

Welding Consumables for Pipeline Construction





Lasting Connections

Creating lasting connections is the most important part of the welding process. Böhler Welding offers a globally unique product portfolio for all conventional arc welding processes and our best-in-class welding consumables ensure these lasting connections – even in the most challenging applications and industries.

These merits are equally valid for our extensive range of arc welding consumables for pipeline fabrication. The voestalpine Böhler Welding program answers the industry's general trend towards semi-and fully automatic welding processes, the use of high strength steels with reduced wall thickness, as well as application under demanding climatic conditions.

A wide selection of manual arc welding electrodes comprises types with cellulosic coating for highly efficient vertical-down welding and basic low-hydrogen types with vertical-down or vertical-up operability. A broad range of products for semi-and fully- mechanized welding features solid wires and rods, self- and gas-shielded cored wires and submerged arc wire/flux combinations for double jointing.

The range presented in this catalogue covers normal strength pipeline steel grades up to API X60/EN L415MB, high tensile grades up to API X100/ENL690MB, standard stainless steel grades, duplex and super duplex stainless steel, nickel base alloy 625 and CRA clad pipes alloy 316L, 625 and 825.

As part of the voestalpine Group – Austria's largest steel manufacturer and one of the world's leading suppliers of specialized steel products – we are part of a global network of metallurgy experts. Absolute customer focus is our guiding principle. You will benefit from:

- Comprehensive welding and steel know-how under one roof
- Co-ordinated complete solutions comprised of steel and welding filler materials
- A partner offering maximum economic stability and technological expertise

Overview of products

	Process	Product Name	AWS Classification	EN ISO Classification	Page
Cellulosic electrodes for vertical-down welding	SMAW	BÖHLER FOX CEL	A5.1: E6010	2560-A: E 38 3 C 2 1	10
		BÖHLER FOX CEL+	A5.1: E6010	2560-A: E 38 2 C 2 1	10
		BÖHLER FOX CEL-S	A5.1: E6010	2560-A: E 38 3 C 2 1	11
		Phoenix Cel 70	A5.1: E6010	2560-A: E 42 2 C 2 5	11
		BÖHLER FOX CEL Mo	A5.5: E7010-A1	2560-A: E 42 3 Mo C 2 5	12
		BÖHLER FOX CEL 70-P	A5.5: E7010-P1	2560-A: E 42 3 C 2 5	12
		BÖHLER FOX CEL 75	A5.5: E7010-P1	2560-A: E 42 3 C 2 5	13
		BÖHLER FOX CEL 75-G	A5.5: E7010-G		13
		Phoenix Cel 75	A5.5: E7010-P1	2560-A: E 42 2 C 2 5	<?>
		BÖHLER FOX CEL 80-P	A5.5: E8010-P1	2560-A: E 46 3 1Ni C 2 5	14
		BÖHLER FOX CEL 85	A5.5: E8010-P1	2560-A: E 46 4 1Ni C 2 5	15
		BÖHLER FOX CEL 85-G	A5.5: E8010-G		15
		Phoenix Cel 80	A5.5: E8010-P1	2560-A: E 46 3 C 2 5	<?>
		BÖHLER FOX CEL 90	A5.5: E9010-P1	2560-A: E 50 3 1Ni C 2 5	16
Phoenix Cel 90	A5.5: E9010-G	2560-A: E 50 3 1Ni C 2 5	17		
Basic electrodes for vertical-down welding		BÖHLER FOX BVD 85	A5.5: E8045-P2	2560-A: E 46 5 1Ni B 4 5	22
		BÖHLER FOX BVD 90	A5.5: E9045-P2 (mod.)	18275-A: E 55 5 Z2Ni B 4 5	22
		BÖHLER FOX BVD 100	A5.5: E10045-P2 (mod.)	18275-A: E 62 5 Z2Ni B 4 5	23
		BÖHLER FOX BVD 110	A5.5: E11018-G	18275-A: E 69 3 Mn2NiMo B 4 5	23
		BÖHLER FOX BVD 120	A5.5: E12018-G	18275-A: E 69 3 Mn2NiMo B 4 5	24
Basic electrodes for vertical-up welding		BÖHLER FOX EV PIPE	A5.1: E7016-1	2560-A: E 42 4 B 1 2	27
		BÖHLER FOX EV 50-W	A5.1: E7016-1H4R	2560-A: E 42 5 B 1 2 H5	27
		BÖHLER FOX EV 50	A5.1: E7018-1H4R	2560-A: E 42 5 B 4 2 H5	28
		Phoenix 120 K	A5.1: E7018-1	2560-A: E 42 5 B 3 2 H5	28
		BÖHLER FOX EV 60	A5.5: E8018-C3H4R	2560-A: E 46 6 1Ni B 4 2 H5	29
		BÖHLER FOX EV 60 PIPE	A5.5: E8016-GH4R	2560-A: E 50 4 1Ni B 1 2 H5	29
		BÖHLER FOX EV 65	A5.5: E8018-GH4R	18275-A: E 50 6 1NiMo B 4 2 H5	30
		Phoenix SH V 1	A5.5: E8018-G/E8018-C3 (mod.)	2560-A: E 50 6 Mn 1Ni B 4 2 H5	30
		BÖHLER FOX EV 70	A5.5: E9018-GH4R	18275-A: E 55 6 1NiMo B 4 2 H5	31
		BÖHLER FOX EV 70 PIPE	A5.5: E9016-GH4R	18275-A: E 55 4 ZMn2NiMo B 1 2 H5	31
		BÖHLER FOX EV 75	A5.5: E10018-GH4R	18275-A: E 62 6 MnNiCrMo B 4 2 H5	32
		BÖHLER FOX EV 85	A5.5: E11018-GH4R	18275-A: E 69 6 Mn2NiCrMo B 4 2 H5	32
Flux-cored wires for automatic and semiautomatic pipeline welding	FCAW	BÖHLER Ti 52-FD	A5.36: E71T1-M21A4-CS1-H8	17632-A: T 46 4 P M 1 H10/T 42 2 P C 1 H5	33
		BÖHLER Ti 60- FD	A5.36: E81T1-M21A8-Ni1-H4	17632-A: T 50 6 1Ni P M 1 H5	33
		BÖHLER Ti 70 Pipe-FD	A5.36: E91T1-M21A4-G	18276-A: T 55 4 Mn1Ni P M 1 H5	34
		BÖHLER Ti 80 Pipe-FD	A5.36: E111T1-M21A4-GH4	18276-A: T 69 4 Z P M 1 H5	34
Self shielded flux-cored wire for vertical-down welding		BÖHLER Pipeshield 71 T8-FD	A5.36: E71T8-A4-K6		36
		BÖHLER Pipeshield 71.1T8-FD	A5.36: E71T8-A4-Ni1		36
		BÖHLER Pipeshield 81 T8-FD	A5.36: E81T8-A4-Ni2		37
Solid wires for automatic pipeline welding	GMAW	BÖHLER SG3-P	A5.18: ER70S-G	14341-A: G 46 5 M21 Z/G 42 4 C1 Z	38
		Union K 52 S	A5.18: ER70S-6	14341-A: G 42 4 M21 3Si1/G 42 2 C1 3Si1	38
		Union K 56 S	A5.18: ER70S-6	14341-A: G 46 4 M21 4Si1/G 46 2 C1 4Si1	39
		Union K NOVA	A5.28: ER70S-G	14341-A: G 46 5 M21 Z/G 42 4 C1 Z	39
		BÖHLER SG8-P	A5.18: ER80S-G (ER80S-Ni1 mod.)	14341-A: G 50 6 M21 Z3Ni1/ G 46 4 C1 Z3Ni1	40
		Union K NOVA NI	A5.18: ER80S-G (ER80S-Ni1 mod.)	14341-A: G 50 6 M21 Z3Ni1/ G 46 4 C1 Z3Ni1	40
		BÖHLER NiMo 1-IG	A5.28: ER90S-G	16834-A: G 55 6 M Mn3 Ni1 Mo	41
		Union NiMo 80	A5.28: ER90S-G	16834-A: G 62 5 M21 Mn3Ni1Mo/G 55 4 C1 Mn3Ni1Mo	41
		Union Ni1MoCr	A5.28: ER100S-G	16834-A: G Z Mn3Ni0.9MoCr	42
		Union NiMoCr	A5.28: ER100S-G (ER100S-1 mod.)	16834-A: G 69 6 M21 Mn4Ni1.5CrMo	42

	Process	Product Name	AWS Classification	EN ISO Classification	Page
Rods for TIG welding	GTAW	BÖHLER ER 70 S-2	A5.18: ER70S-2		44
		BÖHLER EMK 6	A5.18: ER70S-6	636-A: W 42 5 W3Si1	44
		Union I 2	A5.18: ER70S-3	636-A: W 42 5 W2Si1	45
		Union I 52	A5.18: ER70S-6	636-A: W 42 5 W3Si1	45
		BÖHLER EML 5	A5.18: ER70S-3	636-A: W 46 5 W2Si1	46
		BÖHLER Ni 1-IG	A5.28: ER80S-G	636-A: W 46 5 W3Ni1	46
		BÖHLER NiMo1-IG	A5.28: ER90S-G	16834-A: W 55 6 1Mn3Ni1Mo	47
		BÖHLER NiCrMo2,5-IG	A5.28: ER110S-G	16834-A: W 69 6 1Mn3Ni2.5CrMo	47
Wires and flux for SAW welding	SAW	Union S 2	A5.17: EM12	756: S2	48
		Union S 3 Si	A5.17: EH12K	756: S3Si	48
		Union S 2 NiMo1	A5.23: ENi1	756: SZ2Ni1	49
		Union S 3 NiMo1	A5.23: EF3	756: S3Ni1Mo	49
		Union S 3 NiMoCr	A5.23: EG (EF6 mod.)	14295: SZ3Ni2.5CrMo	50
		UV 421 TT		760: SA FB 1 65 DC H5	48-50
Electrodes for corrosion resistant alloys (CRA)	SMAW	BÖHLER FOX EAS 4 M-A	A5.4: E316L-17	3581-A: E 19 12 3 L R 3 2	51
		BÖHLER FOX EAS 4 M	A5.4: E316L-15	3581-A: E 19 12 3 L B 2 2	51
		BÖHLER FOX CN 22/9 N	A5.4: E2209-17	3581-A: E 22 9 3 NL R 3 2	52
		BÖHLER FOX CN 22/9 N-B	A5.4: E2209-15	3581-A: E 22 9 3 NL B 2 2	52
		BÖHLER FOX CN 25/9 CuT	A5.4: E2595-15	3581-A: E 25 9 4 NL B 2 2	53
		Thermanit 625	A5.11: ENiCrMo-3	14172 E Ni 6625 (NiCr22Mo9Nb)	53
		Thermanit 686	A5.14: ERNiCrMo-14	18274: S Ni 6686 (NiCr21Mo16W4)	53
Flux cored wires for corrosion resistant alloys (CRA)	FCAW	BÖHLER EAS 4 PW-FD	A5.22: E316LT1-4/ E316LT1-1	17633-A: T 19 12 3 L P M21 1/ T 19 12 3 L P C1 1	55
		BÖHLER CN 22/9 PW-FD	A5.22: E2209T1-4/ E2209T1-1	17633-A: T 22 9 3 N L P M21 1/ T 22 9 3 N L P C1 1	55
		BÖHLER CN 25/9 PW-FD	A5.22: E2594T1-4/ E2594T1-1	17633-A: T 25 9 4 N L P M21 2/ T 25 9 4 N L P C1 2	56
		BÖHLER NIBAS 625 PW-FD	A5.34: ENiCrMo3T1-4	12153 T Ni 6625 P M21 2	56
Solid wires for corrosion resistant alloys (CRA)	GMAW	Thermanit GE-316L Si	A5.9: ER316LSi	14343-A: G 19 12 3 L Si	57
		Thermanit 22/09 LH	A5.9: ER2209	14343-A: G 22 9 3 N L	57
		Thermanit 25/09 CuT LH	A5.9: ER2594	14343-A: G 25 9 4 N L	57
		Thermanit 625	A5.14: ERNiCrMo-3	18274: S Ni 6625 (NiCr22Mo9Nb)	58
		Thermanit 686	A5.14: ERNiCrMo-14	18274: S Ni 6686 (NiCr21Mo16W4)	58
TIG rods for corrosion resistant alloys (CRA)	GTAW	Thermanit GE-316L	A5.9: ER316L	14343-A: W 19 12 3 L	59
		Thermanit 22/09	A5.9: ER2209	14343-A: W 22 9 3 NL	59
		Thermanit 25/09 CuT	A5.9: ER2594	14343-A: W 25 9 4 NL	60
		Thermanit 625	A5.14: ERNiCrMo-3	18274: S Ni 6625 (NiCr22Mo9Nb)	60
		Thermanit 686	A5.14: ERNiMo-14	18274: S Ni 6686 (NiCr21Mo16W4)	61
Wires and flux for corrosion resistant alloys (CRA)	SAW	Thermanit GE-316L	A5.9: ER316L	17633-A: S 19 12 3 L	62
		Thermanit 22/09	A5.9: ER2209	14343-A: S 22 9 3 N L	62
		Thermanit 625	A5.14: ERNiCrMo3	18274: S Ni 6625 (NiCr22Mo9Nb)	62
		Marathon 431		760: SA FB 2 64 DC	62
		Marathon 444		760: SA FB 2 AC	62

Selection guide

ISO 3183 pipe steel yield strength level		Welding process				
EN	API 5L	MMA / SMAW			MAG / GMAW	
		Cellulosic	Basic vertical-down	Basic vertical-up		
L175	A25	BÖHLER FOX CEL BÖHLER FOX CEL + BÖHLER FOX CEL-S Phoenix Cel 70	BÖHLER FOX BVD 85	BÖHLER FOX EV PIPE BÖHLER FOX EV 50-W BÖHLER FOX EV 50 Phoenix 120K	BÖHLER SG 3-P Union K 52 S	
L210	A	BÖHLER FOX CEL BÖHLER FOX CEL + BÖHLER FOX CEL-S Phoenix Cel 70	BÖHLER FOX BVD 85	BÖHLER FOX EV PIPE BÖHLER FOX EV 50-W BÖHLER FOX EV 50 Phoenix 120K	BÖHLER SG 3-P Union K 52 S	
L245	B	BÖHLER FOX CEL BÖHLER FOX CEL + BÖHLER FOX CEL-S Phoenix Cel 70	BÖHLER FOX BVD 85	BÖHLER FOX EV PIPE BÖHLER FOX EV 50-W BÖHLER FOX EV 50 Phoenix 120K	BÖHLER SG 3-P Union K 52 S	
L290	X42	BÖHLER FOX CEL BÖHLER FOX CEL + BÖHLER FOX CEL-S Phoenix Cel 70	BÖHLER FOX BVD 85	BÖHLER FOX EV PIPE BÖHLER FOX EV 50-W BÖHLER FOX EV 50 Phoenix 120K	Union K 52 S BÖHLER SG 3-P Union K 56 S Union K Nova	
L320	X46	BÖHLER FOX CEL BÖHLER FOX CEL + BÖHLER FOX CEL-S Phoenix Cel 70	BÖHLER FOX BVD 85	BÖHLER FOX EV PIPE BÖHLER FOX EV 50-W BÖHLER FOX EV 50 Phoenix 120K	Union K 52 S BÖHLER SG 3-P Union K 56 S Union K Nova	
L360	X52	BÖHLER FOX CEL BÖHLER FOX CEL + BÖHLER FOX CEL-S Phoenix Cel 70	BÖHLER FOX BVD 85	Böhler FOX EV PIPE Böhler FOX EV 50-W Böhler FOX EV 50 Phoenix 120K BÖHLER FOX EV 60 Phoenix SH V 1	Union K 52 S BÖHLER SG 3-P Union K 56 S Union K Nova	
L390	X56	BÖHLER FOX CEL BÖHLER FOX CEL + BÖHLER FOX CEL-S Phoenix Cel 70 BÖHLER FOX CEL Mo BÖHLER FOX CEL 70-P BÖHLER FOX CEL 75 BÖHLER FOX CEL 75-G Phoenix Cel 75	BÖHLER FOX BVD 85	Böhler FOX EV PIPE Böhler FOX EV 50-W Böhler FOX EV 50 Phoenix 120K BÖHLER FOX EV 60 Phoenix SH V 1	Union K 52 S BÖHLER SG 3-P Union K 56 S Union K Nova	
L415	X60	BÖHLER FOX CEL BÖHLER FOX CEL + BÖHLER FOX CEL-S Phoenix Cel 70 BÖHLER FOX CEL Mo BÖHLER FOX CEL 70-P BÖHLER FOX CEL 75 BÖHLER FOX CEL 75-G Phoenix Cel 75 BÖHLER FOX CEL 80-P BÖHLER FOX CEL 85	BÖHLER FOX BVD 85	FOX EV PIPE FOX EV 50-W FOX EV 50 Phoenix 120K BÖHLER FOX EV 60 Phoenix SH V 1 BÖHLER FOX EV 60 PIPE BÖHLER FOX EV 65	Union K 52 S BÖHLER SG 3-P Union K 56 S Union K Nova Union K Nova Ni	

	TIG / GTAW	FCAW	SAW
	BÖHLER ER 70 S-2 BÖHLER EMK 6 Union I 2 Union I 52 BÖHLER EML 5	BÖHLER Ti 52-FD BÖHLER Pipeshield 71 T 8-FD BÖHLER Pipeshield 71.1 T 8-FD	Union S 2 / UV 421 TT Union S 3 Si / UV 421 TT
	BÖHLER ER 70 S-2 BÖHLER EMK 6 Union I 2 Union I 52 BÖHLER EML 5	BÖHLER Ti 52-FD BÖHLER Pipeshield 71 T 8-FD BÖHLER Pipeshield 71.1 T 8-FD	Union S 2 / UV 421 TT Union S 3 Si / UV 421 TT
	BÖHLER ER 70 S-2 BÖHLER EMK 6 Union I 2 Union I 52 BÖHLER EML 5	BÖHLER Ti 52-FD BÖHLER Pipeshield 71 T 8-FD BÖHLER Pipeshield 71.1 T 8-FD	Union S 2 / UV 421 TT Union S 3 Si / UV 421 TT
	BÖHLER ER 70 S-2 BÖHLER EMK 6 Union I 2 Union I 52 BÖHLER EML 5	BÖHLER Ti 52-FD BÖHLER Pipeshield 71 T 8-FD BÖHLER Pipeshield 71.1 T 8-FD	Union S 2 / UV 421 TT Union S 3 Si / UV 421 TT
	BÖHLER ER 70 S-2 BÖHLER EMK 6 Union I 2 Union I 52 BÖHLER EML 5	BÖHLER Ti 52-FD BÖHLER Pipeshield 71 T 8-FD BÖHLER Pipeshield 71.1 T 8-FD	Union S 2 / UV 421 TT Union S 3 Si / UV 421 TT
	BÖHLER ER 70 S-2 BÖHLER EMK 6 Union I 2 Union I 52 BÖHLER EML 5 BÖHLER Ni 1-IG	BÖHLER Ti 52-FD BÖHLER Ti 60-FD BÖHLER Pipeshield 71 T 8-FD BÖHLER Pipeshield 71.1 T 8-FD	Union S 2 / UV 421 TT Union S 3 Si / UV 421 TT
	BÖHLER ER 70 S-2 BÖHLER EMK 6 Union I 2 Union I 52 BÖHLER EML 5 BÖHLER Ni 1-IG	BÖHLER Ti 52-FD BÖHLER Ti 60-FD BÖHLER Pipeshield 71 T 8-FD BÖHLER Pipeshield 71.1 T 8-FD	Union S 3 Si / UV 421 TT
	BÖHLER ER 70 S-2 BÖHLER EMK 6 Union I 2 Union I 52 BÖHLER EML 5 BÖHLER Ni 1-IG	BÖHLER Ti 52-FD BÖHLER Ti 60-FD BÖHLER Pipeshield 71 T 8-FD BÖHLER Pipeshield 71.1 T 8-FD	Union S 3 Si / UV 421 TT Union S 2 NiMo 1 / UV 421 TT

Legend:

 Root pass only

FCAW Ti -X = Gas shielded flux cored wire for vertical-up and -down welding

FCAW Pipeshield -X = Self shielded flux cored wire for vertical-down welding

GMAW= solid wires for mechanized vertical-down welding

FOX EV PIPE and FOX EV 50-W are special designed for root pass welding

**ISO 3183
pipe steel yield
strength level**

Welding process

		MMA / SMAW				MAG / GMAW	
EN	API 5L	Cellulosic	Basic vertical-down	Basic vertical-up			
L415 (cont.)	X60 (cont.)	BÖHLER FOX CEL 85-G Phoenix Cel 80					
L450	X65	BÖHLER FOX CEL BÖHLER FOX CEL + BÖHLER FOX CEL-S Phoenix Cel 70 BÖHLER FOX CEL 80-P BÖHLER FOX CEL 85 BÖHLER FOX CEL 85-G Phoenix Cel 80	BÖHLER FOX BVD 85	BÖHLER FOX EV PIPE BÖHLER FOX EV 50-W BÖHLER FOX EV 60 Phoenix SH V 1 BÖHLER FOX EV 60 PIPE BÖHLER FOX EV 65	Union K 52 S BÖHLER SG 3-P Union K 56 S Union K Nova Union K Nova Ni BÖHLER SG 8-P		
L485	X70	BÖHLER FOX CEL BÖHLER FOX CEL + BÖHLER FOX CEL 70 Phoenix Cel-S BÖHLER FOX CEL 80-P BÖHLER FOX CEL 85 BÖHLER FOX CEL 85-G Phoenix Cel 80 BÖHLER FOX CEL 90 Phoenix Cel 90	BÖHLER FOX BVD 90	BÖHLER FOX EV PIPE BÖHLER FOX EV 50-W BÖHLER FOX EV 65 BÖHLER FOX EV 70 PIPE BÖHLER FOX EV 70	Union K 56 S Union K Nova Union K Nova Ni BÖHLER SG 8-P BÖHLER NiMo 1-IG		
L555	X80	BÖHLER FOX CEL BÖHLER FOX CEL + BÖHLER FOX CEL-S	BÖHLER FOX BVD 90 BÖHLER FOX BVD 100	BÖHLER FOX EV PIPE BÖHLER FOX EV 50-W BÖHLER FOX EV 70 PIPE BÖHLER FOX EV 75	Union K Nova Ni Union Ni Mo 80 BÖHLER NiMo 1-IG		
L625	X90		BÖHLER FOX BVD 100	BÖHLER FOX EV 85	BÖHLER NiMo 1-IG Union Ni1MoCr		
L690	X100		BÖHLER FOX BVD 110 BÖHLER FOX BVD 120	BÖHLER FOX EV 85	BÖHLER NiMo 1-IG Union Ni1MoCr		
L830	X120				Union NiMoCr		
Stainless Steel/ Cladded Pipes							
13% Cr		BÖHLER FOX CN 22/9 N BÖHLER FOX CN 22/9 N-B BÖHLER FOX CN 25/9 CuT			Thermanit 22/09 Thermanit 25/09 CuT		
316L		BÖHLER FOX EAS 4 M-A BÖHLER FOX EAS 4 M			Thermanit GE-316L Si		
22% Cr		BÖHLER FOX CN 22/9 N BÖHLER FOX CN 22/9 N-B			Thermanit 22/09		
25% Cr		BÖHLER FOX CN 25/9 CuT			Thermanit 25/09 CuT		
CRA 625/825		Thermanit 625 Thermanit 686			Thermanit 625 Thermanit 686		

