X8CrNiMoAl15-7-2, 1.4540 X4CrNiCuNb16-4, 1.4542 X5CrNiCuNb16-4, 1.4548 X5CrNiCu17-4

UNS S15700, S15500, S17400, S17480; AISI 630, 632

17-4 PH, 248 SV, XM12

Typical analysis of all-weld metal

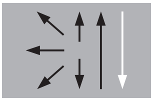
	C	Si	Mn	Cr	Ni	Mo	Nb	Cu
wt.-%	0.03	0.3	0.6	16.0	5.1	0.4	0.2	3.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–50°C	Hardness HRC
u						32 – 39
a1	940	1030	10	20		37 – 40
a2	830	1110	8	15		
a3	630	940	15	24 – 30		29 – 31
a4	920	1030	15	60 – 66		
a5	550	880	18	69 – 75	55	27 – 29

u untreated, as-welded
a 540°C for 3 h / cooling in air
a1 480°C for 1 h / cooling in air
a2 760°C for 2 h / cooling in air + 620°C for 4 h / cooling in air
a3 solution annealed 1040°C for 0.5 h / cooling in air + 580°C for 4 h / cooling in air
a4 solution annealed 1040°C for 0.5 h / cooling in air + 620°C for 4 h / cooling in air

Operating data



Polarity DC+

Electrode identification FOX CN 17/4 PH E Z 17 4 Cu B

Dimension mm	Current A
2.5 × 300	65 – 85
3.2 × 350	90 – 110
4.0 × 350	120 – 140
5.0 × 450	140 – 180

The interpass temperature has to be kept very low (max. 80ºC).
Re-drying at 300 – 350ºC for min. 2 h if necessary.

Approvals

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BÖHLER CN 13/4-IG

TIG rod, high-alloyed, soft-martensitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 13 4	ER410NiMo (mod.)

Characteristics and typical fields of application

TIG rod of W 13 4 / ER410NiMo (mod.) type. Low-carbon rod suited for soft-martensitic steels such as 1.4313 / UNS S41500. Corrosion resistance similar to matching 13Cr(Ni)-steels and cast steel grades. High resistance to corrosion fatigue. Designed with precisely tuned alloying composition creating a weld deposit featuring very good ductility and crack resistance despite high strength. Typical applications are within hydro and steam turbines.

Base materials

1.4313 X3CrNiMo13-4, 1.4317 GX4CrNi13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4

ACI Grade CA 6 NM UNS S41500, J91540

Typical analysis of the wire rod

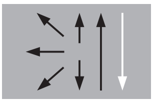
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.01	0.7	0.7	12.3	4.7	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	840	960	19	180
a	780	870	23	200

u untreated, as-welded – shielding gas Ar
a annealed, 600°C for 8 h / furnace down to 300°C followed by air cooling

Operating data



Rod marking W 13 4

Dimension mm	Current A	Voltage V
1.2 × 1000	60 – 80	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Maximum heat input 1.5 kJ/mm. Preheating and interpass temperatures in case of thick-walled sections 100 – 160°C.

Tempering at 580 – 620°C.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (04110), CE

BÖHLER KW 10-IG

Solid wire, high-alloyed, stainless

Classifications

EN ISO 14343-A	**AWS A5.9 / SFA-5.9**
G Z 13	ER410 (mod.)

Characteristics and typical fields of application

Solid wire of G Z 13 / ER410 (mod.) type for joining and surfacing applications with matching or similar 13Cr-steels and cast steel grades. Predominantly used for surfacing sealing faces of water, steam and gas valves and accessories made of unalloyed and low-alloy steels for service temperatures up to 450°C. The machinability of the weld metal depends largely on the kind of base metal and degree of dilution. Joint welding of similar 13Cr-steels shows matching color of the weld metal.

Base materials

Welding of corrosion resistant Cr-steels as well as other matching a C-content < 0.20% (repair welding).

Heat resistant Cr-steels of similar chemical composition.

1.4006 X12Cr13, 1.4021 X20Cr13

AISI 410, 420

Corrosion resistant weld surfacing of most weldable unalloyed and low-alloyed steels.

Typical analysis of the solid wire

	C	Si	Mn	Cr
wt.-%	0.06	0.07	0.6	13.6

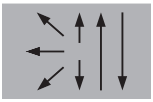
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Hardness HB
u				320
a	(≥ 450)	(≥ 650)	(≥ 15)	200

u untreated, as-welded – shielding gas Ar + 8% CO_2

a annealed – shielding gas Ar + 8% CO_2, 750°C for 2 h / cooling in furnace

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30
1.6 spray arc	250 – 330	27 – 32

Suggested preheating and interpass temperature 200 – 300°C. Post weld heat treatment at 700 – 750°C depending on base material and requirements.

The hardness of the deposit is increasing with the dilution with the base metal (depending on the relevant welding conditions) and by its chemical composition. Gas mixtures containing more CO_2 result in higher deposit hardness.

Shielding gas: Ar + 8 – 10% CO_2 or Ar + 2 – 3% CO_2 (M12) or Ar + 1 - 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

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BÖHLER CN 13/4-IG

Solid wire, high-alloyed, soft-martensitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 13 4	ER410NiMo (mod.)

Characteristics and typical fields of application

Solid wire of G 13 4 / ER410NiMo (mod.) type. Low-carbon wire suited for soft-martensitic steels such as 1.4313 / UNS S41500. Corrosion resistance similar to matching 13Cr(Ni)-steels and cast steel grades. High resistance to corrosion fatigue cracking. Designed with precisely tuned alloying composition creating a weld deposit featuring very good ductility and crack resistance despite high strength. For applications like hydro and steam turbines.

Base materials

1.4313 X3CrNiMo13-4, 1.4317 GX4CrNi13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4

ACI Grade CA 6 NM UNS S41500, J91540

Typical analysis of the solid wire

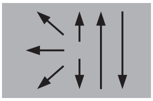
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.01	0.65	0.7	12.2	4.8	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–20°C
u	950 (≥ 750)	1210 (≥ 950)	12 (≥ 10)	36 (≥ 30)	
a	705 (≥ 680)	880 (≥ 800)	21 (≥ 15)	80 (≥ 50)	58

u untreated, as-welded – shielding gas Ar + 8% CO_2
a annealed – shielding gas Ar + 8% CO_2, 600°C for 8 h / cooling in furnace to 300°C followed by air cooling
a1 annealed – shielding gas Ar + 2.5% CO_2, 600°C for 8 h / cooling in furnace to 300°C followed by air cooling
Preheating to 100°C; interpass temperature 150°C

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30

Preheating and interpass temperatures of heavy-wall components 100 – 160°C.
Maximum heat input 1.5 kJ/mm. Post-weld heat treatment at 580 – 620°C.
Shielding gas: Ar + 2 – 3% CO_2 or Ar + 8 - 10% CO_2. Gas flow: 15 – 20 l/min.
Polarity: DC+

Approvals

CE

BÖHLER CN 13/4-UP - BÖHLER BB 203

SAW wire/flux combination, high-alloyed, soft-martensitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 13 4	ER410NiMo (mod.)	S A FB 2 DC

Characteristics and typical fields of application

BÖHLER CN 13/4-UP - BB 203 is a wire/flux combination for submerged arc welding of soft-martensitic steels such as 1.4313 / UNS S41500.

Solid wire of S 13 4 / ER410NiMo (mod.) type. Corrosion resistance similar to matching 13Cr(Ni)-steels and cast steel grades. High resistance to corrosion fatigue cracking. The weld deposit shows a relative high ductility and CVN toughness with high crack resistance. Especially suitable for applications in hydro and steam turbines.

BÖHLER BB 203 is a fluoride-basic, agglomerated flux providing good operating characteristics, smooth beads and a low hydrogen weld metal (HD < 5 ml/100 g). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4313 X3CrNiMo13-4, 1.4317 GX4CrNi13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4

ACI Grade CA 6 NM UNS S41500

Typical analysis of the weld metal

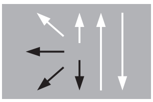
wt.-%	C	Si	Mn	Cr	Ni	Mo
wire	0.01	0.7	0.7	12.3	4.8	0.5
all-weld metal	0.01	0.8	0.7	12.0	4.7	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
a1	730 (≥ 650)	850 (≥ 750)	19 (≥15)	50 (≥27)
a2	785	845	22	80 (≥27)
u	880	1000	<10	27

a1 600°C for 8 h
a2 960°C for 1 h + 580°C for 8 h
u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33
3.0	320 – 450	29 – 33

Preheating and interpass temperatures of heavy-wall components 100 – 160ºC.

Maximum heat input 1.5 kJ/mm. Post-weld heat treatment (tempering) at 580 – 620ºC.

Polarity: DC+

Approvals

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Avesta 248 SV - Avesta Flux 805

SAW wire/flux combination, high-alloyed, soft-martensitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 16 5 1	EG	S A AF 2 DC

Characteristics and typical fields of application

Avesta 248 SV - Avesta Flux 805 is a wire/flux combination for submerged arc welding with an austenitic-ferritic-martensitic weld metal deposit.

Solid wire of S 16 5 1 type for welding and repair of propellers, pumps, valves and shafts in 248 SV / 420 and similar types of steels and castings where it provides a relative low crack sensitivity compared to many other martensitic weld metals. The properties of the weld are largely the same as those of the parent metal. The general and pitting corrosion resistance corresponds to that of the base material 1.4301 / 304.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4028 X30Cr13, 1.4405 GX4CrNiMo16-5-1, 1.4418 X4CrNiMo16-5-1

AISI 420

248 SV

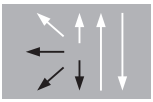
Typical analysis of the weld metal

wt.-%	C	Si	Mn	Cr	Ni	Mo
wire	0.02	0.35	1.3	16.0	5.5	1.0
all-weld metal	0.02	0.60	1.0	16.5	5.0	1.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Hardness
a1	550 (≥ 400)	880 (≥ 600)	16	40	260
a1 590°C for 4 h					

Operating data



Dimension mm	Current A	Voltage V
3.2	350-500	29-33

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC. Polarity: DC+

Preheating is normally not necessary, but when welding thick materials where high stresses can be expected, preheating to 75 – 100ºC is recommended.

To stabilize structure and reduce brittle martensite, post-weld heat treatment for 4 h at 590ºC, followed by air cooling is recommended.

Approvals

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BÖHLER CN 13/4 PW-FD

Flux-cored wire, high-alloyed, soft-martensitic stainless

Classifications

EN ISO 17633-A
T 13 4 P M21 (C1) 1 (H5)

AWS A5.22 / SFA-5.22
E410NiMoT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 13 4 P / E410NiMoT1 type for welding of 13Cr-4Ni soft-martensitic stainless steels such as 1.4313 / UNS S41500. Applications are for instance turbine components in the hydropower industry. Results in very low weld metal hydrogen content (HD of 1 – 3 ml/100 g) and high weld metal impact toughness after post-weld heat treatment. Fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion.

Base materials

1.4313 X3CrNiMo13-4, 1.4317 GX4CrNi13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4

ACI Grade CA 6 NM UNS S41500, J91540

Typical analysis of the wire

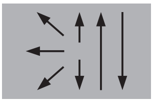
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.03	0.7	0.9	12.0	5.0	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–20°C	–50°C
u	800	1100	11	30	28	25
a	790 (≥ 500)	920 (≥ 760)	17 (≥ 15)	50	45	40
a1	760 (≥ 500)	900 (≥ 760)	16 (≥ 15)	45	40	35

u untreated, as-welded – shielding gas Ar + 18% CO_2
a annealed, 600°C for 2 h / cooling in air – shielding gas Ar + 18% CO_2
a1 annealed, 600°C for 2 h / cooling in air – shielding gas 100% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.6	~ 3	160 – 330	22 – 30	4 – 11

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can also be used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. Recommended stick out 18 – 20 mm, 100 – 150ºC preheating and 150ºC interpass temperature. The heat input should not exceed 1.5 kJ/mm. Annealing performed at 590 – 620ºC.

Approvals

TÜV (18993), CE

BÖHLER CN 13/4-MC

Metal-cored wire, high-alloyed, soft-martensitic stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 13 4 M M12 2	EC410NiMo (mod.)

Characteristics and typical fields of application

Metal-cored wire of T 13 4 M / EC410NiMo type for welding of 13Cr-4Ni soft martensitic stainless steels such as 1.4313 / UNS S41500. Applications are for instance turbine components in the hydropower industry. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. The wire shows good wetting behavior and results in a smooth surface. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. It is easy operate in all welding positions. Additionally, precise alloy adjustment ensures very good weld metal impact toughness after heat treatment. The diffusible hydrogen content is extra low with maximum 3 ml / 100 g to prevent cold cracking.

Base materials

1.4313 X3CrNiMo13-4, 1.4317 GX4CrNi13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4

ACI Grade CA 6 NM UNS S41500, J91540

Typical analysis of the wire

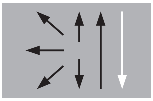
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.022	0.7	0.9	12.0	4.6	0.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	0°C	–20°C
a	760 (≥ 500)	900 (≥ 760)	16 (≥ 15)	65		60 (≥ 47)
a1	730	860	17	68		62 (≥ 47)
a2	635	850	23		80	

a annealed, 600°C for 2 h / furnace cooling to 300°C followed by air cooling – shielding gas Ar + 2.5% CO_2
a1 annealed, 580°C for 8 h / furnace cooling to 300°C followed by air cooling – shielding gas Ar + 2.5% CO_2
a2 annealed, 620°C for 6 h / furnace cooling to 300°C followed by air cooling – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	max. 3	100 – 280	10 – 27	3.5 – 13.0
1.6	max. 3	110 – 380	20 – 27	1.5 – 8.0

Welding with conventional or pulsed power sources using DC+ polarity, but pulsed arc may be advantageous and especially when welding out of position. Forehand (pushing) technique preferred with a work angle of appr. 80º. Ar + 2 – 3% CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min and the wire stick-out 15 – 20 mm. When welding out of position, the metal-cored wires are similar to solid wires and pulsed arc welding is recommended. Recommended preheating and interpass temperatures in case of heavy wall thickness are 100 – 160ºC. The heat input should not exceed 1.5 kJ/mm. Tempering performed at 590 – 620ºC.

Approvals

TÜV (12880), LR (M21, supplementary list), CE

BÖHLER CN 13/4-MC (F)

Metal-cored wire, high-alloyed, soft-martensitic stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 13 4 M M12 2	EC410NiMo (mod.)

Characteristics and typical fields of application

Metal-cored wire of T 13 4 M / EC410NiMo type for welding and repair welding of cast 13Cr-4Ni soft-martensitic stainless steels such as 1.4407. Applications are for instance turbine components in the hydropower industry. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. The wire shows good wetting behavior and results in a smooth surface. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. It is easy operate in all welding positions. Additionally, precise alloy adjustment ensures very good weld metal impact toughness after heat treatment. The diffusible hydrogen content is extra low with maximum 3 ml / 100 g to prevent cold cracking. Significant gains in productivity can be realized by higher deposition rates and reduced post weld grinding as compared to GMAW using solid wires.

Base materials

1.4313 X3CrNiMo13-4, 1.4317 GX4CrNi13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4

ACI Grade CA 6 NM UNS S41500, J91540

Typical analysis of the wire

	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.023	0.7	0.9	12.2	4.6	0.6

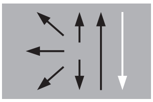
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–20°C
a	745 (≥ 500)	900 (≥ 760)	16 (≥ 15)	55 (≥ 50)	50 (≥ 47)
a1	715	840	18		50

a annealed/tempered, 600°C for 2 h / furnace cooling to 300°C followed by air cooling - shielding gas Ar + 2.5% CO_2

a1 annealed/tempered, 580°C for 12 h / furnace cooling to 300°C followed by air cooling - shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	Max. 3	100 – 280	10 – 27	3.5 – 13.0
1.6	Max. 3	110 – 380	20 – 27	1.5 – 8.0

Welding with conventional or pulsed power sources using DC+ polarity, but pulsed arc may be advantageous and especially when welding out of position. Forehand (pushing) technique preferred with a work angle of appr. 80º. Ar + 2 – 3% CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min and the wire stick-out 18 – 20 mm. When welding out of position, the metal-cored wires are similar to solid wires and pulsed arc welding is recommended. Recommended preheating and interpass temperatures in case of heavy wall thickness are 100 – 180ºC. The heat input should not exceed 1.5 kJ/mm. Tempering performed at 580 – 620ºC.

Approvals

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BÖHLER CN 13/4-MC HI

Metal-cored wire, high-alloyed, soft-martensitic stainless

Classifications

EN ISO 17633-A
T 13 4 M M12 2

AWS A5.22 / SFA-5.22
EC410NiMo (mod.)

Characteristics and typical fields of application

Metal-cored wire of T 13 4 M / EC410NiMo type for welding of 13Cr-4Ni soft-martensitic stainless steels such as 1.4313 / UNS S41500. Applications are for instance turbine components in the hydropower industry. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. The wire shows good wetting behavior and results in a smooth surface. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. It is easy operate in all welding positions. BÖHLER CN 13/4-MC HI offers extra high impact values for heat treated weld metal and a very low hydrogen content with maximum 4 ml / 100 g to prevent cold cracking.

Base materials

1.4313 X3CrNiMo13-4, 1.4317 GX4CrNi13-4, 1.4407 GX5CrNiMo13-4, 1.4414 GX4CrNiMo13-4

ACI Grade CA 6 NM UNS S41500, J91540

Typical analysis of the wire

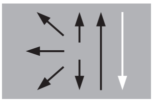
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.014	0.3	0.6	12.0	4.7	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	0°C	–20°C
u	800	950	11	50	45	45
a	685 (≥ 500)	770 (≥ 760)	21 (≥ 15)	90	85	75 (≥ 47)
a1	665 (≥ 500)	785 (≥ 760)	21 (≥ 15)	80	75	70 (≥ 47)

u untreated, as-welded – shielding gas Ar + 2.5% CO_2
a annealed, 580°C for 8 h / furnace cooling to 300°C followed by air cooling – shielding gas Ar + 2.5% CO_2
a1 annealed, 600°C for 2 h / furnace cooling to 300°C followed by air cooling – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	Max. 3	100 – 280	10 – 27	3.5 – 13.0

Welding with conventional or pulsed power sources using DC+ polarity, but pulsed arc may be advantageous and especially when welding out of position. Forehand (pushing) technique preferred with a work angle of appr. 80º. Ar + 2 – 3% CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min and the wire stick-out 15 – 20 mm. When welding out of position, the metal-cored wires are similar to solid wires and pulsed arc welding is recommended. Recommended preheating and interpass temperatures in case of heavy wall thickness are 100 – 160ºC. The heat input should not exceed 1.5 kJ/mm. Tempering performed at 580 – 620ºC.

Approvals

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MCW

Welding consumables for ferritic stainless steels

◆ Content

Stick electrodes

Product name	C	Si	Mn	Cr	Mo
BÖHLER FOX SKWA	0.08	0.40	0.30	17.00	
BÖHLER FOX SKWAM	0.22	0.30	0.40	17.00	1.30

Solid wires

Product name	C	Si	Mn	Cr	Ni	Mo	Nb	Ti
BÖHLER CAT 409 Cb-IG	≤ 0.05	0.60	0.60	11.50			≥ 10 × C	
BÖHLER CAT 430L Cb-IG	0.02	0.50	0.50	18.00			0.46 (≥ 12 × C)	
BÖHLER CAT 430L CbTi-IG	0.02	0.50	0.50	18.00			≥ 12xC	0.40
BÖHLER CAT 439L Ti-IG	0.02	0.80	0.80	18.00				0.35 (≥ 12 × C)
BÖHLER SKWA-IG	0.07	0.80	0.60	17.50				0.30
BÖHLER SKWAM-IG	0.20	0.65	0.55	17.00	0.40	1.10		

SAW wire/flux combinations

Product name	C	Si	Mn	Cr	Ni	Mo
BÖHLER SKWAM-UP - BÖHLER BB 203	0.15	0.70	0.55	17.00	0.40	1.10

Flux-cored and metal-cored wire

Product name	C	Si	Mn	Cr	Nb	Ti
BÖHLER CAT 430L Cb-MC	0.02	0.50	0.70	18.50	0.65	0.12
BÖHLER CAT 430L CbTi-MC	0.02	0.50	0.70	18.50	0.55	0.35
BÖHLER CAT 439L Ti-MC	0.02	0.50	0.70	18.50		0.85

BÖHLER FOX SKWA

Stick electrode, high-alloyed, ferritic stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 17 B 2 2	E430-15

Characteristics and typical fields of application

Basic coated, cored wire alloyed electrode of E 17 B / E430-15 type. Good welding characteristics in all positions except vertical-down. Mainly used for surfacing on sealing faces of gas, water and steam valves to meet stainless and wear resistant overlays. Be careful with dilution, at least two layers build up should remain after machining. Joint welding of similar, stainless and heat resistant chromium steels provides a very good ability to polishing. Hydrogen content in weld deposit < 5 ml/100 g. Scaling resistance up to 900°C.

Base materials

Surfacing can be performed on all weldable base materials, unalloyed and low-alloyed.

Welding of corrosion resistant chromium steels as well as other similar-alloyed steels with C-contents up to 0.20% (repair welding).

1.4001 X7Cr14, 1.4006 X12Cr13, 1.4057 X17CrNi16-2, 1.4000 X6Cr13, 1.4002 X6CrAl13, 1.4016 X6Cr17, 1.4059 X17CrNi16-2 1.4509 X2CrTiNb18, 1.4510 X3CrTi17, 1.4511 X3CrNb17, 1.4512 X2CrTi12, 1.4520 X2CrTi17, 1.4712 X10CrSi6, 1.4713 X10CrAlSi7 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18

AISI 403, 405, 409, 410, 429, 430, 430Cb, 430Ti, 439, 431, 442

UNS S40300, S40500, S40900, S41000, S42900, S43000, S43035, S43036, S43100, S44200

Typical analysis of all-weld metal

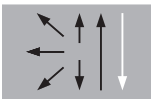
	C	Si	Mn	Cr
wt.-%	0.08	0.4	0.3	17.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Hardness HB
u				250
a	370 (≥ 300)	560 (≥ 450)	23 (≥ 15)	200

u untreated, as-welded
a annealed, 750°C for 2 h / cooling in furnace

Operating data



Polarity DC+

Electrode identification FOX SKWA 430-15 E 17 B

Dimension mm	Current A
2.5 × 300	60 – 80
3.2 × 350	80 – 110
4.0 × 350	110 – 140
5.0 × 450	140 – 180

The hardness of the deposit is greatly influenced by the degree of dilution with the base metal (depending on the relevant welding conditions) and by its chemical composition. As a general rule it can be observed that the higher the degree of dilution and the C-content of the base metal, the higher the deposit hardness.

Preheating and interpass temperature 200 – 300°C, post-weld heat treatment at 730 – 800°C.

Re-drying if necessary at 120 – 200°C for min. 2 h.

Approvals

KTA 1408.1 (08098.00), CE

SMAW

BÖHLER FOX SKWAM

Stick electrode, high-alloyed, ferritic stainless

Classifications

EN ISO 3581-A
E Z 17 Mo B 2 2

Characteristics and typical fields of application

Basic coated, cored wire alloyed electrode of E Z 17 Mo B type. Good welding characteristics in all positions except vertical-down. Mainly used for surfacing on sealing faces of gas, water and steam valves to meet stainless and wear resistant overlays. Be careful with dilution, at least two layers build up should remain after machining. Joint welding of similar, stainless and heat resistant chromium steels provides a very good ability to polishing. Hydrogen content in weld deposit < 5 ml/100 g. Weld metal retention of hardness up to 500ºC. Scaling resistant up to 900ºC.

Base materials

Surfacing can be performed on all weldable base materials, unalloyed and low-alloyed.

Welding of corrosion resistant chromium steels as well as other similar-alloyed steels with C-contents up to 0.20% (repair welding).

1.4122 X39CrMo17-1, 1.4113 X6CrMo17-1, 1.4513 X2CrMoTi17-1

UNS S S43400, 43600

AISI 440C, 434, 436

Typical analysis of all-weld metal

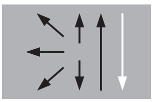
	C	Si	Mn	Cr	Mo
wt.-%	0.22	0.3	0.4	17.0	1.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Hardness HB
u	400
a	250

u untreated, as-welded
a annealed, 750°C for 2 h / cooling in furnace

Operating data



Polarity	DC+
Electrode identification	FOX SKWAM E Z 17 Mo B

Dimension mm	Current A
2.5 × 300	60 – 80
3.2 × 350	80 – 110
4.0 × 350	110 – 140
5.0 × 450	140 – 180

Preheating as required by the base metal, with temperatures between 100ºC and 200ºC being generally sufficient (for joint welding operations 250 – 400ºC). Annealing at 650 – 750ºC may be carried out to improve the toughness values in the weld metal and in the transition zone of the base metal. The hardness of the deposit is greatly influenced by the degree of dilution with the base metal (depending on the relevant welding conditions) and by its chemical composition. As a general rule it can be observed that the higher the degree of dilution and the C-content of the base metal, the higher the hardness of the deposit.

Re-drying if necessary at 120 – 200ºC for min. 2 h.

Approvals

KTA 1408.1 (08043.03), DB, CE

BÖHLER CAT 409 Cb-IG

Solid wire, high-alloyed, ferritic stainless, stabilized

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G Z 13 Nb L	ER409Nb

Characteristics and typical fields of application

Solid wire of Z 13 Nb L / 409Nb type especially for joint welding of exhaust systems. For matching or similar materials. Resistant to scaling up to 900ºC. Outstanding feeding characteristics and very good welding and flow characteristics.

Base materials

1.4006 X12Cr13, 1.4021 X20Cr13, 1.4024 X15Cr13, 1.4512 X2CrTi12 / X6CrTi12

AISI 409

Typical analysis of the solid wire

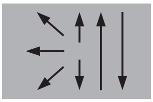
	C	Si	Mn	Cr	Nb
wt.-%	≤ 0.05	0.6	0.6	11.5	≥ 10 × C

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Hardness
u	~150
a	~130

u untreated, as-welded – shielding gas Ar + 2% CO_2
a annealed – shielding gas Ar + 2% CO_2, 750°C for 2 h

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30

Preheating 200 – 300ºC.

Post-weld heat treatment can be performed at 700 – 750ºC.

Shielding gas: Ar + 2 – 3% CO_2 (M12), Ar + 8 – 10% CO_2 oder 1 – 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

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BÖHLER CAT 430L Cb-IG

Solid wire, high-alloyed, ferritic stainless, stabilized

Classifications

EN ISO 14343-A	**AWS A5.9 / SFA-5.9**
G Z 18 L Nb	ER430 (mod.)

Characteristics and typical fields of application

Solid wire of G Z 18 Nb L / ER430 (mod.) type especially for joint welding of exhaust systems. For matching or similar materials. Stabilized with Nb to reduce tendency to grain growth. Resistant to scaling up to 900ºC. Outstanding feeding characteristics and very good welding and flow characteristics.

Base materials

1.4016 X6Cr17, 1.4511 X3CrNb17

UNS S43000

AISI 430

Typical analysis of the solid wire

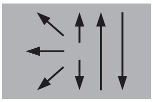
	C	Si	Mn	Cr	Nb
wt.-%	0.02	0.5	0.5	18	0.46 (≥ 12 × C)

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Hardness
u	150
a	130

u untreated, as-welded – shielding gas Ar + 2% CO_2
a annealed – shielding gas Ar + 2% CO_2, 760°C for 2 h

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	90 – 120	18 – 22
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30

Preheating as required by the base metal. Thicker matching ferritic steels can be preheated to 200 – 300ºC and post weld heat treated at 700 – 750ºC.

Shielding gas: Ar + 2 – 3% CO_2 (M12) or Ar + 1 – 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

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BÖHLER CAT 430L CbTi-IG

Solid wire, high-alloyed, ferritic stainless, stabilized

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G Z 18 L NbTi	ER430 (mod.)

Characteristics and typical fields of application

Solid wire of G Z 18 NbTi L / ER430 (mod.) for exhaust manifolds, catalytic converters, silencers and diesel particle filters of matching or similar materials. Double stabilized (Nb + Ti) to reduce tendency to grain growth. Resistant to scaling up to 900ºC. Outstanding feeding characteristics and very good welding and flow characteristics.

Base materials

1.4509 X5CrTiNb 18, 1.4016 X6Cr17, 1.4511 X3CrNb17

UNS S43940, S43000

AISI 430, 441

Typical analysis of the solid wire

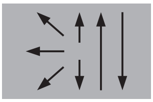
	C	Si	Mn	Cr	Nb	Ti
wt.-%	0.02	0.5	0.5	18	≥ 12xC	0.40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Hardness HB
u	150
a	130

u untreated, as-welded – shielding gas Ar + 2% CO_2
a annealed – shielding gas Ar + 2% CO_2, 760°C for 2 h

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29

Preheating as required by the base metal. Thicker matching ferritic steels can be preheated to 200 – 300ºC. Post weld heat treated at 700 – 750ºC.

Shielding gas: Ar + 2 – 3% CO_2 (M12) or Ar + 1 – 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

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BÖHLER CAT 439L Ti-IG

Solid wire, high-alloyed, ferritic stainless, stabilized

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G Z 18 L Ti	ER439

Characteristics and typical fields of application

Solid wire of G Z 18 Ti L / ER439 type for exhaust manifolds, catalytic converters, silencers and diesel particle filters of matching or similar materials. Stabilized with Ti to reduce tendency to grain growth. Resistant to scaling up to 900ºC. Outstanding feeding characteristics and very good welding and flow characteristics.

Base materials

1.4510 X3CrTi17, 1.4016 X6Cr17, 1.4502 X8CrTi18

AISI 430, 439

Typical analysis of the solid wire

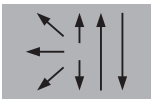
	C	Si	Mn	Cr	Ti
wt.-%	0.02	0.8	0.8	18	0.35 (≥ 12 × C)

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Hardness HB
u	150
a	130

u untreated, as-welded – shielding gas Ar + 2% CO_2
a annealed – shielding gas Ar + 2% CO_2, 800°C for 1 h

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29

Preheating as required by the base metal. Thicker matching ferritic steels can be preheated to 200 – 300ºC. Stress relieving heat treatment at 800ºC. Air cooling is recommended when multi-layer welding.

Shielding gas: Ar + 2 – 3% CO_2 (M12) or Ar + 1 – 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

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BÖHLER SKWA-IG

Solid wire, high-alloyed, ferritic stainless, stabilized

Classifications

EN ISO 14343-A	**AWS A5.9 / SFA-5.9**
G Z 17 Ti	ER430 (mod.)

Characteristics and typical fields of application

Solid wire of G Z 17 Ti / ER430 (mod.) type for joining and surfacing work on matching ferritic and similar Cr-steels and cast steel grades, suitable for quenching and tempering. Corrosion resistance similar to matching 17 Cr steels in seawater, diluted organic and inorganic acids. Service temperatures up to 500ºC. Lowest possible heat input is required, as ferritic 17Cr steels are susceptible to embrittlement due to grain growth. Resistant to scaling up to 900ºC.

Base materials

Surfacing can be performed on all weldable base materials, unalloyed and low-alloyed.

Welding of corrosion resistant chromium steels as well as other similar-alloyed steels with C-contents up to 0.20% (repair welding).

1.4001 X7Cr14, 1.4006 X12Cr13, 1.4057 X17CrNi16-2, 1.4000 X6Cr13, 1.4002 X6CrAl13, 1.4016 X6Cr17, 1.4059 X17CrNi16-2/1.4509 X2CrTiNb18, 1.4510 X3CrTi17, 1.4511 X3CrNb17, 1.4512 X2CrTi12, 1.4520 X2CrTi17, 1.4712 X10CrSi6, 1.4713 X10CrAlSi7/1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18

AISI 403, 405, 409, 410, 429, 430, 430Cb, 430Ti, 439, 431, 442

UNS S40300, S40500, S40900, S41000, S42900, S43000, S43035, S43036, S43100, S44200

Typical analysis of the solid wire

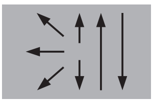
	C	Si	Mn	Cr	Ti
wt.-%	0.07	0.8	0.6	17.5	0.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Hardness HB
u				150 – 170
u – 1st layer				300 – 400
u – 2nd layer				200 – 300
u – 3rd layer				170 – 220
a	(≥ 300)	(≥ 500)	(≥ 20)	130

u untreated, as-welded – shielding gas Ar + 8% CO_2
a annealed – shielding gas Ar + 8% CO_2, 750°C for 2 h

Operating data



Dimension mm	**Current A**	**Voltage V**
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30
1.6 spray arc	250 – 330	27 – 32

Depending on steel grade preheating to 200 – 400ºC.

After air cooling, annealing can be performed at 650 – 800ºC to improve the toughness of the weld deposit and to improve the resistance to intercrystalline corrosion.

Matching grades suitable for quenching and tempering can after air cooling to 120ºC be subject to a temper or quench and temper operation in accordance with the recommendation for the base material.

The hardness of the deposit is increasing with the dilution with the base metal. Gas mixtures containing CO_2 promotes higher hardness.

Shielding gas: Ar + 8 – 10% CO_2 or Ar + 2 – 3% CO_2 (M12) or Ar + 1 – 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

DB (20.132.22), ÖBB, CE

BÖHLER SKWAM-IG

Solid wire, high-alloyed, ferritic stainless

Classifications

EN ISO 14343-A
G Z 17 Mo H

Characteristics and typical fields of application

Solid wire of G Z 17 Mo type for surfacing on sealing faces of gas, water and steam valves and fittings made from unalloyed or low-alloyed steels, for service temperatures up to 450ºC. The weld deposit is normally machinable. Scaling resistant up to 900ºC. Also suited for joint welding of stainless ferritic steels containing 13 – 18% chromium, above all for applications where uniform color of the base metal and weld seam is required. For thick-walled components it is recommended to use Thermanit X wire for the filler passes in order to improve the ductility behavior of the joint weld.

Base materials

Surfacing can be performed on all weldable base materials, unalloyed and low-alloyed.

Welding of corrosion resistant chromium steels as well as other similar-alloyed steels with C-contents up to 0.20% (repair welding).

1.4122 X39CrMo17-1, 1.4113 X6CrMo17-1, 1.4513 X2CrMoTi17-1

UNS SS43400, S43600

AISI 440C, 434, 436

Typical analysis of the solid wire

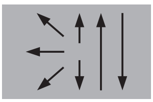
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.20	0.65	0.55	17	0.4	1.1

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Hardness HB
a	(≥ 500)	(≥ 700)	(≥ 15)	200
u				350
u – 1st layer				400 – 500
u – 2nd layer				380 – 450
u – 3rd layer				330 – 400

u untreated, as-welded – shielding gas Ar + 8% CO_2
a annealed – shielding gas Ar + 8% CO_2, 720°C for 2 h

Operating data



Dimension mm	Current A	Voltage V
1.2 spray arc	200 – 270	26 – 30
1.6 spray arc	250 – 330	27 – 32

Preheating to 100 – 150ºC for materials up to 10 mm wall thickness. Preheating to 150 – 200ºC for materials over 10 mm wall thickness. Tempering or quenching and tempering according to the parent metal.

Shielding gas: Ar + 1 – 2% O_2 (M13), Ar + 8 – 10 % CO_2 or Ar + 2 – 3 % CO_2 (M12). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV (08044), DB (20.132.23), NAKS, ÖBB, CE

BÖHLER SKWAM-UP - BÖHLER BB 203

SAW wire/flux combination, high-alloyed, ferritic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S Z 17 Mo H	ER430 (mod.)	S A FB 2 DC

Characteristics and typical fields of application

BÖHLER SKWAM-UP - BB 203 is a wire/flux combination for submerged arc welding of matching ferritic and similar quenchable and temperable Cr-steels and cast steel grades.

Solid wire of S Z 17 Mo H / ER430 (mod.) type for surfacing on sealing faces of gas, water and steam valves and fittings made from unalloyed or low-alloy steels, for service temperatures up to 450ºC. Corrosion resistance similar to matching 17 Cr steels in seawater, diluted organic and inorganic acids. Excellent anti-friction properties. The weld deposit is still machinable. Scaling resistant up to 900ºC.

BÖHLER BB 203 is a fluoride-basic, agglomerate flux providing good operating characteristics, smooth beads and a low hydrogen weld metal. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

Surfacings: All weldable materials, unalloyed, low-alloyed

Joint welds: Corrosion resistant Cr-steels as well as other similar-alloyed steels with C-contents up to 0.20% (repair welding).

Typical analysis of the weld metal

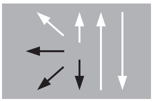
wt.-%	C	Si	Mn	Cr	Ni	Mo
wire	0.20	0.60	0.60	17.5	0.40	1.1
all-weld metal	0.15	0.70	0.55	17.0	0.40	1.1

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Hardness HB
u	320 – 420
a1	200

u untreated, as-welded
a1 720°C for 2 h

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33

Polarity: DC+. Preheating as required by the base metal. Thicker matching ferritic steels can be preheated to 150 – 300ºC.
Surfacing of thicker unalloyed, low-alloyed or high strength steels may require preheating to 100 – 250ºC.
For the reduction of stresses induced by welding, matching ferritic steels can be annealed at 800ºC followed by air cooling.
Lowest possible heat input is required as ferritic 17Cr steels are susceptible to embrittlement due to coarse grain growth.

Approvals

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BÖHLER CAT 430L Cb-MC

Metal-cored wire, high-alloyed, ferritic stainless, stabilized

Classifications

EN ISO 17633-A	**AWS A5.22 / SFA-5.22**
T Z 17 Nb M M12 1	EC439Nb

Characteristics and typical fields of application

Metal-cored wire of T Z 17 Nb / EC439Nb type for catalyzers, silencers, exhaust mufflers and inlet manifolds with same-type or of similar composition. Stabilized with niobium to reduce tendency to grain coarsening. The wire is resistant to scaling up to 900ºC. The easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. The focus application is robotic welding of exhaust systems for the automotive industry, especially for thin sheet one-layer joints with a high travel speed.

Base materials

1.4016 X6Cr17, 1.4511 X3CrNb17

UNS S43000

AISI 430

Typical analysis of the wire

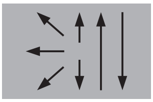
	C	Si	Mn	Cr	Nb	Ti
wt.-%	0.02	0.5	0.7	18.5	0.65	0.12

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Hardness HB
u	180

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	60 – 280	13 – 30	3.5 – 13.0

Welding with conventional or pulsed power sources using DC+ polarity, but pulsed arc may be advantageous and especially when welding out of position. Forehand (pushing) technique preferred with a work angle of appr. 80º. The preferred shielding gas is Ar + 2 – 3% CO_2. The gas flow should be 15 – 20 l/min and the wire stick-out 15 – 20 mm. When welding out of position, the metal-cored wires are similar to solid wires and pulsed arc welding is recommended. Preheating and interpass temperature as required by the base metal.

Approvals

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BÖHLER CAT 430L CbTi-MC

Metal-cored wire, high-alloyed, ferritic stainless, stabilized

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T Z 17 Nb Ti L M M12 1	EC430G, EC439Nb

Characteristics and typical fields of application

Metal-cored wire of T Z 17 Nb Ti L / EC439Nb type for joints in exhaust systems with similar or dissimilar materials. Double-stabilized (niobium and titanium) formula and a low carbon content with reduced tendency for grain coarsening. Resistant to scaling up to 900ºC. The easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. The focus application is robotic welding of exhaust systems for the automotive industry, especially for thin sheet one-layer joints with a high travel speed.

Base materials

1.4016 X6Cr17, 1.4509 X2CrTiNb18, 1.4511 X3CrNb17

UNS S43000, S43940

AISI 430, 441

Typical analysis of the wire

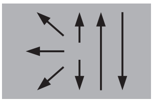
	C	Si	Mn	Cr	Nb	Ti
wt.-%	0.02	0.5	0.7	18.5	0.55	0.35

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Hardness HB
u	180

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	60 – 280	13 – 30	3.5 – 13.0

Welding with conventional or pulsed power sources using DC+ polarity, but pulsed arc may be advantageous and especially when welding out of position. Forehand (pushing) technique preferred with a work angle of appr. 80º. Ar + 2 – 3% CO_2 or Ar + 1 – 2% O_2 can be used as shielding gas. The gas flow should be 15 – 20 l/min and the wire stick-out 15 – 20 mm. When welding out of position, the metal-cored wires are similar to solid wires and pulsed arc welding is recommended. Preheating and interpass temperature as required by the base metal.

Approvals

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BÖHLER CAT 439L Ti-MC

Metal-cored wire, high-alloyed, ferritic stainless, stabilized

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T Z 17 Ti L M M12 1	EC439

Characteristics and typical fields of application

Metal-cored wire of T Z 17 Ti L / EC439 type for catalyzers, silencers, exhaust mufflers and inlet manifolds of similar or matching composition. Stabilized with titanium to reduce tendency to grain coarsening. The wire is resistant to scaling up to 900ºC. The easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. The focus application is robotic welding of exhaust systems for the automotive industry, especially for thin sheet one-layer joints with a high travel speed.

Base materials

1.4016 X6Cr17, 1.4510 X3CrTi17

UNS S43000, S43035

AISI 430, 439

Typical analysis of the wire

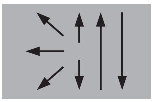
	C	Si	Mn	Cr	Ti
wt.-%	0.02	0.5	0.7	18.5	0.85

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Hardness HB
u	180

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	60 – 280	13 – 30	3.5 – 13.0

Welding with conventional or pulsed power sources using DC+ polarity, but pulsed arc may be advantageous and especially when welding out of position. Forehand (pushing) technique preferred with a work angle of appr. 80º. Ar + 2 – 3% CO_2 or Ar + 1 – 2% O_2 can be used as shielding gas. The gas flow should be 15 – 20 l/min and the wire stick-out 15 – 20 mm. When welding out of position, the metal-cored wires are similar to solid wires and pulsed arc welding is recommended. Preheating and interpass temperature as required by the base metal.

Approvals

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Welding consumables for austenitic stainless steels

◆ Content

Stick electrodes

Product name	C	Si	Mn	Cr	Ni	Mo	Nb	N	Cu
BÖHLER FOX EAS 2	0.03	0.40	1.30	19.80	9.60				
BÖHLER FOX EAS 2-A	0.03	0.80	0.80	19.80	10.20				
BÖHLER FOX EAS 2 (LF)	0.03	0.40	1.30	19.50	10.50				
BÖHLER FOX EAS 4 M	0.03	0.40	1.20	18.80	11.80	2.70			
BÖHLER FOX EAS 4 M-A	0.03	0.80	0.80	18.80	11.50	2.70			
BÖHLER FOX EAS 4 M (LF)	0.03	0.40	1.20	18.50	12.80	2.40			
Avesta 316L/SKR-4D	0.02	0.80	0.70	18.20	12.20	2.60			
Avesta 317L/SNR	0.02	0.70	0.90	19.00	13.60	3.60			
Thermanit 19/15 H	< 0.04	< 0.50	6.00	20.00	16.50	3.00		0.18	
BÖHLER FOX SAS 2	0.03	0.40	1.30	19.80	10.20		0.42		
BÖHLER FOX SAS 2-A	0.03	0.80	0.80	19.50	10.00		0.32		
BÖHLER FOX SAS 4	0.03	0.40	1.30	18.80	11.80	2.70	0.41		
BÖHLER FOX SAS 4-A	0.03	0.80	0.80	19.00	12.00	2.70	0.31		
Thermanit 20/25 CuW	< 0.03	< 0.7	1.30	20.00	25.00	4.50			1.50
Thermanit 25/22 H	< 0.035	< 0.4	5.00	24.50	22.00	2.20		0.15	
Avesta 904L	0.02	0.70	1.20	20.50	25.00	4.50			1.50

GTAW rods

Product name	C	Si	Mn	Cr	Ni	Mo	Nb	N	Cu
Thermanit JE-308L	≤ 0.02	0.50	1.80	20.00	10.00				
BÖHLER EAS 2-IG (LF)	0.02	0.50	1.80	20.00	10.00				
Thermanit GE-316L	≤ 0.02	0.50	1.80	18.50	12.30	2.80			
Thermanit GE-316L SI	0.02	0.90	1.70	18.50	12.00	2.60			
Avesta 317L/SNR	0.02	0.40	1.70	19.00	13.50	3.50			
BÖHLER ASN 5-IG	≤ 0.02	0.40	5.50	19.00	17.20	4.30		0.16	
Thermanit A	0.04	0.40	1.70	19.50	11.50	2.70	≥ 12×C		
Thermanit H-347	0.05	0.50	1.80	19.50	9.50		≥ 12×C		
Thermanit 20/25 Cu	< 0.025	0.20	2.50	20.50	25.00	4.80			1.50
BÖHLER SAS 4-IG (Si)	0.04	0.80	1.40	19.00	11.50	2.80	0.61		
Thermanit 20/25 Cu	< 0.025	0.20	2.50	20.50	25.00	4.80			1.50
BÖHLER CN 20/25 M-IG	≤ 0.02	0.70	4.70	20.00	25.40	6.20		0.12	1.50

Solid wires

Product name	C	Si	Mn	Cr	Ni	Mo	W	Nb	N	Ti	Cu
BÖHLER A 7 CN-IG	0.08	0.90	7.00	19.20	9.00						
Thermanit 17/15 TT	0.20	0.40	10.50	17.50	14.00		3.50				
Thermanit JE-308L Si	≤0.02	0.90	1.70	20.00	10.20						
BÖHLER EAS 2-IG (LF)	≤ 0.02	0.50	1.70	20.00	10.50						
Thermanit GE-316L	0.02	0.40	1.70	18.40	12.40	2.80					
Thermanit GE-316L SI	0.02	0.80	1.70	18.40	12.40	2.80					
Thermanit 19/15	0.03	0.50	7.50	20.50	15.50	3.00			0.18		
Avesta 317L/SNR	0.02	0.40	1.70	19.00	13.50	3.50					
BÖHLER ASN 5-IG (Si)	0.02	0.40	5.50	19.00	17.20	4.30			0.16	17.20	
Thermanit A Si	0.05	0.80	1.50	19.00	12.00	2.80		≥ 12×C			
Thermanit H Si	0.06	0.80	1.50	19.50	9.50			≥ 12×C			
Thermanit 20/25 Cu	< 0.025	0.20	2.50	20.50	25.00	4.80					1.50
BÖHLER CN 20/25 M-IG (Si)	≤ 0.02	0.70	4.70	20.00	25.40	6.20			0.12		1.50

SAW wire/flux combinations

Product name	C	Si	Mn	Cr	Ni	Mo	Nb	N	Cu
Thermanit JE-308L - Marathon 213	0.02	0.65	1.10	19.50	9.80				
Thermanit JE-308L - Marathon 431	0.02	0.60	1.30	19.50	9.80				
Thermanit JE-308L - Avesta Flux 805	0.02	0.60	1.20	20.50	10.00				
BÖHLER EAS 2-UP (LF) - BÖHLER BB 203	0.02	0.50	1.50	19.50	10.80				
Thermanit GE-316L - Marathon 213	0.02	0.70	1.10	17.90	12.20	2.60			
Thermanit GE-316L - Avesta Flux 805	0.01	0.60	1.20	19.00	12.20	2.70			
Thermanit GE-316L - Marathon 431	0.01	0.55	1.20	18.00	12.20	2.70			
Avesta 317L/SNR - Avesta Flux 805	0.01	0.60	1.20	19.50	13.40	3.60			
BÖHLER ASN 5-UP - BÖHLER BB 203	0.01	0.50	4.50	18.50	16.80	4.10		0.15	
Thermanit H-347 - Marathon 213	0.05	0.60	1.30	18.70	9.20		0.50		
Thermanit H-347 - Marathon 431	0.04	0.60	1.30	18.80	9.20		0.55		
Thermanit H-347 - Avesta Flux 805	0.04	0.60	1.30	19.50	9.20		0.55		
Thermanit A - Marathon 213	0.04	0.60	1.20	19.00	11.50	2.60	0.50		
Thermanit A - Marathon 431	0.04	0.50	1.30	19.00	11.50	2.60	0.50		
Thermanit A - Avesta Flux 805	0.04	0.50	1.30	20.00	11.50	2.60	0.50		
Thermanit 20/16 SM - Marathon 104	0.02	0.70	7.00	21.80	18.00	3.70		0.20	
Thermanit 20/25 Cu - Marathon 104	0.02	0.45	1.60	19.70	25.00	4.50			1.50
Thermanit 25/22 H - Marathon 104	0.02	0.25	5.20	24.70	22.50	2.20		0.12	
BÖHLER AM 500-UP - Marathon 104	0.02	0.30	6.00	24.50	23.00	3.60		0.24	

Flux-cored and metal-cored wire

Product name	C	Si	Mn	Cr	Ni	Mo	Nb	FN
BÖHLER EAS 2-MC	0.03	0.60	1.40	19.80	10.50			3 – 10
BÖHLER EAS 2-FD	0.03	0.70	1.50	19.80	10.50			3 – 10
Avesta FCW-2D 308L/MVR	0.03	0.70	1.50	19.50	10.50			3 – 10
BÖHLER EAS 2 PW-FD	0.03	0.70	1.50	19.80	10.50			3 – 10
Avesta FCW 308L/MVR-PW	0.03	0.70	1.50	19.80	10.50			3 – 10
BÖHLER SAS 2-FD	0.03	0.60	1.40	19.50	10.60		0.37	5 – 13
BÖHLER SAS 2 PW-FD	0.03	0.70	1.40	19.00	10.40		0.35	5 – 13
Avesta FCW 308L/MVR Cryo	0.03	0.60	1.40	19.30	10.90			2 – 4
BÖHLER EAS 2 PW-FD (LF)	0.03	0.60	1.40	19.30	10.90			2 – 4
BÖHLER EAS 4 M-MC	0.03	0.60	1.40	18.80	12.20	2.70		4 – 10
BÖHLER EAS 4 M-FD	0.03	0.70	1.50	19.00	12.00	2.70		3 – 10
Avesta FCW-2D 316L/SKR	0.03	0.70	1.30	18.40	12.10	2.60		3 – 10
BÖHLER EAS 4 PW-FD	0.03	0.70	1.50	19.00	12.00	2.70		3 – 10
Avesta FCW 316L/SKR-PW	0.03	0.70	1.50	19.00	12.00	2.70		3 – 10
BÖHLER EAS 4 PW-FD (LF)	0.03	0.70	1.40	18.10	12.50	2.10		2 – 4
BÖHLER E 317L-FD	0.03	0.70	1.30	18.80	13.10	3.40		2 – 7
BÖHLER E 317L PW-FD	0.03	0.70	1.30	18.80	13.10	3.40		2 – 7
BÖHLER SAS 4-FD	0.03	0.60	1.30	18.80	12.20	2.70	0.29	5 – 13
BÖHLER SAS 4 PW-FD	0.03	0.60	1.30	18.80	12.20	2.70	0.46	5 – 13

SMAW

BÖHLER FOX EAS 2

Stick electrode, high-alloyed, austenitic stainless

Classifications

EN ISO 3581-A	**AWS A5.4 / SFA-5.4**
E 19 9 L B 2 2	E308L-15

Characteristics and typical fields of application

Basic coated, core wire alloyed electrode of E 19 9 L B / E308L-15 type. Primarily used for 1.4306 / 304L and 304LN grades. Very good root pass and positional welding characteristics, good gap bridging ability, easy weld pool and slag control as well as easy slag removal even in narrow preparations resulting in clean bead surfaces and minimum post weld cleaning. An excellent electrode for welding on site! Max. service temperature 350ºC. Packed into hermetically sealed tins. This type of consumables is also available as a special low ferrite version, BÖHLER FOX EAS 2 (LF).

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 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

Typical analysis of all-weld metal

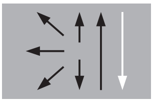
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.03	0.4	1.3	19.8	9.6	4 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–196°C
u	420 (≥ 320)	570 (≥ 520)	38 (≥ 30)	110	40 (≥ 34)

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification FOX EAS 2 308L-15 E 19 9 L B

Dimension mm	**Current A**
2.5 × 300	50 – 80
3.2 × 350	80 – 110
4.0 × 350	110 – 140
5.0 × 450	140 – 180

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC.

Approvals

TÜV (00152), DB (30.014.10), Equinor, CE

böhler welding by voestalpine

BÖHLER FOX EAS 2-A

Stick electrode, high-alloyed, austenitic stainless

Classifications

EN ISO 3581-A	**AWS A5.4 / SFA-5.4**
E 19 9 L R 3 2	E308L-17

Characteristics and typical fields of application

Rutile coated, core wire alloyed electrode of E 19 9 L R / E308L-17 type. Primarily used for 1.4306 / 304L and 304LN steel grades. Easy handling, good welding characteristics, suitable for welding on AC or DC. Other characteristics include high current carrying capacity, minimum spatter formation, self-releasing slag, smooth and clean weld profile, safety against formation of porosity due to moisture resistant coating and packaging into hermetically sealed tins. Max. service temperature 350°C.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of all-weld metal

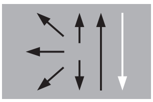
	C	Si	Mn	Cr	Ni
wt.-%	0.03	0.8	0.8	19.8	10.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–120°C	–196°C
u	430 (≥320)	560 (≥520)	40 (≥30)	70	43 (≥32)	40 (≥32)

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification FOX EAS 2-A 308L-17 E 19 9 L R

Dimension mm	**Current A**
1.5 × 250	25 – 40
2.0 × 300	40 – 60
2.5 × 250/300/350	50 – 90
3.2 × 300/350	80 – 120
4.0 × 350/450	110 – 160

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150°C.

Redrying if necessary at 120 – 200°C for min. 2 h.

Approvals

TÜV (01095), DB (30.014.15), ABS, DNV GL, CE, CWB

BÖHLER FOX EAS 2 (LF)

Stick electrode, high-alloyed, austenitic stainless, cryogenic

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 19 9 L B 2 2	E308L-15

Characteristics and typical fields of application

Basic coated, core wire alloyed electrode of E 19 9 L B / E308L-15 type. Preferably used for 1.4306 / 304L, 304LN steel grades.

Due to the specific alloying concept and a controlled ferrite content of 3 – 8 FN (stricter on demand), the weld metal provides excellent impact toughness down to –196ºC along with lateral expansion values of > 0.38 mm, which makes it especially suitable for LNG applications. Good gap bridging ability, very good root pass and excellent X-ray safety. Good welding characteristics in all positions except vertical-down with easy weld pool and slag control. Easy slag removal even in narrow preparations result in clean bead surfaces with minimum post-weld cleaning. deal electrode for welding on site. Max. service temperature 350ºC.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of all-weld metal

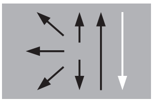
	C	Si	Mn	Cr	Ni
wt.-%	0.03	0.4	1.3	19.5	10.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C	Lateral expansion mm –196°C
u	410 (≥ 320)	560 (≥ 520)	40 (≥ 30)	125	40 (≥ 34)	0.71 (≥ 0.38)

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	FOX EAS 2 (LF) 308L-15 E 19 9 L B

Dimension mm	Current A
2.5 × 350	50 – 80
3.2 × 350	80 – 110
4.0 × 350	110 – 140

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 150ºC.

Approvals

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BÖHLER FOX EAS 4 M

Stick electrode, high-alloyed, austenitic stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 19 12 3 L B 2 2	E316L-15

Characteristics and typical fields of application

Basic electrode, core wire alloyed electrode of E 19 12 3 L B / E316L-15 type. Primarily used for 1.4404,

1.4435 / 316L austenitic steel grades. Reliable toughness values down to –196°C. 100% X-ray safety together with very good root pass and positional welding characteristics. Good gap bridging ability, easy weld pool and slag control. Easy slag removal even in narrow preparations result in clean bead surfaces with minimum post weld cleaning. Max. service temperature 400°C.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of all-weld metal

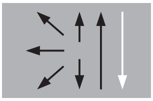
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.03	0.4	1.2	18.8	11.8	2.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C	–196°C
u	440 (≥ 320)	580 (≥ 510)	38 (≥ 25)	100	62 (≥ 32)	38 (≥ 27)

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	FOX EAS 4 M 316L-15 E 19 12 3 L B

Dimension mm	Current A
2.5 × 300	50 – 80
3.2 × 350	80 – 110
4.0 × 350	110 – 140
5.0 × 450	140 – 180

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC.

Approvals

TÜV (00772), DNV GL, CE

BÖHLER FOX EAS 4 M-A

Stick electrode, high-alloyed, austenitic stainless

Classifications

EN ISO 3581-A
E 19 12 3 L R 3 2

AWS A5.4 / SFA-5.4
E 316L-17

Characteristics and typical fields of application

Rutile coated electrode of E 19 12 3 L R / E316L-17 type. Preferably used for 1.4404 and 1.4435 / 316L austenitic stainless steel grades. Designed for first class weld seems and easy handling on AC or DC. High current carrying capacity with minimum spatter formation. Self-releasing slag, smooth and clean weld profile. Good resistance to general and pitting corrosion. Max. service temperature 400ºC.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3, 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of all-weld metal

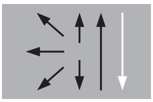
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.03	0.8	0.8	18.8	11.5	2.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C
u	460 (≥ 320)	600 (≥ 510)	36 (≥ 25)	70	≥ 32

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification FOX EAS 4 M-A 316L-17 E 19 12 3 L R

Dimension mm	Current A
1.5 × 250	25 – 40
2.0 × 250/300	40 – 60
2.5 × 250/300/350	50 – 90
3.2 × 300/350	80 – 120
3.2 × 350	80 – 120
4.0 × 350/450	110 – 160
4.0 × 350	110 – 160

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC.

Redrying if necessary at 120 – 200ºC for min. 2 h.

Approvals

TÜV (00773), DB (30.014.14), ABS, DNV GL, LR, Equinor, CWB, CE

BÖHLER FOX EAS 4 M (LF)

Stick electrode, high-alloyed, austenitic stainless, cryogenic

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E Z 19 12 3 L B 2 2	E316L-15

Characteristics and typical fields of application

Basic coated, core wire alloyed electrode of E 19 12 3 L B / E316L-15 type. Controlled low delta ferrite content, 3 – 8 FN (stricter on demand). Designed to produce first class weld deposits with reliable CVN impact toughness values down to –196ºC especially for use in, for instance, LNG applications. Good gap bridging ability, very good root pass and excellent X-ray safety. Easy weld pool and slag control. Easy slag removal even in narrow preparations result in clean bead surfaces with minimum post-weld cleaning. Max. service temperature 400ºC.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of all-weld metal

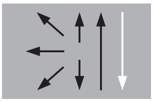
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.03	0.4	1.2	18.5	12.8	2.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C	Lateral expansion mm –196°C
u	430 (≥ 320)	570 (≥ 510)	36 (≥ 25)	100	50 (≥ 27)	0.69 (≥ 0.38)

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	FOX EAS 4 M (LF) 316L-15

Dimension mm	Current A
2.5 × 300	50 – 80
3.2 × 350	80 – 110
4.0 × 350	110 – 140

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 150ºC.

Approvals

NAKS, CE

SMAW

Avesta 316L/SKR-4D

Stick electrode, high-alloyed, austenitic stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 19 12 3 L R 3 2	E316L-17

Characteristics and typical fields of application

Rutile thin-coated electrode of E 19 12 3 L R / E316L-17 type. Specially developed for welding thin-walled pipes and sheets, mainly in the chemical process and papermaking industries. Highly suitable for welding restrained positions and under difficult site conditions, where it offers considerably higher productivity than manual TIG welding. It is also recommended for root runs and multi-pass welds in general fabrication of 1.4404 and 1.4436 / 316L type austenitic stainless steels. Excellent resistance to general, pitting and intergranular corrosion in chloride containing environments. Intended for severe conditions, e.g. in dilute hot acids. Scaling temperature approximately 850ºC in air.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of all-weld metal

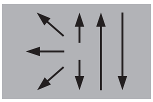
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.02	0.8	0.7	18.2	12.2	2.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –20°C	Hardness HB
u	450 (≥ 320)	580 (≥ 510)	34 (≥ 25)	60	55	210

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification 316L-17/SKR-4D

Dimension mm	Current A
2.0 × 250/300	25 – 55
2.5 × 300	30 – 85
3.2 × 350	45 – 110

Suggested heat input is max. 2.0 kJ/mm, interpass temperature max. 150ºC.

Preheating and post-weld heat treatment not necessary. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (10710), CE

Avesta 317L/SNR

Stick electrode, high-alloyed, austenitic stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E Z 19 13 4 N L	E317L-17

Characteristics and typical fields of application

Rutile coated, core wire alloyed electrode of E Z 19 13 4 N L R / E317L-17 type with high Mo-content. Suited for welding corrosion resistant CrNiMo(N)-steels such as 1.4438 / 317L. It fulfills the high demands of offshore fabricators, shipyards building chemical tankers as well as the chemical / petrochemical and pulp & paper industries. Higher corrosion resistance than 1.4404 / 316L in acid and chloride containing solutions. Scaling temperature approximately 850°C in air.

Base materials

CrNiMo(N) austenitic stainless steels with higher Mo content or corrosion resistant claddings on mild steels

1.4429 X2CrNiMoN17-13-3, 1.4434 X2CrNiMoN18-12-4, 1.4435 X2CrNiMo18-14-3, 1.4438 X2CrNiMo19-14-4 1.4439 X2CrNiMoN17-13-5

AISI 316L, 316LN, 317L, 317LN, 317LMN

UNS S31600, S31653, S31703, S31726, S31753

Typical analysis of all-weld metal

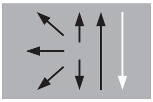
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.02	0.7	0.9	19.0	13.6	3.6	4 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	500	610 (≥ 520)	32 (≥ 30)	45 (≥ 34)

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification 317L-17/SNR

Dimension mm	Current A
2.5 × 300	45 – 80
3.2 × 350	70 – 120
4.0 × 350	90 – 160
5.0 × 350	150 – 220

Suggested heat input is max. 1.5 kJ/mm, interpass temperature max. 100°C.

Preheating and post-weld heat-treatment not necessary. In special cases, solution annealing can be performed at 1050°C followed by water quenching.

Redrying if necessary at 250°C for min. 2 h.

Metal recovery approximately 110%.

Approvals

DNV GL, CE

Thermanit 19/15 H

Stick electrode, high-alloyed, austenitic stainless

Classifications

EN ISO 3581-A	**AWS A5.4 / SFA-5.4**
E 20 16 3 Mn N L B 2 2	E316LMn-15

Characteristics and typical fields of application

Basic coated non-magnetic electrode of E 20 16 3 Mn N L B / E316LMn-15 type. Particularly suited to corrosion conditions in urea synthesis plants for welding work on steel X2CrNiMo18-12. and the overlay side of Thermanit 21/17 E weld claddings. Well-suited for joining and surfacing applications with matching austenitic CrNi(N) and CrNiMo(Mn,N) steels and cast steel grades. Max. service temperature 350ºC. Corrosion resistance similar to low carbon CrNiMo(Mn,N)-steels. Seawater resistant and good resistance to nitric acid. Huey test in acc. ASTM A 262: Max. 3.3 µm / 48 h (0.54 g/m^2h), selective attack 200 µm max. Resulting all-weld metal microstructure is austenite with max. 0.6% ferrite.

Base materials

Matching / similar steels CrNi(N) steels/cast steel grades and cryoge- nic CrNi(N) steels/cast steel grades.

1.3941(G)X4CrNi18-3, 1.3945 X2CrNiN18-13, 1.3948 X4CrNiMnMoN19-13–8, 1.3952(G)X2CrNiMoN18-14-3

1.3953(G)X2CrNiMo18-15, 1.3955 GX12Cr18-11, 1.3965 X8CrMnNi18-8, 1.4315 X5CrNiN19-9, 1.4429 X2CrNiMoN17-13-3 1.4561 X1CrNiMoTi18-13-2, 1.6903 10CrNiTi18-10

Cryogenic 3.5 – 5% Ni-steels

UNS S31653

AISI 316LN

Typical analysis of all-weld metal

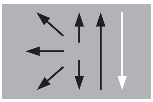
	C	Si	Mn	Cr	Ni	Mo	N
wt.-%	< 0.04	< 0.50	6.0	20	16.5	3	0.18

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	430(≥ 320)	640 (≥ 550)	30 (≥ 25)	80

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	Thermanit 19/15H E 20 16 3 Mn L B

Dimension mm	Current A
2.5 × 300	55 – 75
3.2 × 350	70 – 110
4.0 × 350	90 – 140

Suggested heat input max. 1.5 kJ/mm and interpass temperature max. 100ºC.

When cladding high temperature and cast steel grades, preheating is according to the parent material (150ºC), In case if excessive hardening of the parent material, stress relieving can be performed at 510ºC for max. 20 h, annealing above 530ºC only prior to the final pass.

Approvals

TÜV (01813), CE

BÖHLER FOX SAS 2

Stick electrode, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 19 9 Nb B 2 2	E347-15

Characteristics and typical fields of application

Basic coated stabilized electrode of E 19 9 Nb B / E347-15 type. Mainly for welding titanium and niobium-stabilized 1.4541 / 321 und 1.4546 / 347 austenitic stainless steel grades. Designed to produce first class weld deposits with reliable CVN impact toughness values down to –196°C. Good gap bridging ability, very good root pass and excellent X-ray safety. Good welding characteristics in all positions except vertical-down with easy weld pool and slag control as well as easy slag removal. Clean bead surfaces and minimum post-weld cleaning. An excellent electrode for welding on site and for heavy and rigid components. Max. service temperature 400°C.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11

UNS S30400, S30403, S30453, S32100, S34700

AISI 347, 321,302, 304, 304L, 304LN

Typical analysis of all-weld metal

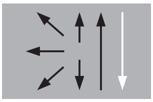
	C	Si	Mn	Cr	Ni	Nb
wt.-%	0.03	0.4	1.3	19.8	10.2	0.42

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	450 (≥ 350)	620 (≥ 550)	36 (≥ 25)	110	39 (≥ 32)

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	FOX SAS 2 347-15 E 19 9 Nb B

Dimension mm	Current A
2.5 × 300	50 – 80
3.2 × 350	80 – 110
4.0 × 350	110 – 140
5.0 × 450	140 – 180

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 150°C.

Generally no heat treatment needed.

BÖHLER FOX SAS 2 can be used for cladding, which normally requires stress relieving at approximately 590°C. Such a heat treatment will lower the ductility at room temperature. BÖHLER FOX E 347 H may be an alternative in this case.