	TIG / GTAW	FCAW	SAW
	BÖHLER Ni 1-IG BÖHLER NiMo 1-IG	BÖHLER Ti 52-FD BÖHLER Ti 60-FD BÖHLER Ti 70 Pipe-FD BÖHLER Pipeshield 81 T8-FD	Union S 3 Si / UV 421 TT Union S 2 NiMo 1 / UV 421 TT Union S 3 NiMo 1 / UV 421 TT
	BÖHLER NiMo 1-IG	BÖHLER Ti 60-FD BÖHLER Ti 70 Pipe-FD BÖHLER Ti 80 Pipe-FD BÖHLER Pipeshield 81 T8-FD	Union S 2 NiMo 1 / UV 421 TT Union S 3 NiMo 1 / UV 421 TT Union S 3 NiMoCr / UV 421 TT
	BÖHLER NiMo 1-IG	BÖHLER Ti 80 Pipe-FD	Union S 3 NiMoCr / UV 421 TT
	BÖHLER NiCrMo 2,5-IG		Union S 3 NiMoCr / UV 421 TT
	BÖHLER NiCrMo 2,5-IG		Union S 3 NiMoCr / UV 421 TT
	Thermanit 22/09 Thermanit 25/09 CuT	BÖHLER CN22/9 PW-FD BÖHLER CN 25/9 PW-FD	Thermanit 22/09 Marathon 431
	Thermanit GE-316L	BÖHLER EAS 4 PW-FD	Thermanit GE-316L Marathon 431
	Thermanit 22/09	BÖHLER CN22/9 PW-FD	Thermanit 22/09 Marathon 431
	Thermanit 25/09 CuT	BÖHLER CN 25/9 PW-FD	
	Thermanit 625 Thermanit 686	BÖHLER NIBAS 625 PW-FD	Thermanit 625 Marathon 444

Legend:

 Root pass only

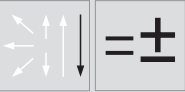
FCAW Ti -X = Gas shielded flux cored wire for vertical-up and -down welding

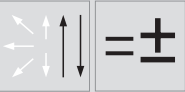
FCAW Pipeshield -X = Self shielded flux cored wire for vertical-down welding

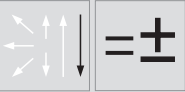
GMAW= solid wires for mechanized vertical-down welding


FOX EV PIPE and FOX EV 50-W are special designed for root pass welding

Cellulosic electrodes for vertical-down welding


BÖHLER FOX CEL	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades		
EN ISO 2560-A: E 38 3 C 2 1 AWS A5.1: E6010	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L	
 <p>Root pass negative polarity</p> <p>Re-drying not allowed</p> <p>For preheating, interpass temperature and welding procedure note our recommendations p. 18</p>	C	0.12	450	550	26	+20	100	2.5	50-90	L210NB-L415NB	A
	Si	0.14	(≥ 380)	(470-600)	(≥ 22)	0	90	3.2	80-130	L290MB-L415MB	B
	Mn	0.50				-20	80	4.0	120-180		X42 -X56
						-30	50 (≥ 47)	5.0	160-210		
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
			65	80	26	+68	74	3/32	50-90		
			(≥ 48)	(≥ 60)	(≥ 22)	+32	66	1/8	80-130		
						-4	59	5/32	120-180		
						-22	37 (≥ 20)	3/16	160-210	Root pass up to L555NB, L555MB	X80
Characteristics and application											
Cellulosic electrode for vertical-down welding of large diameter pipelines; suitable for root runs, hot passes, filler passes and capping. 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. It can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Test values for SSC test are available too.											
Approvals											
TÜV (01281), DNV (3), Statoil, SEPROZ, CE, NAKS (ø3.2, 4.0 mm)											

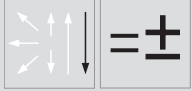
BÖHLER FOX CEL+	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades		
EN ISO 2560-A: E 38 2 C 2 1 AWS A5.1: E6010	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L	
 <p>Root pass positive polarity (negative polarity possible)</p> <p>Re-drying not allowed</p> <p>For preheating, interpass temperature and welding procedure note our recommendations p. 18</p>	C	0.17	450	520	26	+20	105	2.5	50-90	L210NB-L415NB	A
	Si	0.15	(≥ 380)	(470-600)	(≥ 22)	0	95	3.2	80-130	L290MB-L415MB	B
	Mn	0.6				-20	65 (≥ 47)	4.0	120-180		X42 -X56
						-30	≥ 27				
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
			65	75	26	+68	77	3/32	50-90		
			(≥ 48)	(≥ 60)	(≥ 22)	+32	70	1/8	80-130		
						-4	48	5/32	120-180		
						-22	≥ 20			Root pass up to L555NB, L555MB	X80
Characteristics and application											
Cellulosic electrode for vertical-down welding of large diameter pipelines. Especially recommended for root pas welding on DC positive polarity in the vertical-down and vertical-up welding positions. Apart from its good weldability and gap bridging characteristics, Böhler FOX CEL+ provides a powerful arc that deposits well-penetrated, smooth root passes at high travel speed 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. NACE TM-02-84). Test values for SSC test are available too.											


BÖHLER FOX CEL-S	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 2560-A: E 38 3 C 2 1 AWS A5.1: E6010	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
	C 0.10	480	550	23	+20	110	2.5	50-90	L210NB-L415NB	A, B
	Si 0.20	(≥ 380)	(470-600)	(≥ 22)	-30	≥ 47	3.2	80-130	L290MB-L415NB	X42-X56
Root pass negative polarity	Mn 0.50			YS	TS	E (L=4d)	CVN			
Re-drying not allowed			ksi	ksi	%	°F	ft-lbf	ø	inch	A
For preheating, interpass temperature and welding procedure note our recommendations p. 18			70	80	23	+68	81	3/32	50-90	Root pass up to X80
			(≥ 48)	(≥ 60)	(≥ 22)	-22	≥ 20	1/8	80-130	
								5/32	110-170	
Characteristics and application										
Cellulosic for the vertical-down welding of filler and cap layers on large diameter pipelines. Root passes with diameters 2.5 and 3.2 on negative polarity, vertically-up and down.										


Phoenix Cel 70	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 2560-A: E 42 2 C 2 5 AWS A5.1: E6010	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
	C 0.14	440	540	24	+20	80	2.5	50 - 80	L210NB-L390NB	A
	Si 0.18	(≥ 420)	(500-640)	(≥ 20)	± 0	70	3.2	80 - 130	L290MB-L390MB	B
Root pass negative polarity	Mn 0.55				-20	55 (≥ 47)	4.0	120 - 180		X42 - X56
Re-drying not allowed			YS	TS	E (L=4d)	CVN				
For preheating, interpass temperature and welding procedure note our recommendations p. 18			ksi	ksi	%	°F	ft-lb	ø	inch	A
			64	78	24	+68	59	3/32	50 - 80	Root pass up to L485NB, L485MB
			(≥ 48)	(≥ 60)	(≥ 22)	+32	51	1/8	80 - 130	
					-4	37	5/32	120 - 180		
					-40	20	3/16	160 - 220	X70	
Characteristics and application										
Cellulosic electrode for vertical down circumferential welds in pipeline constructions. Excellent weldability in root pass welding (DC ±); also in the vertical up position. CTOD, HIC and HSCC tested.										
Approvals										
TÜV (00247), DB (10.132.44), ABS, DNV, GL, LR, CE										

Cellulosic electrodes for vertical-down welding

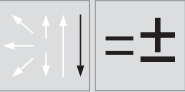
BÖHLER FOX CEL Mo		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 2560-A: E 42 3 Mo C 2 5 AWS A5.5: E7010-A1		%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Root pass negative polarity</p> <p>Re-drying not allowed</p> <p>For preheating, interpass temperature and welding procedure note our recommendations p. 18</p> <p>Characteristics and application</p> <p>Cellulosic 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 cap layers. Besides the excellent weld metal toughness properties, it offers easy operation and a concentrated, intensive arc with 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.</p> <p>Approvals</p> <p>TÜV (01325), ABS (E7010-A1), SEPROZ, CE</p>	C	0.1	480	550	23	+ 20	100	3.2	80-130	L210 NB-L415NB	A
	Si	0.14	(≥ 420)	(500-640)	(≥ 20)	0	95	4.0	120-180	L290MB-L415MB	B
	Mn	0.4				-20	85	5.0	160-210		X42 -X60
	Mo	0.5				-30	50 (≥ 47)				
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
			70	80	23	+ 68	74	1/8	80-130		
			(≥ 57)	(≥ 70)	(≥ 22)	+ 32	70	5/32	120-180	Root pass up to L555MB	X80
						-4	63	3/16	160-210		
						-22	37 (≥ 20)				
						-40	31				


BÖHLER FOX CEL 70-P		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 2560-A: E 42 3 C 2 5 AWS A5.5: E7010-P1		%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Root pass negative polarity</p> <p>Re-drying not allowed</p> <p>For preheating, interpass temperature and welding procedure note our recommendations p. 18</p> <p>Characteristics and application</p> <p>Cellulosic electrode for vertical-down welding of high strength large diameter pipelines. Especially recommended hot passes, filler and cap layers. Highly economical compared with conventional vertical-up welding. Böhler FOX CEL 70-P provides a more intensive arc and a more fluid weld metal compared with the well-known Böhler FOX CEL 75. Böhler FOX CEL 70-P can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Test values for SSC test are available too.</p>	C	0.15	460	550	23	+20	100	3.2	60-130	L210NB-L415NB	A
	Si	0.10	(≥ 420)	(500-640)	(≥ 22)	-20	80	4.0	100-180	L290MB-L415MB	B
	Mn	0.45				-30	65 (≥ 47)	5.0	140-210		X42 -X60
	Ni	0.17									
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
			67	75	23	+ 68	74	1/8	60-130		
			(≥ 57)	(≥ 70)	(≥ 22)	-4	59	5/32	100-180		
						-22	48 (≥ 20)	3/16	140-210	Root pass up to L480MB	X70


BÖHLER FOX CEL 75		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 2560-A: E 42 3 C 2 5 AWS A5.5: E7010-P1			Re	Rm	A5	CVN		ø	A	EN	API 5L
		%	MPa	MPa	%	°C	J				
	C	0.14	480	550	23	+20	100	3.2	80-130	L210-L415NB	A
	Si	0.14	(≥ 420)	(500-640)	(≥ 22)	-20	65	4.0	120-180	L290MB-L415MB	B
	Mn	0.7				-30	55 (≥ 47)	5.0	160-210		X42 -X60
Root pass negative polarity			YS	TS	E (L=4d)	CVN		ø	A		
			ksi	ksi	%	°F	ft-lbf				
Re-drying not allowed			70	80	23	+68	81	1/8	80-130		
			(≥ 57)	(≥ 70)	(≥ 22)	-4	70	5/32	120-180		
For preheating, interpass temperature and welding procedure note our recommendations p. 18						-22	48 (≥ 20)	3/16	160-210		
						-40	33			Root pass up to L480MB	X70
Characteristics and application											
Cellulosic electrode for vertical-down welding of high strength large diameter pipelines. Especially recommended for hot passes, filler and cap layers. Highly economical compared with conventional vertical-up welding. The penetrating arc and the low slag formation allow good bead control and ensure best performance, even with larger diameter electrodes and high amperages. 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.											
Approvals											
TÜV (533)											


BÖHLER FOX CEL 75 G		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
AWS A5.5: E7010-G			Re	Rm	A5	CVN		ø	A	EN	API 5L
		%	MPa	MPa	%	°C	J				
	C	0.17	450	560	23	+20	90	3.2	60-130	L415NB-L450NB	X56-X65
	Si	0.15	(≥ 390)	(≥ 490)	(≥ 22)	-20	75	4.0	100-180	L415MB-L450MB	
	Mn	0.55				-30	55	5.0	140-210		
	Ni	0.6									
Re-drying not allowed			YS	TS	E (L=4d)	CVN		ø	A		
			ksi	ksi	%	°F	ft-lbf				
For preheating, interpass temperature and welding procedure note our recommendations p. 18			65	81	23	+68	66	1/8	60-130		Root pass up to X70
			(≥ 57)	(≥ 70)	(≥ 22)	-4	55	5/32	100-180		
						-22	40	3/16	140-210		
Characteristics and application											
Cellulosic electrode for vertical-down welding of high strength large diameter pipelines. Especially recommended for hot passes, filler and cap layers. Highly economical compared with conventional vertical-up welding. The electrode has superior operating characteristics and consistently produces high quality welds with outstanding low-temperature impact toughness. Results from SSC testing are available.											

Cellulosic electrodes for vertical-down welding


Phoenix Cel 75	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 2560-A: E 42 2 C 2 5 AWS A5.5: E7010-P1	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Root pass negative polarity</p> <p>Re-drying not allowed</p> <p>For preheating, interpass temperature and welding procedure note our recommendations p. 18</p> <p>Characteristics and application</p> <p>Cellulosic electrode for vertical down circumferential welds in pipeline constructions. Excellent weldability in root and hot hot pass, filler and cap layers. Easy slag removal. Particularly suitable for root pass welding (DC ±); also in the vertical up position. CTOD, HIC and HSCC tested.</p> <p>Approvals</p> <p>TÜV (03199), LR, CE</p>	C 0.15	440	540	24	+20	80	3.2	80 - 130	L210NB - L415NB	A
	Si 0.20	(≥ 420)	(500-640)	(≥ 20)	-20	55 (≥ 47)	4.0	120 - 180	L290MB - L415MB	B
	Mn 0.60				-40	28	5.0	160 - 220		X42 - X60
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lb	ø inch	A		
		64	78	24	+ 68	59	1/8	80 - 130		
		(≥ 60)	(≥ 70)	(≥ 22)	-4	41	5/32	120 - 180	Root pass up to L485NB, L485MB	X70
					-40	20	3/16	160 - 220		


BÖHLER FOX CEL 80-P	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 2560-A: E 46 3 1Ni C 2 5 AWS A5.5: E8010-P1	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying not allowed</p> <p>For preheating, interpass temperature and welding procedure note our recommendations p. 18</p> <p>Characteristics and application</p> <p>Cellulosic 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 cap layers. Böhler FOX CEL 80-P provides a more intensive arc and a more fluid weld metal compared with the well-known Böhler FOX CEL 85. Böhler FOX CEL 80-P can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Test values for SSC test are available too.</p> <p>Approvals</p> <p>TÜV (11181), CE</p>	C 0.15	490	580	23	+20	90	3.2	60-130	L415NB-L485NB	X56-X70
	Si 0.15	(≥ 460)	(550-680)	(≥ 20)	-20	80	4.0	100-180	L415MB-L485MB	
	Mn 0.7				-30	60 (≥ 47)	5.0	140-210		
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
		71	84	23	+68	66	1/8	60-130		
		(≥ 67)	(≥ 80)	(≥ 19)	-4	59	5/32	100-180		
					-22	44 (≥ 20)	3/16	140-210		


BÖHLER FOX CEL 85		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 2560-A: E 46 4 1Ni C 2 5 AWS A5.5: E8010-P1		%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying not allowed</p> <p>For preheating, interpass temperature and welding procedure note our recommendations p. 18</p>	C	0.14	490	570	23	+20	110	3.2	80-130	L415NB-L485NB	X56-X70
	Si	0.15	(≥ 460)	(550-680)	(≥ 20)	0	105	4.0	120-180	L415MB-L485MB	
	Mn	0.75				-20	100	5.0	160-210		
	Ni	0.7				-40	70 (≥ 47)				
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
			71	83	23	+68	81	1/8	80-130		
			(≥ 67)	(≥ 80)	(≥ 19)	+32	77	5/32	120-180		
						-4	74	3/16	160-210		
						-22	≥ 20				
						-40	52				
Characteristics and application Cellulosic 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 cap layers. Böhler FOX CEL 85 is the most popular cellulosic electrode, very well meeting all exacting demands of cross country pipeline field welding. It ensures highest joint weld quality down to -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.											
Approvals TÜV (01361), ABS (E8010-P1), SEPROZ, CE											

BÖHLER FOX CEL 85 G		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
AWS A5.5: E8010-G		%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying not allowed</p> <p>For preheating, interpass temperature and welding procedure note our recommendations p. 18</p>	C	0.15	490	580	23	+20	90	3.2	60-130	L415NB-L485NB	X56-X70
	Si	0.15	(≥ 460)	(≥ 550)	(≥ 19)	0	85	4.0	100-180	L415MB-L485MB	
	Mn	0.7				-30	60	5.0	140-210		
	Ni	0.8									
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
			71	84	23	+68	66	1/8	60-130		
			(≥ 67)	(≥ 80)	(≥ 19)	+32	63	5/32	100-180		
						-22	44	3/16	140-210		
Characteristics and application Cellulosic electrode for vertical-down welding of high strength large diameter pipelines. Especially recommended for hot passes, filler and cap layers. Highly economical compared with conventional vertical-up welding. The electrode has superior operating characteristics and consistently produces high quality welds with outstanding low-temperature impact toughness.											

Cellulosic electrodes for vertical-down welding

Phoenix Cel 80	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 2560-A: E 46 3 C 2 5 AWS A5.5: E8010-P1	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying not allowed</p> <p>For preheating, interpass temperature and welding procedure note our recommendations p. 18</p>	C 0.16	490	580	23	-20	60	3.2	80 - 130	L415NB - L485NB	X56 - X70
	Si 0.20	(≥ 460)	(530-680)	(≥ 20)	-30	≥ 47	4.0	140 - 190	L415MB - L485MB	
	Mn 0.85						5.0	160 - 220		
	Ni 0.2									
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lb	ø inch	A		
		71	84	23	-4	44	1/8	80 - 130		
		(≥ 67)	(≥ 80)	(≥ 19)	-22	35 (≥ 20)	5/32	140 - 190		
							3/16	160 - 220	Root pass up to L555MB, L555NB	X80
Characteristics and application										
Cellulosic electrode for vertical-down circumferential welding of pipelines. Suitable for welding of root pass, hot pass, filler and cap layers. Welding of root pass with AC (+/-). CTOD values at -10 °C > 0,25mm HIC and HSCC testet.										
Approvals										
TÜV (03199), ABS, LR, CE										

BÖHLER FOX CEL 90	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 2560-A: E 50 3 1Ni C 2 5 AWS A5.5: E9010-P1	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying not allowed</p> <p>For preheating, interpass temperature and welding procedure note our recommendations p. 18</p>	C 0.17	580	650	21	+20	100	4.0	120-180	L450MB, L485MB	X65-X80
	Si 0.15	(≥ 530)	(620-720)	(≥ 18)	0	90	5.0	160-210		
	Mn 0.9				-20	75				
	Ni 0.8				-30	65 (≥ 47)				
					-40	40				
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
		84	94	21	+68	74	5/32	120-180		
		(≥ 77)	(≥ 90)	(≥ 17)	+32	66	3/16	160-210		
					-4	55				
					-22	48 (≥ 20)				
					-40	30				
Characteristics and application										
Cellulosic electrode for vertical down welding of large diameter, high strength pipelines. Highly economical compared with conventional vertical-up welding. Especially recommended for hot passes, filler and cap layers. The special design of coating and core guarantees the highest metallurgical quality and soundness of the weld deposit with excellent mechanical properties. The electrode allows good weld pool visibility 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. NACE TM-02-84). Test values for SSC test are available too.										
Approvals										
TÜV (1324), Statoil, SEPROZ, CE										

Phoenix Cel 90		Typical analyses all weld metal		Typical mechanical properties all weld metal				Diameter and welding current		Pipeline steel grades		
EN ISO 2560-A: E 50 3 1 Ni C 2 5 AWS A5.5: E9010-G		%		Re	Rm	A5	CVN	ø	A	EN	API 5L	
		C	0.18	570	640	20	+20	70	3.2	80 - 140	L415NB - L555NB	X60 - X80
		Si	0.20	(≥ 500)	(560-720)	(≥ 18)	-20	55	4.0	140 - 190	L415MB - L555MB	
		Mn	0.85				-30	≥ 47	5.0	160 - 220		
		Ni	0.75									
Re-drying not allowed				YS	TS	E (L=4d)	CVN	ø				
For preheating, interpass temperature and welding procedure note our recommendations p. 18				ksi	ksi	%	°F	ft-lb	inch	A		
				82	93	20	+68	52	1/8	80 - 140		
				(≥ 77)	(≥ 90)	(≥ 17)	-4	41	5/32	140 - 190		
							-22	35 (≥ 20)	3/16	160 - 220		
Characteristics and application												
Cellulosic electrode for circumferential welds; developed for field welding of higher strength pipeline steels in the vertical-down position. Excellent weldability in root and hot pass, filler and cap layers.												
Approvals												
TÜV (00105), CE												



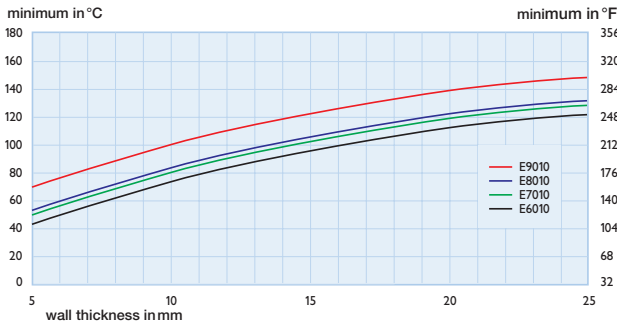
Welding Techniques Cellulosic Electrodes

Preheating and interpass temperature

In order to prevent hydrogen induced cracking, it is necessary to preheat pipes before starting to weld and to maintain an interpass temperature during the welding of individual beads.

In respect of the quite often difficult site conditions, preheating at 150°C (300°F) is recommended in general. This covers all wall thicknesses up to 25 mm (1") and weld metals up to class E9010 (FOX CEL 90). Be aware that lower preheat and interpass temperatures are valid, when welding thin-walled pipes.

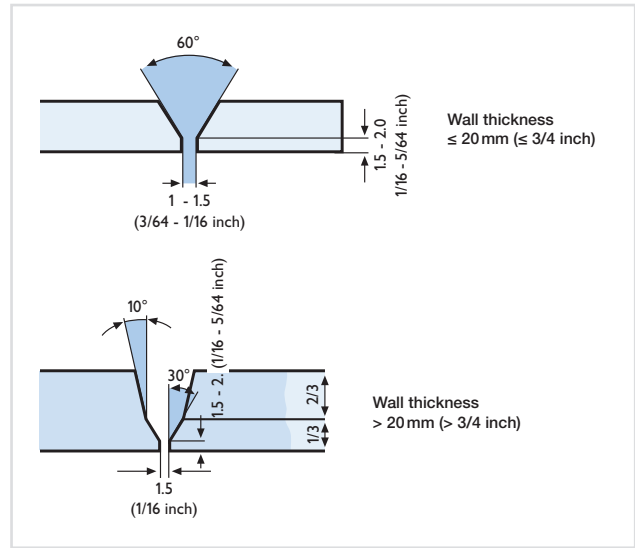
The diagram below shows minimum required preheat temperatures, in dependence of wall thickness and type of electrode. This is related to both preheating and interpass.



Welding machines

Cellulosic electrodes can only be operated on direct current. Welding machines must have a dropping characteristic and high open circuit voltage.

Recommended joint preparation



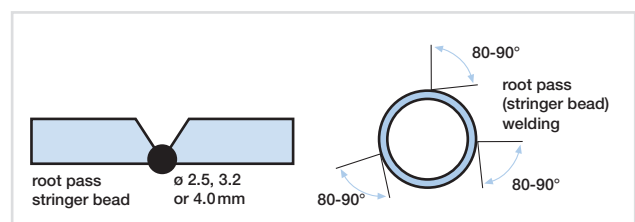
Welding technique Stringer bead or root pass

The root pass is a critical part of any pipe weld, requiring perfect penetration. Electrode diameter, travel speed and amperage must be selected to match pipe diameter and wall thickness. For pipe diameters up to about 250 mm (10") and wall thickness up to 8 mm (5/16"), we recommend to use 3.2 mm (1/8") diameter electrodes, for larger sizes, 4 mm (5/32") diameter electrodes.

Welding is performed in vertical-down direction, with the electrode in good contact with both beveled plate edges.

Electrode diameter:		
2.5 mm	(3/32")	50 - 80 A
3.2 mm	(1/8")	80 - 100 A
4.0 mm	(5/32")	120 - 150 A

Line-up clamps should be removed only after completing the root pass over the full circumference and, when welding larger diameter pipe, only after completing the hot pass. While making the hot pass, do not move pipes in order to avoid the risk of crack formation.



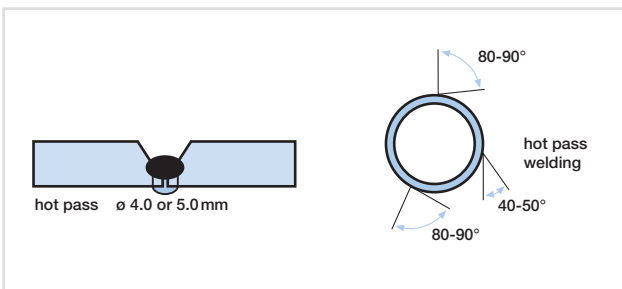
Hot pass

In order to prevent lateral slag inclusions (showing up as „waggon tracks“ in weld radiographs), slight grinding of the stringer bead is essential.

Electrode sizes commonly used are:

Electrode diameter:		
3.2mm	(1/8")	80 - 130 A
4.0mm	(5/32")	150 - 180 A
5.0mm	(3/16")	170 - 210 A

Use of a relatively high welding current is favourable, because it gives a good penetration making any remaining slag inclusions re-melt and float to the surface, while ensuring that the root pass is annealed thoroughly. The hot pass should be welded immediately after deposition of the stringer bead, but in no case more than 10 minutes later. This is of special importance for high strength line pipe grades to avoid underbead cracking in the base material.



Filler layers

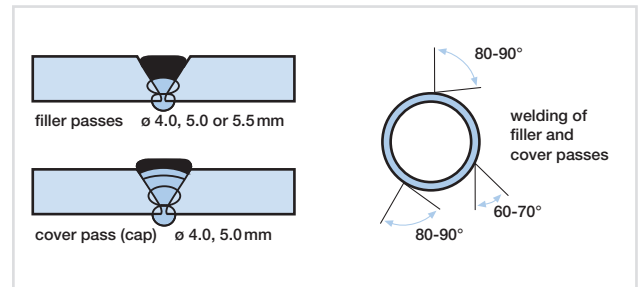
Beads will be sufficiently flat and free from undercut and slag inclusions, if the electrode is applied with a slight circular or stepping motion, especially in positions 12 to 2 o'clock, 12 to 10 o'clock, 4 to 6 o'clock and 8 to 6 o'clock. Weaving of max. $2 \times \varnothing$ is recommended for all other positions.

Electrode sizes and amperages recommended for filler pass welding on positive (+) polarity:

Electrode diameter:		
3.2mm	(1/8")	80 - 130 A
4.0mm	(5/32")	100 - 180 A
5.0mm	(3/16")	140 - 210 A

Cover pass (cap)

The cover pass is executed with a slight weaving of the electrode. The weld should not overlap the groove edge by more than 1.5 mm (1/16"). If the cover pass is applied correctly, weld reinforcement is about 1 to 2 mm (1/16").


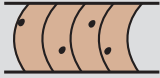
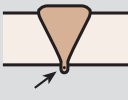


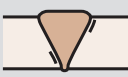

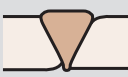

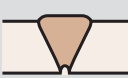
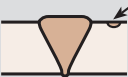


Storage of cellulosic electrodes

The coating of cellulosic electrodes has a relatively high content of moisture which is necessary for welding characteristics and metallurgical properties of the deposit.

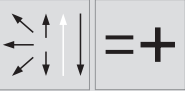
Electrodes must be stored in a closed area, away from solar radiation and excessive variations in temperature. Once a can has been opened, the electrodes must be used as soon as possible. Rebaking of cellulosic electrodes is not permitted.


Trouble shooting

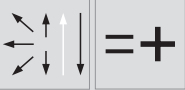
Trouble shooting	Defects	Causes	How to avoid defects
	Porosity visible on the surface	<ul style="list-style-type: none"> ■ excessive and uncontrolled weaving ■ base metal overheated (increased risk in thin wall pipe) ■ moisture content of electrode coating too low 	<ul style="list-style-type: none"> ■ weaving not to exceed 2 x electrode dia. ■ choose electrode dia. and amperage as a function of pipe wall thickness ■ keep electrodes in closed containers
	Pinholes not visible on the surface	<ul style="list-style-type: none"> ■ delayed deoxidation process in weld deposit ■ moisture content in electrode coating too low or too high 	<ul style="list-style-type: none"> ■ avoid excessive upsetting of metal deposited ■ see chapter „storage“
	Piping or hollow bead almost exclusively in the reinforcement of stringer bead - therefore, practically no reduction of cross section	<ul style="list-style-type: none"> ■ root gap too narrow: degassing hindered by excessive dilution ■ chemical composition of base metal: high Al levels usually favour piping formation 	<ul style="list-style-type: none"> ■ root gap width not less than 1 mm ■ the optimum root gap width of 1.5mm should be observed for 0.040% Al steels in particular. If trouble continues, use smaller electrode dia.
	Slag inclusions generally occurring in groove faces and in stringer bead area (waggon tracks)	<ul style="list-style-type: none"> ■ insufficient cleaning in between passes ■ stringer bead poorly ground ■ incorrect electrode manipulation ■ amperage too low 	<ul style="list-style-type: none"> ■ clean each layer with rotary wire brush ■ grind stringer bead sufficiently before applying hot pass ■ improve electrode manipulation ■ increase amperage
	Lack of fusion (cold laps)	<ul style="list-style-type: none"> ■ insufficient melting of groove faces ■ amperage too low ■ groove faces contaminated and/or oxidized 	<ul style="list-style-type: none"> ■ choose amperage to match electrode dia. and welding position ■ clean groove faces properly
	Underbead cracks almost exclusively in the hardened HAZ	<ul style="list-style-type: none"> ■ combined action of hydrogen, stresses, hardened structure 	<ul style="list-style-type: none"> ■ preheat pipe material to favour hydrogen effusion, increase of heat input is also advantageous ■ avoid moving pipe string ■ considerable hardening is to be expected during welding of the stringer bead, therefore the hot pass must be applied immediately after its completion
	Cracks caused by mechanical stresses usually in the stringer bead region	<ul style="list-style-type: none"> ■ moving of pipes during welding of stringer bead and/or before applying hot pass ■ edge offset too large, resulting in reduced root cross section and increased risk of crack formation 	<ul style="list-style-type: none"> ■ avoid moving pipe particularly during welding of stringer bead ■ refer to relevant standards and specifications for maximum offset which, however, should be kept to a minimum
	Undercut in the region of stringer bead and cover passes	<ul style="list-style-type: none"> ■ amperage too high ■ incorrect manipulation 	<ul style="list-style-type: none"> ■ selection of correct amperage to match electrode size
	Excess reinforcement	<ul style="list-style-type: none"> ■ Incorrect manipulation 	<ul style="list-style-type: none"> ■ select amperage to match joint width ■ allowance for desired cap layer weld reinforcement is to be made already when applying last filler pass (e.g. by additional layers or grinding of filler layers that are too high)
	Sagging stringer bead	<ul style="list-style-type: none"> ■ amperage too high ■ poor joint preparation, root gap too large 	<ul style="list-style-type: none"> ■ select correct amperage to match joint preparation for stringer bead
	Striking marks	<ul style="list-style-type: none"> ■ striking right or left of the joint causes local hardening – risk of hardening cracks 	<ul style="list-style-type: none"> ■ strike arc in the groove

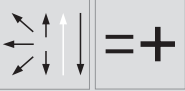


Basic electrodes for vertical-down welding

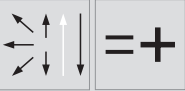
BÖHLER FOX BVD 85	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
		Re	Rm	A5	CVN		ø	A	EN	API 5L
EN ISO 2560-A: E 46 5 1Ni B 4 5 AWS A5.5: E8045-P2	%	MPa	MPa	%	°C	J	mm			
 <p>Re-drying if necessary: 300-350 °C (570-660 °F) / min. 2h</p> <p>Recommended interpass temperature > 80 °C (176 °F)</p>	C 0.05	510	560	27	+20	170	3.2	110-160	L290NB- L450NB	A
	Si 0.4	≥ 460	(550-680)	≥ 20	0	150	4.0	180-210	L290MB- L450MB	B X42 -X65
	Mn 1.1				-20	120	4.5	200-240		
	Ni 0.9				-40	85				
					-50	65 (≥ 47)				
		YS	TS	E (L=4d)	CVN		ø	A		
		ksi	ksi	%	°F	ft-lbf	inch	A		
		74	81	26	+68	125	1/8	110-160		
		≥ 67)	≥ 80)	≥ 19)	+32	110	5/32	180-210		
					-4	89	11/16	200-240		
					-22	≥ 20				
					-40	63				
					-58	48				
Characteristics and application										
Basic electrode for vertical-down welding of large diameter, high strength pipelines and for structural work. Suitable for filler and cap layers in pipe welds. The deposit is extremely crack resistant and features a high toughness and very low hydrogen content. The deposition rate is 80-100% higher than obtainable in vertical-up welding. The weld deposit of Böhler FOX BVD 85 shows the ideal combination of high strength and cryogenic toughness down to -50 °C (-58 °F). Due to the specially designed electrode tip, the arc striking is improved and start porosity can be avoided. Good additional welding characteristics make this special basic electrode very suited for convenient field welding. Böhler FOX BVD 85 can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Test values for SSC test are available too.										
Approvals										
TÜV (03531), SEPROZ, CE										

BÖHLER FOX BVD 90	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
		Re	Rm	A5	CVN		ø	A	EN	API 5L
EN ISO 18275-A: E 55 5 Z2Ni B 4 5 AWS A5.5: E9018-G / E9045-P2 (mod.)	%	MPa	MPa	%	°C	J	mm	A		
 <p>Re-drying if necessary: 300-350 °C (570-660 °F) / min. 2h</p> <p>Recommended interpass temperature > 90 °C (194 °F)</p>	C 0.05	600	650	27	+20	170	3.2	110-160	L458MB, X70, X80	
	Si 0.3	≥ 550)	(620-780)	≥ 18)	0	145	4.0	180-210	L555MB	
	Mn 1.2				-20	130	4.5	200-240		
	Ni 2.2				-40	110				
					-50	80 (≥ 47)				
		YS	TS	E (L=4d)	CVN		ø	A		
		ksi	ksi	%	°F	ft-lbf	inch	A		
		87	94	26	+68	125	1/8	110-160		
		≥ 77)	≥ 90)	≥ 17)	+32	107	5/32	180-210		
					-4	96	11/16	200-240		
					-22	≥ 20				
					-40	81				
					-58	59				
Characteristics and application										
Basic electrode for vertical-down welding of large diameter, high strength pipelines and for structural work. Suitable for filler and cap layers in pipe welds. The deposit is extremely crack resistant and features a high toughness and very low hydrogen content. The deposition rate is 80-100% higher than obtainable in vertical-up welding. Due to the specially designed electrode tip, the arc striking is improved and start porosity can be avoided. Good additional welding characteristics make this special basic electrode very suited for convenient field welding.										
Approvals										
TÜV (03402), Staoil, SEPROZ, CE, GAZPROM (ø 3.2, 4.0, 4.5 mm)										

BÖHLER FOX BVD 100		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades		
EN ISO 18275-A: E 62 5 Z2Ni B 4 5			Re	Rm	A5	CVN			EN	API 5L		
AWS A5.5: E10018-G /E10045-P2 (mod.)		%	MPa	MPa	%	°C	J	ø	A			
		C	0.07	670	730	24	+20	150	4.0	180-210	L555MB	X80
		Si	0.4	≥ 620	(690-890)	≥ 18	0	125	4.5	200-240		
Re-drying if necessary: 300-350 °C (570-660 °F) / min. 2h Recommended interpass temperature > 100 °C (212 °F)		Mn	1.2				-20	120				
		Ni	2.3				-50	70 (≥ 47)				
			YS	TS	E (L=4d)	CVN			ø			
			ksi	ksi	%	°F	ft-lbf	inch	A			
			97	106	26	+68	110	5/32	180-210			
			≥ 87)	≥ 100)	≥ 16)	+32	92	11/64	200-240			
						-4	89					
						-22	≥ 20					
						-58	52					
Characteristics and application Basic electrode for vertical-down welding of large diameter, high strength pipelines and for structural work. Suitable for filler and cap layers in pipe welds. The deposit is extremely crack resistant and features a high toughness and very low hydrogen content. The deposition rate is 80-100% higher than obtainable in vertical-up welding. Due to the specially designed electrode tip, the arc striking is improved and start porosity can be avoided. Good additional welding characteristics make this special basic electrode very suited for convenient field welding.												
Approvals TÜV (06333), SEPROZ, CE												

BÖHLER FOX BVD 110		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades		
EN ISO 18275-A: E 69 3 Mn2NiMo B 4 5			Re	Rm	A5	CVN			EN	API 5L		
AWS A5.5: E11018-G		%	MPa	MPa	%	°C	J	ø	A			
		C	0.07	720	810	20	+20	90	4.0	180-210	L690	X100
		Si	0.4	≥ 690)	(760-960)	≥ 17)	-20	70	4.5	200-240		
Re-drying if necessary: 300-350 °C (570-660 °F) / min. 2h Recommended interpass temperature > 110 °C (230 °F)		Mn	1.5				-30	50 (≥ 47)				
		Ni	2.2									
		Mo	0.4									
			YS	TS	E (L=4d)	CVN			ø			
			ksi	ksi	%	°F	ft-lbf	inch	A			
			104	117	20	+68	66	5/32	180-210			
			≥ 97)	≥ 110)	≥ 15)	-4	52	11/64	200-240			
						-22	37					
Characteristics and application Basic electrode for vertical-down welding of large diameter, high strength pipelines and for structural work. Suitable for filler and cap layers in pipe welds. The deposit is extremely crack resistant and features a high toughness and very low hydrogen content. The deposition rate is 80-100% higher than obtainable in vertical-up welding. Due to the specially designed electrode tip, the arc striking is improved and start porosity can be avoided. Good general welding characteristics make this special basic electrode suited for convenient welding, also under difficult conditions.												
Approvals SEPROZ												

Basic electrodes for vertical-down welding

BÖHLER FOX BVD 120 EN ISO 18275-A: E 69 3 Mn2NiMo B 4 5 AWS A5.5: E12018-G	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying if necessary: 300-350 °C (570-660 °F) / min. 2h</p> <p>Recommended interpass temperature > 120 °C (248 °F)</p>	C 0.07	815	870	18	+20	80	3.2	110-160	L690	X100
	Si 0.4	(≥ 740)	(≥ 830)	(≥ 17)	-20	60	4.0	180-220		
	Mn 1.85				-30	50 (≥ 47)				
	Ni 2.25									
	Mo 0.35									
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
		118	126	18	+68	59	1/8	110-160		
		(≥ 107)	(≥ 120)	(≥ 14)	-4	44	5/32	180-220		
					-22	37				

Characteristics and application
Basic electrode for vertical-down welding of large diameter, high strength pipelines and for structural work. Suitable for filler and cap layers in pipe welds. The deposit is extremely crack resistant and features a high toughness and very low hydrogen content. The deposition rate is 80-100% higher than obtainable in vertical-up welding. Due to the specially designed electrode tip, the arc striking is improved and start porosity can be avoided. Good general welding characteristics make this special basic electrode suited for convenient welding, also under difficult conditions.





Welding Techniques Basic Electrodes for Vertical-down Welding

Combined technology with cellulosic and basic electrodes

In combination with basic vertical-down electrodes (BVD) root passes can either be welded with cellulosic or basic vertical-up electrodes.

When root passes are welded with cellulosic electrodes in the vertical-down position, hot passes shall preferably be welded with cellulosic electrodes as well.

Preheating and interpass temperature

The interpass temperature influences the metallurgical processes that take place in the deposit during solidification and cooling and thus influences to a certain extent also the mechanical properties of the basic vertical-down weld metal.

It is generally recommended that the interpass temperature shall be maintained in the range of 100°C - 200°C (210°F - 392°F) throughout welding.

Joint preparation, preheating and interpass for cellulosic electrodes shall be according to the recommendation on page 18.

Welding machines

Basic vertical-down electrodes can only be operated on direct current. Welding machines must have a dropping characteristic and high open circuit voltage.

Welding Techniques Basic Electrodes for Vertical-down Welding

Filler passes

These passes are executed with 3.2 mm, 4.0 mm and 4.5 mm dia electrodes, depending upon pipe thickness.

Electrode diameter:		
3.2 mm	(1/8")	110 - 160 A
4.0 mm	(5/32")	180 - 210 A
4.5 mm	(3/16")	200 - 240 A

The high amperage ensures sufficient penetration and satisfactory economy of the process.

Slight weaving is always recommended as this prevents short-circuiting the arc.

For welding heavy wall pipe, we recommend to deposit two to three beads side by side, removing all slag before applying the next bead.

Keep the arc as short as possible.

Cap

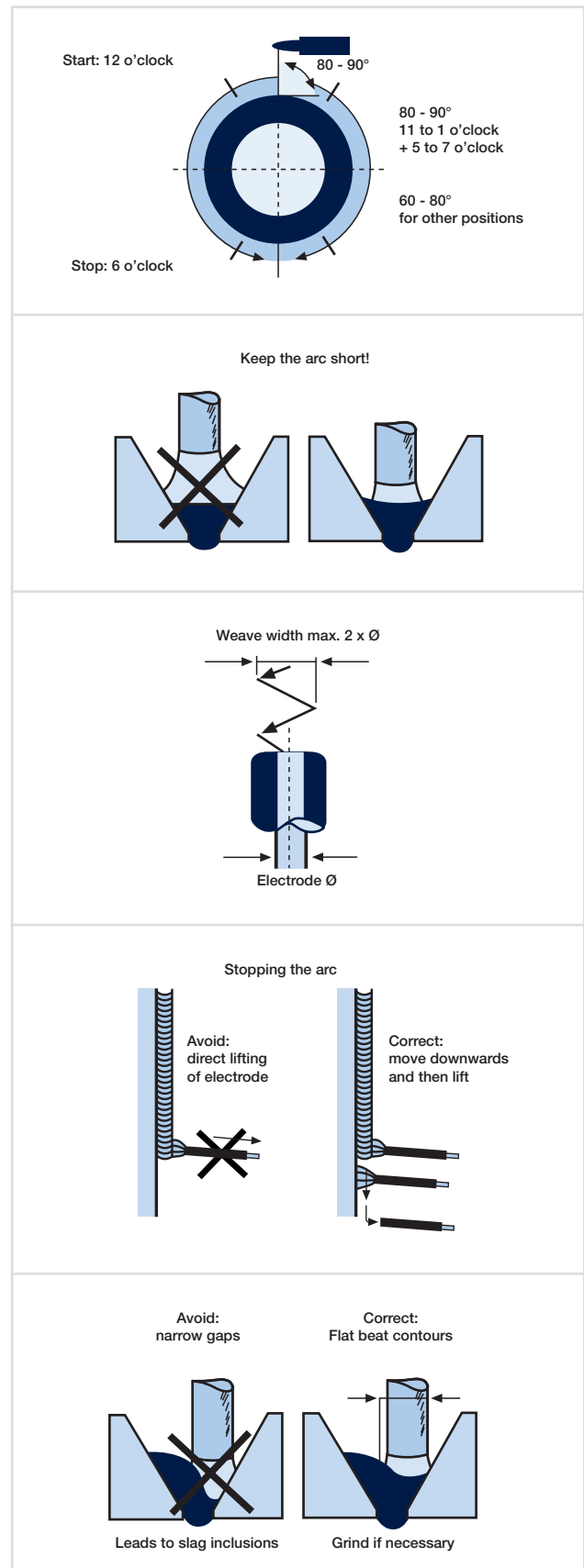
The cap is deposited with a slight weaving technique, with a maximum weave of twice the electrode diameter.