Approvals

TÜV (01282), DB (30.014.04), ABS, DNV GL, CE

SMAW

BÖHLER FOX SAS 2-A

Stick electrode, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 19 9 Nb R 3 2	E347-17

Characteristics and typical fields of application

Rutile coated, cored wire alloyed stabilized electrode of E 19 9 Nb R / E347-15 type. Mainly for welding titanium and niobium-stabilized 1.4541 / 321, 1.4546 / 347 austenitic stainless steel grades. Designed for first class weld seems and easy handling on AC or DC. High current carrying capacity with minimum spatter formation. Self-releasing slag, smooth and clean weld profile. Safety against formation of porosity due to moisture resistant coating. The corrosion resistance corresponds to that of 316Ti with good resistance to general and pitting corrosion. Max. service temperature 400°C.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11

UNS S30400, S30403, S30453, S32100, S34700

AISI 347, 321,302, 304, 304L, 304LN

Typical analysis of all-weld metal

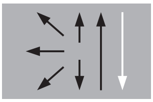
	C	Si	Mn	Cr	Ni	Nb
wt.-%	0.03	0.8	0.8	19.5	10.0	0.32

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C
u	450 (≥ 350)	620 (≥ 550)	35 (≥ 25)	70	36 (≥ 32)

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification FOX SAS 2-A 347-17 E 19 9 Nb R

Dimension mm	Current A
1.5 × 250	25 – 40
2.0 × 300	40 – 60
2.5 × 250/300/350	50 – 90
3.2 × 300/350	80 – 120
4.0 × 350	110 – 160

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 150°C.

Generally no heat treatment needed.

BÖHLER FOX SAS 2-A can be used for cladding, which normally requires stress relieving at approximately 590°C. Such a heat treatment will lower the ductility at room temperature. BÖHLER FOX E 347 H may be an alternative in this case.

Re-drying if necessary at 120 – 200°C for min. 2 h.

Approvals

TÜV (01105), DB (30.014.06), ABS, DNV GL, NAKS (Ø 2.5 mm, 3.2 mm, 4.0 mm), CE

BÖHLER FOX SAS 4

Stick electrode, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 19 12 3 Nb B 2 2	E318-15

Characteristics and typical fields of application

Basic coated stabilized electrode of E 19 12 3 Nb B / E318-15 type. Mainly for welding titanium and niobium-stabilized 1.4571 / 316Ti and 1.4580 / 316Cb austenitic stainless steel grades. Designed to produce first class weld deposits with reliable CVN impact toughness values down to –90°C. Good gap bridging ability, very good root pass and excellent X-ray safety. Good welding characteristics in all positions except vertical-down with easy weld pool and slag control as well as easy slag removal. Clean bead surfaces and minimum post-weld cleaning. An excellent electrode for welding on site and for heavy and rigid components. Max. service temperature 400°C.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3 / 1.4436 X3CrNiMo17-13-3, 1.4437 GX6CrNiMo18-12, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2 / 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316, 316L, 316Ti, 316Cb

Typical analysis of all-weld metal

	C	Si	Mn	Cr	Ni	Mo	Nb
wt.-%	0.03	0.4	1.3	18.8	11.8	2.7	0.41

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–90°C
u	490 (≥ 350)	660 (≥ 550)	31 (≥ 25)	120	75 (≥ 32)

u untreated, as-welded

Operating data

Polarity	DC+
Electrode identification	FOX SAS 4 318-15 E 19 12 3 Nb B

Dimension mm	Current A
2.5 × 300	50 – 80
3.2 × 350	80 – 110
4.0 × 350	110 – 140

Suggested heat input max. 1.5 kJ/mm and interpass temperature max. 150°C.

Approvals

TÜV (00774), DB (30.014.05), ABS, DNV GL, CE

BÖHLER FOX SAS 4-A

Stick electrode, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 19 12 3 Nb R 3 2	E318-17

Characteristics and typical fields of application

Rutile coated, cored wire alloyed stabilized electrode of E 19 12 3 Nb R / E318-17 type. Mainly for welding titanium and niobium-stabilized 1.4571 / 316Ti and 1.4580 / 316Cb austenitic stainless steel grades. Designed for first class weld seems and easy handling on AC or DC. High current carrying capacity with minimum spatter formation. Self-releasing slag, smooth and clean weld profile. Safety against formation of porosity due to moisture resistant coating. The corrosion resistance corresponds to that of 316Ti with good resistance to general and pitting corrosion. Max. service temperature 400ºC.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3 1.4436 X3CrNiMo17-13-3, 1.4437 GX6CrNiMo18-12, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653, AISI 316, 316L, 316Ti, 316Cb

Typical analysis of all-weld metal

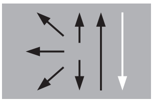
	C	Si	Mn	Cr	Ni	Mo	Nb
wt.-%	0.03	0.8	0.8	19.0	12	2.7	0.31

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–90°C
u	460 (≥ 350)	600 (≥ 550)	32 (≥ 25)	60	47 (≥ 32)

u untreated, as-welded

Operating data



Polarity	DC+ / AC
Electrode identification	FOX SAS 4-A 318-17 E 19 12 3 Nb R

Dimension mm	Current A
2.0 × 300	40 – 60
2.5 × 250/300/350	50 – 90
3.2 × 300/350	80 – 120
4.0 × 350	110 – 160
5.0 × 450	140 – 200

Suggested heat input max. 1.5 kJ/mm and interpass temperature max. 150ºC.

Re-drying if necessary at 120 – 200ºC for min. 2 h.

Approvals

TÜV (00777), DB (30.014.07), NAKS (Ø 2.5 mm, 3.2 mm, 4.0 mm), CE

böhler welding by voestalpine

Thermanit 20/25 CuW

Stick electrode, high-alloyed, austenitic stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 20 25 5 Cu N L R 3 2	E385-16

Characteristics and typical fields of application

Rutile coated electrode of E 20 25 5 Cu N L R / E385-16 type. For joining and surfacing work with matching austenitic CrNiMoCu-steels / cast steel grades and for dissimilar welding with unalloyed / low alloyed steels. Max. service temperature 350ºC. Good corrosion resistance similar to matching steels, above all in reducing environments.

Base materials

1.4465 X1CrNiMoN25-25-2, 1.4505 X4NiCrMoCuNb20-18-2, 1.4506 X5NiCrMoCuTi20-18, 1.4537 X1CrNiMoCuN25-25-5 1.4538 X2NiCrMoCuN20-18, 1.4539 X2NiCrMoCuN25-20-5, 1.4586 X5NiCrMoCuNb22-18

UNS N08904

AISI 904L

Typical analysis of all-weld metal

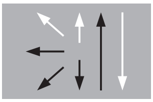
	C	Si	Mn	Cr	Ni	Mo	Cu
wt.-%	< 0.03	< 0.7	1.3	20.0	25.0	4.5	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	350 (≥ 320)	550 (≥ 510)	35 (≥ 25)	55

u untreated, as-welded

Operating data



Polarity	DC+ / AC
Electrode identification	Thermanit 20/25 CuW 385-16

Dimension mm	Current A
2.5 × 300	50 – 80
3.2 × 350	80 – 110
4.0 × 350	100 – 135
5.0 × 450	140 – 180

Suggested heat input is max.1.5 kJ/mm, interpass temperature max. 150ºC.

No preheating unless required by the parent material.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1120ºC.

Approvals

TÜV (04112), CE

Thermanit 25/22 H

Stick electrode, high-alloyed, austenitic stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E Z 25 22 2 L B 2 2	E310Mo-15 (mod.)

Characteristics and typical fields of application

Rutile coated austenitic electrode of E 25 22 2 N L R. Particularly suited to corrosion conditions in urea synthesis plants. For joining and surfacing applications with matching / similar steels. For weld cladding on high temperature steels and for fabricating joints on claddings. Excellent corrosion resistance in strongly oxidizing and slightly reducing environments. High resistance to intergranular, selective, chloride-induced pitting and stress corrosion. Max. service temperature 350ºC. Seawater resistant, good resistance to nitric acid. Huey test in acc. ASTM A 262: max. 1.5 µm / 48 h max. (0.54 g/m^{2}h), selective attack max. 100 µm. Resistant to scaling up to 1050ºC. Resulting all weld metal microstructure is austenite with max. 0.5% ferrite.

Base materials

1.4335 X1CrNi25-21, 1.4435 X2CrNiMo18-14-3, 1.4465 X1CrNiMoN22-25-3, 1.4466 X1CrNiMoN25-22-2, 1.4577 X3CrNiMoTi25-25

UNS S31050, S31603

AISI 316L, 725LN

Typical analysis of all-weld metal

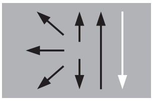
	C	Si	Mn	Cr	Ni	Mo	N
wt.-%	< 0.035	< 0.4	5.0	24.5	22.0	2.2	0.15

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	400 (≥ 320)	600 (≥ 510)	30 (≥ 25)	80

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	Thermanit 25/22 H EZ 25 22 2 N L B

Dimension mm	Current A
2.5 × 300	55 – 80
3.2 × 350	80 – 105
4.0 × 350	90 – 135

Suggested heat input is max. 1.5 kJ/mm, interpass temperature max. 150ºC.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (04171), CE

böhler welding by voestalpine

Avesta 904L

Stick electrode, stainless, high-alloyed, austenitic stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 20 25 5 Cu N L R	E385-17

Characteristics and typical fields of application

Rutile coated fully austenitic electrode of E 20 25 5 Cu N L R / E385-17 type designed for welding 1.4539 / 904L type steels. It can also be used for welding 1.4404 / 316L components where a ferrite free weld is required, e.g. in cryogenic or non-magnetic applications. The weld metal has very good impact toughness at low temperatures. To minimize the risk of hot cracking when welding fully austenitic steels, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Very good resistance to general corrosion in non-oxidizing environments such as sulfuric acid and phosphoric acid. Very good resistance to pitting and crevice corrosion in chloride containing solutions. Meets the corrosion test requirements as per ASTM G48 Methods A, B and E (40ºC). Scaling temperature approximately 1000ºC in air.

Base materials

1.4505 X4NiCrMoCuNb20-18-2, 1.4506 X5NiCrMoCuTi20-18, 1.4537 X1CrNiMoCuN25-25-5, 1.4538 X2NiCrMoCuN20-18 1.4539 X1NiCrMoCu25-20-5, 1.4586 X5NiCrMoCuNb22-18

UNS S31726, N08904

AISI 904L

Typical analysis of all-weld metal

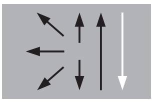
	C	Si	Mn	Cr	Ni	Mo	Cu
wt.-%	0.02	0.7	1.2	20.5	25.0	4.5	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–60°C	–196°C	Hardness HB
u	420	600	34	70	60	40	200

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification Avesta 904L

Dimension mm	Current A
2.5 × 350	50 – 75
3.2 × 350	80 – 110
4.0 × 400	100 – 150
5.0 × 400	140 – 190

Suggested heat input is max. 1.5 kJ/mm, interpass temperature max. 100ºC.

Metal recovery approximately 110% at max. welding current.

Approvals

TÜV (03496), DB (30.014.23), CE

Thermanit JE-308L

TIG rod, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 19 9 L	ER308L

Characteristics and typical fields of application

TIG rod of W 19 9 L / ER308L type for joining and surfacing applications with matching and similar stabilized and unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching low-carbon and stabilized austenitic 18/8 CrNi(N)-steels. The wire shows very good wetting characteristics, with excellent weld metal toughness down to –196ºC. Application temperature max. 350ºC.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the wire rod

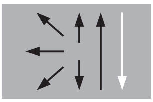
	C	Si	Mn	Cr	Ni
wt.-%	≤ 0.02	0.5	1.8	20	10.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –269°C
u	400 (≥ 320)	550 (≥ 510)	38 (≥ 25)	150	75 (≥ 32)

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking -

Dimension mm	Current A	Voltage V
1.0 × 1000	50 – 70	9 – 11
1.2 × 1000	60 – 80	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Heat input max. 2.0 kJ/mm, interpass temperature max. 150ºC.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (09451), DB (43.132.19), DNV GL, ABS, BV, CE

BÖHLER EAS 2-IG (LF)

TIG rod, high-alloyed, austenitic stainless, cryogenic

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 19 9 L	ER308L

Characteristics and typical fields of application

TIG rod of W 19 9 L / ER308L type for welding 1.4306 / 304L, 304LN steel grades. Controlled weld metal ferrite content, 3 – 8 FN (stricter on demand), particularly for good cryogenic toughness and lateral expansion down to –196°C. Max. service temperature 350°C.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the wire rod

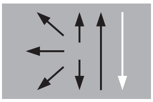
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.02	0.5	1.8	20	10.0	3 – 8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C	Lateral expansion mm –196°C
u	430 (≥ 320)	550 (≥ 510)	38 (≥ 25)	150 (≥ 100)	65 (≥ 32)	≥ 0.38

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking W 19 9 L
ER308L

Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Heat input max. 1.5 kJ/mm, interpass temperature max. 100°C.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

-

Thermanit GE-316L

TIG rod, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	**AWS A5.9 / SFA-5.9**
W 19 12 3 L	ER316L

Characteristics and typical fields of application

TIG rod of W 19 12 3 L / ER316L type for joining and surfacing application with matching and similar unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching low-carbon and stabilized austenitic 17Cr-12Ni-2Mo-steels and cast steel grades. Resistant to intergranular corrosion. Excellent weld metal toughness down to –196ºC. Max. service temperature 400ºC.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3,

1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2,

1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the wire rod

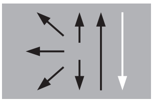
	C	Si	Mn	Cr	Ni	Mo
wt.-%	≤ 0.02	0.5	1.8	18.5	12.3	2.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–20°C	–196°C
u	470 (≥ 320)	610 (≥ 510)	38 (≥ 25)	140 (≥ 25)140	130	58 (≥ 32)

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking

W 19 12 3 L
ER 316 L

Dimension mm	**Current A**	**Voltage V**
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Heat input max. 2.0 kJ/mm, interpass temperature max. 150ºC.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (09500), DB (43.132.20), DNV GL, ABS, BV, NAKS, CE

Thermanit GE-316L Si

TIG rod, high-alloyed, austenitic stainless

GTAW

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 19 12 3 L Si	ER316LSi

Characteristics and typical fields of application

TIG rod of W 19 12 3 L Si / ER316LSi type for welding austenitic stainless steel of 17Cr-12Ni-2.5Mo type or similar. Also suitable for welding steels that are stabilized with titanium or niobium, such as 1.4571 / 316Ti for service temperatures not exceeding 400ºC.
For higher temperatures a niobium-stabilized consumable such as BöHLER SAS 4-IG (Si) is required. Excellent resistance to general, pitting and intercrystalline corrosion in chloride containing environments. Intended for severe service conditions, e.g. in dilute hot acids. Microstructure is austenite with 5 – 10% ferrite. Max. service temperature 400ºC.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3,

1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2, 1.4580

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

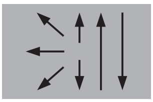
Typical analysis of the wire rod

	C	Si	Mn	Cr	Ni	Mo	Ferrit
wt.-%	0.02	0.9	1.7	18.5	12.0	2.6	7 FN (WRC-92)

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C	Hardness HB
u	470 (≥ 320)	610 (≥ 510)	31 (≥ 25)	140 (≥ 25)	58 (≥ 32)	210

Operating data



Rod marking

W 19 12 3 LSi
ER 316 LSi

Dimension mm
0.8
1.0
1.2
1.6 × 1000
2.0 × 1000
2.4 × 1000
3.2 × 1000

Heat input max. 2.0 kJ/mm, interpass temperature max. 150ºC.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Shielding gas: Ar, Ar + 20 – 30% He, Ar + 1 – 5% H_2. The addition of helium and hydrogen increases the energy of the arc.
Gas flow: 8 – 12 l/min (somewhat higher with helium).

Polarity: DC-

Approvals

TÜV (00488), DB (43.132.35), DNV GL, CE

GTAW

Avesta 317L/SNR

TIG rod, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	**AWS A5.9 / SFA-5.9**
W 19 13 4 L	ER317L

Characteristics and typical fields of application

TIG rod of W 19 13 4 L / ER317L for welding 18Cr-14Ni-3Mo / 317L austenitic stainless steels and similar. The enhanced content of chromium, nickel and molybdenum compared to 1.4404 / 316L gives improved corrosion properties in acid chloride containing environments. The microstructure is austenite with 5 – 10% ferrite. Better resistance to general, pitting and intercrystalline corrosion in chloride containing environments than 1.4404 / 316L. Intended for severe service conditions, i.e. in dilute hot acids.

Base materials

CrNiMo(N) austenitic stainless steels with higher Mo content or corrosion resistant claddings on mild steels

1.4429 X2CrNiMoN17-13-3, 1.4434 X2CrNiMoN18-12-4, 1.4435 X2CrNiMo18-14-3, 1.4438 X2CrNiMo19-14-4, 1.4439 X2CrNiMoN17-13-5

AISI 316L, 316LN, 317L, 317LN, 317LMN

UNS S31600, S31653, S31703, S31726, S31753

Typical analysis of the wire rod

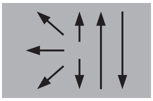
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.02	0.4	1.7	19	13.5	3.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Hardness HB
u	440	630	28	100	200

u untreated, as-welded – shielding gas Ar + 1 – 5% H_2.

Operating data



Dimension mm	**Current A**	**Voltage V**
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 - 18
3.2 × 1000	160 – 200	17 – 20

Heat input is max. 1.5 kJ/mm, interpass temperature max. 100°C.

Preheating and post-weld heat-treatment not necessary. In special cases, solution annealing can be performed at 1050°C followed by water quenching.

Shielding gas: Ar, Ar + 20 – 30% He, Ar + 1 – 5% H_2. The addition of helium and hydrogen increases the energy of the arc. Gas flow: 8 – 12 l/min (somewhat higher with helium).

Polarity: DC-

Approvals

-

BÖHLER ASN 5-IG

TIG rod, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W Z 18 16 5 N L	ER317L (mod.)

Characteristics and typical fields of application

TIG rod of W Z 18 16 5 N L / ER317L (mod.) type for 3 – 4% molybdenum alloyed CrNi-steels such as 1.4438 / 317L. Recommended for TIG root welding in combination with other welding methods. The weld metal shows a stable austenitic microstructure with good pitting resistance (PREN > 35) and crevice corrosion resistance as well as excellent CVN toughness behavior down to –269ºC. Resistant to intergranular corrosion. Increased molybdenum content to compensate segregation during welding of molybdenum-alloyed steels. Application temperature max. 400ºC.

Base materials

1.4436 X3CrNiMo17-13-3, 1.4439 X2CrNiMoN17-13-5, 1.4429 X2CrNiMoN17-13-3, 1.4438 X2CrNiMo18-15-4, 1.4583 X10CrNiMoNb18-12

AISI 316Cb, 316LN, 317LN, 317L

UNS S31726

Typical analysis of the wire rod

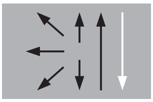
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	≤ 0.02	0.4	5.5	19	17.2	4.3	0.16	38	≤ 0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C	–269°C
u	440 (≥ 400)	650 (≥ 600)	35 (≥ 30)	120	75	70 (≥ 32)

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking

W Z 18 16 5 NL
1.4453

Dimension mm	Current A	Voltage V
1.0 × 1000	50 – 70	9 – 11
1.2 × 1000	60 – 80	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Heat input max. 1.5 kJ/mm, interpass temperature max. 150ºC. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1080 – 1130ºC followed by water quenching.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (00017), CE

Thermanit A

TIG Rod, stainless, high-alloyed

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 19 12 3 Nb	ER318

Characteristics and typical fields of application

Solid wire TIG rod of W 19 12 3 Nb Si / ER318 (mod.) type for joining and surfacing application with matching and similar stabilized and non-stabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching stabilized CrNiMo-steels.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-13-3, 1.4437 GX6CrNiMo18-12, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653, AISI 316, 316L, 316Ti, 316Cb

Typical analysis of the wire rod

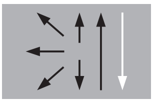
	C	Si	Mn	Cr	Ni	Mo	Nb
wt.-%	0.04	0.4	1.7	19.5	11.5	2.7	≥ 12×C

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	400	600	30	100

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Suggested heat input max. 1.5 kJ/mm and interpass temperature max. 100°C. Post-weld heat treatment generally not needed. In special cases solution annealing at 1050°C followed by water quenching. Pay attention to tendency to embrittlement.

Polarity: DC-

Shielding gas: 100% Ar. Gas flow: 4 – 8 l/min.

Approvals

TÜV (09474), DB (43.132.27), DNV GL

Thermanit H-347

TIG Rod, stainless, high-alloyed

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 19 9 Nb	ER347

Characteristics and typical fields of application

Solid wire TIG rod of W 19 9 Nb / ER347 type for joining and surfacing application with matching and similar stabilized and non-stabilized austenitic CrNi(N)-steels and cast steel grades. Resistant to intercrystalline corrosion and wet corrosion up to 400°C. Corrosion-resistant similar to matching stabilized austenitic CrN- steels and cast steel grades.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11

UNS S30400, S30403, S30453, S32100, S34700

AISI 347, 321,302, 304, 304L, 304LN

ASTM A296 Gr. CF 8 C, A157 Gr. C9, A320 Gr. B8C or D

Typical analysis of the wire rod

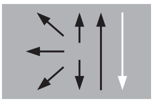
	C	Si	Mn	Cr	Ni	Nb
wt.-%	0.05	0.5	1.8	19.5	9.5	≥ 12×C

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	400	570	30	65

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100°C. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050°C followed by water quenching. Can be used for cladding, which normally requires stress relieving at approximately 590°C. Such a heat treatment will lower the ductility at room temperature. Always consult the supplier of the parent material or seek other expert advice to ensure that the correct heat treatment process is carried out.

Polarity: DC-

Shielding gas: 100% Ar. Gas flow: 4 – 8 l/min.

Approvals

TÜV (09475), DB (43.132.21), CE

Thermanit 20/25 Cu

TIG rod, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	**AWS A5.9 / SFA-5.9**
W 20 25 5 Cu L	ER385

Characteristics and typical fields of application

TIG rod of W 20 25 5 Cu L / ER385 for joining and surfacing work on matching austenitic 1.4539 / 904L CrNiMoCu-steels and cast steel grades. For joining these steels with unalloyed / low-alloy steels and cast steel grades. Good corrosion resistance similar to matching steels and cast steel grades, above all in reducing environment. Max. service temperature 350°C.

Base materials

1.4465 X1CrNiMoN25-25-2, 1.4505 X4NiCrMoCuNb20-18-2, 1.4506 X5NiCrMoCuTi20-18, 1.4537 X1CrNiMoCuN25-25-5, 1.4538 X2NiCrMoCuN20-18, 1.4539 X2NiCrMoCuN25-20-5, 1.4586 X5NiCrMoCuNb22-18

UNS N08904, S31726

AISI 904L

Typical analysis of the wire rod

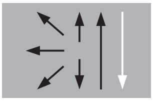
	C	Si	Mn	Cr	Ni	Mo	Cu
wt.-%	< 0.025	0.2	2.5	20.5	25.0	4.8	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	350	550	35	120

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking W 20 25 5 Cu L / ER385

Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Heat input max.1.5 kJ/mm, interpass temperature max. 150°C.

No preheating unless required by the parent material.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1120°C followed by water quenching.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (04301), CE

böhler welding by voestalpine

BÖHLER SAS 4-IG (Si)

TIG rod, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 19 12 3 Nb Si	ER318 (mod.)

Characteristics and typical fields of application

TIG rod of W 19 12 3 Nb Si / ER318 (mod.) type for joining and surfacing application with matching and similar stabilized and unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching stabilized CrNiMo-steels. Max. service temperature 400ºC.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3,

1.4436 X3CrNiMo17-13-3, 1.4437 GX6CrNiMo18-12, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2,

1.4401 X5CrNiMo17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4437 GX6CrNiMo18-12, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316, 316L, 316Ti, 316Cb

Typical analysis of the wire rod

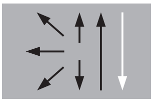
	C	Si	Mn	Cr	Ni	Mo	Nb
wt.-%	0.035	0.8	1.4	19	11.5	2.8	0.61

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C
u	490 (≥ 390)	670 (≥ 600)	33 (≥ 30)	100	(≥ 32)

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking

W 19 12 3 Nb Si
ER318 mod

Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Heat input max. 1.5 kJ/mm, interpass temperature max. 150ºC.

Post-weld heat treatment generally not needed. In special cases solution annealing at 1050ºC followed by water quenching.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (04427), CE

Thermanit 20/25 Cu

TIG rod, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 20 25 5 Cu L	ER385

Characteristics and typical fields of application

TIG rod of W 20 25 5 Cu L / ER385 for joining and surfacing work on matching austenitic 1.4539 / 904L CrNiMoCu-steels and cast steel grades. For joining these steels with unalloyed / low-alloy steels and cast steel grades. Good corrosion resistance similar to matching steels and cast steel grades, above all in reducing environment. Max. service temperature 350°C.

Base materials

1.4465 X1CrNiMoN25-25-2, 1.4505 X4NiCrMoCuNb20-18-2, 1.4506 X5NiCrMoCuTi20-18, 1.4537 X1CrNiMoCuN25-25-5, 1.4538 X2NiCrMoCuN20-18, 1.4539 X2NiCrMoCuN25-20-5, 1.4586 X5NiCrMoCuNb22-18

UNS N08904, S31726

AISI 904L

Typical analysis of the wire rod

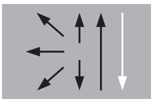
	C	Si	Mn	Cr	Ni	Mo	Cu
wt.-%	< 0.025	0.2	2.5	20.5	25.0	4.8	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	350	550	35	120

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking W 20 25 5 Cu L / ER385

Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Heat input max.1.5 kJ/mm, interpass temperature max. 150°C.

No preheating unless required by the parent material.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1120°C followed by water quenching.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (04301), CE

BÖHLER CN 20/25 M-IG

TIG rod, stainless, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W Z 20 25 5 Cu L NL	ER385 (mod.)

Characteristics and typical fields of application

TIG rod of W 20 25 5 Cu L / ER385 (mod.) type designed for welding corrosion resistant 4 – 5% Mo-alloyed CrNi-steels such as 1.4539 / 904L. Due to the high Mo content (6.2%) as compared to 1.4539 / UNS N08904, the segregation high Mo-alloyed CrNi-weld metal can be compensated. The fully austenitic weld metal possesses a marked resistance towards pitting and crevice corrosion in chloride containing media. Very high pitting resistant equivalent ($PRE_N \geq 45$). Highly resistant against sulfuric, phosphoric, acetic and formic acid, as well as seawater and brackish water. Due to the low C-content of the weld metal, the risk of intergranular corrosion is low. The high Ni-content in comparison to standard CrNi-weld metals leads to high resistance to stress corrosion cracking. Especially suitable for sulfur and phosphorus production, pulp and paper industry, flue gas desulfurization plants. Other applications include, but are not limited to; fertilizer production, petrochemical industry, fatty, acetic and formic acid production, seawater sludge fittings and pickling plants.

Base materials

1.4505 X4NiCrMoCuNb20-18-2, 1.4506 X5NiCrMoCuTi20-18, 1.4537 X1CrNiMoCuN25-25-5, 1.4538 X2NiCrMoCuN20-18, 1.4539 X1NiCrMoCu25-20-5, 1.4586 X5NiCrMoCuNb22-18

UNS S31726, N08904

AISI 904L

Typical analysis of the wire rod

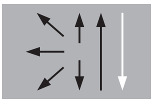
	C	Si	Mn	Cr	Ni	Mo	N	Cu	PRE_N
wt.-%	≤ 0.02	0.7	4.7	20	25.4	6.2	0.12	1.5	≥ 45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–296°C
u	440 (≥ 320)	670 (≥ 510)	42 (≥ 25)	145	90 (≥ 32)

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking

WZ 20 25 5 Cu NL
ER385

Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Suggested heat input is max.1.5 kJ/mm, interpass temperature max. 100°C.

No preheating unless required by the parent material.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1120°C.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (04881), Equinor, CE

BÖHLER A 7 CN-IG

Solid wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
18 8 Mn	ER307 (mod.)

Characteristics and typical fields of application

Solid wire G 18 8 Mn / ER307 (mod.) for joining heat resistant Cr-steels and heat resistant austenitic steels. Max. service temperature 850ºC. Suited for fabricating dissimilar austenitic-ferritic joints at a max. application temperature of 300ºC. Very well suited für joining of thin plates in fully automized prozesses for example exhaust systems. Available in Böhler BASEdrum 250 and ECOdrum 100, 250, 400.

Base materials

For fabrication, repair and maintenance! Dissimilar joints, tough buffer and intermediate layers prior to hardfacing, 14% manganese steels, 13 – 17% chromium and heat resistant steels up to 850ºC, armour plates, high carbon and quenched and tempered steels, surfacing of gears, valves, turbine blades etc.

Typical analysis of the solid wire

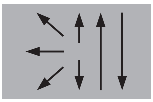
	C	Si	Mn	Cr	Ni
wt.-%	0.08	0.9	7.0	19.2	9.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–110°C
u	430 (≥350)	640 (≥500)	36 (≥25)	110	≥32

u untreated, as welded – shielding gas Ar + max. 2.5% CO_2

Operating data



Polarity	DC+
Shielding gas (EN ISO 14175)	Ar + max. 2.5% CO_2

Dimension mm
0.8
1.0
1.2
1.4

Preheating and interpass temperature as required by the base metal.

Approvals

TÜV (00024.), DB (43.014.07), C.E

böhler welding by voestalpine

Thermanit 17/15 TT

Solid wire, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A
S G Z 17 15 Mn W

Characteristics and typical fields of application

Solid wire of G Z 17 15 Mn W type for joining applications with cryogenic austenitic CrNi(N)-steels and cast steel grades and cryogenic 9Ni-steels suitable for quenching and tempering. Good toughness at subzero temperatures as low as –196ºC.

Base materials

1.5662 X8Ni9, 1.4311 X2CrNiN18-10

Typical analysis of the solid wire

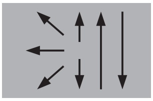
	C	Si	Mn	Cr	Ni	W
wt.-%	0.20	0.4	10.5	17.5	14.0	3.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–196°C
u	430	600	30	80	50

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30

Preheating as required by the base metal.

Shielding gas: Ar + 8 – 10% CO_2, Ar + 2 – 3% CO_2 (M12) or Ar + 1 – 2 % O_2 (M13). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV (02890), BV, DNV GL, LR, CE

Thermanit JE-308L Si

Solid wire, high-alloyed, stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 19 9 L Si	ER308LSi

Characteristics and typical fields of application

Solid wire of G 19 9 L Si / ER308LSi type for joining and surfacing applications with matching and similar stabilized and unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching low-carbon and stabilized austenitic 18Cr8Ni(N)-steels. The wire shows very good wetting and feeding characteristics, with excellent weld metal toughness down to –196ºC. Application temperature max. 350ºC.

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

Typical analysis of the solid wire

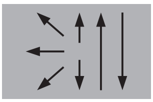
	C	Si	Mn	Cr	Ni
wt.-%	≤0.02	0.9	1.7	20	10.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	390 (≥ 320)	540 (≥ 510)	38 (≥ 35)	110	46 (≥ 32)

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	90 – 120	18 – 22
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC.

Post-weld heat treatment generally not needed. In special cases solution annealing at 1000ºC followed by water quenching.

Shielding gas: Ar + 2 – 3 % CO_2 or Ar + 1 – 2 % O_2. Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV (00555), DB (43.132.08), DNV GL, ABS, BV, NAKS, CE

BÖHLER EAS 2-IG (LF)

Solid wire, high-alloyed, austenitic stainless, cryogenic

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 19 9 L	ER308L

Characteristics and typical fields of application

Solid wire G 19 9 L / ER308L type for welding 1.4306 / 304L, 304LN steel grades. Controlled weld metal ferrite content, particularly for good cryogenic toughness and lateral expansion down to –196ºC. Max. service temperature 350ºC.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the solid wire

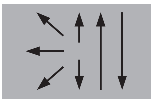
	C	Si	Mn	Cr	Ni	FN
wt.-%	≤ 0.02	0.5	1.7	20	10.5	3 – 6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C	Lateral expansion mm –196°C
u	410 (≥ 320)	540 (≥ 510)	38 (≥ 35)	110 (≥ 100)	50 (≥ 32)	≥ 0.38

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 150ºC.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1000ºC followed by water quenching.

Shielding gas: Ar + 2 – 3% CO_2. Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

On request

Thermanit GE-316L

Solid wire, high-alloyed, austenitic stainless

Classifications

EN 12072	AWS A5.9 / SFA-5.9
G 19 12 3 L	ER316L

Characteristics and typical fields of application

GMAW solid wire of type 316L / 19 12 3 L for joining and surfacing application with matching and similar unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion-resistance similar to matching low-carbon and stabilized austenitic 17Cr-12Ni-2Mo-steels. The wire shows very good wetting and feeding characteristics, with excellent weld metal toughness down to -196ºC. Max. service temperature 400ºC.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-13-3, 1.4571 X6CrNiMoTi17-12-2 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the solid wire

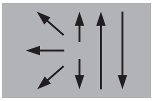
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.02	0.4	1.7	18.4	12.4	2.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–196°C
u	430 (≥ 320)	580 (≥ 510)	38 (≥ 25)	120	≥ 32

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Rod marking W 19 12 3 L
ER 316 L

Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC.

Shielding gas: Ar + 2 – 3 % CO_2 (M12) or Ar + 1 – 2 % O_2 (M13). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

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Thermanit GE-316L Si

Solid wire, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 19 12 3 L Si	ER316LSi

Characteristics and typical fields of application

Solid wire of G 19 12 3 L Si / ER316LSi type for joining and surfacing application with matching and similar non-stabilized austenitic CrNi(N) and CrNiMo(N) steels and cast steel grades. Corrosion resistance similar to matching low-carbon and stabilized austenitic CrNiMo-steels and cast steel grades. Max. service temperature 400ºC. Low temperature service down to –196ºC.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3, 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the solid wire

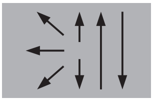
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.02	0.8	1.7	18.4	12.4	2.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	430 (≥ 320)	580 (≥ 510)	38 (≥ 25)	120	45 (≥ 32)

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	90 – 120	18 – 22
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Polarity: DC+

Shielding gas: Shielding gas: Ar + 2% CO_2, Ar + 2 – 3% CO_2 (M13) or Ar + 0 – 5% H_2 + 0 – 5% CO_2 (M11). Gas flow: 15 – 20 l/min.

Approvals

TÜV (00489), DB (43.132.10), DNV GL, ABS, BV, LR (spec. List), NAKS, CE

Thermanit 19/15

Solid wire, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
S G 20 16 3 Mn N L	ER316LMn

Characteristics and typical fields of application

Solid wire of G 20 16 3 Mn N L / ER316L (mod.) type for joining and surfacing applications with matching and similar austenitic CrNi(N) and CrNiMo(Mn,N)-steels. Corrosion resistance similar to low-carbon CrNiMo(Mn,N)-steels and cast steel grades. Seawater resistant, good resistance to nitric acid, selective attack max. 200 µm. Non-magnetic (permeability in field of 8000 A/m max. µr 1.01). Particularly suited for corrosion conditions in urea synthesis plants for welding work on steel X2CrNiMo18-12. Resulting all-weld metal microstructure is austenite with max. 0.6% ferrite. Max. service temperature 350ºC.

Base materials

1.3941 (G)X4CrNi18-3, 1.3945 X2CrNiN18-13, 1.3948 X4CrNiMnMoN19-13-8, 1.3952 (G)X2CrNiMoN18-14-3 1.3953 (G)X2CrNiMo18-15, 1.3955 GX12Cr18-11, 1.3965 X8CrMnNi18-8, 1.4315 X5CrNiN19-9, 1.4429 X2CrNiMoN17-13-3 1.4561 X1CrNiMoTi18-13-2, 1.6903 10CrNiTi18-10

Cryogenic 3.5 – 5% Ni-steels

UNS S31653, AISI 316LN

Typical analysis of the solid wire

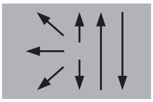
	C	Si	Mn	Cr	Ni	Mo	N
wt.-%	0.03	0.5	7.5	20.5	15.5	3.0	0.18

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	430	650	30	80

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 260	26 – 30

Suggested heat input max. 1.5 kJ/mm and interpass temperature max. 100ºC.

When cladding high temperature and cast steel grades, preheating is according to the parent material (150ºC). In case if excessive hardening of the parent material, stress relieving can be performed at 510ºC for max. 20 h, annealing above 530ºC only prior to the final pass.

Shielding gas: Ar + 2 – 3% CO_2 (M12) or Ar + 1 – 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV (10267), DB (43.132.12), CE

böhler welding by voestalpine

Avesta 317L/SNR

Solid wire, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 19 13 4 L	ER317L

Characteristics and typical fields of application

Solid wire of G 19 13 4 L / ER317L type for welding 18Cr-14Ni-3Mo / 317L austenitic stainless steels and similar. The enhanced content of chromium, nickel and molybdenum compared to 1.4404/316L gives improved corrosion properties in acid chloride containing environments. The microstructure is austenite with 5 – 10% ferrite. Better resistance to general, pitting and intercrystalline corrosion in chloride containing environments than 1.4404 / 316L. Intended for severe service conditions, i.e. in dilute hot acids.

Base materials

CrNiMo(N) austenitic stainless steels with higher Mo content or corrosion resistant claddings on mild steels

1.4429 X2CrNiMoN17-13-3, 1.4434 X2CrNiMoN18-12-4, 1.4435 X2CrNiMo18-14-3, 1.4438 X2CrNiMo19-14-4, 1.4439 X2CrNiMoN17-13-5

AISI 316L, 316LN, 317L, 317LN, 317LMN

UNS S31600, S31653, S31703, S31726, S31753

Typical analysis of the solid wire

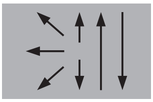
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.02	0.4	1.7	19	13.5	3.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –40°C	Hardness HB
u	420 (≥ 350)	630 (≥ 550)	31 (≥ 25)	85	(≥ 70)	200

u untreated, as-welded – shielding gas Ar + 1.8% CO_2 + 0.03% NO

Operating data



Dimension mm	Current A	Voltage V
1.2 spray arc	200 – 260	26 – 30

Suggested heat input is max. 1.5 kJ/mm, interpass temperature max. 100°C.

Preheating and post-weld heat-treatment not necessary. In special cases, solution annealing can be performed at 1050°C followed by water quenching.

Shielding gas: Ar + 2 – 3% CO_2 or Ar + 1 – 2% O_2. Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

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GMAW

BÖHLER ASN 5-IG (Si)

Solid wire, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G Z 18 16 5 N L	ER317L (mod.)

Characteristics and typical fields of application

Solid wire of G Z 18 16 5 N L / ER317L (mod.) type for joining of 3 – 4% Mo alloyed CrNi-steels such as 1.4438 / 317L. High Mo content provides high resistance to chloride-containing aqueous media and pitting corrosion. Non-magnetic. Well-suited for joining and surfacing of matching and similar austenitic unstabilized and stabilized stainless and non-magnetic CrNiMo(N)-steels and cast steel grades. Excellent CVN toughness behavior down to –196ºC. Can also be used for depositing intermediate layers when welding products clad with a matching or similar overlay. Resistant to intergranular corrosion. Application temperature max. 400ºC.

Base materials

1.4436 X3CrNiMo17-13-3, 1.4439 X2CrNiMoN17-13-5, 1.4429 X2CrNiMoN17-13-3, 1.4438 X2CrNiMo18-15-4, 1.4583 X10CrNiMoNb18-12

AISI 316Cb, 316LN, 317LN, 317L

UNS S31726

Typical analysis of the solid wire

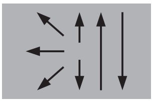
	C	Si	Mn	Cr	Ni	Mo	N	Ti	PRE_N	FN
wt.-%	0.02	0.4	5.5	19	17.2	4.3	0.16	17.2	37.1	≤ 0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	430 (≥ 400)	650 (≥ 600)	35 (≥ 30)	110	50 (≥ 32)

u untreated, as-welded – shielding gas Ar + 20% He + 0.05% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	90 – 120	18 – 22
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 150ºC.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1080 – 1130ºC followed by water quenching.

Shielding gas: Ar + 20 – 30% He + max. 2% CO_2, Ar + 20% He + 0.5% CO_2. Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV (04139), DNV GL, CE

Thermanit A Si

Solid wire, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 19 12 3 Nb Si	ER318 (mod.)

Characteristics and typical fields of application

Solid wire of G 19 12 3 Nb Si / ER318 (mod.) type type for joining and surfacing application with matching and similar stabilized and non-stabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching stabilized CrNiMo-steels. Max. service temperature 400ºC.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-13-3, 1.4437 GX6CrNiMo18-12, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653, AISI 316, 316L, 316Ti, 316Cb

Typical analysis of the solid wire

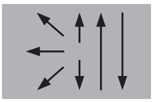
	C	Si	Mn	Cr	Ni	Mo	Nb
wt.-%	0.05	0.8	1.5	19	12.0	2.8	≥ 12×C

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	390	600	30	70

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	90 – 120	18 – 22
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30

Suggested heat input max. 1.5 kJ/mm and interpass temperature max. 100ºC. SPost-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Polarity: DC+

Shielding gas: Shielding gas: Ar + 2% O_2 or Ar + 2 – 3% CO_2 (M13). Gas flow: 12 – 16 l/min.

Approvals

TÜV (00601), DB (43.132.02), CE

GMAW

Thermanit H Si

Solid wire, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 19 9 Nb Si	ER347Si

Characteristics and typical fields of application

Solid wire of G 19 9 Nb Si / ER347Si type for joining and surfacing application with matching and similar stabilized and non-stabilized austenitic CrNi(N)-steels and cast steel grades. Max. service temperature 400ºC. Corrosion-resistant similar to matching stabilized austenitic CrNi-steels .

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11

UNS S30400, S30403, S30453, S32100, S34700

AISI 347, 321,302, 304, 304L, 304LN

Typical analysis of the solid wire

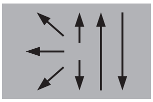
	C	Si	Mn	Cr	Ni	Nb
wt.-%	0.06	0.8	1.5	19.5	9.5	≥ 12×C

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	400 (≥ 350)	570 (≥ 550)	30 (≥ 25)	65

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	90 – 120	18 – 22
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Generally no heat treatment needed. Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC.

Polarity: DC+

Shielding gas: Ar + 2% CO_2 (M12) or Ar + 2 – 3% CO_2 (M13). Gas flow: 12 – 16 l/min.

Approvals

TÜV (00604), DB (43.132.06), CE

Thermanit 20/25 Cu

Solid wire, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 20 25 5 Cu L	ER385

Characteristics and typical fields of application

Solid wire of G 20 25 5 Cu L / ER385 type for joining and surfacing of matching austenitic CrNiMoCu-steels. For joining these steels with unalloyed / low-alloyed steels. Good corrosion resistance similar to matching steels and cast steel grades, above all in reducing environment. Max. service temperature 350ºC.

Base materials

1.4465 X1CrNiMoN25-25-2, 1.4505 X4NiCrMoCuNb20-18-2, 1.4506 X5NiCrMoCuTi20-18, 1.4537 X1CrNiMoCuN25-25-5 1.4538 X2NiCrMoCuN20-18, 1.4539 X2NiCrMoCuN25-20-5, 1.4586 X5NiCrMoCuNb22-18

UNS N08904

AISI 904L

Typical analysis of the solid wire

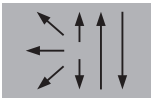
	C	Si	Mn	Cr	Ni	Mo	Cu
wt.-%	< 0.025	0.2	2.5	20.5	25.0	4.8	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	350	550	35	55

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 260	26 – 30

Suggested heat input is max.1.5 kJ/mm, interpass temperature max. 150ºC.

No preheating unless required by the parent material.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1120ºC.

Shielding gas: Ar + 2 – 3% CO_2 or Ar + 1 – 2% O_2. Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV (04302), CE

GMAW

BÖHLER CN 20/25 M-IG (Si)

Solid wire, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G Z 20 25 5 Cu N L	ER385 (mod.)

Characteristics and typical fields of application

Solid wire of G 20 25 5 Cu L / ER385 (mod.) type for welding corrosion resistant 4 – 5% Mo-alloyed CrNi-steels such as 1.4539 / 904L. Due to the high Mo content (6.2%) in comparison to 1.4539 / UNS N08904, the high segregation rate of high Mo-alloyed CrNi-weld metal can be compensated. The fully austenitic weld metal possesses a marked resistance to pitting and crevice corrosion in chloride containing media. Very high pitting resistant equivalent (PREN ≥ 45). Highly resistant against sulfuric, phosphoric, acetic and formic acid, as well as seawater and brackish water. Due to the low C-content of the weld metal, the risk of intergranular corrosion is low. The high Ni-content in comparison to standard CrNi-weld metals leads to high resistance to stress corrosion cracking. Especially suitable for sulfur and phosphorus production, pulp and paper industry, flue gas desulfurization plants. Other applications include, but are not limited to; fertilizer production, petrochemical industry, fatty, acetic and formic acid production, seawater sludge fittings and pickling plants.

Base materials

1.4505 X4NiCrMoCuNb20-18-2, 1.4506 X5NiCrMoCuTi20-18, 1.4537 X1CrNiMoCuN25-25-5, 1.4538 X2NiCrMoCuN20-18, 1.4539 X1NiCrMoCu25-20-5, 1.4586 X5NiCrMoCuNb22-18

UNS S31726, N08904

AISI 904L

Typical analysis of the solid wire

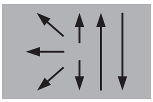
	C	Si	Mn	Cr	Ni	Mo	N	Cu	PRE_N
wt.-%	≤ 0.02	0.7	4.7	20	25.4	6.2	0.12	1.5	≥ 45.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	410 (≥ 320)	650 (≥ 510)	39 (≥ 25)	100	55 (≥ 32)

u untreated, as-welded – shielding gas Ar + 20% He + 0.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	60 – 100	18 – 20
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 260	26 – 30

Suggested heat input is max.1.5 kJ/mm, interpass temperature max. 100°C.

No preheating unless required by the parent material.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1120°C.

Shielding gas: Ar + 20 – 30% He + max. 2% CO_2, Ar + 20% He + 0.5% CO_2. Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV (04897), Equinor, CE

Thermanit JE-308L - Marathon 213

SAW wire/flux combination, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 9 L	ER308L	S F CS 2 DC

Characteristics and typical fields of application

Thermanit JE-308L - Marathon 213 is a wire/flux combination for submerged arc welding of stainless steel grades such as 1.4306 / 304L.

Solid wire of S 19 9 L / ER308L type for joining and surfacing applications with matching and similar stabilized and unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Max. service temperature 350ºC. Corrosion resistance similar to matching low-carbon and stabilized austenitic 18Cr-8Ni(N)-steels. Good toughness at subzero temperatures as low as –196ºC.

Marathon 213 is a fused flux with good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the weld metal

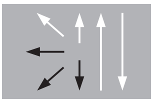
wt.-%	C	Si	Mn	Cr	Ni
wire	0.015	0.45	1.6	20.0	10.0
all-weld metal	0.016	0.65	1.1	19.5	9.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	(≥ 320)	(≥ 550)	(≥ 35)	(≥ 70)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	26 – 30
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (09612), CE

SAW

Thermanit JE-308L - Marathon 431

SAW wire/flux combination, high-alloyed, austenitic stainless

SAW

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 9 L	ER308L	S A FB 2 DC

Characteristics and typical fields of application

Thermanit JE-308L - Marathon 431 is a wire/flux combination for submerged arc welding of stainless steel grades such as 1.4306 / 304L.

Solid wire of S 19 9 L / ER308L type for joining and surfacing applications with matching and similar stabilized and unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Max. service temperature 350ºC. Corrosion resistance similar to matching low-carbon and stabilized austenitic 18Cr-8Ni(N)-steels and cast steel grades. Good toughness at subzero temperatures as low as –196ºC.

Marathon 431 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the weld metal

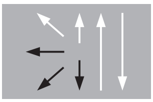
wt.-%	C	Si	Mn	Cr	Ni
wire	0.015	0.45	1.6	20.0	10.0
all-weld metal	0.015	0.60	1.3	19.5	9.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–196°C
u	(≥ 320)	(≥ 550)	(≥ 30)	(≥ 65)	40

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	26 – 30
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (06114), CE

Thermanit JE-308L - Avesta Flux 805

SAW wire/flux combination, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 9 L	ER308L	S A AF 2 DC

Characteristics and typical fields of application

Thermanit JE-308L - Avesta Flux 805 is a wire/flux combination for submerged arc welding of stainless steel grades such as 1.4306 / 304L.

Solid wire of S 19 9 L / ER308L type for joining and surfacing applications with matching and similar stabilized and unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Max. service temperature 350ºC. Corrosion resistance similar to matching low-carbon and stabilized austenitic 18Cr-8Ni(N)-steels. Good toughness at subzero temperatures as low as –196ºC.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the weld metal

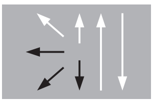
wt.-%	C	Si	Mn	Cr	Ni
wire	0.015	0.45	1.6	20.0	10.0
all-weld metal	0.015	0.60	1.2	20.5	10.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–196°C
u	410 (≥ 320)	580 (≥ 550)	36 (≥ 30)	85 (≥ 65)	35

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	26 – 30
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

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BÖHLER EAS 2-UP (LF) - BÖHLER BB 203

SAW wire/flux combination, high-alloyed, austenitic stainless, cryogenic

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 9 L	ER308L	S A FB 2 DC

Characteristics and typical fields of application

BÖHLER EAS 2-UP (LF) - BB 203 is a wire/flux combination for submerged arc welding of stainless steel grades such as 1.4306 / 304L.

Solid wire of S 19 9 L / ER308L type with controlled weld metal ferrite content (6 FN), particularly for good cryogenic toughness and lateral expansion down to –196ºC. Max. service temperature 350ºC. Applications can be found in multiple cryogenic applications like LNG.

BB 203 is an agglomerated basic flux with relative high basicity index, however with good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the weld metal

wt.-%	C	Si	Mn	Cr	Ni	FN
wire	0.02	0.40	1.8	20.0	11.0	3 – 8
all-weld metal	0.02	0.50	1.5	19.5	10.8	3 – 8

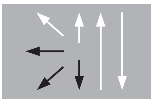
* FN according to WRC-92

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C	Lateral expansion mm –196°C
u	410 (≥ 320)	580 (≥ 550)	36 (≥ 30)	85 (≥ 65)	(≥ 40)	(≥ 0.38)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	200 – 300	26 – 30
3.2	300 – 400	29 – 33

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1000ºC followed by water quenching.

Approvals

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SAW

Thermanit GE-316L - Marathon 213

SAW wire/flux combination, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 12 3 L	ER316L	S F CS 2 DC

Characteristics and typical fields of application

Thermanit GE-316L - Marathon 213 is a wire-flux-combination for welding of stainless steel grades such as 1.4435 / 316L.

Solid wire of S 19 12 3 L / ER316L type for joining and surfacing application with matching and similar unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching low-carbon and stabilized austenitic CrNiMo-steels. Max. service temperature 400ºC. Low temperature service down to –196ºC.

Marathon 213 is an fused flux with good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3,

1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2,

1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the weld metal

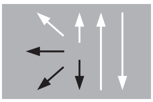
wt.-%	C	Si	Mn	Cr	Ni	Mo
wire	0.01	0.45	1.6	18.5	12.2	2.7
all-weld metal	0.015	0.70	1.1	17.9	12.2	2.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–60°C
u	405 (≥ 350)	580 (≥ 560)	37 (≥ 30)	90 (≥ 70)	80

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

No preheating. Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (09613), CE, DNV GL, LR

SAW

SAW

Thermanit GE-316L - Avesta Flux 805

SAW wire/flux combination, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 12 3 L	ER316L	S A AF 2 DC

Characteristics and typical fields of application

Thermanit GE-316L - Marathon 431 is a wire-flux-combination for welding of stainless steel grades such as 1.4435 / 316L.

Solid wire of S 19 12 3 L / ER316L type for joining and surfacing application with matching and similar unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching low-carbon and stabilized austenitic CrNiMo-steels. Max. service temperature 400ºC. Low temperature service down to –196ºC.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3,

1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2,

1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the weld metal

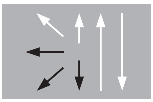
wt.-%	C	Si	Mn	Cr	Ni	Mo
wire	0.01	0.45	1.6	18.5	12.2	2.7
all-weld metal	0.01	0.60	1.2	19	12.2	2.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	430 (≥ 350)	570 (≥ 550)	36 (≥ 30)	80 (≥ 60)	35

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

No preheating. Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

DNV GL

Thermanit GE-316L - Marathon 431

SAW wire/flux combination, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 12 3 L	ER316L	S A FB 2 DC

Characteristics and typical fields of application

Thermanit GE-316L - Marathon 431 is a wire-flux-combination for welding of stainless steel grades such as 1.4435 / 316L.

Solid wire of S 19 12 3 L / ER316L type for joining and surfacing application with matching and similar unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching low-carbon and stabilized austenitic CrNiMo-steels. Max. service temperature 400ºC. Low temperature service down to –196ºC.

Marathon 431 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3,

1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2,

1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the weld metal

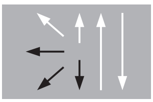
wt.-%	C	Si	Mn	Cr	Ni	Mo
wire	0.01	0.45	1.6	18.5	12.2	2.7
all-weld metal	0.01	0.55	1.2	18.0	12.2	2.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–120°C
u	(≥ 350)	(≥ 550)	(≥ 30)	(≥ 70)	(≥ 60)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

No preheating. Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC. Polarity DC+.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (06113), CE

SAW

Avesta 317L/SNR - Avesta Flux 805

SAW wire/flux combination, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 13 4 L	ER317L	S A AF 2 DC

Characteristics and typical fields of application

Avesta 317L/SNR - Avesta Flux 805 is a wire/flux combination for submerged arc welding of 18Cr-14Ni-3Mo / 317L austenitic stainless steels and similar.

Solid wire of S 19 13 4 L / ER317L type resulting in an austenitic microstructure with 5 – 10% ferrite. The enhanced content of chromium, nickel and molybdenum compared to 316L gives improved corrosion properties in acid chloride containing environments. Better resistance to general, pitting and intercrystalline corrosion in chloride containing environments than the base material 1.4404 / 316L. Intended for severe service conditions, i.e. in dilute hot acids. Scaling temperature approximately 850ºC in air.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4429 X2CrNiMoN17-13-3, 1.4434 X2CrNiMoN18-12-4, 1.4435 X2CrNiMo18-14-3, 1.4438 X2CrNiMo19-14-4,

1.4439 X2CrNiMoN17-13-5

AISI 316L, 316LN, 317L, 317LN, 317LMN

UNS S31600, S31653, S31703, S31726, S31753

Typical analysis of the weld metal

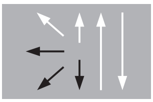
wt.-%	C	Si	Mn	Cr	Ni	Mo
wire	0.01	0.45	1.4	19.0	13.5	3.6
all-weld metal	0.01	0.60	1.2	19.5	13.4	3.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–40°C
u	410 (≥ 350)	580 (≥ 550)	36 (≥ 25)	70	60

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
3.2	350 – 500	29 – 33

Suggested heat input is max. 1.5 kJ/mm, interpass temperature max. 100ºC. Polarity: DC+

Preheating and post-weld heat-treatment not necessary. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

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BÖHLER ASN 5-UP - BÖHLER BB 203

SAW wire/flux combination, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S Z 18 16 5 N L	ER317L (mod.)	S A FB 2 DC

Characteristics and typical fields of application

BÖHLER ASN 5-UP - BB 203 is a wire/flux combination for submerged arc welding of CrNiMo-steels containing 3 – 4% Mo e.g. 1.4438 / 317L.

Solid wire of S Z 18 16 5 N L / ER317L (mod.) type for joining and surfacing of matching and similar austenitic un-stabilized and stabilized stainless and non-magnetic CrNiMo(N)-steels and cast steel grades. Excellent CVN toughness behavior down to –196ºC. Well-suited for depositing intermediate layers when welding products clad with a matching or similar overlay. The weld metal shows a stable austenitic microstructure and the high Mo content provides high resistance to pitting and crevice corrosion in chloride-bearing aqueous media. Resistant to intergranular corrosion. Application temperature max. 400ºC.

BÖHLER BB 203 is an agglomerated fluoride-basic flux providing good operating characteristics, smooth beads and a low-hydrogen weld metal. For more information regarding the sub-arc welding flux, see the separate datasheet.

Base materials

1.4436 X3CrNiMo17-13-3, 1.4439 X2CrNiMoN17-13-5, 1.4429 X2CrNiMoN17-13-3, 1.4438 X2CrNiMo18-15-4, 1.4583 X10CrNiMoNb18-12

AISI 316Cb, 316LN, 317LN, 317L

UNS S31726

Typical analysis of the weld metal

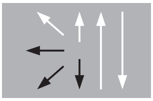
wt.-%	C	Si	Mn	Cr	Ni	Mo	N	PRE_N
wire	0.01	0.40	5.2	19.0	17.0	4.1	0.17	34.6
all-weld metal	0.01	0.50	4.5	18.5	16.8	4.1	0.15	34

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	420 (≥ 360)	630 (≥ 550)	30 (≥ 25)	100 (≥ 70)	60 (≥ 34)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
3.0	320 – 450	29 – 33

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 150ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1080 – 1130ºC followed by water quenching.

Approvals

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SAW

Thermanit H-347 - Marathon 213

SAW wire/flux combination, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 9 Nb	ER347	S F CS 2 DC

Characteristics and typical fields of application

Thermanit H 347 - Marathon 213 is a wire/flux-combination for submerged arc welding of stainless steel grades such as 1.4541 / 347.

Solid wire of S 19 9 Nb / ER347 type for joining and surfacing application with matching and similar stabilized and unstabilized austenitic CrNi(N)-steels and cast steel grades. Max. service temperature 400ºC. Corrosion resistance similar to matching stabilized austenitic CrNi-steels.

Marathon 213 is a fused flux with good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11

UNS S30400, S30403, S30453, S32100, S34700

AISI 347, 321, 302, 304, 304L, 304LN

Typical analysis of the weld metal

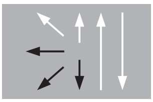
wt.-%	C	Si	Mn	Cr	Ni	Nb
wire	0.05	0.40	1.7	19.2	9.2	0.65
all-weld metal	0.05	0.60	1.3	18.7	9.2	0.50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	(≥ 380)	(≥ 550)	(≥ 30)	(≥ 70)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	28 – 32
3.0	320 – 450	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Polarity: DC+

Generally no heat treatment needed.

Approvals

TÜV (09613), CE

Thermanit H-347 - Marathon 431

SAW wire/flux combination, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 9 Nb	ER347	S A FB 2 DC

Characteristics and typical fields of application

Thermanit H 347 - Marathon 431 is a wire/flux-combination for submerged arc welding of stainless steel grades such as 1.4541 / 347.

Solid wire of S 19 9 Nb / ER347 type for joining and surfacing application with matching and similar stabilized and unstabilized austenitic CrNi(N)-steels and cast steel grades. Max. service temperature 400ºC. Corrosion resistance similar to matching stabilized austenitic CrNi-steels.

Marathon 431 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10,

1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11

UNS S30400, S30403, S30453, S32100, S34700

AISI 347, 321, 302, 304, 304L, 304LN

Typical analysis of the weld metal

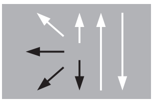
wt.-%	C	Si	Mn	Cr	Ni	Nb
wire	0.05	0.40	1.7	19.2	9.2	0.65
all-weld metal	0.04	0.60	1.3	18.8	9.2	0.55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C
u	(≥ 380)	(≥ 550)	(≥ 30)	(≥ 65)	(≥ 40)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	28 – 32
3.0	320 – 450	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Polarity: DC+

Generally no heat treatment needed.

Approvals

TÜV (06479), CE

Thermanit H-347 - Avesta Flux 805

SAW wire/flux combination, high-alloyed, austenitic stainless, stabilized

SAW

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 9 Nb	ER347	S A AF 2 DC

Characteristics and typical fields of application

Thermanit H 347 - Marathon 805 is a wire/flux-combination for submerged arc welding of stainless steel grades such as 1.4541 / 347.

Solid wire of S 19 9 Nb / ER347 type for joining and surfacing application with matching and similar stabilized and unstabilized austenitic CrNi(N)-steels and cast steel grades. Max. service temperature 400°C. Corrosion resistance similar to matching stabilized austenitic CrNi-steels.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10,

1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11

UNS S30400, S30403, S30453, S32100, S34700

AISI 347, 321, 302, 304, 304L, 304LN

Typical analysis of the weld metal

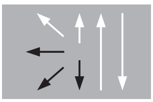
wt.-%	C	Si	Mn	Cr	Ni	Nb
wire	0.05	0.40	1.7	19.2	9.2	0.65
all-weld metal	0.04	0.60	1.3	19.5	9.2	0.55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	440 (≥ 380)	640 (≥ 550)	35 (≥ 30)	70 (≥ 55)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	28 – 32
3.0	320 – 450	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100°C. Polarity: DC+

Generally no heat treatment needed.

Approvals

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Thermanit A - Marathon 213

SAW wire/flux combination, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 12 3 Nb	ER318	S F CS 2 DC

Characteristics and typical fields of application

Thermanit A - Marathon 213 is a wire-flux-combination for submerged arc welding of stainless steel grades such as 1.4571 / 316Ti.

Solid wire of G 19 12 3 Nb Si / ER318 (mod.) type for joining and surfacing application with matching and similar stabilized and unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching stabilized CrNiMo-steels. Max. service temperature 400ºC. Applicable for service temperatures down to –120ºC.

Marathon 213 is an fused flux with good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3,

1.4436 X3CrNiMo17-13-3, 1.4437 GX6CrNiMo18-12, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2,

1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653, AISI 316, 316L, 316Ti, 316Cb

Typical analysis of the weld metal

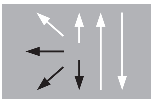
wt.-%	C	Si	Mn	Cr	Ni	Mo	Nb
wire	0.04	0.40	1.8	19.5	11.5	2.6	0.6
all-weld metal	0.04	0.60	1.2	19.0	11.5	2.6	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	(≥ 380)	(≥ 600)	(≥ 30)	(≥70)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Suggested heat input max. 1.5 kJ/mm and interpass temperature max. 100ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (09616), CE

SAW

Thermanit A - Marathon 431

SAW wire/flux combination, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 12 3 Nb	ER318	S A FB 2 DC

Characteristics and typical fields of application

Thermanit A - Marathon 431 is a wire-flux-combination for submerged arc welding of stainless steel grades such as 1.4571 / 316Ti.

Solid wire of G 19 12 3 Nb Si / ER318 (mod.) type for joining and surfacing application with matching and similar stabilized and unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching stabilized CrNiMo-steels. Max. service temperature 400ºC. Applicable for service temperatures down to –120ºC.

Marathon 431 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3,

1.4436 X3CrNiMo17-13-3, 1.4437 GX6CrNiMo18-12, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2,

1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316, 316L, 316Ti, 316Cb

Typical analysis of the weld metal

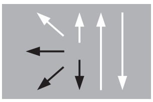
wt.-%	C	Si	Mn	Cr	Ni	Mo	Nb
wire	0.04	0.40	1.8	19.5	11.5	2.6	0.6
all-weld metal	0.04	0.50	1.3	19.0	11.5	2.6	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C
u	(≥ 380)	(≥ 550)	(≥ 30)	(≥ 70)	(≥ 40)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Suggested heat input max. 1.5 kJ/mm and interpass temperature max. 100ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (06985), CE

SAW

Thermanit A - Avesta Flux 805

SAW wire/flux combination, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 12 3 Nb	ER318	S A AF 2 DC

Characteristics and typical fields of application

Thermanit A – Avesta Flux 805 is a wire-flux-combination for submerged arc welding of stainless steel grades such as 1.4571 / 316Ti.

Solid wire of G 19 12 3 Nb Si / ER318 (mod.) type for joining and surfacing application with matching and similar stabilized and unstabilized austenitic CrNi(N) and CrNiMo(N)-steels and cast steel grades. Corrosion resistance similar to matching stabilized CrNiMo-steels. Max. service temperature 400ºC. Applicable for service temperatures down to –120ºC.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3,

1.4436 X3CrNiMo17-13-3, 1.4437 GX6CrNiMo18-12, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2,

1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316, 316L, 316Ti, 316Cb

Typical analysis of the weld metal

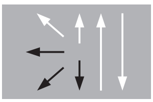
wt.-%	C	Si	Mn	Cr	Ni	Mo	Nb
wire	0.04	0.40	1.8	19.5	11.5	2.6	0.6
all-weld metal	0.04	0.50	1.3	20.0	11.5	2.6	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	490 (≥ 380)	660 (≥ 550)	30	50

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Suggested heat input max. 1.5 kJ/mm and interpass temperature max. 100ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

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SAW

Thermanit 20/16 SM - Marathon 104

SAW wire/flux combination, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S Z 22 17 8 4 N L	EG	S A FB 2 AC

Characteristics and typical fields of application

Thermanit 20/16 SM - Marathon 104 is a wire/flux combination for submerged arc welding of high-alloyed for welding and cladding of non-magnetic CrNiMo(Mn,N)-steels and castings.

Solid wire of S Z 22 17 8 4 N L type. Resistant to saltwater and ductile at low temperatures. Max. service temperature 350ºC.

Marathon 104 is an agglomerated fluoride-basic welding flux without Cr-support and neutral metallurgical behavior. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.3948 X4CrNiMnMoN19-13-8, 1.3951 X2CrNiMoN22-15, 1.3952 X2CrNiMoN18-14-3, 1.3957 X2CrNiMoNbN21-15,

1.3964 X2CrNiMnMoNNb21-16-5-3, 1.4569 GX2CrNiMoNbN21-15-4-3, 1.5662 X8X9

UNS S20910

Typical analysis of the weld metal

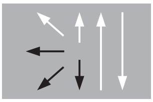
wt.-%	C	Si	Mn	Cr	Ni	Mo	N
wire	0.03	0.70	7.3	22.3	18.0	3.7	0.24
all-weld metal	0.02	0.70	7.0	21.8	18.0	3.7	0.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	450 (≥ 400)	680 (≥ 620)	37 (≥ 30)	90 (≥ 50)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Polarity: DC+

Preheating and post-weld heat treatment generally not needed.

Approvals

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Thermanit 20/25 Cu - Marathon 104

SAW wire/flux combination, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 20 25 5 Cu L	ER385	S A FB 2 AC

Characteristics and typical fields of application

Thermanit 20/25 Cu - Marathon 104 is a wire/flux combination for submerged arc welding of corrosion resistant 4 – 5% Mo-alloyed CrNi-steels such as 1.4539 / 904L.

Solid wire of S 20 25 5 Cu L / ER385 type for joining and surfacing work on matching austenitic CrNiMoCu-steels and cast steel grades. For joining these steels with unalloyed and low-alloyed steels. Especially applicable in sulfur and phosphorus production, pulp and paper industry, flue gas desulfurization plants, further on for fertilizer production, petrochemical industry, fatty, acetic and formic acid production, seawater sludge fittings and pickling plants which are proceeded with sea or brackish water. Good corrosion resistance similar to matching steels, above all in reducing environment. The fully austenitic weld metal possesses a marked resistance towards pitting and crevice corrosion in chloride containing media. Highly resistant against sulfuric, phosphoric, acetic and formic acid, as well as seawater and brackish water. The high Ni-content in comparison to standard CrNi-weld metals also leads to high resistance against stress corrosion cracking. Max. service temperature 350ºC.

Marathon 104 is an agglomerated fluoride-basic flux for submerged arc welding of stainless and heat resistant steel grades. The weld metal is characterized by high resistance to hot cracking and is recommended for the highest demanding applications. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4465 X1CrNiMoN25-25-2, 1.4505 X4NiCrMoCuNb20-18-2, 1.4506 X5NiCrMoCuTi20-18, 1.4537 X1CrNiMoCuN25-25-5,
1.4538 X2NiCrMoCuN20-18, 1.4539 X2NiCrMoCuN25-20-5, 1.4586 X5NiCrMoCuNb22-18

UNS N08904 AISI 904L

Typical analysis of the weld metal

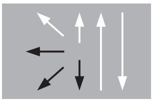
wt.-%	C	Si	Mn	Cr	Ni	Mo	Cu
wire	0.01	0.35	1.6	20.0	25.0	4.5	1.5
all-weld metal	0.02	0.45	1.6	19.7	25.0	4.5	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–196°C
u	410 (≥ 320)	650 (≥ 550)	34 (≥ 30)	(≥ 90)	60

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	39 – 33
3.2	350 – 500	29 – 33

The weld metal has a fully austenitic microstructure and therefore sensitive to hot cracking. No preheating unless required by the parent material. Single wire technique with wire diameter of max. 3.2 mm recommended. Suggested heat input is max.1.5 kJ/mm, interpass temperature max. 100ºC. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1120ºC. Polarity: DC+

Approvals

TÜV (07213), CE

SAW

Thermanit 25/22 H - Marathon 104

SAW wire/flux combination, high-alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 25 22 2 N L	ER310 (mod.)	S A FB 2 AC

Characteristics and typical fields of application

Thermanit 25/22 H - Marathon 104 is a wire/flux combination for submerged arc welding of high-alloyed corrosion resistant steel grades such as 1.4465 / UNS S31050. Solid SAW wire of S 25 22 2 N L / ER310 (mod.) type for joining and surfacing applications with matching/similar steels. Max. service temperature 350ºC. Good resistance to nitric acid and pitting corrosion in chloride-bearing environment. Especially for joining and surfacing applications in the equipment manufacturing for urea synthesis plants.

Marathon 104 is an agglomerated fluoride-basic flux for submerged arc welding of stainless and heat resistant steel grades. The weld metal is characterized by high resistance to hot cracking and is recommended for the highest demanding applications. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

Joining: 1.4465, X1CrNiMoN25-25-2, 725LN / UNS S31050

Overlay welding: On unalloyed and low-alloyed steel grades.

Typical analysis of the weld metal

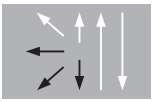
wt.-%	C	Si	Mn	Cr	Ni	Mo	N
wire	0.01	0.10	6.0	25	22.5	2.2	0.12
all-weld metal	0.02	0.25	5.2	24.7	22.5	2.2	0.12

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	(≥ 350)	(≥ 580)	(≥ 35)	(≥ 80)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
3.0	320 – 450	30 – 34

Suggested heat input is max. 1.0 kJ/mm adn interpass temperature max. 100ºC. Polarity: DC+

Post-weld heat treatment generally not needed when welding similar austenitic base metals.

When cladding and joining creep resistant steels and cast steel grades, preheating is determined by the parent metal, usually 150ºC. In case post-weld heat treatment is needed to soften the HAZ of the base metal, stress relieving should be limited to max 530ºC (recommended is 510ºC for max. 20 h). If it is necessary to apply a post-weld heat treatment above 530ºC, the last (cladding) layer should be performed after this post-weld heat treatment.

Approvals

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BÖHLER AM 500-UP - Marathon 104

SAW wire/flux combination, high alloyed, austenitic stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S Z 25 23 3 Mn N L	EG	S A FB 2 AC

Characteristics and typical fields of application

BÖHLER AM 500-UP - Marathon 104 is a wire/flux combination for SAW welding of high alloyed non-magnetic steel grades such as 1.3974.

Solid wire of S Z 25 23 3 Mn N L type especially for joining and surfacing applications in the manufacturing of submarines.

Marathon 104 is an agglomerated fluoride-basic welding flux without Cr support and neutral metallurgical behavior. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.3952-X2CrNiMoN18-14, 1.3964-X2CrNiMnMoNNb21-16-5-3, 1.3974-X2CrNiMnMoNNb23-17-6-3

Typical analysis of the weld metal

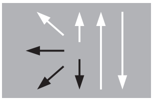
wt.-%	C	Si	Mn	Cr	Ni	Mo	N
wire	0.01	0.20	6.6	25.0	23.0	3.6	0.30
all-weld metal	0.02	0.30	6.0	24.5	23.0	3.6	0.24

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	460 (≥ 400)	720 (≥ 660)	37 (≥ 30)	100 (≥ 60)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33

Suggested heat input max. 1.5 kJ/mm, interpass temperature max. 120ºC.

Preferred wire diameter is 2.0 mm – suggested starting welding parameters: 300 A, 29 V and 0.45 m/min. Polarity: DC+

Preheating and post-weld heat treatment typically not required.

Approvals

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SAW

BÖHLER EAS 2-MC

Metal-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 9 L M M12 2	EC308L

Characteristics and typical fields of application

Austenitic metal-cored wire of T 19 9 L / EC308L type for welding matching and similar, stabilized or unstabilized, corrosion resistant austenitic CrNi-steels. The easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. The wire shows good wetting behavior and results in a smooth surface. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. This makes the metal-cored wire less sensitive to edge misalignment and variation in gap width as compared to solid wires. Suitable for service temperatures from –196ºC to 350ºC. The scaling temperature is approx. 800ºC in air. Ferrite measured with FeritScope FMP30 4 – 12 FN.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the wire

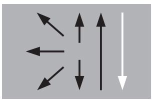
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.025	0.6	1.4	19.8	10.5	3 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C
u	420 (≥320)	560 (≥ 520)	36 (≥ 30)	105	40 (≥ 32)

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	100 – 280	10 – 27	3.5 – 13.0

Welding with conventional or pulsed power sources using DC+ polarity, but pulsed arc may be advantageous and especially when welding out of position. Forehand (pushing) technique preferred with a work angle of appr. 80º. Ar + 2 – 3 % CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min and the wire stick-out 15 – 20 mm. Then welding out of position, the metal-cored wires are similar to solid wires and pulsed arc welding is recommended.

Approvals

TÜV (09987), CWB, CE

BÖHLER EAS 2-FD

Flux-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A
T 19 9 L R M21 (C1) 3

AWS A5.22 / SFA-5.22
E 308LT0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 9 L R / E308LT0 type for welding of stainless steels such as 1.4307 / 304L. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures from –196ºC to 350ºC. The scaling temperature is approx. 850ºC in air. For welding in vertical-up and overhead positions, BÖHLER EAS 2 PW-FD should be preferred.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the wire

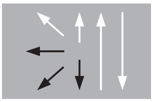
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.03	0.7	1.5	19.8	10.5	3 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C	–196°C
u	360 (≥ 320)	530 (≥ 520)	40 (≥ 30)	60	41	35 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0
1.6	~ 3	200 – 350	25 – 30	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (5348), DB (43.014.14), DNV GL, CE

FCW

Avesta FCW-2D 308L/MVR

Flux-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 9 L R M21 (C1) 3	E308LT0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 9 L R / E308LT0 type designed for welding 1.4307 / 304L type stainless steels with very good corrosion resistance under fairly severe conditions, e.g. in oxidizing acids and cold or dilute reducing acids. Also suitable for welding stainless steels that are stabilized with titanium or niobium, such as 1.4541 / 321, 1.4878 / 321H and 1.4550 / 347 in cases where the construction will be operating at temperatures below 400ºC. For higher temperatures, a niobium-stabilized consumable such as BÖHLER SAS 2-FD is required. The scaling temperature is approximately 850ºC in air.

Avesta FCW-2D 308L/MVR provides excellent weldability in flat as well as horizontal-vertical position. Great slag detachability and almost no spatter formation. Optimized to result in a shiny weld metal surface; also when welding with 100% CO_2. Due to the slow freezing rutile slag, the weld metal shows very smooth bead appearance and low temper discoloration, which makes post-weld cleaning easier. Welding in vertical-up and overhead positions is preferably done using Avesta FCW 308L/MVR-PW.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the wire

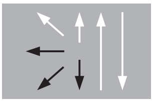
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.03	0.7	1.5	19.5	10.5	3 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C	Hardness HB
u	380 (≥ 320)	540 (≥ 520)	39 (≥ 30)	52	37	200

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0
1.6	~ 3	200 – 350	25 – 30	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. Suitable gas flow rate for welding outdoors is 18 – 25 l/min. Suggested heat input is max. 2.0 kJ/mm, interpass temperature max. 150ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (10744), CWB, DB (43.014.38), ABS, CE

BÖHLER EAS 2 PW-FD

Flux-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 9 L P M21 (C1) 1	E308LT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 9 L P / E308LT1 type for welding of stainless steels such as 1.4307 / 304L. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures from –196°C to 350°C. The scaling temperature is approximately 850°C in air. For flat and horizontal welding positions, BÖHLER EAS 2-FD may be preferred.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the wire

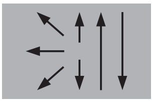
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.03	0.7	1.5	19.8	10.5	3 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	380 (≥ 320)	535 (≥ 520)	39 (≥ 30)	70	38 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
0.9	~ 3	100 – 160	22 – 27	8.0 – 15.0
1.2	~ 3	150 – 280	22 – 30	6.0 – 15.0
1.6	~ 3	200 – 360	23 – 28	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80°. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150°C and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050°C followed by water quenching.

Approvals

TÜV (09117), DB (43.014.23), DNV GL, CE

FCW

Avesta FCW 308L/MVR-PW

Flux-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 9 L P M21 (C1) 1	E308LT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 9 L P / E308LT1 type designed for welding 1.4307 / 304L type stainless steels with very good corrosion resistance under fairly severe conditions, e.g. in oxidizing acids and cold or dilute reducing acids. Also suitable for welding steels that are stabilized with titanium or niobium, such as 1.4541 / 321, 1.4878 / 321H and 1.4550 / 347 in cases where the construction will be operating at temperatures below 400ºC. For higher temperatures, a niobium-stabilized wire such as BÖHLER SAS 2 PW-FD is required. The scaling temperature is approximately 850ºC in air.

Avesta FCW 308L/MVR-PW has a stronger arc and a faster freezing slag compared to Avesta FCW-2D 308L/MVR. It is designed for all-round welding and can be used in all positions without changing the parameter settings. Very good slag detachability and almost no spatter formation. Due to the fast freezing rutile slag, the weldability is excellent also in the vertical-up and overhead positions.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the wire

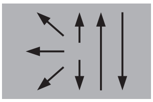
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.03	0.7	1.5	19.8	10.5	3 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C	Hardness HB
u	380 (≥ 320)	535 (≥ 520)	39 (≥ 30)	70	38 (≥ 32)	200

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
0.9	~ 3	100 – 160	22 – 27	8.0 – 15.0
1.2	~ 3	150 – 280	22 – 30	6.0 – 15.0
1.6	~ 3	200 – 360	23 – 28	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. Suitable gas flow rate for welding outdoors is 18 – 25 l/min. Suggested heat input is max. 2.0 kJ/mm, interpass temperature max. 150ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (10738), CWB, DB (43.014.39), ABS, CE

BÖHLER SAS 2-FD

Flux-cored wire, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 9 Nb R M21 (C1) 3	E 347T0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 9 Nb R / E347T0 type for welding of stainless steels such as 1.4546 / 347. Designed for single and multipass welding mainly in the flat and horizontal position and horizontal/vertical position. The corrosion resistance corresponds to that of the base material 308H, i.e. good resistance to general corrosion. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Stabilized with niobium and suitable for service temperatures from –196ºC to 400ºC. The scaling temperature is approximately 850ºC in air. For welding in vertical-up and overhead positions, BÖHLER SAS 2 PW-FD should be preferred.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11

UNS S30400, S30403, S30453, S32100, S34700

AISI 347, 321,302, 304, 304L, 304LN

Typical analysis of the wire

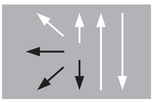
	C	Si	Mn	Cr	Ni	Nb	FN
wt.-%	0.03	0.6	1.4	19.5	10.6	0.37	5 – 13

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C	–196°C
u	420 (≥ 350)	585 (≥ 550)	40 (≥ 30)	80	41	32 (≥ 32)

u untreated, as-welded - shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 230	22 – 30	5.0 – 15.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed.

Approvals

TÜV (09740), CE

BÖHLER SAS 2 PW-FD

Flux-cored wire, high-alloyed, stabilized austenitic stainless, stabilized

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 9 Nb P M21 (C1) 1	E347T1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 9 Nb P / E347T1 type for welding of stainless steels such as 1.4546 / 347. The corrosion resistance corresponds to that of the base material 308H, i.e. good resistance to general corrosion. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Stabilized with niobium and suitable for service temperatures from –120ºC to 400ºC. The scaling temperature is approximately 850ºC in air. For flat and horizontal welding positions, BÖHLER SAS 2-FD may be preferred.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11

UNS S30400, S30403, S30453, S32100, S34700

AISI 347, 321,302, 304, 304L, 304LN

Typical analysis of the wire

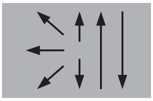
	C	Si	Mn	Cr	Ni	Nb	FN
wt.-%	0.03	0.7	1.4	19.0	10.4	0.35	5 – 13

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C	–196°C
u	420 (≥ 350)	590 (≥ 550)	35 (≥ 30)	70	40	32 (≥ 32)

u untreated, as welded - shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 230	22 – 29	6.0 – 13.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed.

Approvals

TÜV (10059), CE

FCW

Avesta FCW 308L/MVR Cryo

Flux-cored wire, high-alloyed, austenitic stainless, cryogenic

Classifications

EN ISO 17633-A
T 19 9 L P M21 (C1) 1

AWS A5.22 / SFA-5.22
E308LT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 9 L P / E308LT1 type designed for welding austenitic stainless steels of 1.4301 / 304 type with very good corrosion resistance under fairly severe conditions, e.g. in oxidizing acids and cold or dilute reducing acids. Primarily for use in low temperature applications. The carefully controlled chemical composition gives a weld metal with a ferrite content in the range of 3 – 6 FN (measured with FeritScope FMP30) and very good toughness down to –196ºC as specified for LNG applications. The lateral expansion at –196ºC is ≥ 0.38 mm. The scaling temperature is approximately 850ºC in air.

Avesta FCW 308L/MVR Cryo is designed for all-round welding and can be used in all positions without changing the parameter settings. Very good slag detachability and almost no spatter formation. Due to the fast freezing rutile slag, the weldability is excellent also in the vertical-up and overhead positions. Suitable for service temperatures from –196ºC to 350ºC. Also fulfills AWS A5.22 / SFA-5.22 E308LT1-4J and E308LT1-1J.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the wire

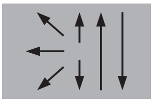
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.03	0.6	1.4	19.3	10.9	2 – 4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C	Hardness HB	Lateral expansion mm –196°C
u	390 (≥ 350)	550 (≥ 520)	40 (≥ 30)	80	42 (≥ 32)	200	≥ 0.38

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 250	22 – 29	6.0 – 13.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. Gas flow rate 18 – 25 l/min. Suggested heat input is 0.5 – 2.0 kJ/mm, interpass temperature max. 150ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

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BÖHLER EAS 2 PW-FD (LF)

Flux-cored wire, high-alloyed, austenitic stainless, cryogenic

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 9 L P M21 (C1) 1	E308LT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 9 L P / E308LT1 type for welding of stainless steels such as 1.4306 / 304L. Controlled weld metal ferrite content (3 – 6 FN measured with FeritScope FMP30), particularly for good cryogenic toughness and lateral expansion down to –196ºC as specified for LNG applications. Also fulfills AWS A5.22 / SFA-5.22 E308LT1-4J and E308LT1-1J. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as good slag removal with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures from –196ºC to 350ºC. The scaling temperature is approx. 850ºC in air.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4307 X2CrNi18-9, 1.4311 X2CrNiN18-9, 1.4312 GX10CrNi18-8, 1.4541 X6CrNiTi18-10, 1.4546 X5CrNiNb18-10, 1.4550 X6CrNiNb18-10

UNS S30400, S30403, S30453, S32100, S34700

AISI 304, 304L, 304LN, 302, 321, 347

Typical analysis of the wire

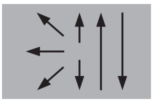
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.03	0.6	1.4	19.3	10.9	2 – 4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C	Lateral expansion mm –196°C
u	390 (≥ 350)	550 (≥ 520)	40 (≥ 30)	80	42 (≥ 32)	≥ 0.38

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 250	22 – 29	6.0 – 13.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

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BÖHLER EAS 4 M-MC

Metal-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 12 3 L M M12 2	EC316L

Characteristics and typical fields of application

Austenitic metal-cored wire of T 19 12 3 L / EC316L type for welding matching and similar, stabilized or unstabilized, corrosion resistant austenitic CrNiMo-steels. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. The wire shows good wetting behavior and results in a smooth surface. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. This makes the metal-cored wire less sensitive to edge misalignment and variation in gap width as compared to solid wires. Suitable for service temperatures from –196ºC to 400ºC. The scaling temperature is approx. 850ºC in air. Ferrite measured with FeritScope FMP30: 4 – 12 FN.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the wire

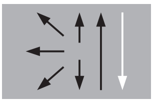
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.025	0.6	1.4	18.8	12.2	2.7	4 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C
u	420 (≥ 320)	560 (≥ 520)	35 (≥ 30)	65	38 (≥ 32)

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	100 – 280	10 – 27	3.5 – 13.0

Welding with conventional or pulsed power sources using DC+ polarity, but pulsed arc may be advantageous and especially when welding out of position. Forehand (pushing) technique preferred with a work angle of appr. 80º. Ar + 2 – 3 % CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min and the wire stick-out 15 – 20 mm. When welding out of position, the metal-cored wires are similar to solid wires and pulsed arc welding is recommended.

Approvals

TÜV (09988), CWB, CE

MCW

BÖHLER EAS 4 M-FD

Flux-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 12 3 L R M21 (C1) 3	E316LT0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 12 3 L R / E316LT0 type for welding of stainless steels such as 1.4435 / 316L. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures from –120ºC to 400ºC. The scaling temperature is approx. 850ºC in air. For higher temperatures a niobium-stabilized consumable such as BÖHLER SAS 4-FD is required. For welding in vertical-up and overhead positions, BÖHLER EAS 4 M PW-FD should be preferred.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the wire

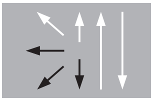
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.03	0.7	1.5	19.0	12.0	2.7	3 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C
u	410 (≥ 320)	560 (≥ 510)	34 (≥ 30)	55	35 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0
1.6	~ 3	200 – 350	25 – 30	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (5349), DB (43.014.15), DNV GL, LR (M21), CE

Avesta FCW-2D 316L/SKR

Flux-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A
T 19 12 3 L R M21 (C1) 3

AWS A5.22 / SFA-5.22
E316LT0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 12 3 L R / E316LT0 type designed for welding 1.4436 / 316L type stainless steels with excellent resistance to general, pitting and intergranular corrosion in chloride containing environments. Intended for severe service conditions, e.g. in dilute hot acids. Also suitable for welding steels that are stabilized with titanium or niobium, such as 1.4571 / 316Ti for service temperatures not exceeding 400ºC. For higher temperatures a niobium-stabilized consumable such as BÖHLER SAS 4-FD is required. The scaling temperature is approximately 850ºC in air.

Avesta FCW-2D 316L/SKR provides excellent weldability in flat as well as horizontal-vertical position. Great slag detachability and almost no spatter formation. Optimized to result in a shiny weld metal surface; also when welding with 100% CO_2. Due to the slow freezing rutile slag, the weld metal shows very smooth bead appearance and low temper discoloration, which makes post-weld cleaning easier. Welding in vertical-up and overhead positions is preferably done using Avesta FCW 316L/SKR-PW.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3, 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the wire

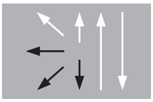
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.03	0.7	1.3	18.4	12.1	2.6	3 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	-20°C	–120°C	Hardness HB
u	390 (≥ 320)	560 (≥ 510)	39 (≥ 30)	52	47	37 (≥ 32)	210

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0
1.6	~ 3	200 – 350	25 – 30	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. Suitable gas flow rate for welding outdoors is 18 – 25 l/min. Suggested heat input is max. 2.0 kJ/mm, interpass temperature max. 150ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (10745), CWB, DNV GL, ABS, CE

FCW

BÖHLER EAS 4 PW-FD

Flux-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A	**AWS A5.22 / SFA-5.22**
T 19 12 3 L P M21 (C1) 1	E316LT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 12 3 L P / E316LT1 type for welding of stainless steels such as 1.4435 / 316L. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures from –120ºC to 400ºC. The scaling temperature is approx. 850ºC in air. For flat and horizontal welding positions, BÖHLER EAS 4 M-FD may be preferred.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the wire

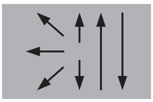
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.03	0.7	1.5	19.0	12.0	2.7	3 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–20°C	–120°C
u	430 (≥ 320)	560 (≥ 510)	34 (=> 30)	65	55	40 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
0.9	~ 3	100 – 160	22 – 27	8.0 – 15.0
1.2	~ 3	150 – 280	22 – 30	6.0 – 15.0
1.6	~ 3	200 – 360	23 – 28	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (09118), DB (43.014.24), LR (M21), DNV GL, ABS (M21), BV (M21 + Ø 1.2 mm), CE

Avesta FCW 316L/SKR-PW

Flux-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 12 3 L P M21 (C1) 1	E316LT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 12 3 L P / E316LT1 type designed for welding 1.4436 / 316L type stainless steels with excellent resistance to general, pitting and intergranular corrosion in chloride containing environments. Intended for severe service conditions, e.g. in dilute hot acids. Also suitable for welding steels that are stabilized with titanium or niobium, such as 1.4571 / 316Ti for service temperatures not exceeding 400ºC. For higher temperatures a niobium-stabilized consumable such as BÖHLER SAS 4 PW-FD is required. The scaling temperature is approximately 850ºC in air.

Avesta FCW 316L/SKR-PW has a stronger arc and a faster freezing slag as compared to Avesta FCW-2D 316L/SKR. It is designed for all-round welding and can be used in all positions without changing the parameter settings. Very good slag detachability and almost no spatter formation. Due to the fast freezing rutile slag, the weldability is excellent also in the vertical-up and overhead positions.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the wire

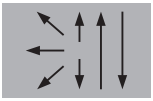
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.03	0.7	1.5	19.0	12.0	2.7	3 – 10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$	Tensile strength R_m	Elongation A (L_0=5d_0)	Impact values ISO-V KV J			Hardness
	MPa	MPa	%	20°C	–20°C	–120°C	HB
u	430 (≥ 320)	560 (≥ 510)	34 (≥ 30)	65	55	40 (≥ 32)	210

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
0.9	~ 3	100 – 160	22 – 27	8.0 – 15.0
1.2	~ 3	150 – 280	22 – 30	6.0 – 15.0
1.6	~ 3	200 – 360	23 – 28	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. Suitable gas flow rate for welding outdoors is 18 – 25 l/min. Suggested heat input is max. 2.0 kJ/mm, interpass temperature max. 150ºC and wire stick-out 15 – 20 mm. Post weld heat treatment is generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (10746), CWB, DB (43.014.40), DNV GL, ABS, BV (M21 + Ø 1.2 mm), CE

FCW

BÖHLER EAS 4 PW-FD (LF)

Flux-cored wire, high-alloyed, austenitic stainless, cryogenic

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T Z 19 12 3 L P M21 (C1) 1	E316LT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 12 3 L P / E316LT1 type with controlled weld metal ferrite content (3 – 6 FN measured with Fischer FeriteScope). Particularly for good cryogenic toughness and lateral expansion down to –196ºC as specified for LNG applications. Also fulfills AWS A5.22 / SFA-5.22 E316LT1-4J and E316LT1-1J. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as good slag removal with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures from –196ºC to 350ºC. The scaling temperature is approx. 850ºC in air.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4429 X2CrNiMoN17-12-3 1.4432 X2CrNiMo17-12-3, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4571 X6CrNiMoTi17-12-2 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653

AISI 316L, 316Ti, 316Cb

Typical analysis of the wire

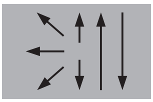
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.03	0.7	1.4	18.1	12.5	2.1	2 – 4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C	Lateral expansion mm –196°C
u	400 (≥ 320)	550 (≥ 510)	36 (≥ 30)	75	35 (≥ 32)	0.68 (≥ 0.38)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 250	22 – 29	6.0 – 13.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (12823), RINA, CE

BÖHLER E 317L-FD

Flux-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A	**AWS A5.22 / SFA-5.22**
T Z 19 13 4 L R M21 (C1) 3	E317LT0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T Z 19 13 4 L R / E317LT0 type for welding of corrosion resistant CrNiMo(N) austenitic stainless steels. Better resistance to general, pitting and intergranular corrosion in chloride containing environments than 1.4436 / 316L. Intended for severe service conditions, e.g. in dilute hot acids and satisfies the high demands of offshore fabricators, shipyards building chemical tankers as well as the chemical/petrochemical, pulp and paper industries. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures from –60ºC to 300ºC. The weld metal exhibits resistance to pitting corrosion and intergranular corrosion resistance (ASTM A 262 / Practice E) up to 300ºC. Ferrite measured with FeritScope FMP30 3 – 8 FN. For corrosion resistant single layer cladding, the wire should be used under mixed gas (Ar + 15 – 25% CO_2) to ensure > 3 FN. For welding in vertical-up and overhead positions, BÖHLER E 317 L PW-FD should be preferred.

Base materials

CrNiMo(N) austenitic stainless steels with higher Mo content or corrosion resistant claddings on mild steels

1.4429 X2CrNiMoN17-13-3, 1.4434 X2CrNiMoN18-12-4, 1.4435 X2CrNiMo18-14-3, 1.4438 X2CrNiMo19-14-4, 1.4439 X2CrNiMoN17-13-5

AISI 316L, 316LN, 317L, 317LN, 317LMN

UNS S31600, S31653, S31703, S31726, S31753

Typical analysis of the wire

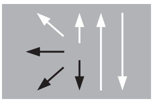
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.03	0.7	1.3	18.8	13.1	3.4	2 – 7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–60°C
u	420 (≥ 350)	570 (≥ 550)	32 (≥ 25)	50	45 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 1.5 kJ/mm, the interpass temperature be limited to max. 100ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

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FCW

BÖHLER E 317L PW-FD

Flux-cored wire, high-alloyed, austenitic stainless

Classifications

EN ISO 17633-A	**AWS A5.22 / SFA-5.22**
T Z 19 13 4 L P M21 (C1) 1	E317LT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T Z 19 13 4 L P / E317LT1 type for welding of corrosion resistant CrNiMo(N) austenitic stainless steels. Better resistance to general, pitting and intergranular corrosion in chloride containing environments than 1.4436 / 316L. Intended for severe service conditions, e.g. in dilute hot acids and satisfies the high demands of offshore fabricators, shipyards building chemical tankers as well as the chemical/petrochemical, pulp and paper industries. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures from –60ºC to 300ºC. The weld metal exhibits resistance to pitting and intergranular corrosion (ASTM A 262 / Practice E) up to 300ºC. Ferrite measured with FeritScope FMP30: 3 – 8 FN. For corrosion resistant single layer cladding, the wire should be used under mixed gas (Ar + 15 – 25% CO_2) to ensure a ferrite content of > 3 FN. For flat and horizontal welding positions, BÖHLER E 317 L-FD may be preferred.

Base materials

CrNiMo(N) austenitic stainless steels with higher Mo content or corrosion resistant claddings on mild steels

1.4429 X2CrNiMoN17-13-3, 1.4434 X2CrNiMoN18-12-4, 1.4435 X2CrNiMo18-14-3, 1.4438 X2CrNiMo19-14-4, 1.4439 X2CrNiMoN17-13-5

AISI 316L, 316LN, 317L, 317LN, 317LMN

UNS S31600, S31653, S31703, S31726, S31753

Typical analysis of the wire

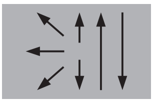
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.03	0.7	1.3	18.8	13.1	3.4	2 – 7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–60°C
u	430 (≥ 350)	560 (≥ 550)	36 (≥ 25)	58	50 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	**Arc length mm**	**Current A**	**Voltage V**	**Wire feed m/min**
1.2	~ 3	150 – 250	22 – 29	6.0 – 13.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 1.5 kJ/mm, the interpass temperature be limited to max. 100ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

BV (C1 + Ø 1.2 mm), CE

FCW

BÖHLER SAS 4-FD

Flux-cored wire, high-alloyed, austenitic stainless, stabilized

Classifications

EN ISO 17633-A
T 19 12 3 Nb R M21 (C1) 3

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 12 3 Nb R / "E318T0" type for welding of CrNiMo(Ti/Nb) austenitic stainless steels. Designed for single and multi-pass welding mainly in the flat and horizontal position and horizontal/vertical position. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Stabilized with niobium and suitable for service temperatures from –120ºC to 400ºC. The scaling temperature is approx. 850ºC in air. For welding in vertical-up and overhead positions, BÖHLER SAS 4 PW-FD should be preferred.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3 1.4436 X3CrNiMo17-13-3, 1.4437 GX6CrNiMo18-12, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653, AISI 316, 316L, 316Ti, 316Cb

Typical analysis of the wire

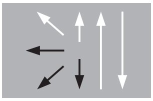
	C	Si	Mn	Cr	Ni	Mo	Nb	FN
wt.-%	0.03	0.6	1.3	18.8	12.2	2.7	0.29	5 – 13

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–100°C
u	458 (≥ 350)	604 (≥ 550)	38 (≥ 25)	70	44 (≥ 32)

u untreated, as welded - shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 230	22 – 30	5.0 – 15.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment is generally not needed.

Approvals

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BÖHLER SAS 4 PW-FD

Flux-cored wire, high-alloyed, stabilized austenitic stainless, stabilized

Classifications

EN ISO 17633-A
T 19 12 3 Nb P M21 (C1) 1

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 12 3 Nb P / "E318T1" type for welding of CrNiMo(Ti/Cb) austenitic stainless steels. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Stabilized with niobium and suitable for service temperatures from –120ºC to 400ºC. The scaling temperature is approximately 850ºC in air. For flat and horizontal welding positions, BÖHLER SAS 4-FD may be preferred.

Base materials

1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4409 GX2CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-13-3, 1.4437 GX6CrNiMo18-12, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12

UNS S31600, S31603, S31635, S31640, S31653, AISI 316, 316L, 316Ti, 316Cb

Typical analysis of the wire

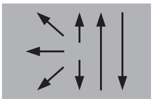
	C	Si	Mn	Cr	Ni	Mo	Nb	FN
wt.-%	0.03	0.6	1.3	18.8	12.2	2.7	0.46	5 – 13

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –100°C
u	480 (≥ 350)	665 (≥ 550)	32 (≥ 25)	68	50 (≥ 32)

u untreated, as-welded - shielding gas Ar + 18 % CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 230	22 – 29	6.0 – 13.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed.

Approvals

NAKS

Welding consumables for duplex stainless steels

◆ Content

Stick electrodes

Product name	**C**	**Si**	**Mn**	**Cr**	**Ni**	**Mo**	**N**	**PRE_N**	**FN**
Avesta 2205-PW AC/DC	0.02	0.80	0.80	23.00	9.50	3.10	0.18	> 35	
Avesta LDX 2101	0.04	0.85	0.70	23.50	7.40	0.34	0.12	~ 26	25 – 55
Avesta 2507/P100 rutile	0.03	0.40	1.00	24.80	9.30	3.70	0.23	> 40	45
Avesta 2507/P100	0.02	0.80	0.90	24.80	9.80	3.60	0.22	40	45

GTAW rods

Product name	**C**	**Si**	**Mn**	**Cr**	**Ni**	**Mo**	**W**	**N**	**Cu**	**PRE_N**	**PRE_W**
Avesta 2304	0.02	0.40	0.50	23.50	7.00	< 0.5		0.14			
Avesta 2205	≤ 0.015	0.40	1.70	22.50	8.80	3.20		0.15		≥ 35	
Avesta 2507/P100	0.02	0.40	0.40	25.00	9.50	4.00		0.25			
Avesta 2507/P100$^{Cu/W}$	0.02	0.40	0.40	25.00	9.50	4.00	0.70	0.25	0.60	42	43

Solid wires

Product name	**C**	**Si**	**Mn**	**Cr**	**Ni**	**Mo**	**W**	**N**	**Cu**	**PRE_N**	**PRE_W**
Avesta 2304	0.02	0.40	0.50	23.50	7.00	< 0.5		0.14		> 26	
Avesta 2205	0.02	0.50	1.60	22.80	8.50	3.10		0.17		> 35	
Avesta 2507/P100	0.02	0.35	0.50	25.00	9.50	4.00		0.25		> 41.5	
Avesta 2507/P100$^{Cu/W}$	0.02	0.35	0.90	25.50	9.50	3.80	0.60	0.22	0.50	> 41.5	43

SAW wire/flux combinations

Product name	**C**	**Si**	**Mn**	**Cr**	**Ni**	**Mo**	**W**	**N**	**Cu**	**PRE_N**	**FN**
Avesta LDX 2101 - Avesta Flux 805	0.02	0.70	0.60	24.00	7.40	0.25		0.14			40
Avesta 2304 - Avesta Flux 805	0.02	0.70	0.60	24.00	7.40	0.25		0.13			40
Avesta 2205 - Avesta Flux 805	0.02	0.50	1.10	23.50	8.80	3.20		0.14		35	
Thermanit 22/09 - Marathon 431	0.02	0.50	1.30	22.80	8.80	3.10		0.14			
Avesta 2507/P100$^{Cu/W}$ - Avesta Flux 805	0.02	0.50	0.70	26.00	9.50	3.80	0.60	0.21	0.50		40
Thermanit 25/09 CuT - Marathon 431	0.02	0.50	0.70	25.50	9.50	3.80	0.60	0.20	0.50		

Flux-cored wire

Product name	**C**	**Si**	**Mn**	**Cr**	**Ni**	**Mo**	**N**	**PRE_N**	**FN**
Avesta FCW-2D LDX 2101	0.03	0.70	1.10	24.60	9.00	0.40	0.14		30
Avesta FCW LDX 2101-PW	0.03	0.70	1.10	24.60	9.00	0.40	0.14	27.00	> 30
Avesta FCW-2D 2304	0.03	0.70	1.10	24.60	9.00	0.40	0.14	27.00	> 30
Avesta FCW 2304-PW	0.03	0.70	1.10	24.60	9.00	0.40	0.14	27.00	> 30
Avesta FCW-2D 2205	0.03	0.70	0.90	22.70	9.00	3.20	0.13	> 35	35 – 65
Avesta FCW 2205-PW	0.03	0.70	1.00	23.00	9.10	3.20	0.13	> 35	45 – 65
Avesta FCW LDX 2404-PW	0.03	0.70	1.50	25.10	8.80	2.20	0.19	36	45 – 65
Avesta FCW 2507/P100-PW	0.03	0.70	0.90	25.30	9.80	3.70	0.23	> 41	45 – 55
Avesta FCW 2507/P100-PW NOR	0.03	0.70	0.90	25.30	9.80	3.70	0.23	> 41	35 – 65

böhler welding by voestalpine

Avesta 2205-PW AC/DC

Stick electrode, high-alloyed, duplex stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 22 9 3 N L R	E2209-17

Characteristics and typical fields of application

Rutile coated electrode of E 22 9 3 N L R / E2209-17 type. Primarily designed for welding 22Cr (1.4462 / UNS S32205 and S31803) duplex stainless steels used in offshore, shipyards, chemical tankers, chemical/petrochemical, pulp & paper, etc.

Avesta 2205-PW is an all-position electrode with special advantages in the vertical-up and overhead positions. Developed for first class weld seems and easy handling on AC or DC. Thanks to the sharp and concentrated arc, these electrodes are extremely suitable for maintenance and repair welding, especially when joint surfaces are not particularly clean. The weld metal has very good resistance to pitting and stress corrosion cracking in chloride containing environments.

Base materials

1.4462 X2CrNiMoN22-5-3, 1.4362 X2CrNiN23-4, 1.4162 X2CrNiMoN21-5-1

UNS S32205, S31803, S32304, S32101

2205, 2304, LDX 2101®, SAF 2205, SAF 2304

Typical analysis of all-weld metal

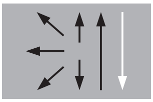
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N
wt.-%	0.02	0.8	0.8	23.0	9.5	3.1	0.18	> 35

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –40°C	Hardness HB
u	635 (≥ 450)	830 (≥ 690)	25 (≥ 20)	55	40	240

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification 2209-17/2205

Dimension mm	Current A
2.5 × 300	50 – 80
3.2 × 350	70 – 110
4.0 × 350	100 – 160
5.0 × 350	160 – 220

Suggested heat input is 0.5 – 2.5 kJ/mm, interpass temperature max. 150ºC.

Metal recovery approximately 110%.

Approvals

TÜV (04486), DNV GL, Certified by CWB to CSA W48, CE

Avesta LDX 2101

Stick electrode, high-alloyed, lean duplex stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E Z 23 7 N L R 3 2	E2307-17 (mod.)

Characteristics and typical fields of application

Rutile coated electrode of E Z 23 7 N L R / E2307-17 (mod.) type. Designed for welding the lean duplex stainless steel LDX 2101® (1.4162 / UNS S23101) and similar alloys. The combination of excellent strength and better resistance to pitting corrosion, crevice corrosion and stress corrosion cracking than 1.4301 / 304 makes this alloy suitable for construction of i.e. storage tanks, containers, heat exchangers and pressure vessels. Typical applications are within civil engineering, transportation, desalination, water treatment, pulp & paper, etc.

Avesta LDX 2101 is over-alloyed with nickel to promote weld metal austenite formation and designed to result in weld metal ferrite levels of 25 – 55 FN. When welding LDX 2101® base material, the slag removal and surface appearance are improved as compared to covered electrodes of E 22 9 3 N L / E2209 type.

Base materials

1.4162 X2CrMnNiN21-5-1, 1.4362 X2CrNiN23-4, 1.4482 X2CrMnNiMoN21-5-3

UNS S32101, S32001, S32304

LDX 2101®, SAF 2304, 2001

ASME SA 240, ASME SA 790, ASME Code Case 2418 and similar alloys.

Typical analysis of all-weld metal

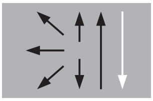
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.04	0.85	0.7	23.5	7.4	0.34	0.12	~ 26	25 – 55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –40°C	Hardness HB
u	590 (≥ 450)	780 (≥ 570)	25 (≥ 20)	45	30	260

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification Avesta LDX 2101

Dimension mm	Current A
2.5 × 300	50 – 80
3.2 × 350	70 – 120
4.0 × 400	100 – 160

Suggested heat input 0.5 – 2.0 kJ/mm and interpass temperature max. 150ºC.

Re-drying at 250 – 300ºC for min. 2 h if necessary.

Metal recovery approximately 110% at max. welding current.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1020 – 1080ºC followed by water quenching.

Approvals

TÜV (11410), CE

Avesta 2507/P100 rutile

Stick electrode, high-alloyed, superduplex stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 25 9 4 N L R 4 2	E2594-16

Characteristics and typical fields of application

Rutile coated electrode of E 25 9 4 N L R / E2594-17 type. Designed for welding of superduplex steel and equivalent steel grades such as 1.4410 / UNS S32570, 1.4507 / UNS S32550 and 1.4501 / UNS S32760, used in desalination, pulp & paper, flue gas desulfurization and seawater systems. Developed to fulfill severe requirements stated in NORSOK M-601 and similar standards. Properties of the weld metal match those of the parent metal, offering high tensile strength and toughness as well as an excellent resistance to stress corrosion cracking and localized corrosion in chloride containing environments. Meets the corrosion test requirements for ASTM G48 Methods A, B and E (40ºC) in both as-welded condition and after post-weld heat treatment. Over-alloyed in nickel to promote austenite formation. Designed for welding in all positions. The operating temperature range is –50ºC to 220ºC.

Base materials

1.4410 X2CrNiMoN25-7-4, 1.4467 X2CrMnNiMoN26-5-4, 1.4468 GX2 CrNiMoN25-6-3, 1.4501 X2CrNiMoCuWN25-7-4 1.4507 X2CrNiMoCuN25-6-3, 1.4515 GX2CrNiMoCuN26-6-3, 1.4517 GX2CrNiMoCuN25-6-3-3

UNS S32750, S32760, J93380, S32520, S32550, S39274, S32950

Typical analysis of all-weld metal

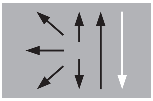
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.03	0.4	1.0	24.8	9.3	3.7	0.23	> 40	45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –46°C	Hardness HB
u	700 (≥ 550)	880 (≥ 760)	26 (≥ 18)	80	45	250

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification 2507/P100 rutile

Dimension mm	Current A
2.5 × 300	50 – 70
3.2 × 350	80 – 100
4.0 × 350	100 – 140

Suggested heat input 0.3 – 1.5 kJ/mm and interpass temperature max. 100ºC.

Re-drying of the electrode possible at 250 – 300ºC for min. 2 h if necessary.

Metal recovery approximately 110% at max. welding current.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1150ºC followed by water quenching.

Approvals

-

SMAW

Avesta 2507/P100

Stick electrode, high-alloyed, superduplex stainless

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 25 9 4 N L R 3 2	E2594-17

Characteristics and typical fields of application

Rutile coated electrode of E 25 9 4 N L R / E2594-17 type. Designed for welding superduplex steel and equivalent steel grades such as 1.4410 / UNS S32570, 1.4507 / UNS S32550 and 1.4501 / UNS S32760. Avesta 2507/P100 is characterized by its exceptionally good arc stability and weld pool control. It is particularly well-suited for applications where impact toughness requirements are moderate, i.e. < 27 J at 0ºC. For higher requirements, Avesta 2507/P100 rutile should be preferred.

Excellent resistance to pitting, crevice and stress corrosion cracking in chloride containing environments. Meets the corrosion test requirements per ASTM G48 Methods A, B, E (40ºC). Over-alloyed in nickel to promote austenite formation. Designed for welding in all positions. The operating temperature range is 0ºC to 220ºC.

Base materials

1.4410 X2CrNiMoN25-7-4, 1.4467 X2CrMnNiMoN26-5-4, 1.4468 GX2CrNiMoN25-6-3, 1.4501 X2CrNiMoCuWN25-7-4 1.4507 X2CrNiMoCuN25-6-3, 1.4515 GX2CrNiMoCuN26-6-3, 1.4517 GX2CrNiMoCuN25-6-3-3

UNS S32750, S32760, J93380, S32520, S32550, S39274, S32950

Typical analysis of all-weld metal

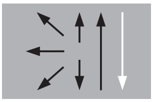
	C	Si	Mn	Cr	Ni	Mo	N	PRE$_N$	FN
wt.-%	0.02	0.8	0.9	24.8	9.8	3.6	0.22	40	45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Hardness HB
u	720 (≥ 550)	880 (≥ 760)	23 (≥ 18)	32	250

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification 2507/P100

Dimension mm	Current A
2.5 × 300	50 – 75
3.2 × 350	80 – 100
4.0 x 350/450	100 - 140

Suggested heat input is 0.3 – 1.5 kJ/mm, interpass temperature max. 100ºC.

Re-drying of the electrode possible at 250 – 300ºC for min. 2 h if necessary.

Metal recovery approximately 110% at max. welding current.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1150ºC followed by water quenching.

Approvals

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Avesta 2304

TIG rod, high-alloyed, lean duplex stainless

GTAW

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 23 7 N L	ER2307

Characteristics and typical fields of application

TIG rod of W 23 7 N L / ER2307 type for welding the lean duplex grade 2304 (1.4362 / UNS S32304) and similar materials. Provides a ferritic-austenitic weld metal. The low content of molybdenum makes it well suited for nitric acid environments. Welding without filler metal (i.e. TIG-dressing) is not allowed since the ferrite content will increase drastically and both mechanical and corrosion properties will be negatively affected. Over-alloyed with nickel to promote ferrite levels of 35 – 55%.

Base materials

1.4362 X2CrNiN23-4, 1.4162 X2CrMnNiN21-5-1, 1.4482 X2CrMnNiMoN21-5-3

UNS S32304, S32101, S32001

SAF 2304, LDX 2101®, 2001

ASME SA 240, ASME SA 790, ASME Code Case 2418 and similar alloys.

Typical analysis of the wire rod

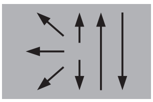
	C	Si	Mn	Cr	Ni	Mo	N	FN
wt.-%	0.02	0.4	0.5	23.5	7.0	< 0.5	0.14	10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–40°C
u	550 (≥ 450)	730 (≥ 690)	30 (≥ 20)	180 (≥ 47)	180

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Suggested heat input is 0.5 – 2.0 kJ/mm and interpass temperature max. 150°C.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1020 – 1080°C followed by water quenching.

Shielding gas: Ar, Ar + 2% N_2, Ar + 30% He + 2% N_2. The addition of helium increases the energy of the arc. Nitrogen counteracts nitrogen loss from the weld pool. Gas flow: 8 – 12 l/min (somewhat higher with helium).

Polarity: DC-

Approvals

TÜV (10013), CE

Avesta 2205

TIG rod, high-alloyed, duplex stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 22 9 3 N L	ER2209

Characteristics and typical fields of application

TIG rod of W 22 9 3 N L / ER2209 designed for welding 22Cr duplex grades, such as SAF 2205 (1.4462 / UNS S32205), used in offshore, shipyards, chemical tankers, chemical/petrochemical, pulp & paper, etc. Provides a ferritic-austenitic weld metal. Welding without filler metal (i.e. TIG-dressing) is not allowed since the ferrite content will increase drastically and both mechanical and corrosion properties will be negatively affected. Over-alloyed in nickel. The resulting microstructure is austenite with 45 – 55% ferrite. The weld metal has very good resistance to pitting and stress corrosion cracking in chloride containing environments.

Base materials

1.4462 X2CrNiMoN22-5-3, 1.4362 X2CrNiN23-4, 1.4162 X2CrNiMoN21-5-1

UNS S32205, S31803, S32304, S32101

2205, 2304, LDX 2101®, SAF 2205, SAF 2304

Typical analysis of the wire rod

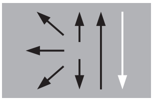
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N
wt.-%	≤ 0.015	0.4	1.7	22.5	8.8	3.2	0.15	≥ 35

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–40°C
u	600 (≥ 45)	800 (≥ 500)	33 (≥ 20)	200	170 (≥ 32)

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Suggested heat input is 0.5 – 2.5 kJ/mm and interpass temperature max. 150°C.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1150°C followed by water quenching.

Shielding gas: Ar, Ar + 2% N_2, Ar + 30% He + 2% N_2. The addition of He increases the energy of the arc. Nitrogen counteracts nitrogen loss from the weld pool. Gas flow: 8 – 12 l/min (somewhat higher with helium).

Polarity: DC-

Approvals

TÜV (19161), DB (43.132.72), DNV GL, CE

böhler welding by voestalpine

Avesta 2507/P100

TIG rod, high-alloyed, superduplex stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 25 9 4 N L	ER2594

Characteristics and typical fields of application

TIG rod of W 25 9 4 N L / ER2594 type designed for welding superduplex alloys such as 1.4410 / UNS S32570, 1.4507 / UNS S32550 and 1.4501 / UNS S32760. It can also be used for welding duplex type 2205 if extra high corrosion resistance is required, e.g. in root runs in tubes and pipe. Avesta 2507/P100 provides a ferritic-austenitic weld metal. The resulting microstructure is austenite with 45-55% ferrite. Excellent resistance to pitting and stress corrosion cracking in chloride containing environments. Meets the corrosion test requirements per ASTM G48 Methods A, B and E (40°C). Welding without filler metal (i.e. TIG-dressing) is not allowed since the ferrite content will increase drastically and both mechanical and corrosion properties will be negatively affected.

Base materials

1.4410 X2CrNiMoN25-7-4, 1.4467 X2CrMnNiMoN26-5-4, 1.4468 GX2CrNiMoN25-6-3, 1.4501 X2CrNiMoCuWN25-7-4,

1.4507 X2CrNiMoCuN25-6-3, 1.4515 GX2CrNiMoCuN26-6-3, 1.4517 GX2CrNiMoCuN25-6-3-3

UNS S32750, S32760, J93380, S32520, S32550, S39274, S32950

Typical analysis of the wire rod

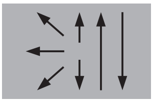
	C	Si	Mn	Cr	Ni	Mo	N
wt.-%	0.02	0.4	0.4	25	9.5	4.0	0.25

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–40°C
u	660	860	28	190	170

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Suggested heat input is 0.3 – 1.5 kJ/mm, interpass temperature max. 100°C.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1150°C followed by water quenching.

Shielding gas: Ar, Ar + 2% N_2, Ar + 30% He + 2% N_2. The addition of helium increases the energy of the arc. Nitrogen counteracts nitrogen loss from the weld pool. Gas flow: 8 – 12 l/min (somewhat higher with helium). The corrosion resistance on the rootside may be improved by use of nitrogen-based backing gas.

Polarity: DC-

Approvals

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Avesta 2507/P100$^{Cu/W}$

TIG rod, high-alloyed, superduplex stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 25 9 4 N L	ER2595

Characteristics and typical fields of application

TIG rod of W 25 9 4 N L / ER2595 type designed for welding ferritic-austenitic superduplex stainless steel such as 1.4410 / UNS S32570 and 1.4501 / UNS S32760. Can also be used for joints between superduplex and austenitic alloys or carbon steels and for welding duplex type 1.4462 / UNS S32205 if extra high corrosion resistance is required, e.g. in root runs in tubes and pipes. Superduplex grades are particularly popular for desalination, pulp & paper, flue gas desulphurization and seawater systems. The properties of the weld metal match those of the parent metal, offering high tensile strength and toughness as well as excellent resistance to stress corrosion cracking and localized corrosion in chloride containing environments. Meets the corrosion test requirements as per ASTM G48 Methods A and E (24h at 40°C). The operating temperature range is -50°C to 220°C. Welding without filler metal (i.e. TIG-dressing) is not allowed since the ferrite content will increase drastically and both mechanical and corrosion properties will be negatively affected.

Base materials

1.4410 X2CrNiMoN25-7-4, 1.4467 X2CrMnNiMoN 26-5-4, 1.4468, GX2 CrNiMoN 25-6-3, 1.4501 X2CrNiMoCuWN25-7-4, 1.4507 X2CrNiMoCuN 25-6-3, 1.4515 GX2CrNiMoCuN 26-6-3, 1.4517 GX2CrNiMoCuN 25-6-3-3

UNS S32750, S32760, J93380, S32520, S32550, S39274, S32950

Typical analysis of the wire rod

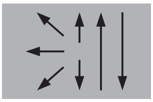
	C	Si	Mn	Cr	Ni	Mo	W	N	Cu	PRE_N	PRE_W	FN
wt.-%	0.02	0.4	0.4	25	9.5	4.0	0.7	0.25	0.6	42	43	50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–60°C	Hardness HB
u	660 (≥ 550)	860 (≥ 760)	28 (≥ 18)	190	150 (≥ 32)	280

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100°C . The root side corrosion resistance may be improved by use of nitrogen-based backing gas. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1150°C followed by water quenching. Ferrite measured with Fischer Feritescope: 45 – 51 FN.

Shielding gas: Ar, Ar + 2% N_2, Ar + 30% He + 2% N_2. The addition of helium increases the energy of the arc. Nitrogen counteracts nitrogen loss from the weld pool. Gas flow: 8 – 12 l/min (somewhat higher with helium).

Polarity: DC-

Approvals

TÜV (18949), CE

Avesta 2304

Solid wire, high-alloyed, lean duplex stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 23 7 N L	ER2307

Characteristics and typical fields of application

Solid wire of G 23 7 N L / ER2307 type for welding the lean duplex grade 2304 (1.4362 / UNS S32304) and similar materials. Provides a ferritic-austenitic weld metal. The low content of molybdenum makes it well suited for nitric acid environments. 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. Over-alloyed with nickel to promote ferrite levels of 35 – 55%.

Base materials

1.4362 X2CrNiN23-4, 1.4162 X2CrMnNiN21-5-1, 1.4482 X2CrMnNiMoN21-5-3

UNS S32304, S32101, S32001

SAF 2304, LDX 2101®, 2001

ASME SA 240, ASME SA 790, ASME Code Case 2418 and similar alloys.

Typical analysis of the solid wire

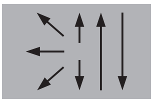
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.02	0.4	0.5	23.5	7.0	< 0.5	0.14	> 26	45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$	Tensile strength R_m	Elongation A ($L_0=5d_0$)	Impact values ISO-V KV J		Hardness
	MPa	MPa	%	20°C	–40°C	HB
u	520 (≥ 450)	710 (≥ 550)	30 (≥ 20)	150	110	240

u untreated, as-welded – shielding gas Ar + 1.8% CO_2 + 0.03% NO

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	60 – 100	18 – 20
1.0 short arc	90 – 120	19 – 21
1.0 spray arc	180 – 220	27 – 30
1.2 spray arc	200 – 240	28 – 31
1.6 spray arc	250 – 330	29 – 32

Suggested heat input is 0.5 – 2.0 kJ/mm and interpass temperature max. 150°C. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1020 – 1080°C followed by water quenching.

Shielding gas: 1. Ar + 30% He + 2 – 3% CO_2, 2. Ar + 2 – 3% CO_2 or Ar + 1 – 2% O_2. The addition of helium increases the energy of the arc. Gas flow: 15 – 20 l/min (somewhat higher with helium).

Polarity: DC+

Approvals

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Avesta 2205

Solid wire, high-alloyed, duplex stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 22 9 3 N L	ER2209

Characteristics and typical fields of application

Solid wire of G 22 9 3 N L / ER2209 type designed for welding 22Cr duplex grades such as 1.4462 / UNS S32205 and S31803 used in offshore, shipyards, chemical tankers, chemical/petrochemical, pulp + paper, etc. Provides a ferritic-austenitic weld metal. 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. Over-alloyed in nickel. The resulting microstructure is austenite with 45 – 55% ferrite. The weld metal has very good resistance to pitting and stress corrosion cracking in chloride containing environments.

Base materials

1.4462 X2CrNiMoN22-5-3, 1.4362 X2CrNiN23-4, 1.4162 X2CrNiMoN21-5-1

UNS S32205, S31803, S32304, S32101

2205, 2304, LDX 2101®, SAF 2205, SAF 2304

Typical analysis of the solid wire

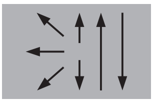
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.02	0.5	1.6	22.8	8.5	3.1	0.17	> 35	50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –50°C	Hardness
u	560 (≥ 450)	780 (≥ 550)	30 (≥ 20)	150	100	230

u untreated, as-welded – shielding gas Ar + 1.8% CO_2 + 0.03% NO

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	60 – 100	18 – 20
1.0 short arc	90 – 120	19 – 21
1.0 spray arc	180 – 220	27 – 30
1.2 spray arc	200 – 240	28 – 31
1.6 spray arc	250 – 330	29 – 32

Suggested heat input is 0.5 – 2.5 kJ/mm and interpass temperature max. 150°C. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1150°C followed by water quenching.

Shielding gas: 1. Ar + 30% He + 2% CO_2, 2. Ar + 2 – 3% CO_2 or Ar + 1 – 2% O_2. The addition of helium increases the energy of the arc. Gas flow: 15 – 20 l/min (somewhat higher with helium).

Polarity: DC+

Approvals

TÜV (19156), DNV GL, DB (43.132.71), CE

Avesta 2507/P100

Solid wire, high-alloyed, superduplex stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 25 9 4 N L	ER2594

Characteristics and typical fields of application

Solid wire of G 25 9 4 N L / ER2594 type for welding superduplex steel and equivalent steel grades such as 1.4410 / UNS S32570, 1.4507 / UNS S32550 and 1.4501 / UNS S32760. 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 1.2 mm wire. To minimize pore formation shielding gas mixtures of He with max. 0,5% CO2 can be used.

Base materials

1.4410 X2CrNiMoN25-7-4, 1.4467 X2CrMnNiMoN26-5-4, 1.4468 GX2CrNiMoN25-6-3, 1.4501 X2CrNiMoCuWN25-7-4, 1.4507 X2CrNiMoCuN25-6-3, 1.4515 GX2CrNiMoCuN26-6-3, 1.4517 GX2CrNiMoCuN25-6-3-3

UNS S32750, S32760, J93380, S32520, S32550, S39274, S32950

Typical analysis of the solid wire

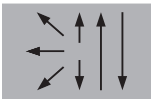
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.015	0.35	0.5	25	9.5	4.0	0.25	> 41.5	50

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –50°C	Hardness HB
u	570 (≥ 550)	830 (≥ 620)	29 (≥ 18)	140	100	280

u untreated, as-welded – shielding gas Ar + 1.8% CO_2 + 0.03% NO

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	90 – 120	19 – 21
1.0 spray arc	180 – 220	27 – 30
1.2 spray arc	200 – 240	28 – 31

Suggested heat input is 0.3 – 1.5 kJ/mm, interpass temperature max. 100°C.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1150°C followed by water quenching.

Shielding gas: 1. Ar, 2. Ar + 30% He + 0.05 – 1% CO_2, 3. Ar + 2 – 3% CO_2 or Ar + 1 – 2% O_2. Gas flow: 15 – 20 l/min (somewhat higher with helium).

Polarity: DC+

Approvals

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Avesta 2507/P100 Cu/W

Solid wire, high-alloyed, superduplex stainless

GMAW

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 25 9 4 N L	ER2595

Characteristics and typical fields of application

Solid wire of G 25 9 4 N L / ER2595 type for welding superduplex steel and equivalent steel grades such as 1.4410 / UNS S32570, 1.4507 / UNS S32550 and 1.4501 / UNS S32760. Can also be used for joints between superduplex and austenitic alloys or carbon steels and for welding duplex type 1.4462 / UNS S32205 if extra high corrosion resistance is required. Superduplex grades are particularly popular for desalination, pulp & paper, flue gas desulphurization and seawater systems. The properties of the weld metal match those of the parent metal, offering high tensile strength and toughness as well as excellent resistance to stress corrosion cracking and localized corrosion in chloride containing environments. 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 1.2 mm wire. To minimize pore formation shielding gas mixtures of He with max. 0,5% CO_2 can be used.

Base materials

1.4410 X2CrNiMoN25-7-4, 1.4467 X2CrMnNiMoN26-5-4, 1.4468 GX2CrNiMoN25-6-3, 1.4501 X2CrNiMoCuWN25-7-4 1.4507 X2CrNiMoCuN25-6-3, 1.4515 GX2CrNiMoCuN26-6-3, 1.4517 GX2CrNiMoCuN25-6-3-3

UNS S32750, S32760, J93380, S32520, S32550, S39274, S32950

Typical analysis of the solid wire

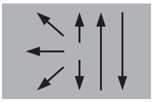
	C	Si	Mn	Cr	Ni	Mo	W	N	Cu	PRE_N	PRE_W	FN
wt.-%	0.02	0.35	0.9	25.5	9.5	3.8	0.6	0.22	0.5	> 41.5	43	45

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–50°C	Hardness HB
u	600 (≥ 550)	830 (≥ 760)	27 (≥ 18)	140	100	280

u untreated, as-welded – shielding gas Ar + 1.8% CO_2 + 0.03% NO

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	90 – 120	19 – 21
1.0 spray arc	180 – 220	27 – 30
1.2 spray arc	200 – 240	28 – 31

Suggested heat input is max. 1.5 kJ/mm, interpass temperature max. 100°C.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1150°C followed by water quenching.

Shielding gas: 1. Ar, 2. Ar + 30% He + 0.05 – 1% CO_2, 3. Ar + 2 – 3% CO_2 or Ar + 1 – 2% O_2. Gas flow: 15 – 20 l/min (somewhat higher with helium).

Polarity: DC+

Approvals

TÜV (18949), CE

Avesta LDX 2101 - Avesta Flux 805

SAW wire/flux combination, high-alloyed, lean duplex stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S Z 23 7 N L	ER2307	S A AF 2 DC

Characteristics and typical fields of application

Avesta LDX 2101 - Avesta Flux 805 is a wire/flux combination for submerged arc welding the lean duplex stainless steel LDX 2101® (1.4162 / UNS S32101) and similar alloys.

Solid wire of S 23 7 N L / ER2307 type. Over-alloyed with nickel to promote weld metal austenite formation and designed to result in weld metal ferrite levels of 35 – 55%. The combination of excellent strength and better resistance to pitting corrosion, crevice corrosion and stress corrosion cracking than the base material 1.4307 / 304L makes this alloy suitable for construction of i.e. storage tanks, containers, heat exchangers and pressure vessels. Typical applications are within civil engineering, transportation, desalination, water treatment, pulp & paper, etc. Good resistance to general corrosion and pitting resistance similar to or somewhat better than 304L. Very good resistance to pitting and stress corrosion cracking in nitric acid environments.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4162 X2CrMnNiN21-5-1, 1.4362 X2CrNiN23-4, 1.4482 X2CrMnNiMoN21-5-3

UNS S32101, S32001, S32304

LDX 2101®, SAF 2304, 2001

ASME SA 240, ASME SA 790, ASME Code Case 2418 and similar alloys.

Typical analysis of the weld metal

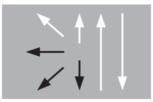
wt.-%	C	Si	Mn	Cr	Ni	Mo	N	FN
wire	0.015	0.40	0.75	23.5	7.5	0.25	0.15	-
all-weld metal	0.019	0.70	0.60	24.0	7.4	0.25	0.14	40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–40°C
u	(≥ 570)	(≥ 750)	(≥ 25)	140	60

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 500	28 – 33
3.2	400 – 600	29 – 34

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Post-weld heat treatment generally not needed.

In special cases, solution annealing can be performed at 1020 – 1080ºC followed by water quenching.

Polarity: DC+

Approvals

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SAW

Avesta 2304 - Avesta Flux 805

SAW wire/flux combination, high-alloyed, lean duplex stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 23 7 N L	ER2307	S A AF 2 DC

Characteristics and typical fields of application

Avesta 2304 - Avesta Flux 805 is a wire/flux combination for submerged arc welding the duplex steel 1.4362 / UNS S32304 and similar grades.

Solid wire of S 23 7 N L / ER2307 type with low molybdenum content, which makes it well-suited for nitric acid environments. Over-alloyed with nickel to promote weld metal austenite formation and designed to result in weld metal ferrite levels of 35 – 55%. Very good resistance to pitting corrosion and stress corrosion cracking in nitric acid environments.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux see the separate datasheet.

Base materials

1.4362 X2CrNiN23-4, 1.4162 X2CrMnNiN21-5-1, 1.4482 X2CrMnNiMoN21-5-3

UNS S32304, S32101, S32001

SAF 2304, LDX 2101®, 2001

ASME SA 240, ASME SA 790, ASME Code Case 2418 and similar alloys.

Typical analysis of the weld metal

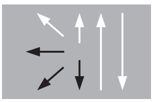
wt.-%	C	Si	Mn	Cr	Ni	Mo	N	FN
wire	0.015	0.50	0.75	23.5	7.5	0.25	0.15	
all-weld metal	0.015	0.70	0.60	24.0	7.4	0.25	0.13	40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	(≥ 480)	(≥ 650)	(≥ 25)	100

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 500	28 – 33
3.2	400 – 600	29 – 34

Suggested heat input is 0.5 – 2.0 kJ/mm and interpass temperature max. 150ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1020 – 1080ºC followed by water quenching.

Approvals

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Avesta 2205 - Avesta Flux 805

SAW wire/flux combination, high-alloyed, duplex stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 22 9 3 N L	ER2209	S A AF 2 DC

Characteristics and typical fields of application

Avesta 2205 - Avesta Flux 805 is a wire flux combination for submerged arc welding of duplex stainless steels such as 1.4462 / UNS S32205, S31803.

Solid wire of S 22 9 3 N L / ER2209 type primarily designed for welding 22Cr duplex grades used in offshore, shipyards, chemical tankers, chemical/petrochemical, pulp & paper, etc. Over-alloyed in nickel. The resulting microstructure is austenite with 45 – 55% ferrite. The weld metal has very good resistance to pitting and stress corrosion cracking in chloride containing environments.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

Similar duplex stainless steels, also combinations of duplex, ferritic and austenitic steels

1.4462 X2CrNiMoN22-5-3, 1.4362 X2CrNiN23-4, 1.4162 X2CrNiMoN21-5-1

UNS S32205, S31803, S32304, S32101

2205, 2304, LDX 2101®, SAF 2205, SAF 2304

Typical analysis of the weld metal

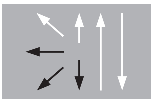
wt.-%	C	Si	Mn	Cr	Ni	Mo	N	PRE_N
wire	0.015	0.40	1.5	23.3	8.8	3.2	0.15	36.0
all-weld metal	0.015	0.50	1.1	23.5	8.8	3.2	0.14	35

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–40°C
u	590 (≥ 450)	800 (≥ 690)	29 (≥ 20)	100 (≥ 80)	70 (≥ 40)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.4	300 – 500	28 – 33
3.2	400 – 600	29 – 34
4.0	425 – 575	30 – 34

No preheating.

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150°C.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050°C followed by water quenching.

Polarity: DC+

Approvals

DNV GL, LR

SAW

Thermanit 22/09 - Marathon 431

SAW wire/flux combination, high-alloyed, duplex stainless

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 22 9 3 N L	ER2209	S A FB 2 DC

Characteristics and typical fields of application

Thermanit 22/09 - Marathon 431 is a wire/flux combination for submerged arc welding of duplex steel grades such as 1.4462 / S31803 used in offshore, shipyards, chemical tankers, chemical/petrochemical, pulp & paper, etc.

Solid wire of S 22 9 3 N L / ER2209 type with high Cr and Mo-contents for good resistance to pitting corrosion and stress corrosion cracking in chlorine and hydrogen sulfide-bearing environment. Over-alloyed in nickel to promote austenite formation. Suitable for service temperatures from –40ºC to 250ºC.