Recommended amperages:


Electrode diameter:		
3.2 mm	(1/8")	110 - 160 A
4.0 mm	(5/32")	180 - 210 A

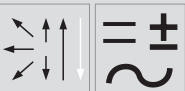
Storage of basic electrodes

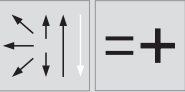
Basic electrodes which have been stored in sealed cans do not need to be rebaked. Once a can has been opened, the electrodes can be used up to 8 hours. Basic electrodes which are taken from unsealed, damaged cans or those which have been kept in open storage for more than 8 hours, should be rebaked at 300 - 350 °C (570 - 660 °F) for two hours minimum and ten hours maximum. In the event of a relative air humidity of more than 70% it is recommended to use heated quivers maintaining a temperature of 120 - 200 °C (248 - 400 °F) prior to use.




Basic electrodes for vertical-up welding

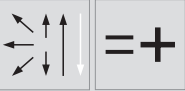
BÖHLER FOX EV PIPE	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
		Re	Rm	A5	CVN		ø	A	EN	API 5L
EN ISO 2560-A: E 42 4 B 1 2 AWS A5.5: E7016-1	%	MPa	MPa	%	°C	J	mm	A		
 <p>Root pass negative polarity</p> <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material. The optimum gap width for root passes is 2-3mm, the root face should be in the range 2-2.5mm.</p> <p>Characteristics and application</p> <p>Basic electrode with some additions of rutile and silicates. Excellent suited for positional welding of root passes using DC- negative polarity. Also for filler and cap layers in pipes, tubes and plates using DC+ positive polarity, or even AC. User-friendly electrode with good gap bridging capability and with easy slag removal ensuring minimum grinding. Good weld metal impact toughness down to -45°C (-50°F). Böhler FOX EV PIPE offers considerable time savings in root pass welding compared with AWS E7018 type electrodes, due to increased travel speed. Use of diameter 3.2mm electrodes is possible as from 8mm wall thickness. Böhler FOX EV PIPE can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Test values for SSC test are available too.</p> <p>Approvals</p> <p>TÜV (7620), DB (10.014.77), LTSS, SEPROZ, CE, NAKS (ø 2.5-4.0mm), GAZPROM (ø 2.5-4.0mm)</p>	C 0.06	470	560	29	+20	170	2.0	30-60	L290NB-L360NB	A
	Si 0.60	(≥ 420)	(500-640)	(≥ 20)	-20	100	2.5	40-90	L290MB-L415MB	B
	Mn 0.9				-40	60 (≥ 47)	3.2	60-130	L450 MB1-555MB1	X42-X60
					-45	55 (≥ 27)	4.0	110-180		X65 ¹ -X80 ¹
		YS	TS	E (L=4d)	CVN		ø	A	¹ Only for root pass	
	ksi	ksi	%	°F	ft-lbf	inch	A			
	68 (≥ 58)	81 (≥ 70)	29 (≥ 22)	+68 -4 -40 -50	125 74 44 41 (≥ 27)	5/64 3/32 1/8 5/32	30-60 40-90 60-130 110-180			

BÖHLER FOX EV 50-W	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
		Re	Rm	A5	CVN		ø	A	EN	API 5L
EN ISO 2560-A: E 42 5 B 12 H5 AWS A5.1: E7016-1H4R	%	MPa	MPa	%	°C	J	mm	A		
 <p>Root pass negative polarity</p> <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material.</p> <p>Characteristics and application</p> <p>Basic 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 ambient and sub-zero temperatures. Very low diffusible hydrogen content - AWS class H4/ HDM < 4 ml/100g weld metal. Especially suited for welding on AC. DC negative polarity recommended for root passes.</p> <p>Approvals</p> <p>TÜV (4180), GL (3YH5), LTSS, SEPROZ</p>	C 0.07	460	560	28	+20	200	2.5	55-85	L245NB-L415NB	A, B
	Si 0.5	(≥ 420)	(500-640)	(≥ 20)	-20	150	3.2	80-140	L245MB-L415MB	X42-X60
	Mn 1.1				-50	≥ 47	4.0	110-180		
							5.0	180-230		
		YS	TS	E (L=4d)	CVN		ø	A		
	ksi	ksi	%	°F	ft-lbf	inch	A			
	67 (≥ 58)	81 (≥ 70)	28 (≥ 22)	+68 -4 -50	148 111 ≥ 20	3/32 1/8 5/32 3/16	55-85 80-140 110-180 180-230			

BÖHLER FOX EV 50	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
		Re	Rm	A5	CVN		ø	A	EN	API 5L
EN ISO 2560-A: E 42 5 B 4 2 H5 AWS A5.1: E7018-1H4R	%	MPa	MPa	%	°C	J	mm	A		
 <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material.</p>	C 0.08	460	560	27	+20	190	2.0	50-70	L245NB-L415NB	A,B
	Si 0.4	≥ 420)	(500-640)	(≥ 20)	-20	160	2.5	80-110	L245MB-L415MB	X42-X60
	Mn 1.2				-50	70 (≥ 47)	3.2	100-140		
							4.0	130-180		
							5.0	180-230		
		YS	TS	E (L=4d)	CVN		ø	A		
		ksi	ksi	%	°F	ft-lbf	inch	A		
		67	81	27	+68	140	5/64	50-70		
		(≥ 58)	(≥ 70)	(≥ 22)	-4	118	3/32	80-110		
					-50	52 (≥ 20)	1/8	100-140		
							5/32	130-180		
							3/16	180-230		
Characteristics and application										
Basic electrode designed for high-quality welds. Excellent strength and toughness properties down to -50 °C (-58 °F). Metal recovery approx. 110%. Good weldability in all positions, except vertical-down. Very low diffusible hydrogen weld metal- AWS class H4 / HDM < 4ml/100g weld metal. Suitable for welding low-purity steels with a high carbon content. Used in steel construction, boiler and tank manufacture, vehicle construction, shipbuilding and machine construction, as well as for buffer layers on high carbon steels. Especially suited for offshore construction. CTOD tested at -10 °C (14 °F). Böhler FOX EV 50 can be used in sour gas applications (HIC-Test acc. NACE TM-02-84). Results from SSC testing are available too.										
Approvals										
TÜV (0426), DB (10.014.02), ABS (3H5, 4Y), BV (3YHHH), DNV (3YH10), GL (4Y40H15), LR (3, 3YH5), RMR (3YHH), RINA (4YH5/4H5), LTTS, VUZ, SEPROZ, PDO, CRS (3YH5), CE. NAKS										

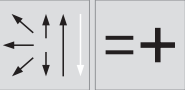
Phoenix 120 K	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
		Re	Rm	A5	CVN		ø	A	EN	API 5L
EN ISO 2560-A: E 42 5 B 3 2 H5 AWS A5.1: E7018-1	%	MPa	MPa	%	°C	J	mm	A		
 <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material.</p>	C 0.07	440	530	30	+20	190	2.0	45 - 65	L245NB - L415NB	A,B
	Si 0.35	≥ 420)	(500-640)	(≥ 20)	-50	100	2.5	65 - 110	L245MB - L415MB	X42 - X60
	Mn 1.20						3.2	100 - 145		
							4.0	135 - 200		
							5.0	180 - 280		
		YS	TS	E (L=4d)	CVN		ø	A		
		ksi	ksi	%	°F	ft-lbf	inch	A		
		64	77	30	+68	140	5/64	45 - 65		
		(≥ 58)	(≥ 70)	(≥ 22)	-50	(≥ 20)	3/32	65 - 110		
					-58	74	1/8	100 - 145		
							5/32	135 - 200		
							3/16	180 - 280		
Characteristics and application										
Basic covered electrode. Excellent welding characteristics including out of position work, except vertical-down. 120 % weld metal recovery. H ₂ -content in the weld metal ≤ 5 ml / 100 g. Very pure cryogenic weld metal at temperatures as low as -50 °C (-58 °F); CTOD tested up to -10 °C (14 °F).										
Approvals										
TÜV (00348), DB (10.132.17), ABS, BV, DNV, GL, LR, CE										

Basic electrodes for vertical-up welding

BÖHLER FOX EV 60 EN ISO 2560-A: E 46 6 1Ni B 4 2 H5 AWS A5.5: E8018-C3H4R	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material.</p>	C 0.07	510	610	27	+20	180	2.5	80-100	L360NB, L415NB	X52-X65
	Si 0.4	(≥ 460)	(580-740)	(≥ 20)	-60	110 (≥ 47)	3.2	110-140	L360MB-L450MB	
	Mn 1.15						4.0	140-180		
	Ni 0.9						5.0	190-230		
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
		74	88	27	+68	133	3/32	80-100		
		(68-80)	(≥ 80)	(≥ 24)	-76	81	1/8	110-140		
					-40	≥ 20	5/32	140-180		
							3/16	190-230		

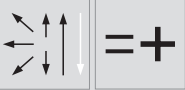
Characteristics and application
Basic <1% Ni-alloyed electrode with excellent mechanical properties, particularly low-temperature toughness and crack resistance. Suitable for service temperatures from 350°C (662°F) down to -60°C (-76°F). Very good impact toughness in aged condition. Metal recovery about 115%. Good weldability in all positions, except vertical-down. Very low diffusible hydrogen content - AWS class H4 / HDM < 4ml/100g weld metal. CTOD tested at -40°C (-40°F). Results from SSC testing available.

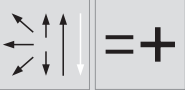
Approvals
TÜV (1524), DNV (3YHH), RMR (3YHH), Statoil, LTSS, SEPROZ, CRS (3YH5), VG 95132, CE, ABS

BÖHLER FOX EV 60 PIPE EN ISO 2560-A: E 50 4 1Ni B 1 2 H5 AWS A5.5: E8016-GH4R	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material.</p>	C 0.07	550	590	29	+20	170	2.5	40-90	L210NB-L450NB	X42-X65
	Si 0.60	(≥ 500)	(560-720)	(≥ 18)	0	150	3.2	60-130	L210MB-L450MB	
	Mn 1.2				-20	140	4.0	110-180		
	Ni 0.9				-40	110 (≥ 47)	5.0	180-230		
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
		80	85	29	+68	125	3/32	40-90		
		(≥ 67)	(≥ 80)	(≥ 19)	+32	110	1/8	60-130		
					-4	103	5/32	110-180		
					-40	81	3/16	180-230		
					-50	44				

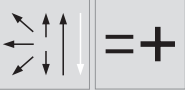
Characteristics and application
Basic coated electrode for positional welding of filler and cap layers in tubes and plates. Good impact toughness down to -40°C (-40°F) and low hydrogen content (HDM < 5ml/100g). Packed in hermetically sealed tins.

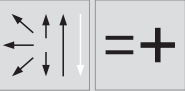
Approvals
NAKS (ø 3.2mm), GAZPROM (ø 3.2mm)

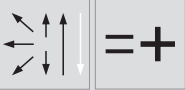
BÖHLER FOX EV 65	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 18275-A: E 55 1NiMo B 4 2 H5										
AWS A5.5: E8018-GH4R / E8018-D1H4R	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material.</p>	C 0.06	600	650	25	+20	180	2.5	80-100	L415NB	X60-X70
	Si 0.3	(≥ 550)	(620-780)	(≥ 18)	-60	80 (≥ 47)	3.2	100-140	L415MB,	
	Mn 1.2						4.0	140-180	L485MB	
	Ni 0.8						4.8	180-220		
Mo 0.35						5.0	190-230			
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
		87	94	25	+68	132	3/32	80-100		
		(≥ 67)	(≥ 80)	(≥ 19)	-76	59	1/8	100-140		
					-60	≥ 20	5/32	140-180		
							-	180-220		
							3/16	190-230		
Characteristics and application										
Basic electrode providing a high ductility, crack resistant weld deposit for service temperatures down to -60°C (-76°F). Resistant to ageing. Good weldability in position, except vertical-down. Very low diffusible hydrogen weld content - AWS class H4 / HDM < 4ml/100g weld metal.										
Approvals										
TÜV (1802), SEPPOZ, NAKS, VG 95132, BV, RMR, ABS, CE										

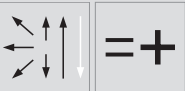
Phoenix SH V 1	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 2560-A: E 50 6 Mn1Ni B 4 2 H5										
AWS A5.1: E8018-G (E8018-C3 mod.)	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material.</p>	C 0.07	540	630	28	+20	180	3.2	100 - 150	L360NB -	X52 - X70
	Si 0.25	(≥ 500)	(560-720)	(≥ 18)	-60	80 (≥ 47)	4.0	140 - 200	L485NB	
	Mn 1.50						5.0	170 - 250	L360MB -	
	Ni 0.95								L485MB	
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A		
		78	91	28	+68	133	1/8	100 - 150		
		(≥ 67)	(≥ 80)	(≥ 19)	-76	59	5/32	140 - 200		
							3/16	170 - 250		
Characteristics and application										
Basic covered MnNi-alloyed electrode. High toughness at temperatures as low as -60°C (-76°F). High radio-graphical soundness. H ₂ -content ≤ 5 ml / 100 g (HD). CTOD- and NDT tested.										
Approvals										
TÜV (00531), DB (10.132.37), ABS, BV, DNV, GL, LR, VG 95132-1, CE										

Basic electrodes for vertical-up welding

BÖHLER FOX EV 70	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 18275-A: E 55 6 1NiMo B 4 2 H5 AWS A5.5: E9018-GH4R / E9018-D1H4R (mod.)	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material.</p> <p>Characteristics and application Basic Mo-Ni-alloyed electrode depositing a high ductility, crack resistant weld, for welding high strength, fine-grained steels. Suitable for service temperatures from +350°C (662°F) down to -60°C (-76°F). Metal recovery of approximately 115%. Good weldability in all positions, except vertical-down. Very low diffusible hydrogen content - AWS class H4 / HDM < 4ml/100g weld metal.</p> <p>Approvals TÜV (0112), SEPROZ, CE</p>	C 0.04	650	700	24	+20	160	2.5	80-100	L415MB, L485MB	X60-X70
	Si 0.3	(≥ 550)	(620-780)	(≥ 18)	-60	70 (≥ 47)	3.2	100-140		
	Mn 1.2						4.0	140-180		
	Ni 0.9						5.0	190-230		
Mo 0.4	YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A			
	94	101	24	+68	118	3/32	80-100			
	(≥ 77)	(≥ 90)	(≥ 17)	-76	52	1/8	100-140			
				-60	≥ 20	5/32	140-180			
						3/16	190-230			

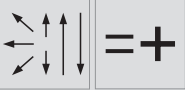
BÖHLER FOX EV 70 PIPE	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter and welding current		Pipeline steel grades	
EN ISO 18275-A: E 55 4 ZMn2NiMo B 1 2 H5 AWS A5.5: E9016-GH4R	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material.</p> <p>Characteristics and application Böhler FOX EV 70 PIPE is a high strength, basic electrode for positional welding of filler and cap layers in tubes, pipes and plate using DC+ positive polarity. It is user-friendly, has good gap bridging ability and easy slag removal to ensure minimal grinding. Good impact toughness down to -40°C (-40°F) and low hydrogen content (HDM < 5ml/100g). Packed in hermetically sealed tins.</p> <p>Approvals TÜV (12809), CE</p>	C 0.06	620	680	20	+20	140	2.5	40-90	L450MB - L555MB	X65-X80
	Si 0.5	(≥ 550)	(620-780)	(≥ 18)	-20	80	3.2	60-130		
	Mn 1.7				-40	70 (≥ 47)	4.0	110-180		
	Ni 2.2				-45	55				
Mo 0.3	YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A			
	90	98	20	+68	103	3/32	40-90			
	(≥ 77)	(≥ 90)	(≥ 17)	-4	59	1/8	60-130			
				-40	52	5/32	110-180			
				-50	48					

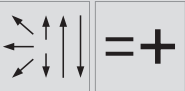
BÖHLER FOX EV 75		Typical analyses all weld metal		Typical mechanical properties all weld metal				Diameter and welding current		Pipeline steel grades		
EN ISO 18275-A: E 62 6 Mn2NiCrMo B 4 2 H5 AWS A5.5: E10018-GH4R / E10018MH4R (mod.)		%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material.</p> <p>Characteristics and application Basic Cr-Ni-Mo-alloyed electrode depositing a high ductility, crack resistant weld, for welding high strength, fine-grained steels. Suitable for service temperatures from +400°C (752°F) down to -60°C (-76°F). Metal recovery of approximately 120%. Good weldability in all positions, except vertical-down. Very low diffusible hydrogen content - AWS class H4 / HDM 4ml/100g weld metal.</p> <p>Approvals SEPROZ</p>	C	0.05	700	750	23	+20	140	2.5	80-100	L555MB	X80	
	Si	0.4	(≥ 620)	(690-980)	(≥ 18)	-60	≥ 47	3.2	100-140			
	Mn	1.6						4.0	140-180			
	Cr	0.4						5.0	190-230			
	Ni	2.0										
Mo	0.4											
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A			
			101	109	23	+68	103	3/32	80-100			
			(≥ 87)	(≥ 100)	(≥ 16)	-60	≥ 20	1/8	100-140			
								5/32	140-180			
								3/16	190-230			

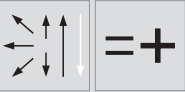
BÖHLER FOX EV 85		Typical analyses all weld metal		Typical mechanical properties all weld metal				Diameter and welding current		Pipeline steel grades		
EN ISO 18275-A: E 69 6 Mn2NiCrMo B 4 2 H5 AWS A5.5: E11018-GH4R / E11018-MH4R (mod.)		%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	A	EN	API 5L
 <p>Re-drying if necessary: 300 - 350°C (570 - 660°F) / min. 2h</p> <p>Preheat and interpass temperature as required by the base material.</p> <p>Characteristics and application Basic Cr-Ni-Mo-alloyed electrode depositing a high ductility, crack resistant weld, for welding high strength, fine-grained steels. Suitable for service temperatures down to -60°C (-76°F). Good weldability in all positions, except vertical-down. Very low diffusible hydrogen content - AWS class H4 / HDM < 4ml/100g weld metal.</p> <p>Approvals TÜV (4313), DB (10.014.22), SEPROZ, BV, CE</p>	C	0.05	780	840	20	+20	110	2.5	70-100	L625, L690	X90, X100	
	Si	0.4	(≥ 690)	(760-960)	(≥ 17)	-60	60 (≥ 47)	3.2	100-140			
	Mn	1.7						4.0	140-180			
	Cr	0.4						5.0	190-230			
	Ni	2.1										
Mo	0.5											
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	A			
			113	122	20	+68	81	3/32	70-100			
			(≥ 97)	(≥ 110)	(≥ 15)	-60	≥ 20	1/8	100-140			
								5/32	140-180			
								3/16	190-230			

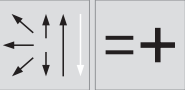


Flux-cored wires for automatic and semi-automatic pipeline welding

BÖHLER Ti 52-FD	Typical analyses all weld metal	Typical mechanical properties all weld metal						Diameter	Pipeline steel grades		
EN ISO 17632-A: T 46 4 P M 1 H10 / T 42 2 P C 1 H5 AWS A5.36: E71T1-M21A4-CS1-H8 E71T1-C1A2-CS1-H4											
 <p>Shielding gas: M21: Ar + 15-25% CO₂ C1: 100% CO₂</p> <p>Preheating and interpass temperature as required by base metal</p> <p>Re-drying possible at 150 °C (300 °F) / 24h, but generally not needed</p> <p>Characteristics and application All-positional rutile flux-cored wire with fast freezing slag system. Welder-friendly characteristics. The diameter 1.2 mm size can be used in all welding positions with the same parameter setting. Low spatter losses, easy slag removal, finely rippled bead surface. High X-ray quality welds with excellent mechanical properties. The most productive consumable for manual positional welding with deposition rates up to three times as high as with SMAW / mmA. Can be used with conventional non-pulse power sources.</p> <p>Approvals TÜV (11164), DB (42.014.35), ABS, GL, LR, DNV, BV, CRS, CE</p>	%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L	
	C	0.06	M21	500	580	26	+20	180	1.2	L245NB-L415NB	A,B
	Si	0.5		(≥ 460)	(550-740)	(≥ 20)	-20	130	1.6	L450QB	X42-X65
	Mn	1.2					-40	90 (≥47)		L245MB-L450MB	
	Ti	0.05	C1	480	550	25	+20	160			
				(≥ 420)	(500-670)	(≥ 20)	-20	110 (≥47)			
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch			
		M21	72	84	26	+68	133	0.045			
			(≥ 58)	(70-95)	(≥ 22)	-4	96	1/16			
						-40	66 (≥ 20)				
		C1	70	80	25	+68	118				
			(≥ 58)	(70-95)	(≥ 22)	-20	81 (≥ 20)				

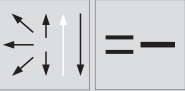
BÖHLER Ti 60-FD	Typical analyses all weld metal	Typical mechanical properties all weld metal						Diameter	Pipeline steel grades		
EN ISO 17632-A: T 50 6 1Ni P M 1 H5 AWS A5.36: E81T1-M21A8-Ni1-H4											
 <p>Shielding gas: M21: Ar + 15-25% CO₂</p> <p>Preheating and interpass temperature as required by base metal</p> <p>Re-drying possible at 150 °C (300 °F) / 24h, but generally not needed</p> <p>Characteristics and application All-positional rutile flux-cored wire with fast freezing slag system for welding low-temperature steels. Outstanding welding characteristics in all positions. Low spatter losses, good slag detachability, finely rippled smooth beads and notch-free toes. Exceptionally good low-temperature impact toughness down to -60 °C (-80 °F). The wire is CTOD tested. The most productive consumable for manual positional welding with deposition rates up to three times as high as with SMAW / mmA. Can be used with conventional non-pulse power sources. BÖHLER Ti 60-FD can be used for sour gas applications (HIC test acc. to NACE TM 02-84). Test results from SSC testing available too.</p> <p>Approvals TÜV (11544), DB (42.014.42), GL (6Y46H5S), ABS, DNV, LR, BV, CE</p>	%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L	
	C	0.06	M21	530	570	27	+20	140	1.2	L245NB-L415NB	B
	Si	0.45		(≥ 500)	(560-720)	(≥ 18)	-20	120		L245MB-L485MB	X42-X70
	Mn	1.3					-40	100			
	Ni	0.9					-60	60 (≥47)			
				YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
		M21	77	83	27	+68	103	0.045			
			(≥ 68)	(80-100)	(≥ 19)	-4	86				
						-40	74				
						-80	44 (≥ 20)				

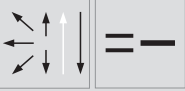
BÖHLER Ti 70 Pipe-FD		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 18276-A: T 55 4 Mn1Ni P M 1 H5 AWS A5.36: E91T1-M21A4-G		%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
	C	0.07	≥ 550	640-820	≥ 18	-40	≥47	1.2	L450MB-L485MB (L555MB)	X65-X70 (X80)
	Si	0.50								
	Mn	1.50								
	Ni	0.95								
Shielding gas: M21: Ar + 15-25% CO ₂			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
Re-drying possible at 150 °C (300 °F) / 24h, but generally not needed			≥ 78	90-110	≥ 17	-40	≥ 20	0.045		
Preheating and interpass temperature as required by base metal										
Characteristics and application										
Rutile micro alloyed flux-cored wire for single or multipass welding of carbon-manganese steels and high strength steels with Ar-CO ₂ shielding gas. Main features: excellent weldability in all positions, excellent bead appearance, no spatter; fast freezing and easily removable slag. The exceptional mechanical properties of this wire even at the low temperature (-40 °C) (-40 °F), as well as the low content of diffusible hydrogen make it especially suitable for pipeline applications. Further applications are found in the offshore industry, shipbuilding and structures built with high strength steels. Spray arc operation with all parameters allows the used of standard, non-pulse power sources.										
Approvals										
TÜV (12279), CE, GAZPROM										


BÖHLER Ti 80 Pipe-FD		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 18276-A: T 69 4 Z P M 1 H5 AWS A5.36: E111T1-M21A4-GH4		%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
	C	0.07	790	850	18	-40	65 (≥ 47)		L485MB, L555MB	X70, X80
	Si	0.3	(≥ 690)	(770-940)	(≥ 17)					
	Mn	1.8								
	Ni	2.1								
Shielding gas: M21: Ar + 15-25% CO ₂			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
Re-drying possible at 150 °C (300 °F) / 24h, but generally not needed			114 (≥ 98)	123 (110-130)	18 (≥ 15)	-40	48 (≥ 20)	0.045		
Preheating and interpass temperature as required by base metal										
Characteristics and application										
Seamless rutile Ni-Mo alloyed flux-cored wire for single- or multi-pass welding of high strength steels, using Ar-CO ₂ shielding gas. It features excellent weldability in all positions, excellent bead appearance, no spatter and a fast freezing slag that is easily removed. Its very low hydrogen weld metal and good impact toughness down to -40 °C (-40 °F) make the wire especially suited for pipeline applications. Further use is found in offshore fabrication, shipbuilding and in high strength steel structures. Spray arc operation with all parameters allows the use of standard, non-pulse power sources.										