Marathon 431 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

Similar duplex stainless steels, also combinations of duplex, ferritic and austenitic steels

1.4462 X2CrNiMoN22-5-3, 1.4362 X2CrNiN23-4, 1.4162 X2CrNiMoN21-5-1

UNS S32205, S31803, S32304, S32101

2205, 2304, LDX 2101®, SAF 2205, SAF 2304

Typical analysis of the weld metal

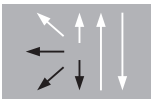
wt.-%	C	Si	Mn	Cr	Ni	Mo	N
wire	0.015	0.40	1.5	23.3	8.8	3.2	0.15
all-weld metal	0.015	0.50	1.3	22.8	8.8	3.1	0.14

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–40°C
u	≥ 450	≥ 690	≥ 20	≥ 80	≥ 40

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.0	250 – 350	28 – 33
2.5	300 – 500	28 – 33
3.0	380 – 580	29 – 34

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC. Polarity: DC+. No preheating.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (06112), ABS, DNV GL, LR, CE

Avesta 2507/P100$^{Cu/W}$ - Avesta Flux 805

SAW wire/flux combination, high-alloyed, stainless, superduplex

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 25 9 4 N L	ER2594	S A AF 2 DC

Characteristics and typical fields of application

Avesta 2507/P100^{CuW} - Avesta Flux 805 is a wire/flux combination for submerged arc welding of super duplex stainless steel grades such as 1.4410 / UNS S32570, 1.4507 / UNS S32550 and 1.4501 / UNS S32760.

Solid wire of S 25 9 4 N L / ER2594 type. Resistant to intercrystalline corrosion. The weld metal shows excellent resistance to pitting and crevice corrosion in chlorine containing media as well as to stress corrosion cracking especially in H_2S containing media. Suitable for service temperatures from –50ºC to 220ºC.

Duplex alloys have good weldability, but the welding procedure should be adapted to the base material considering fluidity, joint design, heat input, etc.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr- burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4410 X2CrNiMoN25-7-4, 1.4467 X2CrMnNiMoN26-5-4, 1.4468 GX2CrNiMoN25-6-3, 1.4501 X2CrNiMoCuWN25-7-4, 1.4507 X2CrNiMoCuN25-6-3, 1.4515 GX2CrNiMoCuN26-6-3, 1.4517 GX2CrNiMoCuN25-6-3-3

UNS S32750, S32760, J93380, S32520, S32550, S39274, S32950

Typical analysis of the weld metal

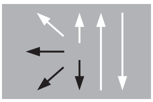
wt.-%	C	Si	Mn	Cr	Ni	Mo	W	N	Cu	FN
wire	0.015	0.40	0.90	26.0	9.5	3.8	0.6	0.23	0.6	50
all-weld metal	0.015	0.50	0.70	26.0	9.5	3.8	0.6	0.21	0.5	40

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J –46°C
u	700 (≥ 600)	890 (≥ 800)	23 (≥ 20)	70 (≥ 45)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33

Suggested heat input max. 1.5 kJ/mm, interpass temperature max. 120ºC. Polarity: DC+. No preheating.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1150ºC followed by water quenching.

Approvals

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SAW

Thermanit 25/09 CuT - Marathon 431

SAW wire/flux combination, high-alloyed, stainless, superduplex

SAW

Classifications

EN ISO 14343-A	**AWS A5.9 / SFA-5.9**	**EN ISO 14174**
S 25 9 4 N L	ER2594	S A FB 2 DC

Characteristics and typical fields of application

Thermanit 25/09 CuT - Marathon 431 is a wire/flux combination for submerged arc welding of super duplex stainless steel grades such as such as 1.4410 / UNS S32570, 1.4507 / UNS S32550 and 1.4501 / UNS S32760.

Solid wire of S 25 9 4 N L / ER2594 type. Resistant to intercrystalline corrosion. The weld metal shows excellent resistance to pitting and crevice corrosion in chlorine containing media as well as to stress corrosion cracking especially in H_2S containing media. Well-suited for the conditions in the offshore field. Application temperature is –50ºC up to 220ºC.

Marathon 431 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4410 X2CrNiMoN25-7-4, 1.4467 X2CrMnNiMoN26-5-4, 1.4468, GX2 CrNiMoN25-6-3, 1.4501 X2CrNiMoCuWN25-7-4 1.4507 X2CrNiMoCuN25-6-3, 1.4515 GX2CrNiMoCuN26-6-3, 1.4517 GX2CrNiMoCuN25-6-3-3

UNS S32750, S32760, J93380, S32520, S32550, S39274, S32950

Typical analysis of the weld metal

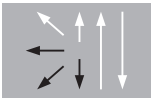
wt.-%	C	Si	Mn	Cr	Ni	Mo	W	N	Cu
wire	0.015	0.40	0.90	26.0	9.5	3.8	0.6	0.23	0.6
all-weld metal	0.015	0.50	0.70	25.5	9.5	3.8	0.6	0.20	0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J –46°C
u	700 (≥ 600)	890 (≥ 800)	23 (≥ 20)	70 (≥ 45)

u untreated, as-welded

Operating data



Dimension mm	**Current A**	**Voltage V**
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33

Suggested heat input max. 1.5 kJ/mm, interpass temperature max. 120ºC. Polarity: DC+. No preheating.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1150ºC followed by water quenching.

Approvals

ABS, DNV GL, BV

Avesta FCW-2D LDX 2101

Flux-cored wire, high-alloyed, lean duplex stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 7 N L R M21 (C1) 3	E2307T0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 23 7 N L R / E2307T0 type for welding the lean duplex stainless steel LDX 2101® (1.4162/UNS S32101) and similar alloys. The combination of excellent strength and better resistance to pitting corrosion, crevice corrosion and stress corrosion cracking than 1.4301 / 304 makes this alloy suitable for construction of for instance storage tanks, containers, heat exchangers and pressure vessels. Typical applications are within civil engineering, transportation, desalination, water treatment, pulp & paper, etc.

Avesta FCW-2D LDX 2101 provides excellent weldability in flat as well as horizontal-vertical position. Welding in vertical-up and overhead positions is preferably done with Avesta FCW LDX 2101-PW. The wire is over-alloyed with nickel to promote weld metal austenite formation. Ferrite measured with FeritScope FMP30 27 – 34 FN. Suitable for service temperatures from –50ºC to 250ºC.

Base materials

1.4162 X2CrMnNiN21-5-1, 1.4362 X2CrNiN23-4, 1.4482 X2CrMnNiMoN21-5-3

UNS S32101, S32001, S32304

LDX 2101®, SAF 2304, 2001

ASME SA 240, ASME SA 790, ASME Code Case 2418 and similar alloys.

Typical analysis of the wire

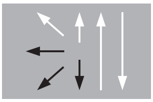
	C	Si	Mn	Cr	Ni	Mo	N	FN
wt.-%	0.025	0.7	1.1	24.6	9.0	0.4	0.14	30

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–40°C	–60°C	Hardness HB
u	570 (≥ 450)	760 (≥ 690)	28 (≥ 20)	65	45	41	240

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 280	24 – 30	6.5 – 15.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V and the weld metal austenite content increases somewhat. Gas flow rate 18 – 25 l/min. Suggested heat input is 0.5 – 2.0 kJ/mm, interpass temperature max. 150ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1020 – 1080ºC followed by water quenching.

Approvals

TÜV (11411), ABS (C1), CE

Avesta FCW LDX 2101-PW

Flux-cored wire, high-alloyed, lean duplex stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 7 N L P M21 (C1) 1	E2307T1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 23 7 N L P / E2307T1 type for welding the lean duplex stainless steel LDX 2101® (1.4162/UNS S32101) and similar alloys. The combination of excellent strength and better resistance to pitting corrosion, crevice corrosion and stress corrosion cracking than 1.4301 / 304 makes this alloy suitable for construction for instance storage tanks, containers, heat exchangers and pressure vessels. Typical applications are within civil engineering, transportation, desalination, water treatment, pulp & paper, etc.

Avesta FCW LDX 2101-PW has a stronger arc and a faster freezing slag compared to Avesta FCW-2D LDX 2101. 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. The wire is over-alloyed with nickel to promote weld metal austenite formation. Ferrite measured with FeritScope FMP30 27 – 34 FN. Suitable for service temperatures from –50°C to 250°C.

Base materials

1.4162 X2CrMnNiN21-5-1, 1.4362 X2CrNiN23-4, 1.4482 X2CrMnNiMoN21-5-3

UNS S32101, S32001, S32304

LDX 2101®, SAF 2304, 2001

ASME SA 240, ASME SA 790, ASME Code Case 2418 and similar alloys.

Typical analysis of the wire

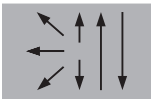
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.03	0.7	1.1	24.6	9.0	0.4	0.14	27	> 30

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –30°C	Hardness HB
u	580 (≥ 450)	750 (≥ 690)	31 (≥ 20)	67	54 (≥ 32)	240

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 230	23 – 30	5.5 – 11.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80°. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V and the weld metal austenite content increases somewhat. Gas flow rate 18 – 25 l/min. Suggested heat input is 0.5 – 2.0 kJ/mm, interpass temperature max. 150°C and wire stick-out 15 – 20 mm. Post weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1020 – 1080°C followed by water quenching.

Approvals

ABS (C1), CE

Avesta FCW-2D 2304

Flux-cored wire, high-alloyed, lean duplex stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 7 N L R M21 (C1) 3	E2307T0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 23 7 N L R / E2307T0 type for welding the lean duplex stainless steel SAF 2304 (1.4362/UNS S32304) and similar grades. The corrosion resistance is in general higher than for austenitic stainless steel of 1.4401 / 316L type. Thanks to the low molybdenum content, the resistance to pitting corrosion and stress corrosion cracking in nitric acid containing environments is very good. Typical applications are for example storage tanks, pressure vessels, heat exchangers and containers within civil engineering, pulp & paper, transportation, chemical industry, etc.

Avesta FCW-2D 2304 provides excellent weldability in flat position. Welding in vertical-up and overhead positions is preferably done using Avesta FCW 2304-PW. The wire is over-alloyed with nickel to promote weld metal austenite formation. Ferrite measured with FeritScope FMP30 27 – 34 FN.

Base materials

1.4362 X2CrNiN23-4, 1.4162 X2CrMnNiN21-5-1, 1.4482 X2CrMnNiMoN21-5-3

UNS S32304, S32101, S32001

SAF 2304, LDX 2101®, 2001

ASME SA 240, ASME SA 790, ASME Code Case 2418 and similar alloys.

Typical analysis of the wire

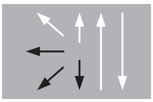
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.025	0.7	1.1	24.6	9.0	0.4	0.14	27	> 30

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–40°C	–60°C	Hardness HB
u	570 (≥ 450)	760 (≥ 690)	28 (≥ 20)	65	45	41	240

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 280	24 – 30	6.5 – 15.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V and the weld metal austenite content increases somewhat. Gas flow rate 18 – 25 l/min. Suggested heat input is 0.5 – 2.0 kJ/mm, interpass temperature max. 150ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1020 – 1080ºC followed by water quenching.

Approvals

TÜV (11416), CE

FCW

Avesta FCW 2304-PW

Flux-cored wire, high-alloyed, lean duplex stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 7 N L R M21 (C1) 1	E2307T1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 23 7 N L P / E2307T1 type for welding the lean duplex stainless steel SAF 2304 (1.4362/UNS S32304) and similar grades. The corrosion resistance is in general higher than for austenitic stainless steel of 1.4401 / 316L type. Thanks to the low molybdenum content, the resistance to pitting corrosion and stress corrosion cracking in nitric acid containing environments is very good. Typical applications are storage tanks, pressure vessels, heat exchangers and containers within civil engineering, pulp & paper, transportation, chemical industry, etc.

Avesta FCW 2304-PW has a stronger arc and a faster freezing slag compared to Avesta FCW-2D 2304. It is designed for all-round welding and can be used in all positions without changing the parameter settings. The weldability is excellent in the vertical-up and overhead welding positions. The wire is over-alloyed with nickel to promote weld metal austenite formation. Ferrite measured with FeritScope FMP30 27 – 34 FN.

Base materials

1.4362 X2CrNiN23-4, 1.4162 X2CrMnNiN21-5-1, 1.4482 X2CrMnNiMoN21-5-3

UNS S32304, S32101, S32001

SAF 2304, LDX 2101®, 2001

ASME SA 240, ASME SA 790, ASME Code Case 2418 and similar alloys.

Typical analysis of the wire

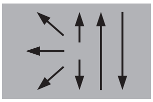
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.03	0.7	1.1	24.6	9.0	0.4	0.14	27	> 30

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –30°C	Hardness HB
u	580 (≥ 450)	750 (≥ 690)	31 (≥ 20)	67	54 (≥ 32)	240

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 230	23 – 30	5.5 – 11.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V and the weld metal austenite content increases somewhat. Gas flow rate 18 – 25 l/min. Suggested heat input is 0.5 – 2.0 kJ/mm, interpass temperature max. 150ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1020 – 1080ºC followed by water quenching.

Approvals

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FCW

Avesta FCW-2D 2205

Flux-cored wire, high-alloyed, duplex stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 22 9 3 N L R M21 (C1) 3	E2209T0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 22 9 3 N L R / E 2209T0 type primarily designed for welding 2205 (1.4462 / UNS S32205, S31805) duplex stainless steels used in offshore, shipyards, chemical tankers, chemical/petrochemical, pulp & paper, etc.

Avesta FCW-2D 2205 provides excellent weldability in flat as well as horizontal-vertical position. Welding in vertical-up and overhead positions is preferably done using FCW 2205-PW. The weld metal has very good resistance to pitting and stress corrosion cracking in chloride containing environments and meets the corrosion test requirements per ASTM G48 Methods A, B and E (22ºC), ASTM G36 and NACE TM 0177 Method A. Over-alloyed in nickel to promote austenite formation. Ferrite measured with FeritScope FMP30 39 – 47 FN.

Base materials

1.4462 X2CrNiMoN22-5-3, 1.4362 X2CrNiN23-4, 1.4162 X2CrNiMoN21-5-1

UNS S32205, S31803, S32304, S32101

2205, 2304, LDX 2101®, SAF 2205, SAF 2304

Typical analysis of the wire

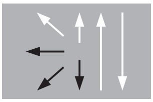
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.027	0.7	0.9	22.7	9.0	3.2	0.13	> 35	35 – 65

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –30°C	Hardness HB
u	620 (≥ 450)	800 (≥ 690)	27 (≥ 20)	60	45 (≥ 32)	240

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 180	24 – 30	6.5 – 15.5
1.6	~ 3	200 - 350	26 – 30	5.0 - 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V and the weld metal austenite content increases somewhat. Gas flow rate 18 – 25 l/min. Suggested heat input is 0.5 – 2.5 kJ/mm, interpass temperature max. 150ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1150ºC followed by water quenching.

Approvals

TÜV (10742), BV (C1 + Ø 1.2 mm), CWB, DNV GL, LR, RINA (M21), DB (43.014.44), ABS, CE

Avesta FCW 2205-PW

Flux-cored wire, high-alloyed, duplex stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 22 9 3 N L P M21 (C1) 1	E2209T1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 22 9 3 N L P / E 2209T1 type primarily designed for welding 2205 (1.4462 / UNS S32205, S31803) duplex stainless steels used in offshore, shipyards, chemical tankers, chemical/petrochemical, pulp & paper, etc.

Avesta FCW 2205-PW has a stronger arc and a faster slag compared to Avesta FCW-2D 2205. It is designed for all-round welding and can be used in all positions without changing the parameter settings. The weldability is excellent in the vertical-up and overhead welding positions. Very good resistance to pitting and stress corrosion cracking in chloride containing environments. Meets the corrosion test requirements per ASTM G48 Methods A, B and E (25ºC). Over-alloyed in nickel to promote austenite formation. Ferrite measured with FeritScope FMP30 35 – 41 FN.

Base materials

1.4462 X2CrNiMoN22-5-3, 1.4362 X2CrNiN23-4, 1.4162 X2CrNiMoN21-5-1

UNS S32205, S31803, S32304, S32101

2205, 2304, LDX 2101®, SAF 2205, SAF 2304

Typical analysis of the wire

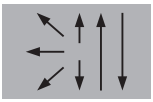
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.029	0.7	1.0	23.0	9.1	3.2	0.13	> 35	45 – 65

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –46°C	Hardness HB
u	600 (≥ 450)	800 (≥ 690)	27 (≥ 20)	58	45	240

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 230	23 – 30	5.5 – 11.5
1.6	~ 3	200 – 320	25 – 30	5.0 – 9.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V and the weld metal austenite content increases somewhat. Gas flow rate 18 – 25 l/min. Suggested heat input is 0.5 – 2.5 kJ/mm, interpass temperature max. 120ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1185ºC followed by water quenching.

Approvals

TÜV (10743), BV (C1 + Ø 1.2 mm), CWB, DNV GL, LR, RINA (M21), ABS, CCS, CE

böhler welding by voestalpine

Avesta FCW LDX 2404-PW

Flux-cored wire, high-alloyed, duplex stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T Z 25 9 4 N L P M21 (C1) 2	E2594T1-G

Characteristics and typical fields of application

Rutile flux-cored wire of T Z 25 9 4 L P / E2594T1-G type primarily designed for welding of LDX 2404® (1.4462/UNS S82441) – a "lean duplex" stainless steel with excellent strength and good resistance to general corrosion. Main applications are civil engineering, storage tanks, containers, etc.

Avesta FCW LDX 2404-PW can be used in all positions without changing the parameter settings. The weldability is excellent in the vertical-up and overhead welding positions. The critical pitting temperature (CPT) for welded joints (sand blasted and pickled condition) is 20 – 30ºC according to ASTM G48 E. The wire is overalloyed in order to promote austenite formation. Ferrite measured with FeritScope FMP30 37 – 41 FN.

Base materials

LDX 2404®, 1.4662 X2CrNiMnMoCuN24-4-3-2, UNS S82441

Typical analysis of the wire

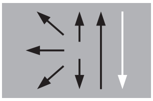
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.03	0.7	1.5	25.1	8.8	2.2	0.19	36	45 – 65

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –40°C	Hardness HB
u	630 (≥ 550)	830 (≥ 760)	30 (≥ 18)	58	46	240

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 230	23 – 30	5.5 – 11.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability and mechanical properties. Gas flow rate 18 – 25 l/min. Suggested heat input is 0.5 – 1.5 kJ/mm, interpass temperature max. 150ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1020 – 1080ºC followed by water quenching.

Approvals

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Avesta FCW 2507/P100-PW

Flux-cored wire, high-alloyed, superduplex stainless

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 25 9 4 N L P M21 (C1) 2	E2594T1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 25 9 4 N L P / E2594T1 type designed for welding ferritic-austenitic superduplex steel and equivalent steel grades such as 1.4410 / UNS S32570 and 1.4501 / UNS S32760. Can also be used for joints between superduplex grades and austenitic stainless steels or carbon steels. Superduplex steels are particularly popular for desalination, pulp & paper, flue gas desulphurization and sea water systems. The properties of the weld metal match those of the parent metal, offering high tensile strength and toughness as well as an excellent resistance to stress corrosion cracking and localized corrosion in chloride containing environments. Meet the corrosion test requirements per ASTM G48 Methods A, B and E (40ºC). Over-alloyed in nickel to promote austenite formation. Ferrite measured with FeritScope FMP30 45 – 51 FN. Designed for all-round welding and can be used in all positions without changing the parameter settings. The weldability is excellent in the vertical-up and overhead welding positions. The operating temperature range is –40ºC to 220ºC.

Base materials

25Cr superduplex ferritic-austenitic stainless steel and castings 1.4410 X2CrNiMoN25-7-4, 1.4467 X2CrMnNiMoN26-5-4 1.4468 GX2CrNiMoN25-6-3, 1.4501 X2CrNiMoCuWN25-7-4, 1.4507 X2CrNiMoCuN25-6-3, 1.4515 GX2CrNiMoCuN26-6-3 1.4517 GX2CrNiMoCuN25-6-3-3

UNS S32750, S32760, J93380, S32520, S32550, S39274, S32950

Typical analysis of the wire

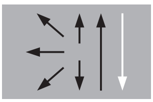
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.03	0.7	0.9	25.3	9.8	3.7	0.23	> 41	45 – 55

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –40°C	Hardness
u	690 (≥ 550)	890 (≥ 760)	27 (≥ 18)	60 (≥ 50)	38 (≥ 32)	260

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 230	23 – 30	5.5 – 11.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability and mechanical properties. Gas flow rate 18 – 25 l/min. Suggested heat input is 0.5 – 1.5 kJ/mm, interpass temperature max. 120ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1185ºC followed by water quenching.

Approvals

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Avesta FCW 2507/P100-PW NOR

Flux-cored wire, high-alloyed, superduplex stainless

Classifications

EN ISO 17633-A
T 25 9 4 N L P M21 (C1) 2

AWS A5.22 / SFA-5.22
E2594T1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 25 9 4 N L P / E2594T1 type designed for welding ferritic-austenitic superduplex steel and equivalent steel grades such as 1.4410 / UNS S32570 and 1.4501 / UNS S32760. Can also be used for joints between superduplex grades and austenitic stainless steels or carbon steels. Superduplex steels are particularly popular for desalination, pulp & paper, flue gas desulphurization and sea water systems. Developed to fulfill severe requirements, such as those in NORSOK M-601 and similar standards. Properties of the weld metal match those of the parent metal, offering high tensile strength and toughness as well as an excellent resistance to stress corrosion cracking and localized corrosion in chloride containing environments. Meet the corrosion test requirements per ASTM G48 Methods A, B and E (40ºC). Over-alloyed in nickel to promote austenite formation. Ferrite measured with FeritScope FMP30 45 – 51 FN. Designed for all-round welding and can be used in all positions without changing the parameter settings. The weldability is excellent in the vertical-up and overhead welding positions. The operating temperature range is –50ºC to 220ºC.

Base materials

25Cr superduplex ferritic-austenitic stainless steel and castings 1.4410 X2CrNiMoN25-7-4, 1.4467 X2CrMnNiMoN26-5-4 1.4468 GX2CrNiMoN25-6-3, 1.4501 X2CrNiMoCuWN25-7-4, 1.4507 X2CrNiMoCuN25-6-3, 1.4515 GX2CrNiMoCuN26-6-3 1.4517 GX2CrNiMoCuN25-6-3-3

UNS S32750, S32760, J93380, S32520, S32550, S39274, S32950

Typical analysis of the wire

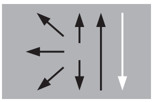
	C	Si	Mn	Cr	Ni	Mo	N	PRE_N	FN
wt.-%	0.03	0.7	0.9	25.3	9.8	3.7	0.23	> 41	35 – 65

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–50°C	Hardness
u	640 (≥ 550)	880 (≥ 760)	20 (≥ 18)	70 (≥ 50)	41	250

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 230	23 – 30	5.5 – 11.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability and mechanical properties. Gas flow rate 18 – 25 l/min. Suggested heat input is 0.5 – 1.5 kJ/mm, interpass temperature max. 120ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1100 – 1185ºC followed by water quenching.

Approvals

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Welding consumables for dissimilar joints and special applications

◆ Content

Stick electrodes

Product name	C	Si	Mn	Cr	Ni	Mo	N
BÖHLER FOX A 7	0.09	0.70	6.50	18.60	8.80		
BÖHLER FOX A 7-A	0.10	1.50	4.00	19.50	8.50	0.70	
BÖHLER FOX CN 19/9 M	0.04	0.70	0.80	20.20	10.30	3.20	
Thermanit 20/10 W 140 K	0.05	0.90	0.80	20.00	10.50	3.30	
BÖHLER FOX CN 23/12-A	0.02	0.70	0.80	23.20	12.50		
BÖHLER FOX CN 23/12 Mo-A	0.02	0.70	0.80	23.00	12.50	2.70	
Thermanit 30/10 W	0.10	1.10	0.80	29.00	9.00		0.10
BÖHLER FOX CN 29/9-A	0.11	0.90	0.70	28.80	9.50		

GTAW rods

Product name	C	Si	Mn	Cr	Ni	Mo
Thermanit X	0.08	0.80	7.00	19.00	9.00	
Thermanit 25/14 E-309L	0.02	0.50	1.70	23.50	13.20	
Thermanit 25/14 E-309L Si	0.02	0.80	1.80	23.50	13.50	
BÖHLER CN 23/12 Mo-IG	0.01	0.40	1.50	21.50	15.00	2.70

Solid wires

Product name	C	Si	Mn	Cr	Ni	Mo	FN
Thermanit X	0.08	0.80	7.00	19.00	9.00		
Thermanit 20/10	0.05	0.50	1.30	20.50	10.50	3.30	
Thermanit 25/14 E-309L	≤ 0.02	0.50	1.70	24.00	13.20		
Thermanit 25/14 E-309L Si (-)	0.03	0.90	2.00	24.00	13.00		
BÖHLER CN 23/12 Mo-IG	0.01	0.35	1.50	21.50	15.00	2.80	8
Thermanit 30/10	0.15	0.50	1.60	30.00	9.00		

SAW wire/flux combinations

Product name	C	Si	Mn	Cr	Ni	Mo	FN
BÖHLER A 7 CN-UP - BÖHLER BB 203	0.06	0.80	6.00	18.70	9.00		
Thermanit 25/14 E-309L - Marathon 213	0.01	0.70	1.30	23.50	13.50		
Thermanit 25/14 E-309L - Marathon 431	0.01	0.60	1.40	23.50	13.50		
Thermanit 25/14 E-309L - Avesta Flux 805	0.01	0.60	1.40	24.50	13.50		
Avesta P5 - Avesta Flux 805	0.01	0.50	1.10	22.00	14.80	2.60	15 FN (DeLong)
Avesta P7 - Avesta Flux 805	0.10	0.60	1.60	30.50	8.80		

Flux-cored and metal-cored wire

Product name	C	Si	Mn	Cr	Ni	Mo	FN
BÖHLER A 7-FD	0.10	0.80	6.80	18.80	9.00		2 – 4
BÖHLER A 7 PW-FD	0.10	0.80	6.80	18.80	9.00		2 – 4
BÖHLER A 7-MC	0.10	0.60	6.30	18.80	9.20		2 – 4
BÖHLER CN 23/12-FD	0.03	0.70	1.40	23.00	12.50		12 – 23
Avesta FCW-2D 309L	0.03	0.70	1.20	23.10	12.50		12 – 23
BÖHLER CN 23/12 PW-FD	0.03	0.70	1.40	23.00	12.50		12 – 23
Avesta FCW 309L-PW	0.03	0.70	1.40	23.00	12.50		12 – 23
BÖHLER CN 23/12-MC	0.03	0.60	1.40	23.00	12.50		12 – 23
BÖHLER CN 23/12 Mo-FD	0.03	0.60	1.40	23.00	12.50	2.70	27 – 42
BÖHLER CN 23/12 Mo PW-FD	0.03	0.70	1.40	23.00	12.50	2.70	23 – 36

BÖHLER FOX A 7

Stick electrode, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 18 8 Mn B 2 2	E307-15 (mod.)

Characteristics and typical fields of application

Basic coated, core wire alloyed austenitic electrode of E 18 8 Mn B / E307-15 type for welding and cladding in all positions except vertical down. Versatile electrode for numerous applications – welding of "hard-to-weld" steels, dissimilar welding as well as repair and maintenance. For tough buffer and intermediate layers for cladding of rails and switches, valve seats and in hydropower plants. The weld metal offers exceptionally high ductility and elongation together with outstanding crack resistance. Good resistance to embrittlement when operating at service temperatures from –100ºC up to 650ºC. The weld metal work hardens and offers good resistance to cavitation. The weld metal is resistant to scaling up to 850ºC, but at temperatures above 500ºC there is not sufficient resistance to sulfurous combustion gases. The weld deposit offers high ductility, elongation and resistance to hot cracking, also after high dilution of "hard-to-weld" steels.

Base materials

Dissimilar joints, tough buffer and intermediate layers prior to hardfacing, 14Mn-steels, 13 – 17% Cr and heat resistant Cr and austenitic steels up to 850ºC, armor plates, high carbon and quenched and tempered steels, surfacing of gears, valves, turbine blades, etc. For joint welding of unalloyed / low-alloyed or Cr steels with high-alloyed Cr and CrNi-steels. Welding of austenitic high manganese steels and with other steels.

Typical analysis of all-weld metal

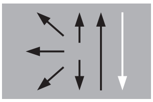
	C	Si	Mn	Cr	Ni
wt.-%	0.09	0.7	6.5	18.6	8.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–110°C
u	440 (≥ 350)	600 (≥ 500)	35 (≥ 25)	90	34 (≥ 32)

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification FOX A 7 / E 18 8 Mn B

Dimension mm	Current A
2.5 × 300	55 – 75
3.2 × 350	80 – 100
4.0 × 350	100 – 130
5.0 × 450	140 – 170

Preheat, interpass temperature and post-weld heat treatment as required by the base metal.

Approvals

TÜV (06786), DB (30.014.24), DNV GL, CE

BÖHLER FOX A 7-A

Stick electrode, high-alloyed, austenitc stainless, special applications

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E Z 18 9 MnMo R 3 2	E307-16 (mod.)

Characteristics and typical fields of application

Rutile basic coated austenitic electrode of E Z 18 9 MnMo R / E307-16 (mod.) type for welding and cladding in all positions except vertical down. Versatile electrode for numerous applications – welding of "hard-to-weld" steels, dissimilar welding as well as repair and maintenance. For tough buffer and intermediate layers for cladding of rails and switches, valve seats and in hydropower plants.

The weld metal offers exceptionally high ductility and elongation together with outstanding crack resistance. Good resistance to embrittlement when operating at service temperatures from –100ºC up to 650ºC. The weld metal work hardens and offers good resistance to cavitation. The weld metal is resistant to scaling up to 850ºC, but at temperatures above 500ºC there is not sufficient resistance to sulfurous combustion gases. The weld deposit offers high ductility, elongation and resistance to hot cracking, also after high dilution of "hard-to-weld" steels. Designed for first class weld seems and easy handling on AC or DC. Ferrite according to WRC 92 is 4 – 8 FN.

Base materials

Dissimilar joints, tough buffer and intermediate layers prior to hardfacing, 14Mn-steels, 13 – 17% Cr and heat resistant Cr and austenitic steels up to 850ºC, armor plates, high carbon and quenched and tempered steels, surfacing of gears, valves, turbine blades, etc. For joint welding of unalloyed / low-alloyed or Cr steels with high-alloyed Cr and CrNi-steels. Welding of austenitic high manganese steels and with other steels.

Typical analysis of all-weld metal

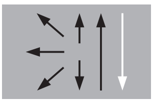
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.10	1.5	4.0	19.5	8.5	0.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–20°C	–100°C
u	520 (≥ 350)	620 (≥ 500)	35 (≥ 25)	57	75	(≥ 32)

u untreated, as-welded

Operating data



Polarity	DC+ / AC
Electrode identification	FOX A 7-A / E Z 18 9 MnMo R

Dimension mm	Current A
2.5 × 300/350	60 – 80
3.2 × 300/350	80 – 110
4.0 × 350	110 – 140
5.0 × 450	140 – 170

Preheat, interpass temperature and post-weld heat treatment as required by the base metal.

Redrying at 120 – 200°C for min. 2 h if necessary.

Approvals

TÜV (09101), NAKS (Ø 3.2 mm), CE

BÖHLER FOX CN 19/9 M

Stick electrode, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 3581-A	**AWS A5.4 / SFA-5.4**
E 20 10 3 R 3 2	E308Mo-17 (mod.)

Characteristics and typical fields of application

Rutile coated, core wire alloyed electrode of E 20 10 3 R / E308Mo-17 type. Designed for dissimilar joints and weld cladding. BÖHLER FOX CN 19/9 M offers a lower chromium and ferrite content than an E309LMo weld deposit with the result that carbon diffusion and Cr-carbide formation is reduced after post-weld heat treatment and lower ferrite contents can be achieved in the second layer of 316L surfacing. Suitable for service temperatures from –80ºC to 300ºC. Excellent weldability in all positions except vertical down. Runs well also on AC.

Base materials

Welding and dissimilar joining of high-strength, mild steels and low-alloyed constructional steels; quench tempered steels, armour plates and austenitic manganese steels. Welding of non-alloyed as well as alloyed boiler or constructional steels to high-alloyed stainless Cr and CrNi-steels.

Typical analysis of all-weld metal

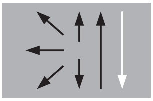
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.04	0.7	0.8	20.2	10.3	3.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–80°C
u	500 (≥ 400)	700 (≥ 620)	28 (≥ 20)	70	42 (≥ 32)

u untreated, as-welded

Operating data



Polarity	DC+ / AC
Electrode identification	FOX CN 19 9 M / E 20 10 3 R

Dimension mm	Current A
2.5 × 250	50 – 85
3.2 × 350	75 – 115
4.0 × 350	110 – 160
5.0 × 450	160 – 200

Preheating and interpass temperature as required by the base metal.
Redrying if necessary at 250 – 300ºC for min. 2 h.

Approvals

TÜV (01086), DB (30.014.03), ABS, DNV GL, LR, CE

SMAW

Thermanit 20/10 W 140 K

Stick electrode, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 20 10 3 R 5 3	E308Mo-17 (mod.)

Characteristics and typical fields of application

Rutile coated electrode of E 20 10 3 R / E308Mo-17 (mod.) type. For joining of stainless Cr and austenitic CrNiMo-steels/cast steel grades. Especially suited for dissimilar austenitic ferritic joints at a max. service temperature of 300ºC. For tough joints on high manganese steel (steel castings), CrNiMn-steels and armor steels. For surfacing and repair welding on wear parts such as rotors and rails. Particularly for tough joints between unalloyed and low-alloyed steels or stainless and heat resistant Cr-steels to austenitic steels. Not recommended for buffer layers on weld claddings or clad plates. Max. application temperature 300ºC.

Base materials

Combinations of austenitic steels with ferritic steels.

Typical analysis of all-weld metal

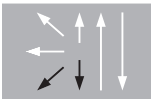
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.05	0.9	0.8	20.0	10.5	3.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	400	650	25	50

u untreated, as-welded

Operating data



		Dimension mm	Current A
Polarity	DC+ / AC	3.2 × 350	90 – 120
Electrode identification	Thermanit 20/10 W 140K E 20 10 3 R	4.0 × 350	130 – 160

Suggested heat input is max.1.5 kJ/mm, interpass temperature max. 200ºC. High manganese steels become brittle at 400 – 600ºC so these should be welded as cold as possible.

Preheating only if required by the parent material.

Postweld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC. Stress relieving only if allowed by the parent material.

Approvals

-

BÖHLER FOX CN 23/12-A

Stick electrode, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 23 12 L R 3 2	E309L-17

Characteristics and typical fields of application

Rutile coated, core wire alloyed electrode of E 23 12 L / E309L-17 type providing increased delta ferrite contents (FN ~17) in the weld deposit for safe and crack resistant dissimilar joint welds and surfacing. Designed for first class weld seems and easy handling on AC or DC+. High current carrying capacity with minimum spatter formation. Self-releasing slag, smooth and clean weld profile. Safety against formation of porosity due to moisture resistant coating and its packaging into hermetically sealed tins. Operating temperature from –60ºC to 300ºC and for weld claddings up to 400ºC.

Base materials

Primarily used for surfacing (buffer layer) unalloyed or low-alloyed steels and when joining non-molybdenum-alloyed stainless and carbon steels. Joints and mixed joints between austenitic steels such as

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640

AISI 304, 304L, 316, 316L, 316Ti, 321, 347

or mixed joints between austenitic and heat resistant steels such as

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12

with ferritic steels to pressure boiler steels P295GH and fine grained structural steels to P355N, ship building steel grades A – E, AH 32 – EH 36, A40 – F40, etc.

Typical analysis of all-weld metal

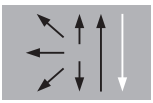
	C	Si	Mn	Cr	Ni
wt.-%	0.02	0.7	0.8	23.2	12.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–60°C
u	450 (≥ 320)	570 (≥ 520)	37 (≥ 25)	55	42 (≥ 32)

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification FOX CN 23/12-A / 309L-17 E 23 12 L R

Dimension mm	Current A
2.5 × 300/350	60 – 80
3.2 × 300/350	80 – 110
4.0 × 350/450	110 – 140
5.0 × 450	140 – 180

Preheating and interpass temperature as required by the base metal.

Redrying at 120 – 200°C for min. 2 h if necessary.

Approvals

TÜV (01771), DB (30.014.08), ABS, BV, LR, DNV GL, CWB, NAKS (Ø 3.2 mm, Ø 4.0 mm), CE

SMAW

BÖHLER FOX CN 23/12 Mo-A

böhler welding by voestalpine

Stick electrode, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 23 12 2 L R 3 2	E309LMo-17

Characteristics and typical fields of application

Rutile coated electrode of E 23 12 2 L / E309LMo-17 type. Provides increased delta ferrite content (FN ~20) in the weld metal for safe and crack resistant dissimilar joints as well as for cladding or root passes of clad steel. Designed for first class weld seems and easy handling on AC or DC+. High current carrying capacity with minimum spatter formation. Self-releasing slag, smooth and clean weld profile. Safety against formation of porosity due to moisture resistant coating and its packaging into hermetically sealed tins. Operating temperature from –10ºC to 300ºC and for weld surfacing (1st layer) up to 400ºC.

Base materials

Joints and mixed joints between austenitic stainless steels such as

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640, S31653

AISI 304, 304L, 304LN, 302, 321, 347, 316, 316L, 316Ti, 316Cb

or duplex stainless steels such as

1.4162 X2CrNiMoN21-5-1, 1.4362 X2CrNiN23-4, 1.4462 X2CrNiMoN22-5-3

UNS S32101, S32304, S31803, S32205

LDX 2101®, SAF 2304, SAF 2205

or mixed joints between austenitic and heat resistant steels

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12

with ferritic steels to pressure boiler steels P295GH and also fine grained structural steels to P355N, shipbuilding steels grade A – E, AH 32 – EH 36, A40 – F40, etc.

Dissimilar joint welds – overlay welding the first corrosion resistant surface layer on P235GH, P265GH, S255N, P295GH, S355N – S500N and high-temperature quenched and tempered fine-grained steels.

Typical analysis of all-weld metal

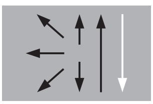
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.02	0.7	0.8	23.0	12.5	2.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–60°C
u	550 (≥ 350)	700 (≥ 550)	27 (≥ 25)	50	40 (≥ 32)

u untreated, as-welded

Operating data



Polarity	DC+ / AC
Electrode identification	FOX CN 23/12 Mo-A / E 23 12 2 L R

Dimension mm	Current A
2.0 × 300	45 – 60
2.5 × 250/350	60 – 80
3.2 × 350	80 – 120
4.0 × 350/450	100 – 160
5.0 × 450	140 – 220

Preheating and interpass temperature as required by the base metal.

Redrying at 250 – 300°C for min. 2 h if necessary.

Approvals

TÜV (01362), ABS, RINA, DNV GL, BV, LR, NAKS (Ø 2.5 mm), CE

Thermanit 30/10 W

Stick electrode, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 29 9 R 1 2	E312-16 (mod.)

Characteristics and typical fields of application

Rutile coated electrode of E 29 9 R / E312-16 type. Wet corrosion up to 300ºC. High resistance to hot cracking and good toughness at high yield strength. For joining and surfacing applications with matching and similar steel grades. For fabricating tough joints on unalloyed and low-alloyed structural steels of higher strength, on high manganese and CrNiMn-steels, between dissimilar metals e.g. between stainless or heat resistant and unalloyed or low-alloyed steels and cast steel grades.

Base materials

For welding of unalloyed steels with limited weldability and low-alloyed steels of higher strength. Used as stress-relieved buffer layer when cladding cold and warm machine tools. For joining of high manganese and CrNiMn-steels, as well as for combinations on steels of different chemical composition or strength.

1.3401 X120Mn12, 1.4006 X10Cr13, 1.4339 GX32CrNi28-10, 1.4340 GX49CrNi27-4, 1.4347 GX8CrCrNiN26-7 1.4460 X3CrNiMoN27-5-2 UNS S41000 AISI 329, 410. S235, E295

Typical analysis of all-weld metal

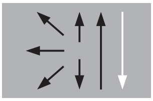
	C	Si	Mn	Cr	Ni	N
wt.-%	0.10	1.1	0.8	29.0	9.0	0.1

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	> 550	> 700	> 18	25

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification Thermanit 30/10 W E 29 9 R

Dimension mm	Current A
2.0 × 250	45 – 60
2.5 × 300	50 – 80
3.2 × 350	60 – 110
4.0 × 350	90 – 150
5.0 × 450	150 – 210

Suggested heat input max. 2.0 kJ/mm and interpass temperature max. 150ºC.
Preheating and interpass temperature as required by the base metal.
Weld with a short arc, use stringer beads or slight weaving, as applicable.
Redrying at 120 – 200ºC for min. 2h if necessary.

Approvals

CE

BÖHLER FOX CN 29/9-A

Stick electrode, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 29 9 R 3 2	E312-17

Characteristics and typical fields of application

Rutile coated, core wire alloyed electrode of E 29 9 R / E312-17 type. Highly alloyed electrode with high ferrite content to offer high tensile strength and excellent resistance to cracking. Primarily intended for dissimilar welding between stainless steel, high strength steel, tool steel; spring steel and 14Mn-steel as well as other difficult-to-weld combinations. The weld metal work hardens making it suitable for wear resisting build-ups on clutches, gear wheels, shafts, etc. Also suitable for repair and maintenance; for instance welding of tools. Designed for first class weld seems and easy handling on AC or DC+. Very good corrosion resistance in wet sulfuric environments, such as in sulfate digesters used by the pulp & paper industry.

Base materials

For steels with higher strength and difficult welding characteristics, joining of dissimilar materials, tool steels, heat treatable or quenched and tempered steels, spring steels, high carbon steels etc.

1.4339 GX32CrNi28-10, 1.4347 GX8CrCrNiN26-7, 1.4340 GX49CrNi27-4, 1.4460 X3CrNiMoN27-5-2

Typical analysis of all-weld metal

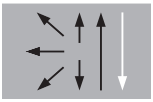
	C	Si	Mn	Cr	Ni
wt.-%	0.11	0.9	0.7	28.8	9.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	650 (≥ 450)	790 (≥ 660)	24 (≥ 15)	30

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification FOX CN 29/9-A E 29 9 R

Dimension mm	Current A
2.5 × 300	60 – 80
3.2 × 350	80 – 110
4.0 × 350	110 – 140
5.0 × 450	140 – 180

Recommended heat input max. 2.0 kJ/mm and interpass temperature max. 150°C.
Preheating and interpass temperature as required by the base metal.
Redrying at 250 – 300°C for min. 2 h if necessary.

Approvals

DB (30.014.16, 20.014.07), CE

Thermanit X

TIG rod, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 18 8 Mn	ER307 (mod.)

Characteristics and typical fields of application

TIG rod of W 18 8 Mn / ER307 (mod.) type for joining and surfacing applications with heat resistant Cr-steels and heat resistant austenitic steels. Max. service temperature 850ºC. Well-suited for fabricating dissimilar austenitic-ferritic joints for a max. application temperature of 300ºC. For joining unalloyed, low-alloyed or Cr-steels to austenitic steels. Low heat input required in order to avoid brittle martensitic transition zones. Inadequate resistance against sulfurous combustion gases at temperatures above 500ºC.

Base materials

Dissimilar joints, tough buffer and intermediate layers prior to hardfacing, 14Mn-steels, 13 – 17% Cr and heat resistant Cr and austenitic steels up to 850ºC, armor plates, high carbon and quenched and tempered steels, surfacing of gears, valves, turbine blades, etc. For joint welding of unalloyed / low-alloyed or Cr steels with high-alloyed Cr and CrNi-steels. Welding of austenitic high manganese steels and with other steels.

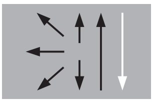
Typical analysis of the wire rod

	C	Si	Mn	Cr	Ni
wt.-%	0.08	0.8	7.0	19	9.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	450 (≥ 350)	620 (≥ 500)	35 (≥ 25)	100

Operating data



Rod marking W 18 8 Mn / 1.4370

Dimension mm	Current A	Voltage V
1.0 × 1000	50 – 70	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Preheat, interpass temperature and post-weld heat treatment as required by the base metal. Thicker heat resistant Cr-steels can be preheated to 150 – 300ºC. In case of post weld heat treatment of dissimilar joints, attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement. For dissimilar joining with unalloyed or low-alloy steels, no post weld heat treatment should be performed above 300ºC due to the risk of carbide precipitation in the weld fusion zone causing loss of toughness.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (01234), DB (43.132.26), DNV GL, CE

GTAW

Thermanit 25/14 E-309L

TIG rod, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 23 12 L	ER309L

Characteristics and typical fields of application

TIG rod of W 23 12 L / ER309L type for welding dissimilar joints. Well-suited for depositing intermediate layers when welding of cladded materials. Designed for very good welding and wetting characteristics as well as good safety after dilution when welding dissimilar joints. Due to the high ferrite content, 16 FN, the weld metal is less susceptible to hot cracking. Suitable for service temperatures between –80°C and 300°C.

Base materials

Primarily used for surfacing (buffer layer) unalloyed or low-alloyed steels and when joining non-molybdenum-alloyed stainless and carbon steels.

Joints and mixed joints between austenitic steels such as

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640

AISI 304, 304L, 316, 316L, 316Ti, 321, 347

or mixed joints between austenitic and heat resistant steels such as

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12

with ferritic steels to pressure boiler steels P295GH and fine grained structural steels to P355N, ship building steel grades A – E, AH 32 – EH 36, A40 – F40, etc.

Typical analysis of the wire rod

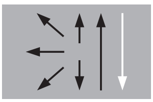
	C	Si	Mn	Cr	Ni
wt.-%	0.02	0.5	1.7	23.5	13.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C
u	440 (≥ 320)	580 (≥ 520)	34 (≥ 25)	150	(≥ 32)

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking W 23 12 L
ER 309 L

Dimension mm	Current A	Voltage V
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Heat input max. 1,5 kJ/mm, interpass temperature max. 100°C.

Preheating and interpass temperature as required by the base metal. In case of post weld heat treatment of dissimilar joints, attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement. For dissimilar joining with unalloyed or low-alloyed steels, no post-weld heat treatment should be performed above 300°C due to the risk of carbide precipitation in the weld fusion zone causing loss of toughness.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (02661), DNV GL, ABS, BV, NAKS, CE

böhler welding by voestalpine

Thermanit 25/14 E-309L Si

TIG rod, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
23 12 L Si	ER309LSi

Characteristics and typical fields of application

TIG rod of W 23 12 L Si / ER309LSi for joining and surfacing applications. Designed for dissimilar welding between mild steel and stainless steels and surfacing of low-alloy steels, offering a ductile and crack resistant weldment. The chemical composition when surfacing is equivalent to that of base material 1.4301 / 304 from the first run. One or two layers of 309L are usually combined with a final layer of 308L, 316L or 347. The resulting microstructure is austenite with 5 – 10% ferrite. The corrosion resistance is superior to type 308L already in the first clad layer.

Base materials

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640

AISI 304, 304L, 316, 316L, 316Ti, 321, 347

or mixed joints between austenitic and heat resistant steels such as

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12

with ferritic steels to pressure boiler steels P295GH and fine grained structural steels to P355N, ship building steel grades A – E, AH 32 – EH 36, A40 – F40, etc.

Typical analysis of the wire rod

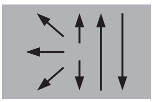
	C	Si	Mn	Cr	Ni
wt.-%	0.02	0.8	1.8	23.5	13.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	470	650	28	100

u untreated, as-welded – shielding gas Ar + 30% He

Operating data



Polarity DC-

Dimension mm
0.8

Heat input max. 2.0 kJ/mm, interpass temperature max. 150ºC. Post-weld heat treatment generally not needed. For constructions that include low-alloyed steels in mixed joints, a stress-relieving annealing stage may be advisable. This type of alloy may be susceptible to embrittlement-inducing precipitation in the temperature range 550 – 950ºC. .

Shielding gas: 100% Ar or Ar + 20 – 30% He, Ar + 1 – 5% H_2. The addition of helium and hydrogen increases the energy of the arc. Gas flow: 8 – 12 l/min (somewhat higher with helium).

Approvals

TÜV (02661), DNV GL, ABS, BV, NAKS, CE

BÖHLER CN 23/12 Mo-IG

TIG rod, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 23 12 2 L	ER309LMo

Characteristics and typical fields of application

TIG rod of W 23 12 2 L / ER309LMo type for welding dissimilar joints between duplex and stainless steels with low-alloyed steels and surfacing low-alloyed steels. Very good wetting characteristics and high resistance against cracking. When used for surfacing the composition is more or less equal to that of base material 1.4401/316 from the first run. Suitable for service temperatures between -40ºC and 300ºC. The corrosion resistance is superior to that of 316L even in the first layer of cladding.

Base materials

Joints and mixed joints between austenitic stainless steels such as

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640, S31653

AISI 304, 304L, 304LN, 302, 321, 347, 316, 316L, 316Ti, 316Cb

or duplex stainless steels such as

1.4162 X2CrNiMoN21-5-1, 1.4362 X2CrNiN23-4, 1.4462 X2CrNiMoN22-5-3

UNS S32101, S32304, S31803, S32205

LDX 2101®, SAF 2304, SAF 2205 or mixed joints between austenitic and heat resistant steels

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12 with ferritic steels to pressure boiler steels P295GH and also fine grained structural steels to P355N, shipbuilding steels grade A – E, AH 32 – EH 36, A40 – F40, etc.

Dissimilar joint welds – overlay welding the first corrosion resistant surface layer on P235GH, P265GH, S255N, P295GH, S355N – S500N and high-temperature quenched and tempered fine-grained steels.

Typical analysis of the wire rod

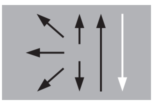
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.014	0.4	1.5	21.5	15.0	2.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–40°C
u	470 (≥ 350)	640 (≥ 550)	34 (≥ 25)	140 (≥ 47)	90 (≥ 32)

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking 1.4459

Dimension mm	Current A	Voltage V
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Preheating and interpass temperature as required by the base metal, max. 150ºC.

Suggested heat input is max. 2.0 kJ/mm.

For constructions that include low-alloyed steels in mixed joints, a stress-relieving annealing stage may be advisable. However, this type of alloy may be susceptible to embrittlement-inducing precipitation in the temperature range 550 – 950ºC.

Shielding gas: Ar or Ar + 20 – 30% He. The addition of helium and hydrogen increases the energy of the arc. Gas flow: 8 – 12 l/min (somewhat higher with helium).

Polarity: DC-

Approvals

TÜV (10990), CE

Thermanit X

Solid wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 18 8 Mn	ER307 (mod.)

Characteristics and typical fields of application

Solid wire of G 18 8 Mn / ER307 (mod.) type for joining and surfacing applications with heat resistant Cr-steels and heat resistant austenitic steels. Well-suited for fabricating dissimilar austenitic-ferritic joints for a max. application temperature of 300ºC. For joining unalloyed / low-alloyed or Cr-steels to austenitic steels. Low heat input required in order to avoid brittle martensitic transition zones. Max. service temperature 850ºC.

Base materials

Dissimilar joints, tough buffer and intermediate layers prior to hardfacing, 14Mn-steels, 13 – 17% Cr and heat resistant Cr and austenitic steels up to 850ºC, armor plates, high carbon and quenched and tempered steels, surfacing of gears, valves, turbine blades, etc. For joint welding of unalloyed / low-alloyed or Cr steels with high-alloyed Cr and CrNi-steels. Welding of austenitic high manganese steels and with other steels.

Typical analysis of the solid wire

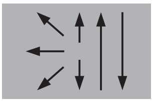
	C	Si	Mn	Cr	Ni
wt.-%	0.08	0.8	7.0	19	9.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	370	600	35	100

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	90 – 120	18 – 22
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30
1.6 spray arc	250 – 330	27 – 32

Preheat, interpass temperature and post-weld heat treatment as required by the base metal. Thicker heat resistant Cr-steels can be preheated to 150 – 300ºC. In case of post weld heat treatment of dissimilar joints, attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement. For dissimilar joining with unalloyed or low-alloy steels, no post weld heat treatment should be performed above 300ºC due to the risk of carbide precipitation in the weld fusion zone causing loss of toughness.

Shielding gas: Ar + 2 – 3% CO_2 (M12) or Ar + 1 – 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV (05651), DB (43.132.01), DNV GL, VG 95132-1, CE

Thermanit 20/10

Solid wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 20 10 3	ER308Mo (mod.)

Characteristics and typical fields of application

Solid wire of G 20 10 3 / ER308Mo (mod.) type for joining of stainless Cr and similar austenitic CrNiMo-steels and cast steel grades. For joining of dissimilar materials. For tough joints on high manganese steel (steel castings), CrNiMn-steels and cast steel grades and armor steels. For surfacing and repair welding on wear-exposed parts such as rotors and rails. Especially suited for dissimilar austenitic-ferritic joints at maximum application temperature of 300ºC. Particularly for tough joints of unalloyed / low-alloyed steels and cast steel grades or stainless heat resistant Cr-steels and cast steel grades with austenitic steels and cast steel grades. Application temperature max. 300ºC.

Base materials

Welding and dissimilar joining of high-strength, mild steels and low-alloyed constructional steels; quench tempered steels, armour plates and austenitic manganese steels. Welding of unalloyed as well as alloyed boiler or constructional steels to high-alloyed stainless Cr and CrNi-steels.

Typical analysis of the solid wire

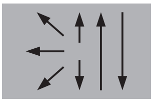
	C	Si	Mn	Cr	Ni	Mo
wt.-%	0.05	0.5	1.3	20.5	10.5	3.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	470 (≥ 400)	670 (≥ 620)	25 (≥ 20)	50

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.2 spray arc	200 – 270	26 – 30
1.6 spray arc	250 – 330	27 – 32

Suggested heat input is max.1.5 kJ/mm, interpass temperature max. 200ºC. High manganese steels become brittle at 400 – 600ºC so these should be welded as cold as possible.

Preheating only if required by the parent material.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC. Stress relieving only if allowed by the parent material.

Shielding gas: Ar + 1 – 2% O_2 or Ar + 2 – 3% CO_2. Gas flow: 15 – 20 l/min. Polarity: DC+

Approvals

TÜV (01773), CE

Thermanit 25/14 E-309L

Solid wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 23 12 L Si	ER309LSi

Characteristics and typical fields of application

GMAW solid wire of type 309L / 23 12 L for welding dissimilar joints with an average ferrite content 16 FN. Well suited for depositing intermediate layers when welding cladded materials. Due to the high ferrite content, the weld metal is less susceptible to hot cracking. Suitable for service temperatures between -80°C and 300°C.

Base materials

Dissimilar Joints of and between high-strength, mild steels and low-alloyed QT-steels, stainless, ferritic Cr and austenitic Cr-Ni-steels, high manganese steels

Surfacing: for the first layer of corrosion resistant weld surfacing on ferritic-perlitic steels in boiler and pressure vessel parts up to fine-grained steel S500N, as well as of high temperature steels.

Typical analysis of the solid wire

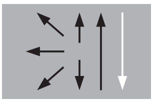
	C	Si	Mn	Cr	Ni
wt.-%	≤ 0.02	0.5	1.7	24.0	13.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–80°C
u	420 (≥ 320)	570 (≥ 520)	32 (≥ 25)	90	(≥ 32)

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	60 – 100	18 – 20
1.0 short arc	110 – 140	20 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 260	27 – 30
1.6 spray arc	250 – 330	29 – 32

Post-weld heat treatment generally not needed. For constructions that include low-alloyed steels in mixed joints, a stress-relieving annealing stage may be advisable. However, this type of alloy may be susceptible to embrittlement-inducing precipitation in the temperature range 550 – 950°C. Always consult the supplier of the parent metal or seek other expert advice to ensure that the correct heat treatment process is carried out. Heat input max. 2.0 kJ/mm, interpass temperature max. 150°C.

Shielding gas: Ar + 2 – 3% CO_2 or Ar + 1 – 2% O_2. Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV (09362), DNV GL, ABS, BV, CE

GMAW

Thermanit 25/14 E-309L Si

Solid wire, high-alloyed, austenitic stainless, special applications

Classifications

EN 12072	AWS A5.9 / SFA-5.9
G 23 12 L Si	ER309LSi

Characteristics and typical fields of application

Solid wire of G 23 12 L Si / ER309LSi type for joining unalloyed and low-alloyed steels and cast steel grades or stainless heat resistant Cr-steels to austenitic steels. Well-suited for depositing intermediate layers when welding cladded materials. Favorably high Cr and Ni contents, low C content. For depositing intermediate layers when welding the side of plates clad with low-carbon unstabilized or stabilized austenitic CrNiMo(N) austenitic metals. Application temperature max. 300ºC.

Base materials

Primarily used for surfacing (buffer layer) unalloyed or low-alloyed steels and when joining non-molybdenum-alloyed stainless and carbon steels. Joints and mixed joints between austenitic steels such as

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640

AISI 304, 304L, 316, 316L, 316Ti, 321, 347

or mixed joints between austenitic and heat resistant steels such as

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12

with ferritic steels to pressure boiler steels P295GH and fine grained structural steels to P355N, ship building steel grades A – E, AH 32 – EH 36, A40 – F40, etc.

Typical analysis of the solid wire

	C	Si	Mn	Cr	Ni
wt.-%	0.03	0.9	2.0	24	13.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	400	550	30	55

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data

Dimension mm
0.8
1.0
1.2
1.6

Preheating and interpass temperature as required by the base metal.

Shielding gas: Ar + 2 – 3% CO_2 or Ar + 1 – 2% O_2. Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV (12312), DNV GL, NAKS, CE

BÖHLER CN 23/12 Mo-IG

Solid wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 23 12 2 L	ER309LMo

Characteristics and typical fields of application

Solid wire of G 23 12 L Mo / ER309LMo type for surfacing low-alloyed steels and welding dissimilar joints between duplex and austenitic stainless steels with low-alloyed steels. When used for surfacing the composition is more or less equal to that of ER316 from the first run. Designed for very good welding and wetting characteristics and ensuring a high resistance against cracking. Suitable for service temperatures between -40ºC and 300ºC. The corrosion resistance is superior to that of 316L even in the first layer of cladding.

Base materials

Joints and mixed joints between austenitic stainless steels such as

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640, S31653

AISI 304, 304L, 304LN, 302, 321, 347, 316, 316L, 316Ti, 316Cb

with duplex stainless steels such as

1.4162 X2CrNiMoN21-5-1, 1.4362 X2CrNiN23-4, 1.4462 X2CrNiMoN22-5-3

UNS S32101, S32304, S31803, S32205

LDX 2101®, SAF 2304, SAF 2205

or mixed joints between austenitic and heat resistant steels

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12

with ferritic steels to pressure boiler steels P295GH and also fine grained structural steels to P355N, shipbuilding steels grade A – E, AH 32 – EH 36, A40 – F40, etc.

Dissimilar joint welds – overlay welding the first corrosion resistant surface layer on P235GH, P265GH, S255N, P295GH, S355N – S500N and high-temperature quenched and tempered fine-grained steels.

Typical analysis of the solid wire

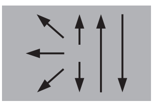
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.014	0.35	1.5	21.5	15.0	2.8	8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –40°C
u	470 (≥ 350)	640 (≥ 550)	34 (≥ 25)	140 (≥ 47)	90 (≥ 32)

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.2 spray arc	200 – 260	26 – 30

Preheating and interpass temperature as required by the base metal and should not exceed 150ºC. Suggested heat input is max. 2.0 kJ/mm.

For constructions that include low-alloyed steels in mixed joints, a stress-relieving annealing stage may be advisable. However, this type of alloy may be susceptible to embrittlement in the temperature range 550 – 950ºC.

Shielding gas: Ar + 2 – 3% CO_2 or Ar + 1 – 2% O_2. Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

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Thermanit 30/10

Solid wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 29 9	ER312

Characteristics and typical fields of application

Solid wire of G 29 9 / ER312 type for joining and surfacing applications with matching / similar steels and cast steel grades. For fabricating tough joints (one layer) on unalloyed / low-alloyed structural steels of higher strength on high manganese steel and CrNiMn steels. High resistance to hot cracking, good toughness and strength properties. The weld metal also work hardens making it suitable for wear resisting build-ups on clutches, gear wheels, shafts, etc. It is also suitable for repair welding of tools. Application temperature max. 300ºC.

Base materials

For welding of unalloyed steels with limited weldability and low-alloyed steels of higher strength. Used as stress-relieved buffer layer when cladding cold and warm machine tools. For joining of high manganese and CrNiMn-steels and combinations of steels of different chemical composition or strength.

1.3401 X120Mn12, 1.4006 X10Cr13, 1.4339 GX32CrNi28-10, 1.4340 GX49CrNi27-4, 1.4347 GX8CrCrNiN26-7, 1.4460 X3CrNiMoN27-5-2

UNS S41000, AISI 329, 410, S235, E295

GMAW

Typical analysis of the solid wire

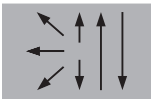
	C	Si	Mn	Cr	Ni
wt.-%	0.15	0.5	1.6	30	9.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	500	750	20	27

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 spray arc	170 – 210	24 – 28
1.2 spray arc	200 – 240	25 – 29

Suggested heat input max. 2.0 kJ/mm and interpass temperature max. 150ºC.

Preheating and interpass temperature as required by the base metal.

Shielding gas: Ar + 2 – 3% CO_2 (M12) or Ar + 1 – 2% O_2 (M13). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

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BÖHLER A 7 CN-UP - BÖHLER BB 203

SAW wire/flux combination, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 18 8 Mn	ER307 (mod.)	S A FB 2 DC

Characteristics and typical fields of application

BÖHLER A 7 CN-UP - BB 203 is as wire/flux combination for submerged arc welding for multiple applications.

Solid wire of S 18 8 Mn / ER307 (mod.) type for joining and surfacing applications with heat resistant Cr-steels and heat resistant austenitic steels. Well-suited for fabricating dissimilar austenitic-ferritic joints at a max. application temperature of 300ºC. For joining unalloyed / low-alloyed or Cr-steels to austenitic steels. The weld deposit offers exceptionally high ductility and elongation together with outstanding crack resistance. There is low risk for embrittlement when operating temperatures cool down to –100ºC or rise till 500ºC. The deposit work hardens and offers good resistance against cavitation. Ductility remains good even after high dilution or when subjected to thermal shock or scaling. Resistant to scaling up to 850ºC. Inadequate resistance against sulfurous combustion gases at temperatures above 500ºC.

BÖHLER BB 203 is a fluoride-basic, agglomerated flux providing good operating characteristics, smooth beads and a low hydrogen weld metal. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

14Mn-steels, 13 – 17% Cr and heat resistant Cr and austenitic steels up to 850ºC, armor plates, high carbon and quenched and tempered steels, surfacing of gears, valves, turbine blades, etc.

Typical analysis of the weld metal

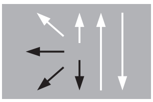
wt.-%	C	Si	Mn	Cr	Ni
wire	0.08	0.90	7.0	19.0	9.0
all-weld metal	0.06	0.80	6.0	18.7	9.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J –100°C
u	(≥ 350)	(≥ 500)	(≥ 25)	(≥ 40)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33
3.0	320 – 450	29 – 33

Preheat, interpass temperature and post-weld heat treatment as required by the base metal. Polarity: DC+. Thicker heat resistant Cr-steels can be preheated to 150 – 300ºC. In case of post weld heat treatment of dissimilar joints, attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement. For dissimilar joining with unalloyed or low-alloy steels, no postweld heat treatment should be performed above 300ºC due to the risk of carbide precipitation in the weld fusion zone causing loss of toughness.

Approvals

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Thermanit 25/14 E-309L - Marathon 213

SAW wire/flux combination, high-alloyed, austenitic stainless, special applications

SAW

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 23 12 L	ER309L	S F CS 2 DC

Characteristics and typical fields of application

Thermanit 25/14 E-309L - Marathon 213 is a wire/flux combination for submerged arc welding. This is a standard combination for welding dissimilar joints, and the first layer in weld overlay (wire cladding). The average ferrite content is 16 FN.

Solid wire of S 23 12 L / ER309L type for joining unalloyed/low-alloyed steels and cast steel grades or stainless heat resistant Cr-steels to austenitic steels. For depositing intermediate layers when welding the side of plates clad with low-carbon unstabilized and stabilized austenitic CrNi(MoN)-alloys. Favorably high chromium and nickel contents, low carbon content. Max. service temperature 350ºC. Well-suited for depositing intermediate layers when welding cladded materials.

Marathon 213 is an fused flux with good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

Dissimilar joint welds: Of and between high-strength, mild steels and low-alloyed QT-steels, stainless, ferritic Cr and austenitic CrNi-steels, manganese steels.

Surfacing: For the first layer of corrosion resistant weld surfacing on ferritic-pearlitic steels in boiler and pressure vessel parts up to fine-grained steel S500N, as well as of high temperature steels such as 1.6310 20MnMoNi5-5, 1.6755 22NiMoCr4-7 and 1.6759 GS-18NiMoCr3-7.

Typical analysis of the weld metal

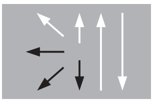
wt.-%	C	Si	Mn	Cr	Ni
wire	0.01	0.50	1.8	24.0	13.5
all-weld metal	0.01	0.70	1.3	23.5	13.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	≥ 380	≥ 580	≥ 30	≥ 80

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Preheating and interpass temperature as required by the base metal. Polarity: DC+.

In case of post weld heat treatment of dissimilar joints, attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement. For dissimilar joining with unalloyed or low-alloyed steels, no postweld heat treatment should be performed above 300ºC due to the risk of carbide precipitation in the weld fusion zone causing loss of toughness.

Approvals

TÜV (09617), CE

Thermanit 25/14 E-309L - Marathon 431

SAW wire/flux combination, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 23 12 L	ER309L	S A FB 2 DC

Characteristics and typical fields of application

Thermanit 25/14 E-309L - Marathon 431 is a wire/flux combination for submerged arc welding. This is a standard combination for welding dissimilar joints, and the first layer in weld overlay (wire cladding).

Solid wire of S 23 12 L / ER309L type for joining unalloyed/low-alloyed steels and cast steel grades or stainless heat resistant Cr-steels to austenitic steels. For depositing intermediate layers when welding the side of plates clad with low-carbon unstabilised and stabilised austenitic CrNi(MoN)-alloys. Favorably high chromium and nickel contents, low carbon content. Max. service temperature 350ºC. Well-suited for depositing intermediate layers when welding cladded materials.

Marathon 431 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

Dissimilar joint welds: Of and between high-strength, mild steels and low-alloyed QT-steels, stainless, ferritic Cr and austenitic CrNi-steels, manganese steels.

Surfacing: For the first layer of corrosion resistant weld surfacing on ferritic-pearlitic steels in boiler and pressure vessel parts up to fine-grained steel S500N, as well as of high temperature steels such as 1.6310 20MnMoNi5-5, 1.6755 22NiMoCr4-7 and 1.6759 GS-18NiMoCr3-7.