Self-shielded flux-cored wires for semi-automatic pipeline welding

BÖHLER Pipeshield 71 T8-FD		Typical analyses all weld metal		Typical mechanical properties all weld metal				Diameter	Pipeline steel grades	
AWS A5.36: E71T8-A4-K6		%		Re	Rm	A5	CVN	ø	EN	API 5L
				MPa	MPa	%	°C			
	C	0.045	435	535	28	+20	200	2.0		A, B X42-X60
	Si	0.14	(≥ 400)	(490-660)	(≥ 22)	-30	150			
	Mn	1.1				-40	100 (≥27)			
	Al	0.8	YS	TS	E (L=4d)	CVN	°F	ft-lbf	inch	
Self-shielded	Ni	0.7	63	77	28	+68	148	5/64		
Recommended stick-out: 10-25 mm (0.4-1")			(≥ 58)	(70-95)	(≥ 22)	-22	111			
						-40	74 (≥ 20)			
Characteristics and application										
BÖHLER Pipeshield 71 T8-FD is a self-shielded flux-cored wire especially developed for semi-automatic pipe welding in vertical-down (5G) position. It is also suitable for welding unalloyed steel constructions. This wire has a fast freezing, easily removable slag, excellent welding characteristics, is welder-friendly and provides high productivity. BÖHLER Pipeshield 71 T8-FD is designed to provide good mechanical properties as well as high impact toughness at low temperatures. Outstanding characteristics for vertical-down welding of hot pass, fill and cap layers. Due to the fluoride-basic filling, a similar interpass temperatures as with basic electrodes can be applied (we recommend 80 - 200 °C (176-392 °F)). This self-shielded flux cored wire is easy to handle by welders, due to a very tolerant stick-out length and low tendency to porosity also when welding with a high arc length as a result of higher voltage.										
Approvals										
NAKS, GAZPROM										

BÖHLER Pipeshield 71.1 T8-FD		Typical analyses all weld metal		Typical mechanical properties all weld metal				Diameter	Pipeline steel grades	
AWS A5.36: E71T8-A4-Ni1		%		Re	Rm	A5	CVN	ø	EN	API 5L
				MPa	MPa	%	°C			
	C	0.045	435	535	28	+20	200	2.0		A, B X42-X60
	Si	0.14	(≥ 400)	(490-660)	(≥ 22)	-30	150			
	Mn	1.1				-40	120 (≥27)			
	Al	0.8	YS	TS	E (L=4d)	CVN	°F	ft-lbf	inch	
Self-shielded	Ni	0.95	63	77	28	+68	148	5/64		
Recommended stick-out: 10-25 mm (0.4-1")			(≥ 58)	(70-95)	(≥ 22)	-22	111			
						-40	89 (≥ 20)			
Characteristics and application										
BÖHLER Pipeshield 71.1 T8-FD is a self-shielded flux-cored wire especially developed for semi-automatic pipe welding in vertical-down (5G) position. It is also suitable for welding unalloyed steel constructions. This wire has a fast freezing, easily removable slag, excellent welding characteristics, is welder-friendly and 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. Outstanding characteristics for vertical-down welding of hot pass, fill and cap layers. Due to the fluoride-basic filling, a similar interpass temperatures as with basic electrodes can be applied (we recommend 80 - 200 °C (176-392 °F)). This self-shielded flux cored wire is easy to handle by welders, due to a very tolerant stick-out length and low tendency to porosity also when welding with a high arc length as a result of higher voltage.										

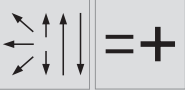
BÖHLER Pipeshield 81 T8-FD		Typical analyses all weld metal		Typical mechanical properties all weld metal				Diameter	Pipeline steel grades	
AWS A5.36: E81T8-A4-Ni2				Re	Rm	A5	CVN	ø	EN	API 5L
		%		MPa	MPa	%	°C			
	C	0.05	500	600	25	+20	170	2.0		X65, X70
	Si	0.15	(≥ 470)	(550-690)	(≥ 19)	-30	120			
	Mn	1.4				-40	90 (≥27)			
	Al	0.8	YS	TS	E (L=4d)	CVN			ø	
Self-shielded	Ni	1.95	ksi	ksi	%	°F	ft-lbf	inch		
Recommended stick-out: 10-25 mm (0.4-1")			72	87	25	+68	125	5/64		
			(≥ 68)	(80-100)	(≥ 19)	-22	89			
						-40	66 (≥ 20)			

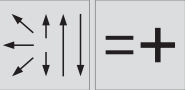
Characteristics and application
 BÖHLER Pipeshield 81 T8-FD is a self-shielded flux-cored wire especially developed for semi-automatic pipe welding in vertical-down (5G) position. It is also suitable for welding low-alloyed steel constructions. This wire has a fast freezing, easily removable slag, excellent welding characteristics, is welder-friendly and provides high productivity. BÖHLER Pipeshield 81 T8-FD is designed to provide good mechanical properties as well as high impact toughness at low temperatures. Outstanding characteristics for vertical-down welding of hot pass, fill and cap layers. Due to the fluoride-basic filling, similar interpass temperatures as with basic electrodes can be applied (we recommend 80 - 200 °C (176-392 °F)). This self-shielded flux cored wire is easy to handle by welders, due to a high tolerance for stick-out length and low tendency to porosity also when welding with a high arc length as a result of higher voltage.

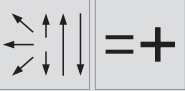
Approvals
 NAKS, GAZPROM

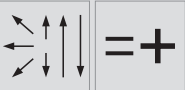


Solid wires for automatic pipeline welding

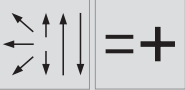
BÖHLER SG 3-P	Typical analyses all weld metal	Typical field results in X70 obtained with various automatic processes						Diameter	Pipeline steel grades				
EN ISO 14341-A: G 46 5 M21 Z / G 42 4 C1 Z AWS A5.18: ER70S-G	%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L			
 <p>Shielding gas: M21: Ar + 15-25% CO₂ C1: 100% CO₂</p> <p>Preheating and interpass temperature as required by the base metal</p> <p>Characteristics and application BÖHLER SG 3-P is a micro alloyed GMAW solid wire designed for high quality automatic welding of pipelines. An optimally balanced alloying concept ensures good weld metal properties to fulfil the high requirements in the on- and offshore pipeline industry. Deposit is extremely crack resistant with good weld metal toughness down to -50°C. Good wire feeding properties are promoted due to close control of important quality aspects during production, such as cast and helix, copper coating, narrow diameter tolerance and precision layer wound spooling. BÖHLER SG 3-P can be used in sour gas applications (HIC-test acc. to NACE TM 02-84). Test values for SSC-test available too.</p> <p>Approvals TÜV (07682), CE, NAKS</p>	C 0.06	M21	670 (≥ 460)	720 (530-680)	29 (≥ 20)	+20 -40	100 75	0.9 1.0 1.2	L290MB- L485MB	X42-X70			
	Si 0.75												
	Mn 1.55												
	Ti +	C1	630 (≥ 420)	690 (500-640)	30 (≥ 20)	+20 -40	195 50 (≥ 47)						
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch					
		M21	97 (≥ 58)	105 (≥ 70)	29 (≥ 22)	+68 -40	74 65	0.035 0.040 0.045					
		C1	91 (≥ 40)	100 (≥ 70)	30 (≥ 22)	+68 -40	70 37						

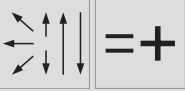
Union K 52 S	Typical analyses all weld metal	Typical mechanical properties all weld metal						Diameter	Pipeline steel grades				
EN ISO 14341-A: G 42 4 M31 3Si1 AWS A5.18: ER70S-6	%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L			
 <p>Shielding gas: M31: Ar + 40% CO₂</p> <p>Preheating and interpass temperature as required by the base metal</p> <p>Characteristics and application Mn, Si-alloyed solid wire electrode with a highly purified weld metal. Very low trace element content. Low spatter development in short and spray arc. For fully automatic vertical-down and vertical-up welding of pipe steels up to X70.</p>	C 0.07	M31	490 (≥ 420)	590 (500-640)	27 (≥ 22)	+20 -30	155 105	0.9 1.0 1.2	L290MB - L450MB	A, B, X42 - X65			
	Si 0.85												
	Mn 1.50												
				YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf			ø inch		
		M31	71 (≥ 65)	86 (≥ 78)	27 (≥ 24)	+68 -22	114 (≥ 20)	0.035 0.040 0.045					

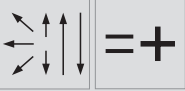
Union K 56 S	Typical analyses all weld metal	Typical mechanical properties all weld metal						Diameter	Pipeline steel grades	
EN ISO 14341-A: G 46 4 M21 4Si1 / G 46 2 C1 4Si1 AWS A5.18: ER70S-6	%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
 <p>Shielding gas: M21: Ar + 15-25% CO₂ C1: 100% CO₂</p> <p>Preheating and interpass temperature as required by the base metal</p>	C 0.08	M21	520 (≥ 460)	620 (530-680)	25 (≥ 20)	+20 -20 -40	170 160 100 (≥ 47)	1.0 1.2	L290MB - X42 - X70 L485MB	
	Si 1.05									
	Mn 1.65									
		C1	470 (≥ 460)	580 (530-680)	30 (≥ 20)	+20 -20 -40	130 95 (≥ 47) 60			
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
		M21	75 (≥ 58)	90 (≥ 70)	25 (≥ 22)	+68 -4 -22 -40	125 118 ≥20 73	0.040 0.045		
	C1	68 (≥ 58)	84 (≥ 70)	30 (≥ 22)	+68 -4 -22 -40	103 89 ≥20 44				
Characteristics and application										
All-purpose Mn-, Si-alloyed solid wire electrode for use with C1 and Ar/CO ₂ mixed gas. Low-spatter metal transfer in short and spray arc mode. For fully automatic vertical-down and vertical-up welding on steel pipes.										

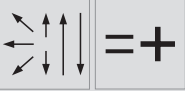
Union K Nova	Typical analyses all weld metal	Typical field results in X70 obtained with various automatic processes						Diameter	Pipeline steel grades	
EN ISO 14341-A: G 46 5 M21 Z / G 42 4 C1 Z AWS A5.18: ER70S-G	%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
 <p>Shielding gas: M21: Ar + 15-25% CO₂ C1: 100% CO₂</p> <p>Preheating and interpass temperature as required by the base metal</p>	C 0.06	M21	670 (≥ 460)	720 (530-680)	29 (≥ 20)	+20 -40 -50	100 65 ≥ 47	0.9 1.0 1.2	L290MB - X42 - X70 L485MB	
	Si 0.75									
	Mn 1.55									
	Ti +	C1	630 (≥ 420)	690 (500-640)	30 (≥ 20)	+20 -40	95 50 (≥ 47)			
			YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
		M21	97 (≥ 58)	105 (≥ 70)	29 (≥ 22)	+68 -40	74 65	0.035 0.040 0.045		
	C1	91 (≥ 40)	100 (≥ 70)	30 (≥ 22)	+68 -40	70 37				
Characteristics and application										
Union K Nova is a GMAW solid wire for automatic circumferential pipe welding. All quality characteristics regarding chemical composition, arc stability and feeding behaviours are optimised to meet the special quality requirements. CTOD values up to -5°C (-21°F). Fulfills strength-overmatching of X70 pipe steel.										
Approvals										
TÜV (05926), CE										

Solid wires for automatic pipeline welding

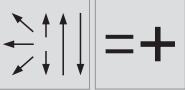
BÖHLER SG 8-P	Typical analyses all weld metal	Typical field results in X70 obtained with various automatic processes						Diameter	Pipeline steel grades	
EN ISO 14341-A: G 50 6 M21 Z3Ni1 / G 46 4 C1 Z3Ni1 AWS A5.18: ER80S-G (ER80S-Ni1(mod.))	%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
 <p>Shielding gas: M21: Ar + 15-25% CO₂ C1: 100% CO₂</p> <p>Preheating and interpass temperature as required by the base metal</p> <p>Characteristics and application BÖHLER SG 8-P is a micro alloyed GMAW solid wire designed for high quality automatic welding of pipelines. An optimally balanced alloying concept ensures good weld metal properties to fulfil the high requirements in the on- and offshore pipeline industry. Deposit is extremely crack resistant with good weld metal toughness down to -50°C (-58°F).</p> <p>Approvals DNV (IV Y46 MS)</p>	C < 0.09	M21	590 (≥ 500)	670 (560-720)	26 (≥ 18)	+20 -60	200 100 (≥47)	0.9 1.0 1.2	L290MB- L555MB	X42-X80
	Si 0.75	C1	560 (≥ 460)	630 (530-680)	25 (≥ 20)	+20 -40	110 95 (≥ 47)			
	Mn 1.60		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
	Ni 0.9	M21	85 (≥ 68)	91 (≥ 80)	26 (≥ 24)	+68 -76	148 74	0.035 0.040		
Ti +	C1	91 (≥ 68)	100 (≥ 80)	25 (≥ 24)	+68 -40	81 70	0.045			

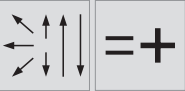
Union K Nova Ni	Typical analyses all weld metal	Typical field results in X70 obtained with various automatic processes						Diameter	Pipeline steel grades	
EN ISO 14341-A: G 50 6 M21 Z3Ni1 / G 46 4 C1 Z3Ni1 AWS A5.18: ER80S-G (ER80S-Ni1(mod.))	%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
 <p>Shielding gas: M21: Ar + 15-25% CO₂ C1: 100% CO₂</p> <p>Preheating and interpass temperature as required by the base metal</p> <p>Characteristics and application Union K Nova Ni is a GMAW solid wire electrode for fully automatic circumferential vertical-down and vertical-up pipe welding with especially good impact toughness even at low temperatures.</p> <p>Approvals TÜV (11542), DNV, CE</p>	C < 0.09	M21	590 (≥ 500)	670 (≥ 560-720)	26 (≥ 18)	+20 -60	200 100 (≥ 47)	0.9 1.0 1.2	L290MB - L555MB	X42 - X80
	Si 0.75	C1	560 (≥ 460)	630 (530-680)	25 (≥ 20)	+20 -40	110 95 (≥ 47)			
	Mn 1.60		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
	Ni 0.9	M21	85 (≥ 68)	91 (≥ 80)	26 (≥ 24)	+68 -76	148 74	0.035 0.040		
Ti +	C1	91 (≥ 68)	100 (≥ 80)	25 (≥ 24)	+68 -40	81 70	0.045			

BÖHLER NiMo 1-IG		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 14341-A: G 55 6 M21 Mn3Ni1Mo G 55 4 C1 Mn3Ni1Mo AWS A5.18: ER90S-G		%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
 <p>Shielding gas: M21: Ar + 15-25% CO₂ C1: 100% CO₂</p> <p>Preheating and interpass temperature as required by the base metal</p> <p>Characteristics and application Copper-coated GMAW wire for high strength, quenched and tempered, fine-grained construction steels. The wire is used for joint welding in boiler, pressure vessel, pipeline, and crane construction, as well as in structural steel engineering. The typical composition of the wire satisfies the requirements of the NORSOK7 regulation for water injection systems. Due to precise addition of micro alloying elements and low weld metal hydrogen, NiMo 1-IG wire features excellent ductility and crack resistance, in spite of its high strength. Good low-temperature impact energy down to -60 °C (-76 °F). Good wire feeding properties.</p> <p>Approvals TÜV (11763), DB (42.014.06), GL (4Y55S), SEPROZ, NAKS (1.2 mm), GAZPROM (1.2 mm), CE, VG 95132.</p>	C	0.08	M21	620	700	23	+20	140	0.9	L415MB- X60-X80 L555MB X60Q- L515QB- X80Q L555QB
	Si	0.6		(≥ 550)	(640-820)	(≥ 18)	-40	110	1.0	
	Mn	1.8					-60	≥ 47	1.2	
	Mo	0.3	C1	590	680	22	+20	140		
Ni	0.9		(≥ 550)	(620-770)	(≥ 20)	-40	≥ 47			
			YS	TS	E (L=4d)	CVN		ø		
			ksi	ksi	%	°F	ft-lbf	inch		
		M21	90	101	23	+68	103	0.035		
				(≥ 90)		-40	81	0.040		
		C1	85	98	22	+68	103	0.045		
				(≥ 90)						

Union NiMo 80		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 16834-A: G 62 5 M21 Mn3Ni1Mo AWS A5.28: ER90S-G		%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
 <p>Shielding gas: M21: Ar + 15-25% CO₂ C1: 100% CO₂</p> <p>Preheating and interpass temperature as required by the base metal</p> <p>Characteristics and application Union NiMo 80 is a GMAW solid wire for automatic girth welding. All quality characteristics regarding chemical composition, arc stability and feeding behaviour are optimised to meet the special quality requirements. Fulfills strength-overmatching of X80 pipe steel.</p> <p>Approvals TÜV (06525), CE</p>	C	0.09	M21	680	760	22	+20	190	0.9	L485MB - X70 - X80 L555MB
	Si	0.65		(≥ 620)	(700-890)	(≥ 18)	-50	90 (≥ 47)	1.0	
	Mn	1.55							1.14	
	Ni	1.10	C1	620	705	21	+20	110		
Mo	0.40					-40	75			
			YS	TS	E (L=4d)	CVN		ø		
			ksi	ksi	%	°F	ft-lbf	inch		
		M21	98	110	22	+68	140	0.035		
						-58	66	0.040		
		C1	90	102	21	+68	81	0.045		
						-40	55			

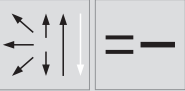
Solid wires for automatic pipeline welding

Union Ni1MoCr	Typical analyses all weld metal	Typical mechanical properties all weld metal						Diameter	Pipeline steel grades	
EN ISO 16834-A: G Z Mn3Ni0.9MoCr AWS A5.28: ER100S-G	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L	
 Shielding gas: M21: Ar + 15-25% CO ₂	C 0.08	M21 630	720	22	+20	135	1.0	L625M - L690MB	X90 - X100	
	Si 0.50				-40	95	1.2			
	Mn 1.60				-60	80				
	Ni 0.9									
	Mo 0.40	YS	TS	E (L=4d)	CVN		ø			
	Cr 0.27	ksi	ksi	%	°F	ft-lbf	inch			
Preheating and interpass temperature as required by the base metal		M21 91	104	22	+68	100	0.040			
		(≥ 88)	(≥ 100)	(≥ 16)	-40	70	0.045			
					-76	59				
Characteristics and application										
Union Ni1MoCr is a copper coated, medium-alloy wire electrode for quenched and tempered and thermomechanically rolled fine-grained structural steels. Excellent weld metal toughness at low temperatures when deposited in combination with gas mixtures. Application in components of offshore equipment like pipework and tubes.										

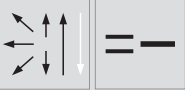
Union NiMoCr	Typical analyses all weld metal	Typical mechanical properties all weld metal						Diameter	Pipeline steel grades	
EN ISO 16834-A: G 69 6 M21 Mn4Ni1.5CrMo AWS A5.28: ER100S-G (ER100S-1(mod.))	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L	
 Shielding gas: M21: Ar + 15-25% CO ₂ C1: 100% CO ₂	C 0.08	M21 750	830	21	+20	135	0.8	L830M	X120	
	Si 0.60	(≥ 690)	(770-940)	(≥ 17)	-60	70 (≥ 47)	1.0			
	Mn 1.70						1.2			
	Ni 1.50	C1 680	740	18	+20	80				
	Mo 0.50				-40	47				
	Cr 0.20	YS	TS	E (L=4d)	CVN		ø			
Preheating and interpass temperature as required by the base metal		ksi	ksi	%	°F	ft-lbf	inch			
		M21 108	120	21	+68	99	0.032			
					-76	51	0.040			
							0.045			
		C1 99	107	18	+68	59				
		(≥ 88)	(≥ 100)	(≥ 16)	-40	35				
Characteristics and application										
Union NiMoCr is low-alloyed solid wire electrode for shielded arc welding of quenched and tempered and thermomechanically treated fine grained structural steels. For use with CO ₂ and Ar/CO ₂ mixed gas. Outstanding toughness of the weld metal at low temperatures.										
Approvals										
TÜV (02760), DB (42.132.08), ABS, BV, DNV, GL, LR, VG 95132-1, CE										



Rods for TIG-welding

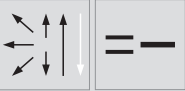
BÖHLER ER 70 S-2		Typical analyses all weld metal		Typical mechanical properties all weld metal				Diameter	Pipeline steel grades	
AWS A5.18: ER70S-2		%		Re	Rm	A5	CVN	ø	EN	API 5L
				MPa	MPa	%	°C	mm		
	C	0.05	420	520	23	+20	180	1.6	L245NB-L415NB	A, B
	Si	0.5	(≥ 400)	(≥ 480)	(≥ 22)	-30	120 (≥ 27)	2.0	L245MB-L415MB	X42-X60
	Mn	1.2				-50	80	2.4		
Shielding gas: I1: 100% Ar				YS	TS	E (L=4d)	CVN	ø		
Preheating and interpass temperature as required by base metal				ksi	ksi	%	°F	ft-lbf	inch	
				61	75	23	+68	133	1/16	
				(≥ 58)	(≥ 70)	(≥ 22)	-22	89	5/64	
							-58	59	3/32	
							-20	(≥ 20)		

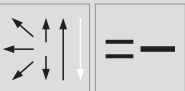
Characteristics and application
Copper-coated GTAW rod containing Al, Ti and Zr as strong deoxidizers in addition to Mn and Si - often referred to as triple deoxidized. This has advantages when rimming or semi-killed steels are welded or where joint preparations are rusty or contaminated. BÖHLER ER 70 S-2 is primarily used for single pass welding. For applications involving single and multi pass GTAW - and/or low-temperature toughness demands down to -50 °C (-58 °F) - we recommend our GTAW rod BÖHLER EML 5 (ER70S-3). BÖHLER ER 70 S-2 can be used in sour gas applications (HIC-test acc. to NACE TM-02-84).

BÖHLER EMK 6		Typical analyses all weld metal		Typical mechanical properties all weld metal				Diameter	Pipeline steel grades	
EN ISO 636-A: W 42 5 W3Si1		%		Re	Rm	A5	CVN	ø	EN	API 5L
AWS A5.18: ER70S-6		%		MPa	MPa	%	°C	mm		
	C	0.08	450	560	28	+20	180	1.6	L245NB-L415NB	A, B
	Si	0.9	(≥ 420)	(500-640)	(≥ 20)	-40	80	2.0	L245MB-L415MB	X42-X60
	Mn	1.45				-50	≥47			
Shielding gas: I1: 100% Ar				YS	TS	E (L=4d)	CVN	ø		
Preheating and interpass temperature as required by base metal				ksi	ksi	%	°F	ft-lbf	inch	
				65	81	28	+68	132	1/16	
				(≥ 58)	(≥ 70)	(≥ 22)	-40	59	5/64	
							-20	(≥ 20)	3/32	

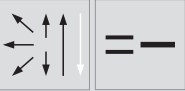
Characteristics and application
GTAW rod with high silicon content, suited for joints in boiler and vessel fabrication, as well as in structural engineering. BÖHLER EMK 6 can be used in sour gas applications (HIC-test acc. to NACE TM-02-84). Results from SSC testing are available too.

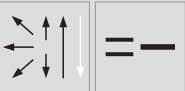
Approvals
TÜV (09717), LTSS, SEPROZ, CE

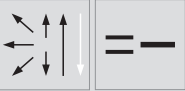
Union I 2	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 636-A: W 42 5 W2Si AWS A5.18: ER70S-3	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
 <p>Shielding gas: I1: 100% Ar</p> <p>Preheating and interpass temperature as required by base metal</p>	C 0.08	435	520	28	+20	220	1.6	L245NB - L415NB	A, B
	Si 0.60	(≥ 420)	(500-640)	(≥ 20)	-50	200 (≥ 47)	2.0	L245MB - L415MB	X42 - X60
	Mn 1.15						2.4		
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
		63	75	28	+68	162	1/16		
		(≥ 58)	(≥ 70)	(≥ 22)	-4	(≥ 20)	5/64		
					-58	148	3/32		
<p>Characteristics and application Copper coated, unalloyed GTAW rod for TIG welding of unalloyed structural steels. Due to its high purity the weld metal obtains high impact values down to -50 °C (-58 °F). Suited for root pass welding.</p> <p>Approvals TÜV (09482), CE</p>									

Union I 52	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 636-A: W 42 5 W3Si1 AWS A5.18: ER70S-6	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
 <p>Shielding gas: I1: 100% Ar</p> <p>Preheating and interpass temperature as required by base metal</p>	C 0.08	450	580	27	+20	210	1.6	L245NB - L415NB	A, B
	Si 0.60	(≥ 420)	500-640	(≥ 20)	-50	90 (≥ 47)	2.0	L245MB - L415MB	X42 - X60
	Mn 1.15						2.4		
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
		65	84	27	+68	155	1/16		
		(≥ 58)	(≥ 70)	(≥ 22)	-22	(≥ 20)	5/64		
					-58	66	3/32		
<p>Characteristics and application Copper coated, GTAW rod for TIG welding. Suited for root pass welding. Can be used in sour gas applications (HIC-test acc. to NACE TM-02-84).</p> <p>Approvals TÜV (09482), CE</p>									

Rods for TIG-welding

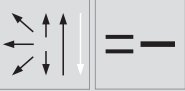
BÖHLER EML 5	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 636-A: W 46 5 W2Si AWS A5.18: ER70S-3	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
	C 0.1	520	620	26	+20	220	1.6	L245NB-L415NB	A, B
	Si 0.6	(≥ 460)	(530-680)	(≥ 23)	-20	200	2.0	L245MB-L415MB	X42-X60
	Mn 1.2				-50	90 (≥47)	2.4		
Shielding gas: I1: 100% Ar		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
Preheating and interpass temperature as required by base metal		75	90	26	+68	162	1/16		
		(≥ 58)	(≥ 70)	(≥ 22)	-4	148 (≥ 20)	5/64		
					-58	66	3/32		
Characteristics and application GTAW rod for high integrity welds. The low S-content makes this filler metal particularly suited for joint welds that are subjected to enamelling or galvanizing. Especially suited for root pass welding (approved at -50 °C (-58 °F)). BÖHLER EML 5 can be used in sour gas applications (HIC-test acc. to NACE TM-02-84). Results from SSC testing are available too.									
Approvals TÜV (1096) DB (42.014.02), Statoil, CE									

BÖHLER Ni 1-IG	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 636-A: W 46 5 W3Ni1 AWS A5.28: ER80S-Ni1 (mod.)	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
	C 0.07	500	600	25	-20	150	2.0	L360NB-L415NB	X52-X65
	Si 0.7	(≥ 460)	(550-740)	(≥ 20)	-50	≥ 47	2.4	L360MB-L450MB	
	Mn 1.4								
Shielding gas: I1: 100% Ar	Ni 0.9	YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
Preheating and interpass temperature as required by base metal		72	87	25	+68	162	5/64		
		(≥ 68)	(≥ 80)	(≥ 24)	-50	(≥ 20)	3/32		
Characteristics and application Ni-alloyed GTAW rod for the welding of offshore pipework and similar high integrity applications. Good impact toughness down to -50 °C (-58 °F). Results from SSC testing are available too.									
Approvals TÜV (12808), CE									

BÖHLER NiMo 1-IG	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 16834-A: W 55 6 1Mn3Ni1Mo AWS A5.28: ER90S-G	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
 Shielding gas: I1: 100% Ar Preheating and interpass temperature as required by base metal	C	620	700	23	+20	140	2.4	L450MB-L555MB	X65-X80
	Si	(≥ 550)	(640-820)	(≥ 18)	-40	110			
	Mn				-60	≥ 47			
	Mo								
	Ni								
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
		90	101	23	+68	103	3/32		
			(≥ 90)		-40	81			

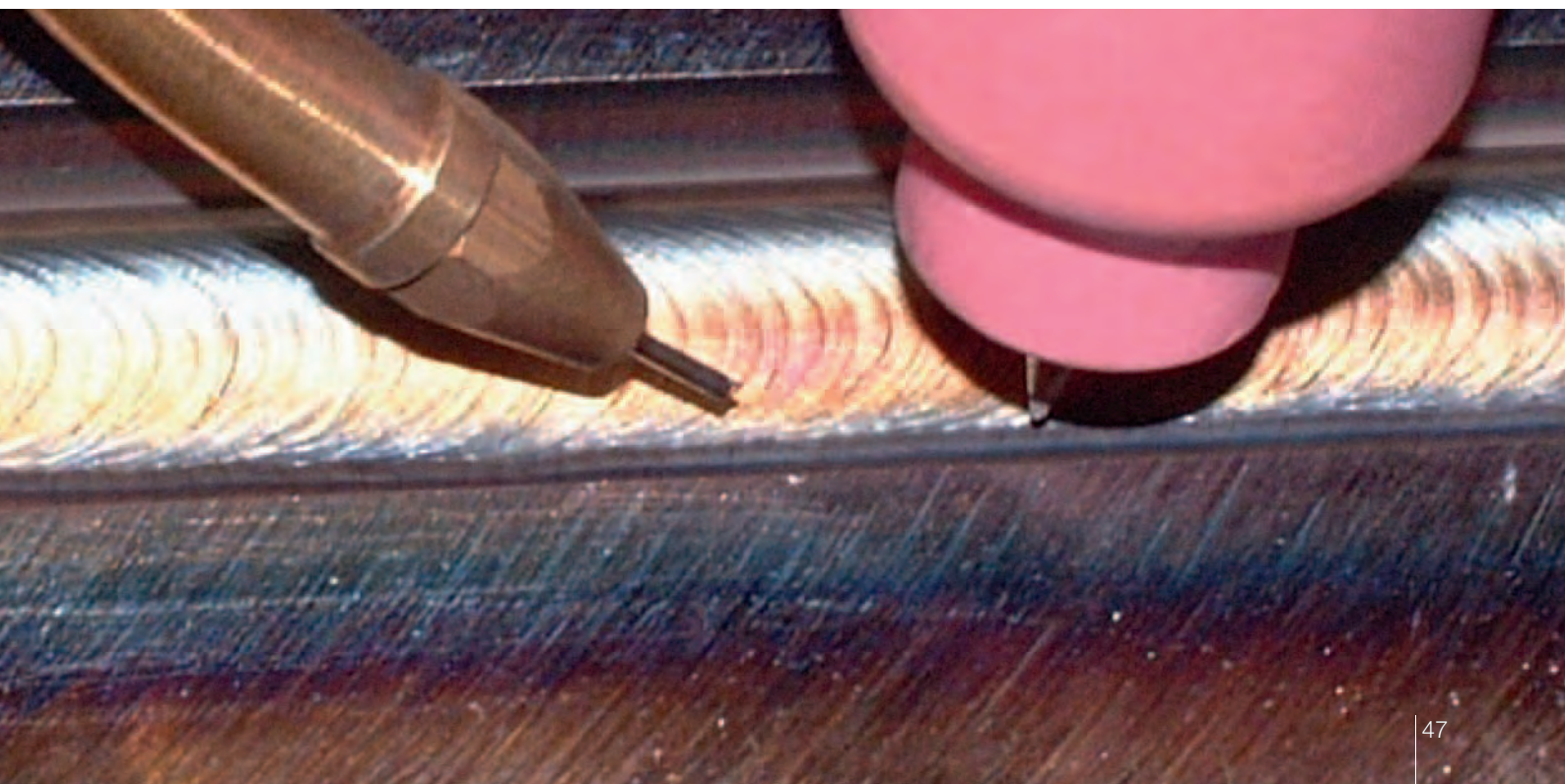
Characteristics and application

GTAW rod for welding high strength, quenched & tempered, fine-grained construction steels. The rod is suited for joint welding in boiler, pipeline and crane construction, as well as in structural steel engineering. BÖHLER NiMo 1-IG features excellent ductility and crack resistance in spite of its high strength, due to precise addition of micro-alloying elements. Very low-hydrogen weld deposit and good impact toughness down to -60 °C (-76 °F).

BÖHLER NiCrMo 2.5-IG	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 16834-A: W 69 6 1Mn3Ni2.5CrMo AWS A5.28: ER110S-G	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	API 5L
 Shielding gas: I1: 100% Ar	C	750	830	22	+20	160	2.4	L625, L690	X90, X100
	Si	(≥ 690)	(770-960)	(≥ 17)	-40	80			
	Mn				-60	≥ 47			
	Cr								
	Ni								
	Mo								
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
		109	120	26	+68	118	3/32		
			(≥ 110)		-40	59			

Characteristics and application

GTAW rod for welding high strength, fine-grained constructional steels with stringent requirements on low-temperature impact toughness down to -60 °C (-76 °F) e.g. in the construction of LPG tankers.



Wires and flux for SAW welding

Union S 2 UV 421 TT	Typical analyses			Typical mechanical properties all weld metal					Dia- meter	Pipeline steel grades		
	%	Wire	Weld metal	Re MPa	Rm MPa	A5 %	CVN °C	J		ø mm	EN	API 5L
Classification flux	C	0.10	0.07	420	515	29	+20	200	2.0	L175(P)	A25	
EN ISO 14174: SA FB 1 55 AC H5	Si	0.10	0.10				-20	170				2.5
Classification wire	Mn	1.00	1.00				-40	140				3.0
EN ISO 14171-A: S2												4.0
AWS A5.17: EM12												
Classification weld metal				YS	TS	E (L=4d)	CVN		ø			
EN ISO 14171-A: S 35 4 FB S2				ksi	ksi	%	°F	ft-lbf	inch			
AWS A5.17: F7A6-EM12 / F6P6-EM12				61	74	29	+68	147	5/64			
Polarity: DC+/AC							-4	125	3/32			
Flux has to be redried before use for approx. 2h at 300 - 350°C (570 - 660°F)							-40	103	1/8			
Preheating and interpass temperature as required by base metal: 150 – 200°C (300-400°F)									5/32			
Characteristics and application												
Flux UV 421 TT is a high basicity, fluoride-basic agglomerated flux combining good weldability with excellent CVN toughness properties down to -60°C. It has a neutral metallurgical behaviour and has been designed to promote a homogeneous weld chemistry and consistent mechanical properties in multi-layer welds, such as in double- and triple-jointing. This wire/flux combination features good wetting properties along with good slag detachability and a nice bead appearance. It is welded on DC+ polarity. The flux yields a low-hydrogen weld deposit (≤ 5 ml/100g acc ISO 3690).												
Approvals												
TÜV (05497), DB (51.132.06), LR, CE												

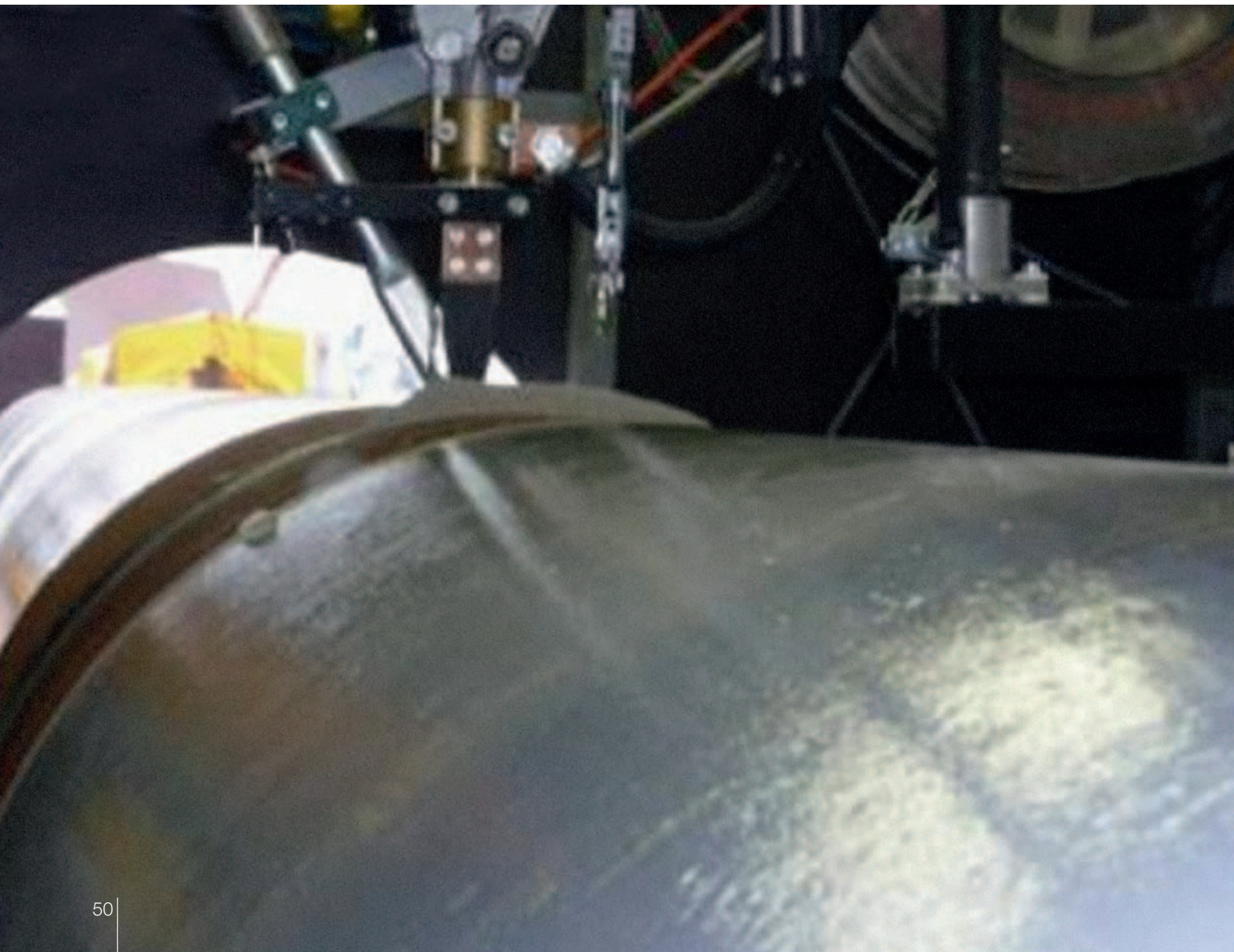
Union S 3 Si UV 421 TT	Typical analyses			Typical mechanical properties all weld metal					Dia- meter	Pipeline steel grades		
	%	Wire	Weld metal	Re MPa	Rm MPa	A5 %	CVN °C	J		ø mm	EN	API 5L
Classification flux	C	0.10	0.07	465	560	24	+20	160	2.5	L175(P)	A25	
EN ISO 14174: SA FB 1 55 AC H5	Si	0.30	0.30				-40	90				3.0
Classification wire	Mn	1.70	1.55				-60	50				4.0
EN ISO 14171-A: S3Si												
AWS A5.17: EH12K												
Classification weld metal				YS	TS	E (L=4d)	CVN		ø			
EN ISO 14171-A: S 46 6 FB S3Si				ksi	ksi	%	°F	ft-lbf	inch			
AWS A5.17 : F7A8-EH12K / F6P10-EH12K				67	81	24	+68	118	3/32			
Polarity: DC+/AC							-40	66	1/8			
Flux has to be redried before use for approx. 2h at 300 - 350°C (570 - 660°F)							-76	37	5/32			
Preheating and interpass temperature as required by base metal: 150 – 200°C (300-400°F)												
Characteristics and application												
Flux UV 421 TT is a high basicity, fluoride-basic agglomerated flux combining good weldability with excellent CVN toughness properties down to -60°C. It has a neutral metallurgical behaviour and has been designed to promote a homogeneous weld chemistry and consistent mechanical properties in multi-layer welds, such as in double- and triple-jointing. This wire/flux combination features good wetting properties along with good slag detachability and a nice bead appearance. It is welded on DC+ polarity. The flux yields a low-hydrogen weld deposit (≤ 5 ml/100g acc ISO 3690).												
Approvals												
TÜV (10424), DNV, LR, CE												

Union S 2 NiMo 1 UV 421 TT	Typical analyses			Typical mechanical properties all weld metal					Dia- meter	Pipeline steel grades		
	%	Wire	Weld metal	Re MPa	Rm MPa	A5 %	CVN °C	J		ø mm	EN	API 5L
Classification flux				505	590	26	+20	180	2.5	L415M-L485M	X60-X70	
EN ISO 14174: SA FB 1 55 AC H5	C	0.10	0.06				-40	120				3.0
Classification wire	Si	0.10	0.20				-60	70				
EN ISO 14174-A: SZ	Mn	1.10	1.10									
AWS A5.23: ENi1	Ni	0.90	0.90									
Classification weld metal	Mo	0.25	0.25									
EN ISO 14171-A: S 50 6 FB SZ				YS	TS	E (L=4d)	CVN		ø			
AWS A5.23: F8A10-ENi-Ni1 / F8P10-ENi-1-Ni				ksi	ksi	%	°F	ft-lbf	inch			
Polarity: DC+/AC				73	85	26	+68	133	3/32			
Flux has to be redried before use for approx. 2h at 300 - 350 °C (570 - 660 °F)							-40	88	1/8			
Preheating and interpass temperature as required by base metal: 150 – 200 °C (300-400 °F)							-76	52	5/32			
Characteristics and application												
Flux UV 421 TT is a high basicity, fluoride-basic agglomerated flux combining good weldability with excellent CVN toughness properties down to -60 °C. It has a neutral metallurgical behaviour and has been designed to promote a homogeneous weld chemistry and consistent mechanical properties in multi-layer welds, such as in double- and triple-jointing. This wire/flux combination features good wetting properties along with good slag detachability and a nice bead appearance. It is welded on DC+ polarity. The flux yields a low-hydrogen weld deposit (≤ 5 ml/100g acc ISO 3690).												
Approvals												
TÜV (10425), DNV, LR, CE												