SAW

Typical analysis of the weld metal

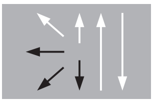
wt.-%	C	Si	Mn	Cr	Ni
wire	0.01	0.50	1.8	24.0	13.5
all-weld metal	0.01	0.60	1.4	23.5	13.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	≥ 380	≥ 600	≥ 25	≥ 100

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Preheating and interpass temperature as required by the base metal. Polarity: DC+.

In case of post-weld heat treatment of dissimilar joints, attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement. For dissimilar joining with unalloyed or low-alloyed steels, no post weld heat treatment should be performed above 300ºC due to the risk of carbide precipitation in the weld fusion zone causing loss of toughness.

Approvals

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Thermanit 25/14 E-309L - Avesta Flux 805

SAW wire/flux combination, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 23 12 L	ER309L	S A AF 2 DC

Characteristics and typical fields of application

Thermanit 25/14 E-309L - Avesta Flux 805 is a wire/flux combination for submerged arc welding. This is a standard combination for welding dissimilar joints, and the first layer in weld overlay (wire cladding).

Solid wire of S 23 12 L / ER309L type for joining unalloyed/low-alloyed steels or stainless heat resistant Cr-steels to austenitic steels. For depositing intermediate layers when welding the side of plates clad with low-carbon unstabilised and stabilised austenitic CrNi(MoN)-alloys. Favorably high chromium and nickel contents, low carbon content. Max. service temperature 350ºC. Well-suited for depositing intermediate layers when welding cladded materials.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

Dissimilar joint welds: Of and between high-strength, mild steels and low-alloyed QT-steels, stainless, ferritic Cr and austenitic CrNi-steels, manganese steels.

Surfacing: For the first layer of corrosion resistant weld surfacing on ferritic-pearlitic steels in boiler and pressure vessel parts up to fine-grained steel S500N, as well as of high temperature steels such as 1.6310 20MnMoNi5-5, 1.6755 22NiMoCr4-7 and 1.6759 GS-18NiMoCr3-7.

Typical analysis of the weld metal

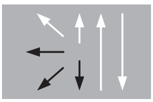
wt.-%	C	Si	Mn	Cr	Ni
wire	0.01	0.50	1.8	24.0	13.5
all-weld metal	0.01	0.60	1.4	24.5	13.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	400	550	36 (≥ 30)	100

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Preheating and interpass temperature as required by the base metal. Polarity: DC+.

In case of post-weld heat treatment of dissimilar joints, attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement. For dissimilar joining with unalloyed or low-alloyed steels, no post-weld heat treatment should be performed above 300ºC due to the risk of carbide precipitation in the weld fusion zone causing loss of toughness.

Approvals

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Avesta P5 - Avesta Flux 805

SAW wire/flux combination, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 23 12 2 L	ER309LMo (mod.)	S A AF 2 DC

Characteristics and typical fields of application

Avesta P5 - Avesta Flux 805 is a wire/flux combination for submerged arc welding. Solid wire of S 23 12 2 L / ER309LMo (mod.) type for surfacing low-alloyed steels and welding dissimilar joints between duplex and stainless steels with unalloyed and low-alloyed steels. The all-weld metal is austenitic - ferrite. When used for surfacing the composition is more or less equal to that of the base material 1.4401/316 from the first run. Designed for very good welding and wetting characteristics and ensuring a high resistance against cracking. Suitable for service temperatures between –40ºC and 300ºC. The corrosion resistance is superior to that of 1.4404/316L even in the first layer of cladding. Scaling temperature approximately 950ºC in air.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

Suitable for dissimilar joints of unalloyed or low-alloyed steels with stainless steels as well as for cladding on low-alloyed steels.

Typical analysis of the weld metal

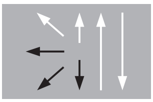
wt.-%	C	Si	Mn	Cr	Ni	Mo	FN
wire	0.02	0.35	1.5	21.5	15.0	2.7	
all-weld metal	0.01	0.50	1.1	22.0	14.8	2.6	15 FN (DeLong)

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	420 (≥ 380)	600 (≥ 550)	30 (≥ 24)	≥ 70

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33
3.2	350 – 500	29 – 33
4.0	425 – 575	30 – 34

Preheating and interpass temperature as required by the base metal and should not exceed 150ºC. Suggested heat input is max. 2.0 kJ/mm. Polarity: DC+.

For constructions that include low-alloyed steels in mixed joints, a stress-relieving annealing stage may be advisable. However, this type of alloy may be susceptible to embrittlement-inducing precipitation in the temperature range 550 – 950ºC. Always consult the supplier of the parent metal or seek other expert advice to ensure that the correct heat treatment process is carried out.

Approvals

DNV GL

Avesta P7 - Avesta Flux 805

SAW wire/flux combination, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 29 9	ER312	S A AF 2 DC

Characteristics and typical fields of application

Avesta P7 - Avesta Flux 805 is a wire/flux combination for submerged arc welding.

Solid wire of S 29 9 / ER312 type for joining and surfacing applications with matching / similar steels and cast steel grades. For fabricating tough joints (one layer) on unalloyed / low-alloyed structural steels of higher strength on high manganese steel and CrNiMn-steels. The all-weld metal is has as high ferrite content as 40 – 60% ferrite. In high dilution applications with unalloyed or low-alloyed steel grades, Avesta P7 can, for this reason, be advantageous over an ER309L wire. Suitable also for "difficult-to-weld steels".
High resistance to hot cracking, good toughness and strength properties. Scaling temperature 850ºC in air. Application temperature max. 300ºC.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux see the detailed data sheet.

Base materials

Suitable for dissimilar joints of unalloyed or low-alloyed steels with stainless steels as well as for cladding on low-alloyed steels. Difficult-to-weld steels.

Typical analysis of the weld metal

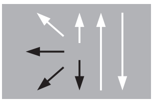
wt.-%	C	Si	Mn	Cr	Ni
wire	0.10	0.40	1.9	30.0	9.0
all-weld metal	0.10	0.60	1.6	30.5	8.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	(≥ 640)	(≥ 770)	(≥ 22)	(≥ 35)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33

Preheating and interpass temperature as required by the base metal and should not exceed 150ºC. Suggested heat input is max. 2.0 kJ/mm. Polarity: DC+.

For constructions that include low-alloyed steels in mixed joints, a stress-relieving annealing stage may be advisable. However, this type of alloy may be susceptible to embrittlement-inducing precipitation in the temperature range 550 – 950ºC. Always consult the supplier of the parent metal or seek other expert advice to ensure that the correct heat treatment process is carried out.

Approvals

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BÖHLER A 7-FD

Flux-cored wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 17633-A	**AWS A5.22 / SFA-5.22**
T 18 8 Mn R M21 (C1) 3	E307T0-G

Characteristics and typical fields of application

Austenitic rutile flux-cored wire of T 18 8 Mn R / E307LT0 type for welding and cladding in flat and horizontal position. One of the most universal alloys and for some applications a cost-efficient alternative to T 29 9 / E312 or T 23 12 L / E309L. For tough buffer and intermediate layers for cladding of rails and switches, valve seats and in hydropower plants. Good resistance to embrittlement when operating at service temperatures from –60ºC up to 650ºC. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Used for fabrication, repair and maintenance. The weld deposit offers high ductility and elongation, also after high dilution of "hard-to-weld" steels. The weld metal work hardens and offers good resistance to cavitation. The weld metal is resistant to scaling up to 850ºC, but at temperatures above 500ºC there is not sufficient resistance to sulfurous combustion gases. Ferrite measured with FeritScope FMP30 2 – 7 FN. For welding in vertical-up and overhead positions, BÖHLER A 7 PW-FD should be preferred.

Base materials

Dissimilar joints, tough buffer and intermediate layers prior to hardfacing, 14Mn-steels, 13 – 17% Cr and heat resistant Cr and austenitic steels up to 850ºC, armor plates, high carbon and quenched and tempered steels, surfacing of gears, valves, turbine blades, etc. For joint welding of unalloyed, low-alloyed or Cr steels with high-alloyed Cr and CrNi-steels. Welding of austenitic high manganese steels and with other steels.

Typical analysis of the wire

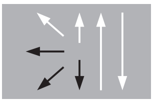
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.10	0.8	6.8	18.8	9.0	2 – 4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –60°C	Hardness HB	Stress hardened HV
u	395 (≥ 350)	595 (≥ 590)	40 (≥ 30)	60	36 (≥ 32)	~ 200	≤ 400

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0
1.6	~ 3	200 – 350	25 – 30	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The wire stick-out should be 15 – 20 mm and the heat input not exceed 2.0 kJ/mm. Preheating and interpass temperature as required by the base metal.

Approvals

TÜV (11101), CE

BÖHLER A 7 PW-FD

Flux-cored wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 18 8 Mn P M21 (C1) 2	E307T1-G

Characteristics and typical fields of application

Austenitic rutile flux-cored wire of T 18 8 Mn P / E307LT1 type for welding and cladding in all positions. One of the most universal alloys and for some applications a cost-efficient alternative to T 29 9 / E312 or T 23 12 L / E309L. For tough buffer and intermediate layers for cladding of rails and switches, valve seats and in hydropower plants. Good resistance to embrittlement when operating at service temperatures from –100ºC up to 650ºC. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. The weld deposit offers high ductility, elongation and resistance to hot cracking, also after high dilution of "hard-to-weld" steels. The weld metal work hardens and offers good resistance to cavitation. The weld metal is resistant to scaling up to 850ºC, but at temperatures above 500ºC there is not sufficient resistance to sulfurous combustion gases. Ferrite measured with FeritScope FMP30 2 – 7 FN. For flat and horizontal welding positions, BÖHLER A 7-FD may be preferred.

Base materials

Dissimilar joints, tough buffer and intermediate layers prior to hardfacing, 14Mn-steels, 13 – 17% Cr and heat resistant Cr and austenitic steels up to 850ºC, armor plates, high carbon and quenched and tempered steels, surfacing of gears, valves, turbine blades, etc. For joint welding of unalloyed, low-alloyed or Cr-steels with high-alloyed Cr and CrNi-steels. Welding of austenitic high manganese steels and with other steels.

Typical analysis of the wire

	C	Si	Mn	Cr	Ni	FN
wt.-%	0.10	0.8	6.8	18.8	9.0	2 – 4

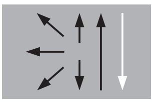
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –60°C	Hardness HB	Stress hardened HV
u	400 (≥ 350)	610 (≥ 590)	38 (≥ 30)	51	40 (≥ 32)	~ 200	≤ 400

u untreated, as-welded – shielding gas Ar + 18% CO_2

FCW

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 230	22 – 29	6.0 – 13.0
1.6	~ 3	200 – 360	23 – 28	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The wire stick-out should be 15 – 20 mm and the heat input not exceed 2.0 kJ/mm. Preheating and interpass temperature as required by the base metal.

Approvals

TÜV (11102), CE

BÖHLER A 7-MC

Metal-cored wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 18 8 Mn M M12 1	EC307 (mod.)

Characteristics and typical fields of application

Austenitic metal-cored wire of T 18 8 Mn / EC307 type for numerous applications. The corrosion resistance is on par with T 19 9 L R / E308LT0. The easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. The wire shows good wetting behavior and results in a smooth surface. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. This makes the metal-cored wire less sensitive to edge misalignment and variation in gap width as compared to solid wires. This is for instance utilized for robotic welding of exhaust systems in the automotive industry.

Used for fabrication, repair and maintenance. The weld deposit offers exceptionally high ductility and elongation, also after high dilution of "hard-to-weld" steels. The resistance to cracking is excellent also when subject to thermal shock. The weld metal work hardens and offers good resistance to cavitation. Good resistance to embrittlement when operating at service temperatures from –110ºC up to 650ºC. The weld metal is resistant to scaling up to 850ºC, but at temperatures above 500ºC there is not sufficient resistance to sulfurous combustion gases. Ferrite measured with FeritScope FMP30 2 – 7 FN.

Base materials

Dissimilar joints, tough buffer and intermediate layers prior to hardfacing, 14Mn-steels, 13 – 17% Cr and heat resistant Cr and austenitic steels up to 850ºC, armor plates, high carbon and quenched and tempered steels, surfacing of gears, valves, turbine blades, etc. For joint welding of unalloyed / low-alloyed or Cr steels with high-alloyed Cr and CrNi-steels. Welding of austenitic high manganese steels and with other steels.

Typical analysis of the wire

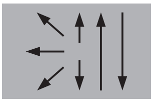
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.10	0.6	6.3	18.8	9.2	2 – 4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–60°C
u	408 (≥ 350)	608 (≥ 590)	40 (≥ 30)	55	40 (≥ 32)

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	100 – 280	10 – 27	3.5 – 13.0
1.6	~ 3	110 – 380	10 – 27	1.5 – 8.0

Welding with conventional or pulsed power sources using DC+ polarity, but pulsed arc may be advantageous and especially when welding out of position. Forehand (pushing) technique preferred with a work angle of appr. 80º. Ar + 2.5% CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min and the wire stick-out 15 – 20 mm. Preheating and interpass temperature as required by the base metal.

Approvals

TÜV (10871), DB (43.014.27), CE

MCW

BÖHLER CN 23/12-FD

Flux-cored wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 12 L R M21 (C1) 3	E309LT0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 23 12 L R / E309LT0 type for welding of dissimilar joints of Cr and CrNi(Mo)-steels and unalloyed or low-alloyed steels, as well as weld cladding of unalloyed or low-alloyed base metals preferably in flat or horizontal position. Ferrite measured with FeritScope FMP30 14 – 22 FN. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures from –60ºC to 300ºC. For welding in vertical-up and overhead positions, BÖHLER CN 23/12 PW-FD should be preferred.

Base materials

Primarily used for surfacing (buffer layer) unalloyed or low-alloyed steels and when joining non-molybdenum-alloyed stainless and carbon steels.

Joints and mixed joints between austenitic steels such as

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640

AISI 304, 304L, 316, 316L, 316Ti, 321, 347

or mixed joints between austenitic and heat resistant steels such as

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12

with ferritic steels to pressure boiler steels P295GH and fine grained structural steels to P355N, ship building steel grades A – E, AH 32 – EH 36, A40 – F40, etc.

FCW

Typical analysis of the wire

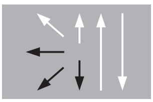
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.03	0.7	1.4	23.0	12.5	12 – 23

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–60°C
u	400 (≥ 320)	540 (≥ 520)	33 (≥ 30)	55	45 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0
1.6	~ 3	200 – 350	25 – 30	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The wire stick-out should be 15 – 20 mm and the heat input not exceed 2.0 kJ/mm. For dissimilar welding, slight weaving is recommended for all welding positions. The scaling temperature is approx. 1000ºC in air. Post-weld heat treatment generally not needed. Preheat and interpass temperatures as required by the base material.

Approvals

TÜV (05350), DB (43.014.16), DNV GL, LR, CE, RINA, BV (C1 + Ø 1.2 mm), ABS (M21), CE

Avesta FCW-2D 309L

Flux-cored wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 12 L R M21 (C1) 3	E309LT0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 23 12 L R / E309T0 type. Primarily intended for surfacing low-alloyed steels and for dissimilar welds between mild steel and stainless steels. Ferrite measured with FeritScope FMP30 14 – 22 FN. Corrosion resistance superior to T 19 9 L / E308L type fillers. When used for overlay welding on mild steel a corrosion resistance equivalent to that of base metal 1.4301 / 304 is obtained already in the first layer.

Avesta FCW-2D 309L provides excellent weldability in flat as well as horizontal-vertical position. Great slag detachability and almost no spatter formation. Optimized to result in a shiny weld metal surface; also when welding with 100% CO_2. Due to the slow freezing rutile slag, the weld metal shows very smooth bead appearance and low temper discoloration, which makes post-weld cleaning easier. Welding in vertical-up and overhead positions is preferably done using Avesta FCW 309L-PW. Maximum service temperature 300ºC. The scaling temperature is approximately 1000ºC in air.

Base materials

Primarily used for surfacing (buffer layer) unalloyed or low-alloyed steels and when joining non-molybdenum- alloyed stainless and carbon steels.

Joints and mixed joints between austenitic steels such as

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640 304, 304L, 316, 316L, 316Ti, 321, 347,

or mixed joints between austenitic and heat resistant steels such as

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12

with ferritic steels to pressure boiler steels P295GH and also fine grained structural steels to P355N, ship building steels grade A – E, AH 32 – EH 36, A40 – F40, etc.

FCW

Typical analysis of the wire

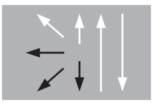
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.03	0.7	1.2	23.1	12.5	12 – 23

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–60°C	Hardness HB
u	390 (≥ 320)	560 (≥ 520)	35 (≥ 30)	49	48 (≥ 32)	210

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0
1.6	~ 3	200 – 350	25 – 30	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. Suitable gas flow rate for welding outdoors is 18 – 25 l/min. Suggested heat input is max. 2.0 kJ/mm and wire stick-out 15 – 20 mm. For dissimilar welding, slight weaving is recommended for all welding positions. Post-weld heat treatment generally not needed. For constructions that include dissimilar welding of low-alloyed steels, a stress-relieving annealing stage may be advisable. Always consult the supplier of the parent material or seek other expert advice to ensure that the correct heat treatment process is carried out. Preheat and interpass temperatures as required by the base metal.

Approvals

TÜV (10747), CWB, DB (43.014.41), DNV GL, RINA (M21), BV (C1 + Ø 1.2 mm), ABS, CE

BÖHLER CN 23/12 PW-FD

Flux-cored wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 12 L P M21 (C1) 1	E309LT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 23 12 L P / E309LT1 type for welding of dissimilar joints of Cr and CrNi(Mo)-steels and unalloyed or low-alloyed steels, as well as weld cladding of unalloyed or low-alloyed base metals. Ferrite measured with FeritScope FMP30 14 – 22 FN. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures from –60ºC to 300ºC. For flat and horizontal welding positions, BÖHLER CN 23/12-FD may be preferred.

Base materials

Primarily used for surfacing (buffer layer) unalloyed or low-alloyed steels and when joining non-molybdenum-alloyed stainless and carbon steels. Joints and mixed joints between austenitic steels such as

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640

AISI 304, 304L, 316, 316L, 316Ti, 321, 347

or mixed joints between austenitic and heat resistant steels such as

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12

with ferritic steels to pressure boiler steels P295GH and fine grained structural steels to P355N, ship building steel grades A – E, AH 32 – EH 36, A40 – F40, etc.

Typical analysis of the wire

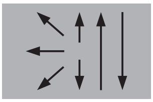
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.03	0.7	1.4	23.0	12.5	12 – 23

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–60°C
u	420 (≥ 320)	540 (≥ 520)	36 (≥ 30)	65	50 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
0.9	~ 3	100 – 160	20 – 31	8.0 – 15.0
1.2	~ 3	150 – 280	21 – 29	6.0 – 15.0
1.6	~ 3	200 – 360	21 – 29	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The wire stick-out should be 15 – 20 mm and the heat input not exceed 2.0 kJ/mm. For dissimilar welding, slight weaving is recommended for all welding positions. Post-weld heat treatment generally not needed, but depends on the base material being used. Preheat and interpass temperatures as required by the base material.

Approvals

TÜV (09115), DB (43.014.22), DNV GL, LR, RINA (M21), BV (Ø 1.2 mm), ABS (M21), CE

Avesta FCW 309L-PW

Flux-cored wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 12 L P M21 (C1) 1	E309LT1-4(1)

Characteristics and typical fields of application

Austenitic stainless steel flux-cored wire of T 23 12 L P / E309LT1 type, primarily intended for surfacing low-alloyed steels and for dissimilar welds between mild steel and stainless steels. Ferrite measured with FeritScope FMP30 14 – 22 FN. Corrosion resistance superior to T 19 9 L / E308L fillers. When used for overlay welding on mild steel a corrosion resistance equivalent to that of 1.4301 / 304 is obtained already in the first layer. Avesta FCW 309L-PW has a stronger arc and a faster freezing slag compared Avesta FCW-2D 309L. It is designed for all-round welding and can be used in all positions without changing the parameter settings. Very good slag detachability and almost no spatter formation. Due to the fast freezing rutile slag, the weldability is excellent also in the vertical-up and overhead positions. Maximum application temperature 300ºC. The scaling temperature is approx. 1000ºC in air.

Base materials

Primarily used for surfacing (buffer layer) unalloyed or low-alloyed steels and when joining non-molybdenum- alloyed stainless and carbon steels. Joints and mixed joints between austenitic steels such as 1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640

AISI 304, 304L, 316, 316L, 316Ti, 321, 347

or mixed joints between austenitic and heat resistant steels such as 1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12 with ferritic steels to pressure boiler steels P295GH and also fine grained structural steels to P355N, ship building steels grade A – E, AH 32 – EH 36, A40 – F40, etc.

Typical analysis of the wire

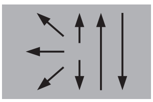
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.03	0.7	1.4	23.0	12.5	12 – 23

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J			Hardness HB
				20°C	–20°C	–60°C	
u	420 (≥ 320)	540 (≥ 520)	36 (≥ 30)	65	55	50 (≥ 32)	210

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
0.9	~ 3	100 – 160	22 – 27	8.0 – 15.0
1.2	~ 3	150 – 280	22 – 30	6.0 – 15.0
1.6	~ 3	200 – 360	23 – 28	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. Suitable gas flow rate for welding outdoors is 18 – 25 l/min. Suggested heat input is max. 2.0 kJ/mm, interpass temperature max. 150ºC and wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (10739), CWB, DB (43.014.42), DNV GL, LR, RINA (M21), BV (Ø 1.2 mm), ABS, CCS, CE

BÖHLER CN 23/12-MC

Metal-cored wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 12 L M M12 2	EC309L

Characteristics and typical fields of application

Austenitic metal-cored wire of T 23 12 L / EC309L type for welding dissimilar joints between high-alloyed Cr and corrosion resistant austenitic CrNi(Mo) steels and mild or low-alloyed steels. The easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. The wire shows good wetting behavior and results in a smooth surface. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. This makes the metal-cored wire less sensitive to edge misalignment and variation in gap width as compared to solid wires. Suitable for service temperatures from –120ºC to 300ºC.

Base materials

Primarily used for surfacing (buffer layer) unalloyed or low-alloyed steels and when joining non-molybdenum-alloyed stainless and carbon steels. Joints and mixed joints between austenitic steels such as 1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2, 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10 UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640

AISI 304, 304L, 316, 316L, 316Ti, 321, 347 or mixed joints between austenitic and heat resistant steels such as 1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12 with ferritic steels to pressure boiler steels P295GH and fine grained structural steels to P355N, ship building steel grades A – E, AH 32 – EH 36, A40 – F40, etc.

Typical analysis of the wire

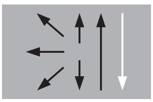
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.025	0.6	1.4	23.0	12.5	12 – 23

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –120°C
u	400 (≥ 320)	550 (≥ 520)	33 (≥ 32)	75	51 (≥ 32)

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	Max. 3	100 – 280	10 – 27	3.5 – 13.0

Welding with conventional or pulsed power sources, but pulsed arc may be advantageous and especially when welding out of position. Forehand (pushing) technique preferred with a work angle of appr. 80º. Ar + 2.5% CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min and the wire stick-out 15 – 20 mm. When welding out of position, the metal-cored wires are similar to solid wires and pulsed arc welding is recommended.

Approvals

CWB, CE

MCW

BÖHLER CN 23/12 Mo-FD

Flux-cored wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 12 2 L R M21 (C1) 3	E309LMoT0-4(1)

Characteristics and typical fields of application

Austenitic stainless rutile flux-cored wire of T 23 12 2 L R / E309LMoT0 type for welding and cladding preferably in flat and horizontal position. The corrosion resistance is superior to T 19 12 3 L / E316L type fillers. Primarily designed for welding dissimilar joints between stainless steels and low-alloyed steels. It can also be used for overlay welding, providing an 18Cr-8Ni-2Mo deposit from the very first layer. The wire offers high safety against hot cracking even at high dilution. Alloying with molybdenum increases the corrosion resistance and weld metal strength. Easy handling and high deposition rate result in high productivity with excellent welding performance, very low spatter formation and a smooth surface. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures from –60ºC to 300ºC. For welding in vertical-up and overhead positions, BÖHLER CN 23/12 Mo PW-FD should be preferred. Ferrite measured with FeritScope FMP30 15 – 23 FN.

Base materials

Joints and mixed joints between austenitic stainless steels such as

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640, S31653

AISI 304, 304L, 304LN, 302, 321, 347, 316, 316L, 316Ti, 316Cb

with duplex stainless steels such as

1.4162 X2CrNiMoN21-5-1, 1.4362 X2CrNiN23-4, 1.4462 X2CrNiMoN22-5-3

UNS S32101, S32304, S31803, S32205

LDX 2101®, SAF 2304, SAF 2205

or mixed joints between austenitic and heat resistant steels

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12

with ferritic steels to pressure boiler steels P295GH and also fine grained structural steels to P355N, shipbuilding steels grade A – E, AH 32 – EH 36, A40 – F40, etc.

Dissimilar joint welds – overlay welding the first corrosion resistant surface layer on P235GH, P265GH, S255N, P295GH, S355N – S500N and high-temperature quenched and tempered fine-grained steels.

Typical analysis of the wire

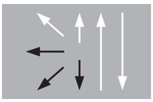
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.03	0.6	1.4	23.0	12.5	2.7	27 – 42

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–60°C
u	520 (≥ 350)	700 (≥ 550)	28 (≥ 25)	50	36 (≥ 32)

u untreated, as-welded - shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0
1.6	~ 3	200 – 350	25 – 30	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min and the wire stick-out 15 – 20 mm. The heat input should not exceed 2.0 kJ/mm. For dissimilar welding, slight weaving is recommended for all welding positions. Preheat and interpass temperatures as required by the base metal. Post-weld heat treatment generally not needed. For constructions that include dissimilar welding of low-alloyed steels, a stress-relieving annealing stage may be advisable. Always consult the supplier of the parent material or seek other expert advice to ensure that the correct heat treatment process is carried out.

Approvals

TÜV (05351), DB (43.014.17), ABS (M21), DNV GL, LR (M21), RINA (M21), CWB, CE

BÖHLER CN 23/12 Mo PW-FD

Flux-cored wire, high-alloyed, austenitic stainless, special applications

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 12 2 L P M21 (C1) 1	E309LMoT1-4(1)

Characteristics and typical fields of application

Austenitic stainless rutile flux-cored wire of T 23 12 2 L P / E309LMoT1 type. The corrosion resistance is superior to T 19 12 3 L / E316L type fillers. Primarily designed for welding dissimilar joints between stainless steels and low-alloyed steels. It can also be used for overlay welding, providing an 18Cr-8Ni-2Mo deposit from the very first layer. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Provides high resistance to hot cracking even at high dilution. Alloying with molybdenum increases the corrosion resistance and weld metal strength. Suitable for service temperatures from –60ºC to 300ºC. For flat and horizontal welding positions, BÖHLER CN 23/12 Mo-FD may be preferred. Ferrite measured with FeritScope FMP30 15 – 23 FN.

Base materials

Joints and mixed joints between austenitic stainless steels such as

1.4301 X5CrNi18-10, 1.4306 X2CrNi19-11, 1.4308 GX5CrNi19-10, 1.4401 X5CrNiMo17-12-2, 1.4404 X2CrNiMo17-12-2, 1.4408 GX5CrNiMo19-11-2, 1.4435 X2CrNiMo18-14-3, 1.4436 X3CrNiMo17-12-3, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4552 GX5CrNiNb19-11, 1.4571 X6CrNiMoTi17-12-2, 1.4580 X6CrNiMoNb17-12-2, 1.4581 GX5CrNiMoNb19-11-2 1.4583 X10CrNiMoNb18-12, 1.4948 X6CrNi18-10

UNS S30400, S30403, S30809, S31600, S31603, S31635, S32100, S34700, S31640, S31653

AISI 304, 304L, 304LN, 302, 321, 347, 316, 316L, 316Ti, 316Cb

with duplex stainless steels such as

1.4162 X2CrNiMoN21-5-1, 1.4362 X2CrNiN23-4, 1.4462 X2CrNiMoN22-5-3

UNS S32101, S32304, S31803, S32205

LDX 2101®, SAF 2304, SAF 2205

or mixed joints between austenitic and heat resistant steels

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4832 GX25CrNiSi20-14, 1.4837 GX40CrNiSi25-12

with ferritic steels to pressure boiler steels P295GH and also fine grained structural steels to P355N, shipbuilding steels grade A – E, AH 32 – EH 36, A40 – F40, etc.

Dissimilar joint welds – overlay welding the first corrosion resistant surface layer on P235GH, P265GH, S255N, P295GH, S355N – S500N and high-temperature quenched and tempered fine-grained steels.

FCW

Typical analysis of the wire

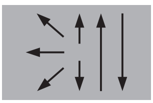
	C	Si	Mn	Cr	Ni	Mo	FN
wt.-%	0.03	0.7	1.4	23.0	12.5	2.7	23 – 36

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–60°C
u	540 (≥ 350)	705 (≥ 550)	28 (≥ 25)	65	44 (≥ 32)

u untreated, as-welded - shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
0.9	~ 3	100 – 160	22 – 27	8.0 – 15.0
1.2	~ 3	150 – 200	22 – 29	6.0 – 13.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm and the wire stick-out 15 – 20 mm. For dissimilar welding, slight weaving is recommended for all welding positions. Preheat and interpass temperatures as required by the base metal. Post-weld heat treatment generally not needed. For constructions that include dissimilar welding of low-alloyed steels, a stress-relieving annealing stage may be advisable. Always consult the supplier of the parent material or seek other expert advice to ensure that the correct heat treatment process is carried out.

Approvals

TÜV (09116), BV (C1 + Ø 1.2 mm), LR (C1) , DNV GL, CWB, ABS (M21), CE

Welding consumables for heat and creep resistant stainless steels

◆ Content

Stick electrodes

Product name	C	Si	Mn	Cr	Ni	Nb	N	Ti	FN
Avesta 253 MA	0.08	1.50	0.70	22.00	10.50		0.18		
BÖHLER FOX CN 18/11	0.05	0.30	1.30	19.40	10.40				3 – 8
BÖHLER FOX CN 16/13	0.14	0.50	3.80	16.00	13.00	1.50			
BÖHLER FOX E 347 H	0.05	0.30	1.30	19.00	10.20	≥ 8 × C			3 – 8
BÖHLER FOX E 308 H	0.05	0.60	0.80	19.80	10.20				
BÖHLER FOX FA	0.10	0.50	1.20	25.00	5.40				
Avesta 309 AC/DC	0.06	0.80	1.10	24.30	13.30				14
BÖHLER FOX FFB	0.12	0.60	3.20	25.00	20.50				
BÖHLER FOX FFB-A	0.12	0.50	2.20	26.00	21.00				
Avesta 310	0.11	0.70	2.00	26.00	21.40				
Thermanit 21/33 So	0.15	0.50	4.50	22.00	33.00	1.30			
Thermanit 25/35 R	0.40	1.00	1.80	25.00	35.00	1.30		0.10	

GTAW rods

Product name	C	Si	Mn	Cr	Ni	Mo	Nb	N	Cu
Thermanit ATS 4	0.05	0.40	1.80	18.80	9.30				
Thermanit 304 H Cu	0.10	0.40	3.20	18.00	16.00	0.80	0.40	0.20	3.00
BÖHLER FA-IG	0.07	0.80	1.20	25.70	4.50				
BÖHLER FF-IG	0.10	1.10	1.60	22.50	11.50				
Thermanit 310	0.12	0.40	1.80	25.80	21.00				
BÖHLER FFB-IG	0.13	0.90	3.20	24.60	20.50				
Thermanit CR	0.45	0.90	1.50	26.00	21.50				
BÖHLER CN 21/33 Mn-IG	0.12	0.20	4.80	21.80	32.50		1.20		
Thermanit 25/35 R	0.42	1.00	1.80	26.00	35.00		1.30		
Thermanit 35/45 Nb	0.42	1.50	1.00	35.00	45.50		0.80		

Solid wires

Product name	C	Si	Mn	Cr	Ni	Nb
Thermanit ATS 4	0.05	0.30	1.80	18.80	9.30	
BÖHLER FA-IG	0.07	0.80	1.20	25.70	4.50	
BÖHLER FF-IG	0.10	1.10	1.60	22.50	11.50	
Thermanit 310	0.13	0.40	1.80	25.80	20.80	
BÖHLER FFB-IG	0.13	0.90	3.20	24.60	20.50	
BÖHLER CN 21/33 Mn-IG	0.12	0.20	4.80	21.80	32.50	1.20
Thermanit 25/35 R	0.42	1.20	1.80	26.00	35.00	1.30

SAW wire/flux combinations

Product name	C	Si	Mn	Cr	Ni	N
Thermanit ATS 4 - Marathon 104	0.05	0.50	1.30	18.50	9.30	
Avesta 253 MA - Avesta Flux 805	0.07	1.70	0.30	21.50	9.50	0.15
Thermanit D - Marathon 104	0.10	1.00	1.20	22.20	11.50	

Flux-cored and metal-cored wire

Product name	C	Si	Mn	Cr	Ni	Nb	FN
BÖHLER E 308 H-FD	0.05	0.60	1.20	19.40	10.10		2 – 8
BÖHLER E 308 H PW-FD	0.05	0.60	1.20	19.40	10.10		2 – 8
BÖHLER E 309L H-FD	0.03	0.60	1.30	23.00	12.20		10 – 19
BÖHLER E 309L H PW-FD	0.04	0.70	1.30	23.00	12.50		10 – 23
BÖHLER E 347L H-FD	0.03	0.60	1.30	18.50	10.50	0.45	2 – 7
BÖHLER E 347 H PW-FD	0.05	0.60	1.30	18.50	10.50	0.45	2 – 7
BÖHLER FF-MC	0.07	0.60	0.60	20.20	10.60		5 – 9

Avesta 253 MA

Stick electrode, high-alloyed, austenitic stainless, creep resistant

Classifications

EN ISO 3581-A
E 21 10 N R

Characteristics and typical fields of application

Rutile coated electrode of E 21 10 N R type. Designed for welding the high temperature stainless steel 253 MA® (1.4835 / UNS S30815), used for furnaces, combustion chambers and burners. Both the steel and filler metal offers excellent resistance to oxidation up to 1100ºC. The chemical composition of Avesta 253 MA has a balanced ferrite content of max. 6 FN to give a crack resistant weld metal. Excellent resistance to high temperature corrosion. Not intended for applications exposed to wet corrosion.

Base materials

1.4835 X9CrNiSiNCe21-11-2, 1.4818 X6CrNiSiNCe19-10

UNS S30815, S30415

253 MA®, 153 MA™

Typical analysis of all-weld metal

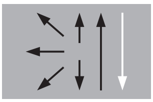
	C	Si	Mn	Cr	Ni	N
wt.-%	0.08	1.5	0.7	22.0	10.5	0.18

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Hardness
u	535	725	37	60	215

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification 253 MA

Dimension mm	Current A
2.0 × 300	45 – 65
2.5 × 350	45 – 80
3.2 × 350	70 – 120
4.0 × 400	90 – 160
5.0 × 400	150 – 200

Suggested heat input is max. 1.5 kJ/mm, interpass temperature max. 150ºC

Metal recovery approximately 110%.

Approvals

-

BÖHLER FOX CN 18/11

Stick electrode, high-alloyed, austenitic stainless, creep resistant

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 19 9 B 4 2	E308-15

Characteristics and typical fields of application

Basic coated, core wire alloyed electrode of E 19 9 N / E308-15 type. Controlled delta ferrite content (3 – 8 FN) for heat and creep resistant austenitic CrNi-steels with increased carbon contents (e.g. 1.4948 / 304H), for boiler, reactor and turbine fabrication. Approved in long-term condition up to 700°C service temperature (300°C in the case of wet corrosion). High resistance to hot cracking. Excellent weldability in all positions except vertical down. Also suitable for 1.4550 / 347 and 1.4541 / 321, which are approved for temperatures up to 550°C.

Base materials

Similar alloyed creep and heat resistant steels

1.4878 X8CrNiTi18-10, 1.4912 X7CrNiNb18-10, 1.4940 X7CrNiTi18-10, 1.4948 X6CrNi18-10, 1.4949 X3CrNiN18-11

UNS S30409, S32100

AISI 304H, 321

Typical analysis of all-weld metal

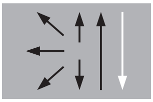
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.05	0.3	1.3	19.4	10.4	3 – 8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–40°C
u	420 (≥ 350)	580 (≥ 550)	40 (≥ 30)	85	57 (≥ 32)

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	FOX CN 18/11 308-15 E 19 9 B

Dimension mm	Current A
2.5 × 250	50 – 80
3.2 × 350	80 – 100
4.0 × 350	110 – 140

Preheating is only necessary in case of wall thickness above 25 mm preheat up to 150°C.

Low heat input, max. 1.5 kJ/mm is recommended. Interpass temperatures should not exceed 150°C.

Re-drying at 300 – 350°C for min. 2 h if necessary.

Approvals

TÜV (00138), KTA 1408.1 (08067), LTSS, CE

SMAW

BÖHLER FOX CN 16/13

Stick electrode, high-alloyed, austenitic stainless, creep resistant

Classifications

EN ISO 3581-A
E Z 16 13 Nb B 4 2

Characteristics and typical fields of application

Basic coated, core wire alloyed electrode of E Z 16 13 Nb B type for welding of heat and creep resistant CrNi-alloyed austenitic stainless steels in high efficiency boilers and turbine components. Approved in long-term condition up to 800ºC. Fully austenitic weld deposit. Resistant to embrittlement and hot cracking. Excellent weldability in all positions except vertical down.

Base materials

Similar alloyed heat and creep resistant steels

1.4878 X8CrNiTi18-10, 1.4910 X3CrNiMoBN17-13-3, 1.4919 X6CrNiMoB17-12-2, 1.4981 X8CrNiMoNb16-6, 1.4988 (G) X8CrNiMoVNb16-13

UNS S31635, S32100

AISI 316H, 321

Typical analysis of all-weld metal

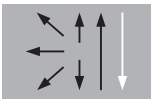
	C	Si	Mn	Cr	Ni	Nb
wt.-%	0.14	0.5	3.8	16.0	13.0	1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	450 (≥ 390)	600 (≥ 550)	31 (≥ 30)	55 (≥ 32)

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	FOX CN 16/13 E Z16 13 Nb B

Dimension mm	**Current A**
2.5 × 250	60 – 80
3.2 × 350	80 – 110

Preheating is only necessary in case of wall thickness above 25 mm preheat up to 150ºC.

Low heat input, max. 1.5 kJ/mm is recommended.

Interpass temperature should not exceed 150ºC.

Re-drying at 250 – 300ºC for min. 2 h if necessary.

Approvals

TÜV (00550), CE

böhler welding by voestalpine

BÖHLER FOX E 347 H

Stick electrode, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 19 9 Nb B	E347-15

Characteristics and typical fields of application

Basic coated electrode of E 19 9 Nb B / E347-15 type for welding of heat and creep resistant CrNi-alloyed austenitic stainless steels such as 1.4541 / 347H for service temperatures exceeding 400°C. Controlled ferrite content of 3 – 8 FN. The deposit is less susceptible to embrittlement and is scaling resistant. Excellent weldability in all positions except vertical down.

Base materials

1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4878 X8CrNiTi18-10, 1.4912 X7CrNiNb18-10, 1.4940 X7CrNiTi18-10

UNS S32100, S32109, S34700, S34709

AISI 321, 321H, 347, 347H

Typical analysis of all-weld metal

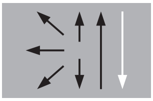
	C	Si	Mn	Cr	Ni	Nb	FN
wt.-%	0.05	0.3	1.3	19.0	10.2	≥ 8 × C	3 – 8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	470 (≥ 350)	630 (≥ 550)	36 (≥ 25)	95 (≥ 32)

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	FOX E 347 H-15 E 19 9 Nb B

Dimension mm	Current A
2.5 × 300	50 – 80
3.2 × 350	75 – 110
4.0 × 350	110 – 145

Preheating is not required; only in case of wall thickness above 25 mm preheat up to 150°C.

Interpass temperature should not exceed 200°C.

Approvals

-

SMAW

BÖHLER FOX E 308 H

Stick electrode, high-alloyed, austenitic stainless, creep resistant

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 19 9 H R 4 2	E308H-16

Characteristics and typical fields of application

Rutile-basic coated electrode of E 19 9 H R / E308H-16 type for welding of creep resistant CrNi-alloyed austenitic stainless steels such as 1.4948 / 304H. Controlled ferrite content of 3 – 8 FN. The deposit is resistant to embrittlement and scaling. Excellent weldability in all position except vertical down. Service temperatures up to 700ºC.

Base materials

1.4301 X5CrNi18-10, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4878 X8CrNiTi18-10, 1.4948 X7CrNi18-9

UNS S30400, S30409, S32100, S34700

AISI 304, 304H, 321, 321H, 347, 347H

Typical analysis of all-weld metal

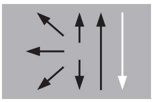
	C	Si	Mn	Cr	Ni
wt.-%	0.05	0.6	0.8	19.8	10.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	420 (≥ 350)	580 (≥ 550)	40 (≥ 30)	70 (≥ 32)

u untreated, as-welded

Operating data



Polarity DC+ / AC

Electrode identification FOX E 308 H-16 E 19 9 H R

Dimension mm	Current A
2.5 × 300	45 – 75
3.2 × 350	70 – 110
4.0 × 350	110 – 145

Preheating is not required; only in case of wall thickness above 25 mm preheat up to 150ºC.

Interpass temperature should not exceed 200ºC.

Re-drying at 120 – 200ºC for min. 2 h if necessary.

Approvals

TÜV (11178), CE

BÖHLER FOX FA

Stick electrode, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 3581-A
E 25 4 B 2 2

Characteristics and typical fields of application

Basic coated, cored wire alloyed electrode of E 25 4 B type for welding heat resistant steels. For furnaces requiring elevated resistance to reducing and oxidizing sulfurous gases as well as for final passes of weld joints in heat resistant, ferritic CrSiAl-steels. Scaling resistant up to 1100ºC.

Base materials

1.4347 GX8CrCrNiN26-7, 1.4340 GX49CrNi27-4, 1.4745 GX40CrSi23, 1.4746 X8CrTi25, 1.4762 X10CrAlSi25, 1.4776 GX40CrSi29, 1.4821 X15CrNiSi25-4, 1.4822 GX40CrNi24-5, 1.4823 GX40CrNiSi27-4

AISI 327, ASTM 297 HC

Typical analysis of all-weld metal

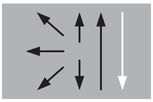
	C	Si	Mn	Cr	Ni
wt.-%	0.10	0.5	1.2	25.0	5.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	520 (≥ 400)	680 (≥ 600)	22 (≥ 15)	45

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification FOX FA E 25 4 B

Dimension mm	Current A
2.5 × 300	50 – 75
3.2 × 350	80 – 105
4.0 × 350	100 – 130

Preheating and interpass temperatures 200 – 400ºC, depending on the relevant base metal and material thickness.

Approvals

-

SMAW

Avesta 309 AC/DC

Stick electrode, high-alloyed, austenitic stainless, special applications, heat resistant

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 22 12 R	E309-17

Characteristics and typical fields of application

Rutile coated high-carbon electrode of E Z 22 12 R / E309-17 type for welding heat resistant steels such as 1.4833 / 309S. The weld metal is suitable for high temperature applications up to 1000ºC. Can also be used for dissimilar welding between stainless and mild or low-alloyed steels and surfacing on unalloyed steels. Designed for first class weld seems and easy handling on AC or DC. Resulting all weld metal microstructure: austenite with approximately 10 – 15% ferrite. Scaling temperature approximately 1000ºC in air.

Base materials

Over-alloyed electrode primarily used for welding of high temperature steels such as 1.4833 / 309S, but it may also be used for surfacing unalloyed steel, joint welding stainless steel to unalloyed steel and welding cladded material.

Typical analysis of all-weld metal

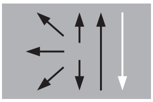
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.055	0.8	1.1	24.3	13.3	14

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	450 (≥ 320)	570 (≥ 550)	30 (≥ 25)	40

u untreated, as-welded

Operating data



Polarity	DC+ / AC
Electrode identification	309-17

Dimension mm	Current A
2.5 × 300	50 – 80
3.2 × 350	80 – 120
4.0 × 350	100 – 160

Suggested heat input is max. 2.0 kJ/mm, interpass temperature max. 150ºC.

Metal recovery approximately 110%.

Approvals

Certified by CWB to CSA W48, CE

BÖHLER FOX FFB

Stick electrode, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 25 20 B 2 2	E310-15 (mod.)

Characteristics and typical fields of application

Basic coated, cored wire alloyed electrode of E 25 20 B / E310-15 (mod.) type for welding heat resistant rolled and forged steels as well as cast steels e.g. in annealing plants, hardening plants, steam boiler construction, the crude oil industry and the ceramic industry. Heat resistant CrSiAl-steels exposed to sulfurous gases should be welded with a final layer of FOX FA after joining. Cryogenic resistance down to –196ºC. Avoid the service temperature range between 650ºC and 900ºC due to the risk of embrittlement. Scaling resistant up to 1200ºC.

Base materials

1.4586 X5NiCrMoCuNb22-18, 1.4710 GX30CrSi6, 1.4713 X10CrAl7, 1.4724 X10CrAl13, 1.4740 GX40CrSi17, 1.4742 X10CrAl18, 1.4762 X10CrAl 25, 1.4826 GX40CrNiSi22-9, 1.4840 GX15CrNi25-20, 1.4841 X15CrNiSi25-20, 1.4845 X12CrNi25-21, 1.4828 X15CrNiSi20-12, 1.4837 GX40CrNiSi25-12, 1.4840 GX15CrNi25-20, 1.4846 GX40CrNi25-21

UNS S31000, S31400, S44600

AISI 305, 310, 314, 446

Typical analysis of all-weld metal

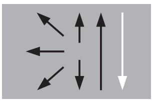
	C	Si	Mn	Cr	Ni
wt.-%	0.12	0.6	3.2	25.0	20.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	420 (≥ 350)	570 (≥ 550)	39 (≥ 30)	100	≥ 32

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification FOX FFB E 25 20 B

Dimension mm	Current A
2.5 × 300	50 – 75
3.2 × 350	80 – 110
4.0 × 350	110 – 140
5.0 × 450	140 – 180

Preheating and interpass temperatures for ferritic steels 200 – 300ºC.

Approvals

TÜV (00143), CE

BÖHLER FOX FFB-A

Stick electrode, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 3581-A	**AWS A5.4 / SFA-5.4**
E 25 20 R 3 2	E310-16

Characteristics and typical fields of application

Rutile coated electrode of E 25 20 R / E310-16 type for welding heat resistant rolled steels e.g. in annealing plants, hardening plants, steam boiler construction, the crude oil industry and the ceramic industry. Heat resistant CrSiAl-steels exposed to sulfurous gases should be weld with a final layer of BÖHLER FOX FA after joining. For thick-walled components the basic coated BÖHLER FOX FFB is recommended. Avoid the service temperature range between 650ºC and 900ºC due to the risk of embrittlement. Scaling resistant up to 1200ºC.

Base materials

1.4586 X5NiCrMoCuNb22-18, 1.4710 GX30CrSi6,1.4713 X10CrAl7, 1.4724 X10CrAl13, 1.4740 GX40CrSi17, 1.4742 X10CrAl18 1.4762 X10CrAl25, 1.4826 GX40CrNiSi22-9, 1.4840 GX15CrNi25-20, 1.4841 X15CrNiSi25-20, 1.4845 X12CrNi25-21, 1.4828 X15CrNiSi20-12, 1.4837 GX40CrNiSi25-12, 1.4840 GX15CrNi25-20, 1.4846 GX40CrNi25-21

UNS S31000, S31400, S44600

AISI 305, 310, 314, 446

Typical analysis of all-weld metal

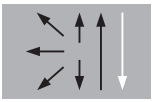
	C	Si	Mn	Cr	Ni
wt.-%	0.12	0.5	2.2	26.0	21.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	400 (≥ 350)	580 (≥ 550)	35 (≥ 30)	80 (≥ 47)

u untreated, as-welded

Operating data



Polarity	DC+ / AC
Electrode identification	FOX FFB-A 310-16 E 25 20 R

Dimension mm	Current A
2.0 × 300	40 – 60
2.5 × 300	50 – 80
3.2 × 300/350	80 - 110
3.2 × 350	80 – 110
4.0 × 350	110 – 140

Preheating and interpass temperatures for ferritic steels 200 – 300ºC.

Re-drying if necessary at 120 – 200ºC for min. 2 h.

Approvals

Equinor

Avesta 310

Stick electrode, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 3581-A	AWS A5.4 / SFA-5.4
E 25 20 R 3 2	E310-17

Characteristics and typical fields of application

Rutile coated fully austenitic electrode of E 25 20 R / E310-17 type designed for welding of high temperature stainless steel such as 1.4845 / 310S and similar grades. To minimize the risk of hot cracking when welding fully austenitic steels, the heat input and interpass temperature must be kept low and there must be as little dilution as possible from the parent metal. Primary intended for constructions running at high temperatures. Wet corrosion properties are moderate. Scaling temperature approximately 1150ºC in air.

Base materials

1.4841 X15CrNiSi25-21, 1.4845 X8CrNi25-21, 1.4846 X40CrNi25-21

UNS S31000, S31400

AISI 310, 310S, 314

Typical analysis of all-weld metal

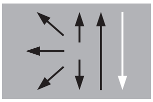
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.11	0.7	2.0	26.0	21.4	0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C	Hardness HB
u	420 (≥ 350)	560 (≥ 550)	25 (≥ 20)	65	45	170

u untreated, as-welded

Operating data



Polarity	DC+ / AC
Electrode identification	310-17

Dimension mm	Current A
2.5 × 300	45 – 80
3.2 × 350	70 – 120
4.0 × 350	100 – 150

Suggested heat input is max. 1.0 kJ/mm, interpass temperature max. 100ºC.

Preheating and post-weld heat-treatment not necessary.

Metal recovery approximately 115%.

Approvals

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Thermanit 21/33 So

Stick electrode, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 3581-A
E Z 21 33 B 4 2

Characteristics and typical fields of application

Basic coated electrode of E Z 21 33 B 4 2 type. Heat resistant up to 1050ºC. Good resistance to carburizing atmospheres. For joining and surfacing applications with matching / similar heat resistant steels and cast steel grades.

Max. service temperature	Sulfur-free	Max. 2 g S/Nm^3
Air and oxidizing combustion gases	1050ºC	1000ºC
Reducing combustion gases	1000ºC	950ºC

Base materials

1.4847 X8CrNiAlTi20-20, 1.4849 GX40NiCrSiNb38-18, 1.4958 X5NiCrAlTi31-20, 1.4859 GX10NiCrNb32-20 / GX10NiCrNb38-18, 1.4861 X10NiCr32-20, 1.4864 X12NiCrSi36-16 / X12NiCrSi 35-16, 1.4865 GX40NiCrSi38-18, 1.4876 X10NiCrAlTi32-20 / X10NiCrAlTi32-21

UNS N08810

AISI 330, 334

Alloy 800, 800H, 800HT

Typical analysis of all-weld metal

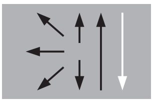
	C	Si	Mn	Cr	Ni	Nb
wt.-%	0.15	0.5	4.5	22.0	33.0	1.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	> 410	> 600	> 25	> 50

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	Thermanit 21/33 So

Dimension mm	Current A
2.5 × 300	50 – 75
3.2 × 350	70 – 110

Suggested heat input is max.1.5 kJ/mm, interpass temperature max. 150ºC.
Welding with stringer bead technique or limited weaving motion advisable.
Creep rupture properties according to matching heat resistant parent metals.
Post-weld heat treatment generally not needed. If required 875ºC for 3 h followed by air cooling.

Approvals

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Thermanit 25/35 R

Stick electrode, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 3581-A
E Z 23 35 Nb B 2 2

Characteristics and typical fields of application

Thermanit 25/35 R is suitable for joining and surfacing of heat resistant CrNi-cast steels (centrifugal and mould cast parts) of the same or of similar nature. Resistant to scaling up to 1050ºC

Base materials

1.4840 GX15CrNi25-20, 1.4849 GX40NiCrSiNb38-18, 1.4852 GX40NiCrSiNb35-25, 1.4857 GX40NiCrSi35-25, 1.4865 GX40NiCrSi38-18

Typical analysis of all-weld metal

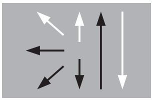
	C	Si	Mn	Cr	Ni	Nb	Ti	Fe
wt.-%	0.40	1.0	1.8	25.0	35.0	1.3	0.1	Bal.

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	500	700	15

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification Thermanit 25/35 R

Dimension mm	Current A
2.5 × 300	50 – 70
3.2 × 350	70 – 120
4.0 × 350	90 – 135

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.
No preheating or post-weld heat treatment required.

Approvals

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Thermanit ATS 4

TIG rod, high-alloyed, austenitic stainless, creep resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 19 9 H	ER19-10H

Characteristics and typical fields of application

TIG rod of W 19 9 H / ER19-10H type for joining and surfacing applications on matching and similar creep resistant steel and cast steel grades. Creep resistant up to 700°C. Controlled microstructure with max. 5% ferrite.

Base materials

1.4878 X8CrNiTi18-10, 1.4912 X7CrNiNb18-10, 1.4940 X7CrNiTi18-10, 1.4948 X6CrNi18-10

AISI 304H, 321H, 347H

Typical analysis of the wire rod

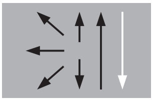
	C	Si	Mn	Cr	Ni
wt.-%	0.05	0.4	1.8	18.8	9.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	400	600	30	100

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.0 × 1000	50 – 70	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Heat input max. 2.0 kJ/mm, interpass temperature max. 150°C.

Creep rupture properties according to matching high temperature steels / alloys.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (01616), CE

Thermanit 304 H Cu

TIG rod, high-alloyed, austenitic stainless, creep resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W Z 18 16 1 Cu H	ER308H (mod.)

Characteristics and typical fields of application

TIG rod of W Z 18 16 1 Cu H / ER308H (mod.) type for joining and surfacing on matching austenitic creep resistant steels and cast steel grades. Good high temperature corrosion resistance.

Base materials

1.4907 X10CrNiCuNb18-9-3 and similar creep resistant austenitic steels such as Super 304 H and DMV 304 HCu

18Cr-9Ni-3Cu-Nb-N ASME SA-213; code case 2328-1

Typical analysis of the wire rod

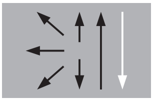
	C	Si	Mn	Cr	Ni	Mo	Nb	N	Cu
wt.-%	0.1	0.4	3.2	18	16.0	0.8	0.4	0.2	3.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	350	590	25	47

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Heat input is max. 2.0 kJ/mm, interpass temperature max. 150°C. Preheating and post-weld heat-treatment not necessary.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (11219), CE

BÖHLER FA-IG

TIG rod, high-alloyed, austenitic stainless, heat resistant

GTAW

Classifications

EN ISO 14343-A
W 25 4

Characteristics and typical fields of application

TIG rod of W 25 4 type for welding of heat resisting, matching or similar Mo-free 25Cr(Ni)-steels and cast steel grades. The low Ni-content renders this filler metal especially recommendable for applications involving the attack of sulfurous oxidizing or reducing combustion gases.

Base materials

1.4347 GX8CrCrNiN26-7, 1.4340 GX49CrNi27-4, 1.4745 GX40CrSi23, 1.4746 X8CrTi25, 1.4762 X10CrAlSi25, 1.4776 GX40CrSi29, 1.4821 X15CrNiSi25-4, 1.4822 GX40CrNi24-5, 1.4823 GX40CrNiSi27-4

AISI 327

Typical analysis of the wire rod

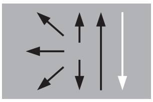
	C	Si	Mn	Cr	Ni
wt.-%	0.07	0.8	1.2	25.7	4.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	540 (≥ 450)	710 (≥ 650)	22 (≥ 15)	70

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
2.4 × 1000	130 – 160	16 – 18

Preheating and interpass temperature as required by the base metal. For parent metals susceptible to embrittlement, interpass temperature must not be allowed to exceed 300°C.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

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BÖHLER FF-IG

TIG rod, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 22 12 H	ER309 (mod.)

Characteristics and typical fields of application

TIG rod of W 22 12 H / ER309 (mod.) type for analogous, heat resisting rolled, forged and cast steels as well as for heat resisting, ferritic CrSiAl-steels, e.g. in annealing shops, hardening shops, steam boiler construction, the crude oil industry and the ceramics industry. Austenitic deposited with a ferrite content of approximately 8%. Preferably used for applications involving the attack of oxidizing gases.

The final layer of joint welds in CrSiAl-steels exposed to sulfurous gases must be deposited by means of BöHLER FOX FA or BöHLER FOX FA-IG. Scaling resistance up to 1000°C.

Base materials

Austenitic 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4833 X12CrNi23-13

Ferritic-pearlitic 1.4710 GX30CrSi7, 1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4740 GX40CrSi17, 1.4742 X10CrAlSi18

AISI 305

Typical analysis of the wire rod

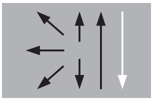
	C	Si	Mn	Cr	Ni
wt.-%	0.1	1.1	1.6	22.5	11.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	500 (≥ 350)	630 (≥ 550)	32 (≥ 25)	115

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Heat input, max. 2.0 kJ/mm, interpass temperature max. 150°C.

Preheating and interpass temperatures for ferrite steels 200 – 300°C. Creep rupture properties according to matching high temperature steels / alloys

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (00020), CE

Thermanit 310

TIG rod, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 25 20	ER310

Characteristics and typical fields of application

GTAW rod of W 25 20 / ER310 type for joining and surfacing of matching / similar heat resistant steels and cast steel grades. For tough fill layers beneath cap passes made with BöHLER FA-IG / FOX FA when welding thicker cross-sections of Cr-steels grades to permit use of such steels in sulfurous atmospheres.

Max. service temperature	Sulfur-free	Max. 2 g S/Nm^3
Air and oxidizing combustion gases	1150ºC	1100ºC
Reducing combustion gases	1080ºC	1040ºC

Base materials

1.4586 X5NiCrMoCuNb22-18, 1.4710 G-X30CrSi6, 1.4713 X10CrAl7, 1.4724 X10CrAl13, 1.4740 G-X40CrSi17, 1.4742 X10CrAl18, 1.4762 X10CrAl25, 1.4826 GX40CrNiSi22-9, 1.4840 G-X15CrNi25-20, 1.4841 X15CrNiSi25-20, 1.4845 X12CrNi25-21, 1.4828 X15CrNiSi20-12, 1.4837 GX40CrNiSi25-12, 1.4840 GX15CrNi25-20, 1.4846 G-X40CrNi25-21

UNS S31000, S31400, S44600

AISI 305, 310, 314, 446

Typical analysis of the wire rod

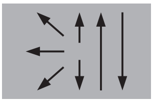
	C	Si	Mn	Cr	Ni
wt.-%	0.12	0.4	1.8	25.8	21.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	420 (≥ 350)	610 (≥ 550)	33 (≥ 20)

u untreated, as welded – Shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Preheating and post-weld heat-treatment not necessary.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

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BÖHLER FFB-IG

TIG rod, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W 25 20 Mn	ER310 (mod.)

Characteristics and typical fields of application

TIG rod of W 25 20 Mn / ER310 (mod.) type for analogous, heat resisting, rolled, forged and cast steels, e.g. in annealing shops, hardening shops, steam boiler construction, the crude oil industry and the ceramics industry. Fully austenitic deposit. Preferably employed for applications involving the attack of oxidizing, nitrogen-containing or low-oxygen gases. In sulfurous atmospheres cap passes should be made with BöHLER FA-IG / BöHLER FOX FA. The temperature range between 650°C and 900°C should be avoided owing to the risk of embrittlement.

Base materials

1.4586 X5NiCrMoCuNb22-18, 1.4710 GX30CrSi6, 1.4713 X10CrAl7, 1.4724 X10CrAl13, 1.4740 G-X40CrSi17,1.4742 X10CrAl18, 1.4762 X10CrAl 25, 1.4826 GX40CrNiSi22-9, 1.4840 GX15CrNi25-20, 1.4841 X15CrNiSi25-20, 1.4845 X12CrNi25-21, 1.4828 X15CrNiSi20-12, 1.4837 GX40CrNiSi25-12, 1.4840 GX15CrNi25-20, 1.4846 GX40CrNi25-21

UNS S31000, S31400, S44600

AISI 305, 310, 314, 446

Typical analysis of the wire rod

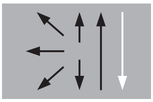
	C	Si	Mn	Cr	Ni
wt.-%	0.13	0.9	3.2	24.6	20.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J –40°C
u	420 (≥ 350)	630 (≥ 550)	33 (≥ 20)	128 (≥ 32)

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Preheating and interpass temperatures for ferritic steels 200 – 300°C.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

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GTAW

Thermanit CR

TIG rod, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
W Z 25 20 H	ER310 (mod.)

Characteristics and typical fields of application

TIG rod of W Z 25 20 H / ER310 (mod.) type for surfacing and joining applications on matching heat resistant cast steel grades. Service temperature max. 1000°C.

Base materials

1.4848 GX40CrNiSi25-20, 1.4826 GX40CrNiSi22-9, 1.4837 GX40CrNiSi25-12

Typical analysis of the wire rod

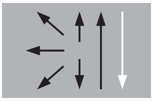
	C	Si	Mn	Cr	Ni
wt.-%	0.45	0.9	1.5	26	21.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	500	700	10

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Suggested heat input is max. 1.0 kJ/mm and interpass temperature max. 100°C.

Creep rupture properties according to matching high temperature steels / alloys.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

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BÖHLER CN 21/33 Mn-IG

TIG rod, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 14343-A
W Z 21 33 Mn Nb

Characteristics and typical fields of application

TIG rod of W Z 21 33 Mn Nb type for joining and surfacing applications with matching / similar heat resistant steels and cast steel grades. Good resistance to carburizing atmospheres.

Max. application temperature	Sulfur-free	Max. 2 g S/Nm^3
Air and oxidizing combustion gases	1050ºC	1000ºC
Reducing combustion gases	1000ºC	950ºC

Base materials

1.4847 X8CrNiAlTi20-20, 1.4849 GX40NiCrSiNb38-18, 1.4958 X5NiCrAlTi31-20, 1.4859 GX10NiCrNb32-20 / GX10NiCrNb38-18, 1.4861 X10NiCr32-20, 1.4864 X12NiCrSi36-16 / X12NiCrSi 35-16, 1.4865 GX40NiCrSi38-18, 1.4876 X10NiCrAlTi32-20 / X10NiCrAlTi32-21

UNS N08810

AISI 330, 334

Alloy 800, 800H, 800HT

Typical analysis of the wire rod

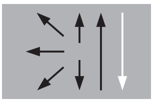
	C	Si	Mn	Cr	Ni	Nb
wt.-%	0.12	0.2	4.8	21.8	32.5	1.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	400	600	17	50

u untreated, as-welded - Shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Heat input max.1.5 kJ/mm, interpass temperature max. 150ºC.
Welding with stringer bead technique or limited weaving motion advisable.
Creep rupture properties according to matching heat resistant parent metals.
If needed, a stabilizing heat treatment can be performed at 875ºC for 3 h followed by air cooling.
Shielding gas: Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

TÜV (11217), CE

Thermanit 25/35 R

TIG rod, high-alloyed, austenitic stainless, heat resistant

GTAW

Classifications

EN ISO 14343-A
W Z 25 35

Characteristics and typical fields of application

TIG rod of W Z 25 35 type for joining and surfacing work with matching / similar heat resistant cast steel grades. Typical application is welding of pyrolysis furnace tubes. Service temperature max. 1050°C.

Base materials

1.4840 GX15CrNi25-20, 1.4849 GX40NiCrSiNb38-18, 1.4852 GX40NiCrSiNb35-25, 1.4857 GX40NiCrSi35-25, 1.4865 GX40NiCrSi38-18

Typical analysis of the wire rod

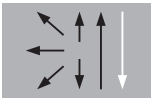
	C	Si	Mn	Cr	Ni	Nb
wt.-%	0.42	1.0	1.8	26	35.0	1.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	450	650	8

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.2 × 1000	60–80	9–11

Heat input max. 1.0 kJ/mm, interpass temperature max. 100°C.
Preheating and post-weld heat-treatment not necessary.
Shielding gas: Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

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böhler welding by voestalpine

Thermanit 35/45 Nb

TIG rod, high-alloyed, nickel-base, heat resistant

Classifications

EN ISO 18274
S Ni Z (NiCr36Fe15Nb0.8)

Characteristics and typical fields of application

Nickel-base TIG rod of W Ni Z (NiCr36Fe15Nb0.6) type for joining and surfacing of heat resistant steels and cast steels of the same or similar chemical composition. Resistant to scaling up to 1180°C. Typical alloy for welding of pyrolysis furnace tubes.

Base materials

GX45NiCrNbSiTi45-35

Typical analysis of the wire rod

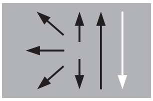
	C	Si	Mn	Cr	Ni	Nb
wt.-%	0.42	1.5	1.0	35	45.5	0.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa
u	450	550

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Heat input max. 1.0 kJ/mm, interpass temperature max. 150°C.
Preheating and post-weld heat treatment not necessary. Service temperature max. 1050°C.
Shielding gas: Ar. Gas flow: 8 – 12 l/min.
Polarity: DC-

Approvals

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Thermanit ATS 4

Solid wire, high-alloyed, austenitic stainless, creep resistant

Classifications

EN ISO 14343-A
G 19 9 H

AWS A5.9 / SFA-5.9
ER19-10H

Characteristics and typical fields of application

Solid wire of G 19 9 H / ER19-10H type for joining and surfacing applications on matching and similar creep resistant steel and cast steel grades. Creep resistant up to 700ºC. Controlled microstructure with approximately 5% ferrite.

Base materials

1.4436 X3CrNiMo17-13-3, 1.4439 X2CrNiMoN17-13-5, 1.4429 X2CrNiMoN17-13-3, 1.4438 X2CrNiMo18-15-4, 1.4583 X10CrNiMoNb18-12

AISI 316Cb, 316LN, 317LN, 317L

UNS S31726

Typical analysis of the solid wire

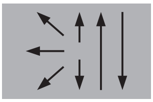
	C	Si	Mn	Cr	Ni
wt.-%	0.05	0.3	1.8	18.8	9.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	350	550	35	70

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	90 – 120	18 – 22
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 270	26 – 30

Up to 25 mm wall thickness no preheating or post weld heat treatment. Over 25 mm wall thickness preheating to max. 200ºC and stress relieving treatment at 1050ºC followed by air cooling.

Suggested heat input is max. 2.0 kJ/mm and interpass temperature max. 150ºC.

Creep rupture properties according to matching high temperature steels / alloys.

Shielding gas: Ar + 2 – 3% CO_2 (M12). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV (06522), CE

BÖHLER FA-IG

Solid wire, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 14343-A
G 25 4

Characteristics and typical fields of application

Solid wire of G 25 4 type for welding of heat resistant, matching or similar Mo-free 25Cr(Ni)-steels and cast steel grades. For parent metals susceptible to embrittlement, interpass temperature must not be allowed to exceed 300ºC. The low Ni-content renders this filler metal especially suitable for applications involving of sulfurous oxidizing or reducing combustion gases. Scaling resistant up to 1100ºC.

Base materials

1.4347 GX8CrCrNiN26-7, 1.4340 GX49CrNi27-4, 1.4745 GX40CrSi23, 1.4746 X8CrTi25, 1.4762 X10CrAlSi25, 1.4776 GX40CrSi29, 1.4821 X15CrNiSi25-4, 1.4822 GX40CrNi24-5, 1.4823 GX40CrNiSi27-4

AISI 327, ASTM A297 HC

Typical analysis of the solid wire

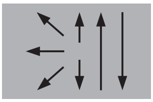
	C	Si	Mn	Cr	Ni
wt.-%	0.07	0.8	1.2	25.7	4.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	520 (≥ 450)	690 (≥ 650)	20 (≥ 15)	50

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 spray arc	180 – 240	25 – 29
1.2 spray arc	190 – 250	26 – 30
1.6 spray arc	250 – 330	29 – 32

Preheating and interpass temperature as required by the base metal.

Shielding gas: Ar + 2 – 3% CO_2. Gas flow: 15 – 20 l/min. Polarity: DC+

Approvals

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BÖHLER FF-IG

Solid wire, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 22 12 H	ER309 (mod.)

Characteristics and typical fields of application

Solid wire of G 22 12 H / ER309 (mod.) type for similar, heat resisting rolled, forged and cast steels as well as for heat resisting, ferritic CrSiAl-steels, e.g. in annealing shops, hardening shops, steam boiler construction, the crude oil industry and the ceramics industry. Scaling resistance up to 950°C. Results in an austenitic microstructure deposited with a ferrite content of approximately 8%. Preferably used for applications involving the attack of oxidizing gases.

The final layer of joint welds in CrSiAl-steels exposed to sulfurous gases must be deposited by means of BöHLER FOX FA or BöHLER FOX FA-IG.

Base materials

Austenitic 1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4833 X12CrNi23-13

Ferritic-pearlitic 1.4710 GX30CrSi7, 1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4740 GX40CrSi17, 1.4742 X10CrAlSi18

AISI 305, ASTM A297 HF

Typical analysis of the solid wire

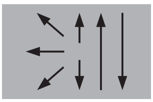
	C	Si	Mn	Cr	Ni
wt.-%	0.1	1.1	1.6	22.5	11.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	480 (≥ 350)	620 (≥ 550)	34 (≥ 25)	110

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	60 – 100	18 – 20
1.0 short arc	110 – 140	20 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 260	27 – 30

Suggested heat input is max. 2.0 kJ/mm, interpass temperature max. 150°C.

Preheating and interpass temperatures for ferrite steels 200 – 300°C. Creep rupture properties according to matching high temperature steels / alloys.

Shielding gas: Ar + 2 – 3% CO_2. Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

TÜV, CE

böhler welding by voestalpine

Thermanit 310

Solid wire, high-alloyed, stainless, heat resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 25 20	ER310

Characteristics and typical fields of application

Solid wire of G 25 20 / ER310 type for joining and surfacing of matching / similar heat resistant steels / cast steel grades. For tough fill layers beneath cap passes made with BöHLER FA-IG / FOX FA when welding thicker cross-sections of Cr-steels and cast steel grades to permit use of such steels in sulfurous atmospheres.

Max. application temperature	Sulfur-free	Max. 2 g S/Nm^3
Air and oxidizing combustion gases	1150°C	1100°C
Reducing combustion gases	1080°C	1040°C

Base materials

1.4841 X15CrNiSi25-21, 1.4845 X8CrNi25-21, 1.4846 X40CrNi25-21

UNS S31000, S31400

AISI 310, 310S, 314

Typical analysis of the solid wire

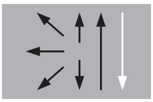
	C	Si	Mn	Cr	Ni
wt.-%	0.13	0.4	1.8	25.8	20.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	350	550	25	80

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 spray arc	180 – 240	25 – 29
1.2 spray arc	19 – 250	26 – 30

Suggested heat input is max. 1.0 kJ/mm, interpass temperature max. 100°C.

Preheating and post-weld heat treatment not necessary.

Shielding gas: Ar + 2 – 3% CO_2 (M13) or Ar + 1 – 2% O_2 (M12). Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

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BÖHLER FFB-IG

Solid wire, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9
G 25 20 Mn	ER310 (mod.)

Characteristics and typical fields of application

Solid wire of G 25 20 Mn / ER310 (mod.) type for joining and surfacing of matching / similar heat resisting, rolled, forged and cast steels, e.g. in annealing shops, hardening shops, steam boiler construction, crude oil industry and the ceramics industry. In sulfurous atmospheres cap passes should be made with BöHLER FA-IG / BöHLER FOX FA. The temperature range between 650 – 900°C should be avoided due to the risk of embrittlement.

Base materials

1.4586 X5NiCrMoCuNb22-18, 1.4710 GX30CrSi6, 1.4713 X10CrAl7, 1.4724 X10CrAl13, 1.4740 GX40CrSi17, 1.4742 X10CrAl18 1.4762 X10CrAl25, 1.4826 GX40CrNiSi22-9, 1.4840 GX15CrNi25-20, 1.4841 X15CrNiSi25-20, 1.4845 X12CrNi25-21, 1.4828 X15CrNiSi20-12, 1.4837 GX40CrNiSi25-12, 1.4840 GX15CrNi25-20, 1.4846 GX40CrNi25-21

UNS S31000, S31400, S44600

AISI 305, 310, 314, 446

Typical analysis of the solid wire

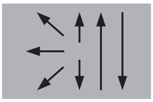
	C	Si	Mn	Cr	Ni
wt.-%	0.13	0.9	3.2	24.6	20.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	400 (≥ 350)	620 (≥ 550)	38 (≥ 20)	95	(≥ 32)

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	60 – 100	20 – 22
1.0 spray arc	180 – 240	25 – 29
1.2 spray arc	190 – 250	26 – 30

Preheating and interpass temperatures for ferritic steels 200 – 300°C.

Shielding gas: Ar + 2 – 3% CO_2. Gas flow: 15 – 20 l/min.

Polarity: DC+

Approvals

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BÖHLER CN 21/33 Mn-IG

Solid wire, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 14343-A
G Z 21 33 Mn Nb

Characteristics and typical fields of application

Solid wire of G Z 21 33 Mn Nb type for joining and surfacing applications with matching / similar heat resistant steels and cast steel grades. Good resistance to carburizing atmospheres. Typical alloy for welding of pyrolysis furnace tubes.

Base materials

1.4847 X8CrNiAlTi20-20, 1.4849 GX40NiCrSiNb38-18, 1.4958 X5NiCrAlTi31-20, 1.4859 – GX10NiCrNb32-20 / GX10NiCrNb38-18, 1.4861 X10NiCr32-20, 1.4864 X12NiCrSi36-16 / X12NiCrSi 35-16, 1.4865 GX40NiCrSi38-18, 1.4876 – X10NiCrAlTi32-20 / X10NiCrAlTi32-21

UNS N08810

AISI 330, 334

Alloy 800, 800H, 800HT

Typical analysis of the solid wire

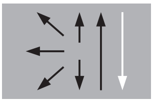
	C	Si	Mn	Cr	Ni	Nb
wt.-%	0.12	0.2	4.8	21.8	32.5	1.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	≥ 400	≥ 600	≥ 17	≥ 50

u untreated, as-welded – shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 short arc	110 – 140	19 – 22
1.0 spray arc	160 – 220	25 – 29
1.2 spray arc	200 – 260	26 – 30

Suggested heat input is max.1.5 kJ/mm, interpass temperature max. 150ºC.
Welding with stringer bead technique or limited weaving motion advisable.
Creep rupture properties according to matching heat resistant parent metals.
If needed, a stabilizing heat treatment can be performed at 875ºC for 3 h followed by air cooling.
Shielding gas: Ar + 2 – 3% CO_2. Gas flow: 15 – 20 l/min.
Polarity: DC+

Approvals

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GMAW

Thermanit 25/35 R

Solid wire, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 14343-A
G 25 35

Characteristics and typical fields of application

For joining and surfacing work on matching / similar heat resistant cast steel grades. Resistant to scaling up to 1050ºC.

Base materials

1.4852 GX40NiCrSiNb35-25

Typical analysis of the solid wire

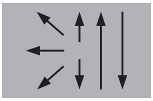
	C	Si	Mn	Cr	Ni	Nb
wt.-%	0.42	1.2	1.8	26.0	35.0	1.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	400	600	8

u untreated, as-welded - Shielding gas Ar + 2.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.2	200 – 260	26 – 30

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.
Preheating and post-weld heat treatment generally not needed.
Shielding gas: Ar + 8 – 10% CO_2, Ar + 2 – 3% CO_2 (M12) or Ar + 1 – 2% O_2 (M13). Gas flow: 15 – 20 l/min.
Polarity: DC+

Approvals

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GMAW

Thermanit ATS 4 - Marathon 104

SAW wire/flux combination, high-alloyed, austenitic stainless, heat and creep resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 19 9 H	ER19-10H	S A FB 2 AC

Characteristics and typical fields of application

Thermanit ATS 4 - Marathon 104 is a wire/flux combination for submerged arc welding of matching/similar high temperature resistant steels and cast steel grades.

Solid wire of S 19 9 H / ER19-10H type for joining and surfacing applications. Creep resistant up to 700ºC. Resistant to scaling up to 800ºC.

Marathon 104 is an agglomerated fluoride-basic flux for submerged arc welding of stainless and heat resistant steel grades. The weld metal is characterized by high resistance to hot cracking and is recommended for the highest demanding applications. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4550 X6CrNiNb18-10, 1.4878 X12CrNiTi18-9, 1.4948 X6CrNi18-1

AISI 304H, 321H, 347H

Typical analysis of the weld metal

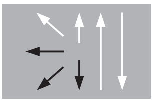
wt.-%	C	Si	Mn	Cr	Ni
wire	0.05	0.40	1.6	18.8	9.3
all-weld metal	0.05	0.50	1.3	18.5	9.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	(≥ 320)	(≥ 550)	(≥ 35)	(≥ 80)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33
3.0	320 – 470	29 – 33

No preheating.

Suggested heat input max. 1.5 kJ/mm and interpass temperature max. 150ºC. Polarity: DC+

Post-weld heat treatment generally not needed. In special cases, solution annealing can be perfiormed at 1050ºC followed by air cooling.

Approvals

TÜV (11232), CE

Avesta 253 MA - Avesta Flux 805

SAW wire/flux combination, high-alloyed, austenitic stainless, heat and creep resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S Z 21 10 N	EG	S A AF 2 DC

Characteristics and typical fields of application

Avesta 253 MA - Avesta Flux 805 is a wire/flux combination for submerged arc welding of matching/similar high temperature resistant steels/cast steel grades.

Solid wire of S Z 21 10 N type designed for welding the high temperature steel 253 MA® (1.4835 / UNS S30815), used for example in furnaces, combustion chambers, burners, etc. Both the steel and the consumable provide excellent properties at temperatures 850 – 1100ºC. The composition of the consumable is balanced to ensure crack resistant weld metal. The resulting microstructure is austenite with 2 – 8% ferrite. Scaling resistance up to 1150ºC in air. Excellence resistance to high temperature corrosion. Not intended for applications exposed to wet corrosion. 253 MA® has a tendency to give a thick oxide layer during welding and hot rolling. Black plates and previous weld beads should be carefully brushed or ground prior to welding.

Avesta Flux 805 is an agglomerated basic flux that ensures good welding properties with nice bead appearance and good slag detachability. The flux avoids excessive Cr-burn-out (Cr-support). For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4835 X9CrNiSiNCe21-11-2, 1.4818 X6CrNiSiNCe19-10

UNS S30815, S30415

253 MA®, 153 MA™

SAW

Typical analysis of the weld metal

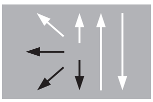
wt.-%	C	Si	Mn	Cr	Ni	N
wire	0.07	1.6	0.50	21.0	10.0	0.15
all-weld metal	0.07	1.7	0.30	21.5	9.5	0.15

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	470	690	39	90

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33

SAW – single wire process with Ø 2.4 mm wire. Suggested heat input is max. 1.5 kJ/mm, interpass temperature max. 150ºC.
Preheating and heat treatment are generally not necessary. Polarity: DC+

Approvals

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Thermanit D - Marathon 104

SAW wire/flux combination, high-alloyed, austenitic stainless, creep and heat resistant

Classifications

EN ISO 14343-A	AWS A5.9 / SFA-5.9	EN ISO 14174
S 22 12 H	ER309 (mod.)	S A FB 2 AC

Characteristics and typical fields of application

Thermanit D - Marathon 104 is a wire/flux combination for submerged arc welding for joining and surfacing applications with matching/similar heat resistant steels and cast steel grades. Solid wire of S 22 12 H / ER309 (mod.) type.

Max. application temperature	Sulfur-free	Max. 2 g S/Nm^3	> 2 g S/Nm^3
Air and oxidizing combustion gases	950°C	930°C	850°C
Reducing combustion gases	900°C	850°C	

Marathon 104 is an agglomerated fluoride-basic welding flux without Cr-support and neutral metallurgical behavior. For more information regarding this sub-arc welding flux, see the separate datasheet.

Base materials

1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12, 1.4833 X12CrNi23-13

AISI 305, ASTM A297 HF

Typical analysis of the weld metal

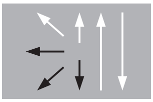
wt.-%	C	Si	Mn	Cr	Ni
wire	0.10	0.90	1.5	22.5	11.5
all-weld metal	0.10	1.0	1.2	22.2	11.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	(≥ 350)	(≥ 550)	(≥ 30)	(≥ 70)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
2.4	300 – 400	29 – 33

No preheating. Suggested heat input is max. 2.0 kJ/mm, interpass temperature max. 150°C. Polarity: DC+
Annealing of heat resistant Cr-steels and cast steel grades not necessary if the service temperature is the same or higher.

Approvals

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SAW

BÖHLER E 308 H-FD

Flux-cored wire, high-alloyed, austenitic stainless, creep resistant

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T Z19 9 H R M21 (C1) 3	E308HT0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T Z 19 9 H R / E308HT0 type for welding of austenitic CrNi-steels such as 1.4948 / 304H for elevated service temperatures. The higher carbon content as compared to T 19 9 L R / E308LT1, provides improved creep resistance properties, which is advantageous at temperatures above 400ºC. Max. temperature according to the TÜV approval is 700ºC. The scaling temperature is approximately 850ºC in air. The corrosion resistance is corresponding to the base material 1.4301 / 304, i.e. good resistance to general corrosion. The enhanced carbon content, compared to 308L, makes it slightly more sensitive to intergranular corrosion. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. The controlled ferrite content of 3 – 8 FN (measured with FeritScope FMP30) offers good resistance to hot cracking and sigma phase embrittlement. The very low bismuth content of < 10 ppm results in excellent elongation and impact toughness also after service at elevated temperatures. For welding in vertical-up and overhead positions, BÖHLER E 308 H PW-FD should be preferred.

Base materials

1.4301 X5CrNi18-10, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4878 X8CrNiTi18-10, 1.4948 X7CrNi18-9

UNS S30400, S30409, S32100, S34700

AISI 304, 304H, 321, 321H, 347, 347H

Typical analysis of the wire

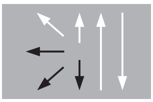
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.05	0.6	1.2	19.4	10.1	2 – 8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	360 (≥ 350)	570 (≥ 550)	45 (≥ 30)	85 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 250	22 – 30	5.0 – 15.0
1.6	~ 3	200 – 350	25 – 30	4.5 – 9.5

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (11179), CE

BÖHLER E 308 H PW-FD

Flux-cored wire, high-alloyed, austenitic stainless, creep resistant

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T Z19 9 H P M21 (C1) 1	E308HT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T Z 19 9 H P / E308HT1 type for welding of CrNi austenitic stainless steels such as 1.4948 / 304H for elevated service temperatures. The higher carbon content as compared to T 19 9 L P / E308LT1, provides improved creep resistance properties, which is advantageous at temperatures above 400ºC. Max. temperature according to the TÜV approval is 700ºC. The scaling temperature is approximately 850ºC in air. The corrosion resistance is corresponding to 1.4301 / 304, i.e. good resistance to general corrosion. The enhanced carbon content, compared to 308L, makes it slightly more sensitive to intergranular corrosion. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. The very low bismuth content of < 10 ppm results in excellent elongation and impact toughness also after service at elevated temperatures. The controlled ferrite content of 3 – 8 FN (measured with FeritScope FMP30) offers good resistance to hot cracking and sigma phase embrittlement. For flat and horizontal welding positions, BÖHLER E 308 H-FD may be preferred.

Base materials

1.4301 X5CrNi18-10, 1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4878 X8CrNiTi18-10, 1.4948 X7CrNi18-9

UNS S30400, S30409, S32100, S34700

AISI 304, 304H, 321, 321H, 347, 347H

Typical analysis of the wire

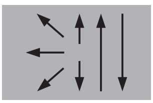
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.05	0.6	1.2	19.4	10.1	2 – 8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	370 (≥ 350)	560 (≥ 550)	45 (≥ 30)	90 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 230	22 – 29	6.0 – 13.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050ºC followed by water quenching.

Approvals

TÜV (11151), CE

BÖHLER E 309L H-FD

Flux-cored wire, high-alloyed, austenitic stainless, special applications, heat resistant

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 12 L R M21 (C1) 3	E309LT0-4(1)

Characteristics and typical fields of application

Rutile austenitic flux-cored wire of T 23 12 L R / E309LT0 type for welding of dissimilar joints of high-alloyed Cr and CrNi(Mo)-steels with unalloyed or low-alloyed steels in flat or horizontal position, as well as the first cladding layer on unalloyed and low-alloyed steels. Especially designed for welding in all positions with Ar + 15 – 25% CO_2 as shielding gas. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures down to –60ºC. The bismuth-free weld deposit (Bi < 10 ppm) and controlled ferrite content of 12 – 18 FN (measured with FeritScope FMP30) meet the recommendations of API RP582 and AWS A5.22 for high temperature service or post-weld heat treatment. For welding in vertical-up and overhead positions, BÖHLER E 309 H PW-FD should be preferred

Base materials

Primarily used for surfacing (buffer layer) unalloyed or low-alloyed steels and when joining non-molybdenum-alloyed stainless and carbon steels. Joints and mixed joints between austenitic steels or mixed joints between austenitic and heat resistant steels with ferritic steels to pressure boiler steels and fine grained structural steels, ship building steels, etc.

Typical analysis of the wire

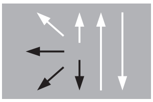
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.030	0.6	1.3	23.0	12.2	10 – 19

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–60°C
u	390 (≥ 350)	530 (≥ 520)	45 (≥ 30)	70 (≥ 47)	50 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 250	22 – 30	5.0 – 15.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The wire stick-out should be 15 – 20 mm and the heat input not exceed 2.0 kJ/mm. For dissimilar welding, slight weaving is recommended for all welding positions. Post-weld heat treatment generally not needed. For constructions that include dissimilar welding of low-alloyed steels, a stress-relieving annealing stage may be advisable. Always consult the supplier of the parent material or seek other expert advice to ensure that the correct heat treatment process is carried out. Preheat and interpass temperatures as required by the base metal.

Approvals

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BÖHLER E 309L H PW-FD

Flux-cored wire, high-alloyed, austenitic stainless, special applications, heat resistant

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 23 12 L P M21 (C1) 1	E309LT1-4(1)

Characteristics and typical fields of application

Rutile austenitic flux-cored wire of T 23 12 L P / E309LT1 type for welding of dissimilar joints of high-alloyed Cr and CrNi(Mo)-steels with unalloyed or low-alloyed steels, as well as the first cladding layer on unalloyed and low-alloyed steels. Especially designed for welding in all positions with Ar + 15 – 25% CO_2 as shielding gas. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposi-tion rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for service temperatures down to –60ºC. The bismuth-free weld deposit (Bi < 10 ppm) and controlled ferrite content of 12 – 18 FN (measured with FeritScope FMP30) meet the recommendations of API RP582 and AWS A5.22 for high temperature service or post-weld heat treatment. For flat and horizontal welding positions, BÖHLER E 309L H-FD may be preferred.

Base materials

Primarily used for surfacing (buffer layer) unalloyed or low-alloyed steels and when joining non-molybdenum-alloyed stainless and carbon steels. Joints and mixed joints between austenitic steels or mixed joints between austenitic and heat resistant steels with ferritic steels to pressure boiler steels and fine grained structural steels, ship building steels, etc.

Typical analysis of the wire

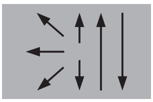
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.035	0.7	1.3	23.0	12.5	10 – 23

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–60°C
u	390 (≥ 350)	530 (≥ 520)	35 (≥ 30)	80 (≥ 47)	60 (≥ 32)

u untreated, as-welded – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 230	22 – 29	6.0 – 13.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The wire stick-out should be 15 – 20 mm and the heat input not exceed 2.0 kJ/mm. For dissimilar welding, slight weaving is recommended for all welding positions. Post-weld heat treatment generally not needed. For constructions that include dissimilar welding of low-alloyed steels, a stress-relieving annealing stage may be advisable. Always consult the supplier of the parent material or seek other expert advice to ensure that the correct heat treatment process is carried out. Preheat and interpass temperatures as required by the base metal.

Approvals

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FCW

BÖHLER E 347L H-FD

Flux-cored wire, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 9 Nb R M21 (C1) 3	E347T0-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 9 Nb R / E347T0 type for welding of creep resistant austenitic CrNi-steels such as 1.4912 / 347H suitable for service temperatures above 400ºC. Especially designed for welding in flat and horizontal position with Ar + 15 – 25% CO_2 as shielding gas. Application examples are heat exchangers, hot separators, hydrocracking and hydrodesulphurization in refineries. The corrosion resistance is corresponding to the base material 1.4301 / 304, i.e. good resistance to general corrosion. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. The bismuth-free weld deposit (Bi < 10 ppm) and controlled ferrite content of 5 – 9 FN (measured with FeritScope FMP30) meet the recommendations of API RP582 and AWS A5.22 for high temperature service or post-weld heat treatment. For welding in vertical-up and overhead positions, BÖHLER E 347 H PW-FD should be preferred.

Base materials

1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4878 X8CrNiTi18-10, 1.4912 X7CrNiNb18-10, 1.4940 X7CrNiTi18-10

UNS S32100, S32109, S34700, S34709

AISI 321, 321H, 347, 347H

Typical analysis of the wire

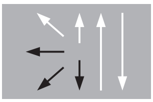
	C	Si	Mn	Cr	Ni	Nb	FN
wt.-%	0.030	0.6	1.3	18.5	10.5	0.45	2 – 7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C	–196°C
u	420 (≥ 350)	580 (≥ 550)	35 (≥ 30)	90 (≥ 32)	50 (≥ 32)	37

u untreated, as welded - shielding gas Ar + 18 % CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 250	22 – 30	5.0 – 15.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm.

Approvals

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BÖHLER E 347 H PW-FD

Flux-cored wire, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 19 9 Nb P M21 (C1) 1	E347HT1-4(1)

Characteristics and typical fields of application

Rutile flux-cored wire of T 19 9 Nb P / E347HT1 type for welding of creep resistant austenitic CrNi-steels such as 1.4912 / 347H suitable for service temperatures above 400ºC. Especially designed for welding in all positions with Ar + 15 – 25% CO_2 as shielding gas. Application examples are heat exchangers, hot separators, hydrocracking and hydrodesulphurization in refineries. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. The bismuth-free weld deposit (Bi < 10 ppm) and controlled ferrite content of 4 – 8 FN (measured with FeritScope FMP30) meet the recommendations of API RP582 and AWS A5.22 for high temperature service or post-weld heat treatment. Also fulfils AWS A5.22 E347T1-4(1). For flat and horizontal welding positions, BÖHLER E 347L H-FD may be preferred.

Base materials

1.4541 X6CrNiTi18-10, 1.4550 X6CrNiNb18-10, 1.4878 X8CrNiTi18-10, 1.4912 X7CrNiNb18-10, 1.4940 X7CrNiTi18-10

UNS S32100, S32109, S34700, S34709

AISI 321, 321H, 347, 347H

Typical analysis of the wire

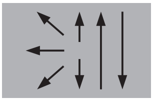
	C	Si	Mn	Cr	Ni	Nb	FN
wt.-%	0.045	0.6	1.3	18.5	10.5	0.45	2 – 7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–120°C	–196°C
u	370 (≥ 350)	560 (≥ 550)	45 (≥ 30)	95 (≥ 32)	55 (≥ 32)	38
a	375	570	44	90	35	28

u untreated, as-welded – shielding gas Ar + 18% CO_2
a post-weld heat treatment at 600°C for 36 h – shielding gas Ar + 18% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	150 – 230	22 – 29	6.0 – 13.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. 100% CO_2 can be also used, but the voltage should be increased by 2 V. The gas flow should be 15 – 20 l/min. The heat input should not exceed 2.0 kJ/mm, the interpass temperature be limited to max. 150ºC and the wire stick-out 15 – 20 mm.

Approvals

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FCW

BÖHLER FF-MC

Metal-cored wire, high-alloyed, austenitic stainless, heat resistant

Classifications

EN ISO 17633-A	AWS A5.22 / SFA-5.22
T 22 12 H M M13 1	EC308H (mod.)

Characteristics and typical fields of application

Austenitic metal-cored wire of T 22 12 H / EC309H type for joint welding of heat resistant austenitic stainless steels such as 1.4828 and 1.4833. The main application area is robotic welding of exhaust systems in the automotive industry. The weld deposit is more stable to hot cracking than when using solid wire and resistant to scaling up to 1000ºC. Easy handling and high deposition rate result in high productivity with excellent welding performance. The wire shows good wetting behavior and results in a smooth surface with minimum spatter formation. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. This makes the metal-cored wire less sensitive to edge misalignment and variation in gap width as compared to solid wires.

Base materials

Stainless austenitic heat resisting steels such as

1.4826 GX40CrNiSi22-10, 1.4828 X15CrNiSi20-12 and 1.4833 X12CrNi23-13

Stainless ferritic high temperature steels such as

1.4713 X10CrAlSi7, 1.4724 X10CrAlSi13, 1.4742 X10CrAlSi18, 1.4710 GX30CrSi7, 1.4740 GX40CrSi17

AISI 305, ASTM A297HF

Typical analysis of the wire

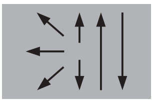
	C	Si	Mn	Cr	Ni	FN
wt.-%	0.07	0.6	0.6	20.2	10.6	5 – 9

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	380 (≥ 350)	560 (≥ 550)	43 (≥ 25)	74

u untreated, as-welded – shielding gas Ar + 2% O_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	Max. 3	140 – 280	15 – 26	4.0 – 12.0

Welding with conventional or pulsed power sources using DC+ polarity, but pulsed arc may be advantageous and especially when welding out of position. Forehand (pushing) technique preferred with a work angle of appr. 80º. Ar + 1 – 2 % O_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min and the wire stick-out 15 – 20 mm. Then welding out of position, the metal-cored wires are similar to solid wires and pulsed arc welding is recommended. Preheating and interpass temperature as required by the base metal.

Approvals

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Nickel-based welding consumables

◆ Content

Stick electrodes

Product name	C	Si	Mn	Cr	Ni	Mo	Co	Nb	Ti	Fe	Al
Thermanit Nicro 182	0.03	0.40	6.00	16.00	Bal.			2.20		6.00	
Thermanit Nicro 82	< 0.05	< 0.4	4.00	19.50	Bal.	1.50		2.00		< 4.0	
Thermanit 617	< 0.08	0.80	0.20	21.00	Bal.	9.00	11.00		0.25	< 1.5	0.70
Thermanit 625	0.03	0.40	0.70	22.00	Bal.	9.00	≤ 0.05	3.30		< 1.0	≤ 0.4
Thermanit 690	0.03	0.50	3.80	28.00	Bal.			1.80		8.50	
Thermanit Nimo C 24	< 0.02	0.10	< 0.5	23.00	Bal.	16.00				< 1.5	

GTAW rods

Product name	C	Si	Mn	Cr	Ni	Mo	W	V	Co	Nb	Ti
Thermanit Nicro 82	0.02	0.10	3.00	20.00	> 67.0					2.50	
Thermanit 625	0.03	0.10	0.10	22.00	Bal.	9.00				3.60	
Thermanit 22	< 0.01	< 0.1	< 0.5	21.00	Bal.	13.00	3.00	< 0.2	< 2.5		
Thermanit Nimo C 24	0.01	< 0.10	< 0.5	23.00	Bal.	16.00					
Thermanit 686	0.01	0.10	< 0.5	22.80	Bal.	16.00	3.80				
Thermanit 690	0.02	0.20	0.30	29.00	Bal.	0.10			< 0.1		
Thermanit 617	0.05	0.10	0.10	21.50	Bal.	9.00			11.00		0.30

Solid wires

Product name	C	Si	Mn	Cr	Ni	Mo	W	Co	Nb	Ti	Fe
Thermanit Nicro 82	0.02	0.20	2.80	19.50	> 67				2.50		< 2.0
Thermanit 625	0.03	0.25	0.20	22.00	Bal.	9.00			3.60		< 0.5
Thermanit 22	< 0.01	< 0.1	< 0.5	22.00	Bal.	13.50	3.00				3.00
Thermanit Nimo C 24	0.01	0.10	< 0.5	23.00	Bal.	16.00					< 1.5
Thermanit 686	0.01	0.08	< 0.5	22.80	Bal.	16.00	3.80				< 1.0
Thermanit 690	0.03	0.30	0.30	29.00	Bal.	0.10		< 0.1			9.00
Thermanit 617	0.05	0.10	0.10	21.50	Bal.	9.00		11.00		0.30	0.50

SAW wire/flux combinations

Product name	C	Si	Mn	Cr	Ni	Mo	W	Nb	Fe
Thermanit 625 - Marathon 104	0.02	0.30	0.20	21.70	Bal.	9.00		3.20	< 1.5
Thermanit 625 - Marathon 504	0.02	0.35	0.10	21.70	Bal.	8.70		3.30	< 2.0
Thermanit 625 - Marathon 444	0.01	0.16	0.20	21.80	Bal.	9.00		3.20	< 1.0
Thermanit Nicro 82 - Marathon 104	0.02	0.25	3.00	20.20	Bal.			2.40	< 1.0
Thermanit Nicro 82 - Marathon 444	0.01	0.25	3.00	20.20	Bal.			2.40	< 1.0
Thermanit Nimo C 276 - Marathon 104	0.01	0.10	0.50	15.40	Bal.	16.00	3.70		6.00

Flux-cored wire

Product name	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
BÖHLER NIBAS 70/20-FD	0.03	0.40	3.20	19.50	Bal.		2.50	2.50
BÖHLER NIBAS 70/20 Mn-FD	0.03	0.30	5.50	19.70	Bal.		2.40	2.00
BÖHLER NIBAS 625 PW-FD	0.05	0.40	0.40	21.00	Bal.	8.50	3.30	< 1.0

Thermanit Nicro 182

Stick electrode, high-alloyed, nickel-base

Classifications

EN ISO 14172	AWS A5.11 / SFA-5.11
E Ni 6182 (NiCr15Fe6Mn)	ENiCrFe-3

Characteristics and typical fields of application

Basic coated nickel-base electrode of E Ni 6182 / ENiCrFe-3 type for welding of nickel-base alloys, creep resistant steels, heat resisting and cryogenic materials, dissimilar joints and low-alloyed steels with limited weldability. Dissimilar joining for service temperatures above 300ºC or applications where post-weld heat treatment is required. Well-suited for dissimilar welding of stainless and nickel alloys to mild steels. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. Scaling resistant up to 950ºC and creep resistant up to 800ºC. Good toughness at subzero temperatures down to –196ºC. Heat resistant with a temperature limit of 500ºC in sulfurous atmospheres and max. 900ºC for fully stressed welds. Resistant to embrittlement, hot cracking and thermal shock. Easy slag removal and excellent welding characteristics in all welding positions, except vertical down.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32–21

Alloy 600, Alloy 600 L, Alloy 800 / 800H

UNS N06600, N07080, N0800, N0810

Typical analysis of all-weld metal

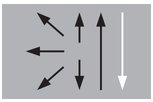
	C	Si	Mn	Cr	Ni	Nb	Fe
wt.-%	0.025	0.4	6.0	16.0	Bal.	2.2	6.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	400 (≥ 360)	670 (≥ 600)	40 (≥ 30)	120 (≥ 90)	80 (≥ 32)

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification Thermanit Nicro 182 NiCrFe-3

Dimension mm	Current A
2.5 × 300	45 – 70
3.2 × 350	65 – 100
4.0 × 350	95 – 130
5.0 × 450	130 – 160

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys.

Re-drying if necessary for 2 h at 250 – 300ºC.

Need for preheating and post-weld heat treatment determined by the base material.

Approvals

TÜV (02073), TÜV (KTA 1408.1) (08128.00), CE

SMAW

Thermanit Nicro 82

Stick electrode, high-alloyed, nickel-base

Classifications

EN ISO 14172	**AWS A5.11 / SFA-5.11**
E Ni 6082 (NiCr20Mn3Nb)	ENiCrFe-3 (mod.)

Characteristics and typical fields of application

Coated nickel-base electrode of E Ni 6082 / ENiCrFe-3 (mod.) type for welding heat and creep resistant Cr and CrNi-steels and nickel-base alloys. Resistant to scaling up to 1000ºC. Heat resistant with a temperature limit of 550ºC in sulfurous atmospheres and max. 900ºC for fully stressed welds. Good toughness at subzero temperatures as low as –269ºC.

Well-suited for dissimilar welding of stainless and nickel alloys to mild steels. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels. Dissimilar welding of 1.4583 X10CrNiMoNb18-12 and 1.4539 X2NiCrMoCu25-20 with ferritic pressure vessel boiler steels.

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32–21

NiCr15Fe, X8Ni9, 10CrMo9-10 Alloy 600, 600L, 800, 800H UNS N06600, N07080, N0800, N0810

Typical analysis of all-weld metal

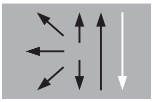
	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wt.-%	< 0.05	< 0.4	4.0	19.5	Bal.	1.5	2.0	< 4.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C	–269°C
u	380	620	40 (≥ 22)	90	70	50

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification Thermanit Nicro 82 Ni 6082 (NiCr20Mn3Nb)

Dimension mm	Current A
2.5 × 300	45 – 70
3.2 × 350	65 – 100
4.0 × 350	85 – 130
5.0 × 450	130 – 160

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys up to 900ºC.

Need for preheating and-weld heat treatment determined by the base material.

Approvals

TÜV (01775), TÜV (KTA 1408.1) (08129.00), DNV GL, CE

Thermanit 617

Stick electrode, high-alloyed, nickel-base

SMAW

Classifications

EN ISO 14172	**AWS A5.11 / SFA-5.11**
E Ni 6117 (NiCr22Co12Mo)	ERNiCrCoMo-1 (mod)

Characteristics and typical fields of application

Coated nickel-base electrode of E Ni 6117 / ENiCrCoMo-1 (mod.) type. Suitable for joining high-temperature and similar nickel-base alloys, heat resistant austenitic stainless steels and cast alloys. The weld metal is resistant to hot-cracking and is used for service temperatures up to 1100°C. Scaling resistant up to 1100°C in oxidizing and carburized atmospheres, e.g. gas turbines, ethylene production plants. Can be welded in all positions except vertical-down. It has a stable arc and the resulting weld finely rippled and notch-free. Easy slag removal.

Base materials

1.4558 X2NiCrAlTi32-20, 1.4859 GX10NiCrNb38-18 / GX10NiCrNb32-20, 1.4861 X10NiCr32-20, 1.4876 X10NiCrAlTi32-20 / X10NiCrAlTi 32-21, 1.4877 X6NiCrNbCe32-27, 1.4959 X8NiCrAlTi32-21, 2.4663 NiCr23Co12Mo, 2.4851 NiCr23Fe

UNS N08810, Alloy 800, 800H, 800HT

AC66

Typical analysis of all-weld metal

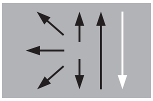
	C	Si	Mn	Cr	Ni	Mo	Co	Ti	Fe	Al
wt.-%	< 0.08	0.8	0.2	21.0	Bal.	9.0	11.0	0.25	< 1.5	0.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	450 (≥ 400)	700 (≥ 620)	35 (≥ 22)	100

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	Thermanit 617ENi 6117 (NiCr22Co-12Mo)

Dimension mm	Current A
2.5 × 250	55 – 75
3.2 × 300	70 – 90
4.0 × 350	90 – 110

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100°C.

Preheating temperature should be adjusted to the base material. Post-weld heat treatments can be applied independently of the weld metal.

Creep rupture properties according to matching high temperature steels / alloys.

Hold stick electrode as vertically as possible, keep a short arc. Use string bead technique. Fill end crater carefully.

Re-drying if necessary at 250 – 300°C for 2 – 3h.

Approvals

TÜV (06844), CE

SMAW

Thermanit 625

Stick electrode, high-alloyed, nickel-base

Classifications

EN ISO 14172	AWS A5.11 / SFA-5.11
E Ni 6625 (NiCr22Mo9Nb)	ENiCrMo-3

Characteristics and typical fields of application

Basic coated nickel-base electrode of E Ni 6625 / ENiCrMo-3 type for welding the nickel-base alloys 625 and 825 as well as CrNiMo-steels with high molybdenum content (e.g. 6% Mo-steels). Also recommended for high temperature and creep resisting steels, heat resisting and cryogenic materials, dissimilar joints, and low-alloyed problem steels. Suitable in pressure vessel fabrication for –196ºC to 550ºC, otherwise up to the scaling resistance temperature of 1200ºC (S-free atmosphere). Due to the weld metal embrittlement at 600 – 850ºC, this temperature range should be avoided. Highly resistant to hot cracking and thermal shock. Extremely resistant to stress corrosion cracking and pitting (PREN 52). Fully austenitic. Excellent welding characteristics in all positions except vertical-down, easy slag removal, high resistance to porosity.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 9% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels

1.4529 X1NiCrMoCuN25–20–7, 1.4547 X1CrNiMoCuN20–18–7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2 / 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32–21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9, 2.4816 NiCr15Fe / 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Dissimilar welding with unalloyed and low-alloyed steels, e.g. P265GH, P295GH, 16Mo3, S355N

254 SMO®

Typical analysis of all-weld metal

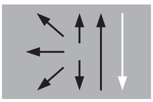
	C	Si	Mn	Cr	Ni	Mo	Co	Nb	Fe	Al
wt.-%	0.025	0.4	0.7	22.0	Bal.	9.0	≤ 0.05	3.3	< 1.0	≤ 0.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–196°C
u	530 (≥ 420)	800 (≥ 760)	40 (≥ 27)	80	45 (≥ 32)

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	Thermanit 625 E Ni 6625 (NiCr-22Mo9Nb)

Dimension mm	Current A
2.5 × 300	45 – 60
3.2 × 300	65 – 95
4.0 × 350	90 – 120

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys.

Re-drying if necessary at 250 – 300ºC for min. 2 – 3 h.

Approvals

TÜV (03463), DNV GL, CE

Thermanit 690

Stick electrode, high-alloyed, nickel-base

Classifications

EN ISO 14172	AWS A5.11 / SFA-5.11
E Ni 6152 (NiCr30Fe9)	ENiCrFe-7

Characteristics and typical fields of application

Basic coated nickel-base electrode of E Ni 6152 / ENiCrFe-7 type. High resistance to stress corrosion cracking in pure water environments and resistance in oxidizing media e.g. nitric acid. Particularly suited for conditions in nuclear fabrication. Applicable for joining matching or similar steels, surfacing of low alloy and stainless steels.

Base materials

2.4642 NiCr29Fe

UNS N06690

Alloy 690

Typical analysis of all-weld metal

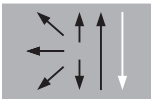
	C	Si	Mn	Cr	Ni	Nb	Fe
wt.-%	0.03	0.5	3.8	28.0	Bal.	1.8	8.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	380	600	35	100

u untreated, as-welded

Operating data



Polarity DC +

Electrode identification Thermanit 690 E NiCrFe-7

Dimension mm	Current A
3.2 × 350	80 – 110
4.0 × 350	100 – 130

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Preheating and post-weld heat treatment not needed.

Approvals

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Thermanit Nimo C 24

Stick electrode, high-alloyed, nickel-base

Classifications

EN ISO 14172	**AWS A5.11 / SFA-5.11**
E Ni 6059 (NiCr23Mo16)	ENiCrMo-13

Characteristics and typical fields of application

Coated nickel-base electrode of E Ni 6059 / ENiCrMo-13 type. High corrosion resistance in reducing and predominantly in oxidizing 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

1.4565 X2CrNiMnMoNb N25-18-5-4 2.4602 NiCr21Mo14W, 2.4605 NiCr23Mo16Al, 2.4610 NiMo16Cr16Ti, 2.4819 NiMo16Cr15W

Alloy C-22, Alloy 59, Alloy C-4, Alloy C-276, Alloy 24 UNS S34565, N06022, N06059, N06455, N10276

Typical analysis of all-weld metal

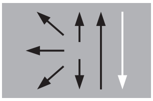
	C	Si	Mn	Cr	Ni	Mo	Fe
wt.-%	< 0.02	0.10	< 0.5	23.0	Bal.	16.0	< 1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	420 (≥ 350)	700 (≥ 690)	30 (≥ 22)	60

u untreated, as-welded

Operating data



Polarity	DC+
Electrode identification	Thermanit Nimo C 24 E Ni 6059 (NiCr23Mo16)

Dimension mm	Current A
2.5 × 250	45 – 70
3.2 × 300	65 – 105
4.0 × 350	85 – 135

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys up to 800ºC.

Re-drying if necessary at 250 – 300ºC for min. 2 h. Postweld heat treatment mostly not needed when following the recommendation. In special cases, solution annealing can be performed at 1150 – 1175ºC followed by water quenching to restore full corrosion resistance.

Approvals

TÜV (09272), CE

Thermanit Nicro 82

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3

Characteristics and typical fields of application

Nickel-base solid wire TIG rod of S Ni 6082 (NiCr20Mn3Nb) / ERNiCr-3 for welding of many creep-resistant steels and nickel-base alloys. Well-suited for dissimilar welding of stainless and nickel alloys to mild steels. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. Heat and high temperature resistant. Good toughness at subzero temperatures as low as -269°C. Service temperature limit is max. 900°C for fully stressed welds.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo-stainless steels. Dissimilar welding of 1.4583 X10CrNiMoNb18-12 and 1.4539 X2NiCrMoCu25-20 with ferritic pressure vessel boiler steels.

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32-21

NiCr15Fe, X8Ni9, 10CrMo9-10

Alloy 600, 600L, 800, 800H,

UNS N06600, N07080, N0800, N08810

Typical analysis of the wire rod

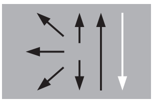
	C	Si	Mn	Cr	Ni	Nb	Fe
wt.-%	0.02	0.1	3.0	20	> 67.0	2.5	< 2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–269°C
u	400	620	35	150	32

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.0 × 1000	50 – 70	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Preheating and post-weld heat treatment according to the parent metal. Attention must be paid to resistance to intercrystalline corrosion and embrittlement in case of austenitic stainless steels. To minimize the risk of hot cracking when welding fully austenitic 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. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100°C.

Creep rupture properties according to matching high temperature steels / alloys up to 900°C.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (01703 / 08125), DB (43.132.11), DNV GL, CE

Thermanit 625

TIG rod, high-alloyed, nickel-base

GTAW

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3

Characteristics and typical fields of application

Nickel-base solid wire TIG rod of S Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 type for joining and surfacing work with matching / similar corrosion resistant materials as well as with matching and similar heat resistant alloys. For joining and surfacing work on cryogenic austenitic CrNi(N)-steels and cast steel grades and on cryogenic Ni-steels suitable for quenching and tempering. High resistance to corrosive environment. Resistant to stress corrosion cracking. Service temperature limit max. 500°C in sulfurous atmospheres, otherwise heat resistant up to 900°C. Good toughness at subzero temperatures as low as -196°C.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 9Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo-stainless steels

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32-21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9, 2.4816 NiCr15Fe, 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Dissimilar welding with unalloyed and low-alloyed steels, e.g. P265GH, P285NH, P295GH, 16Mo3, S355N

254 SMO®

Typical analysis of the wire rod

	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wt.-%	0.03	0.1	0.1	22	Bal.	9.0	3.6	≤ 0.5

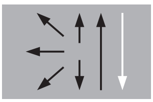
Structure: Austenite

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Yield strength $R_{p1.0}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C
u	460	500	740	35	120	100

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.0 × 1000	50 – 70	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Heat input max. 1.5 kJ/mm, interpass temperature max. 100°C.

Creep rupture properties according to matching high temperature steels / alloys.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (03464), DB (43.132.33), DNV GL, CE

böhler welding by voestalpine

Thermanit 22

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14
S Ni 6022 (NiCr21Mo13Fe4W3)	ERNiCrMo-10

Characteristics and typical fields of application

Nickel-base TIG rod of S Ni 6022 (NiCr21Mo13Fe4W3) / ERNiCrMo-10 for joining and surfacing of matching and similar alloys. For welding the clad side of plates of matching and similar alloys. High corrosion resistance in reducing and oxidizing environments. Also an alternative to Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 and Ni 6059 (NiCr23Mo16) / ERNiCrMo-13 when dissimilar welding of stainless steels containing high levels of nitrogen; e.g. superduplex alloys to superaustenitics.

Base materials

2.4602 NiCr21Mo14W, 2.4603 NiCr30FeMo, 2.4665 NiCr22Fe18Mo

UNS N06002, N06022

Alloy C-22

and combinations with ferritic or austenitic steels

Typical analysis of the wire rod

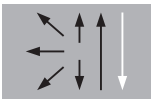
	C	Si	Mn	Cr	Ni	Mo	W	V	Co	Fe	Cu
wt.-%	< 0.01	< 0.1	< 0.5	21	Bal.	13.0	3	< 0.2	< 2.5	3.0	< 0.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	> 400	> 700	> 30	55

u untreated, as-welded - shielding gas Ar

Operating data



Rod marking Ni 6022 / ERNiCrMo-10

Dimension mm	Current A	Voltage V
2.4 × 1000	130 – 160	16 – 18

Heat input max. 1.0 kJ/mm, interpass temperature max. 100°C.

Preheating and post weld heat treatment not required. In special cases, solution annealing can be performed at 1100 – 1150°C followed by water quenching.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

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Thermanit Nimo C 24

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14
S Ni 6059 (NiCr23Mo16)	ERNiCrMo-13

Characteristics and typical fields of application

TIG rod of S Ni 6059 (NiCr23Mo16) / ERNiCrMo-13 type for joining and surfacing with matching and similar alloys and cast alloys. For welding the cladded side of plates of matching and similar alloys. Suitable for welding 7Mo-steels such as 1.4565 / UNS S34565, 625 and 825; and for dissimilar welds between stainless and nickel-base alloys to mild steel. The wire is free from molybdenum, which increases the ductility of dissimilar joints with nitrogen-alloyed stainless steels. To minimize 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. High corrosion resistance in reducing and, above all, in oxidizing environments. Superior resistance to pitting and crevice corrosion. Meets the corrosion test requirements per ASTM G48 Methods A and E (80ºC).

Base materials

1.4565 X2CrNiMnMoNbN25-18-5-4, 2.4602 NiCr21Mo14W, 2.4605 NiCr23Mo16Al, 2.4610 NiMo16Cr16Ti, 2.4819 NiMo16Cr15W

Alloy C-22, Alloy 59, Alloy C-4, Alloy C-276, Alloy 24

UNS S34565, N06022, N06059, N06455, N10276

Typical analysis of the wire rod

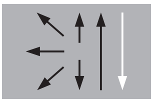
	C	Si	Mn	Cr	Ni	Mo	Fe
wt.-%	0.01	< 0.10	< 0.5	23	Bal.	16.0	< 1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	450	700	35	120

u untreated, as-welded - shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.0 × 1000	50 – 70	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Heat input max. 1.0 kJ/mm, interpass temperature max. 100ºC.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1120ºC followed by water quenching.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (06462), DNV GL, CE

Thermanit 686

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14
S Ni 6686 (NiCr21Mo16W4)	ERNiCrMo-14

Characteristics and typical fields of application

Nickel-base solid wire TIG rod of S Ni 6686 (NiCr21Mo16W4) / ERNiCrMo-14 type for joining and surfacing on matching and similar wrought and cast alloys. For welding the cladded side of plates of matching and similar alloys e.g. flue gas desulfurization scrubber. High corrosion resistance in reducing and oxidizing environments.

Base materials

2.4602 NiCr21Mo14W, 2.4605 NiCr23Mo16Al, 2.4606 NiCr21Mo16W, 2.4819 NiMo16Cr15W

UNS N06022, N06059, N06686, N10276

Alloy 22, Alloy 59, Alloy 686, Alloy C-276

16Mo3

Typical analysis of the wire rod

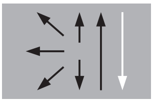
	C	Si	Mn	Cr	Ni	Mo	W	Fe	Al
wt.-%	0.01	0.1	< 0.5	22.8	Bal.	16.0	3.8	< 1.0	0.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	450	760	30	50

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Heat input max. 1.0 kJ/mm, interpass temperature max. 100ºC.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at min. 1180ºC followed by water quenching.

Shielding gas: Ar or Ar + 2% H_2. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

-

GTAW

Thermanit 690

TIG rod, high-alloyed, nickel-base

GTAW

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14
S Ni 6052 (NiCr30Fe9)	ERNiCrFe-7

Characteristics and typical fields of application

Nickel-base TIG rod of S Ni 6052 (NiCr30Fe9) / ERNiCrFe-7 type for joining matching and similar steels, surfacing with low-alloy and stainless steels. Particularly suited for the conditions in nuclear fabrication. High resistance to stress corrosion cracking in oxidizing acids and water at high temperatures.

Base materials

2.4642 NiCr29Fe

UNS N06690

Alloy 690

Typical analysis of the wire rod

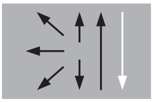
	C	Si	Mn	Cr	Ni	Mo	Co	Fe
wt.-%	0.02	0.2	0.3	29	Bal.	0.1	< 0.1	9.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	380	600	35	100

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking Ni 6052 / ERNiCrFe-7

Dimension mm	Current A	Voltage V
1.2 × 1000	60 – 80	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Heat input max. 1.0 kJ/mm, interpass temperature max. 100°C.

Creep rupture properties according to matching high temperature steels / alloys.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

-

Thermanit 617

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14
S Ni 6617 (NiCr22Co12Mo9)	ERNiCrCoMo-1

Characteristics and typical fields of application

Nickel-base solid wire TIG rod of S Ni 6617 (NiCr22Co12Mo9) / ERNiCrCoMo-1 type for joining and surfacing applications with matching and similar heat resistant steels and alloys. Temperature resistant up to 1000ºC. High resistance to hot gases in oxidizing and carburizing atmospheres.

Base materials

1.4558 X2NiCrAlTi32-20, 1.4859 GX10NiCrNb38-18 / GX10NiCrNb32-20, 1.4861 X10NiCr32-20, 1.4876 X10NiCrAlTi32-20 / X10NiCrAlTi 32-21, 1.4877 X6NiCrNbCe32-27, 1.4959 X8NiCrAlTi32-21, 2.4663 NiCr23Co12Mo, 2.4851 NiCr23Fe

UNS N08810, N08151, N08800, N08811, N06617, N06601 Alloy 800, 800H, 800HT, 617, 617B, 601

Typical analysis of the wire rod

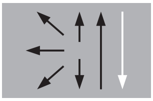
	C	Si	Mn	Cr	Ni	Mo	Co	Ti	Fe	Al
wt.-%	0.05	0.1	0.1	21.5	Bal.	9.0	11.0	0.3	0.5	1.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	> 450	> 700	> 30	> 60

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking Ni 6617 / ER NiCrCoMo-1

Dimension mm	Current A	Voltage V
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

To minimize the risk of hot cracking when welding fully austenitic 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. Suggested heat input is max. 1.0 kJ/mm and interpass temperature max. 100ºC.

Preheating and post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150ºC.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (06845)

Thermanit Nicro 82

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3

Characteristics and typical fields of application

Solid wire of S Ni 6082 (NiCr20Mn3Nb) / ERNiCr-3 type for welding of many creep-resistant steels and nickel-base alloys. Provides high resistance to cracking and is well-suited for dissimilar welding of stainless and nickel-base alloys to mild steels. Heat and high temperature resistant – can be used for welding nickel-base alloys for use in high temperature applications. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. Good toughness at subzero temperatures as low as -269ºC. Service temperature limit is max. 900ºC for fully stressed welds. High resistance to stress corrosion cracking, but also excellent resistance to intergranular corrosion due to the low carbon content and absence of secondary phases.

GMAW

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels. Dissimilar welding of 1.4583 X10CrNiMoNb18-12 and 1.4539 X2NiCrMoCu25-20 with ferritic pressure vessel boiler steels.

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32-21

NiCr15Fe, X8Ni9, 10CrMo9-10

Alloy 600, 600L, 800, 800H,

UNS N06600, N07080, N0800, N08810

Typical analysis of the solid wire

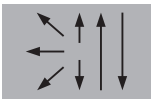
	C	Si	Mn	Cr	Ni	Nb	Fe	FN
wt.-%	0.02	0.2	2.8	19.5	> 67	2.5	< 2.0	0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	380	620	35	90

u untreated, as-welded – shielding gas Ar + 30% He + 2% H_2 + 0.1% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 spray arc	170 – 210	20 – 22
1.2 spray arc	200 – 240	24 – 28
1.6 spray arc	250 – 660	25 – 29

Preheating and post-weld heat treatment according to the parent metal. Attention must be paid to resistance to intercrystalline corrosion and embrittlement in case of austenitic stainless steels. To minimize the risk of hot cracking when welding fully austenitic 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. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys up to 900ºC.

For MAG welding: Polarity DC+. Shielding gas: Ar + 30% He + 2% H_2 + 0.1% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity DC-. Shielding gas: Ar. Gas flow: 5 – 12 l/min.

Approvals

TÜV (03089), DNV GL, CE

Thermanit 625

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3

Characteristics and typical fields of application

Solid wire of S Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 type for joining and surfacing work with matching / similar corrosion resistant materials as well as with matching and similar heat resistant alloys. For joining and surfacing work on cryogenic austenitic CrNi(N)-steels and cast steel grades and on cryogenic Ni-steels suitable for quenching and tempering. High resistance to corrosive environment. Resistant to stress corrosion cracking. Resistant to scaling up to 1000ºC. Service temperature limit max. 500ºC in sulfurous atmospheres, otherwise heat resistant up to 900ºC. Good toughness at subzero temperatures as low as -196ºC. Excellent resistance to general, pitting and intercrystalline corrosion in chloride containing environments.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 9% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels.

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32-21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9 2.4816 NiCr15Fe, 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Dissimilar welding with unalloyed and low-alloyed steels, e.g. P265GH, P285NH, P295GH, 16Mo3, S355N

254 SMO®

Typical analysis of the solid wire

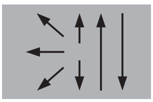
	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wt.-%	0.03	0.25	0.20	22	Bal.	9.0	3.6	< 0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–196°C
u	520 (≥ 460)	790 (≥ 740)	39 (≥ 30)	130	90

u untreated, as-welded – shielding gas Ar + 30% He + 0.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	60 – 100	20 – 22
1.0 spray arc	170 – 210	24 – 28
1.2 spray arc	180 – 220	25 – 29
1.6 spray arc	250 – 330	29 – 32

To minimize the risk of hot cracking when welding fully austenitic 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. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150ºC followed by water quenching.

For MAG welding: Polarity DC+. Shielding gas: Ar + 30% He + 2% H_2 + 0.1 – 0.5% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity DC-. Shielding gas: Ar. Gas flow 5 – 12 l/min.

Approvals

TÜV (03462), DB (43.132.25), BV, CE

Thermanit 22

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274	**AWS A5.14 / SFA-5.14**
S Ni 6022 (NiCr21Mo13Fe4W3)	ERNiCrMo-10

Characteristics and typical fields of application

Nickel-base solid wire ERNiCrMo-10 type for joining and surfacing of matching and similar alloys and cast alloys. For welding the cladded side of plates of matching and similar alloys. High corrosion resistance in reducing and oxidizing environments.

Base materials

2.4602 NiCr21Mo14W, 2.4603 NiCr30FeMo, 2.4665 NiCr22Fe18Mo

UNS N06002, N06022

Alloy C-22

and combinations with ferritic or austenitic steels

Typical analysis of the solid wire

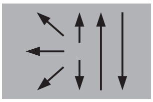
	C	Si	Mn	Cr	Ni	Mo	W	Fe
wt.-%	< 0.01	< 0.1	< 0.5	22.0	Bal.	13.5	3.0	3.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –40°C
u	520 (> 450)	710 (> 700)	30 (> 25)	150 (≥ 47)	110 (≥ 47)

u untreated, as welded – shielding gas Ar + 30 % He + 2 % CO_2

Operating data



Dimension mm	Current A	Voltage V
1.14 spray arc	200 – 240	25 – 29
1.2 spray arc	200 – 240	25 – 29

Suggested heat input is max. 1.0 kJ/mm and interpass temperature max. 100ºC. Preheating and post-weld heat treatment not required. In special cases, solution annealing can be performed at 1100-1150ºC followed by water quenching.

For MAG welding: Polarity DC+. Shielding gas: Ar + 30% He + 2% H_2, Gas flow 15 – 20 l/min.

For automatic TIG welding: Polarity DC-. Shielding gas: Ar or Ar + 30% He + 2% H_2, Gas flow 5 – 12 l/min.

Approvals

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Thermanit Nimo C 24

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274	**AWS A5.14 / SFA-5.14**
S Ni 6059 (NiCr23Mo16)	ERNiCrMo-13

Characteristics and typical fields of application

Solid wire of S Ni 6059 (NiCr23Mo16) / ERNiCrMo-13 type for joining and surfacing with matching and similar alloys and cast alloys. Suitable for welding 7Mo-steels such as 1.4565 / UNS S34565, 625 and 825; and for dissimilar welds between stainless and nickel-base alloys to mild steel. The wire is free from niobium, which increases the ductility of dissimilar joints with nitrogen-alloyed stainless steels. High corrosion resistance in reducing and, above all, in oxidizing environments. Superior resistance to pitting and crevice corrosion. Meets the corrosion test requirements per ASTM G48 Methods A and E (> 80ºC).

Base materials

1.4565.X2CrNiMnMoNbN25-18-5-4, 2.4602 NiCr21Mo14W, 2.4605 NiCr23Mo16Al, 2.4610 NiMo16Cr16Ti, 2.4819 NiMo16Cr15W

Alloy C-22, Alloy 59, Alloy C-4, Alloy C-276, Alloy 24 UNS S34565, N06022, N06059, N06455, N10276

Typical analysis of the solid wire

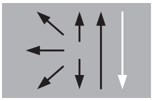
	C	Si	Mn	Cr	Ni	Mo	Fe	FN
wt.-%	0.01	0.1	< 0.5	23	Bal.	16.0	< 1.5	0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	420	700	40	60

u untreated, as-welded – shielding gas Ar + 30% He + 2% H_2 + 0.1% CO_2

Operating data



Dimension mm	**Current A**	**Voltage V**
1.0 spray arc	170 – 210	24 – 28
1.2 spray arc	200 – 240	25 – 29
1.6 spray arc	250 – 660	29 – 32

To minimize the risk of hot cracking when welding fully austenitic 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. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. No preheating for matching alloys. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150 – 1200ºC followed by water quenching.

For MAG welding: Polarity: DC+. Shielding gas: Ar + 30% He + 2% H_2 + 0.1% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity: DC-. Shielding gas: Ar. Gas flow 5 – 12 l/min.

Approvals

TÜV (06461), CE

Thermanit 686

Solid wire high-alloyed, nickel-base

GMAW

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14
S Ni 6686 (NiCr21Mo16W4)	ERNiCrMo-14

Characteristics and typical fields of application

Solid wire of S Ni 6686 (NiCr21Mo16W4) / ERNiCrMo-14 type for joining and surfacing work with matching / similar corrosion resistant materials as well as with matching and similar heat resistant alloys. For joining and surfacing work on cryogenic austenitic CrNi(N)-steels and cast steel grades and on cryogenic Ni-steels suitable for quenching and tempering. High resistance to corrosive environment. Resistant to stress corrosion cracking. Service temperature limit max. 500°C in sulfurous atmospheres, otherwise heat resistant up to 900°C. Good toughness at subzero temperatures as low as -196°C. High corrosion resistance in reducing and oxidizing environments.

Base materials

2.4602 NiCr21Mo14W, 2.4605 NiCr23Mo16Al, 2.4606 NiCr21Mo16W, 2.4819 NiMo16Cr15W

UNS N06022, N06059, N06686, N10276

Alloy 22, Alloy 59, Alloy 686, Alloy C-276

16Mo3

Typical analysis of the solid wire

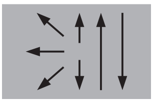
	C	Si	Mn	Cr	Ni	Mo	W	Fe	Al
wt.-%	0.01	0.08	< 0.5	22.8	Bal.	16.0	3.8	< 1.0	0.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	450	760	30	50

u untreated, as-welded – shielding gas Ar + 30% He + 2% H_2 + 0.1% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 spray arc	170 – 210	24 – 28
1.2 spray arc	200 – 240	25 – 29

To minimize the risk of hot cracking when welding fully austenitic 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. Suggested heat input is max. 1.0 kJ/mm and interpass temperature max. 100°C.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1180°C followed by water quenching.

For MAG welding: Polarity DC+. Shielding gas: Ar + 30% He + 2% H_2 + 0.1% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity DC-. Shielding gas: Ar. Gas flow: 5 – 12 l/min.

Approvals

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Thermanit 690

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14
S Ni 6052 (NiCr30Fe9)	ERNiCrFe-7

Characteristics and typical fields of application

Solid wire of S Ni 6052 (NiCr30Fe9) / ERNiCrFe-7 type for joining matching and similar steels, surfacing with low-alloyed and stainless steels. Particularly suited for the conditions in nuclear fabrication. High resistance to stress corrosion cracking in oxidizing acids and water at high temperatures.

Base materials

2.4642 NiCr29Fe

UNS N06690

Alloy 690

Typical analysis of the solid wire

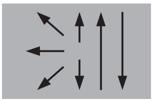
	C	Si	Mn	Cr	Ni	Mo	Co	Fe
wt.-%	0.03	0.3	0.3	29	Bal.	0.1	< 0.1	9.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	350	600	35	80

u untreated, as-welded – shielding gas Ar + 30% He + 0.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.2 spray arc	200 – 240	25 – 29

To minimize the risk of hot cracking when welding fully austenitic 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. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. No preheating or post-weld heat treatment needed for matching alloys.

For MAG welding: Polarity: DC+. Shielding gas: Ar + 30% He + 0.5% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity: DC-. Shielding gas: Ar. Gas flow: 5 – 12 l/min.

Approvals

-

Thermanit 617

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274	**AWS A5.14 / SFA-5.14**
S Ni 6617 (NiCr22Co12Mo9)	ERNiCrCoMo-1

Characteristics and typical fields of application

Solid wire of S Ni 6617 (NiCr22Co12Mo9) / ERNiCrCoMo-1 type for joining and surfacing applications with matching and similar heat resistant steels and alloys. Temperature resistant up to 1000ºC. High resistance to hot gases in oxidizing and carburizing atmospheres.

Base materials

1.4558 X2NiCrAlTi32-20, 1.4859 GX10NiCrNb38-18 / GX10NiCrNb32-20, 1.4861 X10NiCr32-20, 1.4876 X10NiCrAlTi32-20 X10NiCrAlTi 32-21, 1.4877 X6NiCrNbCe32-27, 1.4959 X8NiCrAlTi32-21, 2.4663 NiCr23Co12Mo, 2.4851 NiCr23Fe

UNS N08810, N08151, N08800, N08811, N06617, N06601

Alloy 800, 800H, 800HT, 617, 617B, 601

Typical analysis of the solid wire

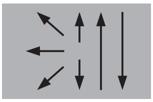
	C	Si	Mn	Cr	Ni	Mo	Co	Ti	Fe	Al
wt.-%	0.05	0.1	0.1	21.5	Bal.	9.0	11.0	0.3	0.5	1.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	400	700	40	100

u untreated, as-welded – shielding gas Ar + 30% He + 0.5% CO_2

Operating data



Dimension mm	**Current A**	**Voltage V**
1.0 spray arc	170 – 210	24 – 28
1.2 spray arc	200 – 240	25 – 29

To minimize the risk of hot cracking when welding fully austenitic 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. Suggested heat input is max. 1.0 kJ/mm and interpass temperature max. 100ºC.

Preheating and post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150ºC.

For MAG welding: Polarity DC+. Shielding gas: Ar + 30% He + 2% H_2 + 0.1% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity DC-. Shielding gas: 100% Ar. Gas flow 5 – 12 l/min.

Approvals

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Thermanit 625 - Marathon 104

SAW wire/flux combination, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	S A FB 2 AC

Characteristics and typical fields of application

Thermanit 625 - Marathon 104 is a wire/flux combination for submerged arc welding. Solid wire of S Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 type for joining similar nickel-alloys and dissimilar joints between Ni-alloys with low-alloyed and stainless steels and surfacing on low-alloyed steels. Also used for joining of 6Mo superaustenitic grades, e.g. 254 SMO® (1.4547 / UNS S31254). Resistant to scaling up to 1000ºC. Service temperature limit max. 500ºC in sulfurous atmospheres, otherwise heat resistant up to 900ºC. Resistant to stress corrosion cracking. Excellent resistance to general, pitting, crevice and intercrystalline corrosion in chloride containing environments. Good toughness at subzero temperatures as low as –196ºC. Creep rupture properties according to matching high temperature steels / alloys.

Marathon 104 is an agglomerated fluoride-basic flux for submerged arc welding of stainless and heat resistant steel grades. The weld metal is characterized by high resistance to hot cracking and is recommended for the highest demanding applications. For more information regarding this flux, see the separate datasheet.