Union S 3 NiMo 1 UV 421 TT	Typical analyses			Typical mechanical properties all weld metal					Dia- meter	Pipeline steel grades		
	%	Wire	Weld metal	Re MPa	Rm MPa	A5 %	CVN °C	J		ø mm	EN	API 5L
Classification flux				589	670	24	+20	180	1.6	L450M-L485M	X65 - X70	
EN ISO 14174: SA FB 1 55 AC H5	C	0.12	0.08				-20	160				2.0
Classification wire	Si	0.10	0.20				-40	100				
EN ISO 14171-A S3Ni1Mo	Mn	1.60	1.55				-60	55				3.0
AWS A5.23: EF3	Mo	0.60	0.55			4.0						
Classification weld metal	Ni	0.95	0.90									
EN ISO 14295: S 55 6 FB S3Ni1Mo				YS	TS	E (L=4d)	CVN		ø			
AWS A5.23: F9A8-EF3-F3				ksi	ksi	%	°F	ft-lbf	inch			
Polarity: DC+/AC				84	97	24	+68	133	1/16			
Flux has to be redried before use for approx. 2h at 300 - 350 °C (570 - 660 °F)							32	89	5/64			
Preheating and interpass temperature as required by base metal: 150 – 200 °C (300-400 °F)							-4	118	3/32			
							-40	74	1/8			
							-76	40	5/32			
Characteristics and application												
Flux UV 421 TT is a high basicity, fluoride-basic agglomerated flux combining good weldability with excellent CVN toughness properties down to -60 °C. It has a neutral metallurgical behaviour and has been designed to promote a homogeneous weld chemistry and consistent mechanical properties in multi-layer welds, such as in double- and triple-jointing. This wire/flux combination features good wetting properties along with good slag detachability and a nice bead appearance. It is welded on DC+ polarity. The flux yields a low-hydrogen weld deposit (≤ 5 ml/100g acc ISO 3690).												
Approvals												
TÜV (10425), DNV, LR, CE												

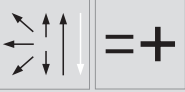
Wires and flux for SAW welding


Union S 3 NiMoCr UV 421 TT	Typical analyses			Typical mechanical properties all weld metal					Dia- meter	Pipeline steel grades	
	%	Wire	Weld metal	Re MPa	Rm MPa	A5 %	CVN °C	J		ø mm	EN
Classification flux											
EN ISO 14174: SA FB 1 55 AC H5	C	0.14	0.08	730	805	21	+20	145	2.0	L485M-L690M	X70 - X100
Classification wire	Si	0.10	0.20				+0	100	2.4		
EN ISO 26304-A: SZ3Ni2,5CrMo	Mn	1.75	1.60				-20	120	3.0		
AWS A5.23: (EG) EF 6 mod.	Cr	0.35	0.32				-40	110	4.0		
Classification weld metal	Mo	0.60	0.58				-60	55			
EN ISO 26304-A: S 69 6 FB SZ3Ni2,5CrMo	Ni	2.10	2.00								
AWS A5.23: F11A8-EG-F6				YS	TS	E (L=4d)	CVN		ø		
Polarity: DC+/AC				ksi	ksi	%	°F	ft-lbf	inch		
Flux has to be redried before use for approx. 2h at 300 - 350°C (570 - 660°F)				105	116	21	+68	107	5/64		
Preheating and interpass temperature as required by base metal: 150 - 200°C (300-400°F)							32	74	3/32		
							-4	88	1/8		
							-40	81	5/32		
							-76	40			
Characteristics and application											
Flux UV 421 TT is a high basicity, fluoride-basic agglomerated flux combining good weldability with excellent CVN toughness properties down to -60°C. It has a neutral metallurgical behaviour and has been designed to promote a homogeneous weld chemistry and consistent mechanical properties in multi-layer welds, such as in double- and triple-jointing. This wire/flux combination features good wetting properties along with good slag detachability and a nice bead appearance. It is welded on DC+ polarity. The flux yields a low-hydrogen weld deposit (≤ 5 ml/100g acc ISO 3690).											
Approvals											
TÜV (05063), DB (51.132.06), ABS, BV, DNV, GL, LR, CE											



Electrodes for corrosion resistant alloys (CRA)

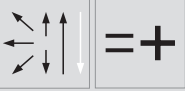
BÖHLER FOX EAS 4 M-A	Typical analyses all weld metal	Typical mechanical properties all weld metal					Dia-meter		Pipeline steel grades	
EN ISO 3581-A: E 19 12 3 L R 3 2 AWS A5.4: E316L-17	%	Re MPa	Rm MPa	A5 %	CVN °C J		ø mm	A	EN	UNS/ AISI
 <p>Re-drying if necessary: 120-200 °C (250-400 °F) / min. 2h</p>	C 0.03	460	600	36	+20	70	1.5	25-40	1.4404	S31603
	Si 0.8	(≥ 320)	(≥ 510)	(≥ 25)	-120	≥ 32	2.0	40-60	X2CrNiMo 17-12-2	316L
	Mn 0.8						2.5	50-90	1.4435	
	Cr 18.8						3.2	80-120	X2CrNiMo 18-14-3	
	Ni 11.5						4.0	120-160		
	Mo 2.7						5.0	140-200		
	YS ksi	TS ksi	E (L=4d) %		CVN °F ft-lbf		ø inch	A		
	66	87	36	+68	51	3/50	25-40			
		(≥ 70)	(≥ 30)	-184	≥ 23	5/64	40-60			
						3/32	50-90			
					1/8	80-120				
					5/32	120-160				
					3/16	140-200				
Characteristics and application Stainless steel, rutile electrode, preferably used for 1.4435 / 316L steel grades. The fully alloyed core wire ensures most reliable corrosion resistance.										
Approvals TÜV (0773), DB (30.014.14), ABS (E316L-17), DNV (316L), GL (4571), LR (316Lm), Statoil, VUZ, SEPROZ, CE, CWB, NAKS (ø 3.2mm; ø 4.0mm)										

BÖHLER FOX EAS 4 M	Typical analyses all weld metal	Typical mechanical properties all weld metal					Dia-meter		Pipeline steel grades	
EN ISO 3581-A: E 19 12 3 L B 2 2 AWS A5.4: E316L-15	%	Re MPa	Rm MPa	A5 %	CVN °C J		ø mm	A	EN	UNS/ AISI
	C 0.03	460	600	38	+20	90	2.5	50-80	1.4404	S31603
	Si 0.4	(≥ 320)	(≥ 510)	(≥ 25)	-120	≥ 32	3.2	80-110	X2CrNiMo 17-12-2	316L
	Mn 1.2				-196	≥ 27	4.0	110-140	1.4435	
	Cr 18.8								X2CrNiMo 18-14-3	
	Ni 11.8									
	Mo 2.7									
	YS ksi	TS ksi	E (L=4d) %		CVN °F ft-lbf		ø inch	A		
	66	87	38	+68	66	3/32	50-80			
		(≥ 70)	(≥ 30)	-184	≥ 24	1/8	80-110			
				-320	≥ 20	5/32	110-140			
Characteristics and application Stainless steel, basic electrode, preferably used for 1.4435 / 316L steel grades. Designed to provide high quality weld deposits with reliable impact toughness values down to -196 °C (-320 °F). The fully alloyed core wire ensures most reliable corrosion resistance.										
Approvals TÜV (0772), DNV (316), Statoil, SEPPROZ, CE										

BÖHLER FOX CN 22/9 N	Typical analyses all weld metal	Typical mechanical properties all weld metal						Dia-meter		Pipeline steel grades	
		Re	Rm	A5	CVN		ø	A	EN	UNS	
EN ISO 3581-A: E 22 9 3 N L R 3 2 AWS A5.4: E2209-17	%	MPa	MPa	%	°C	J	mm	A			
 <p>Re-drying if necessary: 250-300 °C (480-570 °F) / min. 2h</p> <p>Preheating and interpass temperature max. 150 °C (302 °F)</p>	C	0.03	650	820	25	+20	55	2.5	40-75	1.4462	S31803
	Si	0.8	(≥ 450)	(≥ 690)	(≥ 20)	-10	50	3.2	70-120	X2CrNiMoN 22-5-3	S32205
	Mn	0.9				-20	≥ 32	4.0	110-150		
	Cr	22.6						5.0	150-200		
	Ni	9.0									
Mo	3.1										
			YS	TS	E (L=4d)	CVN		ø			
			ksi	ksi	%	°F	ft-lbf	inch	A		
			94	118	25	+68	40	3/32	40-75		
				(≥ 100)	(≥ 22)	+14	37	1/8	70-120		
						-4	≥ 23	5/32	110-150		
								3/16	150-200		

Characteristics and application
Rutile stainless steel electrode designed for the welding of ferritic-austenitic duplex stainless steels such as 1.4462 and UNS 31803. BÖHLER FOX CN 22/9 N offers excellent positional weldability, making it perfectly suited for pipe welding. Pitting resistance equivalent (PREN) of > 35.

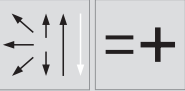
Approvals
TÜV (3636), ABS (E 22 09-17), DNV (Duplex), GL (4462), LR (X), RINA (2209), Statoil, SEPROZ, CE

BÖHLER FOX CN 22/9 N-B	Typical analyses all weld metal	Typical mechanical properties all weld metal						Dia-meter		Pipeline steel grades	
		Re	Rm	A5	CVN		ø	A	EN	UNS	
EN ISO 3581-A: E 22 9 3 N L B 2 2 AWS A5.4: E2209-15	%	MPa	MPa	%	°C	J	mm	A			
 <p>Re-drying if necessary: 250-300 °C / min. 2h</p> <p>Re-drying if necessary: 250-300 °C (480-570 °F) / min. 2h</p>	C	0.03	630	830	27	+20	110	2.5	50-75	1.4462	S31803
	Si	0.3	(≥ 450)	(≥ 690)	(≥ 20)	-20	90	3.2	80-110	X2CrNiMoN 22-5-3	S32205
	Mn	1.1				-40	75	4.0	100-145		
	Cr	22.6				-60	40 (≥ 32)	5.0	140-180		
	Ni	8.8									
Mo	3.1										
Ni	0.16										
			YS	TS	E (L=4d)	CVN		ø			
			ksi	ksi	%	°F	ft-lbf	inch	A		
			91	120	27	+68	81	3/32	50-75		
				(≥ 100)	(≥ 22)	-4	66	1/8	80-110		
						-40	55	5/32	100-145		
						-76	29 (≥ 23)	3/16	140-180		

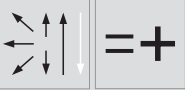
Characteristics and application
Basic stainless steel electrode designed for the welding of ferritic-austenitic duplex stainless steels such as 1.4462 and UNS 31803. Very good impact toughness down to -60 °C (-76 °F). Pitting resistance equivalent (PREN) of > 35.

Approvals
TÜV (7084), CE

Electrodes for corrosion resistant alloys (CRA)

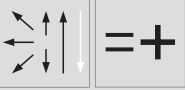
BÖHLER FOX CN 25/9 CuT		Typical mechanical properties all weld metal					Dia-meter		Pipeline steel grades		
Typical analyses all weld metal		Re	Rm	A5	CVN			EN	UNS		
EN ISO 3581-A: E 25 9 4 N L B 2 2		MPa	MPa	%	°C	J	ø				
AWS A5.4: E2595-15		MPa	MPa	%	°C	J	mm	A			
 <p>Re-drying if necessary: 250-300°C (480-570°F) / min. 2h</p>	C	0.03	650	850	25	+20	75	2.5	55-85	1.4501	S32750
	Si	0.5	(≥ 550)	(≥ 760)	(≥ 18)	-50	50 (≥ 32)	3.2	80-105	X2CrNiMoCuWN	S32760
	Mn	1.0						4.0	90-140	25-7-4	
	Cr	25.0									
	Ni	9.5	YS	TS	E (L=4d)	CVN			ø	ZERON 100	
	Mo	3.7	ksi	ksi	%	°F	ft-lbf	inch	A	SAF 25/07	
	N	0.22	94	123	25	+68	55	3/32	55-85	FALC 100	
	Cu	0.7		(≥ 110)	(≥ 15)	-58	37 (≥ 23)	1/8	80-105		
	W	0.7						5/32	90-140		

Characteristics and application
Basic stainless steel electrode designed for the welding of ferritic-austenitic duplex stainless steels. Excellent resistance to pitting corrosion and stress corrosion cracking. Suited for service temperatures from -50 (-58°F) up to +250°C (482°F). Well suited for conditions in offshore oil and gas exploration.

Thermanit 625		Typical mechanical properties all weld metal					Dia-meter		Pipeline steel grades		
Typical analyses all weld metal		Re	Rm	A5	CVN						
EN ISO 14172: E Ni 6625 (NiCr22Mo9Nb)		MPa	MPa	%	°C	J	ø	CRA clad pipes			
AWS A5.11: ENiCrMo-3		MPa	MPa	%	°C	J	mm	A			
 <p>Re-drying if necessary: 250-300°C (480-570°F) / min. 2h</p>	C	< 0.04	470	760	40	+20	90	2.5	45-70	Alloy 316L	
	Si	< 0.7	(≥ 420)	(≥ 760)	(≥ 27)	-196	70 (≥ 32)	3.2	65-105	Alloy 625	
	Mn	< 1.0						4.0	85-130	Alloy 825	
	Cr	21.5						5.0	130-160		
	Ni	Bal.	YS	TS	E (L=4d)	CVN			ø		
	Mo	9.0	ksi	ksi	%	°F	ft-lbf	inch	A		
	Nb	3.3	68	110	40	+68	66	3/32	45-70		
	Fe	< 2.0		(≥ 110)	(≥ 30)	-320	52	1/8	65-105		
								5/32	85-130		
								3/16	130-160		

Characteristics and application
Basic stick electrode with alloyed core wire for high quality welding of corrosion resistant alloyed (CRA) clad steel - Alloy 316L, 625 and 825.

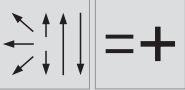
Approvals
TÜV (03463), ABS, GL, CE

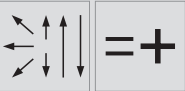
Thermanit 686		Typical mechanical properties all weld metal					Dia-meter		Pipeline steel grades		
Typical analyses all weld metal		Re	Rm	A5	CVN						
EN ISO 14172: E Ni 6686 (NiCr21Mo14W4)		MPa	MPa	%	°C	J	ø	CRA clad pipes			
AWS A5.11: ENiCrMo-14		MPa	MPa	%	°C	J	mm	A			
 <p>Re-drying if necessary: 250-300°C (480-570°F) / min. 2h</p>	C	0.02	480	770	38	+20	60	2.5	50-70	Alloy 316L	
	Si	< 0.2	(≥ 350)	(≥ 690)	(≥ 27)			3.2	70-105	Alloy 625	
	Mn	< 0.5						4.0	90-120	Alloy 825	
	Cr	21.0									
	Ni	Bal.	YS	TS	E (L=4d)	CVN			ø		
	Mo	16.0	ksi	ksi	%	°F	ft-lbf	inch	A		
	W	3.5	69	111	38	+68	44	3/32	50-70		
	Fe	< 1.0		(≥ 100)	(≥ 30)			1/8	70-105		
								5/32	90-120		

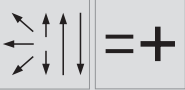
Characteristics and application
Basic stick electrode with alloyed core wire for high quality welding of corrosion resistant alloyed (CRA) clad steel - Alloy 316L, 625 and 825.

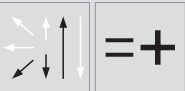


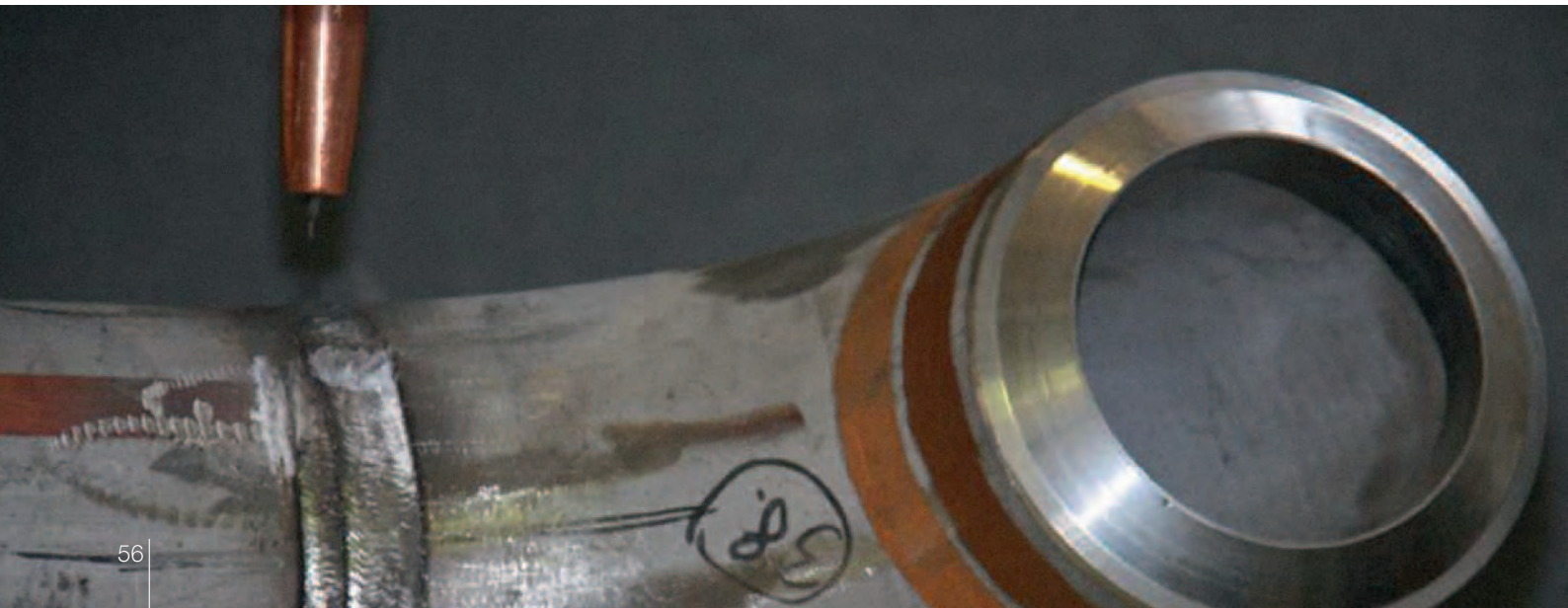
Flux-cored wires for corrosion resistant alloys (CRA)

BÖHLER EAS 4 PW-FD	Typical analyses all weld metal	Typical mechanical properties all weld metal						Diameter	Pipeline steel grades	
EN ISO 17633-A: T 19 12 3 L P M21 1 / T 19 12 3 L P C1 1 AWS A5.22: E316LT1-4 / E316LT1-1	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	UNS/ AISI	
	C 0.03	M21	400	560	38	+20	65	1.2	1.4404	S31603
	Si 0.7		(≥ 320)	(≥ 510)	(≥ 30)	-120	45 (≥ 32)	1.6	X2CrNiMo 17-12-2	316L
Mn 1.5 Cr 19.0 Ni 12.0 Mo 2.7									1.4435	X2CrNiMo 19-14-3
Shielding gas: M1-M3 C1		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch			
		M21	58	81	38	+68	48	0.045		
				(≥ 70)	(≥ 30)	-184	33 (≥ 23)	1/16		
Re-drying possible at 150°C (300 °F) / 24h, but generally not needed										
Characteristics and application										
BÖHLER EAS 4 PW-FD is an all-positional rutile flux-cored wire with fast freezing slag. It has excellent welding characteristics in all welding positions and allows high travel speed and deposition rate. Welds are well suited for service temperatures from -120 (-184 °F) up to + 400 °C (752 °F).										
Approvals										
TÜV (09118), DB (43.014.24), CWB (E316LT-1(4)), LR (DXVu.O, BF 316LS), GL (4571S (C1, M21), SEPROZ, CE, DNV, ABS										

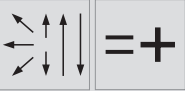
BÖHLER CN 22/9 PW-FD	Typical analyses all weld metal	Typical mechanical properties all weld metal						Diameter	Pipeline steel grades	
EN ISO 17633-A: T 22 9 3 N L P M21 1 / T 22 9 3 N L P C1 1 AWS A5.22: E2209T1-4 / E2209T1-1	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	UNS/ AISI	
	C < 0.03	M21	600	800	27	+20	80	1.2	1.4462	S31803
	Si 0.8		(≥ 450)	(≥ 690)	(≥ 20)	-20	65		X2CrNiMoN 22-5-3	S32205
Mn 0.9 Cr 22.7 Ni 9.0 Mo 3.2										
Shielding gas: M1-M3 C1		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch			
	N 0.13									
	FN 30-50	M21	87	116	27	+68	59	0.045		
				(≥ 100)	(≥ 20)	-4	48			
						-40	40			
						-50	33 (≥ 23)			
Re-drying possible at 150°C (300 °F) / 24h, but generally not needed										
Characteristics and application										
BÖHLER CN 22/9 PW-FD is an all-positional rutile flux-cored wire with fast freezing slag, for welding duplex stainless steel grades 1.4462 / S31803. Weld metal features good pitting corrosion resistance (CP ASTM G48/method A / 24h up to 25 °C, +77 °F) (PREN ≥ 35) and resistance to stress corrosion cracking in chloride-containing fluids e.g. sea water. Welds are well suited for service temperatures from -46 (-50 °F) up to +250 °C (482 °F).										
Approvals										
TÜV (07666), ABS (E 22 09 T1-4(1)), CWB (E2209T1-1(4)), DNV (- (M21, C1) ø 1.2mm), GL (4462S (M21)), LR (X (M21, C1)), RINA (2209S), SEPROZ, CE										

BÖHLER CN 25/9 PW-FD		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades		
EN ISO 17633-A: T 25 9 4 N L P M21 2 / T 25 9 4 N L P C1 2 AWS A5.22: E2594T1-4 / E2594T1-1		%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	UNS/ AISI
		C < 0.03	M21	670 (≥ 550)	880 (≥ 760)	27 (≥ 18)	+20 -40	≥ 50 ≥ 32	1.2	1.4410 X2CrNiMoN 25-7-4 1.4501 X2CrNiMoCu W N 2507-4	SAF 2507 S32750 S32760
Shielding gas: M1-M3 C1 Interpass temperature max. 120°C (+248°F). Heat input 0.5-1.5 kJ/mm Re-drying possible at 150°C (300°F) / 24h, but generally not needed Characteristics and application BÖHLER CN 25/9 PW-FD is an all-positional rutile flux-cored wire with fast freezing slag, for welding super duplex and equivalent stainless steel grades, such as UNS S32760 and EN 1.4501. Weld metal features excellent resistance to stress corrosion and localized corrosion (PREN > 41) and is suited for service temperatures from -50 (-58°F) up to +240°C (464°F).		Mn 0.9 Cr 25.3 Ni 9.8 Mo 3.7 N 0.23 FN > 35		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
			M21	97	127 (≥ 110)	27 (≥ 15)	+68 -40	≥ 37 ≥ 23	0.045		

BÖHLER NIBAS 625 PW-FD		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 12153: T Ni 6625 P M21 2 AWS A5.34M: Tni 6625-14		%		Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	CRA clad pipes
		C 0.05 Si 0.4 Mn 0.4 Cr 21.0 Ni bal. Mo 8.5 Nb 3.3 Fe < 1.0	M21	500 (≥ 420)	740 (≥ 690)	40 (≥ 25)	-20 -196	90 80 (≥ 32)	1.2	Alloy 316L Alloy 625 Alloy 825
Shielding gas: M1-M3 Re-drying possible at 150°C (300°F) / 24h, but generally not needed Characteristics and application Rutile flux-cored wire for high quality joint welding of corrosion resistant alloy (CRA) clad pipes, -alloys 316L, 625 and 825. Approvals TÜV (11223), CE				YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch	
			M21	72	107 (≥ 100)	40 (≥ 25)	+68 -320	66 59 (≥ 23)	0.045	

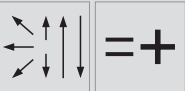


Solid wires for corrosion resistant alloys (CRA)

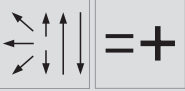
Thermanit GE - 316L Si	Typical analyses all weld metal	Typical mechanical properties all weld metal						Diameter	Pipeline steel grades	
EN ISO 14343-A: G 19 12 3 L Si AWS A5.9: ER316LSi	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	UNS/ AISI	
 Shielding gas: M12	C 0.02	M21 430	600	38	+20	130	0.8	1.4404	S31603, 316L	
	Si 0.8	(≥ 320)	(≥ 510)	(≥ 25)			1.0			
	Mn 1.7						1.2			
	Cr 18.8									
	Ni 12.5									
	Mo 2.8									
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch			
		M21 62	87	38	+68	96	0.030			
		(≥ 88)	(≥ 70)	(≥ 30)			0.040			
							0.045			

Characteristics and application
ER316LSi type GMAW solid wire. Good wire feeding properties, excellent weldability, nice wetting and reliable corrosion resistance up to 400 °C (752 °F). For service temperatures down to -196 °C (-320 °F).