Base materials

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32-21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9, 2.4816 NiCr15Fe 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Cladding and dissimilar welding unalloyed and low-alloyed steels, e.g. P265GH-P295GH, 16Mo3, S355N

254 SMO®

Typical analysis of the weld metal

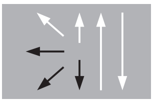
wt.-%	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wire	0.01	0.10	0.10	22.0	Bal.	9.0	3.6	< 1.0
all-weld metal	0.02	0.30	0.20	21.7	Bal.	9.0	3.2	< 1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–196°C
u	(≥ 420)	(≥ 720)	(≥ 35)	(≥ 80)	(≥ 60)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Preheat and interpass temperature: max. 100ºC. Suggested heat input is max. 1.5 kJ/mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150ºC followed by water quenching.

Approvals

-

Thermanit 625 - Marathon 504

SAW wire/flux combination, nickel-base

SAW

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	S A BA 2 AC

Characteristics and typical fields of application

Thermanit 625 - Marathon 504 is a wire/flux combination for submerged arc welding. Especially suitable for surfacing of low-alloyed steels. Solid wire of S Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 type for joining similar nickel-alloys and dissimilar joints between Ni-alloys with low-alloyed and stainless steels and surfacing on low-alloyed steels. Also used for joining of 6Mo superaustenitic grades, e.g. 254 SMO® (1.4547 / UNS S31254). Resistant to scaling up to 1000ºC. Service temperature limit max. 500ºC in sulfurous atmospheres, otherwise heat resistant up to 900ºC. Good toughness at subzero temperatures as low as –196ºC. Resistant to stress corrosion cracking. Excellent resistance to general, pitting and intercrystalline corrosion in chloride containing environments. Creep rupture properties according to matching high temperature steels / alloys.

Marathon 504 is an agglomerated welding flux designed for joining and surfacing applications. It has neutral metallurgical behavior and provides excellent slag detachability. For more information regarding this flux, see the separate datasheet.

Base materials

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32-21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9, 2.4816 NiCr15Fe, 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1 Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Cladding and dissimilar welding un- and low-alloyed steels, e.g. P265GH, P295GH, 16Mo3, S355N

254 SMO®

Typical analysis of the weld metal

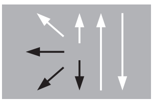
wt.-%	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wire	0.01	0.10	0.10	22.0	Bal.	9.0	3.6	< 1.0
all-weld metal	0.015	0.35	0.10	21.7	Bal.	8.7	3.3	< 2.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C	–196°C
u	490 (≥ 460)	760 (≥ 720)	45 (≥ 35)	80 (≥ 47)	65 (≥ 47)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. No preheating. Suggested heat input is max. 1.2 kJ/mm and interpass temperature max. 120ºC. PWHT generally not needed. In special cases, solution annealing can be performed at 1150ºC followed by water quenching.

Approvals

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Thermanit 625 - Marathon 444

SAW wire/flux combination, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	S A FB 2 AC

Characteristics and typical fields of application

Thermanit 625 - Marathon 444 is a wire/flux combination for submerged arc welding. Solid wire of S Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 type for joining similar nickel-alloys and dissimilar joints between Ni-alloys with low-alloyed and stainless steels and surfacing on low-alloyed steels. Also used for joining of 6Mo superaustenitic grades, e.g. 254 SMO® (1.4547 / UNS S31254). Resistant to scaling up to 1000ºC. Service temperature limit max. 500ºC in sulfurous atmospheres, otherwise heat resistant up to 900ºC. Resistant to stress corrosion cracking. Excellent resistance to general, pitting, crevice and intercrystalline corrosion in chloride containing environments. Good toughness at subzero temperatures as low as –196ºC. Creep rupture properties according to matching high temperature steels / alloys.

Marathon 444 is an agglomerated fluoride basic welding flux with high basic slag characteristics without Cr-support. The weld metals show excellent mechanical properties with high hot cracking resistance. For more information regarding this flux, see the separate datasheet.

Base materials

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32-21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9, 2.4816 NiCr15Fe 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Cladding and dissimilar welding with unalloyed and low-alloyed steels, e.g. P265GH-P295GH, 16Mo3, S355N

254 SMO®

SAW

Typical analysis of the weld metal

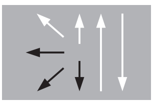
wt.-%	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wire	0.01	0.10	0.10	22.0	Bal.	9.0	3.6	< 1.0
all-weld metal	0.012	0.16	0.20	21.8	Bal.	9.0	3.2	< 1.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	(≥ 420)	(≥ 700)	(≥ 40)	≥ 80	≥ 70

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. No preheating. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Polarity: DC+ or AC.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150ºC followed by water quenching.

Approvals

TÜV (10173), DNV GL, CE

Thermanit Nicro 82 - Marathon 104

SAW wire/flux combination, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3	S A FB 2 AC

Characteristics and typical fields of application

Thermanit Nicro 82 - Marathon 104 is a wire/flux combination for submerged arc welding. Solid wire of S Ni 6082 (NiCr20Mn3Nb) / ERNiCr-3 type for welding of many creep-resistant steels and nickel-base alloys such as Alloy 600. Provides high resistance to cracking and is well-suited for dissimilar welding of stainless and nickel-base alloys to mild steels. Heat and high temperature resistant – can be used for welding nickel-base alloys for use in high temperature applications. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. It is mainly applied for components in chemical and in petrochemical plants. Good toughness at subzero temperatures down to –196ºC. High resistance to stress corrosion cracking, but also excellent resistance to intergranular corrosion due to the low carbon content. Resistant to scaling up to 1000ºC.

Marathon 104 is an agglomerated fluoride-basic flux for submerged arc welding of stainless and heat resistant steel grades. The weld metal is characterized by high resistance to hot cracking and is recommended for the highest demanding applications. For more information regarding this flux, see the separate datasheet.

Base materials

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32-21

NiCr15Fe, 1.5680 X12Ni5, X8Ni9, 10CrMo9-10

Alloy 600, 600L, 800, 800H. UNS N06600, N07080, N0800, N0810

Dissimilar welding of 1.4583 X10CrNiMoNb18-12 and 1.4539 X2NiCrMoCu25-20 with ferritic pressure vessel boiler steels.

Typical analysis of the weld metal

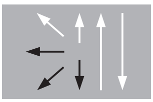
wt.-%	C	Si	Mn	Cr	Ni	Nb	Fe
wire	0.01	0.10	3.2	20.5	Bal.	2.6	< 1.0
all-weld metal	0.02	0.25	3.0	20.2	Bal.	2.4	< 1.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	≥ 380	≥ 600	≥ 35	≥ 100

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.0	250 - 350	28 - 32
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. No preheating. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Attention must be paid to resistance to intercrystalline corrosion and embrittlement in case of austenitic stainless steels.

Polarity: DC+ or AC

Approvals

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Thermanit Nicro 82 - Marathon 444

SAW wire/flux combination, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3	S A FB 2 AC

Characteristics and typical fields of application

Thermanit Nicro 82 - Marathon 444 is a wire – flux combination for submerged arc welding of dissimilar austenite-ferrite joints, joints of stainless, heat resistant, creep resistant and cryogenic steels. Solid wire of S Ni 6082 (NiCr20Mn3Nb) / ERNiCr-3 type for welding of many creep-resistant steels and nickel-base alloys such as Alloy 600. The weld metals show excellent mechanical properties with high hot cracking resistance. It is applicable for chemical apparatus construction on high temperature metals as well as in low temperature sections down to –196ºC. High resistance to stress corrosion cracking, but also excellent resistance to intergranular corrosion due to the low carbon content. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material.

Marathon 444 is an agglomerated fluoride-basic welding flux with high basic slag characteristics. The weld metals show excellent mechanical properties with high hot cracking resistance. For more information regarding this welding flux, see the separate datasheet.

Base materials

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32–21; NiCr15Fe, 1.5680 X12Ni5 ,X8Ni9, 10CrMo9-10

Alloy 600, 600L, 800, 800H,

UNS N06600, N07080, N0800, N0810.

Dissimilar welding of 1.4583 X10CrNiMoNb18-12 and 1.4539 X2NiCrMoCu25-20 with ferritic pressure vessel boiler steels.

Typical analysis of the weld metal

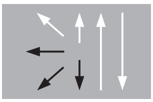
wt.-%	C	Si	Mn	Cr	Ni	Nb	Fe
wire	0.01	0.10	3.2	20.5	Bal.	2.6	< 1.0
all-weld metal	0.012	0.25	3.0	20.2	Bal.	2.4	< 1.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	≥ 380	≥ 580	≥ 35	≥ 110

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.0	250 - 350	28 - 32
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking when welding fully austenitic 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. No preheating. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Polarity: DC+ or AC.

Attention must be paid to resistance to intercrystalline corrosion and embrittlement in case of austenitic stainless steels.

Approvals

TÜV (07767), CE

Thermanit Nimo C 276 - Marathon 104

SAW wire/flux combination, nickel-base

SAW

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6276 (NiCr15Mo16Fe6W4)	ERNiCrMo-4	S A FB 2 AC

Characteristics and typical fields of application

Thermanit Nimo C 276 - Marathon 104 is a wire/flux combination for submerged arc welding. It can be applied for joining similar Ni-alloys and dissimilar joints between Ni-alloys and low-alloyed or stainless steels; and surfacing on low-alloyed steels. Solid wire of S Ni 6276 (NiCr15Mo16Fe6W4) / ERNiCrMo-4. Provides high resistance to cracking and is well-suited for dissimilar welding of stainless and nickel-base alloys to mild steels. This wire/flux combination is especially recommended for joining cryogenic Ni-steels such as X8Ni9 and X12Ni5. The weld metal has an excellent corrosion resistance especially to pitting and crevice corrosion. High resistance to stress corrosion cracking, but also excellent resistance to intergranular corrosion due to the low carbon content. In dissimilar welding and cladding, the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. Good toughness at subzero temperatures down to –196ºC. Resistant to scaling up to 1000ºC.

Marathon 104 is an agglomerated fluoride-basic flux for submerged arc welding of stainless and heat resistant steel grades. The weld metal is characterized by high resistance to hot cracking and is recommended for the highest demanding applications. For more information regarding this welding flux, see the separate datasheet.

Base materials

1.5662 X8Ni9, 1.5680 X12Ni5 and 2.4819 NiMo16Cr15W

Joint welds of listed materials with low-alloyed and stainless steels.

Typical analysis of the weld metal

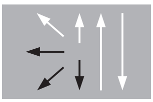
wt.-%	C	Si	Mn	Cr	Ni	Mo	W	Fe
wire	0.01	0.05	0.50	15.5	Bal.	16.0	3.8	6.0
all-weld metal	0.01	0.10	0.50	15.4	Bal.	16.0	3.7	6.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J –196°C
u	450 (≥ 420)	720 (≥ 680)	45 (≥ 35)	110 (≥ 70)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Suggested heat input is max. 1.5 kJ/mm (depending on plate thickness). Preheating and post-weld heat treatment of dissimilar welds, heat-resistant Cr-steels and cryogenic Ni-steels according to the parent metal, but max. 120ºC. Attention must be paid to resistance to intercrystalline corrosion and embrittlement in case of austenitic stainless steels. Polarity:

- Wire diameter 1.6 mm: AC or DC+
- Wire diameter 2.4 mm, full penetration welds in 1G / PA and 2G / PC position: AC
- Wire diameter 2.4 mm, fillet welds: AC or DC+

Approvals

DNV GL, LR, CE, ABS

BÖHLER NIBAS 70/20-FD

Flux-cored wire, high-alloyed, nickel-base

Classifications

EN ISO 12153	AWS A5.34 / SFA-5.34
T Ni 6082 R M21 3	ENiCr3T0-4

Characteristics and typical fields of application

Nickel-base rutile flux-cored wire of T Ni 6082 R / ENiCr3T0 type for welding of many creep-resistant steels and nickel-base alloys. Well-suited for dissimilar welding of stainless and nickel alloys to mild steels and some copper alloys. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. The austenitic structure is very stable and the risk of solidification cracking is low. The weld metal has low coefficient of thermal expansion and is resistant to thermal shock. It provides high resistance to stress corrosion cracking and good resistance to intergranular corrosion. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for pressure vessel fabrication in the service temperature range –196ºC to 550ºC, otherwise resistant to scaling up to 1100ºC (in S-free atmosphere). Especially designed for flat and horizontal welding positions.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32–21

Alloy 600, Alloy 600 L, Alloy 800 / 800H. UNS N06600, N07080, N0800, N0810

Typical analysis of the wire

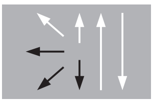
	C	Si	Mn	Cr	Ni	Nb	Fe	FN
wt.-%	0.03	0.4	3.2	19.5	Bal.	2.5	2.5	0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	385 (≥ 360)	650 (≥ 550)	39 (≥ 25)	130	120 (≥ 32)

u untreated, as welded - shielding gas Ar + 18 % CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0
1.6	~ 3	200 – 350	25 – 30	4.5 – 9.5

Welding with standard GMAW power source on DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min. To minimize 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. The heat input should not exceed 1.5 kJ/mm, the interpass temperature be limited to max. 100ºC and the wire stick-out 15 – 20 mm. Slight weaving is recommended for all welding positions. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050 – 1200ºC followed by water quenching.

Approvals

TÜV (10298), CE

BÖHLER NIBAS 70/20 Mn-FD

Flux-cored wire, high-alloyed, nickel-base

Classifications

EN ISO 12153	AWS A5.34 / SFA-5.34
T Ni 6083 R M21 3	ENiCr3T0-4 (mod.)

Characteristics and typical fields of application

Nickel-base rutile flux-cored wire of T Ni 6083 R / ENiCr3T0 type for welding of many creep-resistant steels and nickel-base alloys. Well-suited for dissimilar welding of stainless and nickel alloys to mild steels and some copper alloys. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. The austenitic structure is very stable and the increased Mn content gives further improved resistance to hot cracking. The weld metal has low coefficient of thermal expansion and is resistant to thermal shock. It provides high resistance to stress corrosion cracking and good resistance to intergranular corrosion. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for pressure vessel fabrication in the service temperature range –196ºC to 650ºC, otherwise resistant to scaling up to 1100ºC (in S-free atmosphere). Especially designed for flat and horizontal welding positions.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32-21

Alloy 600, Alloy 600 L, Alloy 800 / 800H UNS N06600, N07080, N0800, N0810

Typical analysis of the wire

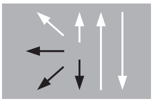
	C	Si	Mn	Cr	Ni	Nb	Fe	FN
wt.-%	0.03	0.3	5.5	19.7	Bal.	2.4	2.0	0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	380 (≥ 360)	640 (≥ 600)	41 (≥ 27)	130	115 (≥ 32)

u untreated, as welded - shielding gas Ar + 18 % CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min. To minimize 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. The heat input should not exceed 1.5 kJ/mm, the interpass temperature be limited to max. 100ºC and the wire stick-out 15 – 20 mm. Slight weaving is recommended for all welding positions. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050 – 1200ºC followed by water quenching.

Approvals

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BÖHLER NIBAS 625 PW-FD

Flux-cored wire, high-alloyed, nickel-base

Classifications

EN ISO 12153	AWS A5.34 / SFA-5.34
T Ni 6625 P M21 2	ENiCrMo3T1-4

Characteristics and typical fields of application

Nickel-base rutile flux-cored wire of T Ni 6625 P / ENiCrMo3T1 type for welding of nickel-base alloys with high Mo content, e.g. Alloy 625 and Alloy 825, as well as "6Mo" austenitic stainless steels such as 1.4547 / UNS S31254 – 254 SMO®. For welding of creep resistant, heat resistant and 9Ni-steels for cryogenic applications (e.g. LNG). The weld metal is exceptionally resistant 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 (50ºC). Suitable for pressure vessel fabrication in the service temperature range –196ºC to 550ºC, otherwise resistant to scaling up to 1100ºC (in S-free atmosphere). The austenitic structure is very stable and the risk of solidification cracking is low. Because of embrittlement of the base material at 550 – 850ºC, service in this temperature range should be avoided. BÖHLER NIBAS 625 PW-FD can also be used for welding of dissimilar joints including low-alloyed "hard-to-weld" steels. High nickel content prevents C-diffusion at high service temperatures or during post-weld heat treatment of dissimilar steels. The weld metal has low coefficient of thermal expansion and is resistant to thermal shock. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 9% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels.

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12 1.4876 X8NiCrAlTi32–21, 1.5662 X8Ni9, 2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 2.4641 NiCr21Mo6Cu, 2.4856 NiCr22Mo9Nb 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Dissimilar welding with unalloyed and low-alloyed steels, e.g. P265GH, P285NH, P295GH, 16Mo3, S355N

Typical analysis of the wire

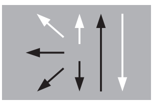
	C	Si	Mn	Cr	Ni	Mo	Nb	Fe	FN
wt.-%	0.05	0.4	0.4	21.0	Bal.	8.5	3.3	< 1.0	0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	Impact values ISO-V KV J –196°C	Lateral expansion mm –196°C
u	460 (≥ 420)	740 (≥ 690)	40 (≥ 25)	90	80 (≥ 32)	1.45
u1	435 (≥ 420)	730 (≥ 690)	43 (≥ 25)	100	84 (≥ 32)	

u untreated, as welded – shielding gas Ar + 18% CO_2
u1 untreated, as welded – shielding gas 100% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	120 – 230	23 – 27	6.0 – 12.0

Welding with standard GMAW power source. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min. To minimize 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. The heat input should not exceed 1.5 kJ/mm, the interpass temperature be limited to max. 100ºC and the wire stick-out 15 – 20 mm. Slight weaving is recommended for all welding positions. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050 – 1200ºC followed by water quenching.

Approvals

TÜV (11223), CE

Welding flux for stainless steels and nickel-base alloys

◆ **Content**

Product	Norm	Class	Page
Avesta Flux 801	EN ISO 14174	S A GS 2 DC	553
Marathon 213	EN ISO 14174	S F CS 2 DC	554
Avesta Flux 805	EN ISO 14174	S A AF 2 DC	555
Marathon 431	EN ISO 14174	S A FB 2 DC	556
BÖHLER BB 203	EN ISO 14174	S A FB 2 DC	557
Marathon 444	EN ISO 14174	S A FB 2 AC	558
Marathon 104	EN ISO 14174	S A FB 2 AC	559
Marathon 504	EN ISO 14174	S A BA 2 AC	560

Avesta Flux 801

SAW flux, agglomerated, magnesium silicate

Classifications

EN ISO 14174
S A GS 2 DC

Characteristics and typical fields of application

Avesta Flux 801 is an agglomerated magnesium silicate flux for submerged arc welding with stainless steel wires. It can be applied for general purpose applications (joining and cladding). The flux provides chromium support to compensate chromium loss when welding. The weld metal for this reason typically has the same or somewhat higher chromium content than the wire itself. Recommended for joining (and cladding) with standard stabilized and unstabilized stainless steel grades. The flux provides very good welding properties / easy slag removal and gives a very nice bead appearance.

Flux properties

Polarity	DC
Basicity index (Boniszewski)	1.0
Grain size (EN ISO 14174)	3 – 16 (0.3 – 1.6 mm)
Apparent density	1.0 kg/dm^3
Redrying	300°C – 350°C for 2 – 10 h

Composition of sub-arc welding flux

	Al_2O_3	$CaO + CaF_2$	$MgO + SiO_2$
wt. %	15	12	60

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Thermanit JE-308L	14343-A	S 19 9 L	A5.9 / -5.9	ER308L
Thermanit GE-316L	14343-A	S 19 12 3 L	A5.9 / -5.9	ER316L
Thermanit A	14343-A	S 19 12 3 Nb	A5.9 / -5.9	ER318
Thermanit 25/14 E-309L	14343-A	S 23 12 L	A5.9 / -5.9	ER309L

Packaging

Type	Weight
PE bag	25 kg

Marathon 213

SAW flux, fused, calcium silicate

Classifications

EN ISO 14174
S F CS 2 DC

Characteristics and typical fields of application

Marathon 213 is a fused calcium silicate flux for submerged arc welding of standard stabilized and unstabilized CrNi(Mo) stainless steel grades. It is mostly applied for its very nice bead appearance without any slag residues. The flux can be applied in multi-pass and single pass welding procedures and for cladding. It provides a high degree of purity in the weld metal. The flux does not compensate chromium loss. The flux is not hygroscopic.

Flux properties

Polarity	DC+. Tandem AC/DC+
Basicity index (Boniszewski)	1.3
Grain size (EN ISO 14174)	1 – 16 (0.1 – 1.6 mm)
Apparent density	1.5 kg/dm³
Redrying	Mostly not necessary. however it can be redried at 100 – 150°C

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
wt. %	30	35	5	20

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Thermanit JE-308L	14343-A	S 19 9 L	A5.9 / -5.9	ER308L
Thermanit GE-316L	14343-A	S 19 12 3 L	A5.9 / -5.9	ER316L
Thermanit H-347	14343-A	S 19 9 Nb	A5.9 / -5.9	ER347
Thermanit A	14343-A	S 19 12 3 Nb	A5.9 / -5.9	ER318
Thermanit 25/14 E-309L	14343-A	S 23 12 L	A5.9 / -5.9	ER309L

Packaging

Type	Weight
PE bag	25 kg

SAW

böhler welding by voestalpine

Avesta Flux 805

SAW flux, agglomerated, aluminate fluoride-basic, Cr-compensating

Classifications

EN ISO 14174
S A AF 2 DC

Characteristics and typical fields of application

Avesta Flux 805 is an agglomerated aluminate-fluoride-basic flux for submerged arc welding with stabilized and unstabilized stainless steel wires. It is primarily designed for welding (and cladding) with high-alloyed austenitic and duplex stainless fillers, but also standard CrNi, CrNiMo and nickel-base alloys can be welded with excellent results.

Avesta Flux 805 provides chromium support to compensate chromium loss when welding. The weld metal for this reason typically has the same or somewhat higher chromium content than the wire itself. Especially suitable for applications where high impact toughness values and high pitting corrosion resistance are required. The flux provides very good welding properties and easy slag removal. Thin fluid slag provides for very nice fillet welds and bead appearance.

Flux properties

Polarity	DC
Basicity index (Boniszewski)	2.0
Grain size (EN ISO 14174)	3–14 (0.3–1.4 mm); also available as 3–16 (0.3–1.6 mm)
Apparent density	1.0 kg/dm³
Redrying	2 h at 300 – 350°C

Composition of sub-arc welding flux

	CaF_2	Al_2O_3	SiO_2
wt. %	48	36	9

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Avesta 248 SV	14343-A	S 16 5 1	A5.9 / -5.9	EG
Avesta LDX 2101	14343-A	S Z 23 7 N L	A5.9 / -5.9	ER2307
Thermanit JE-308L	14343-A	S 19 9 L	A5.9 / -5.9	ER308L
Thermanit GE-316L	14343-A	S 19 12 3 L	A5.9 / -5.9	ER316L
Avesta 317L/SNR	14343-A	S 19 13 4 L	A5.9 / -5.9	ER317L
Thermanit H-347	14343-A	S 19 9 Nb	A5.9 / -5.9	ER347
Thermanit A	14343-A	S 19 12 3 Nb	A5.9 / -5.9	ER318
Thermanit 25/14 E-309L	14343-A	S 23 12 L	A5.9 / -5.9	ER309L
Avesta P5	14343-A	S 23 12 2 L	A5.9 / -5.9	ER309LMo (mod.)
Avesta 2304	14343-A	S 23 7 N L	A5.9 / -5.9	ER2307
Avesta 2205	14343-A	S 22 9 3 N L	A5.9 / -5.9	ER2209
Avesta 2507/P100[Cu/W]	14343-A	S 25 9 4 N L	A5.9 / -5.9	ER2594
Avesta P7	14343-A	S 29 9	A5.9 / -5.9	ER312
Avesta 253 MA	14343-A	S Z 21 10 N	A5.9 / -5.9	EG

Packaging

Type	Weight
Dry System	25 kg
PE bag	25 kg

SAW

Marathon 431

SAW flux, agglomerated, fluoride-basic

Classifications

EN ISO 14174
S A FB 2 DC

Characteristics and typical fields of application

Marathon 431 is a fluoride-basic agglomerated flux for submerged arc welding of stabilized and unstabilized standard CrNi(Mo) and duplex stainless steel grades. The flux can be applied in multi-pass and single pass welding procedures. Thin fluid slag for very nice fillet welds. The weld seams become smooth and finely rippled without any slag residues. Marathon 431 provides a high degree of purity in the weld metal ensuring good mechanical properties with good corrosion resistance. The flux does not compensate chromium loss. This flux has also been available on the market as "BÖHLER BB 202" and "Avesta Flux 807".

Flux properties

Polarity	DC+
Basicity index (Boniszewski)	2.2
Grain size (EN ISO 14174)	3 – 16 (0.3 – 1.6 mm) ; 4 – 14 (0.4 – 1.4 mm)
Apparent density	1.0 kg/dm³
Redrying	300 – 350°C for 2 h

Composition of sub-arc welding flux

	CaF_2	Al_2O_3	SiO_2
wt. %	50	38	10

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Thermanit JE-308L	14343-A	S 19 9 L	A5.9 / -5.9	ER308L
BÖHLER EAS 2-UP (LF)	14343-A	S 19 9 L	A5.9 / -5.9	ER308L
Thermanit GE-316L	14343-A	S 19 12 3 L	A5.9 / -5.9	ER316L
Thermanit H-347	14343-A	S 19 9 Nb	A5.9 / -5.9	ER347
Thermanit A	14343-A	S 19 12 3 Nb	A5.9 / -5.9	ER318
Thermanit 22/09	14343-A	S 22 9 3 N L	A5.9 / -5.9	ER2209
Thermanit 25/09 CuT	14343-A	S 25 9 4 N L	A5.9 / -5.9	ER2594
Thermanit 20/10	14343-A	S 20 10 3	A5.9 / -5.9	ER308Mo (mod.)
Thermanit 25/14 E-309L	14343-A	S 23 12 L	A5.9 / -5.9	ER309L

Packaging

Type	Weight
Dry System	25 kg
Metal bucket	30 kg
PE bag	25 kg

SAW

böhler welding by voestalpine

BÖHLER BB 203

SAW flux, agglomerated, fluoride-basic

Classifications

EN ISO 14174
S A FB 2 DC

Characteristics and typical fields of application

BÖHLER BB 203 is an agglomerated fluoride-basic flux for submerged arc welding with stainless steel wires. It is recommended for joining soft-martensitic CrNi-steels; joining and (cladding) of unstabilized stainless austenitic CrNi(Mo)-steels as well as fully austenitic stainless CrNiMo-steels. Especially suitable for thick walled components with high restraint and where a low amount of diffusible hydrogen is essential. The flux has a high basicity-index and provides a high purity in the weld metal resulting in good mechanical properties. BÖHLER BB 203 does not contain Cr supporting elements. Besides good slag detachability, the flux allows for good fillet weld appearance. The slag has a little higher viscosity as compared to Marathon 431, which can be preferred for straighter weld beads.

Flux properties

Polarity	DC
Basicity index (Boniszewski)	2.5
Grain size (EN ISO 14174)	3 – 16 (0.3 – 1.6 mm); 2 – 12 (0.2 – 1.2 mm)
Apparent density	1.0 kg/dm³
Redrying	300°C – 350°C for 2 – 10 h

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	CaF_2	Al_2O_3
wt. %	20	26	32	18

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
BÖHLER CN 13/4-UP	14343-A	S 13 4	A5.9 / -5.9	ER410NiMo (mod.)
BÖHLER SKWAM-UP	14343-A	S Z 17 Mo H	A5.9 / -5.9	ER430 (mod.)
Thermanit JE-308L	14343-A	S 19 9 L	A5.9 / -5.9	ER308L
BÖHLER EAS 2-UP (LF)	14343-A	S 19 9 L	A5.9 / -5.9	ER308L
Thermanit GE-316L	14343-A	S 19 12 3 L	A5.9 / -5.9	ER316L
BÖHLER A 7 CN-UP	14343-A	S 18 8 Mn	A5.9 / -5.9	ER307 (mod.)
Thermanit 25/14 E-309L	14343-A	S 23 12 L	A5.9 / -5.9	ER309L
BÖHLER ASN 5-UP	14343-A	S Z 18 16 5 N L	A5.9 / -5.9	ER317L (mod.)
BÖHLER AM 500-UP	14343-A	S Z 25 23 3 Mn N L	A5.9 / -5.9	EG

Packaging

Type	Weight
Dry System	25 kg
Metal bucket	30 kg

Marathon 444

SAW flux, agglomerated, fluoride-basic

Classifications

EN ISO 14174
S A FB 2 AC

Characteristics and typical fields of application

Marathon 444 is a highly basic agglomerated welding flux, designed for welding and cladding of nickel-base NiCr(Mo)-alloys. Highly resistant to hot cracking by suppressing weld metal silicon absorption. The flux does not compensate chromium loss. Basic slag characteristics resulting excellent mechanical properties. Widely used in highly corrosive environments, high-temperature applications as well as in low temperature sections down to –196ºC.

Flux properties

Polarity	DC+ / AC
Basicity index (Boniszewski)	2.9
Grain size (EN ISO 14174)	3 – 16 (0.3 – 1.6 mm)
Apparent density	1.0 kg/dm³
Redrying	300 – 350°C for 2 – 10 h

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
wt. %	7	40	30	20

Typical wires to combine

Name	**EN ISO**	**Class**	**AWS / SFA**	**Class**
Thermanit Nicro 82	18274	S Ni 6082 (NiCr20Mn3Nb)	A5.14 / -5.14	ERNiCr-3
Thermanit 625	18274	S Ni 6625 (NiCr22Mo9Nb)	A5.14 / -5.14	ERNiCrMo-3
Thermanit Nimo C 276	18274	S Ni 6276 (NiCr15Mo16Fe6W4)	A5.14 / -5.14	ERNiCrMo-4

Packaging

Type	**Weight**
Metal bucket	30 kg
PE bag	25 kg

SAW

böhler welding by voestalpine

Marathon 104

SAW flux, agglomerated, fluoride basic

Classifications

EN ISO 14174
S A FB 2 AC

Characteristics and typical fields of application

Marathon 104 is an agglomerated fluoride-basic flux for submerged arc welding of stainless / heat resistant steel grades and Ni-base alloys. This flux is – above all – recommended for highest demands on crack resistance and the mechanical properties of the weld metal, especially with heavy wall thickness.

Combined with stainless wire grades, Marathon 104 and it provides a high degree of purity in the weld metal, with good mechanical properties and good corrosion resistance. The flux does not compensate chromium loss. Its metallurgical behavior in regard of carbon, silicon and manganese is neutral.

Good slag detachability and nice bead appearance. The weld metal is characterized by good mechanical properties and high resistance to hot cracking and is recommended for the highest demanding applications, e.g. creep resistant (Thermanit ATS), non-magnetic and cryogenic applications. Especially recommended for LNG applications with Thermanit Nimo C 276 and Thermanit 625.

Flux properties

Polarity	DC+ / AC
Basicity index (Boniszewski)	2.9
Grain size (EN ISO 14174)	1 – 20 (0.1 – 2.0 mm)
Apparent density	1.0 kg/dm³
Redrying	300 – 350°C for 2 – 10 h

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
wt. %	15	36	20	25

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Thermanit 13/04	14343-A	S 13 4	A5.9 / -5.9	ER410NiMo (mod.)
Thermanit 17/15 TT	14343-A	S G Z 17 15 Mn W		
Thermanit 20/16 SM	14343-A	S Z 22 17 8 4 N L	A5.9 / -5.9	EG
Thermanit 25/22 H	14343-A	S 25 22 2 N L	A5.9 / -5.9	ER310 (mod.)
Thermanit 20/25 Cu	14343-A	S 20 25 5 Cu L	A5.9 / -5.9	ER385
BÖHLER AM 500-UP	14343-A	S Z 25 23 3 Mn N L	A5.9 / -5.9	EG
Thermanit ATS 4	14343-A	S 19 9 H	A5.9 / -5.9	ER19-10H
Thermanit D	14343-A	S 22 12 H	A5.9 / -5.9	ER309 (mod.)
Thermanit Nicro 82	18274	S Ni 6082 (NiCr20Mn3Nb)	A5.14 / -5.14	ERNiCr-3
Thermanit 625	18274	S Ni 6625 (NiCr22Mo9Nb)	A5.14 / -5.14	ERNiCrMo-3
Thermanit Nimo C 276	18274	S Ni 6276 (NiCr15Mo16Fe6W4)	A5.14 / -5.14	ERNiCrMo-4

Packaging

Type	Weight
Dry System	25 kg
Metal bucket	30 kg

SAW

Marathon 504

SAW flux, agglomerated, aluminate-basic

Classifications

EN ISO 14174
S A BA 2 AC

Characteristics and typical fields of application

Marathon 504 is an agglomerated flux for submerged arc welding. Recommended for surfacing applications (and joining) especially with Ni-base wire types. The flux does not compensate chromium loss. Neutral metallurgical behavior resulting in good mechanical properties and high resistance to hot cracking. Provides excellent slag detachability and nice bead appearance under direct or alternating current. Especially in weld overlay.

Flux properties

Polarity	DC+ / AC
Basicity index (Boniszewski)	1.0
Grain size (EN ISO 14174)	3 – 16 (0.3 – 1.6 mm)
Apparent density	1.0 kg/dm³
Redrying	250 – 300°C for 2 – 10 h

Composition of sub-arc welding flux

	SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
wt. %	9	12	52	22

Typical wires to combine

Name	EN ISO	Class	AWS / SFA	Class
Thermanit Nicro 82	18274	S Ni 6082 (NiCr20Mn3Nb)	A5.14 / -5.14	ERNiCr-3
Thermanit 625	18274	S Ni 6625 (NiCr22Mo9Nb)	A5.14 / -5.14	ERNiCrMo-3
Thermanit Nimo C 276	18274	S Ni 6276 (NiCr15Mo16Fe6W4)	A5.14 / -5.14	ERNiCrMo-4
Thermanit 617	18274	S Ni 6617 (NiCr22Co12Mo9)	A5.14 / -5.14	ERNiCrCoMo-1

Packaging

Type	Weight
Metal bucket	30 kg
PE bag	25 kg

SAW

Pickling and passivation products

◆ **Content**

CHEM

Pickling Gel 122

Pickling gel for use and storage in warmer climates

Characteristics

Pickling Gel 122 is more free-flowing than a pickling paste to facilitate the application and to give a high coverage. It can hence be used to clean with a good result.

Standard applications

This gel is universal and specifically intended for standard brush pickling of weld seams and smaller surfaces of all stainless steel grades.

Features

- Restores damaged stainless steel surfaces such as weld seams, by removing weld oxides, the underlying chromium-depleted layer and other defects that may cause local corrosion.
- Improved pickling result, offers a brighter surface with less discolouration than classic products.
- The transparent gel consistency gives good adhesion to the stainless steel surface.
- Can be used and stored in warmer climates (the gel is heat-stable up to +45 °C).

Packaging

Pickling Gel 122 is supplied in a 2.4 kg polyethylene container supplied in a 4-pack cardboard box, and a 12 kg polyethylene container.

All packing material follows the UN regulations for hazardous goods.

BlueOne™ Pickling Paste 130

A unique patented, safer-to-use pickling paste!

Characteristics

Many of the processes used for pickling stainless steel lead to the development of hazardous nitric fumes. To improve safety when pickling, we have developed a unique patented low-fuming pickling paste which reduces toxic nitric fumes by 80 %

Standard applications

BlueOne™ Pickling Paste 130 is universally, suitable for brush pickling of welds and smaller surfaces on all stainless steel grades.

Features

- Restores damaged stainless steel surfaces such as weld seams, by removing weld oxides, the underlying chromium-depleted layer and other defects that may cause local corrosion.
- Improved pickling result, offers a brighter surface with less discolouration than classic products.
- Unique and covered by a world patent.
- Higher yield, decreased consumption, thanks to the visible blue colour and its free-flowing consistency which facilitates application. The paste is easy to apply and highly visible.

Packaging

BlueOne™ Pickling Paste 130 is supplied in a 2.4 kg polyethylene container supplied in a 4-pack cardboard box, and a 12 kg polyethylene container.

All packing material follows the UN regulations for hazardous goods.

RedOne™ Pickling Paste 140

A powerful, low-fuming, safer-to-use pickling paste!

Characteristics

Many of the processes used for pickling stainless steel lead to the development of hazardous nitric fumes. To improve safety when pickling, we have developed a unique patented low-fuming pickling paste which reduces toxic nitric fumes by 50 %.

Standard applications

RedOne™ Pickling Paste 140 is intended for powerful brush pickling of welds and smaller surfaces of high-alloy steel grades in tough applications.

For non-heavy-duty applications we suggest our low fuming BlueOne™ Pickling Paste 130 in order to improve the environmental impact and safety when pickling.

Features

- Restores damaged stainless steel surfaces such as weld seams, by removing weld oxides, the underlying chromium-depleted layer and other defects that may cause local corrosion.
- Unique and patented.
- Higher yield, decreased consumption, thanks to the visible red colour and its free-flowing consistency which facilitates application. The paste is easy to apply and highly visible.

Packaging

RedOne™ Pickling Paste 140 is supplied in a 2.4 kg polyethylene container supplied in a 4-pack cardboard box, and a 12 kg polyethylene container.

All packing material follows the UN regulations for hazardous goods.

Pickling Spray 204

A powerful pickling spray for heavy-duty applications

Characteristics

Pickling Spray 204, is intended for heavy-duty applications and offers an aggressive spray pickling result for larger stainless steel surfaces.

Standard applications

Pickling Spray 204 is intended for tougher applications such as heavy hot rolled plates, high-alloyed steels such as 904, duplex and SMO, thicker weld oxides and pickling at lower temperatures.

For non-heavy-duty applications we suggest the use of our low-fuming RedOne™ Pickling Spray 240 in order to improve safety when pickling.

Features

- Restores stainless steel surfaces that have been damaged during fabrication operations such as welding, forming, cutting and blasting. It removes weld oxides, the underlying chromium-depleted layer and other defects that may cause local corrosion.
- Has a thixotropic consistency, which makes it stick well to the surface and hence facilitates the application even in difficult positions.
- The process is sensitive to strong sunlight/high temperatures and the spray may dry into the surface and be difficult to remove.

Passivation

To further improve the result we recommend passivating after pickling using FinishOne Passivator 630, which is a safer acid-free passivation method.

Packaging

Pickling Spray 204 is supplied in 30 kg and 220 kg polyethylene containers or 1200 kg IBC polyethylene containers.

All packing material follows the UN regulations for hazardous goods.

RedOne™ Pickling Spray 240

A unique, safer-to-use pickling spray!

Characteristics

Many of the processes used for pickling stainless steel lead to the development of hazardous nitric fumes. To improve safety when pickling, we have developed a unique lowfuming pickling spray which reduces the toxic nitric fumes by 50 %.

Standard applications

RedOne™ Pickling Spray 240 is universal and suitable for spray pickling larger surfaces of all stainless steel grades. High alloyed steels and duplex steels may need more than one treatment.

Features

- Restores stainless steel surfaces that have been damaged during fabrication operations such as welding, forming, cutting and blasting. It removes weld oxides, the underlying chromium-depleted layer and other defects that may cause local corrosion.
- Improved pickling result, offers a brighter surface with less discolouration than classic products.
- Higher yield, decreased consumption, thanks to the visible red colour and its free-flowing consistency which facilitates application.

Passivation

To further improve the result we recommend passivating after pickling using FinishOne Passivator 630, which is a safer acid-free passivation method.

Packaging

RedOne™ Pickling Spray 240 is supplied in 30 kg and 220 kg polyethylene containers or 1200 kg IBC polyethylene containers.

All packing material follows the UN regulations for hazardous goods.

CHEM

Pickling Bath 302

For immersion pickling!

Characteristics

Pickling Bath 302 is a concentrate that should be diluted with water depending on the stainless steel grade.

Standard applications

The bath fluid is recommended for immersion pickling of small objects and for pickling surfaces that are time-consuming to brush or spray pickle. It can also be used for circulation pickling of pipe systems.

Features

- Restores stainless steel surfaces that have been damaged during fabrication operations such as welding, forming, cutting and blasting. It removes weld oxides, the underlying chromium-depleted layer and other defects that may cause local corrosion.
- Working life; the bath fluid is consumed during usage and the effective working life of the bath fluid is determined by the amount of acids and dissolved metals. The bath fluid should hence be analyzed regularly, and new acid should be added when needed in order to obtain an optimal pickling result. We may assist with this analysis service.

Passivation

To further improve the result we recommend passivating after pickling using FinishOne Passivator 630, which is a safer acid-free passivation method.

Packaging

Pickling Bath 302 is supplied in 33 kg and 240 kg poly-ethylene containers or 1200 kg IBC polyethylene containers.

All packing material follows the UN regulations for hazardous goods.

Cleaner 401

A heavy-duty stainless steel cleaner!

Characteristics

Superficial rust, oil, grease and lime deposits can occasionally appear on any stainless steel surface. Cleaning with Cleaner 401 eliminates these spots with ease, restoring the surface and returning your stainless steel to its original lustrous look, feel and finish.

Standard applications

Cleaner 401 is intended for a wide range of industrial cleaning applications. It offers a good general cleaning result on stainless steel surfaces.

Features

- Restores and brightens stainless steel surfaces that have been contaminated during fabrication or usage. It removes surface rust, water staining and lime deposits and organic contamination such as oil and grease.
- Pre-cleans before pickling. It removes organic contaminants such as grease, oil, etc. which will inhibit pickling.
- Removes atmospheric staining caused by sea water, “tea-staining”, rain water, “water scale” and road salt.

Pasivation

Cleaner 401 can be used in combination with FinishOne Passivator 630, which helps to remove free iron from the surface and regenerate the protective layer in the stainless steel by speeding up the passivation process.

Packaging

Cleaner 401 is supplied in 28 kg polyethylene containers and 1100 kg IBC polyethylene containers.

Neutraliser 502

For simple neutralisation of acid rinse water

Characteristics

Following the pickling of stainless steel, the rinse water is strongly acidic and contains dissolved metals including chromium and nickel. For environmental reasons, this water should be treated before discharge.

Standard applications

Neutraliser 502 is a simple way to neutralise acidic waste water and precipitate heavy metals.

Features

- Gives rapid precipitation of iron, chromium and nickel in the form of a sludge which can be sent for deposition.
- Adjusts the waste water to a pH-value of 7 – 10 before discharge.

Packaging

Neutraliser 502 is supplied in 32 kg polyethylene container.

Passivator 601

A traditional nitric acid based, well-proven passivator

Characteristics

Passivator 601 is intended for use after mechanical de-scaling treatment of stainless steel such as grinding, polishing and blasting. These processes leave a surface which, because of remaining grinding dust and iron particles, is sensitive to corrosion. The product also restores the protective chromium oxide layer.

Standard applications

Passivator 601 is intended for a wide range of industrial passivating applications such as passivation after pickling or passivation after grinding, brushing, blasting or other mechanical treatments.

Passivator 601 contains nitric acid. To improve safety and minimize the environmental impact, we also suggest the use of our acid-free FinishOne Passivator 630.

Surface restauration

Cleaner 401 can be used together with Passivator 601, which helps regenerate the protective layer in the stainless steel by speeding up the natural passivation process.

Features

- Accelerates rebuilding of the protective layer of chromium oxide.
- Removes surface contaminants and iron particles from stainless steel surface.

Packaging

Passivator 601 is supplied in 28 kg and 1100 kg IBC polyethylene containers.

CHEM

FinishOne Passivator 630

An acid-free passivator!

Characteristics

FinishOne Passivator 630 passivate without nitric or citric acid. It helps to remove free iron from the surface and regenerate the protective layer in the stainless steel by speeding up the passivation process.

Standard applications

FinishOne Passivator 630 is intended for a wide range of industrial passivating applications. It offers a good general passivating result on stainless steel surfaces.

Surface restauration

Cleaner 401 can be used together with FinishOne Passivator 630, which helps regenerate the protective layer in the stainless steel by speeding up the thickness of the passive layer.

Features

- Restores the passivation layer on stainless steel surfaces that have been damaged during fabrication such as grinding, brushing, blasting etc or usage.
- Improves the result after pickling by speeding up the passivation process.
- Diminishes the risk of discoloured surfaces caused by flash clouds or free iron (smut) when used wet-on-wet.
- Reduces the formation of toxic nitric fumes during rinsing after pickling.
- Prevents water staining caused by poor rinse water.
- Creates no hazardous waste and contains no nitric acid.
- Is easy to handle and classified as non-dangerous goods.

Packaging

FinishOne Passivator 630 is supplied in 25 kg and 1000 kg IBC polyethylene containers.

Moly-Drop 960

Easy identifying of stainless steel grades

Characteristics

Moly-Drop 960 is an easy to use chemical test that helps differentiate 304 grade stainless steel from 316 grade.

Standard applications

With this simple chemical test you can check if your stock piece or scrap of stainless steel contains molybdenum. This makes it possible to differ the steel grades 304 and 316. The test will identify the grade within 5 – 10 minutes through a colour change.

Features

- Can be used on stainless steel 300 series material to test presence of molybdenum and thereby diffentiate grade 304 (no molybdenum) from 316 (with molybdenum).

Packaging

Moly-Drop 960 is supplied in 30 ml bottles (≈ 200 tests).

Duplex Pickling Spray 250

A unique, stronger and safer-to-use pickling spray

Standard applications

Duplex and other high-alloyed stainless steel

Duplex Pickling Spray 250 is tailor-made for spray pickling of larger surfaces of duplex and other high-alloyed stainless steel.

The pickling spray restores stainless steel surfaces that have been damaged during fabrication operations such as welding, forming, cutting, grinding and blasting. It removes weld oxides, the underlying chromium depleted layer and other defects that may cause local corrosion.

Passivation

To further improve the result we recommend passivating after pickling using FinishOne Passivator 630, which is a safer acid-free passivation method.

Features

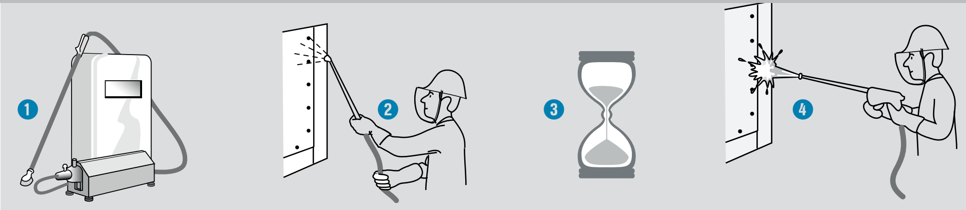
- Excellent results on high-alloyed stainless steel
- Low consumption of pickling product/m2
- Color indicates the covered area
- Excellent pickling results at low ambient temperatures

Packaging

Duplex Pickling Spray 250 is supplied in 30 kg polyethylene containers.

All packing material follows the UN regulations for hazardous goods.

Instructions for use



1. Pre-clean, remove oil and grease using Cleaner 401, and then rinse off with water.
2. Stir the solution before use. Apply the pickling spray with an acid-resistant pump, e.g. Membrane Pump SP-25. Spray evenly over the whole surface.
3. Pickling time depends on steel grade, temperature, surface finish and the welding method used. See typical pickling parameters in table.
4. Remove pickling residues using a high-pressure water jet and then rinse with water. The waste water should be treated before discharge.

Typical pickling parameters

Pickling product	**Duplex Pickling Spray 250**		
Material (EN)	LDX 2101 (1.4162)	2205 (1.4462)	2507 (1.4410)
Weld	FCAW	FCAW	GMAW
Temperature	16-18 °C	16-18 °C	16-18 °C
Pickling time	60 min	100 min	150 min
Consumption	7 m^2/kg		
Package	Package 1 jerrican @ 30 kg / 1 pallet 12 jerricans		

It is recommended not to use the product in direct sunlight or at high temperatures, as this may dry out the product and reduce the effect. Please observe the hazard and safety advice on the jerrican label.

Spray Pump SP-25

Customized pump system for Finishing Chemicals

Characteristics

Spray Pump SP-25 is specially designed for the demanding spraying of cleaning solutions. The SP-25 is a membrane pump made of acid resistant parts.

Standard applications

SP-25 is intended to use for the complete spray cleaning cycle required when cleaning stainless steel surfaces:

1. Cleaner, for pre-cleaning/degreasing
2. Pickling Spray, for spray pickling
3. Passivator, for passivation/decontamination

The same pump can be used for all products, the system require only to be rinsed with water between each product.

Features

- A ¼"diaphragm pump with a 3-6 bar air pressure. Insensitive to viscosity changes due to the possibility to regulate the air pressure.
- Best in class for spraying liquids. A low pulsation gives an even flow when applying the pickling spray.
- Reliable, with a long working life .Easy to dismantle and to clean.
- A typical flow rate of 2 l/min of pickling spray with nozzle Spray-jet SS 11006.
- An optimal max. spray height of 6 m.

Packaging

Moly-Drop 960 is supplied in 30 ml bottles (≈ 200 tests).

Welding consumables for aluminum and aluminum alloys

◆ Content

Stick electrodes

Product name	Si	Mn	Ti	Fe	Cu
UTP 48	11.80	0.04	0.18	0.80	0.23
UTP 49	0.40	1.30		0.30	
UTP 485	5.00				

GTAW rods

Product name	Si	Mn	Cr	Ti	Fe
Union 99,5 Ti	< 0.25	< 0.05		0.1 0.2	< 0.4
Union Al 99,7	< 0.20			< 0.03	< 0.25
Union AlMg 2,7 Mn 0,8	< 0.25	0.5 – 0.8	0.05 0.20	0.05 0.15	< 0.40
Union AlMg 3		0.10 – 0.6	< 0.3	< 0.15	
Union AlMg 4,5 Mn		0.6 – 1.0	0.05 – 0.25	< 0.15	
Union AlMg 4,5 Mn Zr		0.75 – 1.0	0.05 – 0.25	< 0.15	
Union AlMg 5		0.2 – 0.5	< 0.3	< 0.15	
Union AlMg 5 Mn Ti		0.5 1.0	0.05 0.20	0.05 0.20	< 0.4
Union AlMg 5 Mn		0.6 1.0	0.05 0.20	0.05 0.20	< 0.4
Union AlSi 5	4.5 – 6.0				
Union AlSi 10 Cu 4	9.3 10.7	< 0.15	< 0.15		
Union AlSi 12	11.0 – 13.0	< 0.15			

Solid wires

Product name	Si	Mn	Cr	V	Ti
Union 99,5 Ti	< 0.25				0.15
Union Al 99,7	< 0.20				< 0.03
Union AlMg 2,7 Mn 0,8		0.5 – 0.8	0.05 – 0.20		0.05 – 0.15
Union AlMg 3	< 0.4	< 0.5	< 0.3		< 0.15
Union AlMg 4,5 Mn		0.5 – 1.0	0.05 – 0.25		< 0.15
Union AlMg 4,5 Mn Zr	< 0.25	0.75 – 1.0	0.05 – 0.25		< 0.15
Union AlMg 5	< 0.25	0.05 0.2	0.05 0.2		0.06 0.2
Union AlMg 5 Mn		0.6 – 1.0	< 0.2		< 0.20
Union AlMg 5 Mn Ti		0.5 1.0	0.05 0.20		0.05 0.20
Union AlSi 5	4.5 – 6.0				
Union AlSi 7 Mg	6.5 7.5	< 0.05			0.04 0.15
Union AlSi 10 Cu 4	9.3 10.7	< 0.15	< 0.15		
Union AlSi 12	11.0 – 13.0	< 0.15			< 0.15
Union AlCu 6 Mn		0.2 – 0.4		0.05 0.15	0.1 – 0.2

Al	Mg	Zn
Bal.	0.04	0.08
Bal.		
95.00		

Cu	Al	Zr	Mg	Zn	Others
< 0.05	≥ 99.5		< 0.05	< 0.07	< 0.5
	min. 99.7				
	bal.		2.4 2.8		
	bal.		2.6 – 3.6		
	bal.		4.3 – 5.2		
	bal.	0.1 – 0.2	4.5 – 5.2		
	bal.		4.8 – 5.5		
	bal.		4.7 5.5	< 0.25	
	bal.		5.0 5.5	< 0.20	
	bal.				
3.3 4.7	bal.		< 0.15	< 0.2	
	bal.				

Fe	Cu	Al	Zr	Mg	Zn
< 0.40		min. 99.5			
< 0.25		min. 99.7			
		bal.		2.4 – 2.8	
< 0.4	< 0.1	bal.		2.6 – 3.6	< 0.2
		bal.		4.3 – 5.2	
		bal.	0.1 – 0.2	4.5 – 5.2	< 0.25
< 0.4	< 0.1	bal.		4.5 5.5	< 0.1
		Bal.		4.8 – 5.5	
< 0.4		bal.		4.7 5.5	< 0.25
		bal.			
< 0.1	< 0.05	bal.		0.5 0.8	
	3.3 4.7			< 0.15	< 0.2
< 0.6	< 0.3	bal.		< 0.1	< 0.2
	5.8 – 6.8	Bal.	0.10 – 0.25	< 0.02	

SMAW

UTP 48

Stick electrode, aluminium

Classifications

EN ISO 18273
E Al 4047 (AlSi12)

Characteristics and typical fields of application

UTP 48 contains 12% Si for welding of aluminium alloyed with copper, silicon, and magnesium. Also excellent for joining dissimilar grades of aluminium.

Unique self-lifting slag.

Pure white coating outlasts conventional products in moisture resistance.

Available in hermetically sealed aluminium tins

Base materials

EN AC-42100 G-AlSi7Mg 3.2371

EN AC-43000 G-AlSi10Mg 3.2381

EN AC-43200 G-AlSi10Mg(Cu) 3.2383

EN AC-43300 G-AlSi9Mg 3.2373

EN AC-44000 G-AlSi11 3.2211

EN AC-44200 G-AlSi12 3.2581

EN AC-47000 G-AlSi12(Cu) 3.2583

Typical analysis of all-weld metal

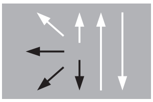
	Si	Mn	Ti	Fe	Cu	Al	Mg	Zn
wt.-%	11.8	0.04	0.18	0.8	0.23	Bal.	0.04	0.08

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	80	180	5

u untreated, as welded

Operating data



Polarity DC+

Dimension mm	Current A
2.5 × 350	50 – 80
3.2 × 350	70 – 120
4.0 × 350	110 – 150

Re-drying at bei 100°C, 1 – 1,5 h (not necessary straight out of the tin)

The stick electrode should be leaded almost at 90° to the base material, holding a short arc. For thicker walls (> 6 mm) pre-heating at 100 – 250°C is necessary to ensure a good bonding to the base material. If the seam is overarched the pre-heating was too low.

Approvals

CE

UTP 49

Stick electrode, aluminium

Classifications

EN ISO 18273 -	AWS A5.3 / SFA-5.3
E Al 3103 (AlMn1)	E3003

Characteristics and typical fields of application

UTP 49 for welding of aluminium alloyed with manganese and magnesium. Also excellent for joining dissimilar grades of aluminium.

Suitable for sea water applications.

Unique self-lifting slag.

Pure white coating outlasts conventional products in moisture resistance.

Available in hermetically sealed aluminium tins

Base materials

AlMn0.6 - 3.0506

AlMn 1 - 3.0515

AlMn 1 Mg0.5 - 3.0525

AlMn 1 Mg 1 - 3.0526

AlMg3 - 3.3535

Typical analysis of all-weld metal

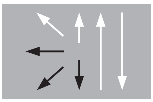
	Si	Mn	Fe	Al
wt.-%	0.4	1.3	0.3	Bal.

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	40	110 (≥ 95)	20

u untreated, as welded

Operating data



Polarity DC+

Dimension mm	Current A
2.5 × 355	50 - 90
3.2 × 355	70 – 120

Re-drying at 100°C, 1 – 1,5 h (not necessary straight out of the tin)

The stick electrode should be leaded almost at 90° to the base material, holding a short arc. For thicker walls (> 6 mm) pre-heating at 100 – 250°C is necessary to ensure a good bonding to the base material. If the seam is overarched the pre-heating was too low.

Approvals

CE

SMAW

UTP 485

Stick electrode, aluminium

Classifications

EN ISO 18273 -	AWS A5.3 / SFA-5.3
E Al 4043 (AlSi5)	E4043

Characteristics and typical fields of application

UTP 485 is an aluminium stick electrode with 5% Si and a special coating. It is suitable for joining and surfacing AlSi alloys with a Si content of up to 7% and for dissimilar joints of different Al-alloys, such as:

3.3206 AlMgSi 0.5 - 3.2371 G-AlSi 7 Mg

3.3210 AlMgSi 0.7 - 3.2341 G-AlSi 5 Mg

3.2315 AlMgSi 1 - 3.2151 G-AlSi 6 Cu 4

3.3211 AlMg 1 SiCu

UTP 485 is suitable for welding of plates of wall-thicknesses > 2 mm. The soft arc produces a flat, finely-rippled weld seam. Easy slag removal.

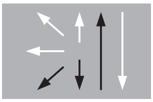
Typical analysis of all-weld metal

	Si	Al
wt.-%	5.0	95.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	> 40	> 120	> 8

Operating data



Polarity DC+

Dimension mm	Current A
2.5 × 355	50 – 70
3.2 × 355	80 – 100
4.0 × 355	90 – 130

The angle between plate and electrode should be kept between 80 - 90°. Weld with a short arc. Preheat bigger work pieces with wall thicknesses > 6 mm to 100 - 250°C in order to ensure a good fusion with the base metal. Raised weld seams indicate too low preheating temperatures.Re-drying: 1 - 1.5 hours at 100°C.

Approvals

-

Union 99,5 Ti

TIG Rod, aluminium

GTAW

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 1070 (Al99,7)	ER1070

Characteristics and typical fields of application

Pure aluminium welding rod for joining and surfacing of aluminium with maximum of 0.5% of alloyed elements. The welding consumable contains Ti for grain refinery. Base material should be cleaned near the seam.

Base materials

EN AW-1200 Al99,0 3.0205
EN AW-1050A Al99,5 3.0255
EN AW-1070A Al99,7 3.0275
EN AW-1350A E-Al 3.0257
and similar.

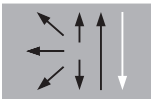
Typical analysis of the wire rod

	Si	Mn	Ti	Fe	Cu	Al	Mg	Zn	Others
wt.-%	< 0.25	< 0.05	0.1 - 0.2	< 0.4	< 0.05	≥ 99.5	< 0.05	< 0.07	< 0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	20	65	35

Operating data



Polarity	AC
Shielding gas (EN ISO 14175)	I1, I3

Dimension mm
2.4 × 1000
3.2 × 1000

Approvals

-

Union Al 99,7

TIG Rod, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 1070 (Al99,7)	ER1070

Characteristics and typical fields of application

Aluminium solid wire rod for welding of very pure aluminium materials according to EN ISO 18273 for applications in electro technical and mechanical construction, food and chemical industry.

Base materials

EN AW-1200 Al99 3.0205

EN AW-1050A Al99,5 3.0255

EN AW-1070A Al99,7 3.0275

EN AW-1350A E-Al 3.0257

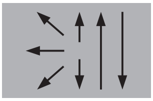
Typical analysis of the wire rod

	Si	Ti	Fe	Al
wt.-%	< 0.20	< 0.03	< 0.25	min. 99.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	20	65	35

Operating data



Polarity	AC
Shielding gas (EN ISO 14175)	I1, I3

Dimension mm
1.6 × 1000
2.0 × 1000
4.0 × 1000

Approvals

-

böhler welding by voestalpine

Union AlMg 2,7 Mn 0,8

TIG rod, Aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5554 (AlMg2,7Mn)	ER5554

Characteristics and typical fields of application

Solid wire for GTAW of AlMg alloys. The limited Mg-content of max. 2,8% to obtains intergranular corrosion resistance. Sea water resistant. Recommended for high temperature applications. For obtaining near matching coloured joints where anodizing is required.

Base materials

EN AW-5754 AlMg3 3.3535
EN AW-5454 AlMg2,7Mn 3.3537
EN AW-5251 AlMg2Mn0,3 3.3523
EN AW-5005A AlMg 3.3315
EN AW-3004A AlMn1Mg 3.0526
EN AC-51100 G-AlMg3 3.3541
and similar.

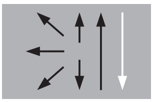
Typical analysis of the wire rod

	Si	Mn	Cr	Ti	Fe	Al	Mg
wt.-%	< 0.25	0.5 - 0.8	0.05 - 0.20	0.05 - 0.15	< 0.40	bal.	2.4 - 2.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	90	200	17

Operating data



Polarity	AC
Shielding gas (EN ISO 14175)	I1, I3

Dimension mm
1.6 x 1000
2.0 x 1000
2.4 x 1000
3.2 x 1000
4.0 x 1000

Approvals

-

GTAW

Union AlMg 3

TIG Rod, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5754 (AlMg3)	ER5754(mod.)

Characteristics and typical fields of application

Rods for GTAW of AlMg containing up to 3% Mg. Seawater resistant weld metal. Good colour matching with base metal after anodizing. Base material should be cleaned near the seam. Pre-heating 150°C for plates > 15 mm

Base materials

EN AW-5754 AlMg3 3.3535
EN AW-5251 AlMg2Mn0,3 3.3525
EN AW-500SA AlMg 3.3315
EN AW-6060 AlMgSi0,5 3.3206
EN AW-5454 AlMg2,7Mn 3.3537
EN AC-51100 G-AlMg3 3.3541
- G-AlMg3Si 3.3241

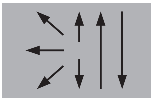
Typical analysis of the wire rod

	Mn	Cr	Ti	Al	Mg
wt.-%	0.10 – 0.6	< 0.3	< 0.15	bal.	2.6 – 3.6

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	80	180	18

Operating data



Polarity AC

Shielding gas (EN ISO 14175) I1

Dimension mm
1.6 × 1000
2.0 × 1000
2.4 × 1000
3.2 × 1000
4.0 × 1000

Approvals

-

Union AlMg 4,5 Mn

TIG Rod, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5183	ER5183

Characteristics and typical fields of application

TIG-rod for welding of AlMg alloys. The weld metal is resistant against sea water.

Base material should be cleaned near the seam. Pre-heating 150°C for plates > 15 mm

Base materials

EN AW-5083 AlMg4,5Mn 3.3547
EN AW-5086 AlMg4Mn 3.3545
EN AW-5019 AlMg5 3.3555
EN AW-6060 AlMgSi0,5 3.3206
EN AW-6005A AlMgSi0,7 3.3210
EN AW-6082 AlMgSi1 3.2315
EN AW-6061 AlMg1SiCu 3.3211
EN AW-7020 AlZn4,5Mg 3.4335
EN AC-51300 G-AlMg5 3.3561
EN AC-51400 G-AlMg5Si 3.3261

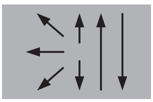
Typical analysis of the wire rod

	Mn	Cr	Ti	Al	Mg
wt.-%	0.6 – 1.0	0.05 – 0.25	< 0.15	bal.	4.3 – 5.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	125	275	17

Operating data



Polarity	AC
Shielding gas (EN ISO 14175)	I1

Dimension mm
1.6 × 1000
2.0 × 1000
2.4 × 1000
3.2 × 1000
4.0 × 1000

Approvals

TÜV (02196), DB (61.132.03), CE

Union AlMg 4,5 Mn Zr

TIG Rod, aluminium

GTAW

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5087 (AlMg4,5MnZr)	ER5087

Characteristics and typical fields of application

Zirconium micro-alloyed aluminium TIG rod. The weld metal is uncritical in terms of hot cracks. Suitable especially for complicated welding constructions with critical tensions. Base material should be cleaned near the seam. Pre-heating 150°C for plates > 15 mm

Base materials

EN AW-5083 AlMg4,5Mn 3.3547
EN AW-5086 AlMg4Mn 3.3545
EN AW-5019 AlMg5 3.3555
EN AW-6060 AlMgSi0,5 3.3206
EN AW-6005A AlMgSi0,7 3.3210
EN AW-6082 AlMgSi1 3.2315
EN AW-6061 AlMg1SiCu 3.3211
EN AW-7020 AlZn4,5Mg 1 3.4335
EN AC-51300 G-AlMg5 3.3561
EN AC-51400 G-AlMg5Si 3.3261

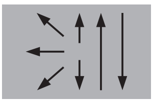
Typical analysis of the wire rod

	Mn	Cr	Ti	Al	Zr	Mg
wt.-%	0.75 – 1.0	0.05 – 0.25	< 0.15	bal.	0.1 – 0.2	4.5 – 5.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	125	275	17

Operating data



Polarity	AC
Shielding gas (EN ISO 14175)	I1

Dimension mm
1.6 × 1000
2.0 × 1000
2.4 × 1000
3.2 × 1000

Approvals

DB (61.132.04), CE

böhler welding by voestalpine

Union AlMg 5

TIG Rod, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5356 (AlMg5Cr(A))	ER5356

Characteristics and typical fields of application

Rods for GTAW of AlMg containing up to 5 % Mg. Seawater resistant weld metal.

Base material should be cleaned near the seam. Pre-heating 150 °C for plates > 15 mm

Base materials

EN AW-5019 AlMg5 3.3555
EN AW-5754 AlMg3 3.3535
EN AW-5086 AlMg4Mn 3.3545
EN AW-6060 AlMgSi0,5 3.3206
EN AW-6005A AlMgSi0,7 3.3210
EN AW-6082 AlMgSi1 3.2315
EN AW-6061 AlMg1SiCu 3.3211
EN AW-5454 AlMg2,7Mn 3.3537
EN AW-7020 AlZn4,5Mg1 3.4335
EN AC-51300 G-AlMg5 3.3561
EN AC-51400 G-AlMg5Si 3.3261
EN AC-51100 G-AlMg3 3.3541

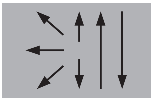
Typical analysis of the wire rod

	Mn	Cr	Ti	Al	Mg
wt.-%	0.2 – 0.5	< 0.3	< 0.15	bal.	4.8 – 5.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	110	240	17

Operating data



Polarity	AC
Shielding gas (EN ISO 14175)	I1

Dimension mm
1.6 × 1000
2.0 × 1000
2.4 × 1000
3.2 × 1000
4.0 × 1000
5.0 × 1000

Approvals

TÜV (02198), DB (61.132.01), CE

Union AlMg 5 Mn Ti

TIG rod, Aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5556 (AlMg5Mn1Ti(A))	ER5556

Characteristics and typical fields of application

Rod for GTAW of AlMg alloys containing up to 5% Mg. Seawater resistant weld metal. Susceptible to stress corrosion cracking if exposed to service temperatures >65°C. Good colour matching with base metal after anodizing. The welding consumable contains Ti for grain refinery. Thorough cleaning of the workpiece bevels is necessary prior to welding.

Base materials

EN AW-5019 AlMg5 3.3555
EN AW-5754 AlMg3 3.3535
EN AW-5086 AlMg4Mn 3.3545
EN AW-6060 AlMgSi0,5 3.3206
EN AW-6005A AlMgSi0,7 3.3210
EN AW-6082 AlMgSi1 3.2315
EN AW-6061 AlMg1SiCu 3.3211
EN AW-7020 AlZn4,5Mg 3.4335
EN AC-51300 G-AlMg5 3.3561
and similar.

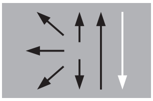
Typical analysis of the wire rod

	Mn	Cr	Ti	Fe	Al	Mg	Zn
wt.-%	0.5 - 1.0	0.05 - 0.20	0.05 - 0.20	< 0.4	bal.	4.7 - 5.5	< 0.25

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Impact values ISO-V KV J %
u	125	275	17

Operating data



Polarity AC

Shielding gas (EN ISO 14175) I1, I3

Dimension mm
1.6 x 1000
2.0 x 1000
2.4 x 1000
3.2 x 1000
4.0 x 1000

Approvals

-

böhler welding by voestalpine

Union AlMg 5 Mn

TIG rod, Aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5556A (AlMg5Mn1(A))	ER5556A

Characteristics and typical fields of application

Rod for GTAW of AlMg alloys containing up to 5% Mg. Seawater resistant weld metal. Susceptible to stress corrosion cracking if exposed to service temperatures > 65°C. Good colour matching with base metal after anodizing. Thorough cleaning of the workpiece bevels is necessary prior to welding.

Base materials

EN AW-5019 AlMg5 3.3555

EN AW-5754 AlMg3 3.3535

EN AW-5086 AlMg4Mn 3.3545

EN AW-6060 AlMgSi0,5 3.3206

EN AW-6005A AlMgSi0,7 3.3210

EN AW-6082 AlMgSi1 3.2315

EN AW-6061 AlMg1SiCu 3.3211

EN AW-7020 AlZn4,5Mg 3.4335

EN AC-51300 G-AlMg5 3.3561

and similar.

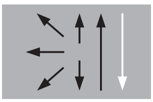
Typical analysis of the wire rod

	Mn	Cr	Ti	Fe	Al	Mg	Zn
wt.-%	0.6 - 1.0	0.05 - 0.20	0.05 - 0.20	< 0.4	bal.	5.0 - 5.5	< 0.20

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	125	275	17

Operating data



Polarity	AC
Shielding gas (EN ISO 14175)	I1, I3

Dimension mm
1.6
2.0
2.4
3.2
4.0

Approvals

CE

Union AlSi 5

TIG Rod, aluminium

Classifications

EN ISO 18273	**AWS A5.10 / SFA-5.10**
S Al 4043A (AlSi5(A))	ER4043A

Characteristics and typical fields of application

Rods for GTAW of AlSi containing up to 5% Si. Oxyacetylene welding respectively brazing with suitable fluxes possible. The weld metal is not suitable for anodizing for decorative purposes. Very fluid weld pool. Base material should be cleaned near the seam. Pre-heating 150 - 200°C for plates > 15 mm. Do not use for welding hardenable alloys is high stressed zones.

Base materials

EN AW-6060 AlMgSi0,5 3.3206

EN AW-6005A AlMgSi0,7 3.3210

EN AW-6082 AlMgSi1 3.2315

EN AW-6061 AlMg1SiCu 3.3211

EN AC-45000 G-AlSi6Cu4 3.2151

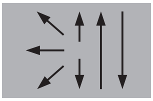
Typical analysis of the wire rod

	Si	Al
wt.-%	4.5 – 6.0	bal.

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	70	130	16

Operating data



Polarity	AC
Shielding gas (EN ISO 14175)	I1

Dimension mm
1.6 × 1000
2.0 × 1000
2.4 × 1000
3.2 × 1000
4.0 × 1000

Approvals

DB (61.132.02), CE

böhler welding by voestalpine

Union AlSi 10 Cu 4

TIG rod, Aluminium

Classifications

EN ISO 18273	AWS A.10 / SFA-5.10
S Al 4145 (AlSi10Cu4)	ER4145

Characteristics and typical fields of application

Rod for GTAW of AlCu alloys. Low melting point and excellent penetration characteristics. Provides superior wetting characteristics compared to Union AlCu 6 Mn when welding AlCu alloys, the strength, on the other hand, is lower. Superior resistance to stress corrosion cracking where high temperature properties are required. The weld metal is not suitable for anodizing for decorative purposes. Thorough cleaning of the workpiece bevels is necessary prior to welding.

Base materials

EN AW-2219 AlCu6Mn

EN AW-2014 AlCu4SiMg 3.1255

EN AW-2036 AlCu2,6Si0,5Mg0,3

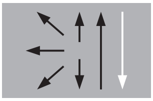
EN AC-45000 G-AlSi5Cu3

and similar.

Typical analysis of the wire rod

	Si	Mn	Cr	Cu	Al	Mg	Zn
wt.-%	9.3 - 10.7	< 0.15	< 0.15	3.3 - 4.7	bal.	< 0.15	< 0.2

Operating data



Polarity	AC
Shielding gas (EN ISO 14175)	I1, I3

Dimension mm
1.6 x 1000
2.0 x 1000
2.4 x 1000
3.2 x 1000
4.0 x 1000

Approvals

-

Union AlSi 12

TIG Rod, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 4047A (AlSi12(A))	ER4047A

Characteristics and typical fields of application

Rods for GTAW of AlSi containing more than 10% Si. Very fluid weld pool. The weld metal is not suitable for anodizing. Pre-heating 150 – 200°C for plates > 15 mm.

Base materials

EN AC-42100 G-AlSi7Mg 3.2371
EN AC-43000 G-AlSi10Mg 3.2381
EN AC-43200 G-AlSi10Mg(Cu) 3.2383
EN AC-43300 G-AlSi9Mg 3.2373
EN AC-44000 G-AlSi11 3.2211
EN AC-44200 G-AlSi12 3.2581
EN AC-47000 G-AlSi12(Cu) 3.2583

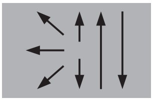
Typical analysis of the wire rod

	Si	Mn	Al
wt.-%	11.0 – 13.0	< 0.15	bal.

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	60	130	≥ 5

Operating data



Polarity	AC
Shielding gas (EN ISO 14175)	I1

Dimension mm
1.6 × 1000
2.0 × 1000
2.4 × 1000
3.2 × 1000

Approvals

-

Union 99,5 Ti

Solid Wire, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 1450 (Al99,5Ti)	ER1450

Characteristics and typical fields of application

Is a pure aluminium welding wire for joining and surfacing of aluminium materials according to EN ISO 18273. It is a welding consumable with Ti for grain refinement and weldable in all positions.

Base materials

Al99.5 3.0255

Al99.7 3.0275

Al99.8 3.0285

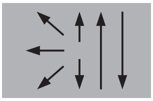
Typical analysis of the solid wire

	Si	Ti	Fe	Al
wt.-%	< 0.25	0.15	< 0.40	min. 99.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	20	65	35

Operating data



Dimension mm
1.2
1.6

Approvals

-

Union Al 99,7

Solid Wire, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 1070 (Al99,7)	ER1070

Characteristics and typical fields of application

Aluminium solid wire for welding of very pure aluminium materials according to EN ISO 18273 for applications in electro technical and mechanical construction, food and chemical industry.

Base materials

EN AW-1200 Al99 3.0205

EN AW-1050A Al99,5 3.0255

EN AW-1070A Al99,7 3.0275

EN AW-1350A E-Al 3.0257

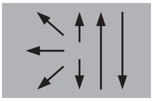
Typical analysis of the solid wire

	Si	Ti	Fe	Al
wt.-%	< 0.20	< 0.03	< 0.25	min. 99.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	20	65	35

Operating data



Dimension mm
1.0

Approvals

-

böhler welding by voestalpine

Union AlMg 2,7 Mn 0,8

Solid Wire, aluminium

Classifications

EN ISO 18273	**AWS A5.10 / SFA-5.10**
S Al 5554 (AlMg2,7Mn)	ER5554

Characteristics and typical fields of application

Rods for GTAW of AlMg alloys. Mg-content max. 2,8% to obtain intergranular corrosion resistance.

Seawater resistant weld metal. For obtaining near matching coloured joints where anodizing is required. Pre-heating 150°C for plates > 15 mm

Base materials

EN AW-5754 AlMg3 3.3535

EN AW-5454 AlMg2,7Mn 3.3537

EN AW-5251 AlMg2Mn0,3 3.3525

EN AW-500SA AlMg 3.3315

EN AW-3004A AlMn1Mg1 3.0526

EN AC-51100 G-AlMg3 3.3541

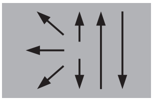
Typical analysis of the solid wire

	Mn	Cr	Ti	Al	Mg
wt.-%	0.5 – 0.8	0.05 – 0.20	0.05 – 0.15	bal.	2.4 – 2.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	90	200	17

Operating data



Dimension mm
1.2
1.6
2.4

Approvals

-

Union AlMg 3

Solid Wire, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5754 (AlMg3)	ER5754

Characteristics and typical fields of application

Solid wire for AlMg alloys containing up to 3% Mg. Seawater resistant weld metal. Good colour matching with base metal after anodizing. Thorough cleaning of the workpiece bevels is necessary. Thicker plate materials require preheating to 150°C.

Base materials

AlMg 3 3.3535 EN AW-5754

AlMg 2 Mn 0.3 3.3525 EN AW-5251

AlMg 3.3315 EN AW-500SA

AlMgSi 0.5 3.3206 EN AW-6060

AlMg 2.7 Mn 3.3537 EN AW-5454

G-AlMg 3 3.3541 EN AC-51100

G-AlMg 3 Si 3.3241 -

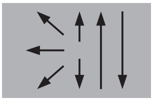
Typical analysis of the solid wire

	Si	Mn	Cr	Ti	Fe	Cu	Al	Mg	Zn
wt.-%	< 0.4	< 0.5	< 0.3	< 0.15	< 0.4	< 0.1	bal.	2.6 – 3.6	< 0.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	80	190	20

Operating data



Dimension mm
1.0
1.2
1.6

Approvals

-

Union AlMg 4,5 Mn

Solid Wire, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5183 (AlMg 4,5Mn0,7(A))	ER5183

Characteristics and typical fields of application

Solid wire for GMAW and GTAW of AlMg alloys. The weld metal is resistant against sea water.

Base material should be cleaned near the seam. Pre-heating 150°C for plates > 15 mm

Base materials

EN AW-5083 AlMg4,5Mn 3.3547
EN AW-5086 AlMg4Mn 3.3545
EN AW-5019 AlMg5 3.3555
EN AW-6060 AlMgSi0,5 3.3206
EN AW-6005A AlMgSi0,7 3.3210
EN AW-6082 AlMgSi1 3.2315
EN AW-6061 AlMg1SiCu 3.3211
EN AW-7020 AlZn4,5Mg 3.4335
EN AC-51300 G-AlMg5 3.3561
EN AC-51400 G-AlMg5Si 3.3261

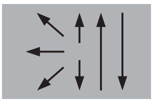
Typical analysis of the solid wire

	Mn	Cr	Ti	Al	Mg
wt.-%	0.5 – 1.0	0.05 – 0.25	< 0.15	bal.	4.3 – 5.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	125	275	17

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

TÜV (02195), DB (61.132.03), ABS, BV, DNV GL, LR, CE

Union AlMg 4,5 Mn Zr

Solid Wire, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5087 (AlMg4,5MnZr)	ER5087

Characteristics and typical fields of application

Zirconium micro-alloyed aluminium wire. The weld metal is uncritical in terms of hot cracks. Suitable especially for complicated welding constructions with critical tensions. Base material should be cleaned near the seam. Pre-heating 150°C for plates > 15 mm

Base materials

EN AW-5083 AlMg4,5Mn 3.3547
EN AW-5086 AlMg4Mn 3.3545
EN AW-5019 AlMg5 3.3555
EN AW-6060 AlMgSi0,5 3.3206
EN AW-6005A AlMgSi0,7 3.3210
EN AW-6082 AlMgSi1 3.2315
EN AW-6061 AlMg1SiCu 3.3211
EN AW-7020 AlZn4,5Mg 1 3.4335
EN AC-51300 G-AlMg5 3.3561
EN AC-51400 G-AlMg5Si 3.3261

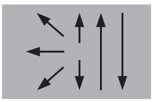
Typical analysis of the solid wire

	Si	Mn	Cr	Ti	Al	Zr	Mg	Zn
wt.-%	< 0.25	0.75 – 1.0	0.05 – 0.25	< 0.15	bal.	0.1 – 0.2	4.5 – 5.2	< 0.25

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	125	275	16

Operating data



Dimension mm
1.2

Approvals

DB (61.132.04), DNV GL, CE

böhler welding by voestalpine

Union AlMg 5

Solid wire, Aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5356 (AlMg5Cr(A))	ER5356

Characteristics and typical fields of application

Solid wire for AlMg alloys containing up to 5% Mg. Seawater resistant weld metal. Good colour matching with base metal after anodizing. Thorough cleaning of the workpiece bevels is necessary.

Thicker plate materials require preheating to 150°C.

Base materials

EN AW-5019 AlMg5 3.3555
EN AW-5754 AlMg3 3.3535
EN AW-5086 AlMg4Mn 3.3545
EN AW-6060 AlMgSi0,5 3.3206
EN AW-6005A AlMgSi0,7 3.3210
EN AW-6082 AlMgSi1 3.2315
EN AW-6061 AlMg1SiCu 3.3211
EN AW-5454 AlMg2,7Mn 3.3537
EN AW-7020 AlZn4,5Mg1 3.4335
EN AC-51300 G-AlMg5 3.3561
EN AC-51400 G-AlMg5Si 3.3261
EN AC-51100 G-AlMg3 3.3541

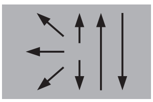
Typical analysis of the solid wire

	Si	Mn	Cr	Ti	Fe	Cu	Al	Mg	Zn
wt.-%	< 0.25	0.05 - 0.2	0.05 - 0.2	0.06 - 0.2	< 0.4	< 0.1	bal.	4.5 - 5.5	< 0.1

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	110	240	17

Operating data



Dimension mm
0.8
1.0
1.2
1.6

Approvals

TÜV (02197), DB (61.132.01), ABS, BV, DNV GL, LR, CE

Union AlMg 5 Mn

Solid Wire, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5556A (AlMg5Mn1(A))	ER5556A

Characteristics and typical fields of application

Solid wire for GMAW of AlMg alloys containing up to 5% Mg. Seawater resistant weld metal. Susceptible to stress corrosion cracking if exposed to service temperatures > 65°C. Good colour matching with base metal after anodizing. Thorough cleaning of the workpiece bevels is necessary prior to welding.

Base materials

EN AW-5019 AlMg5 3.3555
EN AW-5754 AlMg3 3.3535
EN AW-5086 AlMg4Mn 3.3545
EN AW-6060 AlMgSi0,5 3.3206
EN AW-6005A AlMgSi0,7 3.3210
EN AW-6082 AlMgSi1 3.2315
EN AW-6061 AlMg1SiCu 3.3211
EN AW-7020 AlZn4,5Mg 3.4335
EN AC-51300 G-AlMg5 3.3561
and similar.

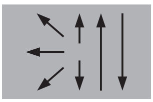
Typical analysis of the solid wire

	Mn	Cr	Ti	Al	Mg
wt.-%	0.6 – 1.0	< 0.2	< 0.20	Bal.	4.8 – 5.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Electrical conductivity Sm/mm²
u	125	275	17	14 - 19

Operating data



Dimension mm
1.2
1.6

Approvals

-

Union AlMg 5 Mn Ti

Solid wire, Aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 5556 (AlMg5Mn1Ti(A))	ER5556

Characteristics and typical fields of application

Solid wire for GMAW of AlMg alloys containing up to 5% Mg. Seawater resistant weld metal. Susceptible to stress corrosion cracking if exposed to service temperatures > 65°C. Good colour matching with base metal after anodizing. The welding consumable contains Ti for grain refinery. Thorough cleaning of the workpiece bevels is necessary prior to welding.

Base materials

EN AW-5019 AlMg5 3.3555
EN AW-5754 AlMg3 3.3535
EN AW-5086 AlMg4Mn 3.3545
EN AW-6060 AlMgSi0,5 3.3206
EN AW-6005A AlMgSi0,7 3.3210
EN AW-6082 AlMgSi1 3.2315
EN AW-6061 AlMg1SiCu 3.3211
EN AW-7020 AlZn4,5Mg 3.4335
EN AC-51300 G-AlMg5 3.3561
and similar.

Typical analysis of the solid wire

	Mn	Cr	Ti	Fe	Al	Mg	Zn
wt.-%	0.5 - 1.0	0.05 - 0.20	0.05 - 0.20	< 0.4	bal.	4.7 - 5.5	< 0.25

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	125	275	17

Operating data

Dimension mm
1.0
1.2
1.6

Approvals

-

GMAW

Union AlSi 5

Solid Wire, aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 4043A (AlSi5(A))	ER4043A

Characteristics and typical fields of application

Rods for GTAW of AlSi containing up to 5% Si. Oxyacetylene welding respectively brazing with suitable fluxes possible. The weld metal is not suitable for anodizing for decorative purposes. Very fluid weld pool. Base material should be cleaned near the seam. Pre-heating 150 - 200°C for plates > 15 mm. Do not use for welding hardenable alloys is high stressed zones.

Base materials

EN AW-6060 AlMgSi0,5 3.3206

EN AW-6005A AlMgSi0,7 3.3210

EN AW-6082 AlMgSi1 3.2315

EN AW-6061 AlMg1SiCu 3.3211

EN AC-45000 G-AlSi6Cu4 3.2151

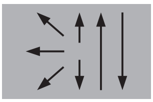
Typical analysis of the solid wire

	Si	Al
wt.-%	4.5 – 6.0	bal.

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	70	130	16

Operating data



Polarity DC+

Shielding gas (EN ISO 14175) I1, I3

Dimension mm
1.0
1.2
1.6
2.4

Approvals

DB (61.132.02), CE

Union AlSi 7 Mg

Solid wire, Aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 4018 (AlSi7Mg)	ER4018

Characteristics and typical fields of application

Union AlSi 7 Mg is a modified 4010 alloy (alloy 4008) with low levels of impurities, specially designed for joining or repairing of 7% Si aluminium cast components like 356.0, A356.0 and A357.0.

The mechanical properties can be increased by heat treatment. Thorough cleaning of the workpiece bevels is necessary prior to welding.

Base materials

EN AC-42000

EN AC-42100

EN AC-42200

and similar.

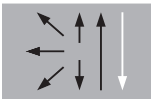
Typical analysis of the solid wire

	Si	Mn	Ti	Fe	Cu	Al	Mg
wt.-%	6.5 - 7.5	< 0.05	0.04 - 0.15	< 0.1	< 0.05	bal.	0.5 - 0.8

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	55	165	18

Operating data



Polarity	DC+
Shielding gas (EN ISO 14175)	I1, I3

Dimension mm
1.2
1.6

Approvals

-

Union AlSi 10 Cu 4

Solid wire, Aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 4145 (AlSi10Cu4)	ER4145

Characteristics and typical fields of application

Solid wire for GMAW of AlCu alloys. Low melting point and excellent penetration characteristics. Provides superior wetting characteristics compared to Union AlCu 6 Mn when welding AlCu alloys, the strength, on the other hand, is lower. Superior resistance to stress corrosion cracking where high temperature properties are required. The weld metal is not suitable for anodizing for decorative purposes. Thorough cleaning of the workpiece bevels is necessary prior to welding.

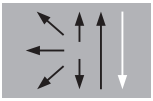
Base materials

EN AW-2219 AlCu6Mn
EN AW-2014 AlCu4SiMg 3.1255
EN AW-2036 AlCu2,6Si0,5Mg0,3
EN AC-45000 G-AlSi5Cu3
and similar.

Typical analysis of the solid wire

	Si	Mn	Cr	Cu	Mg	Zn
wt.-%	9.3 - 10.7	< 0.15	< 0.15	3.3 -4.7	< 0.15	< 0.2

Operating data



		Dimension mm
Polarity	DC+	1.0
Shielding gas (EN ISO 14175)	I1, I3	1.2
		1.6

Approvals

-

Union AlSi 12

Solid Wire, aluminium

Classifications

EN ISO 18273	**AWS A5.10 / SFA-5.10**
S Al 4047A (AlSi12(A))	ER4047A

Characteristics and typical fields of application

Is used for aluminium-silicium casting alloy with a Si-content up to 12%. Good mechanical characteristics, an excellent corrosion resistance and a low melting point ensure high quality welding results.

Base materials

G-AlSi12, G-AlSi10Mg(Cu), G-AlSi11, G-AlSi5Mg, G-AlSi7Mg, ,G-AlSi6Cu 4, AlMgSi0.8, 3.2581, 3.2383, 3.2373

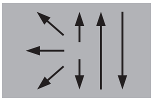
Typical analysis of the solid wire

	Si	Mn	Ti	Fe	Cu	Al	Mg	Zn	Be
wt.-%	11.0 – 13.0	< 0.15	< 0.15	< 0.6	< 0.3	bal.	< 0.1	< 0.2	< 0.0003

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Melting range °C
u	60	130	≥ 5	573 – 585

Operating data



Polarity	DC+
Shielding gas (EN ISO 14175)	I1, I3

Dimension mm
1.0
1.2
1.6

Approvals

-

Union AlCu 6 Mn

Solid wire, Aluminium

Classifications

EN ISO 18273	AWS A5.10 / SFA-5.10
S Al 2319 (AlCu6MnZrTi)	ER2319

Characteristics and typical fields of application

Solid wire for GMAW of AlCu alloys. Provides higher strength and better ductility than AlSi filler alloys when welding AlCu alloys. Superior resistance to stress corrosion cracking where high temperature properties are required. Thorough cleaning of the workpiece bevels is necessary prior to welding.

Base materials

EN AW-2219 AlCu6Mn
EN AW-2014 AlCu4SiMg 3.1255
EN AW-2036 AlCu2,6Si0,5Mg0,3
EN AC-45000 G-AlSi5Cu3
and similar.

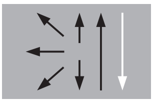
Typical analysis of the solid wire

	Mn	V	Ti	Cu	Al	Zr	Mg
wt.-%	0.2 – 0.4	0.05 - 0.15	0.1 – 0.2	5.8 – 6.8	Bal.	0.10 – 0.25	< 0.02

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	150	250	12
u			

Operating data



Polarity DC+

Shielding gas (EN ISO 14175) I1, I3

Dimension mm
1.2

Approvals

-

Welding consumables for titanium and titanium alloys

◆ Content

GTAW rods

Product name	C	Ni	Mo	V	N	Ti	Fe	Al	H	O
BÖHLER ER Ti 2-IG	< 0.03				< 0.015	Bal.	< 0.12		< 0.008	0.10
BÖHLER ER Ti 5-IG	< 0.05			3.5 – 4.5	< 0.03	Bal.	< 0.15	5.5 – 6.75	< 0.010	0.12 – 0.20
BÖHLER ER Ti 7-IG	< 0.03				< 0.015	Bal.	< 0.12		< 0.008	0.08 – 0.16
BÖHLER ER Ti 12-IG	< 0.03	0.6 – 0.9	0.2 – 0.4		< 0.015	Bal.	< 0.15		< 0.008	0.08 – 0.16

BÖHLER ER Ti 2-IG

TIG rod, Titanium alloy

Classifications

EN ISO 24034	AWS A5.16 / SFA-5.16	Material-No.
S Ti 0120 (Ti99,6)	ERTi-2	3.7035

Characteristics and typical fields of application

GTAW rod for welding pure Titanium and Titanium alloys with similar chemical composition. Suited for welding Titanium grades 1 to 4. Material Nr. 3.7035

Base materials

Pure Titanium and Titanium alloys with a similar composition.

ASTM Grade 1-4

UNS R50400H

Typical analysis of the wire rod

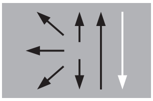
	C	N	Ti	Fe	H	O
wt.-%	< 0.03	< 0.015	bal.	< 0.12	< 0.008	0.10

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	295*	500*	42*	76*

u untreated, as welded – shielding gas 100 % Argon
* depend of the pollutants in the weld metal

Operating data



Polarity	DC –
Shielding gas (EN ISO 14175)	I1

Dimension mm
1.6 × 1000
2.0 × 1000
2.4 × 1000
3.0 × 1000

TIG welding of titanium requires a high standard of cleanness and an additional gas protection to avoid any contact of the weld pool and cooling weld bead with air.

Approvals

-

BÖHLER ER Ti 5-IG

TIG rod, Titanium alloy

Classifications

EN ISO 24034	**AWS A5.16 / SFA-5.16**	**Material-No.**
S Ti 6402 (TiAl6V4B)	ERTi-5	3.7165

Characteristics and typical fields of application

GTAW rod for welding pure Titanium and Titanium alloys with similar chemical composition. Good weldability and can be heat treated for higher strength or toughness. ER Ti 5-IG is used in aircraft components, medical, marine, and chemical process industry.

Base materials

Titanium alloys with a similar composition.

UNS R56402

Typical analysis of the wire rod

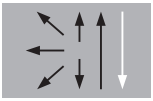
	C	V	N	Ti	Fe	Al	H	O
wt.-%	< 0.05	3.5 - 4.5	< 0.03	bal.	< 0.15	5.5 - 6.75	< 0.010	0.12 - 0.20

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %
u	830 / 120 ksi*	895 / 130 ksi*	10

u untreated, as welded – shielding gas 100 % Argon
* depend of the pollutants in the weld metal

Operating data



Polarity	DC –
Shielding gas (EN ISO 14175)	I1

Dimension mm
1.6 x 1000
2.0 x 1000
2.4 x 1000
3.0 x 1000

TIG welding of titanium requires a high standard of cleanness and an additional gas protection to avoid any contact of the weld pool and cooling weld bead with air.

Approvals

-

BÖHLER ER Ti 7-IG

TIG rod, Titanium alloy

Classifications

EN ISO 24034	AWS A5.16 / SFA-5.16	Material-No.
ERTi-7	ERTi-7	3.7235

Characteristics and typical fields of application

GTAW rod for welding pure Titanium and Titanium alloys with similar chemical composition. The small quantity of Palladium added gives it enhanced crevice corrosion resistance at low temperatures. ER Ti 7-IG can used for welding grade 2 or grade 16 titanium with improved corrosion performance. Chemical process and production equipment components. Werkstoff Nr. 3.7235

Base materials

Pure Titanium and Titanium alloys with a similar composition.

ASTM Grade 1-4; 16

UNS R52401

Typical analysis of the wire rod

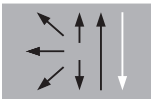
	C	N	Ti	Fe	H	O
wt.-%	< 0.03	< 0.015	bal.	< 0.12	< 0.008	0.08 - 0.16

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	275 / 40 ksi*	345 / 50 ksi*	20

u untreated, as welded – shielding gas 100 % Argon
* depend of the pollutants in the weld metal

Operating data



		Dimension mm
Polarity	DC –	1.6 x 1000
Shielding gas (EN ISO 14175)	I1	2.0 x 1000
		2.4 x 1000
		3.0 x 1000

TIG welding of titanium requires a high standard of cleanness and an additional gas protection to avoid any contact of the weld pool and cooling weld bead with air.

Approvals

-

BÖHLER ER Ti 12-IG

TIG rod, Titanium alloy

Classifications

EN ISO 24034	AWS A5.16 / SFA-5.16	Material-No.
S Ti 3401 (TiNi0,7Mo0,3)	ERTi-12	3.7105

Characteristics and typical fields of application

GTAW rod for welding pure Titanium and Titanium alloys with similar chemical composition.

Provides enhanced crevice corrosion resistance at higher temperatures. Pressure vessels, piping, corrosion applications. Werkstoff Nr. 3.7105

Base materials

Titanium alloys with a similar composition.

UNS R53400

Typical analysis of the wire rod

	C	Ni	Mo	N	Ti	Fe	H	O
wt.-%	< 0.03	0.6 - 0.9	0.2 - 0.4	< 0.015	bal.	< 0.15	< 0.008	0.08 - 0.16

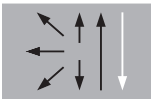
Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength R_e MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %
u	345 / 50 ksi*	485 / 70 ksi*	12

u untreated, as welded – shielding gas 100 % Argon

* depend of the pollutants in the weld metal

Operating data



Polarity	DC –
Shielding gas (EN ISO 14175)	I1

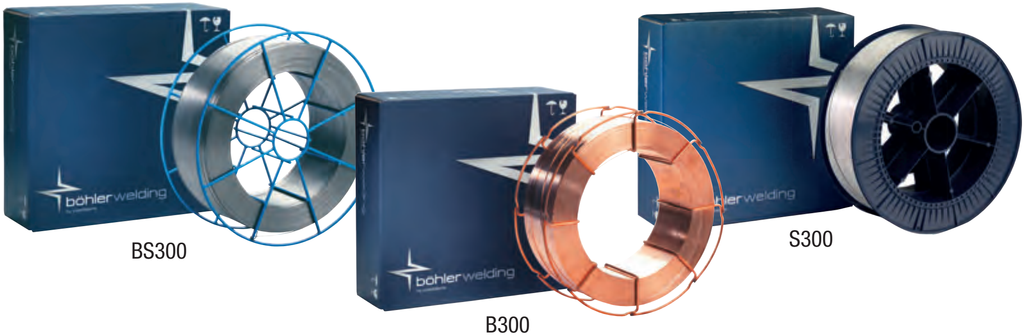
Dimension mm
1.6
2.0
2.4
3.0

TIG welding of titanium requires a high standard of cleanness and an additional gas protection to avoid any contact of the weld pool and cooling weld bead with air.

Approvals

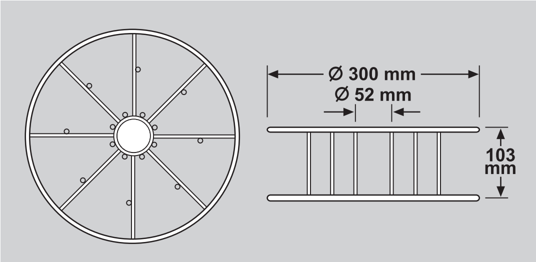
-

Spool body for MIG / MAG wire electrodes
according to EN ISO 544



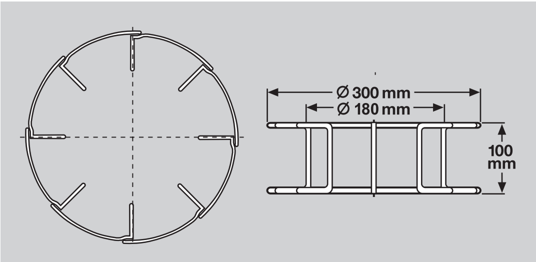
Basket spool BS300

according to EN ISO 544:	BS300-15
Wire weight:	15, 18 kg
Material:	Steel wire, coated
Variants:	blue - high-alloyed, copper-free - NC, copper-plated - standard



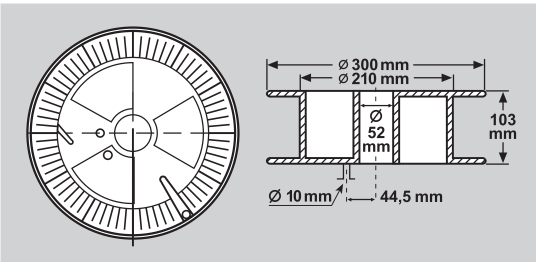
Basket spool adapter B300

according to EN ISO 544:	B300-15
Wire weight:	15, 18 kg
Material:	Steel wire, copper-plated
Variants:	copper-plated



Spool S300

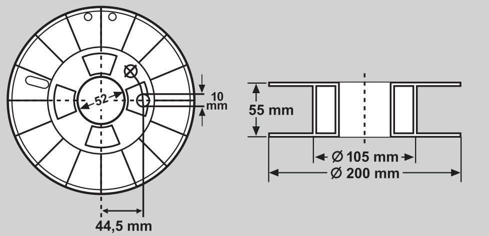
according to EN ISO 544:	S300-15
Wire weight:	15, 18 kg
Material:	Plastic
Variants:	black blue - cored wire, aluminium



Spool body for MIG / MAG wire electrodes
according to EN ISO 544

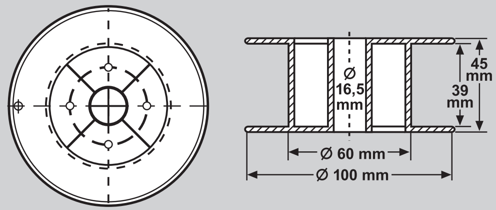
Spool S200

according to EN ISO 544:	S200-5
Wire weight:	5 kg
Material:	Plastic



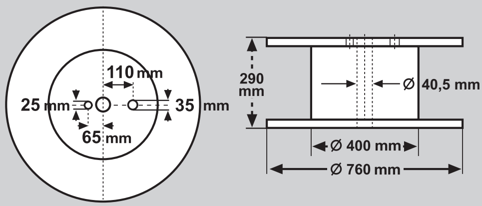
Spool S100

according to EN ISO 544:	S100-1
Wire weight:	1 kg
Material:	Plastic



Spool S760S

according to EN ISO 544:	S760S-300
Wire weight:	300 kg
Material:	Metal



Drum systems

ECOdrum™
BASEdrum™ / CLIMAdrum™

BASEdrum™ 250

Dimensions:	Ø 520 x 720 mm (Ø 520 x 749 mm with hood)
Main advantage:	For difficult transport conditions and working environments

ECOdrum™ 250

Dimensions:	Ø 520 x 870 mm (Ø 520 x 1165 mm with hood)
Main advantage:	Environmentally friendly and easy to dispose of

ECOdrum™ 400

Dimensions:	Ø 600 x 980 mm (Ø 600 x 1280 mm with hood)
Main advantage:	Environmentally friendly and easy to dispose of

SQUAREdrum™ 300

Dimensions:	550 x 550 x 925 mm (550 x 550 x 1215 mm with hood)
Main advantage:	Highest productivity for continuous welding

SQUAREdrum™ 550

Dimensions:	720 x 720 x 1080 mm (720 x 720 x 1140 mm with hood)
Main advantage:	Highest productivity for continuous welding

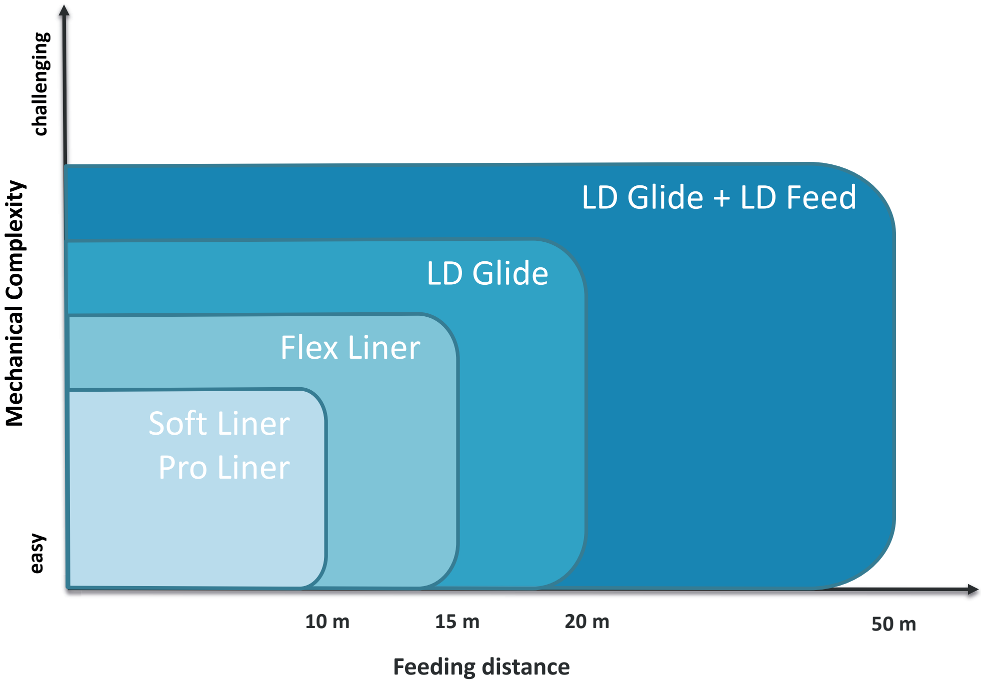
CLIMAdrum™ 250

Dimensions:	Ø 520 x 720 mm (Ø 520 x 749 mm with hood)
Main advantage:	Reliable welding under difficult climatic conditions

SAWdrum™ 350

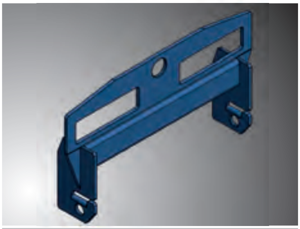
Dimensions:	Ø 570 x 900 mm
Main advantage:	High productivity and wire protection

Drum accessories



böhler welding by voestalpine

Accessories for safe transport and easy installation



Böhler Welding Lift 250
Part No.: 28373

Trolley universal
Part No.: 86594

Hood universal
Part No.: 25254

Böhler Welding Pro Liner Connect

Pro Liner Connect
– ready to use –

4 m	Part No.: 44012
8 m	Part No.: 44013
12 m	Part No.: 44015

Connectors pre-assembled

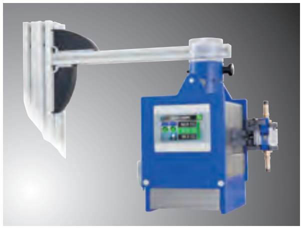
Installation Guide
www.youtube.com/watch?v=SDf_Fzh9NBo

Böhler Welding Soft Liner Connect

Soft Liner Stainless Connect
– ready to use –

4 m	Part No.: 44018
8 m	Part No.: 44019
12 m	Part No.: 44020

Connectors pre-assembled



Böhler Welding LD Feed
Part No.: 24584

Böhler Welding Flex Liner

Flex Liner

4 m	Part No.: 44018
8 m	Part No.: 44019
12 m	Part No.: 44020
30,5 m	Part No.: 44020

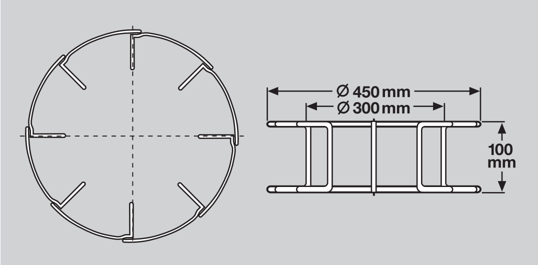
Connectors to be ordered separately

Böhler Welding LD Glide
Part No.: 82392

Spool body for SA wire
according to EN ISO 544

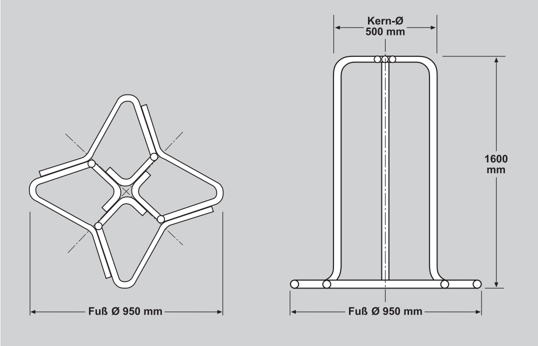
Basket spool adapter B450

according to EN ISO 544:	B450-25
Wire weight:	25 kg



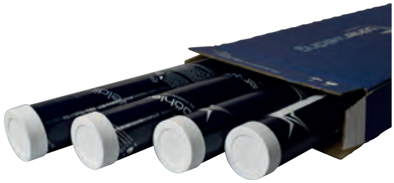
Tube crown for SA wire electrodes

Weight:	400 – 1000 kg
Material:	Tubular frame



Tube packaging for TIG welding sticks

Cardboard tube		
Length:	1000 mm	
Unit:	5 kg VPE	20 kg VKE
Quantity:	1 tube	4 tubes
Dimensions (mm):	L 1015 x Ø 45	L 1025 x H 54 x B 190
Material:	Cardboard tube with integrated VCI film	Corrugated board outer carton



VPE = smallest packaging unit / VKE = smallest sales unit

Packaging for stick electrodes

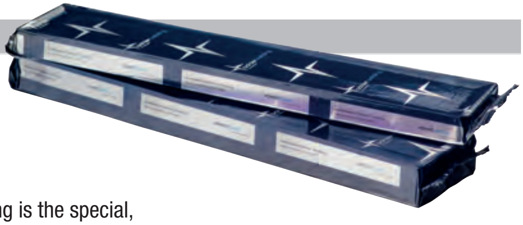
Unalloyed and low-alloyed stick electrodes*				
Box size (mm)	257 x 75 x 59	307 x 75 x 59	357 x 75 x 59	457 x 75 x 59
Electrode length (mm)	250	300	350	450
Carton size (mm)	274 x 268 x 85	324 x 268 x 85	374 x 268 x 85	474 x 268 x 85

4 boxes per outer carton, approx. 4 kg per box.

* Other packaging available.

Packaging for stick electrodes

Dry System



Böhler DrySystem vacuum packaging for stick electrodes represents safe and easy storage and handling under all climatic conditions. Even demanding processing regulations, e.g. in the offshore industry, are reliably met.
The core of the Böhler DrySystem vacuum packaging is the special, multilayer aluminium composite film that is impermeable to vapour. This particularly high-quality packaging ensures perfect welding properties and a reliably low hydrogen content of the stick electrodes under almost all storage conditions. The stick electrodes can be processed directly from the packaging without drying.
The special Böhler welding stick electrodes with moisture-resistant sheath (AWS...H4R - classification) can be processed up to 9 hours after opening the packaging without drying.
The packaging sizes are adapted to the consumption per working shift.

Packaging	Electrode length
DrySys 20	250 mm
	300 mm
	350 mm

12 DrySys packages in an outer carton

Packaging	Electrode length
DrySys 30	300 mm
	350 mm
	450 mm

8 DrySys packages in an outer carton

Stick electrodes for pipeline welding*

Hermetically sealed metal tins, 2 tins per carton, approx. 9 kg per tin

Medium and high-alloyed stick electrodes

Tin size (mm)	73 x 309	73 x 359	73 x 459
Electrode length (mm)	250 & 300	350	450
Carton size (mm)	337 x 238 x 85	387 x 238 x 89	501 x 237 x 80

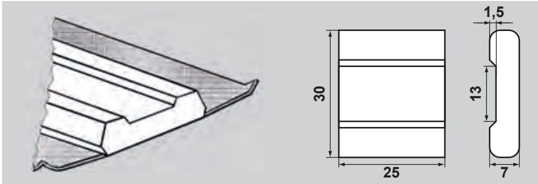
The Böhler Welding metal tin reliably protect the electrodes from moisture and mechanical damage even under harsh conditions - ideal for use on construction sites. The electrodes can be processed directly from the tin without drying.

* Other packaging available.

The most commonly used ceramic weld backing
other types on request

AG 600/5 R

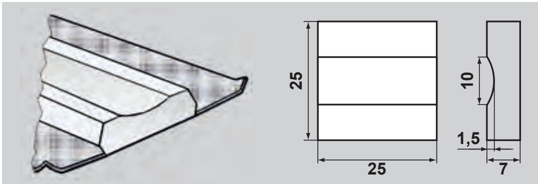
Length:	600 mm
Part No.:	71325
Packaging unit:	42 pcs / carton 25.2 m / carton



Ceramic with trapezoidal groove for butt joints and V-seams; glued on self-adhesive aluminium tape

BG 600/1 R

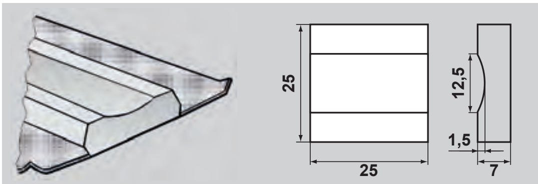
Length:	600 mm
Part No.:	71111
Packaging unit:	42 pcs / carton 25.2 m / carton



Ceramic with semicircular groove for butt joints and V-seams; glued on self-adhesive aluminium tape

BG 600/2 R

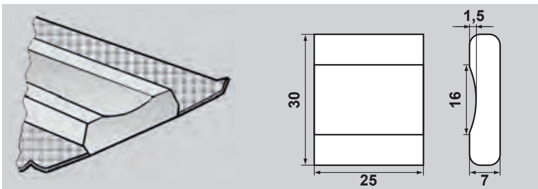
Length:	600 mm
Part No.:	70893 on request
Packaging unit:	42 pcs / carton 25.2 m / carton



Ceramic with semicircular groove for butt joints and V-seams; glued on self-adhesive aluminium tape

BG 600/4 R

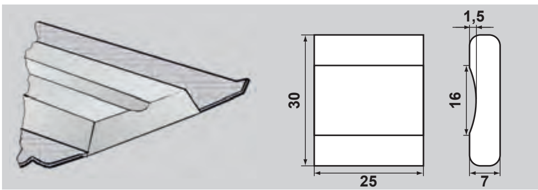
Length:	600 mm
Part No.:	70149 on request
Packaging unit:	42 pcs / carton 25.2 m / carton



Ceramic with semicircular groove for butt joints and V-seams; glued on self-adhesive aluminium tape

BG 600/8 R

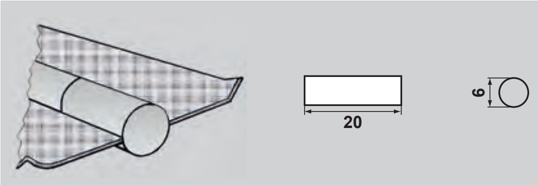
Length:	600 mm
Part No.:	71110 on request
Packaging unit:	42 pcs / carton 25.2 m / carton



Ceramic with semicircular groove for butt joints and V-seams; glued on self-adhesive aluminium tape

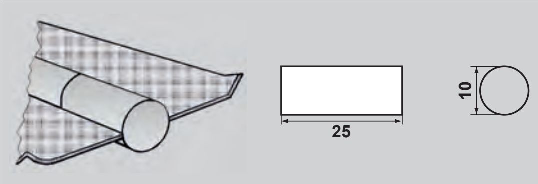
The most commonly used ceramic weld backing
other types on request

DG 600/1 R	
Length:	600 mm
Part No.:	70220
Packaging unit:	100 pcs / carton 60 m / carton



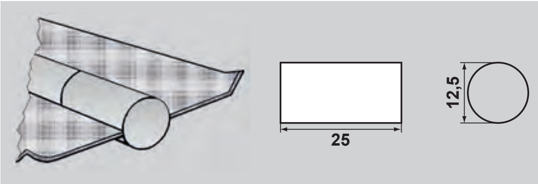
Ceramic with cylindrical shape for X-seams and fillet welds; glued on self-adhesive aluminium tape

DG 600/2 R	
Length:	600 mm
Part No.:	70221
Packaging unit:	72 pcs / carton 43.2 m / carton



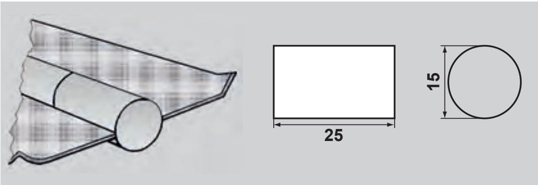
Ceramic with cylindrical shape for X-seams and fillet welds; glued on self-adhesive aluminium tape

DG 600/3 R	
Length:	600 mm
Part No.:	70222
Packaging unit:	60 pcs / carton 36 m / carton



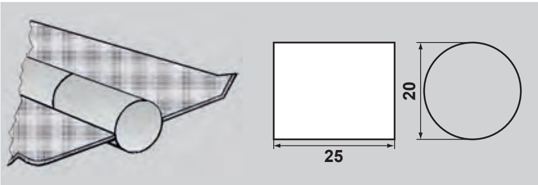
Ceramic with cylindrical shape for X-seams and fillet welds; glued on self-adhesive aluminium tape

DG 600/4 R	
Length:	600 mm
Part No.:	70223 on request
Packaging unit:	36 pcs / carton 21.6 m / carton



Ceramic with cylindrical shape for X-seams and fillet welds; glued on self-adhesive aluminium tape

DG 600/5 R	
Length:	600 mm
Part No.:	71109 on request
Packaging unit:	27 pcs / carton 16.2 m / carton



Ceramic with cylindrical shape for X-seams and fillet welds; glued on self-adhesive aluminium tape

Approvals and certification bodies

	TÜV Verband des Technischen Überwachungsvereins e. V.
	DB Deutsche Bahn AG
EN 13479	**CE** according to EN 13479
	ABS American Bureau of Shipping
	Seproz Ukraine
	BV Bureau Veritas
	GAZPROM Russia
	LR Lloyd’s Register of Shipping
	DNV GL Det Norske Veritas and Germanischer Lloyd
	Snamprogetti Italy
	ÖBB Österreichische Bundesbahnen
ASME III NCA 3800	**ASME**, The American Society of Mechanical Engineers (Rules for Construction of Nuclear Facility Components)
	AREVA, France

Approvals and certification bodies

	WIWEB Wehrwissenschaftliches Institut für Werk-, Explosiv-, und Betriebsstoffe
	RR Russian Maritime Register of Shipping
	CWB Canadian Welding Bureau
	Rina Registro Italiano Navale
	UDT URZEDU DOZURU TECHNICZNEGO, Warsaw/Poland
KTA 1408	**Safety rules of the Nuclear Standards Commission**
Stamicarbon bv	**Stamicarbon** The Netherlands
DIN EN ISO 9001: 2008 ISO/TS 16949: 2009 DIN EN ISO 14001: 2004	**Quality management systems** **Quality management systems in the automotive industry** **Environmental management systems**
	Gaz de France
	Statoil
	Defence Procurement Agency Great Britain
	VG 95132-1 Federal Office of Defence Technology and Procurement

The scope of approvals in relation to base metals, welding positions, heat treatment conditions, diameter ranges, shielding gases, flux etc. can be found in the individual approvals certificates.
Information concerning the detailed approvals of our products can be found in the respective data sheets in the main part or on request.

Test certificate according to EN 10 204

As part of the acceptance of welded components, our customers and supervisory institutions increasingly demand proof of the properties and quality values of filler materials.

Below are some explanations which we ask you to take into consideration in inquiries and orders.

The European Standard EN 10 204 is used for inquiries and orders to determine the execution of such certificates. EN 10 204 specifies who is responsible for testing, who is authorised to sign and whether the certificates must contain information on general guidelines or specific test results relating to the particular delivery.

We would like to point out expressly that EN 10 204 does not contain the following information and this must be communicated by the customer when ordering the goods:

Scope of inspection: e.g. Type and number of inspections,
single elements for chemical analysis

Auxiliary materials: e.g. type of shielding gas

Test parameters: e.g. post weld heat treatment of the test piece, test temperature

Requirements: e.g. minimum values for yield strength, tensile strength,
elongation and notched bar impact energy,
tolerances of the chemical composition

Testing supervision: e.g. TÜV, Germanischer Lloyd, DB

3.1 and 3.2 Inspection certificates according to EN 10 204 are subject to a charge.

Common certificates for filler materials (excerpts)

Certification	Confirmation of the certificate by	Content of the certificate
Works inspection certificate 2.2	The manufacturer	Guideline values based on current operating records
Inspection certificate 3.1	from the manufacturing department, the manufacturer's independent inspection representative	Test results determined on the delivery or on test units, of which the delivery is a part
Inspection certificate 3.2	from the production department, the manufacturer's independent inspection representative and the inspecting officer commissioned by the purchaser or the inspecting officer named in the official regulations	Test results determined on the delivery or on test units, of which the delivery is a part

Classification of shielding gases according to EN ISO 14175

Symbol		Components in volume percent (nominal)					
Main group	Subgroup	Oxidising		Inert		Reducing	Inert
		CO_2	O_2	Ar	He	H_2	N_2
I	1			100			
	2				100		
	3			Residue	$0.5 \leq He \leq 95$		
M1	1	$0.5 \leq CO_2 \leq 5$		Residue (1)		$0.5 \leq H_2 \leq 5$	
	2	$0.5 \leq CO_2 \leq 5$		Residue (1)			
	3		$0.5 \leq O_2 \leq 3$	Residue (1)			
	4	$0.5 \leq CO_2 \leq 5$	$0.5 \leq O_2 \leq 3$	Residue (1)			
M2	0	$5 \leq CO_2 \leq 15$		Residue (1)			
	1	$15 \leq CO_2 \leq 25$		Residue (1)			
	2		$3 \leq O_2 \leq 10$	Residue (1)			
	3	$0.5 \leq CO_2 \leq 5$	$3 \leq O_2 \leq 10$	Residue (1)			
	4	$5 \leq CO_2 \leq 15$	$0.5 \leq O_2 \leq 3$	Residue (1)			
	5	$5 \leq CO_2 \leq 15$	$3 \leq O_2 \leq 10$	Residue (1)			
	6	$15 \leq CO_2 \leq 25$	$0.5 \leq O_2 \leq 3$	Residue (1)			
	7	$15 \leq CO_2 \leq 25$	$3 \leq O_2 \leq 10$	Residue (1)			
M3	1	$25 \leq CO_2 \leq 50$		Residue (1)			
	2		$10 \leq O_2 \leq 15$	Residue (1)			
	3	$25 \leq CO_2 \leq 50$	$2 \leq O_2 \leq 10$	Residue (1)			
	4	$5 \leq CO_2 \leq 25$	$10 \leq O_2 \leq 15$	Residue (1)			
	5	$25 \leq CO_2 \leq 50$	$10 \leq O_2 \leq 15$	Residue (1)			
C	1	100					
	2	Residue	$0.5 \leq O_2 \leq 30$				
R	1			Residue (1)		$0.5 \leq H_2 \leq 5$	
	2			Residue (1)		$15 \leq H_2 \leq 50$	
N	1						100
	2			Residue (1)			$0.5 \leq N_2 \leq 5$
	3			Residue (1)			$5 \leq N_2 \leq 50$
	4			Residue (1)			$0.5 \leq N_2 \leq 5$
	5					$0.5 \leq H_2 \leq 50$	Residue
O	1		100				
Z		Mixed gases with components that are not listed in the table or mixed gases with a composition outside the specified ranges(2)					

1 Argon may be partially or completely replaced by helium.
2 Two mixed gases with the same Z classification must not be exchanged for each other

Handling and Storage Recommendations for Welding Consumables

General Recommendations

Welding consumables can meet promised and expected properties only when treated according to the storage and handling recommendations of the producer.

We recommend to follow the individual and validated technical rules, regulations, recommendations and standards during transport, storage and handling. Mechanical damage and moisture pick up should be avoided.

Böhler Welding filler materials and fluxes will keep their promised performance and properties for two years when always being stored properly under controlled conditions. When this period is exceeded, a visual control and a welding test should be carried out before use, to verify the functionality.

Further information about handling of welding consumables can be retrieved from relevant standards.

- Welding consumables should be stored in their unopened and undamaged original packaging.
- The environment must be clean, free of dust and dry.
- Direct exposure to sunlight has to be avoided.
- **Opened pallets should not be stacked to avoid damage of the individual packaging.**
- Direct contact of the packaging with floor and walls must be avoided.
- Welding consumables must be stored frost free, suitable measures must be undertaken to avoid temperatures below the dew point.

These recommendations do not release the user from his duty to convince himself of the fault free condition of the welding consumable before use.

Covered Electrodes

Depending on the type of electrode, the base material used and the application, covered electrodes need to be protected against moisture pick up. Electrodes in standard packaging need to be stored in a dry and heated atmosphere in their undamaged original packaging. Recommended storage conditions are 18 – 25 °C and max. 60 % rel. humidity. The storage period should not exceed two years. The storage management should follow the first in first out principle to avoid over aging. Covered electrodes in opened or damaged packaging must be stored in a separate, heated room at higher temperatures.

The re-drying time and temperature before use depends on type, kind of packaging and application. Further information is given on the electrode package.

Covered electrodes where no re-drying recommendation is given can be dried at 100 – 120 °C / 1 h. Cellulosic electrodes must not be re-dried.

Electrodes exposed directly to water, oil or grease must not be used.

General recommendations for re-drying of stick electrodes:

Classification EN ISO	Application	Type	Re-drying	Temperature (°C)	Time (h)
2560	Non and low alloyed	A, AR, C, RC, R, RR, RB	no	–	–
		B	yes	250 – 350	2 – 10
18275	High tensile steel	B	yes	300 – 350	2 – 10
3580	Creep resistant steel	R	no	–	–
		B	yes	300 – 350	2 – 10
3581	Stainless steel	R	yes	250 – 300	2 – 10
		B	no	–	–
	(soft-) martensitic and heat resistant ferritic steel	B, R	yes	300 – 350	2 – 10
14172	Ni and Ni-alloys	R, B	yes	250 – 300	2 – 10

If the H2-content in the weld deposit is limited to max. 5 ml/100 g, re-drying is necessary: 300 to 350 °C / 2 h.

Before re-drying, the electrodes should be removed from their packages with the appropriate care and laid in the preheated (80 – 100 °C) baking oven.

Under no circumstances should the stacked height of the electrodes exceed 40 - 50 mm. The electrodes should stay for at least 2 h in the oven after reaching the required re-drying temperature. Re-dryed electrodes can be stored at 100 – 200 °C in a drying cabinet up to four weeks and in a quiver up to 12 hours.
Covered electrodes should be re-dryed not more than two times.

Böhler Welding covered electrodes can be stored under these conditions and in their unopened and undamaged standard packaging up to 24 months.

DRY SYSTEM Vacuum Packaging
No re-drying is necessary for covered electrodes in Böhler Welding DRY SYSTEM vacuum packing, provided the packaging is unopened and undamaged. Before opening the pack it is recommended to ensure a temperature balance to avoid condensation.
The electrodes can be used for welding directly off the pack for up to 9 hours after opening.
The BÖHLER Welding DRY SYSTEM offers different packaging sizes matching the average consumption of one shift. Unused electrodes can be stored and re-dried as previously described. The Böhler Welding DRY SYSTEM guarantees simple and safe handling of stick electrodes in workshops and on construction sites. Dry and optimal conditioned electrodes are available at all time.

Electrodes in DRY SYSTEM vacuum packaging can be stored under normal, dry workshop or construction site conditions without time limit.

SAW flux for joining and cladding

Under dry conditions and constant temperatures joining and cladding fluxes can be kept in their unopened original packaging for up to two years. Flux from damaged packages must be used or repacked immediately.
Fluoride basic fluxes in standard packaging need to be re-dried before use to avoid the risk of hydrogen induced cracking. Detailed information about temperature

General recommendations for re-drying of agglomerated fluxes::

Typ	Re-drying	Temperature (°C)	Time (h)
FB	Y	300 – 350	2 – 10
AB	Y	300 – 350	2 – 10
AR	Y	150 – 200	2 – 10

The construction of the re-drying oven should avoid local over heating by means of a dry blend screw and ensure good ventilation. When applying static drying the height of the flux is restricted to 50 mm. The flux may be re-dried several times, but a total duration of 10 hours must not be exceeded. After re-drying unused flux can be stored up to 30 days at a temperature of 150 °C.

When using flux extraction and circulation systems, the use of dried air must be ensured. During welding at increased temperatures and high humidity, it is recommended to keep the flux at a temperature of 110 – 150 °C.

DRY SYSTEM Vacuum Packaging
Flux delivered in Böhler Welding DRY SYSTEM packacking can be stored up to two years and can be used right away from the DRY SYSTEM Bag – 25 kg or the DRY SYSTEM BigBag without re-drying. The particular characteristics of the packaging reliably prevents moisture pick up during transport and storage.
Welding flux from metal drums can also be used without re-drying.

Cored wires

For the storage of cored wires the general recommendations for the storage of welding consumables should be followed. Recommended storage conditions are max. 60 % rel. humidity at 18 – 25 °C. Temperature fluctuations below the dew point are to be avoided. At storage temperatures below 10 °C there is a risk of condense water forming on the wire surface when being opened and unpacked in heated environment. This can lead to porosity and gas marks at the beginning of the weldment. Only acclimatised wires should be used.

After finishing welding, used spools should be removed from the welding machine and stored in the original packaging.

Böhler Welding cored wires can be stored under these conditions and in their unopened and undamaged original packaging up to 24 months.

Solid Wires and TIG-Rods

For the storage of solid wires and rods, the mentioned general recommendations for the storage of welding consumables are to be considered. Recommended storage conditions are max. 60 % rel. humidity at 15 – 25 °C. Temperature fluctuations below the due point are to be avoided. At storage temperatures below 10 °C there is a risk of condense water forming on the wire surface when being opened and unpacked in heated environment. This can lead to porosity and gas marks at the beginning of the weldment. Only acclimatised wires should be used. Incorrect handling and storage of solid wires can lead to visible damage of wire and spools, like kinks, bendings or
rust forming.
Böhler Welding solid wires and rods can be stored under these conditions and in their unopened

Aluminum wires and rods

Aluminum welding wires must be stored in a dry room with relatively constant temperature in their unopened and undamaged original packaging. High humidity, air flow and quick temperature changes must be avoided. The individual packs should be stored in a way that avoids damage of welding wire or rods. Storing in racks is to be preferred to stacking. Aluminum wires and rods can be stored up to two years under these conditions if the original packaging is unopened and not damaged.

During transport and storage of aluminum alloys, conditions leading to condensation of air humidity on the surfacev must be avoided. With this the risk of hydrogen diffusing into the oxide skin as main source for porosity during welding can be minimized. The maximum tolerable temperature difference between the storage and the welding area where no surface condensation occurs is determined by the dew point interval[t) as a function of the r elative humidity [LR].

Opened material must be stored in the closed original packaging and be kept away from contamination, contact with other metals, temperature and humidity changes. Under these conditions the material can be stored up to one year. Aluminum welding consumables should be stored in their unopened original packaging in the welding area for 24 hours to enable a temperature relieve and avoid condensation.

How to read the table:
Aluminum wire is stored at 50% rel. humidity, Δt = 10 – 13°C. If the storage temperature is 25°C, the surface condensation starts at a temperature of 12 – 15 °C (in the welding area = risk of porosity).

L_R [%]	20	25	30	35	40	45	50	55
Δt [°C]	24-27	21-23	18-21	16-19	13-17	12-14	10-13	9-12

L_R [%]	60	65	70	75	80	85	90	95
Δt [°C]	7-9	6-8	5-6	4-5	3-4	2-3	2	1

L_R – Relative Humidity
Δt – Dew Point Interval

Standards EN ISO

EN ISO	Edition		AWS
636	09/2017	Rods, wires and deposits for tungsten inert gas welding of non-alloy and fine-grain steels	A5.18
2560	03/2010	Covered electrodes for manual metal arc welding of non-alloy and fine grain steels	A5.1, A5.5
3580	08/2017	Covered electrodes for manual metal arc welding of creep-resisting steels	A5.5
3581	03/2018	Covered electrodes for manual metal arc welding of stainless and heat-resisting steels	A5.4
12153	06/2012	Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of nickel and nickel alloys	A5.34
12536	08/2000	Rods for gas welding of non alloy and creep-resisting steels	A5.2
14171	11/2016	Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for submerged arc welding of non alloy and fine grain steels	A5.17, A5.23
14172	01/2016	Covered electrodes for manual metal arc welding of nickel and nickel alloys	A5.11
14174	05/2018	Fluxes for submerged arc welding and electroslag welding	A5.17, A5.23
14175	06/2008	Gases and gas mixtures for fusion welding and allied processes	A5.32
14341	03/2011	Wire electrodes and weld deposits for gas shielded metal arc welding of non alloy and fine grain steels	A5.18, A5.28
14343	07/2017	Wire electrodes, strip electrodes, wires and rods for arc welding of stainless and heat resisting steels	A5.9
16834	08/2012	Wire electrodes, wires, rods and deposits for gas shielded arc welding of high strength steels	A5.28
17632	04/2016	Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of non-alloy and fine grain steels	A5.36
17633	02/2017	Tubular cored electrodes and rods for gas shielded and non-gas shielded metal arc welding of stainless and heat-resisting steels	A5.22
17634	01/2016	Tubular cored electrodes for gas shielded metal arc welding of creep-resisting steels	A5.36
18273	04/2016	Wire electrodes, wires and rods for welding of aluminium and aluminium alloys	A5.10
18274	04/2011	Wire and strip electrodes, wires and rods for fusion welding of nickel and nickel alloys	A5.14
18275	02/2017	Covered electrodes for manual metal arc welding of high-strength steels	A5.5
18276	07/2017	Tubular cored electrodes for gas-shielded and non-gas-shielded metal arc welding of high-strength steels	A5.36
21952	07/2012	Wire electrodes, wires, rods and deposits for gas shielded arc welding of creep-resisting steels	A5.28
24034	01/2011	Solid wire electrodes, solid wires and rods for fusion welding of titanium and titanium alloys	A5.16
24598	08/2012	Solid wire electrodes, tubular cored electrodes and electrode-flux combinations for submerged arc welding of creep-resisting steels	A5.23
26304	11/2011	Solid wire electrodes, tubular cored electrodes and electrode-flux combinations for submerged arc welding of high strength steels	

Standards AWS

AWS	Edition		EN ISO
A5.1	2012	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding	2560
A5.2	2018	Specification for Carbon and Low Alloy Steel Rods for Oxyfuel Gas Welding	12536
A5.3	1999	Aluminum and Aluminum Alloy Electrodes for Shielded Metal Arc Welding	-
A5.4	2012	Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding	3581
A5.5	2014	Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding	2560, 3580, 18275
A5.9	2019	Specification for Bare Stainless Steel Welding Electrodes and Rods	14343
A5.10	2017	Wire Electrodes, Wires and Rods for Welding of Aluminum and Aluminum-Alloys	18273
A5.11	2018	Specification for Nickel and Nickel-Alloy Welding Electrodes for Shielded Metal Arc Welding	14172
A5.14	2018	Specification for Nickel and Nickel-Alloy Bare Welding Electrodes and Rods	18274
A5.16	2013	Specification for Titanium and Titanium-Alloy Welding Electrodes and Rods	24034
A5.17	1997	Specification for Carbon Steel Electrodes and Fluxes for Submerged-Arc Welding	14171, 14174
A5.18	2017	Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding	636, 14341
A5.22	2012	Specification for Stainless Steel Flux Cored and Metal Cored Welding Electrodes and Rods	17633
A5.23	2011	Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding	14171, 14174, 24598
A5.28	2005	Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding	14341, 16834, 21952
A5.32	2011	Gases and Gas Mixtures for Fusion Welding and Allied Processes	14175
A5.34	2013	Specification for Nickel-Alloy electrodes for Flux Cored Arc Welding	12153
A5.36	2016	Specification for Carbon and Low Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding	17632, 17634, 18276

Disclaimer

With the publication of this edition of the "Böhler Welding Product Catalogue" the earlier editions lose their validity.

Details concerning the nature and use of our products are intended to provide the user with information: The information on the mechanical properties always refers to the pure weld metal according to the valid standards. In the weld joint, the welding properties are decisively influenced by the base metal, the welding position and the welding parameters.

Ensuring suitability for a particular use requires an express written agreement in each case.

The latest version of the data sheets can be found on the internet under:
www.voestalpine.com/welding

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