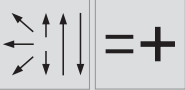
Approvals
TÜV (00489), DB (132.10), DNV, GL, LR, CE

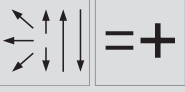
Thermanit 22/09 LH	Typical analyses all weld metal	Typical mechanical properties all weld metal						Diameter	Pipeline steel grades	
EN ISO 14343-A: G 22 9 3 N L AWS A5.9: ER2209	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	UNS/ AISI	
 Shielding gas: M12, M13	C 0.025	M12 615	790	30	+20	120	1.0	1.44062	S31803 X2CrNiMoN 22-5-3	
	Si 0.5	(≥ 450)	(≥ 550)	(≥ 20)	-40	90	1.2			
	Mn 1.6									
	Cr 23.0									
	Ni 9.0									
	Mo 3.0	M12 89	114	30	+68	88	0.040			
	N 0.14		(≥ 100)	(≥ 20)	-40	66	0.045			
	FN 30-60									

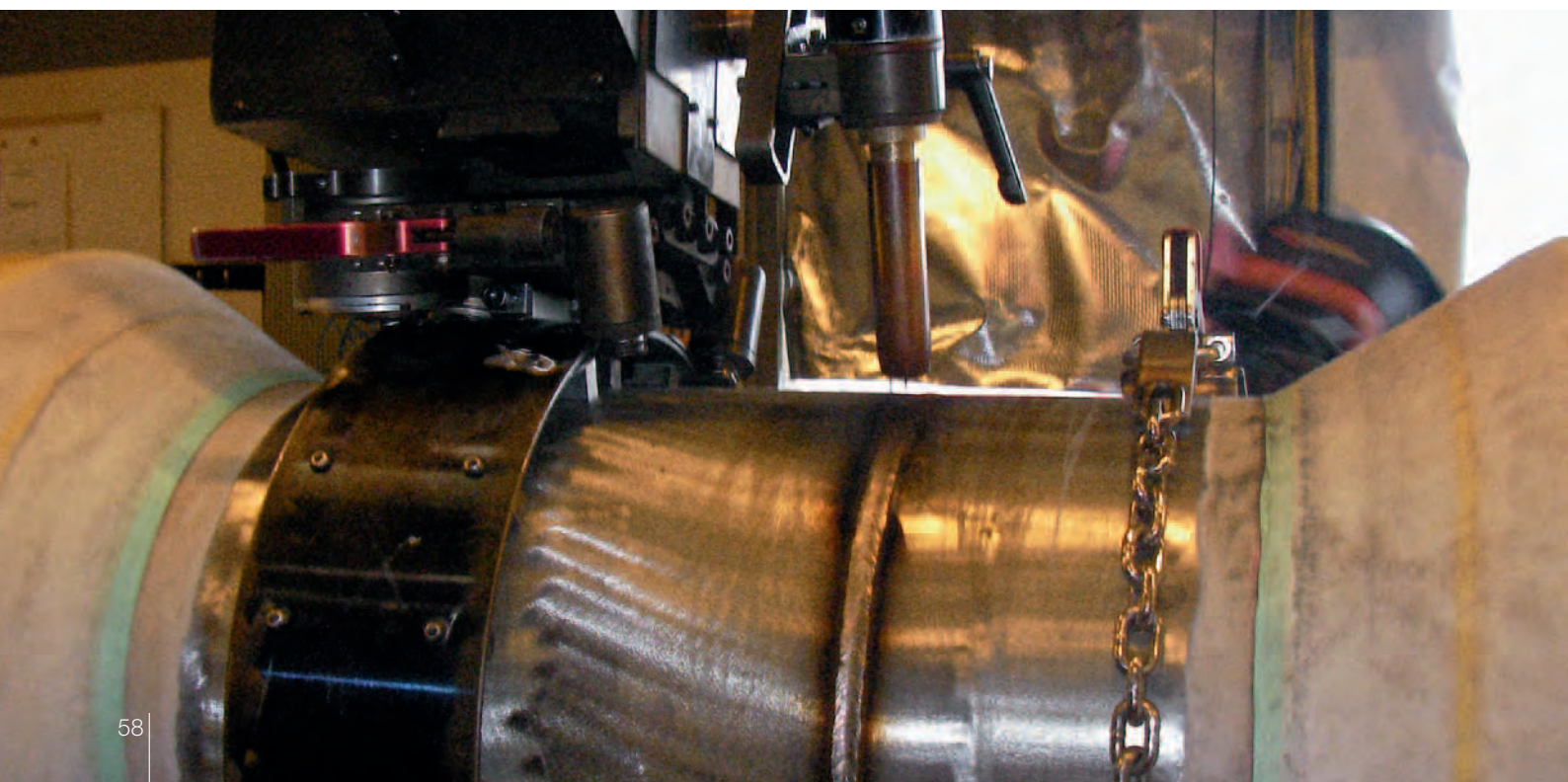
Characteristics and application
GMAW solid wire for welding ferritic-austenitic duplex stainless steel. Excellent resistance to stress corrosion cracking and pitting (PREN > 35). For service temperatures from -40 up to 250 °C. Specifically designed for welding super martensitic stainless steel in offshore applications. Very low weld metal hydrogen content. (H₂ < 3 ppm.)

Thermanit 25/09 CuT LH	Typical analyses all weld metal	Typical mechanical properties all weld metal						Diameter	Pipeline steel grades	
EN ISO 14343-A: G 25 9 4 N L AWS A5.9: ER2594	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	UNS/ AISI	
 Shielding gas: M12, M13	C 0.02	M12 720	850	27	+20	135	1.0	1.4501	S32750 X2CrNiMoCuWN 25-7-4	
	Si 0.3	(≥ 550)	(≥ 620)	(≥ 18)	-46	90				
	Mn 1.5									
	Cr 25.5									
	Ni 9.5									
	Mo 3.7									
	N 0.22	M12 104	123	27	+68	99	0.040	ZERON 100		
	Cu 0.8		(≥ 110)	(≥ 15)	-76	66		SAF 25/07		
	W 0.6							FALC 100		

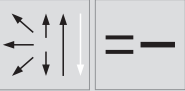
Characteristics and application
GMAW solid wire for welding ferritic-austenitic super duplex stainless steel. Excellent resistance to stress corrosion cracking and pitting (PREN > 40). For service temperatures from -50 (-58 °F) up to 250 °C (482 °F). Specifically designed for welding super martensitic stainless steel in offshore applications. Very low weld metal hydrogen content (H₂ < 3 ppm.)

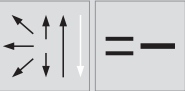
Thermanit 625		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 18274: S Ni 6625 (NiCr22Mo9Nb)			Re MPa	Rm MPa	A5 %	CVN °C	J	σ mm	CRA clad pipes	
AWS A5.14: ERNiMo-3		%								
 Shielding gas: I1 M12 (Argon + 30% He + 0.5% CO ₂)	C	0.03	M12	480	760	42	+20	160	0.8	Alloy 316L
	Si	0.25		(≥ 460)	(≥ 760)	(≥ 25)	-196	130	1.0	Alloy 625
	Mn	0.20							1.2	Alloy 825
	Cr	22.0							1.6	
	Ni	bal.		YS	TS	E (L=4d)	CVN		σ	
Mo	9.0		ksi	ksi	%	°F	ft-lbf	inch		
Nb	3.6		M12	69	110	42	+68	118	0.030	
Fe	< 0.5				(≥ 100)	(≥ 25)	-320	96	0.040	
									0.045	
									1/16	
Characteristics and application										
GMAW solid wire for high quality joint welding of corrosion resistant alloyed (CRA) clad pipes.										
Approvals										
TÜV (03462), DB (43.132.25), CE										

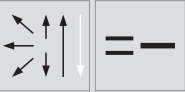
Thermanit 686		Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 18274: S Ni 6686 (NiCr21Mo16W4)			Re MPa	Rm MPa	A5 %	CVN °C	J	σ mm	CRA clad pipes	
AWS A5.14: ERNiMo-14		%								
 Shielding gas: I1 Ar + 30He + 2% H ₂ + ~0.1% CO ₂	C	0.01	M12	550	790	30	+20	55	1.2	Alloy 316L
	Si	0.8		(≥ 460)	(≥ 760)	(≥ 25)				Alloy 625
	Mn	< 0.5								Alloy 825
	Cr	22.8								
	Ni	bal.		YS	TS	E (L=4d)	CVN		σ	
Mo	16.0		ksi	ksi	%	°F	ft-lbf	inch		
W	3.8		M12	79	114	30	+68	41	0.045	
Fe	< 1.0				(≥ 100)	(≥ 30)				
Al	0.3									
Characteristics and application										
GMAW solid wire for high quality joint welding of corrosion resistant alloyed (CRA) clad pipes - alloy 316L, 625 and 825.										

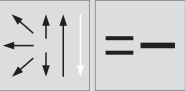


TIG rods for corrosion resistant alloys (CRA)

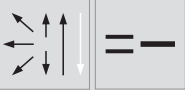
Thermanit GE-316L	Typical analyses all weld metal	Typical mechanical properties all weld metal					Dia-meter	Pipeline steel grades	
EN ISO 14343-A: W 19 12 3 L AWS A5.9: ER316L	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	UNS/ AISI
 <p>Shielding gas: I1: 100% Ar</p> <p>Rod marking Front: W 19 12 3 L, Back: ER316L</p> <p>Preheating and interpass temperature as required by base metal</p> <p>Characteristics and application E316L type GTAW rod. Alloyed with great precision to create a high purity weld deposit with superior hot cracking resistance. Good CVN impact toughness down to -196 °C (-320 °F). resistant to intergranular corrosion up to 400 °C (752 °F).</p> <p>Approvals TÜV (09500), DB (43.132.20), DNV, GL, CE</p>	C 0.02	480	620	37	+20	140	0.8	1.4404	S31603
	Si 0.5	(≥ 320)	(≥ 510)	(≥ 25)			1.6	X2CrNiMoN 17-12-2	316L
	Mn 1.7						2.0		
	Cr 18.5						2.4		
	Ni 12.3						4.0		
	Mo 2.6								
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
		69	90	37	+68	103	0.030		
			(≥ 70)	(≥ 30)			1/16		
							5/64		
							3/32		
							5/32		

Thermanit 22/09	Typical analyses all weld metal	Typical mechanical properties all weld metal					Dia-meter	Pipeline steel grades	
EN ISO 14343-A: W 22 9 3 N L AWS A5.9: ER2209	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	UNS
 <p>Shielding gas: I1: 100% Ar Ar + 1-2% N₂</p> <p>Rod marking Front: W 22 9 3 NL, Back: ER2209</p> <p>Preheating and interpass temperature as required by base metal</p> <p>Characteristics and application GTAW rod of the ER2209/W 22 9 3 N L type for the welding of ferritic-austenitic duplex stainless steel. Excellent resistance to stress corrosion cracking and pitting (PREN > 35). Weld metal is suited for service temperatures from -60 °C (-76 °F) up to +250 °C (482 °F). Especially designed for the welding of super martensitic stainless steel in offshore fabrication.</p> <p>Approvals TÜV (03343), ABS, DNV, GL, LR, CE</p>	C 0.02	620	800	32	+20	220	1.6	1.4462	S31803
	Si 0.4	(≥ 450)	(≥ 550)	(≥ 20)	-60	90 (≥ 32)	2.0	X2CrNiMoN 22-5-3	S32205
	Mn 1.7						2.4		
	Cr 22.5						3.2		
	Ni 8.8								
	Mo 3.2								
	N 0.15								
		YS ksi	TS ksi	E (L=4d) %	CVN °F	ft-lbf	ø inch		
		90	116	32	+68	162	1/16		
			(≥ 100)	(≥ 20)	-76	66 (≥ 23)	5/64		
							3/32		
							1/8		

Thermanit 25/09 CuT	Typical analyses all weld metal	Typical mechanical properties all weld metal						Dia-meter	Pipeline steel grades	
EN ISO 14343-A: W 25 9 4 N L AWS A5.9: ER2594	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	EN	UNS	
 <p>Shielding gas: I1: 100% Ar Ar + 2-3% N2</p> <p>Rod marking Front: W 25 9 4 NL</p> <p>Preheating and interpass temperature as required by base metal</p> <p>Characteristics and application GTAW rod for the welding of ferritic-austenitic super duplex stainless steel. Excellent resistance to stress corrosion cracking and pitting (PREN > 40). Weld metal is suited for service temperatures from -50 °C (-58 °F) up to +250 °C (482 °F). Especially designed for the welding of super martensitic stainless steel in offshore fabrication.</p>	C 0.02	710	860	28	+20	220	1.6	1.4501	S32750	
	Si 0.3	(≥ 550)	(≥ 620)	(≥ 18)	-50	160	2.0	X2CrNiMoCuWN	S32760	
	Mn 0.7						2.4			
	Cr 25.2						3.2			
	Ni 9.2									
	Mo 3.6	YS	TS	E (L=4d)	CVN		ø	ZERON 100		
	N 0.22	ksi	ksi	%	°F	ft-lbf	inch	SAF 25/07		
	Cu 0.6	103	124	28	+68	162	1/16	FALC 100		
	W 0.62		(≥ 110)	(≥ 15)	-58	118	5/64			
							3/32			
						1/8				

Thermanit 625	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades
EN ISO 18274: S Ni 6625 (NiCr22Mo9Nb) AWS A5.14: ERNiCrMo-3	%	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	CRA clad pipes
 <p>Shielding gas: I1: 100% Ar</p> <p>Rod marking Front: Ni6625, Back: ERNiCrMo-3</p> <p>Preheating and interpass temperature as required by base metal</p> <p>Characteristics and application GTAW rod for high quality joint welding of corrosion resistant alloyed (CRA) clad pipes - alloy 316L, 625 and 825.</p> <p>Approvals TÜV (03464), DB (43.132.33), DNV, CE</p>	C 0.03	490	775	40	+20	140	1.6	Alloy 316L
	Si 0.1	(≥ 460)	(≥ 760)	(≥ 35)	-196	120	2.0	Alloy 625
	Mn 0.1						2.4	Alloy 825
	Cr 22.0						3.2	
	Ni Bal.							
	Mo 9.0	YS	TS	E (L=4d)	CVN		ø	
	Nb 3.6	ksi	ksi	%	°F	ft-lbf	inch	
	Fe < 0.05	71	112	40	+68	103	1/16	
			(≥ 100)	(≥ 25)	-320	88	5/64	
							3/32	
						1/8		

TIG rods for corrosion resistant alloys (CRA)

Thermanit 686	Typical analyses all weld metal	Typical mechanical properties all weld metal					Diameter	Pipeline steel grades	
EN ISO 18274: S Ni 6686 (NiCr21Mo16W4)		Re	Rm	A5	CVN		ø	CRA clad pipes	
AWS A5.14: ERNiCrMo-14	%	MPa	MPa	%	°C	J	mm		
	C	≤ 0.01	540	800	30	+20	55	1.6	Alloy 316L
	Si	0.08	(≥ 460)	(≥ 760)	(≥ 25)				2.0
	Mn	< 0.5						2.4	Alloy 825
	Cr	22.8							
Shielding gas: I1: 100% Ar R1: Ar + 2% He	Ni	Bal.	YS	TS	E (L=4d)	CVN		ø	
	Mo	16.0	ksi	ksi	%	°F	ft-lbf	inch	
Rod marking	W	3.8	78	116	30	+68	40	1/16	
Front: Ni6686, Back: ERNiCrMo-14	Al	0.3						5/64	
	Fe	< 1.0		(≥ 100)	(≥ 30)			3/32	
Preheating and interpass temperature as required by base metal									
Characteristics and application									
GTAW rod for high quality joint welding of corrosion resistant alloyed (CRA) clad pipes - alloy 316L, 625 and 825.									



Wire /flux combinations for corrosion resistant alloys (CRA)

Thermanit GE-316L Marathon 431	Typical analyses			Typical mechanical properties all weld metal					Dia- meter	Pipeline steel grades	
Classification flux	%	Wire	Weld metal	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	UNS	AISI
EN ISO 14174: SA FB 2 DC	C	0.01	0.01	350	550	30	+20	70	2.0	S31603, S31653;	316L, 316Ti, 316Cb
Classification wire	Si	0.5	0.6				-120	60	2.4		
EN ISO 14343-A: S 19 12 3 L	Mn	1.7	1.2				3.2				
AWS A5.9: ER316L	Cr	18.5	18.0				4.0				
Flux has to be redried before use for approx. 2h at 300 - 350 °C (570 - 660 °F)	Mo	2.8	2.8	YS	TS	E (L=4d)	CVN		ø		
	Ni	12.2	12.2	ksi	ksi	%	°F	ft-lbf	inch		
				51	80	30	68	52	5/64		
							-184	44	3/32		
Polarity: DC+									1/8		
Approvals TÜV (06113), CE											

Thermanit 22/09 Marathon 431	Typical analyses			Typical mechanical properties all weld metal					Dia- meter	Pipeline steel grades	
Classification flux	%	Wire	Weld metal	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	UNS	
EN ISO 14174: SA FB 2 DC	C	0.01	0.02	450	690	20	+20	80	2.0	S31803, S32205	
Classification wire	Si	0.40	0.50				-40	40	2.5		
EN ISO 14343-A: S 22 9 3 N L	Mn	1.6	1.4				3.0				
AWS A5.9: ER2209	Cr	22.5	22.2								
Flux has to be redried before use for approx. 2h at 300 - 350 °C (570 - 660 °F)	Mo	3.0	3.1	YS	TS	E (L=4d)	CVN		ø		
	Ni	8.8	8.3	ksi	ksi	%	°F	ft-lbf	inch		
	N	0.15	0.14	65	100		68	59	5/64		
							-40	29.5	3/32		
Polarity: DC+									1/8		
Approvals TÜV (06112), ABS, DNV, GL, LR, CE											

Thermanit 625 Marathon 444	Typical analyses			Typical mechanical properties all weld metal					Dia- meter	Pipeline steel grades	
Classification flux	%	Wire	Weld metal	Re MPa	Rm MPa	A5 %	CVN °C	J	ø mm	UNS	
EN ISO 14174: SA FB 2 AC	C	0.01	0.01	420	700	40	+20	80	1.6	N06625	
Classification wire	Si	0.10	0.16				-196	70	2.0		
EN ISO 18274: S Ni 6625 (NiCr22Mo9Nb)	Mn	0.2	0.2				2.4				
AWS A5.14: ERNiCrMo-3	Cr	22.0	21.8								
Flux has to be redried before use for approx. 2h at 300 - 350 °C (570 - 660 °F)	Mo	9.0	9.0	YS	TS	E (L=4d)	CVN		ø	Alloy 625, Alloy 800,	
	Ni	Rest	Rest	ksi	ksi	%	°F	ft-lbf	inch		
	Nb	3.6	3.2	60.9	101.5		68	59	1/16	Alloy 825, 9% Ni-steels	
	Fe	< 1.0	< 1.0				-321	52	5/64		
									3/32		
Polarity: DC+/AC											
Approvals TÜV (10173), GL, CE											



voestalpine Böhler Welding

Welding know-how joins steel

Customers in over 120 countries join the expertise of voestalpine Böhler Welding. Focused on filler metals, voestalpine Böhler Welding offers extensive technical consultation and individual solutions for industrial welding and soldering applications. Customer proximity is guaranteed by 40 subsidiaries in 28 countries, with the support of 2,200 employees, and through more than 1,000 distribution partners worldwide. voestalpine Böhler Welding offers three specialized and dedicated brands to cater our customers' and partners' requirements.



Böhler Welding – More than 2,000 products for joint welding in all conventional arc welding processes are united in a product portfolio that is unique throughout the world. Creating lasting connections is the brand's philosophy in welding and between people.



UTP Maintenance – Decades of industry experience and application know-how in the areas of repair as well as wear and surface protection, combined with innovative and custom-tailored products, guarantee customers an increase in the productivity and protection of their components.



Fontargen Brazing – Through deep insight into processing methods and ways of application, Fontargen Brazing provides the best brazing and soldering solutions based on proven products with German technology. The expertise of this brand's application engineers has been formulated over many years of experience from countless application cases.

forwarded by:

